MANKIND QUARTERLY

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About Mankind Quarterly

Mankind Quarterly was founded as a quarterly journal of anthropology, in the broadest sense of "the science of man," in 1961. This was a time when the study of man had already diversified into physical anthropology, ethnography, quantitative cross-cultural research, archaeology and other subspecialties.

These developments took place against the background of a widening gulf between the biological and social sciences. Following the leading dogma of the day, cultural and social anthropologists in academe had begun to deny the importance of biology for behavioral and cultural phenomena. Conversely, biological (physical) anthropologists aligned themselves with the "hard" sciences, many describing themselves as human biologists rather than anthropologists in an attempt to distance themselves from a social anthropology that they no longer saw as scientifically sound. In many places, these divisions persist to the present day. *Mankind Quarterly* was founded as a response to these centrifugal trends. Its founders believed in the interdependence of human biology, behavior and culture, and they understood biological and cultural diversity as the outcomes of evolutionary, ecological, and historic processes.

In short, *Mankind Quarterly* was established as a journal for those scholars who still believed in a unified "science of man" that studies the interactions between biological and cultural diversity. It was first published in Edinburgh, Scotland in 1961, and then, from 1979 to 2014, by the Council for Social and Economic Studies (chaired by Roger Pearson) in Washington, D.C. In January 2015, publication was transferred to the Ulster Institute for Social Research, a non-profit organization in London, England. Throughout its existence, *Mankind Quarterly* has maintained its character as a journal devoted to the interdisciplinary study of man. New developments in the field were reflected in the journal early on. When first sociobiology and then evolutionary psychology developed descriptions of human nature and explanations for cultural universals, the new developments found expression in the journal. The same happened with behavioral genetics, which like sociobiology saw major advances during the last three decades of the 20^{th} century.

Today the editorial board includes scholars from 12 countries who represent a wide variety of disciplines including primatology, physical anthropology, archaeology, cultural anthropology, human genetics, differential psychology, sociology, and history. Despite their varied expertise and views, the editors share a common interest in the evolutionary and historical processes that generate human diversity, and in the universal features of human nature that constrain this diversity. Because history and biological evolution are ongoing processes, this includes an interest in the social, cultural, demographic and biological changes that are taking place in modern societies.

Some of the articles the journal publishes deal with the evolutionary and historic processes that have created the racial, ethnic, linguistic and cultural diversity we see today. Others describe present-day cultural diversity and ongoing trends, especially at the psychological level. During the last years, intelligence and its change over time have been especially active research areas, and a substantial part of this work has been published in *Mankind Quarterly*. The subject is important because education and intelligence are considered the key drivers of cultural change and economic growth, not only in developing countries but also in mature postindustrial societies. Other areas of special interest are the demographic changes that are taking place in countries today and that are shaping the world of the future.

Historically, *Mankind Quarterly* has earned a reputation for publishing articles in controversial areas, including behavioral race differences and the importance of mental ability for individual outcomes and group differences. During the "Bell Curve wars" of the 1990s, it became a target of attack when opponents realized that some of the work cited by Herrnstein and Murray had first been published in *Mankind Quarterly*. However, much of this science has stood the test of time. For example, the importance of genes for individual differences in intelligence is no longer controversial, and genetic effects on individual and group differences that were merely inferred in earlier research are now studied at the molecular level. There is nothing wrong with being at the embattled forefront of new scientific developments.

Most of the research that *Mankind Quarterly* publishes today is "normal" science, but the editors still welcome controversy and new ideas. They see it as part of the journal's mission to provide a forum for the presentation and discussion of theories and empiric research that challenge entrenched beliefs. Of course, the often contradictory views that are represented in *Mankind Quarterly* are those of the individual authors, not those of the journal's publishers or editors.

Notes for Authors

As a peer-reviewed academic journal of anthropology, *Mankind Quarterly* publishes articles on all aspects of the science of man, ranging from cultural and physical anthropology, and psychology and behavioral genetics, to demography, mythology, and the history of religion.

However, the editors are especially interested in articles relating to cultural and biological evolution, and to the interaction between biology and culture. Such topics include

(1) the historical origins of present-day cultural and biological diversity using approaches from history, archaeology, linguistics, mythology, and population genetics;

(2) the study of cultural and biological trends in contemporary societies including cross-cultural studies of personality, intelligence, and culturally transmitted beliefs and values, as well as the study of demographic trends and trends in physical characters and gene frequencies over time; and

(3) the implications of current trends for future human evolution.

Included in these areas of special interest are articles dealing with the evolution of personality, its expression in varying cultural, ecological, and economic conditions, and its implications for future cultural and biological evolution. Interdisciplinary approaches that integrate findings from historically separate disciplines and subdisciplines are especially encouraged.

Mankind Quarterly publishes research reports, theoretical articles, data-driven reviews, book reviews, and short communications on new discoveries or critical comments on published papers, either in *Mankind Quarterly* or elsewhere. Because *Mankind Quarterly* is read by individuals from diverse backgrounds, the authors of highly specialized or technical articles are asked to present the background and significance of their work clearly and concisely. Book reviews should also deal with publications that will be of interest to a non-specialist audience.

Theoretical articles may be speculative or controversial or both, but must be based on solid data. Submissions are evaluated only based on scientific soundness, relevance, and interest. Manuscripts should be composed in **Microsoft Word** and submitted electronically to:

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The editors may request a printed copy of any article which is accepted for review by the journal's referees. The review process usually takes 1-3 months. Every effort is made to publish articles within six months after final acceptance.

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Lynn, R. & Irwing P. (2002). Sex differences in general knowledge, semantic memory, and reasoning ability. *British Journal of Psychology 93*(4), 545–556. doi: 10.1348/000712602761381394.

Books:

Lynn, R. & Vanhanen, T. (2012). Intelligence: A Unifying Construct for the Social Sciences. London: Ulster Institute for Social Research.

Articles in edited collections:

Rushton, J. P. (2003). Race differences in *g* and the Jensen effect. In: H. Nyborg (ed): The Scientific Study of General Intelligence: A Tribute to Arthur R. Jensen. Amsterdam: Pergamon.

Material published online:

Statistics New Zealand (2013). http://www.indexmundi.com/new_zealand/demographics_profile.html. Retrieved 10th of February 2025.

CONTENTS

The image frames a woman standing confidently before a weathered brick wall - her stance and attire echo the intersections of identity, resilience, and cultural presence. This visual tone complements the study by Biswas & Khatun (2025) in Mankind Quarterly, which examines the double burden of malnutrition among Rajbanshi and Namasudra women in North Bengal. Page 69 explores how socioeconomic and demographic factors intensify nutritional inequality. Photo credit: Unsplash

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Editorial
It's All about Prediction

Gerhard Meisenberg

The ability to predict real-world outcomes is a defining characteristic of science. A scientific hypothesis not only explains observed phenomena parsimoniously. It must also be able to predict the probability of future events above chance, and the results of experiments designed to test the hypothesis. A hypothesis that cannot predict future outcomes and therefore cannot be tested by observation or experiment does not qualify as science. It is guesswork, belief, opinion, prejudice or superstition but not science.

Predicting the social and behavioural life outcomes of individuals is a central task of the social and behavioural sciences. To this end, psychologists have designed predictive tests whose purpose is not only the *description* of people's well-being, character or abilities, but also the *prediction* of their future. These tests are a kind of crystal ball in which the scientifically trained soothsayer can discover a person's secrets and predict the course of his future life — above chance, but of course not in absolute terms.

Of all the tests that psychologists have concocted, those intended to assess intelligence are more predictive and more useful than those assessing other psychological traits, in large part because on intelligence tests, unlike personality tests, people cannot "fake good". They can only fake bad, but are rarely motivated to do so. The scores on intelligence tests do indeed predict success in life well above chance. They can predict a child's learning in school, and to a limited but still important extent, intelligence measured early in life predicts adult earnings, creative achievement, probability of staying out of prison, health, longevity, and much more.

But what is it that these tests measure? Some psychometricians insist on the reality and importance of "general intelligence", also called the *g* factor (e.g., Jensen, 1998). They sometimes treat *g* as a real cognitive ability, the function of a neural circuitry somewhere in the convolutions of the brain that is required for all cognitive tasks. However, such a view is neurologically improbable. For all we know, the human brain has circuitries that are dedicated to specific functions such as categorization, analogical reasoning, language learning, the encoding, storage and retrieval of long-term memories, manipulation of the content of visual and verbal working memory, social skills, good judgement, and much more.

At its core, the *g* factor is merely a description of the fact that at the population level, there are positive correlations among the scores of all the subtests of which intelligence tests are composed: tests of categorisation, inductive and analogical reasoning, word knowledge, jigsaw puzzle ability, mental rotation, mechanical comprehension, and the like. Technically, the *g* factor is extracted from these scores by factor analysis. This method produces a kind of weighted average where the subtest scores that have the highest correlations with the other subtest scores — presumed to be the "purest" or most accurate measures of intelligence — are given the greatest weight.

It is therefore likely that *g* is not a general ability, but a statistical phenomenon caused by the fact that many and perhaps most of the conditions that boost one specialized ability also boost other specialized abilities to various extents (Conway & Kovacs, 2015). Going to school, living in an intellectually enriched environment, absence of nutritional deficiencies in infancy and childhood, and having a low load of genetic mutations that impair brain development and function, all these are non-specific influences that can cause positive correlations among test scores because they all enhance multiple cognitive brain functions. Although specialized abilities contribute to real-world outcomes beyond *g* (Coyle, 2018), the *g* factor is nevertheless the most predictive metric of IQ tests because intelligent responses to most of the challenges and opportunities that people encounter in life require the coordinated functioning of many specialized abilities.

This is the background on which we can try to explain group differences on cognitive tests. Test score differences between groups, for example between males and females, schoolchildren and pensioners,

ethnic and racial groups and the populations of different countries, are universal but can occur at three levels. The first possibility is a difference in scores on the *g*-factor, meaning that one group scores higher than the other on most or all subtests. It indicates that one or more of those factors that have non-specific effects on brain function, such as genes, nutrition and schooling, are different between the groups. The second possibility is that differences on subtest scores are larger than those on *g*. This indicates that the groups are not much different on broad-band thinking and learning ability, but that the differences are in specialized abilities. Neither of these two kinds of group difference implies that the test is "biased". Group differences are expected, and the ultimate criterion of test bias is predictive power. As long as a learning ability test predicts learning in school and a mathematics ability test predicts success in a mathematics study program equally for everyone, independent of group membership, the test is not biased no matter how big the group differences are.

A third possibility is that group differences are specific to individual test items, technically known as differential item functioning (DIF). Does this mean that those items showing the group differences are "biased", that it would be unfair to use them on a test? Again, the ultimate criterion is, in theory, the correlation of item response with the real-world outcomes that the test is intended to predict. Because this would be impractical, psychometricians use a short-cut: They determine whether the probability of answering an item correctly is predicted by the score on the (sub)test alone — assumed to be an approximation of the "latent ability" construct the test is intended to measure —, or also by group membership independent of this hypothetical latent ability. If group membership has an additional effect, the item measures not only the latent ability construct, but also something extraneous, something else that is different between the different groups.

In this issue of *Mankind Quarterly*, Ismael Albursan and his colleagues in Saudi Arabia and Sudan are looking at possible sources of differences between boys and girls in the items of Raven's Coloured Progressive Matrices (CPM), an intelligence test for children. Like the adult versions of the Raven test, the CPM is intended to measure core aspects of "general" intelligence such as pattern recognition, inductive reasoning, and abstraction. It is not intended to measure specialized abilities. Unlike the Wechsler tests for example, it is not composed of multiple subtests, each measuring a different cognitive ability or skill. Studies so far have shown that sex differences on the total score are minimal, interpreted as minimal sex differences in "general intelligence".

The Albursan et al. study is unique in many respects. It used an impressive sample size of 2624 children aged 4 to 12 years, more than in comparable studies elsewhere. The sample is from preschools and schools in the Khartoum area of Sudan, a place where studies of this kind have never been done before. Finally, they describe sex-related differential item functioning not only for the entire group, but also relate such item specificity to the child's age. Indeed, their main result is that the number of DIF items, small in younger children, increases substantially in the oldest age group.

The authors refrain from speculation about the possible causes of such item-specificity. Familiarity with the test items is an improbable explanation. However, we know from earlier studies that although sex differences on across-the-board intelligence tests are very small, there are consistent differences in specialized abilities such as processing speed (favouring females) and spatial relations (favouring males). Perhaps the most parsimonious explanation for differential item functioning is that the Raven test measures not a single general ability, but two or more specialized cognitive skills, at least one on which males do better and another one on which females do better. Some items tap into an ability on which females are better, and others tap into an ability on which males are better.

And why should this differentiation by sex be greater in children aged 10 to 12 than in those aged 4 to 9? Hormones are an easy guess. The result suggests that testosterone, estradiol and other sex steroids promote not only sexual but also cognitive maturation at puberty in a sexually dimorphic way, thereby enhancing cognitive sex differences that are still minimal in younger children. Or is it a cultural effect whereby the specific environment to which children are exposed in Sudan stimulates some cognitive skills more strongly in boys and others more strongly in girls?

What needs to be done now is to assess the cognitive processes that are required to answer the items on the Raven tests, abilities such as holistic perception of visual patterns, analytical ability to abstract

distinctive properties from a visual image, or verbal strategies. We also need cross-cultural comparisons to see which ones of the sex differences are universal and therefore in some way part of "human nature", and which ones are culture-bound. As far as test development is concerned, should all items with sex-related differential item functioning be removed? Probably not, if they predict the outcomes that the test is intended to predict and if male-favouring and female-favouring items are about equally matched on the test. What ultimately counts is the test's, not the item's, ability to predict real-world outcomes such as school grades independent of sex. It's all about prediction.

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Love and Hate: The Convergent and Divergent Validity of the Love of Life Scale in University Students from Lebanon

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Abstract

The main aim of the present study on Lebanese participants was to replicate earlier studies, specifically to compare its results with those of two previous studies conducted on participants from Libya and Sudan living in a stable socio-political state. The Lebanese sample of the present study was exposed to Israeli aggression during the last two months of the year 2024. A volunteer convenience sample of students from four Lebanese universities in Beirut took part in the study (N = 236). Results indicate that women had significantly higher mean total scores for anxiety than did men, whereas men had significantly higher mean total scores for happiness than did women. All the associations between love of life (LOL) and the positive traits (optimism, happiness, and mental health) were statistically significant and positive in men and women. All the LOL associations with negative traits (suicidality, anxiety, and pessimism) were statistically significant and negative, except one. The results support the convergent and divergent validity of the LOL scale. Principal components analysis extracted two components in men and women which were labeled "Positive traits" and "Negative traits". The LOL correlations and factor loadings were higher on the positive traits than the negative traits, indicating the placement of LOL in the subjective well-being nexus. The Israeli aggression seemed to have no effect on the LOL mean score, probably because of its short duration of two months.

Keywords: Love of life, Optimism, Happiness, Mental health, Pessimism, Suicidality, Anxiety, Lebanon.

1 Introduction

Recently, two papers were published under the title: "Love and hate: the convergent and divergent validity of the Love of Life Scale". The participants of these studies were from two Arab countries, Sudan and Libya (Abdel-Khalek et al., 2022a, 2023a). Both studies were conducted under more or less stable political conditions, i.e., before the civil war started in Sudan.

The general aim of the present study was to replicate and compare the last-mentioned two studies with participants from another Arab country, Lebanon. During the last two months of the year 2024, the Lebanese population suffered from Israeli attacks on West Lebanon, Beirut the capital, as well as various important Lebanese towns. The general prediction was: The war atmosphere would affect the participants' responses on the Love of Life (LOL) scale. Lower scores were expected because of reduced well-being.

LOL had been introduced as a new construct proposed to be a sub-component of the subjective well-being (henceforth SWB) domain. LOL is defined by a generally positive evaluation of one's own life and positive regard towards it, holding fast to life, as well as a pleasant attachment to life (Abdel-Khalek, 2004, 2007, 2013b).

Ross et al. (2023) differentiated between LOL and life satisfaction. The difference is between viewing life itself as important and the feelings about one's own life. People can believe life in general is a positive thing, but not necessarily feel content with their own life at the moment. They found that one's family of origin and current beliefs relate to current wellness (LOL, life satisfaction, and happiness).

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Individual differences in love of life versus hate of life are proposed to be on a continuum. It was hypothesized that LOL is positively associated with SWB constructs and scales, such as happiness, optimism, and life satisfaction. On the other hand, it was predicted that LOL is negatively associated with negative affect. Both hypotheses were verified in previous studies (Abdel-Khalek, 2007, 2013b, 2018a). Several research studies have demonstrated statistically significant associations of LOL with the following scales: happiness, optimism, life satisfaction, hope, mental health, physical health, self-esteem, emotional intelligence, positive affect, self-efficacy, social support, etc (Abdel-Khalek, 2007, 2018b, 2020b; Abdel-Khalek et al., 2007; Abdel-Khalek & Al-huwailah, 2013; Abdel-Khalek & Zine El Abiddine, 2019; Al-Fadly, 2009; Al Sa'eedy, 2009; Atef Vahid et al., 2016; Dadfar et al., 2018, 2021; El Nayal 2009a,b).

On the other hand, several studies have found negative associations of LOL with the following negative traits: anxiety, depression, death depression, somatic symptoms, wish to be dead, psychological distress, and suicidal cognitions (Abdel-Khalek, 2018b; Abdel-Khalek & Lester, 2012; Al-Ayoub & Abdel-Khalek, 2012; Atef Vahid et al., 2016; Dadfar et al., 2020a,b).

The association between LOL and personality was the subject of two studies. First, Abdel-Khalek (2013a) explored the correlations of LOL with Eysenck's three personality dimensions. The results indicated positive associations between LOL and extraversion in male and female university students, and negative correlations of LOL with neuroticism and psychoticism scores in women only. Second, based on the Big-Five personality traits, significant associations of LOL were found with the following factors: extraversion, agreeableness, openness, conscientiousness (positive), and neuroticism (negative). Predictors of LOL were low neuroticism, and high levels of agreeableness, conscientiousness, and extraversion (Abdel-Khalek & Alhuwailah, 2021).

Cross-cultural comparisons of LOL scores were conducted between university students from different countries. It was found that Kuwaiti students obtained higher LOL mean scores than Egyptian and Lebanese students. However, American students obtained a slightly higher mean total score than Kuwaiti students (Abdel-Khalek, 2012, 2018b; Abdel-Khalek et al., 2010; Abdel-Khalek & Lester, 2011, 2012). The conclusion is that rich countries tend to have higher levels of LOL.

Abdel-Khalek and El Nayal (2018) compared university students from nine countries on LOL. They found that students from Malaysia and the US obtained the highest mean LOL scores, followed by participants from Qatar, India, Kuwait (men), and India, Iran, Qatar, and Algeria (women). Generally speaking, students from high-income countries tend to obtain high LOL mean scores. Recently, it was found that the mean score on the LOL scale was higher in Libyan than Sudanese participants (Abdel-Khalek et al., 2022a, 2023a). Using an Egyptian sample of university students (N = 298), LOL was associated with quality of life, in particular the psychological and social domains of quality of life. Another recent study indicated that LOL was associated more with positive affect scales than negative affect scales, indicating good convergent validity of the LOL scale (Abdel-Khalek, 2024, 2025).

In Iran, Bahrami et al. (2016) found a significantly elevated mean total score on LOL after participation in the religious retreat of *I'tikaf* compared to before. Dadfar et al. (2021) proposed a LOL model with different roles of psychological well-being, depression, somatic health and spiritual health. Predictors of LOL scores were spiritual health and psychological well-being, indicating the importance of these components. The authors suggested strengthening these predictors in psychiatric outpatients and supporting the development and practice of LOL focused therapy for the treatment of psychiatric outpatients.

In Turkey, Turan et al. (2022) and Yildirim and Özaslan (2022) independently developed two Turkish versions of the LOL scale with good results. Ross and Wright (2023) investigated the associations between humility, personality and psychological functioning, including LOL. They found positive associations between humility and LOL. Abdel-Khalek and Nour Eddin (2024) found significant associations between LOL and hope (positive) and hopelessness (negative).

The LOL scale has been administered to samples from different countries: Egypt, Kuwait, Lebanon, Palestine, Algeria, Qatar, Turkey, Iran, India, Malaysia, and the US (e.g. Abdel-Khalek & Singh, 2019; Abdel-Khalek & Tekke, 2019; Abdel-Khalek et al., 2022b; Al-Arja, 2018). The studies on LOL provide information from different samples, e.g., adolescents, university students, adults, the elderly, mental health patients, cancer patients, and patients with multiple sclerosis (Abdel-Khalek, 2012, 2018b; Abdel-Khalek & Lester, 2011, 2012; Abdel-Khalek et al., 2010; Dadfar et al., 2021; Mohagegh et al., 2021).

2 The present study

During the last few years, Lebanon faced many problems. In addition to serious economic hardships, politically, the Lebanese people failed to elect the state president. Moreover, in the last two months of the year 2024, the Israeli army attacked several parts of Lebanon as well as the capital, Beirut. We predicted that these harsh circumstances may have had a negative impact on the psychological state of the Lebanese population, including their love of life. The main aim of the current investigation was to replicate and compare the findings on the Lebanese participants with the results of previously published studies on two samples, one from Libya and the other from Sudan. Socio-political circumstances were more or less stable in these two Arab countries at the time when these studies were done. It is particularly noteworthy that the previous study on the Sudan sample was conducted before the civil war started.

3 Aims of the present study

Using Lebanese college student participants, the following six aims were stated:

1. To explore the factorial structure of the LOL scale.
2. To estimate the descriptive statistics of the study scales and the sex-related differences in the seven scales (see the questionnaire section).
3. To compute the associations between the scales.
4. To explore the factorial structure of the study variables.
5. To explore the predictors of LOL.
6. To compare the total LOL mean scores between the three samples from Libya, Sudan, and Lebanon.

4 Materials and Method

4.1 Participants

A volunteer convenience sample of Lebanese university students (N = 236: 117 men and 119 women), was sourced from the following four universities: Lebanese University, Lebanese American University, Lebanese International University, and American University of Beirut. All these universities are situated in Beirut, the capital of Lebanon. Respodents' ages ranged between 17 and 35: (M = 20.9, SD = 3.7 for men, M = 23.4, SD = 6.9 for women.

4.2 Questionnaires

Seven scales were used as follows. Each item of the present battery of scales is answered on a five-point Likert-type scale anchored at 1 No and 5 Always. Higher scores indicate a higher trait level.

4.3 The Love of Life (LOL) Scale

The LOL scale (Abdel-Khalek, 2004, 2007, 2013b) was written originally in Arabic and has equivalent English, Persian, and Turkish versions. It consists of 16 items (see the items in Table 2). With an Egyptian sample, principal components analysis of the LOL items had extracted three components, which were labelled: "Positive attitude towards life", "Happy consequences of love of life", and "Meaningfulness of life". Construct validity of the LOL scale was adequately demonstrated by statistically significant positive correlations with measures of happiness, satisfaction with life, optimism, self-esteem, hope, and extraversion (Abdel-Khalek, 2007).

4.4 The Arabic Scale of Suicidal Behavior (ASSB)

The ASSB purports to assess thoughts, cognitions, and intentions to commit suicide. It consists of five statements. Example items are: "I thought about killing myself", "I wished I were dead", and "I tried to commit suicide". This scale was developed by Abdel-Khalek (2023).

4.5 The Arabic Scale of Optimism and Pessimism (ASOP)

The ASOP (Abdel-Khalek, 2020a, Chapter 1) consists of two separate subscales in comparable Arabic and English forms to assess optimism and pessimism. Each subscale contains 15 statements. The total score can range from 15 to 75, with high scores indicating high optimism or pessimism. Cronbach's alpha and test-retest reliabilities were good. Criterion-related validities against scores on the Life Orientation Test by Scheier and Carver (1985) were +0.78 and -0.69, indicating good convergent validity of optimism and pessimism, respectively.

4.6 The Kuwait University Anxiety Scale (KUAS)

The KUAS (Abdel-Khalek, 2000) has comparable Arabic, English, German, and Spanish versions. It consists of 20 brief statements. Alpha reliability of the scale ranged from 0.88 to 0.92 and test-retest reliability between 0.70 and 0.93, indicating good internal consistency and temporal stability. The criterion-related validity of the scale ranged between 0.70 and 0.88 (five criteria), while the loadings of the scale on a general factor of anxiety were 0.93 and 0.95 in two factor analyses, demonstrating the scale's criterion-related and construct validity. Discriminant validity of the scale has also been demonstrated. Factor analysis of the scale items extracted three factors, which were labelled "Cognitive/Affective", "Subjective", and "Somatic anxiety". The scale has displayed good psychometric properties in different Arabic and Western samples of college students.

4.7 The Arabic Scale of Happiness (ASH)

The ASH (Abdel-Khalek, 2013c) comprises 15 brief statements (e.g., "I have an overall sense of wellbeing", "My life has meaning", and "I feel that I am successful"), plus five filler items. The total score on the ASH can range from 15 to 75, with higher scores indicating higher happiness. A principal axis factor analysis, followed by oblique rotation (pattern and structure matrices), extracted two factors, which were labelled: "General happiness" and "Successful life". Cronbach's alpha and test-retest reliabilities ranged from .82 to .94, indicating good internal consistency and temporal stability. The construct validity of the ASH ranged between .55 and .79 against the Fordyce Happiness Measure, the Subjective Happiness Scale, and the Oxford Happiness Inventory. The ASH has equivalent Arabic and English forms.

4.8 The Arabic Scale of Mental Health (ASMH)

This scale was developed as a generic screening measure and research tool for adults and adolescents. It has equivalent Arabic and English forms. The scale comprises 40 brief statements plus 10 filler items. The total score can range from 40 to 200, with higher scores indicating better mental health. A principal components analysis extracted six components, which were labelled: Satisfaction, Self-confidence, Optimism, Enjoyment, Meaningful life, and Stability. Extensive data on reliability and validity are available (Abdel- Khalek, 2011).

4.9 The short scales

Factor analysis was used to reduce the dimensionality of the study scales down to a lesser number of latent variables (called constructs). This also helps reduce the redundancy between sets of correlated variables to eliminate the possibility of multicollinearity, which is a major concern when building causal models. Exploratory factor analysis helps in revealing patterns between variables. When we reduced the full scales down to their "best" three items, those with the highest factor loadings, this did not reduce their reliability and the explained variance. Therefore, we administered these short 3-item versions rather than the complete scales. Only the LOL (16 items) and suicidality (5 items) scales were used with all their items (see Table 1).

4.10 Statistical analysis

SPSS was used for the statistical analysis of the data. Descriptive statistics, t test, d for effect size, Pearson product moment correlation, and principal components analysis were used. Principal components analysis was conducted to examine the factorial structure of the rating scale scores. The Kaiser criterion (eigenvalue ≥ 1.0) and the scree test were applied to extract significant component(s).

4.11 Procedure

The battery of scales was administered to a sample of student volunteers from four universities. The administration of scales was through face-to-face settings, in September and December 2024, during the Israeli aggression on Lebanon.The administration of scales was interrupted at the height of the bombing.

5 Results

Before presenting the findings of the current investigation, it is important to estimate the Cronbach's reliability of the scales in the Lebanese sample. Reference to Table 1 indicates that all alpha reliabilities ranged between .70 and .94, indicating acceptable to good alpha reliabilities.

Table 1: Alpha reliability of the scales.

Scale	Number of items	Men	Women
Love of Life	16	0.93	0.94
Suicidality	5	0.91	0.90
Optimism	3	0.85	0.86
Anxiety	3	0.86	0.92
Happiness	3	0.83	0.87
Pessimism	3	0.87	0.89
Mental Health	3	0.72	0.70

Note. Entries are Cronbach's α.

A principal components analysis (PCA) was conducted to examine the factorial structure of the correlations between the LOL scale items. The Kaiser criterion (eigenvalue ≥ 1.0) and the scree test were applied to extract significant components. Orthogonal (varimax) rotation of axes was performed, i.e., the resulting components after rotation were not correlated with each other. Because the components for men and women were similar, the scores for male and female groups were merged in one sample ($N = 236$). Kaiser-Meyer-Olkin measure of sampling adequacy was .94, and the Bartlett's Test of Sphericity (Approx. Chi square) = 2283.0.

Table 2 indicates that two components were extracted and accounted for 58.5% of the total variance. Before rotation, the first component accounted for 51.6% and the second one accounted for 7.0%. However, the

scree plot indicated that only one component was significant. Therefore, we consider the second component as a residual one and the first component could be labelled "Love of Life". Table 2 sets out the first component before rotation and the two components after rotation. Figure 1 presents the scree plot.

Table 2: Factor loadings of the Love of Life Scale for men and women ($N = 236$).

Item	Factor loadings		
	Before rotation	After rotation 1	After rotation 2
1. Life is full of pleasures.	.82	.93	.15
2. There are many things that make me love life.	.81	.75	.14
3. Love of life adds to its beauty.	.80	.73	.13
4. Life deserves to be loved.	.79	.72	-.11
5. Love of life makes me happy.	.77	.70	.27
6. Life seems beautiful and wonderful to me.	.75	.67	.21
7. I look at life from its beautiful side.	.73	.66	.12
8. Love of life gives me hope.	.71	.62	.15
9. I would like to have a long life to achieve what I hope for.	.69	.48	.16
10. Love of life brings me satisfaction.	.67	.48	-.12
11. Life is a treasure we should guard.	.66	.43	.10
12. Life is beautifully meaningful.	.64	.42	.21
13. Life is a blessing whose value we should appreciate.	.62	.12	-.83
14. I realize that my existence in this life has great meaning.	.59	.01	-.60
15. I always have a wonderful feeling of loving life.	.55	.21	-.55
16. I like to be optimistic about life.	.45	.42	-.42
Eigenvalue	8.25	7.37	5.43
% of variance	51.55	48.74	4.27

Note. Entries are factor loadings (orthogonal varimax). "Eigenvalue" and "% of variance" rows summarize each solution.

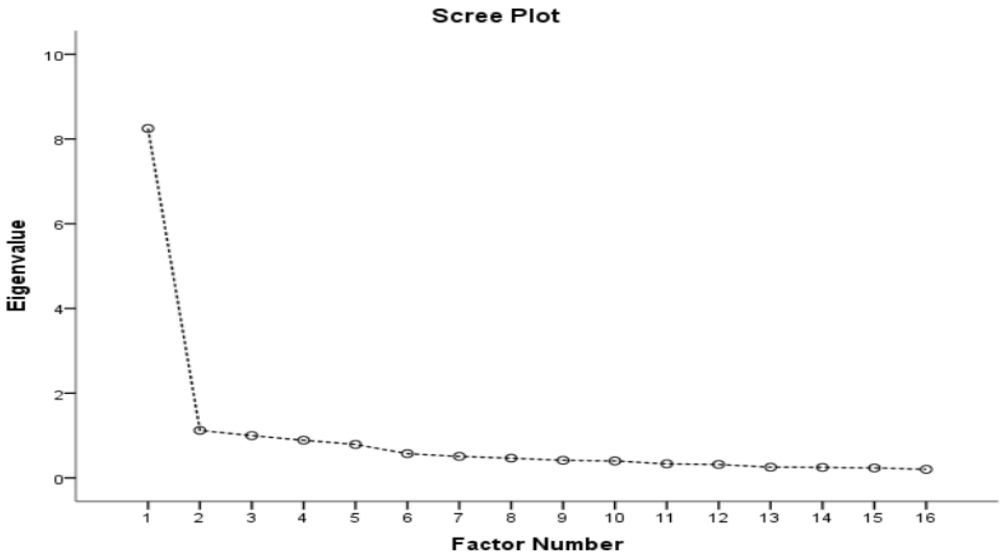

Figure 1: Scree plot for the Love of Life Scale in the current study

Table 3 sets out the descriptive statistics of the scales and the differences between total scores for men and women. Women obtained significantly higher mean total scores than did men for anxiety, whereas men had significantly higher mean total scores than did women for happiness. There were no sex-related significant differences in the other scales.

Table 3: Mean (*M*), standard deviation (*SD*), *t* value, and effect size *d* of the difference between men ($n = 117$) and women ($n = 119$).

Scales	Men		Women		*t*	*p*	*d*
	M	*SD*	*M*	*SD*			
Love of Life	55.07	12.82	56.09	12.17	0.62	–	–
Suicide	7.82	4.78	7.07	3.81	1.30	–	–
Optimism	11.03	3.01	10.65	2.85	0.99	–	–
Anxiety	7.66	3.55	8.89	3.49	2.69	.008	.39†
Happiness	9.47	3.02	8.90	2.96	1.44	.043	.27†
Pessimism	6.13	3.39	5.39	3.10	1.75	–	–
Mental Health	9.84	2.71	9.18	2.58	1.92	–	–

Notes: "–" = not reported. † Small effect size.

Table 4 presents the bivariate Pearson correlations between the study scales, separately for men and women. The important correlations in the present study are for LOL and the other scales. The associations between LOL and the positive traits (optimism, happiness, and mental health) were statistically significant and positive in men and women. Conversely, all the LOL associations with negative traits (suicidality, anxiety, and pessimism) were statistically significant and negative, except between LOL and anxiety among men (n. s.).

Table 4: Pearson correlations between the scales for men (n=117, upper triangle) and women (n=119, lower triangle).

Scales	1	2	3	4	5	6	7
1. Love of Life	—	-0.29^{**}	0.58^{**}	-0.09	0.49^{**}	-0.32^{**}	0.47^{**}
2. Suicidality	-0.24^{**}	—	-0.33^{**}	0.34^{**}	-0.26^{**}	0.53^{**}	-0.23^{*}
3. Optimism	0.62^{**}	-0.19^{*}	—	-0.15	0.40^{**}	-0.33^{**}	0.53^{**}
4. Anxiety	-0.41^{**}	0.36^{**}	-0.48^{**}	—	-0.40^{**}	0.51^{**}	-0.44^{**}
5. Happiness	0.68^{**}	-0.29^{**}	0.53^{**}	-0.53^{**}	—	-0.45^{**}	0.67^{**}
6. Pessimism	-0.45^{**}	0.57^{**}	-0.41^{**}	0.52^{**}	-0.48^{**}	—	-0.47^{**}
7. Mental Health	0.59^{**}	-0.30^{**}	0.54^{**}	-0.48^{**}	0.57^{**}	-0.32^{**}	—

* $p < .05$ (two-tailed); ** $p < .001$ (two-tailed).

A principal components analysis was conducted to examine the factorial structure of the correlations between the total scale scores, separately for men and women (see Table 5). The Kaiser criterion (eigenvalue ≥ 1.0) was applied to extract significant components. Two components were extracted for men and women. They accounted for 68% and 74% of the total variance, respectively, as reported in Table 5. Kaiser-Meyer-Olkin = .86 and .89, and Bartletts Sphericity = 3135 and 3437 for men and women, respectively. The components and the loadings of the scale scores on them were very similar for men and women. The first component could be labelled "Positive traits", because of its high loadings for LOL, optimism, happiness, and mental health. The second component could be labelled "Negative traits" because of its high loadings for suicidality, anxiety, and pessimism.

Table 5: Orthogonal (varimax) two-factor solution for the scales for men ($n = 117$) and women ($n = 119$).

Scales	Men		Women	
	1	**2**	**1**	**2**
Love of Life	0.79	-0.08	0.86	-0.17
Suicidality	-0.09	0.79	-0.12	0.81
Optimism	0.77	-0.19	0.82	-0.19
Anxiety	-0.15	0.77	-0.28	0.73
Happiness	0.85	-0.21	0.88	-0.20
Pessimism	-0.17	0.84	-0.18	0.87
Mental Health	0.84	-0.09	0.86	-0.23
Eigenvalue	2.6	2.1	3.0	2.0
% of Variance	39.1	29.0	44.0	30.0
Total Variance	**68.1%**		**73.9%**	

Notes: Orthogonal varimax rotation. "Total Variance" is the cumulative percentage within sex.

Table 6: Predictors of love of life.

Predictor	***B***	***SE***	β	***t***	***p***
Men					
Suicidality	-0.27	0.23	-.10	1.14	.26
Optimism	1.62	0.38	.38	4.31	.0001
Anxiety	-0.67	0.32	.19	2.11	.04
Happiness	1.26	0.42	.30	2.99	.003
Pessimism	-0.19	0.37	-.05	0.53	.60
Mental Health	0.49	0.52	.10	0.93	.35
Constant	18.62	6.26		2.97	.004
Model fit (Men): $F = 14.65$, $p < .0001$, $R^2 = .44$.					
Women					
Suicidality	0.11	0.24	.04	0.46	.65
Optimism	1.23	0.34	.29	3.61	.0001
Anxiety	0.35	0.28	.10	1.27	.21
Happiness	1.61	0.34	.39	4.70	.0001
Pessimism	-0.55	0.34	.14	1.63	.11
Mental Health	1.05	0.38	.22	2.76	.007
Constant	18.01	5.86		3.07	.003
Model fit (Women): $F = 26.67$, $p < .0001$, $R^2 = .59$.					

Notes: B unstandardized coefficient; β standardized coefficient. Two-tailed *p*. Model rows report overall fit statistics.

The comparison between the participants from three countries on LOL indicated that there were no significant differences between the Lebanese and Libyan samples on LOL. However, the mean score on LOL for the Sudan participants was lower than the other two samples as reported in Table 7.

Table 7: Mean (*M*), standard deviation (*SD*), *t* test and effect size *d* on the Love of Life Scale among three Arab countries.

Country	Group 1			Group 2			*t*	*d*
	N	*M*	*SD*	*N*	*M*	*SD*		
Libya	186	57.00	12.86	521	56.16	11.88	0.78	0.06
Sudan	112	53.30	11.51	342	52.58	12.96	0.56	0.06
Lebanon	117	55.07	12.82	119	56.09	12.17	0.62	-0.08

Note. *t* from independent-samples test; *d* = Cohen's *d*.

6 Discussion

At first, the current investigation using a sample of Lebanese university students computed the reliabilities of the study scales. Cronbach's alpha reliabilities ranged between .70 and .94, indicating acceptable to high internal consistency of these scales (see Table 1). Psychometric authorities stated that a reliability of .70 is a minimum for a good test (Furr, 2011; Kline, 2000; Nunnally & Bernstein, 1994), although it can be argued that this depends on how narrow or how broad the examined construct is. For example, LOL is a very narrow construct, where a high reliability is desirable. In a similar vein, mental health as assessed in the present study, using the ASMH, was relevant only to the positive mental health indicators, and not to the DSM nomenclature. The present reliabilities reached and exceeded that criterion.

Principal components analysis of the LOL scale items extracted two components based on the Kaiser criterion (eigenvalue $\geq$ 1.0) (see Table 2). However, only the first component was considered significant based on the following results: The scree test showed only one significant component, the first unrotated component accounted for a high percentage of variance (51.6% versus 7% for the second component), as well as the percentage of variance after rotation, i.e., 48.7% and 4.3% for the first and second components, respectively, and the loadings onto the first unrotated component ranged from .45 to .82 (see Table 2). Unfortunately, there is a descending trend regarding the loadings onto the LOL items from high to low (see Table 2). This trend was most probably related to either boredom or fatigue. Therefore, it is suggested to develop a short LOL scale.

As to the number of salient components of the LOL scale in previous studies, there was no agreement. In the original study on the Egyptian sample, which introduced the LOL scale, Abdel-Khalek (2007) extracted three components, whereas Atef Vahid et al. (2016) extracted two components on an Iranian sample. One component was extracted in two studies using Turkish samples (Turan et al., 2022; Yildrim & Özalan, 2022). Only one component was extracted for seven samples (Abdel-Khalek et al., 2023b). These differences may be due to either the nature of the samples or to the capricious nature of exploratory factor analysis. Perhaps it is mainly a difference in what the researcher considers a meaningful factor.

Regarding the second aim, the sex-related differences were statistically significant only on two scales: happiness (men scored higher), and anxiety (women scored higher) (see Table 3). This result is expected in light of women's high scoresF on anxiety and neuroticism (Abdel-Khalek, 2013a, 2021; Abdel-Khalek & Alansari, 2004; Lynn & Martin, 1997). Several studies have shown a significant negative association between anxiety and happiness.

The correlations between the LOL scale and the positive traits (optimism, happiness, and mental health) were statistically significant and positive in men and women. On the other hand, the associations between LOL and the negative traits (suicidality, anxiety, and pessimism) were statistically significant and negative, except between LOL and anxiety in men (n. s.) (see Table 4). The last-mentioned result could reflect gender-based emotional processing differences, sample characteristics, or measurement artifacts. Moderations or cultural gender norms may possibly explain this result. These results suggest the convergent and divergent validity of the LOL scale. However, the LOL associations with positive traits were higher than the LOL correlations

with the negative traits. These results were consistent with the findings of two other Arab samples, from Libya and Sudan (Abdel-Khalek et al., 2022a; Abdel Khalek, Al Shahomee et al. 2023a).

Principal components analysis of the total scores on the seven scales extracted two components accounting for 68% and 74% of the total variance in men and women, respectively (see Table 5). The two components were labelled "Positive traits" and "Negative traits." It is noteworthy that the LOL scale had high loadings on the "Positive traits" component: .79 and .86, whereas the LOL loadings on the "Negative traits" component were -.07 and -.17 among men and women, respectively. Therefore, the placement of LOL in the positive traits component, subjective well-being, or the positive emotionality nexus, is evident.

Regression analysis indicated that the predictors of LOL were optimism and happiness in both sexes. In addition, low scores on anxiety and mental health were predictors of LOL among men and women, respectively (see Table 6). Most of the LOL predictors were scales of positive traits. These predictors accounted for 44% and 59% of the variance in LOL scores among men and women, respectively. Again, these results confirm that LOL is in the nexus of positive traits and subjective well-being. However, there is no claim of cause-and-effect relations. Indeed, regression models cannot prove causality. The study of causality needs an experimental design.

The mean total score on the LOL scale among the Lebanese men (see Table 7) was slightly lower than that in the sample from Libya, whereas the mean total score of the LOL in the two countries among women was exactly the same. The lowest total mean score on the LOL scale was in men and women from Sudan, probably because of the modest per capita income in this country as well as the scant opportunity for employment after graduation.

It seems that the Israeli aggression on Lebanon did not affect the participants' level of LOL because of the short duration of this aggression (the last two months in the year 2024). This result was relevant to a study on death anxiety among 673 Lebanese adolescents and emerging adults during the civil war (Abdel-Khalek, 1991). At that time, results indicated that the Lebanese samples obtained either the same or a lower mean total score on death anxiety than their peers from Egypt, Kuwait, and the US. This finding of non-elevated scores on death anxiety among Lebanese participants during the civil war may be explained in light of social, political, and historical factors. In this country, twenty years of civil war around the middle of the nineteenth century aggravated political and religious conflicts. After more than a century, civil war broke out again in 1975 and continued for 16 years. These conditions may operate in much the same manner as the psychotherapeutic principle of flooding, as a sequence of continuous exposure to an insecure environment. People got used to the insecure conditions in the country. Furthermore, we can hypothesize that there is a high level of resilience among this Lebanese sample.

7 Limitations

Strong points of the study are the sufficient size of the sample, which was recruited from four universities, and the acceptable to high internal consistency of the study scales. However, some limitations have to be acknowledged. Foremost among them is the limited age range of participants, as university students. Furthermore, the selection of the sample was based on convenience and not probability. It is suggested to replicate this study using participants from the general population with a wide range of ages.

There is a need to study resilience as a hypothetical buffer against stressful events, particularly war of short duration. Furthermore, the association between habituation and resilience is in need of a separate study.

8 Conclusion

A sample of 236 students was recruited from four Lebanese universities. Principal components analysis (PCA) of the LOL (16) items extracted one high-loaded component, which was labelled LOL. Men obtained a significantly higher score on happiness, whereas women scored higher on anxiety. The associations of LOL with the positive scales: optimism, happiness, and mental health were significant and positive. Except

for one, all other correlations between LOL and the negative traits suicidality, anxiety, and pessimism were negative and statistically significant.

PCA of the correlations between the total scores on the seven scales extracted two components, which were labelled: "Positive traits" and "Negative traits." The LOL scale had high loading on the first one. Predictors of LOL were optimism and happiness in men and women, in addition, the lack of anxiety among men and mental health in women. These predictors accounted for 44% and 59% of the variance in LOL scores among men and women, respectively. It seems that the Israeli aggression had no effect on the LOL mean scores among this sample of students in Lebanon, probably because of the short duration of that aggression (two months) and because the aggression was not country-wide but restricted to selected regions. By and large, the LOL scale is a good indicator of well-being or positive emotionality with good convergent and divergent validity.

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The Role of Traditions in Preserving the Ethnic Identity of the Slovak Minority in Poland: The Case of the Villages of Krempachy, Nowa Biała, and Łapsze Wyżne

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Abstract

This study investigates the impact of cultural events, bilingual education, and cultural organizations on preserving Slovak identity in the context of globalization and assimilation, focusing on the Slovak community in Poland. The research centered on the villages of Krempachy, Nowa Biała, and Łapsze Wyżne, examining the role of local traditions and cultural practices in maintaining ethnic identity. Field observations, interviews, and document analysis revealed that folklore festivals, religious holidays, and traditional rituals are vital for preserving identity, especially through multi-generational participation. While the older generation is most involved in religious rituals, younger people are more engaged in folklore festivals. Bilingual schools in Krempachy and Nowa Biała play a key role in maintaining the Slovak language, though they face challenges like outdated textbooks and teacher shortages. The study also highlights economic difficulties, assimilation with Polish culture, and limited state support as significant challenges to preserving traditions. Cultural organizations, such as the Society of Slovaks in Poland, are working to strengthen ethnic identity, but additional support and resources are needed to address these challenges.

Keywords: Slovak cultural heritage, Nationality, Folklore, Slovak minority, Assimilation, Poland.

1 Introduction

Preservation of ethnic identity in multinational states is important in the context of globalization, when minority cultures and traditions often face the risk of assimilation or oblivion. This is especially true for minorities living in areas dominated by other ethnic groups. One of these minorities in Poland is the Slovak community, which preserves its traditions and culture but faces numerous challenges caused by modern social and economic transformations. The study of the role of traditions in the preservation of ethnic identity is important not only for understanding the processes taking place within specific national minorities, but also for developing strategies for the preservation of cultural heritage in general.

The villages of Krempachy, Nowa Biała, and Łapsze Wyżne, where the Slovak community preserves its ethnic identity through the practice of traditional holidays, rituals, and language practices, are located in a somewhat peripheral, rural area, poorer than the Polish (and Slovak) average. The region is characterized by mountainous terrain with limited road infrastructure and little tourism. These economic and geographical limitations present significant challenges in organizing cultural events and supporting local cultural organizations, as financial resources are limited. However, these same conditions also contribute to the preservation of traditions, as the isolation of the area fosters a sense of community cohesion and continuity of cultural practices. According to the latest data from the Polish census (Central Statistical Office, 2021), there are about 2,800 Slovaks in Poland who identify themselves as a separate national minority. The Slovak minority in Poland is concentrated mainly in the south-west of the country, near the border with Slovakia, particularly in the areas bordering the Tatra Mountains and in the High Tatras. Although this community is small, it

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has cultural and social support, including educational and cultural events that help preserve the language and traditions.

The villages were chosen due to their significant role in preserving Slovak cultural traditions within the Polish context. Located in the Spiš region, these villages house a substantial Slovak minority that actively engages in cultural practices, including folklore festivals and religious rituals. Despite economic and geographical challenges, these villages have maintained a strong sense of community, making them ideal for studying the preservation of ethnic identity through traditions.

Traditions are known to be an important element of cultural identity, but in practice this role can vary depending on the context and conditions in which a minority lives. Traditions can serve not only as cultural symbols, but also as mechanisms of social integration, helping to maintain ties between generations, facilitate adaptation to changing environmental conditions, and strengthen ethnic solidarity. At the same time, traditions can be displaced or transformed by external factors, in particular assimilation processes, which are often accompanied by the threat of losing ethnic identity. In view of this, it is important to examine in more detail the role of specific traditions in preserving the ethnic identity of the Slovak minority in Poland, as well as to understand how these traditions adapt to changing social conditions.

In this study, "ethnic identity" refers to a dynamic, multidimensional self-conception in relation to one's ethnic group, encompassing aspects such as exploration, commitment, group belonging, language, and cultural practices. Drawing on R.J.R. Levesque (2011), ethnic identity is seen as evolving through reflection on and engagement with one's community and heritage. "Assimilation", as described by J.W. Berry (2005), involves the adoption of dominant cultural practices and can vary from complete assimilation to separation, with strategies like integration in between. For the Slovak minority in Poland, traditions such as folk rituals and language are crucial in resisting assimilation and maintaining cultural identity. The concept of "tradition", in turn, following E. Hobsbawm and T. Ranger (1995), is defined as a set of practices, normally governed by overtly or tacitly accepted rules and of a ritual or symbolic nature, which seek to inculcate certain values and norms of behaviour by repetition, which automatically implies continuity with the past. Although they are often presented as ancient, such traditions may be relatively recent, serving to legitimize social structures, forge collective identity, and foster behavior aligned with communal norms.

The study of the ethnic identity of minorities, in particular the Slovak community in Poland, has become an important area of research in recent years, as globalization processes, changes in the socio-cultural context, and intercultural integration threaten the preservation of the cultural identity of ethnic groups. For instance, Slavic communities – such as Russians in Serbia, Serbs in Ukraine, and Slovaks in Vojvodina – often face similar assimilation challenges due to cultural and linguistic similarities. In contrast, groups like the Molise Slavs in Italy or Burgenland Croats in Austria maintain distinct identities. The Slovak community in Poland provides a unique case of how migration and identity preservation intersect with socio-political dynamics. At the same time, a number of works on ethnic identity in other countries provide an opportunity to make comparisons and fill in the gaps in existing research. O. Šrajerová (2024) analysed the factors that determine the ethnic identity of the Slovak minority in the Czech Republic, in particular, drawing attention to the importance of traditions, language, and culture for preserving identity. S. Zlatanović and J. Marušiak (2025) studied the migration practices of the Slovak community from Vojvodina (Serbia) to Slovakia, including the role of institutions in preserving culture and maintaining national identity.

The role of cultural practices, such as music and folk rituals, in the processes of integration and preservation of ethnic identity in the context of the reconstruction of national and ethnic identity in Germany and Poland was studied by P. Madajczyk et al. (2024). O. Pohuliaiev et al. (2024) analysed the development of ethnic minority organizations in Ukraine after independence, in particular emphasizing the importance of public initiatives for the preservation of cultural identity. A.R. Lee et al. (2024) focused on cultural participation and identity among the descendants of Carpathian Rusyns.

J. Marušiak (2023) demonstrated the impact of reparations and justice policies on bilateral relations between Slovakia and Hungary after World War II, in particular on Slovak minorities. This work provides an important perspective on the role of historical trauma in shaping national identity in Central Europe. D. Hejwosz-Gromkowska and D. Hildebrandt-Wypych (2023) studied the influence of religion and the Church on national identity through school textbooks in Poland. S. Sutrisno (2023) focused on changes in

media consumption and their impact on people's cultural identity. This provides valuable information for understanding how media influence cultural practices and linguistic identity, particularly in the context of the Slovak minority. However, the interaction between traditional cultural practices and modern media forms remains unexplored, which may be relevant for the preservation of national identity. L.P. Juang et al. (2022) investigated how ethnic and racial identity is manifested in different European countries through intervention projects. Thus, based on the existing research, several gaps in the scientific analysis of the ethnic identity of the Slovak minority in Poland can be identified, in particular, the impact of specific traditions on the preservation of this identity and the interaction between traditions and modern socio-cultural conditions. These gaps require a more detailed study, which is the purpose of this research.

The purpose of this study is to examine the impact of traditions on the preservation of the ethnic identity of the Slovak minority through cultural practices and holidays. The research focuses on such aspects as folk rituals, music and dance traditions, religious practices, and the preservation of the Slovak language, which we believe are the main factors contributing to the preservation of ethnic identity. The objectives of the study are:

1. Analysing the traditions that play a central role in the life of the Slovak community in the villages of Krempachy, Nowa Biała, and Łapsze Wyżne.
2. Studying the impact of traditions on maintaining ethnic identity among the younger generation.
3. Assessing how cultural practices can become a means of community adaptation to changing social and cultural conditions in Poland.

2 Materials and Methods

A study aimed at exploring the role of traditions in preserving the ethnic identity of the Slovak minority in Poland was conducted in the villages of Krempachy, Nowa Biała, and Łapsze Wyżne, located in the Spiš region. The research was carried out in 2023-2024, during the period of local holidays, cultural events and educational activities. To achieve this goal, various sources and materials were used. Publications describing the development of the Slovak community in Poland were important sources of data, including demographic information from the Central Statistical Office (2021) and documents related to the development of Slovak culture and language, as set out in the Statute of the Society of Slovaks in Poland (2025). Cultural materials related to folklore, traditional holidays and rituals played an important role in the study. Cultural practices preserved in the villages were analysed, as well as the activities of local cultural societies, such as the Society of Slovaks in Poland (Statute of the Society of Slovaks in Poland, 2025). The role of bilingual schools in preserving the Slovak language and traditions among the younger generation was also studied. The Law on National and Ethnic Minorities and on the Regional Language (2005) was taken into account, as it provides the legal framework for the preservation of minority languages and cultures.

The study employed purposive sampling to select 50 participants from the Slovak minority communities of Krempachy, Nowa Biała, and Łapsze Wyżne. The sample included teachers, activists of cultural societies, older residents and young people who are actively involved in the preservation of the Slovak language and traditions. All respondents voluntarily participated based on their engagement in cultural and educational activities. This purposive sampling approach ensured the inclusion of individuals most capable of providing insight into the mechanisms of cultural preservation. The sample covered different age groups, enabling a comprehensive exploration of generational perspectives; however, it should be noted that the sample is not representative of the entire Slovak minority population in Poland, but rather of its most culturally active segment.

Several methods were used to collect data. Field observation was the main method of data collection, during which cultural events such as festivals, holidays, religious ceremonies and classes in local schools were observed. This provided detailed information on the role of traditions in community life and their

importance in maintaining ethnic identity. In-depth interviews were conducted with local residents and representatives of cultural organizations (Table 1). The interview questions covered such aspects as the role of traditions in identity formation, attitudes towards bilingual education, and participation in cultural events. Communication with the respondents allowed us to collect subjective assessments and ideas about the importance of traditions for preserving ethnic identity.

Table 1: Breakdown of respondents by age group.

Age group	Number of respondents	Examples of questions
Young people (18–30 years)	10	What is your attitude to folklore festivals and religious ceremonies? Do you participate in these events?
Middle-aged (31–50 years)	15	What cultural events, in your opinion, contribute the most to maintaining Slovak traditions?
Senior citizens (50+ years)	25	Which traditional rituals and ceremonies are most important to your community? How do they influence the preservation of identity?

Note. Source: compiled by the author.

The interview responses were analysed using a manual thematic approach. Each transcript was carefully read, and recurring ideas were highlighted using colour codes. These repeated ideas were then grouped into broader thematic categories corresponding to the study's research questions. The identified themes included the significance of folklore festivals, intergenerational participation, religious rituals, and attitudes towards bilingual education. SPSS and Excel were used for statistical analysis of demographic and structured interview data, allowing for a quantitative overview of response distributions and respondent characteristics.

All procedures performed in the study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Informed consent was obtained from all individuals included in this study.

3 Results

The Slovak community in Poland, in particular in the Spiš region, has deep historical roots, shaped by centuries of interaction with Polish society. Spiš, located on the border between Poland and Slovakia, was historically part of the Kingdom of Hungary, but due to political changes after the First World War, it became part of Poland. These changes led to the reformatting of national borders, which affected the demographic structure of the region. Migration patterns of Slovaks to Poland were closely linked to economic factors, such as finding work in agriculture and crafts, as well as social processes, including mixed marriages and cultural exchange.

Migration processes played a significant role in the formation of the Slovak community in Poland, especially in the period following World War I. Although the Treaty of Trianon (1920) did not directly establish the Slovak-Polish border, it had important regional implications. The treaty resulted in the redefinition of Hungary's borders, leading to the loss of Hungarian territories including parts of the former Árva and Szepes counties, which had populations with Polish majorities. These areas were subsequently assigned to Poland through an arbitration commission in 1920, influencing migration and demographic patterns in the region. The present-day Poland–Slovakia border was formally established much later, following the peaceful dissolution of Czechoslovakia into two independent states on 1 January 1993. Before that, the eastern border of Czechoslovakia with Poland closely resembled today's Poland–Slovakia border, with only minor adjustments over time. After World War II, Poland and Czechoslovakia agreed on a

final border settlement, which restored pre-war boundaries as of May 1945. This agreement also affected population movements; Slovaks from the Polish parts of the Spiš and Orava regions resettled in newly created industrial towns in Slovakia, such as Svit, Kežmarok, and Poprad, as well as in depopulated German villages. During the socialist period in Poland (1945-1989), the Slovak minority preserved its traditions but often faced restrictions on cultural expression and organization. After the democratic changes of 1989, a renaissance of Slovak ethnic identity emerged, particularly through the formation of cultural organizations and the expansion of minority rights.

The attitude of the Polish state toward national minorities varied across historical periods. In the interwar years, the government was cautious and sometimes restrictive regarding minorities, and during the socialist era, cultural activities were tightly regulated by the state. It was only after the adoption of Poland's democratic constitution in 1997 that the rights of national minorities to preserve their identity were formally enshrined. Subsequently, the Act on National and Ethnic Minorities and Regional Languages provided members of the Slovak community with enhanced opportunities for cultural development and expression (Law on National and Ethnic Minorities. . . , 2005).

Modern Slovak-Polish relations are characterized by good neighbourliness and cooperation, particularly in the area of support for national minorities. Poland and Slovakia actively cooperate within the framework of international projects such as the Carpathian Euroregion, which promotes the preservation of cultural heritage and the exchange of experience between communities. As a result, the Slovak minority in Poland can receive support from the Slovak state through educational programmes and cultural initiatives. After Poland and Slovakia joined the European Union in 2004, new opportunities for preserving Slovak culture were opened up. European programmes, such as Erasmus+, promote cultural exchange between Poland and Slovakia, engaging young people in the preservation of traditions. However, globalization and integration processes also pose risks of assimilation, which is particularly noticeable among the younger generation. These aspects allow for a better understanding of the historical and political preconditions for the preservation of Slovak identity in Poland and deepen the context of the study.

The Slovak minority in Poland, although small, is an important part of the country's cultural diversity. According to the 2021 Polish census, there are about 2.8 thousand people in the country who identify themselves as the Slovak national minority (Central Statistical Office, 2021). The bulk of this community is concentrated in southwestern Poland, near the border with Slovakia, especially in the areas bordering the Tatra Mountains and in the High Tatras. In particular, these settlements include Krempachy, Nowa Biała and Łapsze Wyżne, which together constitute an important centre of Slovak culture in Polish society (Table 2).

Table 2: Population of the study areas.

Settlement	Population (persons)	Percentage of Slovak population (%)
Krempachy	1300	82.7
Nowa Biała	1539	83.9
Łapsze Wyżne	600	81.7

Note. Source: compiled based on data on City Population: Nowa Biała (2021).

This community actively supports its cultural identity through educational and cultural activities aimed at preserving the Slovak language and traditions. Local schools and cultural organizations play an important role in this process, providing Slovak children with the opportunity to learn in their mother tongue and to engage with Slovak culture.

4 Cultural Practices and Traditions

A study of the cultural practices and traditions of the Slovak community in the Polish villages of Krempachy, Nowa Biała, and Łapsze Wyżne showed that cultural events such as folklore festivals, religious holidays and traditional rituals play an important role in preserving and developing the ethnic identity of the community. Observations of these events highlighted their importance both for preserving cultural heritage and for strengthening ties between different generations of local residents.

Folklore festivals are one of the most important events for a community. They have become a kind of "lighthouse" of cultural identity, where culture is passed down from generation to generation. One of the most prominent events is the Krempachy Folklore Festival (*Krempaský folklórny festival*), held every August in the central square of the village. At this event, over 300 people, locals and visitors alike, gather to watch traditional performances. Young children in hand-embroidered *kroje* (folk costumes) perform the *odzemek*, a traditional Slovak mountain dance, while older women sing Slovak hymns passed down orally. This blend of generational participation brings the festival to life and reinforces shared cultural memory. 34 respondents highlighted this generational participation as key to reinforcing cultural memory and identity.

The Slovak Wedding Ceremony in Łapsze Wyżne, staged annually by the cultural group "Tatry Slovenskie", was identified by 31 interviewees as another central ritual in preserving Slovak tradition. It reenacts traditional wedding customs, including a *czepiny* (removal of the bride's veil), blessing with bread and salt, and ceremonial songs. The event brings together over 200 participants and spectators and includes traditional Slovak food like *bryndzové halušky* and poppy seed rolls, served by women in festive aprons.

Religious holidays such as Easter (*Veľká noc*) and Christmas (*Vianoce*) continue to be important elements of the Slovak community's cultural heritage. Easter in Nowa Biała includes *šibačka* (a ritual of light whipping with willow twigs), blessing of Easter baskets in church, and Slovak hymns sung by community choirs. In Krempachy, the Christmas season features *jasličkári* (children performing nativity plays in Slovak), a tradition that local schools and churches uphold. 29 respondents, mostly from the older generation, emphasized these holidays as central to the spiritual and ethnic life of the community. Despite the pressures of modernization and secularization, these customs remain a living practice, particularly among the older generation, while young people still find meaning in participating, often combining it with newer formats like school-based Christmas concerts in Slovak and Polish.

While the influence of secularization has reduced younger people's participation in religious practices, many still engage emotionally through music, crafts, or support roles in these rituals. These events go beyond passive preservation – they are emotional anchors for the community, reaffirming identity and continuity. The field observations reveal that traditions are not static relics but lived, evolving practices that carry deep personal and collective meaning. By experiencing and participating in these rituals, community members, especially across generations, anchor their sense of self within a shared Slovak heritage, despite the broader forces of assimilation.

Religious ceremonies also confirm the importance of church practices that have become an integral part of the cultural identity of the Slovak community in Poland. However, it is essential to understand these practices within the broader context of secularization, a process that has been affecting not only Poland but also Slovakia in recent decades. Secularization has led to a decline in religious participation, particularly among younger generations. This trend is not unique to the Slovak minority but is part of a wider societal shift seen across Central Europe, including in Poland, which mirrors the changes observed in Western Europe. For example, church singing, prayers, and ritualistic elements of Easter and Christmas celebrations continue to allow each generation to feel a sense of belonging to both a religious and ethnic community. Nevertheless, these practices are losing significance for younger people, not because of any specific characteristic of the Slovak minority in Poland, but as part of this larger, secularizing trend. These rituals still serve as a link between the past and the present, between the older and younger generations, which is important for maintaining stability in identity in a changing socio-cultural context. Folklore festivals, religious rituals, and celebrations form a shared environment where everyone involved – from children to older community members – can experience their ethnic and cultural identity, contributing to the strengthening of national identity. The symbolic significance of these events for preserving traditions is a crucial element

for maintaining ethnic diversity amidst the pressures of globalization and cultural assimilation (Table 3).

Table 3: Cultural events.

Event	Location	Type of tradition	Number of participants	Symbolic meaning
Folklore festival	Krempachy	Cultural event	~300	Supporting national identity through music, dance, and national costumes
Easter holiday & Christmas	Nowa Biała	Religious ritual	~150	Support for spirituality and ethnic heritage
Slovak wedding	Łapsze Wyżne	Cultural event	~200	A symbol of community unity and cultural tradition

Note. Source: compiled by the author.

It is important to note that for the younger generation, these events not only ensure the preservation of traditions, but also serve as a platform for forming their own identity, which combines traditional values with new socio-cultural realities. Thus, the analysis of cultural practices and traditions in the villages of Krempachy, Nowa Biała, and Łapsze Wyżne confirms that cultural events and religious rituals are important tools for preserving the ethnic identity of the Slovak community in Poland, as well as contributing to the development of intergenerational relations and cultural cohesion.

4.1 The role of bilingual education in preserving the Slovak language and culture

The bilingual schools operating in the villages of Krempachy and Nowa Biała play an important role in preserving the Slovak language and culture among the local community. They play a key role in shaping the linguistic identity of the younger generation, who have the opportunity to receive education in their mother tongue, Slovak, as well as in Polish. Such schools contribute not only to the preservation of the language, but also to the maintenance of traditions and cultural values that are of great importance to the Slovak community in Poland. Given the cultural and linguistic closeness between the Polish and Slovak peoples, bilingual education helps to foster respect for their ethnicity in young people, while promoting integration into Polish society.

The results of interviews with teachers and parents indicate the importance of such schools in preserving the linguistic heritage. However, several serious problems were identified that limit the effectiveness of bilingual education. Firstly, there is a significant lack of teaching aids, which complicates the process of teaching in Slovak. This includes a shortage of electronic resources and materials for extracurricular activities, despite having sufficient textbooks. Secondly, there is a shortage of qualified teachers in both villages who are proficient in both languages, which also creates difficulties in the learning process. Despite these challenges, the level of support from the community remains high, which confirms the importance of bilingual education for preserving Slovak cultural and linguistic identity. Parents and local residents actively support the existence of bilingual schools, understanding their role in preserving traditions and providing young people with the necessary linguistic and cultural knowledge to adapt to Polish society (Table 4).

Table 4: Bilingual education.

School	Language of instruction	Number of students*	Main challenges	Level of community support
School in Krempachy	Polish; Slovak	44	Lack of materials; not enough teachers	High
School in Nowa Biała	Polish; Slovak	24	Lack of modern textbooks	High

Note. *Attending Slovak language. Based on the total population of these villages, it is estimated that this represents approximately 20% of schoolchildren.
Source. Compiled by the author based on Statute of the Society of Slovaks in Poland (2025).

Polish policy regarding the support of national minorities, and particularly the Slovak minority, is primarily framed and governed by the Law of Poland on National and Ethnic Minorities and Regional Language (2005). This law represents a significant legal foundation aimed at protecting the rights and cultural identity of recognized minorities within Poland. It guarantees that members of the Slovak minority have the right to freely use their mother tongue not only in private settings but also in public life, ensuring that the language remains a living, functional means of communication within their communities. Importantly, the law stipulates that in municipalities where the Slovak minority makes up at least 20% of the population, their language can be officially used as an auxiliary language in dealings with local government authorities. This provision allows Slovak speakers to conduct administrative matters, submit documents, and receive responses in their native language, facilitating greater accessibility and inclusivity in public administration. Additionally, the legislation permits the use of minority languages in the official naming of settlements, streets, and public places alongside their Polish names. This bilingual signage not only serves practical functions but also acts as a visible affirmation of the cultural presence and historical roots of the Slovak community in Poland.

However, despite these legal provisions, the actual implementation of bilingual signage in Slovak-speaking municipalities remains relatively limited. While over a thousand localities in Poland have introduced additional names in minority languages such as Kashubian, German, Lithuanian, Belarusian, and Lemko, the use of Slovak in bilingual signs is far less widespread. Reports by the Council of Europe and minority rights organizations have noted that even in municipalities where minority languages are legally recognized for official use, the practical application of bilingual signs, including Slovak, is inconsistent and often minimal. This limited visibility of Slovak in public spaces poses challenges to fully realizing the symbolic and functional potential of bilingual language rights.

The community's support for bilingual education indicates the high value of this tool for preserving cultural heritage. Parents are keen to ensure that their children have access to education that not only provides knowledge in Polish, but also allows them to preserve their Slovak identity through the language. However, the existing difficulties, such as the lack of modern textbooks and the need to attract additional resources to train qualified teachers, require attention and support from the state and local authorities. Bilingual education is an important factor in the preservation of the Slovak language and culture among young people, but needs to be further developed through improved facilities and professional development of teachers. In order to succeed in preserving the ethnic identity of the community, it is necessary to ensure adequate support for these educational institutions, as well as to improve the processes of preparing educational materials.

4.2 Activities of cultural organizations in supporting ethnic identity

Cultural organizations, in particular the Society of Slovaks in Poland, play a significant role in supporting and preserving the ethnic identity of the Slovak community by organizing various events aimed at preserving traditions, culture, and language. The analysis of documents and interviews with participants of these events shows that cultural organizations actively contribute to the development of local communities by offering opportunities for cultural self-identification and intergenerational interaction.

Among the main activities organized by the Society of Slovaks in Poland are summer camps for young people, folklore festivals, exhibitions of folk art, as well as various cultural events dedicated to important Slovak holidays and traditions. These events not only help to maintain ethnic identity among the local community, but also provide younger generations with the opportunity to deepen their knowledge of their culture and history and strengthen their connection to their ethnic heritage. In particular, summer camps for young people are an effective tool for engaging the youth in the preservation of linguistic and cultural traditions. These camps contribute to the development of linguistic and cultural identity, as well as create conditions for the socialization of young people, giving them the opportunity to actively participate in various cultural activities including folk music, dance, language, crafts and other aspects of Slovak culture. Festivals and exhibitions organized by the Society enable communities to showcase their cultural achievements, share experiences with other communities, and engage new audiences, including young people and the wider public, in the preservation of traditions and language. These events help to maintain a high level of interest in Slovak culture among all age groups and have a positive impact on strengthening social cohesion within the community (Table 5).

Table 5: Cultural organizations.

Organization	Main events	Number of participants (annual)	Impact on identity
Association of Slovaks in Poland	Summer camps; festivals; exhibitions	∼600	Preservation of language and cultural heritage

In addition to these activities, the Society publishes a monthly magazine titled Život (Society of Slovaks in Poland, 2025), which serves as a vital tool for cultural preservation and community engagement. The magazine is published in Slovak and distributed primarily through subscriptions. It provides information on cultural events, educational opportunities, and news pertinent to the Slovak community in Poland. The publication is supported financially by the Polish government, reflecting the state's commitment to preserving minority languages and cultures. The magazine's editorial office is located in Kraków, where it also hosts Slovak language courses, further promoting linguistic and cultural education.

Secondary literature published in Slovakia and Poland in Slovak and Polish provides valuable reflections on the broader significance of these cultural initiatives. For example, a recent study explores how the Slovak minority perceives its own cultural identity and how it is seen by others, emphasizing the formative role that ceremonies, language initiatives, and media – often spearheaded by the Society – play in sustaining ethnic identity. This study confirms that the Society's activities are not merely symbolic but function as key instruments of cultural continuity. Earlier, M. Potočárová (2020) analyzed the development of Slovak minority schools in the Orava region, highlighting how education supports cultural cohesion and facilitates the intergenerational transmission of traditions.

The activities of cultural organizations, such as the Society of Slovaks in Poland, are important for preserving and maintaining the ethnic identity of the Slovak community. Through the organization of summer camps, festivals and exhibitions, these organizations help to strengthen the connection of young people with their cultural heritage and linguistic identity. However, in order to further develop these activities,

it is necessary to increase the level of funding and access to cultural resources, which would allow for even more events and more participants.

4.3 Attitudes of local residents towards preserving ethnic identity

An analysis of local residents' attitudes toward preserving ethnic identity, based on interviews, showed that attitudes toward traditions and their role in the cultural life of the community differ among different age groups. This is especially evident in the attitudes toward participation in cultural and religious rituals that are directly related to the maintenance of ethnic identity. Young people (18-30 years old) show a positive attitude toward folklore festivals but a reduced interest in religious rituals, such as Easter or Christmas celebrations. This is likely due to the dominance of modern cultural practices and assimilation into the Polish environment, which significantly affects the perception of traditions. It is important to note that the role of religious rituals in national identity has historically been limited, particularly because both Poles and Slovaks are predominantly Catholic. Their religious traditions, therefore, are expected to be very similar, with minor variations possibly related to specific saints.

Young people are more inclined to participate in events that do not have a strong religious background but instead reflect modern cultural trends. However, despite their decreased interest in religious aspects, they still recognize the importance of traditions for preserving the cultural heritage of the community. Middle-aged people (31-50 years old) demonstrate significantly higher activity in supporting both religious and cultural rituals. People in this age group are usually the main organizers of festive events and festivals, which indicates that they play a major role in maintaining and passing on traditions to younger generations. However, representatives of this group also note that economic factors, such as time constraints due to work and financial difficulties, prevent them from fully participating in all cultural activities. These difficulties, however, do not diminish their commitment to the traditions they are trying to preserve and pass on.

The older generation (50+ years old) has a very high commitment to tradition and actively participates in religious and cultural rituals. For older people, traditions are an important part of their daily lives, and religious holidays and festivals are an opportunity not only to preserve cultural heritage but also to maintain social ties in the community. However, they also note that the participation of young people in these events is insufficient, which may jeopardize the preservation of traditions in the future. The older generation is actively working to pass on their knowledge and experience, but they face a lack of interest from younger generations. Table 6 demonstrates the difference in attitudes and participation of different age groups in the preservation of traditions. It is important to note that young people, although they support folklore events, demonstrate a reduced activity in religious rituals. On the other hand, older generations are much more actively involved in the preservation of traditions and cultural practices, which underscores their high commitment to cultural heritage. It is important to note that these processes are facing difficulties, in particular due to the assimilation of young people into Polish society and economic difficulties that limit the possibilities for organizing cultural events.

Table 6: Attitudes of local residents towards the preservation of ethnic identity.

Age group	Attitude to traditions	Active participation in events	Obstacles to preserving identity
Young people (18–30)	Positive attitude towards folklore festivals	Medium	Influence of assimilation; interest in contemporary culture
Average age (31–50)	Support for religious and cultural practices	High	Economic factors

Senior citizens (50+)	High commitment to tradition	Very high	Low participation of young people

Note. Entries summarize reported attitudes across age groups.

The biggest obstacles to the preservation of ethnic identity are economic difficulties that limit the community's ability to organize cultural events, as well as the assimilation of young people into the increasingly globalized Polish society. This shift in focus, rather than integration into the Polish-specific environment, often leads to reduced interest in traditions. Young people are not necessarily eager to adopt Polish traditions over Slovak ones; instead, they are integrating into a broader global culture, where local ethnic customs, including those of the Slovak minority, may be overshadowed. To effectively preserve cultural heritage, it is important to engage young people through innovative approaches that combine traditional elements with modern cultural practices.

The analysis of attitudes towards traditions among different age groups of the community showed significant differences in their activity and interest in participating in cultural and religious events. Young people (18-30 years old) show a high interest in folklore festivals, but their participation in religious ceremonies is minimal. This indicates a growing priority of cultural events related to music, dance and other elements of folk art over religious traditions. In the middle-aged group (31-50 years old), there is a more even interest in religious rituals and folklore events. This age group actively supports traditions and participates in religious festivals and rituals, which indicates their desire to preserve the spiritual component of their culture. At the same time, the middle generation also actively participates in cultural events, which allows them to maintain a connection with traditions and educate younger members of the community. The highest level of commitment to traditions is observed among the older generation (50+ years old). This generation actively participates in religious rituals such as Easter and Christmas and actively supports the preservation of folk traditions. Older community members have the highest level of interest in preserving cultural heritage and are often the main carriers of traditional knowledge and practices (Table 7).

Table 7. Comparative analysis between different age groups

Age group	Interest in religious rituals	Interest in folklore events	Forecasts for the future of traditions
Young people (18–30)	Low	High	Moderate level of preservation
Average age (31–50)	Medium	High	High level of preservation
Senior citizens (50+)	High	High	Very high level of preservation

There are differences in attitudes towards traditions among generations: the elderly are more likely to preserve religious rituals, while young people are less likely to participate in religious practices, although they are actively involved in cultural events. To preserve the heritage, it is necessary to attract sponsors, develop volunteer activities, and support youth initiatives. In general, preserving Slovak cultural heritage is an important task for the whole community, and all age groups play a large role in this process. Traditions, although facing various challenges, remain important elements that help to preserve ethnic identity and build a sense of belonging.

4.4 Obstacles and challenges in preserving cultural heritage

The preservation of the cultural heritage and ethnic identity of the Slovak community in Poland faces several significant obstacles. During interviews with local residents, educators and cultural figures, as well as documentary analysis, several key factors were identified that make it difficult to maintain traditions and language. These obstacles include assimilation processes, insufficient state support for bilingual education, and economic difficulties faced by both individual families and cultural organizations.

Assimilation into Polish culture is one of the main obstacles to preserving Slovak identity. In particular, assimilation processes lead to a decrease in interest in traditions, which is especially true for younger generations. Young people are more integrated into Polish society and culture, which leads to a decrease in their participation in cultural and religious rituals that are part of Slovak heritage. To combat this challenge, measures have been proposed to organize youth events, festivals, and to create conditions for the exchange of experience between young people and the older generation. The aim is not only to support traditions, but also to promote awareness of the importance of preserving ethnic identity in the context of globalization (Doszhan, 2023). Insufficient state support for bilingual education also significantly affects the preservation of the Slovak language among young people. There is a lack of effective educational resources, such as modern textbooks, specialized language learning materials, and insufficient funding for bilingual classes and schools. These difficulties create obstacles to proper language learning and development in schools, which reduces the level of language competence among students. To overcome this problem, it is necessary to attract sponsors and cultural organizations to fund initiatives aimed at supporting bilingual education. It is also important to establish cooperation with government agencies to increase state funding to ensure the sustainability and development of bilingual programmes.

Economic challenges have become another significant obstacle to the preservation of the community's cultural heritage. Limited resources do not allow for organizing all the necessary cultural events, such as festivals, exhibitions, and summer camps, which are important for maintaining traditions. The economic instability in the region makes it difficult for cultural organizations to develop. The economic and geographical limitations of the area where these villages are located are significant factors. This is a somewhat peripheral rural area, poorer than the Polish (and Slovak) average, and characterized by mountainous terrain with limited road infrastructure and little tourism. These conditions, while posing financial limitations, can also favor the preservation of traditions, as they contribute to maintaining a close-knit community and a strong connection to local customs. To overcome the economic difficulties, local organizations and communities have begun to actively engage volunteer help and use local funds to finance cultural projects. There is also a need to invest more in partnerships with other communities and cultural institutions to cover the costs of organizing events. Table 8 illustrates the main obstacles and possible measures to overcome them.

Table 8. Obstacles and challenges in the preservation of cultural heritage

Obstacle	**Impact on the preservation of traditions**	**Measures to overcome**
Assimilation with Polish culture	Declining interest in traditions	Organization of youth events
Insufficient state support	Reducing the number of bilingual schools	Attracting sponsors and organizations
Economic challenges	Difficulties in holding events	Volunteer assistance; local funds

Preserving the cultural heritage of the Slovak community in Poland requires an approach that includes combating assimilation processes, supporting bilingual education, and overcoming economic challenges.

5 Discussion

This study of Slovak culture and identity in Poland shows that the preservation of traditions and cultural practices is a key element in maintaining the ethnic identity of the Slovak community. The main cultural instruments that support identity are folklore festivals, religious rituals and bilingual education, although each of these elements faces certain challenges in the context of globalization and assimilation. The findings of this study are consistent with many works that examine the preservation of minority cultural heritage.

A meaningful comparative perspective emerges when juxtaposing the Slovak minority in Poland with other Carpathian highlander communities such as the Gorals and Lemkos. For instance, linguistic and ethnographic studies underline the uniqueness of the Goral ethnolect as a blend of Polish and Slovak linguistic elements, predominantly used in religious, folkloric, and domestic contexts (Afanasev et al., 2023). Similar to the Slovaks in southern Poland, Goral communities emphasize festivals, dialectal speech, and Catholic rituals to sustain collective identity. However, Goral identity is typically nested within a Polish national framework and lacks the institutionalized ethnic autonomy, such as bilingual schooling or official minority status, that characterizes the Slovak case. Therefore, while both communities demonstrate strong tradition-oriented lifestyles, the Slovaks maintain a clearer ethnonational boundary due to their formal minority recognition and sustained cross-border cultural linkages with Slovakia.

In contrast, the Lemkos, a Rusyn-speaking Eastern Slavic minority, represent a model of resilient, trauma-forged identity preservation. Studies show that the Lemko language is primarily confined to family and community spheres with markedly reduced intergenerational transmission (Skrodzka et al., 2020). This linguistic vulnerability is counterbalanced by a strong ethnic consciousness shaped by historical trauma, notably the forced displacements of Operation Vistula in 1947. While the Slovaks in Poland have not experienced such acute ruptures, they too face assimilation pressures and demonstrate signs of linguistic retreat, albeit buffered by institutionalized bilingual education. This positions the Slovak community between the two models: more culturally integrated than the Lemkos but more ethnically distinct than the Gorals.

The study by A. Saefudin et al. (2023) examined the impact of cultural practices on social ties in the Aboge Muslim community in Indonesia. The authors found that culture is a key factor in maintaining social stability and identity, and cultural practices become the basis for adaptation to social change. These conclusions are in line with the findings of the present study, which highlighted the importance of cultural events in maintaining social cohesion among the members of the Slovak community in Poland. Folklore festivals and religious ceremonies have become important elements of preserving traditions and cultural identity. Similarly, S. Letavajová's (2020) research on the Slovak community in Sarvaš, Hungary, underscores the significance of annual and family customs in shaping ethnic identity. Through fieldwork conducted in the summer of 2019, S. Letavajová identified a "bipolar" or "double" Slovak-Hungarian identity among respondents, reflecting a complex interplay of cultural affiliations. Her study also observed a decline in traditional practices, attributed to factors such as institutionalization, reduced religiosity, demographic changes, and the influence of media and Western culture. These findings resonate with the present study's observations on the gradual erosion of traditional cultural practices among the Slovak community in Poland due to similar socio-cultural dynamics.

In turn, the study by A. Örkény and E. Sik (2011) on the Slovak community in Hungary pointed to the importance of language policy as a mechanism for preserving national identity. The authors found that knowledge of the mother tongue among young people is a key factor for preserving ethnic identity, and also emphasized the role of state support in this process. The results of our study confirmed these conclusions: bilingual education in Poland was one of the main tools for preserving the Slovak language among young people, although it was significantly influenced by assimilation processes and globalization trends. L. Macháček (2011) examined the socio-cultural reflections of the Slovak minority in Hungary, and he also pointed out the importance of maintaining cultural identity through linguistic and cultural autonomy. In the context of the study, it was noted that assimilation processes lead to a gradual decline in the participation of young people in traditional cultural practices. The findings of the present study confirm this conclusion, as young people in the Slovak community in Poland were increasingly integrated into the wider Polish culture, which had a negative impact on their participation in folklore and religious events.

In their study, L. Jiao et al. (2023) examined the issue of preserving traditional culture through typomorphological approaches in the historic district of Guangzhou. The authors showed how local cultural traditions can be maintained in the face of rapid urban development. Our study revealed a similar trend: problems related to globalization and urbanization are still threatening the preservation of traditions in Slovak communities in Poland. At the same time, both studies emphasized the importance of preserving cultural heritage through education and communities to prevent the erosion of identity. It is also worth paying attention to the study by L. Khairani and K. Wiradnyana (2023), which examined the evolution of ethnic folklore as an element of power and legitimacy in traditional Indonesian societies. The authors found that the preservation of ethnic folklore ensures not only cultural stability but also political legitimacy. This is similar to the findings of this study, which highlighted that traditional folklore events in Slovak communities in Poland serve not only to preserve cultural identity, but also to promote political and social stability in the communities. K. Lomen (2024) analysed the funeral laments of the Slovak community in Serbia, showing how traditions related to rituals maintain identity in the diaspora. Our own study reflects similar findings to his, where rituals and religious practices (including funeral traditions) have become an important way of preserving the cultural identity of the Slovak community in Poland. At the same time, it was noted that changes in society and assimilation processes contribute to the weakening of participation in such activities among young people.

Another aspect is the relationship between food traditions, culture, and identity in multicultural societies. In the context of Singapore, it was studied by G. Reddy and R.M. van Dam (2020). The authors concluded that the preservation of traditional food practices is an important aspect of cultural identity. This resonates with the findings of our study, where religious and cultural traditions have become key to maintaining identity, and assimilation has led to a decrease in youth participation in traditional practices. In this regard, the interaction of national identity and transnational connections may play a significant role, as discussed by K. Zhao and C.Y. Hoon (2024) using the example of a Chinese temple in Brunei. The authors found that in the context of cultural globalization, transnational connections can affect national identity, creating conditions for traditions to be preserved within a global culture. This study bears a strong resemblance to our own research, which found that the Slovak community in Poland actively maintains its cultural practices, but they are also affected by globalization processes that lead to assimilation.

The study by I. Chervinska et al. (2017) focuses on the traditions and beliefs of highland communities as a way of preserving ethnic identity. The authors show how important cultural practices are for the self-determination of peoples living in remote or mountainous regions. This study is important for comparison with the situation in the Slovak community in Poland, as many traditions related to religious rituals, music, and crafts continue to be key elements of self-identification in communities where ethnic self-determination prevails. The Slovak community in Poland, like the highland communities, actively uses its cultural heritage as a way of preserving ethnic identity. P.R. Brass (2024), in his work on elite groups and the manipulation of identity symbols among South Asian Muslims, examined how elites use cultural symbols to reinforce a sense of national identity. This echoes the findings of our study, which highlight that cultural organizations in Poland also play a role in maintaining and broadcasting cultural identities through the manipulation of symbols such as religious rituals and folklore practices. The study by M. Yapp (2024), in turn, provides a more general approach to understanding political identity through language and religion, which is important for understanding political processes in many South Asian countries. The results of our study correlate with these findings by showing how religious practices and language have become important aspects of the political identity of the Slovak community in Poland.

M.C. Waters' (2022) study examined ethnic and racial identities among second-generation African American immigrants in New York City, emphasizing the complexities of integration not only into the broader American mainstream culture but also into African American cultural contexts, highlighting the layered nature of assimilation processes. Similarly, the study by R. Sharmin and P. Boski (2024) examined how bicultural identity can affect the lives of Bengali immigrants in the UK, highlighting the crucial role of integration into a new culture in improving living standards and overall well-being. However, in the case of Polish and Slovak immigrants, the dynamics of integration may differ. Given the cultural proximity and similar standards of living between Poland and Slovakia, the incentives for rapid assimilation may not be as

strong as for migrants from more distant cultures, such as the Bengali community in the UK. At the same time, the shared cultural background of Poles and Slovaks facilitates smoother adaptation and reduces the obstacles typically encountered in the integration process. These results are consistent with the findings of this study, which indicate that young people in the Slovak community in Poland are increasingly identifying with Polish culture. This shift is evident not only in their weakening ties to Slovak traditions but also in their limited participation in both Slovak and Polish traditional cultural activities.

An analysis of the socio-cultural life of Roma in Lunik IX by P. Sivák (2024) shows how socio-economic conditions and political processes affect the preservation of ethnic identity. The author argues that social and economic barriers often lead to the marginalization of ethnic groups. However, it is not necessarily the case that marginalization inevitably leads to the loss of cultural identity; it may also contribute to its preservation by preventing assimilation. For instance, Jews in the Russian Empire before the First World War were marginalized in many ways, yet this did not result in the loss of their cultural identity. This study has parallels with the realities of the Slovak community in Poland where, despite the preservation of many cultural traditions, globalization and social change pose a risk of losing some aspects of traditional identity, especially among young people. Similarly, N. Taptiani et al. (2024), emphasize that globalization can lead to the loss of unique cultural characteristics, but can also provide a platform for cultural exchange. This reinforces the results of our study, which noted that the Slovak community in Poland is experiencing both the impact of globalization and efforts to preserve its traditions. Especially in the context of migration and changing social structures, globalization is becoming a factor that forces both the majority and minorities to adapt their cultural practices to new realities. The study by C. Kealy and C. Devaney (2023) emphasizes the role of culture in childrearing among Polish migrants in Ireland. The authors note that cultural traditions can have a significant impact on the style of parenting and socialization of children in multicultural societies. This is similar to the results of the present study, which observed the importance of maintaining identity in children of the Slovak community in Poland through cultural practices and educational activities. However, it is noted that current trends towards assimilation into Polish society contribute to a diminishing role of traditions in the upbringing of the new generation.

Research conducted on Slovak minorities in Romania provides valuable comparative insight, particularly in relation to the dynamics of language, culture, and identity preservation. L. Lenovský's (2018) study on the Slovak minority in Hungary, Serbia, and Romania highlights the critical role of language in maintaining ethnic identity, especially in communities facing pressures of assimilation and globalization. L. Lenovský asserts that language, as the primary ethno-identification tool, remains a cornerstone of cultural continuity, even in the context of societal shifts. This argument is particularly relevant when considering the Slovak minority in Romania, where language functions not only as a medium of communication but also as a symbol of ethnic cohesion. The study reveals that, much like the Slovak communities in Poland, the Slovak language acts as an essential link to cultural practices, reinforcing social bonds and fostering a collective sense of identity. Similar to L. Lenovský's findings, our study underscores the significant role of bilingual education in maintaining Slovak language proficiency among the younger generation, despite challenges posed by economic pressures, limited resources, and the broader forces of assimilation. It is evident that both in Romania and Poland, bilingual education serves as a critical tool for ethnic identity preservation, but its effectiveness is contingent on overcoming systemic obstacles such as outdated educational materials and a shortage of qualified teachers. Furthermore, the mutual influence between language, culture, and identity becomes clear when considering the experiences of Slovak minorities across Central Europe. The experiences of Slovaks in Romania mirror those in Poland, revealing the challenges faced by minority communities in maintaining their cultural heritage in the face of globalization. The comparative insights drawn from both regions reinforce the importance of continuing to support cultural and educational initiatives aimed at preserving ethnic identity in a rapidly changing world.

The study by P. Cucco et al. (2023) refers to the model of adaptive use of cultural heritage in accordance with the Sustainable Development Goals and European quality principles. This study provides a deeper understanding of how cultural heritage can be preserved not only through physical objects, but also through the adaptation of cultural practices to modern requirements and standards. We observed a similar situation among the Slovak community in Poland, where the preservation of cultural traditions

is not only a matter of preserving material heritage, but also includes new forms of social practices that allow for adaptation to the changing socio-cultural environment. The study by G. Tagiuri (2014) also examines the process of identity formation within the European Union and its relationship with European culture. The author examines how identity in the EU is formed through the coexistence of different cultural traditions and integration processes. These ideas are important for understanding the situation in Poland, where the Slovak community actively preserves its identity in the context of European integration. As our own research has shown, the preservation of Slovak identity in Poland is an important factor of cultural interaction and integration into the larger European community, which allows preserving traditions without breaking away from common European values. The influence of culture on identity formation in the context of European integration was also considered by S. Constantin and G. Rautz (2003). They argue that culture is an integral part of identification processes in European societies, and that preserving cultural traditions is important for the formation of stable political and social structures.

In the context of the Slovak community in Poland, this study emphasizes the importance of cultural traditions, not only in shaping national identity but also in nurturing a deep sense of local belonging, such as the connection to the High Tatras region. This regional affiliation plays a significant role in the formation of both national and local identities, a process particularly relevant in the face of postmodern globalization and the integration into the broader European context. Most studies, like this one, point out the importance of preserving cultural heritage and adapting to new conditions without losing identity. All of them demonstrate that identity culture is not only the basis for social self-determination, but also a prerequisite for socio-political stability in a globalized world.

6 Conclusions

The study of the cultural practices and traditions of the Slovak community in Poland allowed for a deeper understanding of the role of cultural events, education, and civic initiatives in preserving ethnic identity. The analysis of field observations, interviews with local residents, and documentary sources demonstrated the importance of cultural practices such as folklore festivals, religious rituals, and the activities of cultural organizations for the maintenance and development of Slovak ethnic identity in modern Poland. At the same time, key obstacles to the preservation of this identity were identified, including the impact of assimilation processes, economic difficulties, and limited support from state authorities.

One of the main findings of the study was the confirmation that cultural events, such as folklore festivals and religious ceremonies, are important elements of cultural heritage and active tools for maintaining identity. Folklore festivals, as observed in the villages of Krempachy, Nowa Biała, and Łapsze Wyżne, bring together different generations of the community, giving them the opportunity to experience important elements of national culture, such as traditional music, dance, and national costumes. Religious rituals, such as Easter and Christmas, have not only spiritual but also cultural significance, contributing to the preservation of symbols of Slovak identity through rituals passed down from generation to generation.

An analysis of local residents' attitudes to the preservation of traditions has shown that young people, although less actively involved in religious rituals, still show a significant interest in folklore events, which underscores the importance of adapting cultural initiatives to the needs of the younger generation. Older generations show a strong commitment to traditions, which underscores the importance of preserving religious and cultural rituals as an important element of identity. However, young people, as the results of the study show, face certain barriers to participation in traditional rituals, such as the influence of modern culture, economic factors, and assimilation with Polish culture. A key role in preserving the language and culture of the Slovak community is played by bilingual schools, particularly in Krempachy and Nowa Biała, which provide Slovak-language instruction for local children. However, despite the importance of these educational institutions for preserving linguistic identity, they face challenges related to the lack of teaching materials and qualified teachers. This demonstrates the need for state support to ensure effective mother tongue education, which is an important factor in preserving the ethnic identity of future generations.

The activities of cultural organizations such as the Society of Slovaks in Poland contribute to the

maintenance and preservation of traditions and language through the organization of festivals, summer camps, and exhibitions. However, their sustainable development requires more financial and institutional support, as well as the involvement of more sponsors and partners. Therefore, one of the main areas for further development is to strengthen financial and organizational support for such initiatives. In general, the results of the study showed that the preservation of Slovak ethnic identity in Poland depends on the active involvement of the local community in cultural initiatives, language preservation through bilingual education, and support from cultural organizations. At the same time, to ensure the sustainability of these processes, it is necessary to take into account current challenges such as the impact of assimilation, economic difficulties, and limited state support.

To address the identified challenges and support the preservation of Slovak ethnic identity in Poland, it is recommended to create programs aimed at engaging young people in religious and cultural practices, taking into account their interests and current needs. This can help bridge the generational gap and ensure the continuity of cultural heritage. Future studies should expand the sample of studied communities and compare the situation in different regions of Poland to gain a more comprehensive understanding of the challenges and opportunities for preserving Slovak ethnic identity. Additionally, further research should investigate the relationship between cultural initiatives and economic factors that may influence the community's activity in preserving its identity. Understanding these dynamics can provide insights into how economic conditions impact cultural preservation efforts.

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Addressing Violence against Women through Zimbabwean Hip-Hop Music: A Case Study of Holy Ten's Selected Songs

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Abstract

Violence against women (VAW) remains a pervasive social issue in Zimbabwe, often perpetuated by entrenched cultural norms and limited public discourse. In recent years, popular music — particularly hip-hop — has emerged as a powerful medium for addressing social injustices and advocating for change. The purpose of this study is to examine how VAW is represented and addressed in Zimbabwean hip-hop music, focusing on selected songs by Holy Ten, one of the country's most influential contemporary artists. Specifically, the study investigates how his music influences public awareness and attitudes toward VAW. A qualitative, exploratory research design was employed, using purposive sampling to select four of Holy Ten's songs: Pfumo (Spear) (2022), Kumba Kune Vanhu (There are People at Home) (2020), Pandichamuka (When I Wake Up) (2021), and MaChills (Chills) (2021). Data was collected through lyrical analysis and supported by secondary sources such as interviews, online articles, and audience commentary on digital platforms. The findings reveal that Holy Ten's music vividly portrays various forms of VAW, including economic exploitation, emotional manipulation, and domestic abuse. His narrative style not only critiques societal norms but also raises awareness and promotes dialogue on these issues. Additionally, the study found that his music fosters a deeper public understanding of the complexities surrounding VAW and influences attitudes towards rejecting violence in personal and communal spaces. The study concludes that Holy Ten's work contributes significantly to shifting public perceptions and encouraging positive behavioural change. It recommends that more artists leverage their platforms to address VAW and partner with advocacy initiatives to amplify their social impact. This study ultimately underscores the transformative potential of music as a tool for confronting deeply rooted social issues.

Keywords: Violence against women, Holy Ten, Zim hip-hop music, Music journalism

1 Introduction and Background

Violence against women (VAW) especially in connection with sexual and intimate relationship abuse is a serious public health issue and a violation of women's human rights (WHO, 2024). It compromises the health, dignity, and human rights of women and girls as it appears in various forms such as emotional manipulation, physical abuse, and sexual violence. VAW has multiple causes that vary by context. In many African contexts, for instance, it is linked to traditional gender roles, patriarchy, and socio-economic factors such as poverty and unemployment (Baldasare, 2012). In Zimbabwe, VAW is linked to socio-economic factors like poverty and unemployment, alcohol and drug abuse, and a patriarchal societal structure (Musarandega et al., 2021). To address the challenge of violence against women, it is necessary to implement multidimensional interventions that challenge the ingrained gender inequality that supports these abuses, and to provide assistance to victims while also promoting social change.

At the international level, there have been several conventions and protocols aimed at reducing violence against women. These include, but are not limited to the Convention on the Elimination of

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All Forms of Violence against Women (CEDAW), Beijing Platform for Action, and Council of Europe Convention on Preventing and Combating Violence against Women and Domestic Violence. In addition to these, in October 2000 the United Nations Security Council unanimously passed the United Nations Security Council Resolution 1325 (UNSCR 1325) to address violence against women in wars and other dysfunctional conflicts. At the regional level, the Maputo Protocol provides a progressive framework to reduce VAW in Africa. Zimbabwe is a signatory to a legion of international and regional protocols on gender and women empowerment (Changa & Ndawana, 2024). It ratified CEDAW in 1991 and the Protocol to the African Charter on Human and People's Rights on the Rights of Women in Africa (also known as the Maputo Protocol) in 2007. Zimbabwe also endorsed the SADC Protocol on Gender and Development in 2009 (Zhou et al., 2022).

At the national level, the country has also shown its commitment to reduce VAW through legal, institutional and policy frameworks. The Domestic Violence Act of 2007 signifies a crucial step in protecting women from violence within families. This is also supported by the Gender Based Violence Strategy (2012-2025), which provides some guidelines on how to tackle VAW. Despite all these efforts, VAW remains a pervasive problem globally, with statistics indicating that 1 in every 3 women has experienced violence (WHO, 2021). In complementing the legal, policy, and institutional efforts to curb VAW, music has come in handy to challenge the dominant attitudes and beliefs that lubricate VAW. The centrality of music in fighting VAW lies in the fact that it plays a large role in African culture (Chitando & Chitando, 2008) and can therefore provide a powerful outlet for challenging negative attitudes against women.

African popular music has been deployed to address societal ills in Zimbabwe such as drug abuse, economic collapse, political violence and bad governance (Gwekwerere et al., 2018); Ureke & Washaya, 2016). As such, its power in voicing against VAW cannot be dismissed. As argued by Chitando and Chitando (2008, p. 62), 'music accompanies the African from the cradle to the grave', it imparts values, entertains, consoles the bereaved and cements relationships. Because of this inherent quality, music can thus be a formidable force in shaping or reconfiguring society's attitudes (Mutanda, 2024), including those related to VAW. Bastein (2009, p. 1358) confirms this observation by arguing that songs in Africa have been used as forms of narrative intervention, often incorporated into entertainment education strategies. Zimbabwean popular musicians such as Oliver Mtukudzi have used their music to address various social ills, including VAW. Mtukudzi, for instance, utilised language in his music to fight for women's and children's rights and agitate for the reconstruction of an African identity. His music is both functional and valid art as it advances Africanity in a multicultural context (Mapuranga, 2012). However, in light of the matter at hand, it should be noted that the power of music is not one way, as different genres of music have different impacts on the issue of VAW with some genres reinforcing negative stereotypes and attitudes towards gender and sexuality, while others may challenge and transform them (Ayinla & Amenaghawon, 2021; Mlamla et al., 2021). As such the impact of music on VAW is complex and multifaceted, involving factors such as the content of the music, the context in which it is produced and consumed, and the cultural and social norms that it expresses and shapes (Simmonds, 2022; Kung'u & Kamau, 2023).

The significance of popular music in addressing VAW is two-fold. First, VAW is not a problem that is easily controlled with legislation because laws are difficult to enforce in the domestic sphere, and the cause of the problem lies in people's attitudes: toward women, violence, the nature and purpose of marriage. To exemplify, South Africa still faces high levels of violence against women despite registering more than 26 years of democracy and having some progressive laws against it (Morchain et al., 2015). This is partly because of the country's inability to observe and honour its own constitution on matters of equity and equality. Even in Zimbabwe, violence against women continues to increase despite the passing of legislation on gender-based violence such as the Domestic Violence Act of 2006 (Chuma & Chazovachii, 2012). Therefore, people's ways of thinking are the place to look for both causes and remedies of violence against women. Behavioural change, and this means cultural change, is needed. Second, music, as a central aspect of reality in Africa (Nketia, 1974), can be an important vehicle to both express and influence people's attitudes on matters of violence against women.

This study focuses on Zim hip-hop, a genre that emerged from the marginalized and oppressed communities of the African diaspora and which has been used as a tool for social critique, resistance, and

empowerment. In Zimbabwe, hip-hop has been growing in popularity and influence especially among the youth, who use it to voice their opinions and aspirations on various issues including VAW. This study believes that Zim hip-hop is well-suited to communicate and manage VAW because of its roots in social critique and resistance, its popularity and influence among the youth, and its potential for creative and innovative expression given that Zimbabwe is a youthful nation. This is confirmed by the 2022 Population and Housing Census which reveals that the youth constitute 46% of the population in Zimbabwe (ZIMSTATS, 2022). It is argued in this study that hip-hop in Zimbabwe has developed into a powerful platform for underrepresented voices, enabling musicians to address and reflect on urgent societal concerns including VAW, poverty, and corruption. Zim hip-hop from Zimbabwe provides a distinctive perspective on these social issues, striking a chord with a younger audience and acting as a potent instrument for activism and awareness-raising.

This study analysed how VAW is represented and addressed by one of the most prominent and influential hip-hop artists in Zimbabwe, Holy Ten, who is known for his socially conscious and politically engaged lyrics, which often touch on issues such as poverty, corruption, and violence. As such, the study contributes to the existing literature on VAW and popular music by providing a case study of hip-hop in Zimbabwe, which is an under-researched and under-represented context to understand the specific ways in which hip-hop music contributes to the prevention and reduction of VAW, and how it is effectively used in interventions and campaigns against VAW. This study therefore provides insights on how Zimbabwean hip-hop can be used to promote social change by functioning as a platform to advocate against violence and to change the way society views women.

2 Nature of violence against women

As highlighted earlier, VAW is a global problem that affects individuals and societies at different levels. Women and girls of all races, colours and creeds are vulnerable, partly because of their biology (Dzinavane, 2016). Globally, the statistics are staggering. A comprehensive study by the WHO (2024) reports that approximately 1 in 3 women worldwide have experienced physical or sexual intimate partner violence or non-partner sexual violence, highlighting the ubiquity of this issue. At the continental level, the research by Uthman et al. (2009) illustrates a harrowing picture in Africa, where intimate partner violence in certain regions reaches prevalence rates as high as 66.3%. Zooming in on Zimbabwe, Shamu et al. (2016) deduce that intimate partner violence prevails widely, afflicting 42.7% of the population.

The empirical literature on the subject, encapsulated in the systematic review by Muluneh et al. (2020), outlines multiple types of violence that women face in Sub-Saharan Africa, indicating pervasive issues of physical, sexual, and psychological violence Their results indicate that this is a systemic issue rather than isolated incidents. This holistic perspective is mirrored in White et al.'s (2024) meta-analysis, which articulates a troubling global prevalence of intimate partner violence and its detrimental mental health outcomes, charting a multidimensional landscape of abuse with significant implications for women's mental health.

The relationship between male gender socialisation and gender-based violence has been examined by Fry, Skinner and Wheeler (2019), particularly within refugee populations in Sub-Saharan Africa. Their findings insinuate that traditional masculine norms can underpin attitudes and behaviours that justify or exacerbate violence against women and girls. Expanding further, Alderton et al. (2020) explore urban liveability, revealing the interlinkages between city planning, gender norms, and the safety of women, articulating how urban environments can either mitigate or aggravate VAW risks.

This study contributes to on-going debates on the role of music in the fight against VAW by focusing on the potential of Zim hip-hop lyrics produced by Holy Ten to challenge the normalisation of abuse of women and advocate behaviour change. Previous studies on music and VAW have largely focused on how different genres promote VAW. A study by Chari (2008), for example, revealed that musical lyrics produced by male artists in Zimbabwe celebrate negative stereotypes, violence and commodification of women. Zhou et al. (2022) note that music can normalise VAW by portraying women as sex objects or by demonstrating lack of respect for women as equal human beings. Certain songs use derogatory terms for women to show subordination or tell stories about abuse to affirm male superiority. In relation to hip hop music in general,

scholars have also focused mostly on the negative aspects. Adams and Fuller (2006) for example believe that hip-hop music promotes domestic violence and misogyny. The music and videos by international hip-hop artists such as Eminem, Ludacris and Ja Rule have largely been blamed for depicting women as sex objects with the result of perpetuating violence against them (ibid). Yende (2022) vehemently criticizes contemporary hip-hop music as contributing to toxic masculinity which propels VAW. Echoing the same sentiments, Ncube and Chipfupa (2017) view hip-hop music as a music genre replete with foul language, hyper masculinity, misogyny and violence. This overemphasis on the negative aspects of hip-hop music has detracted attention from the positive role of the genre in challenging the harmful stereotypes and attitudes that perpetuate VAW.

The current study examines how Zim hip-hop, a genre that has been associated with violence, aggression, deviance and misogyny, provides some artistic activism against VAW. The uniqueness of this study lies in its focus on a male artist, Holy Ten, singing anti-VAW lyrics. This is contrary to Zhou et al. (2022), who focused on how female artists raised their concerns through music. This study challenges orthodox claims that male artists always produce lyrics that glorify the subordination and oppression of women in society (Chari, 2008), and simultaneously proves that not all men, let alone Zim hip-hop artists, are enemies of women's liberation and empowerment. To successfully show how Holy Ten's music provides social commentary on VAW, the study is guided by three interrelated objectives: how the music identifies the different forms of VAW, how the music challenges the dominant behaviours that lubricate VAW, and the reflection of agency on the part of the abused women.

3 Zimbabwean hip-hop, VAW, and the theory of social change

Zimbabwean hip-hop (also known as Zim hip-hop) emerged in Zimbabwe in the early 1990s, influenced by global hip-hop culture and local social and political issues (Ncube & Chipfupa, 2017). Zim hip-hop is characterized by its fusion of traditional African rhythms and modern hip-hop beats, as well as its use of indigenous languages and diverse lyrical themes. Zim hip-hop artists often address topics such as poverty, corruption, violence, identity, and resistance (Chidora et al., 2023).

Given the rise of the new generation of Zim hip-hop artists, such as Holy Ten, Tehn Diamond, Bling 4 and Voltz JT among others, an exploration into the content of their music is crucial for understanding the themes of violence against women (VAW) that their work enunciates. While the global influence of hip-hop is significant, Zim hip-hop has begun carving its distinct niche, focusing on local struggles that mirror daily realities, which would include addressing the pervasive issue of VAW (Chidora et al., 2023). Zim hip-hop serves not just as a reflection of daily life but increasingly as a platform for socio-political engagement, including campaigns against VAW. The themes of VAW within hip-hop songs are multi-layered and often encompass aspects such as physical abuse, emotional and psychological manipulation, and economic control. Essential to this is how Zim hip-hop portrays these narratives, whether reinforcing negative stereotypes or challenging the status quo to instigate positive changes. However, the scant literature reveals a gap within academic discourse, which somewhat limits the understanding of these forms. Therefore, this study aims to close this gap by looking closely at Holy Ten's music, to see how he incorporates the themes on VAW and the interaction of his listeners and fans with the music he sings.

The analysis of the selected Zim hip-hop songs is based on the theory of social change which aims to empower individuals and communities to prevent VAW. The theory of social change also advocates measures to eventually eliminate violence against other people based on their gender. According to Ngcobo (2024), music serves as an effective tool for challenging societal norms surrounding VAW. By analysing Holy Ten's selected lyrical content and audience engagements with the songs, this study explores how Zim hip-hop contributes to either positive or negative change towards VAW.

4 Methods

The study utilised qualitative methodology and data were gathered mainly from Holy Ten's four songs selected from YouTube. This was important in appreciating the role of Zim hip-hop music in articulating violence against women. The study focused on Holy Ten as a case study because, as highlighted previously, he is one of the most popular and influential Zim hip-hop musicians. Holy Ten has been vocal about VAW and has collaborated with various organisations and campaigns to raise awareness and advocate change. Four songs were purposively sampled based on their link to the theme of VAW: *Pfumo* (Spear), *Kumba kune Vanhu* (There are people at home); *Pandichamuka* (When I wake up) and *Machills* (At the Chills). Chat box comments were purposively filtered by selecting those that directly focus on VAW and nothing else. This is mainly because the focus of the study was on the contents of their texts (Mutanda, 2024).

The authors made an effort to translate comments written in indigenous languages into English. Minor corrections were made on comments that had some minor spelling errors without losing the original meaning of the text. Critical discourse analysis was engaged to understand the meanings embedded in Holy Ten's selected songs (Mutanda, 2024). To assess the influence of Holy Ten's songs on his audiences, an audience reception study was carried out allowing the researchers to interview a sample of 10 members of Holy Ten's audience. These were purposively selected on the basis that they frequently attend Holy Ten's music shows, which makes them relevant cases for this study. These face-to-face unstructured interviews augmented data obtained from the chat box comments. Unstructured interviews were preferred because they are conversational in nature (Denzin & Lincoln, 2008). This provided a framework for participants to freely share their views and perceptions regarding Holy Ten's musical lyrics and how they shape an anti-VAW discourse in Zimbabwe. Consequently, this allowed the researchers to gain an in-depth understanding of the influence of Zim hip-hop music on audience awareness and attitudes.

5 Results and Discussion

This section presents the data on how Holy Ten expresses the nature of violence against women (VAW) in his musical lyrics. It goes on to discuss how the lyrics influence the audience's perception, awareness and attitudes of VAW. These attitudes and perceptions were gathered from the chat box comments on You Tube and unstructured interviews with some of the followers of Zim hip-hop music.

5.1 Nature of violence against women expressed in Zim hip-hop lyrics

The prevalence of physical violence features prominently in Holy Ten's selected songs. The most pervasive form of violence identified in the selected songs is intimate partner violence (IPV), which is mostly perpetrated by men against their wives. The song *Pfumo* (Spear), for example, highlights instances of physical violence caused by partners in marriage as shown by the following lyrics:

> *You gave me the cuts, you gave me the blade*
>
> *Feeling I don't need to wear shades*
>
> *I am hiding black eye, that would take time*

The above lyrics show a partner crying about the physical violence she has suffered at the hands of her partner, indicated by the metaphors, "To hide black eye" and "Hand crimes" which shows that they are being beaten in private and when they appear in public places, they dress to hide the manifestations of the physical violence and act as if they are fine, which is a common occurrence in some marriages. This observation is akin to the findings by the Zimbabwe Health and Demographic Survey (2005-2006) indicating that 34.7% of Zimbabwean women reported having been physically abused but not having informed anyone about it. In Zimbabwe, as in many other patriarchal societies in Africa, restrictive norms and values promote a culture of silence on the part of the abused woman (ZHDS 2015). In this case therefore Holy Ten through his Zim hip-hop music becomes a voice of the voiceless speaking on behalf of the abused women. Thus,

contrary to the observation by Yende (2022) that hip-hop music promotes violence by promoting misogyny among the youth, Holy Ten's music actually competes with and complements mainstream discourses in addressing social ills such as gender-based violence (Ureke & Washaya, 2016, p. 72). His songs are loaded with anti-VAW themes.

In sync with the above, the song *Pandichamuka* (When I wake up) also laments the prevalence of physical violence against women. The following lyrics bear testimony to this:

When they ask me, I will tell them I have wounds

They pierced me with thorns, they trampled on me

They pressed down my neck

The man of this house is drunk, it means trouble

When he thinks of it, he slaps everyone

You are mad, you beat me your wife, you beat the child, you are high on Marijuana

This song presents another victim crying from the physical violence she has been facing from the husband who beats her, painting a shady picture of marriage. According to Ureke and Washaya (2016), violence against women is a result of power imbalance between men and women. As a result, some men try to assert their dominance over women through violent means. Bandura's Social Learning Theory states that people acquire new behaviours by observing and imitating role models in their surroundings. Holy Ten establishes himself as a social role model for young people by emphasizing the negative effects of physical aggression and offering sympathetic, non-violent alternatives. For listeners who may otherwise normalize such violence, lyrics like '*Mwanangu pfumo, tsveta*' [My son, put down the spear] in the song *Pfumo* serve as cautionary narrative warning against offering vicarious learning opportunities.

Drug and substance abuse by some men is one of the chief drivers of physical violence identified in Holy Ten's selected songs. In the song Pandichamuka, the wife laments:

The man of this house is drunk, it means trouble

When he thinks of it, he slaps everyone

You are mad, you beat me your wife, you beat the child you are high on marijuana

In the same vein, the wife in the song *Pandichamuka* says "You drink from January to December." All these lyrics reveal that drug and substance abuse are a key driver of gender-based violence. This sentiment is also captured by the late musician Oliver Mtukudzi in his song *Tozeza baba* (we are afraid of the father), which depicts a father perennially beating his wife each time he comes home drunk. In relation to this, Benyera (2017) submitted that gender-based violence is inextricably linked to alcohol abuse not only in Zimbabwe, but elsewhere especially in post-colonial countries. Holy Ten therefore raises the awareness of the drivers of gender-based violence in Zimbabwe.

Another observation is that Holy Ten speaks from the position of the women and children, who are the most frequent victims of violence in marriages. This, however, gives the inaccurate notion that only females are being abused. Also some men in the country are victims of marital violence from their wives. The above matter is clear from the sentiments given in the comment section of the two songs:

Comment 1: "*Men or Women, walk away from anything abusive, we all deserve better in this life and nothing in this life is more precious than life.*"

Comment 2: *"The message is clear; Leader of the Youth and we rally behind you and say no to any form of VAW on our women."*

Comment 3: *"Let's join Holy Ten in protecting the girl child."*

Comment 4: *"After this song, we need to start a Boy Child Association, main aim is to teach us boys how to treat woman or girl child."*

The comments above, drawn from the two songs *Spear* and *When I wake up*, confirm the prevalence of physical violence in Zimbabwe, especially within marriages. Most of the participants show that they agree

with the narrative that physical violence is being perpetrated against women as shown in three of the four comments above, and only one of the listeners actually had a broad view and calls upon men and women to move out of abusive relationships. The comments by the listeners are mirrored in progressive legislations against the physical abuse of women in both public and private spaces, such as the Domestic Violence Act of 2007. In this case, it can be argued that Holy Ten's songs played an agenda setting role for the fight against gender-based violence in Zimbabwe (Mutanda, 2024). His music invites public commentary on people's experiences, perceptions and attitudes on gender-based violence, which is critical in sensitising policy makers and other stakeholders involved in the war against this scourge.

Emotional abuse is another major form of VAW in Zimbabwe as espoused in the songs *Pfumo* (Spear), *Pandichamuka* (When I wake up), and *Kumba kune vanhu* (There are people home). These songs articulate the subtleties of emotional abuse, including manipulation, verbal insults, and controlling behaviour. From the song *Kumba kune vanhu* (There are people home) we gather:

When the music ends, we will put her in her place

I am hot, there is no air

Even if I walk around in rags, they just accuse me of being a witch

Being a single lady is no easy business, I am slowly dying

Kumba kune vanhu shows a typical Zimbabwean young woman who is embroiled in socio-economic challenges, but the society does not have mercy on her, and they accuse her of engaging in socially undesirable behaviour for her responses to the situation at hand, even if she is doing it for survival as a last resort. Society and family then denigrate her not considering her situation. This subjects the young woman to unreasonable pressure from all sides, which puts her under emotional strain. The song Spear shows this:

I am never high, though I am feeling slow pain
You are tying me down, then you get fade up every time you insult me

I'm feel that I need to embrace, the feeling that I need to escape (escape)
I'm feeling that I need to just wave goodbye
So, I can get freed of these chains (ahh)

In the song Spear the woman is crying from the emotional abuse she has been facing at the hands of her partner, she feels she needs to escape but she cannot. In another song, When I Wake Up, Holy Ten gives a picture of another woman who is trapped in an abusive marriage where she is subjected to emotional abuse:

I am a human being my friend

Don't do that in front of my kids

I was happy when you took me from my family

You paid the bride price and you put a curse on me

They have dug a grave for me

I lied to myself even though

I was advised to be cautious of loving dogs

This song shows the emotional abuse women are going through in marriages which often subjects them to death or near-death experiences such that they start to regret the choice or the instant they got married. It is also important to note that this form of abuse is shown as deeply scarring, often leaving long-term psychological impacts. The following comments were made by listeners based on the songs above:

Comment 1: *"The song expresses solidarity with young girls who are trapped by harsh socio-economic conditions. They are judged by society for using their bodies to make ends meet. But the song by Ten*

pleads for us to see humanity in them and try to understand that they have not willingly chosen to live like this."

Comment 2*: "Spear... is so emotional, thank you Holy Ten for raising this awareness against VAW."*

Comment 3: "*Eish this is deep.... Many are getting killed coz of VAW. Stop abusing us... we are also human. It hurts and it is not easy to try to fake a smile to your babies while you are broken inside."*

The above comments and lyrics show that emotional abuse resonates with the listeners, validating its existence in Zimbabwean communities. Holy Ten's lyrics and his audience's comments about them show that the musician actually does social commentary in his songs and stands to educate his listeners to shun violence against women. In addition, the findings show that emotional abuse in the songs sometimes takes the form of gas lighting, where victims are led to question their perceptions or sanity.

The songs by Holy Ten also address the grave issue of rape and sexual coercion, elucidating not just the acts themselves but their profound effects on victims, including stigma and silence surrounding the issue. The music also sheds light on sexual harassment both in private and public spaces, highlighting how such behaviours are often normalised or overlooked by society. The song Spear shows sexual abuse in marriages through the lyrics:

Then on the-bed you come with a spear, and you break my legs
Where I was born, they just speak riddles to me
They tell me marriage is maintained because of the children (no-no)
They also say the society looks down on single mothers (aah aiwa, no, no)
But its better (better)

In relation to the above lyrics, listeners made the following comments:

Comment 1: *"This right here ladies and gentlemen is a masterpiece... it talks of abuse in the hands of those who we love or cherish.... "You come with a spear and break my legs", I call it linguistic prowess to convey the message in the right quantities or just sheer brilliance."*

Comment 2: "*Sexual violence coming with a spear to the matrimonial bed is very traumatising, together with the victims we stand."*

The foregoing highlights experiences of marital rape and sexual coercion suffered by women in marriages. The above lyrics complement some progressive legislations in Zimbabwe such as the Marital Rape Act which encourages women and men to report incidences of rape in marriage. As indicated in the lyrics however, it is difficult to report such cases. Culturally, the payment of lobola strips the woman of her right to report sexual abuse in marriage (Matope et. al. 2013, p. 198). This is further reinforced by African cultural norms that promote the objectification of women and reduce them to sex toys.

Economic abuse surfaces in songs through narratives of use of financial resources to exploit women, showing persistent economic dependency. The lyrics also show relationships where economic exploitation is interwoven with emotional or physical abuse, emphasizing the complexity of VAW. In the song There Are People at Home, Holy Ten outlines the economic exploitation of the girl child by stating:

If you show her money, she will show you the legs
whilst she is busy with, she will turn from the way she was raised

This shows that poor girls when they are given money by rich older men or boys, or they are in company of people who they deem may help them because of their societal positions of power expose their bodies and willingly take part in sexual activities due to the pressing situations in their homes. The lyrics also show that poor girls forgo their norms and values when they engage in such behaviour (*achafuratira njanji*). The song At the Chills also shows the economic manipulation of students in higher educational institutions stating:

Just enter the BM (car) Vanessa
Just enter the BM (car) Vanessa
People's children (girls) wake up in our homes with hangover

Whilst their parents think they at Campus
They are made drunk by these sugar daddies (Ah?)
No one can say no to money

The song above shows that financial manipulation is a real challenge in areas with many socio-economic challenges such as Zimbabwe. As a result, many young people fall prey to sexual, emotional or even physical abuse due to the coercion which usually comes from peer pressure, drugs, and alcohol abuse. The comments from the songs also show this:

Comment 1: *"So many Zimbabwean girls can resonate with this song. Societal pressures are messing us up."*

Comment 2: *"You are a star that's shining light on dark serious matters. Thanks, Holy Ten for using your artistry in spreading the message, No to VAW and all violence against the youth."*

Comment 3: *"Then someone says hip-hop does not have a meaning anymore, when the girl child has a defender."*

Comment 4: *"I am a 46-year-old mother of two girl children and my heart goes out to you young people and the challenges you are facing. I am happy to hear you children advising each other through music, there is hope for you and the future generations through young people like you Holy Ten. Well done son!"*

These comments show that financial coercion is a form of VAW predominantly affecting the youth due to the poor socio-economic conditions in the country, and hip-hop music particularly coming from Holy Ten is giving the public an educational tour and shedding light on the dark things happening among the youth and against the youths. Older people and the youth are also appreciating the artist Holy Ten for singing about issues which no-one is really talking about, which makes him fit for the title he gave for himself, "Leader of the Youth, Speaker of the Truth". Stories told through Holy Ten's music also reflect on how economic conditions lead to the exploitation and manipulation of women, framing economic coercion as a facet of VAW in Zimbabwe.

5.2 Influence of Zim hip-hop on the audience's awareness of violence against women

This theme examines the intersection of music, social commentary, and activism. The two main findings of this study outlined below show the impact of VAW undertones in Holy Ten's hip-hop songs on the listeners' awareness of VAW: Holy Ten's songs efficiently educate listeners on the nature and intensity of gender-based violence through his emotional storytelling, eloquently depicting the painful reality of this topic. Holy Ten's music effectively converts abstract concepts into tangible and relevant experiences by placing instances of gender-based violence into recognisable societal and interpersonal contexts. This approach serves to cultivate heightened public awareness as outlined by the comments below.

Comment 1: *"It's so sad, I know this other girl I used to judge her until she told her story. Life is not easy, guys, people are going through a lot. Let's be kind to others. I am sending her the link to the song where there are people at home so that she knows that she is not alone. I hope it will make her feel better."*

Comment 2: *"This song Spear just brought back some flashbacks when my family experienced the same situation. My mum eventually walked away with us and left my Dad. Holy Ten your story telling is top notch, and resonates with real life situations."*

Comment 3: *"This is so emotional (When I Wake Up) . . . thank you Holy Ten for raising this awareness against VAW."*

These remarks highlight the significant influence of Holy Ten's music in imparting knowledge to individuals and shedding light on the harsh truth of VAW in both communities and everyday existence. Holy Ten's songs effectively emphasise that VAW is not just a remote problem, but a widespread and harmful presence in both society and the domestic sphere. Through the skilful integration of complex storylines and thought-provoking contemplations in songs like *There Are People at Home* and *At the Chills*, Holy Ten initiates a transformative change in storytelling, compelling listeners to confront the unsettling realities surrounding gender-based violence that frequently remain concealed. These tracks function as a

reflective tool that portrays the systemic problems and obstacles that perpetuate violence against women and vulnerable individuals, hence challenging prevalent conventions.

In addition, Holy Ten explores the intimate realm in greater depth through songs such as *When I Wake Up* and *Spear*, illuminating the ways in which VAW can penetrate the sacredness of an individual's household. These songs function as a heart-breaking reminder that violence against women (VAW) transcends boundaries and has the potential to impact individuals regardless of their social standing or personal history. Essentially, Holy Ten's music serves to not only raise awareness of the widespread occurrence of VAW, but also to spark a demand for unified action, compelling society to overcome silence, question the existing state of affairs, and strive towards establishing a safer and fairer world for everyone. Holy Ten's artistic prowess acts as a guiding light, motivating listeners to become agents of change in the battle against gender-based violence.

Holy Ten's lyrics mirror prevalent societal issues, indirectly revealing the widespread extent of VAW. This portrayal helps to dismantle the culture of silence around these issues, underscoring their alarming frequency and urgency. The increasing traction of Holy Ten's songs on social media and various platforms signifies a growing spotlight on VAW discussions, with his music serving as a catalyst for broader engagement.

Comment 1: "*By reflecting societal realities, Holy Ten's music not only exposes the pervasiveness of VAW but also challenges societal norms and compels listeners to confront these uncomfortable truths.*"

Comment 2: *"This is just wow. Holy... you have no idea what this song means to the girl child who has been through this. Thank you. God Bless you."*

Comment 3: *"Eish this is deep. Many are getting killed coz of VAW. Stop abusing us, we are also human. It hurts as it is not easy to try fake a smile to your bodies whilst you are broken inside."*

The examination of the aforementioned comments provides a noteworthy understanding of the widespread presence of VAW themes in Holy Ten's music. Two of the three comments emphasise that listeners establish a personal connection with the narratives of VAW portrayed by Holy Ten, suggesting a common experience with the topics he tackles. The resonance observed in Holy Ten's songs provides compelling proof that the depictions of VAW in these songs are not solely imaginary situations, but rather vivid portrayals of unpleasant realities that exist within society. The ability of listeners to connect with and recognise the themes of VAW in Holy Ten's music highlights the inherent and pervasive nature of these issues within communities. It implies that the problems surrounding VAW are not isolated occurrences, but rather deeply rooted societal problems that affect individuals at many levels. Holy Ten's music serves as a platform for marginalised individuals, illuminating the real-life encounters of those impacted by VAW and inciting conversations that question the acceptance of violence as normal in society. Holy Ten's songs shed light on the widespread occurrence of various types of VAW, including domestic violence, emotional abuse, and societal indifference. They act as a reflective tool, revealing the unpleasant reality experienced by numerous individuals. Holy Ten's artistic endeavours not only draw attention to these urgent matters but also cultivate empathy, comprehension, and a shared imperative to confront and eliminate VAW from the societal fabric.

6 Conclusion

The study confirmed Holy Ten's songs as a vivid lens through which the nature of VAW in Zimbabwe is both depicted and contested. His narratives unravel the layered reality of VAW, presenting a nuanced critique of societal norms and offering a voice to the silenced. Holy Ten's music emerges as a significant cultural commentary, shedding light on VAW's complexities and advocating for awareness and change. Holy Ten's portrayal of various VAW forms, from economic exploitation to domestic abuse, fulfils the study's aim to categorize VAW manifestations in Zimbabwe. His artistry brings these issues to the forefront, challenging societal acceptance and highlighting music's role in social awareness and advocacy against VAW. The study concludes that Holy Ten's music significantly influences cultural perceptions and public awareness of VAW. It fosters empathy, challenges societal norms, and encourages positive behavioural shifts, showcasing the transformative power of music in addressing and altering ingrained social issues.

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The Effects of Capitalism on Migration Dynamics: Perspectives of Congolese Migrants in Durban, South Africa

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Abstract

Capitalism remains the prevailing economic system in most contemporary societies. This article examines the effects of capitalism on migration dynamics, focusing on the perspectives of Congolese migrants residing in Durban, South Africa. By analysing the economic factors that drive migration, such as global inequality, the pursuit of better economic opportunities, and labour exploitation, this study illuminates how capitalist systems shape migrants' experiences. Using qualitative methods, including interviews and life histories, the article explores how neoliberal policies, market forces, and competition for resources influence not only the motivations behind migration but also the challenges of integration migrants face in host societies. It further delves into issues related to employment, working conditions, and social exclusion while highlighting the strategies of resilience and survival developed by migrant communities. Based on the results of this study, we argue that capitalism not only drives migration from the Global South but also exacerbates socio-economic marginalization and limits integration for migrants within host societies like South Africa.

Keywords: Capitalism, Migration, Neoliberalism, Labour exploitation, Congolese migrants, Durban.

1 Introduction

Migration patterns have increasingly been shaped by the pressures and structures of global capitalism. While many studies focus on political instability or security concerns as causes of migration, there is a growing recognition that economic systems, particularly capitalism, play a pivotal role in motivating and shaping migration flows. In the context of African migration, individuals often leave their home countries not only due to political unrest but also due to limited access to economic opportunities, social welfare, and sustainable livelihoods. These limitations are, in many cases, exacerbated by the inequalities created by the global capitalist system (Sassen, 2014)

This paper examines how capitalism impacts the migration experiences of Congolese migrants in Durban, South Africa. It does so by exploring both the push factors in the Democratic Republic of Congo and the pull and integration challenges in the host country. Although capitalism is credited with facilitating global economic growth, it also reinforces inequality, labour exploitation, and social exclusion that disproportionately affect migrants from the Global South.

1.1 Central argument

We argue that global capitalism creates conditions that compel Congolese individuals to migrate while simultaneously contributing to their socio-economic marginalization in the host country. This study contends that capitalism, as a structural force, shapes not only the decision to migrate but also the lived experiences of migrants through mechanisms of labour commodification, restricted social access, and systemic inequality.

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1.2 Research question

How does capitalism influence the migration decisions and socio-economic experiences of Congolese migrants residing in Durban, South Africa?

1.3 Gap in the literature

While prior research has explored migration drivers and integration issues, few studies specifically examine capitalism as a central force influencing both the motivation to migrate and post-migration experiences. This study fills that gap by linking neoliberal economic structures to both mobility and marginalization.

1.4 Structure of the paper

The article begins by discussing capitalism's influence on global inequality and its role in driving migration. It then addresses how capitalist systems structure migrant experiences in host societies. Subsequent sections explore economic inequalities, the role of state policy, and the challenges of social integration. The paper concludes with reflections on the implications of capitalism for migration policy and migrant well-being.

One of the core critiques of capitalism is its tendency to create vast economic inequalities. Rather than legally disenfranchising individuals, capitalism perpetuates inequality by concentrating financial and human capital among those who already possess them. Wealthier individuals and corporations have greater opportunities to invest and accumulate more wealth, while those with fewer resources struggle to save or invest as their income is primarily consumed by basic living expenses. This cycle reinforces economic disparities, making upward mobility challenging for many (Moore, 2015).

Another key factor contributing to inequality under capitalism is the uneven distribution of human capital. This refers to economically valuable knowledge and skills, including entrepreneurial abilities, that allow individuals to improve their financial standing. Those with access to quality education and professional networks are more likely to gain wealth, while those without such advantages remain at a disadvantage. Furthermore, human capital is self-reinforcing: individuals who acquire skills and experience through business or specialized professions continue to build their expertise, whereas those with limited access to such opportunities struggle to break the cycle of poverty. This aspect of capitalism is often framed within discussions of meritocracy, where success is attributed to individual ability and effort, even though systemic barriers can limit opportunities for many.

While capitalism itself does not directly prevent individuals from achieving economic success, systemic inequalities and state policies can create additional barriers for certain groups. Migrants in South Africa, for example, often face systematic restrictions that hinder their economic participation. These barriers arise not from capitalism, but from government policies that deviate from free-market principles by imposing restrictions on employment and business opportunities for foreign nationals. As a result, migrants often experience social and economic exclusion, limiting their ability to accumulate wealth and integrate into the host society.

1.5 Capitalism and global migration

At its core, capitalism is a system based on market competition, private ownership, and the pursuit of profit. While capitalism has spurred economic growth globally, it has also exacerbated inequality, particularly in developing regions such as Africa. The economic disparity between wealthy and developing countries creates migration push factors. Individuals from countries like the Democratic Republic of Congo (DRC), who suffer from limited employment opportunities, poor economic infrastructure, and political instability, are drawn to more industrialized countries like South Africa.

Studies indicate that neoliberal economic reforms, such as those supported by the World Bank and International Monetary Fund (IMF), have often deepened socio-economic inequality in African countries. Economic liberalization policies typically prioritize debt repayment, privatization, and market deregulation, leading to reduced government spending on essential public services like education, healthcare, and social welfare (Bond, 2014). As governments cut social programs to comply with structural adjustment policies, vulnerable populations are left without safety nets, exacerbating poverty and economic instability. This misallocation of resources, often channelled toward debt servicing rather than domestic development, further weakens local economies. Under such conditions, people in impoverished countries like the DRC are compelled to migrate in search of better economic opportunities and social stability. Migration, then, becomes not just a personal choice but a survival strategy shaped by global capitalist forces (Adepoju, 2010).

1.6 Economic inequality and migration

For Congolese migrants, the journey to South Africa reflects not only a search for better livelihoods but also an escape from systemic inequalities that persist under global capitalism. While capitalism has been credited with generating economic growth and creating job opportunities, its benefits have not been equitably distributed. In the Democratic Republic of Congo (DRC), a country rich in natural resources, global capitalism has facilitated extensive mineral extraction by multinational corporations, leading to immense profits for foreign investors while local populations remain in poverty (Nzongola-Ntalaja, 2002). This contradiction highlights how capitalism can generate wealth while simultaneously deepening economic disparities, particularly in regions where regulatory frameworks are weak and governance structures fail to ensure equitable distribution.

For many Congolese migrants, South Africa appears more integrated into the global capitalist system, offering greater job opportunities and a higher standard of living than the DRC. However, access to these opportunities remains limited due to structural barriers. Capitalist labour markets in South Africa absorb migrant labour but often confine migrants to low-paying, insecure jobs with little protection or labour rights (Peberdy, 2016). While capitalism incentivizes businesses and governments to invest in skills development to enhance productivity, migrants frequently struggle to access formal employment due to factors beyond purely economic forces, such as restrictive immigration policies and bureaucratic hurdles. These constraints, imposed through government intervention rather than capitalism itself, prevent migrants from competing on an equal footing in the labour market.

Additionally, the competition for scarce resources, such as jobs and housing, fuels social tensions between migrants and local populations. In capitalist economies, an oversupply of unskilled labour can drive down wages, particularly for the working poor. However, it is important to differentiate between economic forces inherent to capitalism and exclusionary policies that suppress free-market competition. For instance, if migrants are unable to secure formal employment due to temporary work permits or legal restrictions, the issue stems from state-imposed barriers rather than market-driven competition. Recognizing these distinctions is crucial in analysing how capitalism shapes migration dynamics and the lived experiences of Congolese migrants in Durban.

1.7 The role of capitalism in shaping migration policies

The capitalist system not only affects the economic conditions of migrants but also plays a crucial role in shaping the migration policies of host countries. In South Africa, for example, economic considerations significantly influence migration policy. While migrant labour contributes to key industries such as agriculture, construction, and domestic work, there is also resistance to migration due to concerns about unemployment and social cohesion (Crush & Tawodzera, 2014). The country benefits from the immigration of highly skilled entrepreneurs and workers, while the influx of low-skilled labour can contribute to wage competition in lower-income jobs and increase pressure on welfare and healthcare systems. Countries with structured

immigration systems, such as Canada and Australia, design their migration policies to attract skilled labour while regulating lower-skilled migration to balance economic needs with social stability.
This tension between employers' demand for affordable labour and the broader population's desire to protect local jobs is a hallmark of capitalist economies. In response, South African migration policies have become increasingly restrictive, aiming to control the influx of migrants while still ensuring the availability of low-wage labour. However, restrictive immigration policies often have unintended consequences. By limiting legal avenues for migration, they push many migrants into informal employment or undocumented status, making them more vulnerable to exploitation. Rather than serving the interests of employers who rely on migrant labour, these restrictive policies are often driven by political pressures, including the need to protect local employment and appease anti-immigrant sentiments. In contrast, a more open migration policy aligned with pure capitalist logic would prioritize market demand, ensuring that employers have access to the labour they need, regardless of skill level.

1.8 The intersection of capitalism and social integration

For Congolese migrants, the capitalist economic system not only shapes their employment prospects but also affects their integration into South African society. Under capitalism, essential services such as housing, healthcare, and education are often commodified, meaning access is determined by financial capacity rather than need. While this system affects both locals and migrants, the latter face additional barriers due to their precarious legal and economic status. Unlike locals, migrants may lack access to government subsidies or social welfare programs, making it even harder to afford these services. Additionally, government policies aimed at protecting local workers and industries can create structural disadvantages for migrants, reinforcing economic inequality rather than alleviating it.
The neoliberal economic model that has influenced South African policies since the end of apartheid has led to the privatization of key services, such as electricity (Eskom's restructuring), water management (municipal outsourcing), and parts of the healthcare system (private hospitals and insurance schemes) (Bond, 2005). This shift has disproportionately impacted economically disadvantaged groups, including migrants, who often struggle to secure stable employment and wages high enough to afford these privatized services.
Moreover, capitalism fosters a highly competitive environment that can weaken social cohesion. While economic insecurity affects both locals and migrants, migrants are often scapegoated as economic threats, exacerbating xenophobic tensions. However, it is important to note that the primary division created by capitalist competition is not necessarily between migrants and locals but between those who succeed within the system and those who do not. Capitalism, in its purest form, prioritizes economic productivity over national identity, meaning that both locals and migrants can contribute effectively to the market benefit, while those who struggle are left behind (Crush, 2000). Thus, rather than merely reinforcing divisions between migrants and locals, capitalism intensifies broader economic disparities, fostering resentment toward those perceived as successful, regardless of their origin.

1.9 Aims of the study

This study aims to critically examine the effects of capitalism on migration dynamics, specifically focusing on how capitalist economic systems influence the migration decisions of Congolese migrants residing in Durban, South Africa. It will explore how factors such as economic opportunities, inequality, and precariousness in their country of origin contribute to migration patterns. Additionally, the study will investigate the socio-economic conditions faced by Congolese migrants in Durban, examining their perceptions and lived experiences of capitalism within the host country, particularly concerning employment, housing, and access to social services. The study will also identify and analyse the economic inequalities and forms of exploitation or marginalization that Congolese migrants encounter in a capitalist economy within the host country and assess how these challenges affect their social integration and overall well-being.

2 Method

This research employs qualitative methods to gain in-depth insights into the perspectives and experiences of Congolese migrants regarding capitalism's influence on their migration and resettlement in Durban. Qualitative methods are well-suited for exploring subjective experiences. They allow for a nuanced analysis of how Congolese migrants interpret economic conditions in both their country of origin and their host city. Through semi-structured interviews and focus groups, the study investigates participants' perceptions of economic disparities, challenges in finding work, and their strategies for adapting to the capitalist economic structures in Durban. This approach emphasizes participants' narratives and perceptions of economic challenges, reflecting Liamputtong's (2020) emphasis on capturing the lived experiences that quantitative methods may overlook.

The study's sample includes a cross-section of adult Congolese migrants currently residing in Durban, selected to represent diverse socio-economic backgrounds and experiences. To enhance the study's depth and reliability, the sample was expanded to include 15 individuals aged between 25 and 60, ensuring a broader representation of economic circumstances and lived experiences. The participants include both men and women, with a mix of singles, married, and parents, reflecting the varied household structures within the migrant community.

Given the study's focus on economic impact, participants were purposefully selected based on their occupational backgrounds, ranging from formal employment to informal economic activities, as well as their involvement in community associations that support migrants. The study employed a snowball sampling method to facilitate access to individuals who could provide rich, diverse perspectives on capitalism's effects. Participants were primarily recruited through community organizations and churches that serve the Congolese migrant population in Durban, such as Faith Ministries and Saint Peter Catholic Church. To further strengthen the study's validity, recruitment also extended to migrant business networks and self-help groups, capturing a wider economic spectrum. The voluntary nature of participation ensured that those most willing to share their experiences were included, and the sample was balanced to encompass different economic realities among Congolese migrants in Durban.

3 Results

3.1 The impacts of capitalism on migrants

Capitalism, as a socio-economic system, prioritizes profit maximization and market-driven growth, which can exacerbate inequalities by marginalizing individuals who lack the necessary social, financial, and human capital to succeed as entrepreneurs or productive workers. Rather than targeting specific groups, capitalism functions through market mechanisms that assess individuals based on their economic value, independent of their group membership (Harvey, 2005). However, in practice, the interplay of capitalism with politics and societal attitudes can result in indirect forms of discrimination that disproportionately impact certain populations, including migrants.

For migrants, particularly those from low-income backgrounds or countries with limited economic opportunities, capitalist structures can contribute to labour exploitation, marginalization, and social exclusion in both their home and host countries. In home countries, capitalist-driven economic disparities and structural adjustments often contribute to unemployment and economic instability, pushing individuals to seek opportunities abroad (Sassen, 2014). In host countries, capitalist economies frequently rely on migrant labour to fill low-wage, precarious jobs that lack security, benefits and adequate protections, heightening their vulnerability. These dynamics fuel job competition and wage suppression, hurting both migrants and low-income native workers.

Additionally, capitalist policies in host countries often prioritize corporate interests, leading to reduced government investment in welfare programs and public services that are crucial for lower-income populations. While such policies apply to all low-income individuals, migrants are disproportionately affected because

they are overrepresented among the poor and often lack access to alternative support systems (Castles & Miller, 2009). As a result, capitalism, when coupled with political and social factors, can perpetuate cycles of poverty and exclusion among migrant communities.

3.2 Economic pressures and employment challenges

Capitalism's emphasis on profit maximization creates competitive labour markets that often disadvantage migrants, especially those from marginalized backgrounds. In Durban, Congolese migrants frequently face limited employment opportunities due to factors such as language barriers, exploitation, discrimination, and limited access to formal networks. Migrants often find work in low-paying or informal jobs with limited job security, few benefits, and poor working conditions, perpetuating cycles of poverty and economic instability. This precarious employment situation highlights the exploitative nature of capitalism for vulnerable populations who lack the resources to compete in a competitive labour market. One participant shared his experience:

> *I have a diploma in administration, but I couldn't find a job in my field. Every time I apply, they ask for experience in South Africa or ask if I speak fluent English. I ended up working in a small shop where I clean and pack goods, earning just enough to eat. But I studied for years, what for? (Y.N., 16 August 2024).*

This is an example of *deskilling*, a process in which higher-skilled migrants are compelled to take low-skilled jobs in their host country, often due to non-recognition of foreign qualifications, language barriers, and limited professional networks. The phenomenon of deskilling has been widely documented in migration literature (Aigner et al., 2025), with research showing that even highly qualified migrants frequently experience downward occupational mobility upon arrival in their host countries.

3.3 Language barriers

Language barriers represent a crucial challenge for Congolese migrants in Durban, shaped by broader economic and structural inequalities between nations. While capitalism facilitates economic mobility and international migration, the immediate drivers of migration are disparities in wealth between countries. The capitalist free-market system tends to amplify these inequalities by directing investments toward already well-developed countries with sufficient human capital and consumer markets, and also to poorer countries, such as India, where human capital and sizable consumer markets exist. Outsourcing of services and relocation of industries often occur from over-regulated high-wage countries in Europe to much poorer countries in Asia. However, this investment trend largely bypasses poor African countries where such conditions are perceived to be absent.

Additionally, capitalism privileges certain languages, most notably English, in globalized economies, reinforcing linguistic hierarchies that shape access to economic and social opportunities. For many migrants who have learned English in school, this can be advantageous, enabling them to integrate more easily into host countries where English is dominant. In such cases, English can act as a powerful facilitator of migration and integration. However, this benefit does not extend to Congolese migrants who have not learned English in school. For them, the need to acquire a new language can delay economic participation and hinder integration. The need to learn a foreign language can even contribute to "brain drain" when it encourages migration of more educated people who have learned English in school, leaving their less educated compatriots behind.

In Durban, English dominates commerce, employment, and public services, while many Congolese migrants primarily speak French, Lingala, or Swahili. This language gap limits their ability to secure formal employment, access essential services, and integrate into South African society. Without proficiency in English or Zulu,

many migrants are relegated to low-skilled and informal work, where language skills are less crucial, but job security and wages remain precarious. One Congolese migrant shared his experience:

> *I am Congolese. I speak French and Lingala, with limited proficiency in English and Zulu, which are widely spoken in Durban. This language gap makes it challenging for me to communicate effectively with potential employers and participate in interviews, pushing me toward low-skilled and informal jobs. That is why I am working as a car guard, where language skills are less essential but pay is low, and job security is minimal. (M.K., 17 August 2024).*

Another participant declared:

> *I've tried to learn English, but it's very hard without money to attend school. Without English, it's like the door is closed everywhere. They just ignore you or shout at you. It's painful because I want to contribute, but the system shuts us out. (M.M., 17 August 2024).*

Thus, language barriers serve as both a symptom and a reinforcement of the socioeconomic challenges Congolese migrants face in a capitalist system that privileges particular linguistic and economic structures.

3.4 Exploitation

Capitalism often leads to the exploitation of migrants by using them as cheap labour. This is evident in the case of Congolese migrants living in South Africa. In a capitalist system, where the economy prioritizes maximum profit, many businesses must rely on low-wage labour to reduce production costs. Migrants, due to their precarious legal status, urgent need for income, and sometimes lack of recognized qualifications in the host country, are in a vulnerable position. This often results in them being paid significantly less than local citizens for similar work. The labour market competition between migrants and native low-skilled workers can lead to wage suppression, exacerbating economic hardship for both groups.

For Congolese migrants in South Africa, these challenges are particularly pronounced. Many leave the Democratic Republic of Congo to escape conflict, political instability, and extreme poverty, only to face integration challenges, language barriers, and discrimination upon arrival. These factors frequently confine them to low-skilled, underpaid jobs in sectors such as agriculture, construction, security, and domestic services (Crush & Tawodzera, 2014). Employers often take advantage of their vulnerable status to minimize labour costs, exploiting migrants' desperation to work even under poor conditions. Additionally, fear of deportation or employer reprisals discourages migrants from reporting workplace abuse, further perpetuating their exploitation.

While cost-cutting in labour is an inherent feature of capitalist economies with competitive labour markets, government policies exacerbate the problem for low-skilled migrants. The imposition of temporary legal status and other bureaucratic restrictions limits migrants' ability to access stable employment and fair wages. These legal barriers contradict the core principles of capitalism and the free market, which thrive on unrestricted yet fair competition. Capitalism ideally operates on a meritocratic "level playing field", but restrictive policies distort labour market dynamics, disproportionately disadvantaging migrant workers. The lack of social protections and labour rights further compounds their hardships, exposing them to excessive working hours, unsafe conditions, and sub-minimum wages (Bolt & Hill, 2016).

Thus, in a capitalist framework that prioritizes cost reduction, Congolese migrants in South Africa are particularly vulnerable to exploitation. Their status as cheap labour enables employers to maximize profits by bypassing labour protections that apply to local workers, perpetuating systemic inequality.

> *I work in a call centre as a customer representative alongside South Africans. However, while my South African colleagues earn between R10,000 and R11,000, I only receive R5,500. Our company employs more foreigners than South Africans, particularly from the Democratic Republic of Congo and Cameroon. If I leave this job, finding another one would be extremely*

> *difficult, and I wouldn't be able to support my family or maintain a steady income. I know that I am being exploited, but I have no other choice. Otherwise, I will starve. (C.M., 17 August 2024)*
>
> *I work as a domestic worker because my diploma is not recognized in South Africa. I live with my employer in a large house with multiple bedrooms and living spaces. My duties included cleaning, laundry, ironing, and preparing meals for the entire family. I work seven days a week because I have nowhere else to go, and despite my workload, I receive only R1,800 per month. (D.M., 18 August 2024)*
>
> *They know we are desperate, so they use that. In my first job, they didn't even pay me the full salary, saying I didn't deserve it because I am a foreigner. I couldn't report them because I don't have a permit yet. What could I do? (S.M., 18 August 2024)*

3.5 Discrimination and xenophobia

Capitalism, as an economic system driven by profit maximization, can reinforce and accentuate discrimination and xenophobia through both structural and social mechanisms. In competitive labour markets, employers may exploit existing prejudices to justify paying migrants lower wages or assigning them to the most insecure and hazardous jobs. This practice not only maximizes profit by reducing labour costs but also entrenches occupational segregation, where migrants, especially those from African countries, are overrepresented in low-status positions (Crush, 2019). Such structural discrimination can feed into negative stereotypes, portraying migrants as "only suited" for certain types of work.

Furthermore, in times of economic downturn or high unemployment, capitalist economies often foster competition over scarce jobs and resources. Political actors and sections of the media may frame migrants as economic threats, diverting attention from systemic inequalities toward scapegoating foreign nationals. This environment can intensify xenophobic attitudes, as locals come to associate their economic hardship with the presence of migrants rather than with broader structural factors such as wage suppression, casualisation of labour, or inadequate social protections (Landau, 2022).

Capitalist urban economies can also reinforce residential segregation, with housing markets driven by profit, pushing migrants into overcrowded or poorly serviced areas. Such spatial separation limits interaction between locals and migrants, allowing stereotypes and prejudices to persist unchallenged. In Durban, some Congolese migrants report being excluded from certain neighbourhoods due to inflated rental prices or landlords' reluctance to rent to foreign nationals. These patterns mirror wider capitalist dynamics, where economic interests intersect with social prejudices to sustain discrimination and xenophobia. One participant declared:

> *When I first arrived, I thought finding work would depend on my skills. I worked as a mechanic back home for more than ten years, so I applied at several garages in Durban. Every time, they told me they already had people or they needed someone 'from here' who understands the customers.*

3.6 The race to cut costs

In the pursuit of maximizing profits, companies frequently reduce production costs by relying on cheap labour, which is often composed of immigrant workers. As a result, many migrants find themselves in precarious, low-wage jobs with poor working conditions. However, this economic reality can foster tensions, as local populations may perceive immigrants as direct competitors for employment opportunities and public services, thereby reinforcing xenophobic sentiments.

This perception, however, overlooks the broader structural issues within the labour market. In reality, both immigrants and native workers often face similar economic hardships. South Africa's Gini index, one of the highest in the world, reflects extreme levels of inequality, which affect all low-skilled workers regardless

of nationality. The real issue is not the presence of migrants but rather an oversupply of poorly qualified workers competing for a limited number of low-wage jobs in a highly advanced capitalist economy that primarily demands skilled labour. However, instead of addressing systemic inequality and labour market failures, public frustration is frequently misdirected toward migrants.

3.7 Economic precariousness and competition

By widening economic inequalities, capitalism increases financial insecurity among the working class. This precariousness fosters a climate of competition for scarce resources, where immigrants are often scapegoated as economic "intruders" despite facing similar struggles as local workers. The fundamental issue is not migration itself but rather the oversupply of low-skilled labour in an unregulated market, which intensifies competition and fuels resentment.

Addressing this challenge requires measures that enhance the skills and employability of both migrants and local workers. Priority should be given to vocational training, skills development programmes, and other initiatives aimed at improving human capital. Such interventions, ideally coordinated through the formal education system and supported by government, employers, and community organisations, can help workers transition into sectors with higher demand and better wages (McGrath & Powell, 2016). By reducing the concentration of workers in low-skilled, low-paid jobs, these measures can ease competition, improve economic stability, and foster better relations between migrants and locals. One Congolese participant explained:

> *If I could get proper training here, I know I could work in something better. Back home, I learned tailoring from my uncle, but here they want certificates. Without that, I can only work as a cleaner or in the market. I wish there were training programmes for people like me so I could get my papers and use my skills to earn more. (L.N., 20 August 2024)*

3.8 Segmentation of the labour market

Capitalist economies frequently display labour market segmentation, where certain jobs are disproportionately held by specific groups. In many cases, low-skilled migrants from poorer countries are confined to low-paying and physically demanding jobs, while native workers secure more stable and desirable employment. This contributes to the formation of stereotypes and reinforces racial and ethnic discrimination. However, this outcome is highly dependent on the skill level of migrants. For instance, highly skilled expatriates in the Gulf States fill positions that locals are unable to perform, leading to a different labour dynamic that does not trigger the same level of xenophobic tensions.

3.9 Consumerism and individualism

Capitalism promotes values such as consumerism and individualism, which may weaken social cohesion and solidarity both within and between different communities. However, this tendency becomes most pronounced when there is segmentation of the labour market and economic outcomes differ for natives and migrants. In such cases, disparities in income, job security, and access to resources can deepen social divides. Conversely, in contexts where economic opportunities and outcomes are relatively equal, individualism may reduce the significance of ethnic and cultural differences, as the emphasis shifts toward personal aspirations and achievements rather than group identity.

Discriminatory policies, whether in employment, housing, or access to services, create or exacerbate economic disparities between migrants and natives. These disparities, in turn, become sources of friction that can undermine social cohesion. Some scholars argue that the emphasis on material success within capitalist systems can intensify such divisions, indirectly contributing to xenophobic sentiments (Pasqualino, 2021). One Congolese participant shared:

Even when I work hard, I cannot get the same kind of jobs as locals. People say it's because I'm not from here. This makes them think I am taking something from them, but I just want to earn enough for my family. If everyone had the same chance, there would be less hate. (P.B., 21 August 2024)

3.10 The media and stereotypes

The media play a crucial role in shaping public perceptions of migration. While it may appear that the media actively create negative stereotypes, it is more likely that media outlets respond to and amplify existing public sentiments to maintain their audience. In competitive media environments, an essential feature of both capitalism and democracy, media organisations are driven above all to capture attention through sensationalist reporting, engage audiences by rousing emotions, and reassure them by reinforcing pre-existing beliefs, stereotypes, and biases, rather than fabricating new ones. As a result, xenophobic narratives can gain traction, further entrenching discrimination against migrant communities.
While capitalism is not inherently xenophobic or discriminatory, its prioritization of profit and economic competition can create conditions that indirectly fuel these social divisions. In some cases, it is not the absence of regulation that disadvantages migrants but rather over-regulation, such as limiting the duration of migrant work permits to six months, which restricts their economic stability and opportunities. Under such circumstances, deregulation could improve migrants' prospects by allowing them to participate more fully and securely in the labour market. Conversely, additional regulations often result in more bureaucracy and corruption without effectively addressing the root causes of exclusion. Tackling these challenges requires focusing on structural drivers of economic inequality rather than framing migration itself as the cause of hardship.

I am Congolese, and I am often the subject of discrimination in my environment and also in my workplace environment because there are a lot of foreigners there. After all, the employer pays us a minimal salary, but South Africans think that we are paid like them and we steal their work, at a time when there are many South Africans who are out of luck. This situation makes us feel insecure because it often leads to xenophobia. South Africans are killing us and burning us alive under the pretext that we are taking their jobs. (T.Z., 18 August 2024)

When xenophobia happens, we feel like animals being hunted. But we are here just to survive. People don't see that we are suffering too. They think we are stealing jobs, but we also struggle to get any job. (H.M., 19 August 2024)

3.11 Inequitable access to resources and services

The role of capitalism in resource distribution is driven by market forces rather than deliberate allocation by managers, politicians, or bureaucrats. As a result, marginalized groups, such as Congolese migrants in Durban, often struggle to access housing, healthcare, and education. Many migrants live in overcrowded and substandard housing due to high rental prices in safer areas, which pushes them into informal settlements with limited access to essential services. Similarly, healthcare remains difficult to obtain, often due to prohibitive costs or discriminatory practices. Under a capitalist system that prioritizes profitability, these disparities persist because of the massive inequality in income and wealth in the country. This makes it challenging for migrants, and also for poor natives, to secure basic necessities.

The salary I receive does not allow me to rent a house in a safe neighbourhood. This is why I live in the township together with the Zulu. It's very difficult because they don't like us. Even if you speak Zulu, they hate us because we are foreigners. In these neighbourhoods, we often face difficulties with drinking water and live in unsafe houses that can sometimes be washed away in heavy rain. Faulty power installations often lead to fires. My children rarely go to school

because there are no good schools in the township where I stay, and access to hospitals is also difficult. (G.M., 18 August 2024)

I waited three hours at the clinic with my child, and they kept taking South Africans first. Finally, they said the doctor was gone. My child had a fever, and I had to go to the church for help. That's where we go now, churches, not government. (M.K., 18 August 2024)

3.12 Remittances and capital outflows

Capitalism incentivizes economic mobility and remittances as a means for migrants to support families left behind. For Congolese migrants in Durban, sending money home is a primary motivator; however, the high cost of living in South Africa reduces their ability to save and send remittances. Remittance outflows, while essential for supporting families in the DRC, can strain the finances of migrants, trapping them in a cycle where they must prioritize family obligations over their economic stability. This system often leaves migrants caught between the demands of a capitalist economy in their host country and familial responsibilities back home. Some of the participants declared:

I came here to South Africa in search of a better life because in Congo, the situation is catastrophic with endless wars and an economy that is almost on the ground. However, the South African economic system only exploits foreigners. The job I have, if I only pay the rent and a little food, I have nothing left. But my wife and children remained in my country, counting on me to take care of them. However, the salary I receive does not even allow me to take care of myself. And if I resign, it's not easy to find another job. (R.N., 20 August 2024)

If I don't send money to my mother, she will not eat. But to send just R500 means I have nothing for me. I feel stuck between hunger here and hunger there. It's like drowning on both sides. (E.K., 20 August 2024)

3.13 Adaptation and informal economic networks

In Durban's capitalist economy, Congolese migrants encounter limited opportunities within the formal sector, often due to language barriers, legal employment restrictions, and discrimination against foreigners. However, employment restrictions and discrimination are not inherent features of capitalism but rather regulatory and social barriers imposed by state policies or societal biases. In contrast, language barriers directly affect migrants' ability to integrate into the capitalist free market system, as they limit access to the social and human capital necessary for economic participation.

As a result, many Congolese migrants turn to the informal economy, where they develop adaptive networks to share resources, support one another, and establish small businesses. These informal networks encompassing activities such as street vending, hairdressing, and cooking services serve as essential means of survival. Rather than resisting capitalism, these migrants create their own small-scale free market system, unimpeded by state-imposed regulations such as taxation and work permit requirements, which can function as anti-capitalist constraints on fair competition.

Through these networks, Congolese migrants demonstrate resilience and adaptability, developing alternative economic structures to sustain their livelihoods. However, the absence of regulation and social protection in the informal sector exposes them to economic vulnerability. This highlights the tension between the advantages of a free-market system and the need for regulatory measures that could provide stability and security for marginalized economic participants.

Beyond economic activities, Congolese migrants form solidarity networks anchored in religious associations, support groups, and cultural organizations. These networks provide not only financial assistance but also social and psychological support, fostering a sense of belonging and security. For instance, they may organize small, interest-free loans or help members find informal economic opportunities. By promoting mutual aid, these networks enhance economic autonomy while also helping migrants navigate the pressures of a

capitalist system that often prioritizes individual success over collective well-being (Crush & Tawodzera, 2017). One participant declared:

> *I started selling fried fish near the taxi rank with my cousin. We make a little money each day. It's not legal, but how else can we survive? We help each other with small loans when someone is sick or needs to send money home. (Y.M., 18 August 2024)*

3.14 Mental health and well-being

Capitalism's focus on productivity, individual success, and financial achievement places unique psychological pressures on migrants, particularly those from economically disadvantaged backgrounds like many Congolese migrants in Durban. These individuals often face immense pressure to secure stable income, support families back home, and integrate economically into the host society. This relentless pursuit of financial stability frequently leads to chronic stress, anxiety, and depression. The expectation to "succeed" within a highly competitive capitalist framework can result in burnout and a deep sense of inadequacy when these goals are not met, further exacerbating mental health struggles. However, this drive for success is also the engine of economic growth, a fundamental aspect of capitalism that fuels national prosperity. At the same time, for those who struggle to succeed, non-capitalist forces such as government intervention or philanthropy are necessary to mitigate economic disparities and provide support.

Moreover, migrants face significant barriers to accessing mental health services due to both economic and institutional constraints. In capitalist societies, healthcare, including mental health support, is often costly and not easily accessible to low-income populations, including both migrants and native-born individuals. This financial burden exacerbates the psychological strain on migrants as they lack adequate resources to address emotional challenges. The difficulty in accessing mental health care highlights how capitalist systems prioritize economic productivity over essential psychological and community support, leaving vulnerable populations without sufficient assistance.

Additionally, migrants from Africa often encounter xenophobia and discrimination, further intensifying their marginalization and contributing to feelings of alienation and exclusion. While these issues are not inherently caused by capitalism, since xenophobia and discrimination contradict the principles of a free labour market, they can be exacerbated by cutthroat competition among economically disadvantaged groups. In societies where job opportunities are scarce, particularly in low-skilled labour sectors, resentment toward migrants can manifest as anti-immigrant attitudes and calls for discriminatory policies. One potential solution could involve large-scale public works projects to create employment opportunities and balance labour supply and demand. However, the key question remains: Who will fund such initiatives? In a capitalist economy, government intervention of this scale often requires careful consideration of taxation, public spending, and economic sustainability.

> *Sometimes I cry without reason. I think I am failing my children. I can't talk to anyone because we are all struggling. Depression is real here, but who cares about our feelings when we are just foreigners? (R.S., 19 August 2024)*

4 Discussion

The findings of this study reveal the complex and often contradictory ways in which capitalism shapes the lived experiences of Congolese migrants in Durban. The results largely align with the literature reviewed earlier, but they also offer localized insights that underscore the specific vulnerabilities experienced by this group.

For instance, as Sassen (2014) argues, global capitalism promotes labour mobility while simultaneously creating structural conditions of inequality in both sending and receiving countries. This was evident in the participants' accounts of limited employment opportunities, even for those with qualifications. Similar to

Castles and Miller (2009), this study confirms that capitalist economies often rely on migrant labour while denying them the social protections available to citizens.
The theme of exploitation aligns with Harvey's (2005) critique of neoliberal capitalism, which commodifies labour and prioritizes profit over worker welfare. Participants' testimonies of wage gaps, poor working conditions, and fear of deportation mirror Harvey's argument that capitalism fosters inequality not just by design but through policy inaction or complicity.
Language barriers, a recurring issue in the results, were highlighted by Crush and Tawodzera (2014) as both a cause and a consequence of social exclusion. This paper deepens that analysis by showing how language intersects with economic marginalization under capitalism. Language not only mediates access to work but also marks migrants as outsiders in the economic order.
The findings on xenophobia and discrimination reinforce Pasqualino's (2021) claim that capitalist values such as individualism and competition can erode social cohesion. Participants' fear and experiences of violence reflect a broader climate of resentment fuelled by labour market saturation and economic desperation, as also emphasized by Bolt and Hill (2016).
Interestingly, the evidence from informal economic networks expands the conversation beyond dependency and victimhood. The ability of Congolese migrants to adapt through mutual aid and small business activities suggests a form of grassroots capitalism, challenging the notion that migrants are merely passive victims of the system. This partially supports the arguments of Crush and Tawodzera (2017) on migrant resilience and economic agency in the informal sector.
However, mental health struggles remain underexplored in the literature on capitalism and migration. This study adds to the discourse by connecting psychological hardship to capitalist metrics of success and productivity, which leave little space for vulnerability or failure.
In sum, while the literature has established the structural impacts of capitalism on migration, this study contributes to the field by foregrounding personal narratives that make visible the daily struggles, adaptive strategies, and contradictions within a capitalist migration system. The voices of Congolese migrants in Durban illustrate the need to rethink economic systems that are profit-driven but socially exclusionary.

5 Conclusion

This article has argued that capitalism significantly influences migration dynamics by shaping both the motivations for migration and the socio-economic realities migrants face in host countries. Drawing on the lived experiences of Congolese migrants in Durban, South Africa, the study demonstrates that while capitalism can generate economic opportunities, it also reinforces systemic inequalities, particularly in the labour market, through exploitative practices and limited social protections. This central argument contributes to migration studies by offering a nuanced analysis that distinguishes capitalism from associated regulatory and ideological frameworks, such as neoliberalism, which often mediate migrants' experiences.
Theoretically, this research adds to the existing scholarship by moving beyond binary critiques of capitalism and instead presenting a layered understanding of how capitalist systems, when unevenly structured, both attract and marginalize migrant populations. It highlights the need to consider capitalist heterogeneity across national contexts, such as the differences between South Africa's diversified economy and the DRC's resource-dependent structure. This underscores that migrants are not rejecting capitalism as an economic system but are seeking inclusion in more developed and stable versions of it.
In terms of knowledge contribution, the article advances a critical yet balanced view of capitalism's dual role as both an enabler of mobility and a generator of precarity. This perspective is valuable for scholars, policymakers, and practitioners working on migration, development, and labour rights, as it encourages context-specific policy responses that recognize structural economic limitations without reducing all migrant challenges to capitalist dynamics. Future research could explore three key themes:

1. Comparative studies of how different capitalist models (e.g., social-democratic vs. neoliberal) affect migrant integration and labour market access.

2. The role of informal economies and survival strategies among African migrants in urban centres.
3. The intersection of capitalism, gender, and migration, especially how capitalist labour structures uniquely affect migrant women.

By identifying these areas, this study opens space for interdisciplinary inquiry into the evolving relationship between global capitalism and human mobility.

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Double Burden of Malnutrition and Its Determinants among Women of Two Ethnicities in North Bengal, India

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Abstract

The double burden of malnutrition, defined as the coexistence of overweight/obesity with undernutrition in the population, has become an emerging public health problem in low-income and middle-income countries where its rising prevalence is now a significant health challenge. Obesity is a well-known risk factor for chronic illnesses including type II diabetes, hypertension, and cardiovascular disease. Also underweight has a direct effect on morbidity and mortality. The present cross-sectional study was done among 828 adult women (Rajbanshi: 414 and Namasudra: 414) aged 19-39 years of Maynaguri block, Jalpaiguri district, West Bengal, India. Asian-specific BMI cut-offs were used to assess the prevalence of underweight, overweight, and obesity. The present study documented a low prevalence of undernutrition among the studied population. According to Asia-specific cut-off values, the overall prevalence of underweight was 9.7%, and overall over-nutrition was 40.0% (overweight 18.0%, obesity 22.0%). The χ^2 analysis showed that most of the socioeconomic variables were statistically related with the nutritional condition of the population except for ethnicity and woman's educational level. Rajbanshi women had a higher prevalence of undernutrition than rates previously reported for Bengalee Kayastha and Nyishi women. Undernutrition among Namasudra women was lower than reported in earlier studies. However, the combined overweight-obesity prevalence was higher than previously reported among both ethnicities. The present study proves the existence of a double burden of malnutrition among the study populations, which is influenced by socioeconomic and demographic determinants. The results suggest a need to develop policies and programs tailored to specific socioeconomic and demographic groups to address the double burden of malnutrition. Intervention programs such as awareness campaigns and nutrition educational programs should be targeted according to the socioeconomic and demographic conditions.

Keywords: Double burden of malnutrition, Asia-specific cutoff, BMI, Rajbanshi, Namasudra

1 Introduction

The double burden of malnutrition (DBM), defined as the coexistence of undernutrition and overnutrition in the same population, has become an emerging public health problem in many parts of the world. DBM will be key to achieving the Sustainable Development Goals, in particular Goal 2 and Target 3.4, and the commitments of the Rome Declaration on Nutrition, within the UN Decade of Action on Nutrition (Oenema, 2019). The factors influencing DBM are complex, including both biological and environmental factors. Some of these factors may include poor water and sanitation systems, favouring diarrheal and parasitic diseases, and weak public health systems (Shrimpton & Rokx, 2012). Undernutrition among women is alarming in developing countries, especially in the South Asian region (Bhandari et al., 2016). Women of reproductive age are among the most susceptible to malnutrition for both social and biological reasons (Kamal & Islam, 2010). While globally, obesity has doubled in the last three decades, it has tripled in low- and medium-income countries (LMICs) in just two decades (WHO, 2011).
Obesity is a natural consequence of overnutrition and a sedentary lifestyle and tends to be strongly associated with gender and socioeconomic status, although the direction of these associations varies according to the

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levels of socioeconomic development (Monteiro et al., 2004; Roskam, 2010). Contrary to high-income countries, overweight/obesity has traditionally been most prevalent among high-income families and well-educated individuals in low- and middle-income countries (Dinsa et al., 2012; Neuman et al., 2013). The rising prevalence of overweight/obesity coexisting with persistent undernutrition is a significant health challenge in low-income and middle-income countries including India, where improved economic conditions, urbanization, sedentary lifestyles and dietary changes have caused a steady increase in overweight/obesity (Afshin et al., 2017 Agrawal et al., 2013; Dutta et al., 2019). Similarly, being underweight is strongly associated with premature mortality, disabilities, and poor health, especially in developing countries (Pednekar et al., 2008; Selvamani & Singh, 2018).

Being underweight, particularly, among women, has a direct effect on health being for example associated with anaemia, and indirectly contributing to maternal and infant mortality (Doku & Neupane, 2015). Also, overweight/obesity is a significant predictor of overall mortality (Whitlock et al., 2009) and of chronic diseases such as diabetes (Hossain et al., 2007), cardiovascular disease (Prabhakaran et al., 2018), and multimorbidity (Arokiasamy et al., 2015).

Factors related to adult underweight may include sociodemographic variables such as early adulthood (15-24 years) (Biswas et al., 2017), having lower education and poorer economic background (Biswas et al., 2017; Hanandita & Tampubolon, 2015; Lemato & Navaneetham, 2014; Siddiqui & Donato, 2017). Also, marital status, age, wealth index, educational level, type of fuel for cooking, and bath place are statistically associated with overnutrition and/or undernutrition.

The present study aims to assess the ethnicity-specific prevalence of double burden of malnutrition (undernutrition and overnutrition) and to examine the relationship of socioeconomic and demographic factors with nutritional conditions among women of both ethnic groups. It also aims to compare the prevalence of double burden of malnutrition of the studied women with other studies.

2 Material & Methods

The present cross-sectional study was done among 828 women (414 Rajbanshi and 414 Namasudra) aged 19-39 years of Maynaguri block, Jalpaiguri district, West Bengal, India. The Maynaguri block is situated at 26.57° north latitude and 88.82° east longitude (Fig. 1). According to Census (2011), the total population of Maynaguri block was 329,932, of which 291,073 were rural and 37,959 were urban residents. There were 170,030 (52%) males and 159,002 (48%) females. Women were randomly selected from 48 Integrated Child Development Scheme (ICDS) centres where their children were enrolled. Data were collected from ICDS centres located in different villages: Uttar Marich Bari, Dharmapur, Dakshin Ulladabri, Putimary, Razar Hat, Uttar Ulladabri, and Barnes. Ethnicity was identified from the polio card provided by the mothers of ICDS beneficiaries.

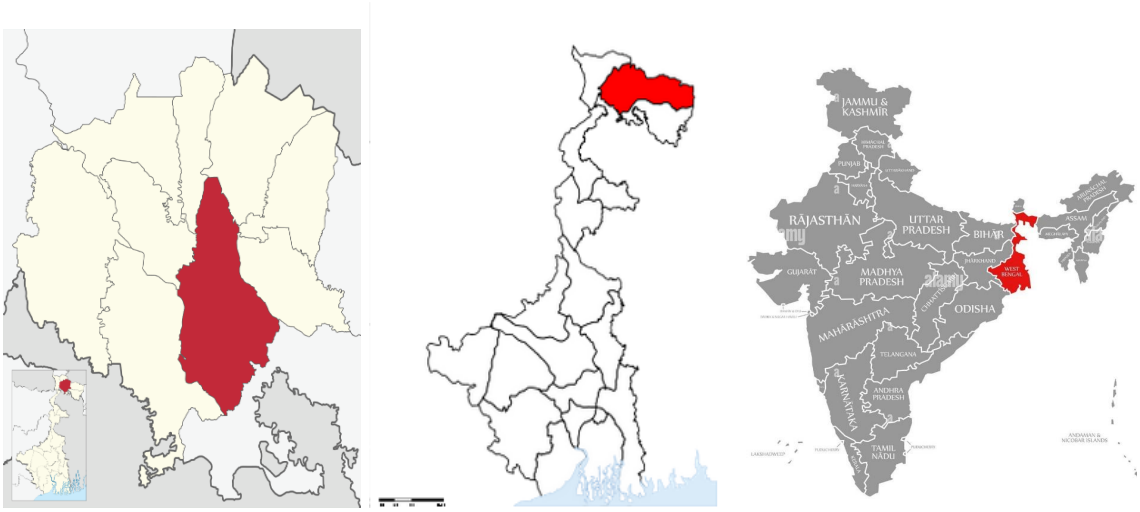

Figure 1. The study area

2.1 Ethnic groups

The Rajbanshi people belong to the Mongolo-Dravidian group. They are a traditionally agriculturist community that claims descent from the Koch. They are believed to have originally spoken a Tibeto-Burman language although they now speak an Indo-Aryan language and practice a form of Vedic Hinduism. They are an endogamous group classified as a Scheduled Caste, although they claim Kshatriya status based on their alleged descent from the 16^{th}-century Koch dynasty.
The Namasudra are believed to be of non-Aryan origin although today they mostly speak the Bengali language. They are mainly agriculturists and boatmen. Risley (1892) opined that the Namasudra are related to the tribe of the Vedic period called Chandal, initially used to refer to the broad group of people sharing a similar despised social position. The Chandal/Namasudra have traditionally been a low-caste (Dalit) group in West Bengal. Namasudra are today categorised as a Scheduled Caste population in the Hindu caste system.

2.2 Data collection

Anthropometric data such as height and weight was collected by the standard procedure developed by Weiner and Lourie (1981), and sociodemographic data (ethnicity, birth weight of child, age groups, education level, type of fuel used for cooking, bath place, source of drinking water, husband's occupation, income) were collected on a structured schedule by first author A.B. Ethical permission was obtained from the University of North Bengal.

2.3 Asia-specific BMI cutoff

The body mass index was calculated as weight (kg) / height (m^2). Asian-specific BMI cut-offs were used to define underweight, overweight and obesity (Tan 2004).

2.4 Statistical Analysis

All types of statistical analysis such as mean, standard deviation, F test, χ^2 test and multinominal regression were done on the Statistical Package for Social Science (SPSS 18). F test was done to analyse age-specific variation. χ^2 tests were used to identify differences in proportions of the categories of exposure by nutritional status of women. Multinominal analysis was done to assess which ones of the predictor variables influence the likelihood of different outcomes most directly, as risk factors of the observed nutritional conditions. For the present study, socioeconomic demographic factors were the predictor variables and nutritional status was the outcome.

3 Results

Table 1 shows that the mean height, weight and BMI of Rajbanshi women were 150.9 cm, 51.4 kg and 22.5 kg/m^2 respectively. The mean height, weight and BMI of Namasudra women were 149.8 cm, 51.4 kg and 22.9 kg/m^2 respectively. Namasudra women but not Rajbanshi women showed, statistically significant age variations for all variables. Ethnic differences in anthropometric variables were not statistically significant.

Table 1: Descriptive statistics of height, weight and BMI of studied populations. Means, with standard deviations in parentheses.

Rajbanshi women				
Age (years)	N	Height (cm)	Weight (kg)	BMI (kg/m^2)
<25	122	150.16 (5.85)	50.07 (9.56)	22.31 (3.53)
25–30	167	151.22 (5.27)	51.34 (8.29)	22.43 (3.32)
>30	125	151.14 (5.49)	52.59 (10.56)	22.97 (4.16)
Total	414	150.89 (5.52)	51.35 (9.43)	22.50 (3.66)
F test		1.49NS	0.11NS	0.18NS
Namasudra women				
Age (years)	N	Height (cm)	Weight (kg)	BMI (kg/m^2)
<25	114	149.31 (5.58)	48.94 (8.60)	21.90 (3.36)
25–30	199	148.89 (5.25)	50.44 (8.68)	22.69 (3.32)
>30	101	152.08 (5.67)	56.16 (10.31)	24.26 (4.14)
Total	414	149.78 (5.59)	51.42 (9.47)	22.85 (3.64)
F test		12.10***	19.16***	12.20***

*** Significant at $p < .001$

Table 2 shows, based on Asia-specific cut-off values, that the overall prevalence of underweight was 9.7%. Overweight was 18% and obesity 22%, adding up to a combined overnutrition of 40%. There was 10.9% undernutrition and 38.2% combined overnutrition found in Rajbanshi women. Whereas, 8.5% undernutrition and 41.8% overnutrition were found among Namasudra women.

Table 2. Prevalence of double burden of malnutrition among the studied population, numbers, with percent in parentheses

Table 2:

Population	Underweight (%)	Overweight (%)	Obese (%)	Combined overnutrition (%)
Rajbanshi	45 (10.90)	73 (17.63)	85 (20.53)	158 (38.16)
Namasudra	35 (8.45)	76 (18.36)	97 (23.42)	173 (41.78)
Total	80 (9.66)	149 (18.00)	182 (21.98)	331 (39.98)

Table 3 depicts the frequency and percentage distribution of Asia-specific cut-off categories in different socioeconomic demographic groups. The χ^2 analysis shows statistically significant associations with nutritional categories for most of the socioeconomic variables such as birth weight of child, age groups, type of fuel used for cooking, bath place, source of drinking water, husband's occupation and income, but not ethnicity and educational level of women.

Table 3. Frequency of nutritional categories using Asia-specific cut-offs[1] with % in parentheses, and χ^2 analysis. * $p < .05$, *** $p < .001$, NS, not significant

Table 3:

Variables	Underweight	Normal	Overweight	Obese	Total	χ^2
Ethnicity						
Rajbanshi	45 (5.43)	211 (25.48)	73 (8.82)	85 (10.26)	414 (50.00)	2.16NS
Namasudra	35 (4.23)	206 (24.88)	76 (9.18)	97 (11.71)	414 (50.00)	
Birth weight of child						
<2.500kg	24 (2.90)	142 (14.15)	40 (4.83)	27 (3.26)	233 (28.14)	**23.40*** **
>2.500kg	56 (6.76)	275 (33.21)	109 (13.16)	155 (18.72)	595 (71.86)	
Age groups (Years)						
<25	31 (3.74)	128 (15.46)	30 (3.62)	47 (5.68)	236 (28.50)	
25-30	32 (3.86)	198 (23.91)	61 (7.37)	75 (9.06)	366 (44.20)	**25.01*** **
>30	17 (2.03)	91 (10.99)	58 (7.00)	60 (7.25)	226 (27.29)	
Education level						
Primary	27 (3.26)	175 (21.13)	60 (7.25)	56 (6.76)	318 (38.40)	
Secondary	30 (3.62)	154 (18.60)	54 (6.52)	70 (8.45)	308 (37.20)	16.20NS
Higher sec.	20 (2.41)	71 (8.57)	28 (3.38)	38 (4.59)	157 (18.86)	
Graduation+	3 (0.36)	17 (2.05)	7 (0.84)	18 (2.17)	45 (5.44)	
Type of fuel used for cooking						
Wood	58 (7.00)	330 (39.85)	94 (11.35)	112 (13.53)	594 (71.74)	
Crop residue	1 (0.12)	9 (1.09)	2 (0.24)	4 (0.48)	16 (1.93)	**28.88*** **
LPG	21 (2.54)	78 (9.42)	53 (6.40)	66 (7.97)	218 (26.33)	
Bath place						
Open	26 (3.14)	157 (18.96)	55 (6.64)	40 (4.83)	278 (33.57)	**14.87***
Closed	54 (6.52)	260 (31.40)	94 (11.35)	142 (17.15)	550 (66.42)	
Source of drinking water						
Tube well	51 (6.16)	317 (38.28)	106 (12.80)	130 (15.70)	604 (72.95)	
Tap water	1 (0.12)	18 (2.17)	10 (1.21)	4 (0.48)	33 (3.99)	**31.39*** **
Well water	20 (2.41)	65 (7.85)	27 (3.26)	24 (2.90)	136 (16.42)	
Mineral water	8 (0.97)	17 (2.05)	24 (2.90)	6 (0.72)	55 (6.64)	
Husband's occupation						
Labour	20 (2.41)	142 (17.15)	37 (4.47)	37 (4.47)	236 (28.50)	
Cultivation	30 (3.62)	135 (16.30)	44 (5.31)	53 (6.40)	262 (31.65)	
Business	12 (1.45)	57 (6.88)	35 (4.23)	50 (6.04)	154 (18.60)	**37.277*** **
Employee	4 (0.48)	46 (5.55)	20 (2.41)	26 (3.14)	96 (11.59)	
Others	14 (1.69)	37 (4.47)	13 (1.57)	16 (1.93)	80 (9.66)	

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Table 3: (Continued)

Variables	Underweight	Normal	Overweight	Obese	Total	χ^2
Income (INR)						
<7500	28 (3.38)	147 (17.75)	38 (4.59)	38 (4.59)	251 (30.31)	
7500-15000	44 (5.31)	228 (27.54)	79 (9.54)	99 (11.96)	450 (54.35)	**33.621*** **
>15000	8 (0.97)	42 (5.07)	32 (3.86)	45 (5.43)	127 (15.34)	

[1] Cut-offs are: BMI $<$ 18.5 = underweight; BMI 18.5–22.9 = normal; BMI 23–24.9 = overweight; BMI 25+ = obese

Table 4 describes the ethnicity-specific prevalence of the double burden of malnutrition. χ^2 analysis shows how socioeconomic and demographic factors such as birth weight of children, type of fuel for cooking and income influence the nutritional status of women of both ethnicities. Statistically significant relationships of age group, educational level, source of drinking water, and husband's occupation are seen only in the Namasudra women but not the Rajbanshi. However, bath place had a statistically significant relation with double burden of malnutrition only among the Rajbanshi.

Table 4. Ethnicty-specific χ^2 analysis of the prevalence of DBM with socioeconomic variables among the studied populations. Numbers with % in parentheses. * p <.05, *** p < .001, NS, not significant

Table 4:

Variables	Underweight	Normal	Overweight	Obese	χ^2	Underweight	Normal	Overweight	Obese	χ^2
Birth weight of child										
<2.500kg	11 (2.7)	53 (12.8)	15 (3.6)	5 (1.2)	**14.44***	13 (3.1)	89 (21.5)	25 (6.0)	22 (5.3)	**12.45***
>2.500kg	34 (8.2)	158 (44.7)	58 (14.0)	80 (19.3)		22 (5.3)	117 (28.3)	51 (12.3)	75 (18.1)	
Age group (years)										
<25	18 (4.4)	63 (15.2)	16 (3.9)	25 (6.0)		13 (3.1)	65 (15.7)	14 (3.4)	22 (5.3)	
25-30	13 (3.1)	94 (22.7)	28 (6.8)	32 (7.7)	9.63NS	19 (4.6)	104 (25.1)	33 (8.0)	43 (10.4)	**22.59*** **
>30	14 (3.4)	54 (13.0)	29 (7.0)	28 (6.8)		3 (0.7)	37 (8.9)	29 (7.0)	32 (7.7)	
Education level										

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Table 4: (Continued)

Variables	Under-weight	Nor-mal	Over-weight	Obese	χ^2	Under-weight	Nor-mal	Over-weight	Obese	χ^2
Primary	15 (3.6)	78 (18.8)	22 (5.3)	28 (6.8)		12 (2.9)	97 (23.4)	38 (9.2)	28 (6.8)	
Secondary	14 (3.4)	82 (19.8)	31 (7.5)	31 (7.5)	5.28NS	16 (3.9)	72 (17.4)	23 (5.6)	39 (9.4)	**17.88***
Higher sec.	14 (3.4)	43 (10.4)	17 (4.1)	20 (4.8)		6 (1.5)	28 (6.8)	11 (2.7)	18 (4.4)	
Graduation+	2 (0.5)	8 (1.9)	3 (0.7)	6 (1.5)		1 (0.2)	9 (2.2)	4 (1.0)	12 (2.9)	
Type of fuel used for cooking										
Wood	30 (7.3)	177 (42.8)	53 (12.8)	57 (13.8)		28 (6.8)	153 (37.0)	41 (9.9)	55 (13.3)	
Crop residue	1 (0.2)	2 (0.5)	0 (0.0)	2 (0.5)	**15.40***	1 (0.2)	7 (1.7)	2 (0.5)	2 (0.5)	**21.10***
LPG	14 (3.4)	32 (7.7)	26 (6.3)	20 (4.8)		7 (1.7)	46 (11.1)	33 (8.0)	40 (9.7)	
Bath place										
Open	17 (4.1)	83 (20.1)	35 (8.5)	19 (4.6)	**12.05***	9 (2.2)	74 (17.9)	20 (4.8)	21 (5.1)	7.47NS
Closed	28 (6.8)	128 (30.9)	38 (9.2)	66 (15.9)		26 (6.3)	132 (31.9)	56 (13.5)	76 (18.4)	
Source of drinking water										
Tube well	30 (7.3)	166 (40.1)	55 (13.3)	65 (15.7)		21 (5.1)	151 (36.5)	51 (12.3)	65 (15.7)	
Tap water	1 (0.2)	5 (1.2)	4 (1.0)	2 (0.5)	10.97NS	0 (0.0)	13 (3.1)	6 (1.5)	2 (0.5)	**24.30***
Well water	10 (2.4)	35 (8.5)	11 (2.7)	11 (2.7)		10 (2.4)	30 (7.3)	16 (3.9)	13 (3.1)	
Mineral water	4 (1.0)	5 (1.2)	3 (0.7)	7 (1.7)		4 (1.0)	12 (2.9)	3 (0.7)	17 (4.1)	
Husband's occupation										
Labour	11 (2.7)	72 (17.4)	22 (5.3)	26 (6.3)		9 (2.2)	70 (16.9)	15 (3.6)	11 (2.7)	
Cultivation	14 (3.4)	76 (18.4)	25 (6.0)	25 (6.0)		16 (3.9)	59 (14.3)	19 (4.6)	28 (6.8)	
Business	7 (1.7)	19 (4.6)	10 (2.4)	16 (3.9)	20.43NS	5 (1.2)	38 (9.2)	25 (6.0)	34 (8.2)	**33.46*****
Employee	1 (0.2)	25 (6.0)	7 (1.7)	10 (2.4)		3 (0.7)	22 (5.3)	13 (3.1)	16 (3.9)	
Others	12 (2.9)	20 (4.8)	9 (2.2)	8 (1.9)						

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Table 4: (Continued)

Variables	Under-weight	Nor-mal	Over-weight	Obese	χ^2	Under-weight	Nor-mal	Over-weight	Obese	χ^2
Income (INR)										
<7500	20 (4.8)	80 (19.3)	24 (5.8)	22 (5.3)		8 (1.9)	67 (16.2)	14 (3.4)	16 (3.9)	
7500-15000	23 (5.6)	116 (28.0)	41 (9.9)	45 (10.9)	**17.18**	21 (5.1)	112 (27.1)	38 (9.2)	54 (13.0)	**22.11*** **
>15000	2 (0.5)	15 (3.6)	8 (1.9)	18 (4.4)		6 (1.5)	27 (6.5)	24 (5.8)	27 (6.5)	

Table 5 depicts that women who used tube well water as a source of drinking water and husband in the labour category were less likely than the reference category to be underweight. Overweight associated with higher income, liquefied propane gas (LPG) as fuel for cooking, and older age. Obesity associated with higher income, closed bath place, mineral water as source of drinking water, LPG as fuel for cooking, older age, and a lesser likelihood of having a low birth weight child.

Table 5: Multinomial regression with malnutrition categories as dependent variables and socio-economic/demographic predictors.

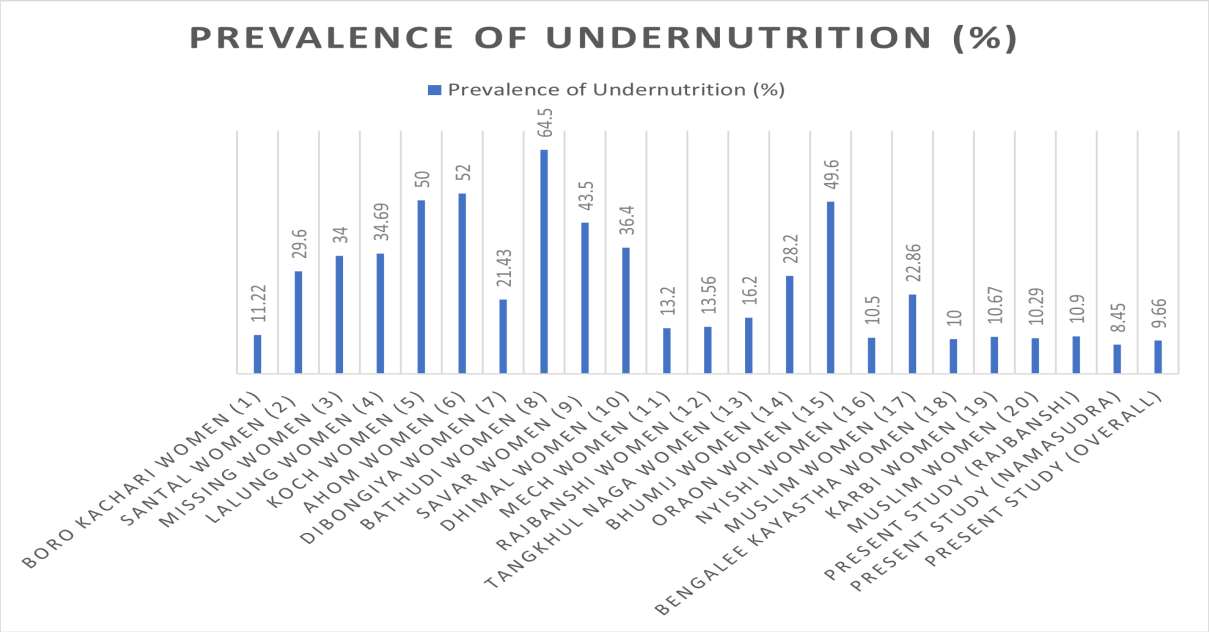
	Category 1					Category 2					Category 3				
Variables	**B**	**SE**	**Wald**	**OR**	**95% CI**	**B**	**SE**	**Wald**	**OR**	**95% CI**	**B**	**SE**	**Wald**	**OR**	**95% CI**
Ethnicity															
Rajbanshi	.159	.267	.352	1.172	(.69–1.98)	-.022	.211	.011	.978	(.64–1.48)	-.129	.198	.424	.879	(.60–1.29)
Namasudra[ref]															
Birth weight of child															
< 2.500 kg	-.105	.281	.140	.900	(.52–1.56)	-.205	.227	.814	.815	(.52–1.27)	-1.028	.247	17.354	**.358*** **	(.22–.58)
≥ 2.500 kg[ref]															
Age groups (years)															
<25	.355	.359	.982	1.427	(.71–2.89)	-1.182	.286	17.101	**.307*** **	(.17–.54)	-.425	.266	2.544	.654	(.39–1.10)
25–30	-.095	.344	.076	.910	(.46–1.78)	-.796	.238	11.181	**.451*** **	(.28–.71)	-.499	.234	4.539	**.607***	(.38–.96)
$\geq$30[ref]															
Education level															
Primary	-.375	.704	.283	.687	(.17–2.73)	.539	.530	1.037	1.715	(.60–4.84)	-.503	.426	1.390	.605	(.26–1.39)
Secondary	-.071	.696	.011	.931	(.24–3.64)	.508	.526	.933	1.663	(.59–4.66)	-.229	.420	.297	.795	(.34–1.81)
Higher sec.	.158	.713	.049	1.171	(.29–4.74)	.662	.550	1.449	1.938	(.66–5.69)	-.283	.442	.411	.753	(.31–1.79)
Graduation+[ref]															
Type of fuel used for cooking															
Wood	-.169	.327	.267	.844	(.44–1.60)	-.844	.252	11.237	**.430*** **	(.26–.70)	-.462	.237	3.803	**.630***	(.40–1.00)
Crop residue	-.653	1.106	.348	.521	(.06–4.55)	-1.406	.827	2.890	.245	(.05–1.24)	-.540	.666	.657	.583	(.16–2.15)
LPG[ref]															
Bath place															
Open	-.067	.282	.057	.935	(.54–1.62)	.209	.220	.905	1.232	(.80–1.89)	-.438	.225	3.801	**.645***	(.41–1.00)
Closed[ref]															
Source of drinking water															

Table 5 (continued)

Variables	Category 1					Category 2					Category 3				
	B	SE	Wald	OR	95% CI	B	SE	Wald	OR	95% CI	B	SE	Wald	OR	95% CI
Tube well	-1.072	.504	4.523	**.342***	(.13–.92)	.678	.526	1.660	1.970	(.70–5.53)	-.569	.377	2.287	.566	(.27–1.18)
Tap water	-2.134	1.133	3.546	.118	(.01–1.09)	.904	.649	1.943	2.470	(.69–8.80)	-1.682	.679	6.131	**.186***	(.05–.70)
Well water	-.425	.542	.617	.653	(.23–1.89)	.709	.561	1.596	2.033	(.68–6.11)	-.878	.434	4.090	**.416***	(.18–.97)
Mineral water[ref]															
Husband's occupation															
Labour	-.871	.412	4.458	**.419***	(.19–.93)	-.031	.382	.066	.970	(.45–2.08)	-.158	.368	.183	.854	(.41–1.75)
Cultivation	-.522	.390	1.791	.594	(.28–1.27)	-.136	.382	.127	.873	(.41–1.84)	-.091	.357	.065	.913	(.45–1.84)
Business	-.798	.487	2.692	.450	(.17–1.17)	.233	.420	.309	1.263	(.55–2.87)	.362	.387	.877	1.436	(.67–3.06)
Employee	-1.658	.648	6.538	.191	(.05–.68)	.036	.456	.006	1.037	(.42–2.54)	-.163	.430	.144	.850	(.37–1.97)
Others[ref]															
Income															
INR < 7500	-.009	.507	.012	.991	(.37–2.67)	-.727	.368	3.899	**.483***	(.23–.99)	-.716	.344	4.338	**.489***	(.24–.96)
INR 7500–15000	-.152	.458	.110	.859	(.35–2.11)	-.620	.307	4.078	**.538***	(.29–.98)	-.579	.282	4.203	**.560***	(.32–.97)
INR > 15000[ref]															

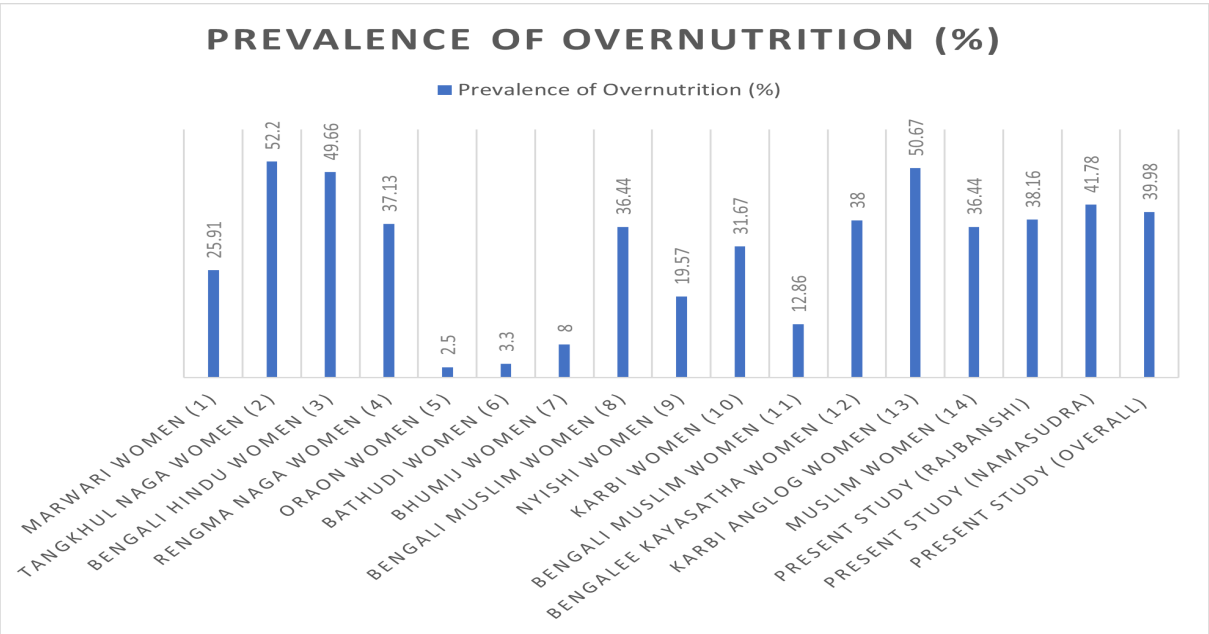
* $p < .05$, *** $p < .001$, [ref] reference category.

Figure 2. Comparison of undernutrition between the present study and previous studies (1) - Khongsdier



2001; (2) - Khongsdier 2001; (3) - Khongsdier 2001; (4) - Khongsdier 2001; (5) - Khongsdier 2001; (6) - Khongsdier 2001; (7) - Gogoi & Sengupta 2002; (8) - Bose & Chakraborty 2005; (9) - Bose et al., 2006 (10) - Datta Banik et al., 2007; (11) - Datta Banik et al., 2009; (12) - Datta Banik et al., 2009; (13) - Mungreipy & Kapoor 2010; (14) - Kshatriya & Acharya 2016; (15) - Kshatriya & Acharya 2016; (16) - Bharali et al., 2017; (17) - Tigga et al., 2018; (18) - Debnath et al., 2019; (19) - Sharma & Mondal 2020; (20) - Debnath 2020.

Figure 3. Comparison of combined overweight-obesity with previous studies. Sources: (1) - Das & Bose



2006; (2) - Mungreipy & Kapoor 2010; (3) - Sen et al., 2013; (4) - Rengma et al., 2015; (5) - Kshatriya &

Acharya 2016; (6) - Kshatriya & Acharya 2016: (7) - Kshatriya & Acharya 2016; (8) - Kalaiselvi et al., 2016; (9) - Bharali et al., 2017; (10) - Mondal et al., 2017; (11) - Tigga et al., 2018; (12) - Debnath et al., 2019; (13) - Sharma & Mondal 2020; (14) - Debnath 2020.

4 Discussion

The co-existence of underweight and overweight/obesity within the same population is called the double burden of malnutrition (Kapoor & Anand, 2002; Khan & Khoi, 2008). The present findings suggest that the dual burden of malnutrition persists in India. Underweight is still prevalent while the prevalence of overweight/obesity is increasing rapidly, particularly among women. According to Asia-specific cut-off values, the present study has documented a low prevalence of undernutrition and a high prevalence of overnutrition among the studied population. Asia-specific cut-offs show the prevalence of overall undernutrition as 9.7% whereas overall over-nutrition was 40.0% (overweight 18.0%, obesity 22.0%).

Asia-specific cut-offs show Rajbanshi women have 10.9% undernutrition and Namasudra women have 8.5% undernutrition. Asia-specific cut-offs place 38.2% of Rajbanshi women in the overnutrition category (overweight 17.6%, obesity 20.5%), and 41.8% of Namasudra women (overweight 18.4%, obesity 23.4%). This shows that the prevalence of double burden of malnutrition is similar for these two ethnicities in Jalpaiguri, West Bengal, India. Recent literature shows that individuals living in developing countries tend to be particularly vulnerable to obesity-related diseases and comorbidities (Bhurosy & Jeewon, 2014; Sen et al., 2013; Tremmel et al., 2017). India has one of the world's highest rates of undernutrition despite evidence of rising overweight-obesity in the urban population. Recent observations showed a rising risk of overweight and obesity also in rural settings, especially among women and among individuals of high socioeconomic status (Dutta et al., 2019; Kulkarni et al., 2017; Mungreiphy & Kapoor, 2010; Rengma et al., 2015; Sen et al., 2013; Subramanian et al., 2007). Several researchers have described rising prevalence of obesity as an age-related effect among the female population (Rengma et al., 2015; Sen et al., 2013; Subramanian et al., 2007).

This makes it necessary to assess the prevalence of double burden of malnutrition (DBM). Such monitoring needs to be based on the sociocultural and environmental factors that determine the prevalence of underweight and overweight (Biernat & Tomaszewski 2015; Rengma et al., 2015; Sen et al., 2013). Several socioeconomic and demographic factors can influence the prevalence of overweight and obesity in Indian populations (Mondal et al., 2017; Mungreiphy & Kapoor, 2010; Subramanian et al., 2007). Recent socioeconomic transitions are responsible for rises in non-communicable diseases, overweight and obesity (Popkin, 2012; Wang et al., 2009). The present study reveals that many socioeconomic and demographic indicators such as age, birth weight of children, type of fuel for cooking, bath place, sources of drinking water, husband's occupation and family income all are associated with the double burden of malnutrition. This is similar to previous findings (Guevara-Romero et al., 2022; Monteiro et al., 2004; Neuman et al., 2013).

Several research investigations have shown relationships of different socioeconomic and demographic factors with the nutritional status of adult women in India (Bharali et al., 2017; Mondal et al., 2017; Mungreiphy & Kapoor, 2010; Rengma et al., 2015; Sen et al., 2013; Subramanian & Smith, 2006; Subramanian et al., 2007; Tigga et al., 2018; Venkatramanan et al., 2017; Waghmare et al., 2022). Population-specific associations of socioeconomic and demographic factors with the prevalence of undernutrition, overweight and obesity were observed to be statistically significant also among the Rajbanshi and Namasudra women of the present study (Table 4). The multinomial analysis reveals that socioeconomic demographic factors significantly influence the BMI among women. Age and source of drinking water are associated with the double burden of malnutrition supporting the results of a previous study (Waghmare et al., 2022). An association of income was reported (Venkatramanan et al., 2017; Tigga et al., 2018). Occupational status has shown a significant association with undernutrition in previous studies (Mugreiphy & Kapoor 2010; Sen et al., 2013). The risk of combined adiposity (overweight + obesity), as defined by BMI $\geq$ 23 kg/m^2, was significantly lower in middle-aged women (25-30 years) than in older women (Table 5).

Studies have reported that in lower-middle-income countries economic development has led to significant

changes and the replacement of traditional foods in diets with high-calorie and fat-containing food, along with processed food (Bose et al., 2021; Debnath et al., 2018; Kosaka & Umezaki, 2017; Temponi & Melendez, 2020). The present findings indicate that the positive relationship between income level and overnutrition may be influenced by other factors. The shift in diet towards high energy density and low micronutrient intakes, coupled with a sedentary lifestyle, has contributed to the household double burden of malnutrition among underweight (BMI < 18.5 kg/m^2) and overweight (BMI > 23 kg/m^2) women. The rise in household income has shifted the burden of overweight or obesity progressively from the wealthy to the poorer groups in India (Subramanian et al., 2007). In many developing countries undernutrition is still considered the main problem, even when the proportion of the overweight population exceeds that of the underweight (Mendez et al., 2005). In India, eradicating undernutrition is still an unfinished agenda. Despite this, India experienced a rising proportion of overweight adult women over the past few decades (Deaton & Dreze, 2009; IIPS Macro International, 2007). Research supported the conclusion that India was about to go through this transition (Sengupta et al., 2014).

The present investigation shows that the prevalence of underweight in our study populations is lower than that reported for most of the ethnic populations in India. Undernutrition was found to be marginally more prevalent in our Rajbanshi women than in previously studied Bengalee Kayastha, Nyishi, Karbi and Muslim women, but undernutrition among the Namasudra population was lower than that found in those previous studies. Conversely, the combined overweight-obesity prevalence of both Rajbanshi and Namasudra ethnicities was higher than that reported for Oraon, Bathudi, Bengali Muslim, Nyishi, Marwari, Karbi, Rengma Naga, and Bengalee Kayastha women.

Limitations of the present study are its cross-sectional nature, smallish sample size, and lack of information about dietary intake among the research participants. The consideration of socioeconomic demographic covariates may be helpful in policy formulation and implementation. There had previously been a dearth of information about socioeconomic and demographic determinants of double burden of malnutrition among Rajbanshi and Namasudra women of Jalpaiguri, West Bengal, India.

5 Conclusion

The present investigation suggests that undernutrition is still a cause for concern among both of the studied populations, although there is also much overweight and obesity. This study proves the existence of a double burden of malnutrition among Rajbanshi and Namasudra women. Intervention programs featuring awareness campaigns, physical activity, balanced diets, and age and gender sensitive programs should utilize people's socioeconomic and demographic profile to combat DBM among women. The findings of the present study might be helpful to government agencies for policy formulation. The issue of DBM among various populations must be addressed through research, public health policy, and nutritional education, specifically in the context of the nutritional transition. Awareness programs are essential to eradicate the double burden of malnutrition among ever-married women of the two studied ethnicities. Adequate nutritional knowledge and awareness at the community level could help to reduce future risks of undernutrition and overnutrition as a cause of morbidity and mortality also among other ethnic groups in India.

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Gender Disparities in Zimbabwe's Audio Engineering Industry

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Abstract

Globally, women are under-represented in in some trades, including the music industry. In many parts of the world, women are beginning to move into the audio engineering field although they are still very few. This situation ought to be addressed given the aim to attain gender parity in communities. The paper discusses the causes of gender disparities in Zimbabwe's audio engineering industry and proposes ways of redressing the situation. Data in this qualitative research was gathered through participant observation, document analysis and semi-structured interviews. Interviews were carried out with both male and female audio engineers and singers. The study revealed that abuse, disrespect, exploitation, fear, disinterest, inability, lack of expertise, lack of role models, and oppression are some of the factors that inhibit women's participation in audio engineering. Using the Unified Theory of Acceptance and Use of Technology, we advocate for women to contribute to the achievement of gender inclusivity by actively partaking in audio engineering roles, enhancing their expertise and experiences as well as developing positive attitudes towards traditionally male-dominated trades such as audio engineering. We argue that background, exposure, preferences and abilities of women are all factors that affect their career choices in audio engineering. The research recommends that females forego the cultural limitations that inhibit them from pursuing audio engineering roles.

Keywords: Audio engineering, Culture, Disparities, Gender, Technology acceptance

1 Introduction

There are fewer women than men in engineering roles the world over, and this includes the sound engineering profession. Audio engineering is a vital aspect of the music industry and females ought to participate in this field to achieve parity in line with Sustainable Development Goal number five. Women constitute five percent of audio engineers (Farrugia, 2012). The ratio of students studying sound production is one female to ten males, and education programmes could help evade the usual studio apprenticeships and informal male networks (Farrugia, 2012). These statistics show gender disparities in audio engineering roles. The male/female ratio in audio engineering is not much different from that in other technical and engineering professions such as industrial engineering and computer science, and this disparity appears to be universal. The unequal representation is attributed to several reasons that include women's abilities, ambitions, and attitudes. This global trend also characterises the audio engineering industry in Zimbabwe.

Against this background, women audio engineers in Zimbabwe find themselves plying their trade in a society where the social commentary is sometimes characterised by patriarchal attitudes. The theoretical lens through which we analyse gender disparities in sound engineering is the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2016). We particularly zero in on its four key constructs, namely performance expectancy, effort expectancy, social influence, and facilitating conditions to explain women's involvement in audio engineering. We examine the degree to which women believe that interest and involvement in the sound engineering profession will help them to excel in this job, the degree of ease they associate with the job, how the perceptions of significant others impact their involvement, and the extent to which they trust an organisation's technical infrastructure and equipment to support their ease of partaking in sound engineering.

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The thrust of this paper is to uncover what keeps females from participating in audio engineering roles. It appears that the responsibility is not entirely on females' incapabilities and disinterest, as there are other factors behind their low participation in music production. We advance the position that there are both intrinsic and external reasons for incapability and lack of interest and this study set out to reveal them. This approach postulates human psychology as a mediator between external factors such as economic constraints and cultural values and the ultimate effect, which is the underrepresentation of women in sound engineering. The objective of the study was to determine what causes gender disparities in audio engineering roles in Zimbabwe. Knowing the causes can help to strategise and promote gender balance in the mixing and mastering of music.

This qualitative study was carried out in cities of Harare, Bulawayo and Gweru in Zimbabwe, which were selected because of their convenience in terms of accessibility to the researchers. The qualitative paradigm allowed for in-depth understanding of life experiences with reference to social and cultural depositions (Muzari et al., 2022). The target population for this research consisted of audio engineers and recording artists in Zimbabwe. The accessible population that formed our study sample comprised all audio engineers and recording artists from these three metropolitan provinces. From this population, we purposively did homogeneous sampling (Thomas, 2022) of six music producers (three males and three females) and four recording artists (two males and two females). To find out the views that the music industry has on gender disparities in the mixing and mastering of music in Zimbabwe, we involved male and female audio engineers and recording artists. The snowball sampling technique where currently enrolled research participants help recruit future subjects for a study was employed as well (Simkus, 2022). Female audio engineers are difficult to find because of their rarity; hence other participants assisted in identifying them. Interviews, participant observation, and document analysis were used to collect data. Thematic and narrative analysis was used to analyse the data.

The study identified the challenges that are associated with gender imbalances in the mixing and mastering of music. Knowledge of these challenges is required to develop any strategies that can be adopted to encourage gender balance in the field. The first part of the paper discusses global gender disparities in the sound engineering profession. The second section zeroes in on the situation in Africa, and in Zimbabwe. The paper goes on to present the views of research participants on the gender imbalance in Zimbabwe's audio engineering industry, embedded with the discussion of findings. The conclusion points to our argument that more and more females ought to embrace technology so as to be able to populate the music industry in technical roles.

2 Global gender inequalities in audio engineering

Davies (2022) examined the disparities experienced in audio engineering, citing the fewer numbers of women who pursue the field and gain credit for it. Women make up less than five percent of sound engineers in the United Kingdom (Farrugia, 2012). There is a struggle for women to be taken seriously, amidst the experience of unwavering sexual advances and degrading comments. The audio engineering industry is characteristically male-dominated and scholars have investigated gender imbalances in the music industry in general (Farrugia, 2012), and gender disparities in the production and performance of music (Davies, 2022; Farrugia & Swiss, 2008; Mathew et al., 2016). The lack of visibility women receive in the industry does little to encourage them to pursue music technology (Wolfe, 2019). There is need for female engineers to surround themselves with positive people and inspiring mentors. Stereotyping leads to lack of role models and demotivates women who desire to take up roles in audio engineering. Lack of female artists to inspire others is one of the hindrances to the growth of the music business. Technology acceptance means everything women see must convince them that the sound space is meant for them. It takes self-drive and determination to push through and be successful. There is a need to rise up and occupy male-dominated fields in order to promote gender balance.

Hopkins and Berkers (2019) explore the complex intersections of gender, music, education, and technology. Male domination in the music technology classroom and the field was the major finding of this study. These authors conclude that males self-select into this specialty and the disparities observed are not caused by

some structural features or discrimination in the music industry. The causes have to be established at a much earlier stage of the career path, even before the student decides to enrol in a study program of music technology. In addition to self-selection into the study program, sex-specific attrition rates need to be considered when students find that this is not the right occupation for them or students fail their exams. Hopkins' (2019) research mainly focuses on music technology education and does not delve into the audio engineering field. Farrugia and Swiss (2008) explore the challenges faced by females as they pursue audio engineering roles. Their findings revealed that sexual harassment and objectification were the main drivers of inequalities found in audio engineering as women felt unsafe and degraded. They advocate for an equal playing field and appeal to the music industry to make opportunities available for females who want to pursue audio engineering roles.

Degrading comments that are given by fellow producers, artists, and fans demotivate women who are into audio engineering roles. Women are known for being easily offended. This stereotype seems to be quite accurate because world-wide, the most consistent sex difference on personality tests such as the various Big Five inventories is a higher female score on neuroticism (Dalton & Ghosal, 2018). This means a stronger experience of negative emotions: fear, depression, and importantly "angry hostility". High neuroticism combined with a female-typical attention to people rather than to things or data is the reason why women often feel offended in situations where men would see no reason for being offended at all. Other explanations such as dogmas taught in school, or traditional culture, or fashion are other links between stereotypes and reality.

Negative comments cause females to lack confidence, thereby keeping them out of the audio engineering space. This is how high neuroticism can lead to vulnerability (Dalton & Ghosal, 2018). Only the bold women will pursue engineering amidst all forms of negative comments. Bold and dominant women have high testosterone and show signs of confidence (Dalton & Ghosal, 2018; Grant & France, 2001). The use of gendered terminology, for example, the XLR cable is referred to as the male and female resembling the superiority of men in the industry. People's attitudes, perspectives, and beliefs shape gender roles in the audio engineering field. Most people think a sound engineer in a recording studio or behind the sound desk at a live performance is a man (Mayhew, 2017). Audio engineering is assumed to be a male activity; hence few females occupy these spaces. Whether this is because nobody wants to hire them or they themselves have internalized this stereotype to the extent of not pursuing this career has to be established. Women are more likely found in the composition and performance of music whilst men engineer it. According to Davies (2022), patriarchy in audio engineering continues to undermine the achievement of gender equity. The presence of girls and women in audio engineering can promote gender parity both locally and globally. Their scarcity points to them being exempted from this socioeconomic slot, and it affects their livelihood.

Sexual abuse is common in the audio engineering field. Failure by the victim to comply to sexual demands could lead to other forms of abuse such as physical abuse. Pell (2021) describes her experiences in this field and explains how one production manager told her that she would never make it unless she opens her legs. It is disheartening that some females give in to such demands, allowing themselves to be sexually abused. A lady can be promised a job in return for sexual relations in record labels (Hill, 2021) by a manager who can access the connections. Baah et al (2022) state that "almost half of all musicians in the UK say they have experienced sexual harassment at work and citing the culture of the industry, only one in five of them felt that they were able to report it." Such situations may give the man the power to forcefully initiate sexual relations with her. Some females might give in because of the desperation caused by joblessness.

Physical abuse is another pandemic that women face in the audio engineering industry. Husbands may feel jealous of their wives especially when they work till late hours or when they interact with male clients. This can result in gender based violence (GBV) where the husband suspects the wife of extramarital affairs with clients and fellow music producers. Females are forced to abandon their passion for audio engineering in an attempt to safeguard their marriage. Single ladies who are in relationships also suffer the same abuse from their boyfriends. GBV can prevent the achievement of gender parity in the audio industry. Females are disrespected in this field because of the belief that they are invading a male-dominated industry. Patriarchy favours male superiority and female inferiority (Mayhew, 2017).

Although there are far fewer women than men in this field, there are a few who have managed to make

progress but their efforts have not been rewarded. Mathew et al. (2016) highlight the contributions of women in the audio engineering industry amidst the challenges they face. They argue that the success and contributions of women in this field have expanded greatly although the gender gap is still wide. Gaston-Bird's (2019) book chronicles careers of women who have been present in audio-related fields and music technology programs. Fogel (2019) cites how Oberlin University has made strides in improving gender diversity in the music technology field on campus. Female tutors were hired, which boosted the confidence of most female students. Concert sound which does live sound for campus events employs more women, which creates a greater appreciation of females in this field. In the United States of America, there is an organisation called SoundGirls which runs Sound Camps in various places in order to encourage girls and introduce them to potential careers in audio. Females therefore need space and resources that will enable them to operate in the field of audio engineering, through the implementation of gender balances in all aspects of life.

Kuhn and Wolter's (2020) research proved that there is a "people versus things" difference between men's and women's interests. Women in general prefer occupations where they interact with people, while men prefer occupations where they interact with things. In the music industry, for the performers there is interaction of sorts with the audience, and of course between members of a band. Audio technicians interact more with microphones, loudspeakers and recording equipment than with people. Therefore, there is an expectation that performing is a female as well as a male thing, whereas sound technology is male-dominated. Jones et al., (2021: 591) say "gaps in vocational interests stem, in part, from race-based variations in the perceptions of accessible jobs depending on one's racial group." This is particularly applicable to the career choices of women in Zimbabwe, where very few take the engineering route.

3 Sound engineering gender imbalances in Africa

In Africa, some laws are gender discriminatory as they are made in favour of males. In countries such as Tanzania, South Africa, and Nigeria women are scarce in all areas of music. Ibekwe (2018) reports gender disparities in music production and performance in Nigeria. Patriarchy makes it difficult for women to pursue professional music careers as they may be considered promiscuous and uncultured. Females disassociate themselves from any activity that is carried out outside the confines of the home for fear of being labelled. They perform music during their leisure hours only as they are considered custodians of folksongs. As most African women do, they spend most of their time nursing their children as well as carrying out household chores while men go out in a bid to fend for the family. Scholars have researched gender inequality in the African music industry. Bakare (2022) posits that women are equally creative as men but still face marginalization in the creative sector. According to Bambalele (2022), in South Africa, the major outcry for women in music is that they are treated as sex objects, physically abused, exploited, underpaid as well as discriminated against based on gender.

In Africa, women are well represented in the performance of music because it seems as if women's role in this industry is entertaining through singing and dancing and nothing else. Some families disown their boys and girls who pursue roles in the music industry hence background has a great impact on one's career choices in this field. Bakare (2022) argues that whilst most Africans who are in the music business are making a living in the global market (though a marginal one in many cases), women who are part of the ecosystem are severely underrepresented. An observation she made in the Nigerian music charts revealed that women's songs that were played on-air were those of self-producers and that on "African Heat", Spotify never played a song produced by a female. This indicates the level of marginalisation of women in music distribution channels as they are also masculinised and reserved mainly for males.

Patriarchy has been cited as the main cause of gender inequality in the Zimbabwean music industry. Katiji and Muranda (2023) say females in Zimbabwe are treated as not equal to their male counterparts hence their difficulties in getting involved in the music industry. Females were viewed as belonging to the house to look after the family. However, some females in the music industry had survived stereotyping due to support from their spouses and family members. Patriarchy is a system in a society where the power to govern in all spheres is given to men whilst women are excluded.

However, we note that music technology is not so much about power and governing, but about interest in technology. Mutekwe et al (2011) urge the "need for all stakeholders involved to help girls by deconstructing the gender role stereotypes or perceptions of roles society considers appropriate for girls and boys". Males and females must learn the same curriculum so that females get an opportunity to take up technological courses. Women make up 51 percent of the population of Zimbabwe and therefore have the capacity to attain parity in the music industry (Vengesai, 2019). If women begin to occupy audio engineering roles they act as role models and take up mentoring positions for those females who would want to pursue the same field. There is need for a change of mindset amongst males and females concerning gender roles in audio engineering. Females also have a role to play in dealing with these gender disparities by supporting each other in trying to have role models in the field. UNESCO pioneered a project which focused on women's empowerment and gender issues in Zimbabwe (Breire, 2020). These researchers concentrated on gender disparities in the Zimbabwe music industry, and this current study compliments them by focusing on gender disparities in the country's audio engineering profession.

4 Obstacles faced by female audio engineers in Zimbabwe

Firstly, respondents reported lack of expertise and experience as hindrances to gender balance in audio engineering. The male respondents were of the view that females lack expertise and they are not experienced enough to carry out roles in audio engineering. Male singer Tedious Gandanhamo (personal communication, 23 December 2022) said, "maybe it is because they have not done much to compete with their male counterparts in order to be recognised, works should speak for themselves." Addington Dzingirayi (personal communication, 18 October 2022), a male audio engineer, said:

> *I was formally trained and did a lot of workshops. In one of my classes, there were 4 females out of 31 classmates. I dropped out because I felt I was not benefiting as I was above the curriculum being offered. Later on, I did one on one training at home with tutors whom I hired.*

Donald Masunungure, a male singer (personal communication, 16 December 2022) suggested the need for workshops and awareness campaigns towards equalising opportunities in audio engineering to all Zimbabweans. Females do not possess the same audio engineering qualifications as their male counterparts. From the above data, the male engineer cites that he was trained in various platforms. He cites that he dropped one program because he felt that he was more knowledgeable in the area of study hence the curriculum was too shallow for him. Contrary to that, females explain their excitement after receiving their first training. The maximum training programmes the females have completed are two, hence males are more experienced than women on average. There is need for females to seek the necessary skills and experience for them to survive in the field of audio engineering. Most females are not able to play musical instruments which are a pre-requisite for one to be successful in music production.
Brighton Chirumbwana (personal communication, 7 December 2022) believes that audio engineering is difficult because artists are tough, hence they need someone strict who will be able to handle them. "If you see a lady who can stay in the field of sound engineering, it shows how bold and tough they are", he says. Roselyn Dube, a female trainee audio engineer (personal communication, 12 December 2022) concurs with the above statement as she explains:

> *Some artists do not get satisfied with their final products and they complain. There is a certain artist who came drunk and he started complaining whilst in the recording process before the song was mixed and mastered. In the studio, you find different types of people so you have to develop social skills so that you can handle the different characters you meet.*

Sound engineers who possess the requisite skills can confidently handle such artists. Bridging the knowledge and experience gap will empower women audio engineers to excel in their job. Females should train and gain skills in audio engineering. The extent to which women perform in audio engineering because of prior

learning and experiences with the technology (Venkatesh et al., 2016) has been found to be a significant predictor of behavioural intention and technology use.

The classroom environments were reported to be accommodative hence females should enrol to learn. Novuyo Dube, a female singer and trained audio engineer (personal communication, 07 December 2022), described her classroom experiences as fun and educative. She highlighted that the tutors treated everyone the same regardless of their gender. She says: "I had fun in class as I gained so much skill and I learnt a lot from the boys as well". Nomazulu Malandu, a female music technology university graduate (personal communication, 13 October 2022), agreed that the classroom experience was accommodative as the students were all treated the same regardless of their gender.

The second obstacle that was reported has to do with sound engineering equipment. Dzingirayi (2022), said: "When you begin this profession, you start by lifting equipment, and ladies do not want that because most of the equipment is heavy." This shows how manufacturers of audio equipment inadvertently masculinise the field. Dube (2022) explained that she has not been practicing audio engineering although she had studied it because she has not acquired enough equipment. Hence, she is currently into performance. Malandu (2022) mentioned that she managed to start practicing because she immediately purchased her equipment and she did not have to wait for someone to employ her. Chirumbwana (2022) mentioned a certain female audio engineer (name withheld) who is no longer practicing but was very passionate about her profession. The reason for her quitting is unknown. He says: "One thing that I know is that once ladies dedicate themselves to something, they put their effort hence there is no limit. Ladies must pursue audio engineering.

Dube (2022) explained how her studies were affected by the covid 19 pandemic where they had to work from home and she did not have the necessary equipment for her to continue practicing her craft. She highlights that "... Covid 19 disturbed us because engineering is something that needs practice so we were at home and there was no equipment for us to use so that we practice." Therefore, many females fail to develop their skill because of lack of equipment. The degree to which a woman believes that the technical infrastructure is able to support her use of the sound system is key to their success in the audio engineering role. It is important to have access to reliable resources; technical infrastructure, knowledge, training, and support, which can impact women's willingness to venture into audio engineering (Venkatesh et al., 2016). The extent to which women believe that using audio engineering gadgets will help them excel in job performance (Venkatesh et al., 2016) is a key driver towards achievement.

The third reported hindrance is abuse. Dube (2022) said: "Personally I have never encountered cases of sexual harassment but I have heard of women who complain of being sexually abused by males in the industry." Dzingirayi (2022) clarified the dangers that female audio engineers are exposed to. He explains how these roles involve lots of travelling as well as working till late hours. He states, "females are vulnerable to abuse as they travel with males. At times you will be given one room to share as the band and engineers which mostly will be males, which then exposes the female that will be on board." He reiterates: "In Zimbabwe, it is difficult to operate. If you are a male engineer, it is easy to tour with female artists, but if you are a lady touring with male artists it is very hard. That is why it is difficult for a lady in Zimbabwe to be an audio engineer." Dube (2022) explains that "when some artists would find me alone in the studio, they would tell me that they love me. They always had a mind of initiating sexual relations at work which made it very difficult for me." Gloria Chikepe, a female live sound engineer (personal communication, 25 October 2022) described how certain females were not comfortable being around a man. She states that she was never sexually harassed in any form. She says: "If you entertain men like you are of them; they will not try to make any sexual advances on you." In her relations with her male counterparts, she was confident to contribute whenever there was a need and she never faced any negative treatment.

We observed that some men in the music industry abuse their power and inappropriately initiate sexual relations with female musicians and audio engineers. They usually take advantage of young and upcoming women because they will be seeking fame and success. Managers, record label owners, and producers can forcefully initiate a relationship in exchange for favours such as employment opportunities or free services. The culprit can abuse women specifically because their leading positions make it challenging for women to turn them down or expose them. Out of fear that their career can come to an end, females usually give in to the abuse. Females tend to choose situations that will benefit them although at times these men never

fulfil their promises. A woman may embrace forced sexual relations not because she wants to but due to a desire to enter the male-dominated audio engineering field.

Verbal abuse is also a common problem. We observed males who pass negative remarks to aspiring women audio engineers. Females take offence at their efforts not being recognised. We also observed some family members and educational mentors in Zimbabwe also give remarks which demoralise girls who would want to pursue audio engineering roles. Some parents and teachers pass negative comments which discourage their girl child from choosing the career they desire. Such remarks cause females to lack confidence and shun audio engineering roles. Losing confidence is another real-world expression of high neuroticism (Dalton & Ghosal, 2018). Pre-conceived ideas about women's inabilities contribute greatly to how society views females who pursue engineering roles. There is a need for a change in the way females in the audio engineering field are addressed.

Fourthly, respondents indicated disrespect as another challenge. We observed that females are disrespected and undermined in the field of audio engineering. Some men believe that women are less knowledgeable when it comes to music technology. According to Shona cultural beliefs, women are not permitted to speak out and challenge their husbands in public lest they are considered disrespectful. In an effort to remain submissive to their husbands, some women will endure all forms of disrespect. Dube (2022) describes how she was belittled by a fellow musician who was supposed to do a collaboration with her. She states, "He made me feel like they know everything and I don't, they have a better voice and I don't and they can produce better and I cannot. The project had to die. I prefer being alone in the studio as it feels safer, nobody undermines you or judges you". This shows the significance of social influence when women engage audio engineering technology (Venkatesh et al., 2016).

Disrespect is also revealed by the degrading comments which are received from males. Chikepe (2022) narrated an incident whereby the fans of her artist did not approve of a female engineer. She recalls a male sighing to the artist that "... *waakutora vakadzi kuisa muband, ah! Zvakuzodakwa manje*" (you are now taking females and putting in the band, ah it will be a disaster now). Although the male later on apologised, Chikepe says that she was offended. Dzingirayi (2022) is of the same view as he says: "Male artists do not expect to find lady engineers, they prefer males".

The outcry is the same in the Zimbabwe music industry where female gospel artist Fungisai Zvakavapano says a woman has to be "three or more times better than their male counterparts to enjoy half the attention and appreciation the male counterpart gets, whether it is from the audience or the corporate world (Kabaya, 2019). If this remains so, females might remain underrepresented in the music industry.

Stereotypes were reported as the fifth obstacle. Masunungure (2022) said "women have an inferiority complex as they think that audio engineering is not their job but for males". The singer Masunungure (2022) commented: "Since there are not many female producers, there is no inspiration." As female role models in audio engineering begin to increase, a rise in the number of women pursuing the field becomes evident. Some women who have managed to enter this area have since quit because of the scarcity of their gender. Gandanhamo (2022), said: "One thing for sure, once a female produced project is excellent and marketed well, another female producer will be inspired and encouraged to join and they will also be recognised by all stakeholders in the industry." There is need for females to take part in audio engineering for others to emulate. This will reduce women's fear. Malandu (2022) described her classroom experiences. She comments: "it is quite funny because on the first day people would ask about the program that I had enrolled in. They got shocked to learn that I enrolled for music technology. That is where I see the stereotyping of this discipline." Malandu added that she was very happy to find other ladies in the technology class although they were few. Gandanhamo (2022) said:

> *Women are not willing to take it up as it is a male-dominated field. The few that could be courageous to take it up are discouraged and face many challenges like being labelled and criticised thus end up being overshadowed or drop out.*

Gandanhamo (2022) also expressed that "maybe they have not done so much to out-compete the male counterparts to be recognised, works should speak for them." Studies about stereotype accuracy in audio engineering are needed. The above evidence reveals that women in this industry are facing prejudice because

of their gender, which then has a negative impact on their participation. The absence of women from audio engineering roles affects those who aspire to enter the field. Mathew et al. (2016:4) indicate that "most women tend to look for instructors or female professionals who are aware of the differential experiences of women and men." In various cultures, children learn by observing what their role models do, hence a lack of females in audio engineering might discourage girls who would want to study music technology. We observed that some females who are greatly talented in technology fail to pursue the field because they presume it is a male domain due to the invisibility of women. In Zimbabwean schools and tertiary institutions, most females shun technological courses because fewer women are interested in music technology than they are in other technical and engineering occupations.

Women have roles of child-rearing and doing household chores whilst men have ample time to pursue their gifts and talents. Women's pursuit of music production despite the patriarchy that characterises the industry suggests that positive attitudes can challenge the existing stereotypes. There is a shift from collectivism to individualism in modern societies. Among many other things it implies a move away from behaviours that are generally viewed (and correctly recognized) as gender-typical to the development of individual preferences, with some women developing male-typical preferences. There is a slippery slope where women are coaxed into male-typical roles and behaviours because these are considered more prestigious than female-typical roles and behaviours. This is not necessarily good for those women who are not naturally inclined to act male. It would simply invert the demand for feminine roles and behaviours that is typical for traditional societies. It would mean rewarding high-testosterone rather than low-testosterone women.

The music industry is made up of men and women and both sexes can swap gender roles as the need arises. God created people with the same type of ears, hence all can engineer sound. Prejudice or discrimination based on sex or gender makes it very difficult for a woman to penetrate audio engineering. The studio environment itself is populated mainly by males, and with mainly males at the top of the hierarchy. Coupled with the heavy equipment and intricate software used, this makes it a male territory. Female audio engineers whom we interviewed narrated their experiences of working in the field where their cultural backgrounds determine how gender roles are distributed in their families. The reason why females struggle is because of the characteristics they acquired socially from the family. The patriarchal society instils feminine qualities of gentleness and submission on women which then affects them when they are carrying out their audio engineering duties as they struggle to handle difficult male clients, especially those who cause trouble. Women ought to be tough and learn how to handle people in the studio. Artists can take advantage of females they find in the studio and end up discouraging them from taking part in this male-dominated role.

The sixth reported obstacle is fear. Dzingirayi (2022) said: "Women fear the unknown because they think this job is for men." Masunungure (2022) said: "The job involves lots of work so females think they are not able to handle it." Dube (2022) stated:

> *I am a producer but I haven't taken it seriously. In my class, there were 10 girls and only one of us was serious about engineering. We have made men feel like they are the bosses in sound engineering. We lack interest and motivation and feel we cannot compete with them.*

Malandu (2022) said: "I think there are few females because women may just feel diffident and inadequate." Nomazulu speaks of how she operates her own studio and is currently producing her own music. Gandanhamo (2022) said: "Women face many challenges like being labelled and criticised thus ending up being overshadowed and even dropping out." Criticism instils fear in women who wish to pursue audio engineering roles. Gandanhamo (2022) says, "There are no limitations to entry, it is open for all so if they are afraid to take it up, it is nobody's fault." Dube (2022) said women ought to get out of the comfort zone and face their fears and start producing music. A change of mindset by females on their career parts can mitigate the gender disparity that exists in audio engineering roles.

We observed that females fear taking up roles in audio engineering, resonating well with personality psychologists' finding of average to high female neuroticism (Dalton & Ghosal, 2018). Primary agents of socialisation play a crucial role in removing fear and developing interest in music technology in the girl child. Parents ought to support the endeavours of their children so that they pursue the careers that they most desire. The family acts as the first agent of socialisation where children are groomed before they are

exposed to the world. Family support for the girl child can be through providing financial and emotional support, as well as protection from abuse. Teachers also impact the career choices of learners. The church should also play a role by encouraging girls and women to partake in sound engineering. Audio engineering should be a free domain to those who wish to pursue it regardless of their gender. These social circles that also include teachers, co-workers, elders, friends, and peers should positively influence women's intention to use sound engineering technologies (Venkatesh et al., 2016).

Lack of interest in audio engineering roles was reported by respondents as the seventh hindrance. Clive Mukundu (personal communication, 8 October 2022) argues that females are not oppressed but only lack interest and dedication in audio engineering. He explains:

> *There is a lady I have been encouraging for a very long time to pursue engineering because I saw a talent in her but she is still not pursuing it. I even offered her to train keyboard but to no avail. The husband is also a musician and he supports her musical career.*

Mukundu (2022) also believes that the pressures of motherhood may affect married women as they have to breastfeed and take care of their children. Dzingirayi (2022) described how women lack interest in these audio engineering roles. He says: "I created a WhatsApp group called Sound on a Sound to promote lady engineers and we were 400 in that group which had only 4 ladies." Dzingirayi (2022) says, "I have a male mentor whom I imitate and who inspires me to work." Females therefore need mentors of the same gender to guide and inspire them without being judged. Dzingirayi indicated that he is part of Audio Engineers Society of Zimbabwe, a group of audio engineers which aims at improving Zimbabwe's Sound. It was founded by a female. However, out of 12 committee members there are only 2 females. Women cannot be promoted if they are not in this society. Females are therefore encouraged to take interest and participate in the male-dominated audio engineering industry. Gandanhamo (2022) says: "The females are the ones to take up the challenge and prove their ability. It is all about them believing in themselves."

These responses show that females are not interested in participating in audio engineering roles. To a certain extent, this opinion is true. However, there are reasons behind this lack of interest. As alluded to by Mukundu (2022), traditional gender roles affect women because these give them no room to practice their career prospects. University admission statistics reveal that fewer women than men enrol in music technology or audio production programs (Mathew et al., 2016). This suggests a pre-existing lack of interest. Teenagers might feel motivated when they see womenfolk working so confidently in technology hence women should be given the platform to practice audio engineering so that they become role models for others to emulate.

Females lack interest in audio engineering roles and Music Technology studies hence they are outnumbered by males in university programmes where we work. In music performances, for instance, women usually sing and dance whilst men play instruments and manage live sound. Perhaps this is because women are better than men at singing and dancing. Gender balance is achievable if strategies are used in order to promote parity in the audio engineering industry in Zimbabwe. Whether equal numbers of males and females in the profession are desirable, whether equal representation is always a good thing, and the benefits and demerits of gender balance are beyond the scope of this study. Women's degree of eagerness to adopt cutting-edge sound engineering gadgets, coupled with their belief in their own capacity to learn and excel (Venkatesh et al., 2016) in the sound engineering profession is very critical.

Given the obstacles highlighted by the respondents, the Zimbabwe music industry ought to make deliberate efforts to try and deal with the gender disparities in the field. Females so inclined should be given the platform to practice audio technology. While this is desirable, it will not lead to equal representation if most women are turned off by anything technological. Without spaces to learn the trade and technical skill of music production, women cannot have access to the audio engineering industry. Exposure to technology has an influence on girls who would want to be involved in audio engineering roles. Initiatives such as Spotify and SoundGirls play a big role in promoting female audio engineers. The Zimbabwean music industry can adopt several strategies in an effort to promote the presence of women who are scarce in audio engineering roles. A positive attitude and development of interest in sound engineering are the starting point for women. Women are invisible yet they can also play an important part in the audio engineering industry in Zimbabwe.

The local music industry could adopt the same principle and deliberately target females to take up audio engineering occupations so as to promote gender parity in the field. Organisations specifically designed for female audio engineers could be established to offer training to those with interest in the field as females ought to be exposed to audio technology. Such organisations could be established in Zimbabwe where females are given the platforms to manipulate audio technology without facing any form of prejudice. Initiatives have been carried out in Zimbabwe to try and encourage girls to engage in audio engineering. Female audio engineers are currently being trained in colleges and universities in Zimbabwe with a view to bridge the gender disparities in the creative industry. However, these initiatives are still very few. To produce the desired results, training and promotions should be ongoing until a change is realised.

5 Conclusion

The paper has revealed lack of knowledge, stereotyping, abuse, patriarchy, lack of interest, lack of equipment, fear, and disrespect as factors leading to gender disparities in Zimbabwe's audio engineering industry. Women continue to be scarce in audio engineering roles in Zimbabwe although efforts have been made to promote them. Marginalisation, prejudice and misogyny continue to be widespread in the audio engineering industry of Zimbabwe. There is a need to find ways of promoting gender balance by addressing the needs of the females. Women play an important part in enhancing the audio engineering industry of Zimbabwe. Gender balance in this field is vital as it aids the development of the Zimbabwean music industry. The data collected proves that females are scarce in audio engineering roles. The reasons include abuse, disinterest, lack of recognition, expert knowledge, skills and experience, and the prevalence of fear. Women lack confidence and motivation to take up roles such audio engineering which are considered masculine.
Patriarchy is a traditional system that gives men power over women in some aspects of life in Zimbabwe. Women are taught to submit to men as they are considered inferior to men. It is very difficult for women audio engineers to succeed in such a patriarchal society as they might not be allowed to occupy the space. When females fail to find role models, they are not inspired to enter the field. It is therefore important for females to be awakened to how they find themselves with limited opportunities to pursue their interests and ambitions in audio engineering roles in a patriarchal system. We conclude that the audio engineering industry is a space where women can use their presence to challenge patriarchal structures, express their artistry, and promote social justice.

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Integrating Indigenous Knowledge into South Africa's Free Basic Water Policy for Sustainable Water Conservation in Low-Income Communities: A Systematic Literature Review

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Abstract

South Africa's Free Basic Water Policy (FBWP) provides low-income households with a baseline amount of water free of charge, addressing basic needs but posing challenges for water conservation due to the lack of direct usage costs. Indigenous Knowledge (IK) offers a valuable complement to FBWP, contributing community-driven, sustainable practices that can encourage conservation while respecting cultural practices. This systematic literature review (SLR) evaluates the potential for integrating IK into FBWP to enhance water conservation efforts in low-income South African communities. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, relevant peer-reviewed studies were identified, screened, and analysed. The key findings highlight strategies such as community-led rainwater harvesting, natural filtration methods, groundwater recharge, traditional governance models, and sustainable agricultural practices. Integrating IK into FBWP can improve water conservation outcomes, support sustainable resource use, and foster a culturally aligned approach to water management in low-income communities.

Keywords: Free basic water policy; Indigenous knowledge; Low-income communities; Sustainable water conservation

1 Introduction

South Africa is currently experiencing a "water crisis" stemming from social, economic and ecological challenges. Increased demand for water resources due to rapid population growth and expanding urbanization, combined with unpredictable climate patterns, has left many low-income and rural communities with disparities in access to water (Whittington & Nauges, 2020).

Recent data from community surveys indicate that only 78% of households in urban areas have access to piped water within their homes, leaving about 3.7 million people reliant on communal stand-pipes. For families living in backyard rentals in Soweto or single-room hostels in eThekwini, the monthly allocation of 6 kiloliters of Free Basic Water (FBW) is often depleted by the middle of the month (Department of Water and Sanitation, 2023). In many of these less privileged communities across South Africa, mothers and children face an almost daily reality of waking at the crack of dawn to line up at the communal taps which can take hours. Mokoena (2022) describes this as a form of structural inequality, where poor households end up paying twice for a basic necessity, once through taxes, and the second time through their coping strategies, for example buying water or sacrificing time and safety in order to collect the water.

While these coping mechanisms demonstrate ingenuity, they also increase the risk of petty crime at stand-pipes during nighttime hours and take away valuable time that could be spent generating income. This ongoing struggle between the promise of FBW policy and the reality of shortages underscores the urgent need to revisit culturally rooted water-saving practices as a significant aspect of policy discussions.

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1.1 Legislative and policy

The existing inequalities in water access are largely attributed to the historical context of apartheid-era policies, which disproportionately favoured white, middle-class urban areas while neglecting the needs of black communities. This legacy has resulted in a systematic allocation of water and sanitation infrastructure that benefits predominantly white neighbourhoods, thereby marginalising black communities in both rural and peri-urban regions (Jegede & Shikwambane, 2021; Mokoena, 2022).

While historical factors may not directly cause contemporary challenges, they continue to obstruct progress by reinforcing deep-seated infrastructural and institutional inequalities that affect disadvantaged communities (Mokoena, 2022) The FBWP provides poor households a minimum amount of 6 kilolitres of free water per month, dealing with an important social need and advancing equitable water access (Whittington & Nauges, 2020).

Indigenous Knowledge Systems (IKS) are recognised within the framework of South Africa's current water legislation. The National Water Act (Act No. 36 of 1998) emphasises equitable access to water and recognises the role of local communities in the formulation of water management strategies (Republic of South Africa, 1998). It provides a comprehensive framework for the protection, sustainable utilisation, development, conservation, and management of water resources, explicitly acknowledging the significance of indigenous practices in ensuring long-term water security. However, whilst this framework lays a robust foundation for the integration of IKS into national water governance, its integration within the FBWP has been inadequate (Botturi et al., 2021).

As such, enhancing this incorporation could yield substantial benefits by utilising indigenous water conservation practices to improve sustainability and resilience in water management, especially in economically disadvantaged communities. There is optimism that by incorporating indigenous knowledge into the structures of the FBWP, adjustments could be made to improve water conservation and management practices, particularly at the household and community levels, where water-use behaviour, cultural norms, and conservation techniques are most directly influenced. However, this review extends beyond policy analysis to explore how end users, especially in low-income urban areas, use Indigenous Knowledge practices to deal with water scarcity and fill formal supply gaps.

Indigenous Knowledge (IK), accumulated by indigenous people and passed down through generations, is ecological knowledge used to sustain the land's productivity while effectively addressing emerging conditions and challenges (Latulippe & Klenk, 2020). These knowledge systems are context-based and adaptive, based on generations of ecological knowledge and enacted through everyday practices such as rainwater harvesting, roof-top collection, and greywater harvesting. It is most pertinent in settings where formal provision of water is inconsistent (Smith & Wishnie, 2000). However, when IK is analysed with attention to context, it can offer culturally relevant, community-driven solutions that are well suited to the realities of South Africa's diverse low-income communities. For example, traditional rainwater harvesting systems and the cultivation of drought-resistant crops have developed in response to various local climatic challenges, providing effective strategies for decentralised water conservation (Grey et al., 2020). These practices are particularly advantageous in regions with limited state-led infrastructure, where community cohesion and local stewardship play pivotal roles in the management of scarce water resources.

Integrating IK into the FBWP provides two key benefits: better water access for everyone, and encouragement of water conservation using culturally appropriate methods (McAllister et al., 2023). However, this type of integration comes with some challenges and raises the question of how the formalisation of IK can be reconciled with the unique IK systems of South Africa's different cultural realities, as well as conflicts with legal frameworks. Furthermore, acknowledging IK systems and incorporating them into the approved governmental frameworks also requires the fundamental shift of valuing IK as an equal partner with conventional science as recognised in the law (Castleden et al., 2017).

1.2 Theoretical framework

This research draws on Ecological Citizenship theory, which highlights the duties of individuals and communities with respect to sustainable environmental behaviour, beyond compliance with regulations. As articulated by Sarid and Goldman (2021), Ecological Citizenship is based on the idea that individuals have an obligation to care for ecological systems and resources as we are all interconnected with nature and society. Ecological Citizenship is about voluntary behaviour change based on ecological awareness and social responsibility, instead of reliance on imposed policies and rules (Bourban, 2023). In terms of water conservation in low-income communities of South Africa, Ecological Citizenship offers a fertile ground of inquiry to understand and foster community-based conservation practices that align with IK.

When combined with the principles of Ecological Citizenship, using IK to guide the FBWP can promote water-use behaviours that are both environmentally responsible and culturally relevant, while supporting sustainable and resilient community water management. The theoretical lens of Ecological Citizenship guides the literature review to explore specific indigenous water conservation practices that reflect community-driven and behaviourally grounded approaches to sustainable resource management.

This paper uses a systematic literature review to assess the feasibility of incorporating IK practices into South Africa's FBWP. The review is based on documented examples of IK practices, including rainwater harvesting, greywater reuse, and seasonal storage, compounded water use and resiliency, particularly in underserviced urban contexts. The review utilises twelve studies that were identified for their depth of methodological rigor, relevance to understandings of context, and general thematic saturation. The study intends to show how IK can improve customary water management practices and encourage sustainable water conservation that considers both cultural traditions and ecological protection. Integrating several indigenous practices into policy can render South Africa's approach to water conservation in vulnerable communities more efficient, benefiting both people and the environment

The rest of the paper is organised as follows: Section 2 comprises the literature review. Section 3 presents the research methodology, outlining the process and steps undertaken to collect and analyse the data. Sections 4 and 5 are dedicated to the presentation of the results, as well as discussion of the findings. Lastly, Section 6 provides the conclusion of the study, summarising the key insights and implications drawn from the research.

2 Literature review

The literature surrounding IKS in water conservation demonstrates how longstanding community-driven practices offer effective, sustainable solutions well suited to the unique challenges faced by South Africa's low-income communities. These methods, developed through intimate knowledge of local ecosystems, represent a valuable but often overlooked resource (Ghorbani et al., 2021) for enhancing contemporary water management policies such as the FBWP. Unlike many traditional, resource-intensive techniques, indigenous water conservation practices prioritize the efficient use of readily available resources, demonstrate respect for local environments, and foster community stewardship through collective participation and deeply ingrained cultural values (Mbah et al., 2021). For example, in Khayelitsha, Cape Town, rainwater harvesting and greywater reuse, drawing on Indigenous conservation knowledge, have been informally adopted by residents to augment municipal supply during periods of water restriction (Mokoena, 2022). In a similar vein, in Bulawayo, Zimbabwe, community stewardship of customary wells during drought provided a viable source of water for peri-urban households when piped supply was unavailable (Dube et al., 2021). The following sub-sections provide an overview of significant IKS practices that are pertinent to water conservation efforts.

2.1 Rainwater harvesting

Indigenous communities have historically adapted rainwater harvesting techniques to suit their local conditions, providing a vital alternative to centralized water systems. (Rawat et al., 2023). For instance, traditional methods such as clay pots, thatched roofs and natural catchment systems effectively facilitate the collection and storage of rainwater. These cost-effective and user-friendly solutions contribute to improving water availability during droughts and alleviating the pressure on municipal water systems, which are often strained in underserved communities. However, these methods are inherently reliant on natural rainfall, making them inadequate during extended periods of drought. FBWP is implemented through municipal piped water systems; however, it does not extend to households in many remote or infrastructure-deficient regions lacking a piped supply. In such contexts, Indigenous practices serve not merely as a supplementary resource to the FBWP but rather as a critical lifeline for achieving basic water access. As of 2021, approximately 11% of South African households did not have access to piped water, either within their homes or in close proximity, with the most significant deficiencies occurring in rural provinces such as Limpopo and the Eastern Cape (Statistics South Africa, 2021). The application of IK is particularly relevant and urgent in these areas (Aklan et al., 2023).

2.2 Natural filtration methods

The absence of modern filtration systems poses significant challenges for water purification in remote rural regions, particularly in under-resourced provinces such as Eastern Cape and Limpopo (Fanteso & Yessoufou, 2022). In these localities in particular, traditional indigenous methods present a viable alternative. By utilizing locally sourced materials such as sand and charcoal, along with plant-based filtration techniques, these methods are not only cost-effective but also environmentally sustainable (Tamagnone et al., 2020). They reflect a deep understanding of local resources and their intrinsic properties, proving essential in areas where untreated water is prone to contamination. These highly effective practices are well-suited for integration into contemporary water management strategies such as the FBWP as they can significantly enhance water quality without necessitating substantial financial investments or extensive technical resources (Huang et al., 2021).

2.3 Groundwater recharge

While stone terraces and contour bunding are commonly linked to groundwater recharge, their primary traditional purpose in various contexts has been to mitigate soil erosion and surface runoff. For instance, in Rajasthan, India, people have constructed contour bunds and Johad systems in semi-arid villages, leading to significantly increased groundwater recharge while restoring dried-up wells and stabilizing water availability for agriculture (Tanwar et al., 2023). However, it is now linked to groundwater recharge, reflecting a sophisticated understanding of hydrology rooted in indigenous knowledge systems. By slowing surface runoff and encouraging water infiltration, these methods play a crucial role, especially in those regions facing an increased risk of drought due to climate change (Tamagnone et al., 2020). Interestingly, research conducted by Wasko et al. (2021) suggests that increased rather than decreased rainfall is the more frequent outcome of climate warming. Both evaporation and precipitation are expected to rise as a result of higher average temperature (Neelin et al., 2022; Tyson et al., 2000). In South Africa, however, droughts are becoming increasingly frequent due to climate change. Incorporating these practices into contemporary water management policies could offer lasting solutions to combat water shortages (Rawat et al., 2023).

2.4 Traditional water source protection

The conservation of water sources by indigenous communities is frequently rooted in the reverence for springs and rivers as sacred or culturally significant. This perspective fosters the establishment of collective rules that govern their use and mitigate pollution (Huang et al., 2021). Such practices underscore the integral role of cultural values in sustainable resource management, which are further supported by community standards and social practices. For example, in the Nqeleni region of the Eastern Cape, local amaXhosa communities continue to protect forest springs in accordance with customary rules limiting access in the dry season and preventing livestock from entering upstream catchments (Amoah, 2021). Indigenous communities effectively manage their water sources through a communal system that prevents overuse and ensures equitable distribution (Fuente-Carrasco et al., 2019). This approach aligns with conservation goals and offers a culturally resonant framework for managing water resources in low-income communities under the FBWP.

2.5 Drought-resistant agriculture

Indigenous agricultural practices for effective water conservation are especially important in rain-fed agricultural areas, such as Limpopo and Eastern Cape regions. Specific practices documented in the literature include drought-resilient crops, less frequent irrigation, and surface mulching to enhance soil moisture in eastern Zimbabwe (Tamagnone et al., 2020). These practices also emphasize the significance of intercropping, mulching, and crop rotation — practices which are prevalent in several sub-Saharan contexts — suited for cultivating crops to enhance soil fertility as well as access to water. These practices are important for food security as they capably retain crop yields despite increasingly volatile impacts of rainfall (Rawat et al., 2023).

However, it remains important to differentiate between water used for household consumption and water required for irrigation farming, as the latter necessitates larger volumes and different infrastructure. Often, the amount of municipal tap water from FBWP is insufficient for irrigation purposes (Alayu & Leta, 2021). Additionally, using municipal tap water for crop irrigation is not cost-effective. According to Masemula (2023), historical research indicates that pre-colonial South African farming was primarily rain-fed, with little reliance on formal irrigation systems. In the case of the latter, IKS emphasizes the importance of soil moisture conservation as opposed to water diversion or engineered irrigation methods (Masemula, 2023).

Integrating indigenous water conservation practices into the FWBP could offer a promising solution, and this approach may address the policy's failings in promoting sustainable water use. This integration needs mindful deliberation of the social and cultural context and the regulations in different communities. Although many indigenous methods are demonstrably effective, they are often sidelined in official policy because they lack institutional recognition and support (Jackson, 2018). A systematic approach to integrating IKS into the FBWP would necessitate fostering cross-cultural understanding, supporting knowledge exchange between indigenous practitioners and policymakers, and creating avenues for community engagement in water governance.

Although these studies provide evidence showing the usefulness of IK to address water scarcity, they also emphasize the contextual challenges affecting the application of this knowledge. The differences between IK in rural contexts and the FBWP in an urban context raise questions about integration, particularly in an era of rapid urbanisation and climate change. IK is often understood as strategies mainly associated with rural contexts and without formal mechanisms, such as rainwater harvesting and natural filtration (Sakapaji, 2022). Nevertheless, residents in many informal urban settlements have adopted traditional practices, such as collecting rooftop rainwater, and reusing greywater, to help meet their needs given the sporadic and unpredictable networked delivery of water (Rawat et al., 2023). These cases illustrate that IK is still in

the process of being adapted to an urban context when faced with water insecurity and provides locally relevant conservation strategies in urban settings, despite its limits (Asad et al., 2023). This development suggests that context-specific forms of integration are needed, considering how IK can support FBWP in urban contexts with under-served citizens, to ultimately strengthen the resilience of communities.

3 Methods

This study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, ensuring transparency in the selection process. The PRISMA flowchart (Figure 1) visually represents the step-by-step filtering of studies, from identification to final inclusion. This systematic literature review was conducted in five key steps as outlined by Hesse-Biber and Johnson (2015): first, defining the research question; second, identifying relevant studies; third, selecting studies for inclusion; fourth, analysing and summarising the data; and fifth, reporting the results.

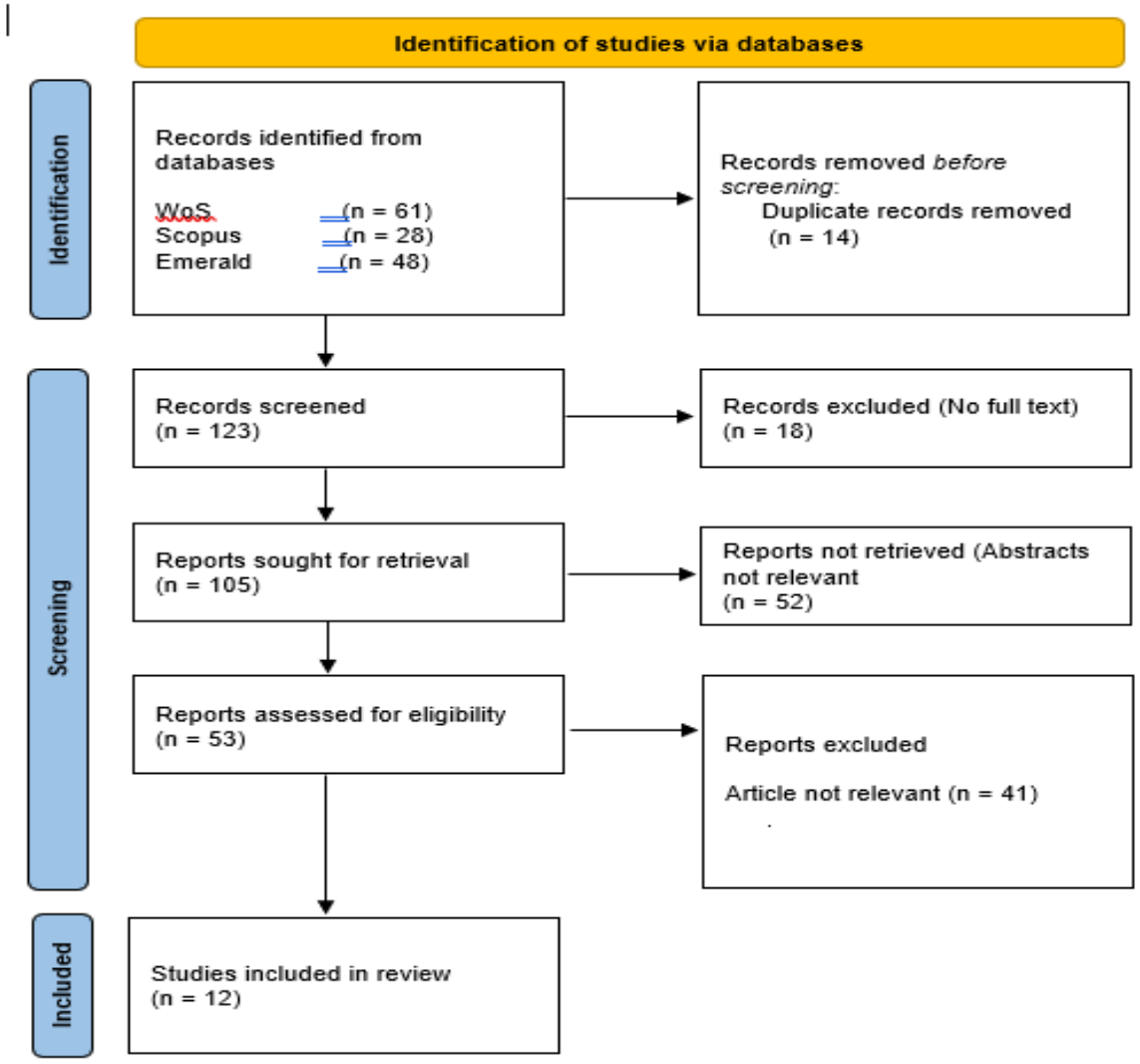

Figure 1: **Figure 1.** PRISMA flow chart

Source: Adapted from Page et al. (2021)

3.1 Defining the research question

The study commenced by establishing broad parameters for the research question, ensuring adherence to the guidelines set forth by Hesse-Biber and Johnson (2015), and incorporating all pertinent literature. This review focused on the following research question:
What are the opportunities and challenges in integrating Indigenous Knowledge (IK) into South Africa's Free Basic Water Policy (FBWP) to promote sustainable water conservation practices in low-income communities?
Key concepts and search terms were developed to identify relevant studies. These included various combinations of the keywords in Table 1.
Table 1. Key concepts and search terms

Concept	Search Operation
Indigenous knowledge	*"Indigenous knowledge" OR "Traditional knowledge" OR "Local knowledge"*
Water conservation	*"Water conservation" OR "Water management" OR "Sustainable practices"*
Community engagement	*"Community engagement" OR "Community-led practices" AND "Indigenous water practices"*

3.2 Identification of relevant studies

A systematic search of academic databases was conducted to identify relevant publications. Several Boolean operators were used to refine the search. The search strategy combined the key terms listed above using Boolean operators like AND, OR and NOT. The databases used included Web of Science (WoS), Scopus, and Emerald, ensuring a comprehensive scope of peer-reviewed studies on IKS and water conservation.
The initial search yielded a total of 132 records distributed as follows:

- **WoS:** 61 records
- **Scopus:** 28 records
- **Emerald:** 43 records

Following the removal of duplicate records (n = 14), a total of 123 unique records proceeded to the screening phase. Th e following criteria guided the search:
Inclusion criteria: Peer-reviewed journal articles, academic books, and credible government or institutional reports from between 2003 and 2023. Only documents published in English were searched. Studies were eligible if they specifically examined Indigenous Knowledge Systems (IKS) frameworks as a category in water conservation, water governance, or sustainable water management practices, especially research focused on low-income and/or resource-poor communities.
Exclusion criteria: Studies unrelated to indigenous knowledge or water conservation.

3.3 Study selection

The screening process followed a two-step approach:
Phase 1: Abstract and title screening

- A total of 123 records were screened based on their title and abstract.
- Studies that did not meet the inclusion criteria were excluded at this stage.
- A total of 18 records were removed due to lack of full-text availability.

Phase 2: Full-text review

- The remaining 105 reports were sought for full retrieval.
- Of these, 52 reports were excluded based on abstract screening, as they were deemed irrelevant to the study's objectives.
- The remaining 53 full-text studies were assessed for eligibility.
- A final exclusion was made, removing 41 articles due to irrelevance after a detailed review.

Thus, 12 studies were included in the systematic review. The 12 included studies were then subjected to detailed data extraction and thematic analysis as outlined in the following sections.

3.4 Charting and synthesising data

Data extraction followed a standardised approach using a data charting form. The form included the following categories:

I. Publication details, specifically the author(s) and the year of publication.

II. Title of Study, which provided significant insights.

III. A comprehensive description of the geographical context of the study setting, along with a thorough explanation of its socio-economic context.

IV. The central aim of the study.

V. An overview of various water conservation methods, encompassing both traditional and contemporary practices.

VI. The integration of Indigenous Knowledge into the Framework-Based Water Planning (FBWP) process, noting that certain factors can either significantly facilitate or hinder this integration depending on the opportunities and challenges encountered.

VII. An exploration of the policy implications of aligning indigenous knowledge with water policy.

VIII. Study outcomes relevant to the research question.

A narrative approach to data synthesis organised these findings into key thematic areas identified through analysis.

3.5 Collating, summarising and reporting results

Thematic analysis utilising NVIVO software (Version 12) was employed to organize and summarize the results. Five key themes were identified, reflecting recurring patterns and insights across the selected studies. These themes included: 1) indigenous water conservation practices; 2) challenges in policy integration; 3) opportunities for community engagement; 4) culturally resonant water governance models; and 5) collaborative frameworks for integrating IK with scientific approaches.

3.6 Methodological justification

In order to ensure methodological rigor, quality was assessed by a simple appraisal adapted from the CASP checklist, specifically focused on aims being clear, methodological transparency, and relevance to the research question. Non-conforming studies were excluded in the full text review stage if they did not meet a minimum threshold. The final number of included studies is twelve, which was a conscious methodological choice; choosing conceptual depth, thematic saturation, and local context over quantity. Each study met all quality requirements. All studied the incorporation of Indigenous Knowledge into water conservation strategies and, as such, were appropriate for this review's scope and purpose. The selection process, based on a transparent and reproducible search strategy, ensures the review's integrity, informed by its aim to provide recommendations for incorporation of IKS into the current Free Basic Water programme.
To achieve the aim of the study, the reviewed sources were purposefully chosen and examined for empirical and conceptual perspectives into how IK practices are used in water conservation, and how these practices could be used within formal water service systems like the FBWP. The findings are presented in a narrative style, incorporating a thematic discussion and several visual aids, including a word cloud. These tools provided a thorough overview of the study's principal findings and pointed out several important implications for policy and practice.

4 Results

The word cloud in Figure 2 highlights key themes relevant to this study on integrating IKS into water management for low-income communities, with a particular focus on South Africa. The word cloud was generated using NVivo 12 software based on word frequency analysis of the 12 academic articles identified as relevant in the systematic review. Dominant terms like "water," "indigenous," "knowledge" and "management" underscore the importance of traditional ecological practices in addressing water-related challenges. The prominence of words such as "climate," "adaptation", "community" and "drought" reflects the interconnectedness of climate adaptation strategies and IKS in supporting resilient water management. The inclusion of "Africa", "responses" and "government" suggests the need for policy integration that respects cultural practices and empowers local communities. Additionally, terms like "project", "resources" and "systems" point to the importance of collaborative efforts and frameworks to sustain water resources. This visual representation of keywords emphasises how indigenous knowledge can enhance adaptive water management, especially in vulnerable regions impacted by climate change and resource scarcity.

Figure 2: **Figure 2.** Word cloud

Source: NVIVO12 software

4.1 Summary of themes

The results and discussion sections of qualitative studies are often structured around key themes to aggregate and compare findings across different studies. Figure 3 presents a project map depicting the five core themes that emerged from the systematic review. These include *Climate Adaptation and Resilience*, *Collaboration between Indigenous and Western Knowledge Systems*, *Cultural and Environmental Stewardship*, *Governance and Policy Integration*, and *Indigenous Water Conservation Practices*. The visual framework illustrates how each theme branches from the central node of "Themes", reflecting their conceptual distinctiveness while highlighting their shared relevance to IKS and water conservation. This thematic structure underscores the multifaceted nature of IKS and its potential role in shaping adaptive and inclusive water governance models within policy frameworks such as the FBWP.

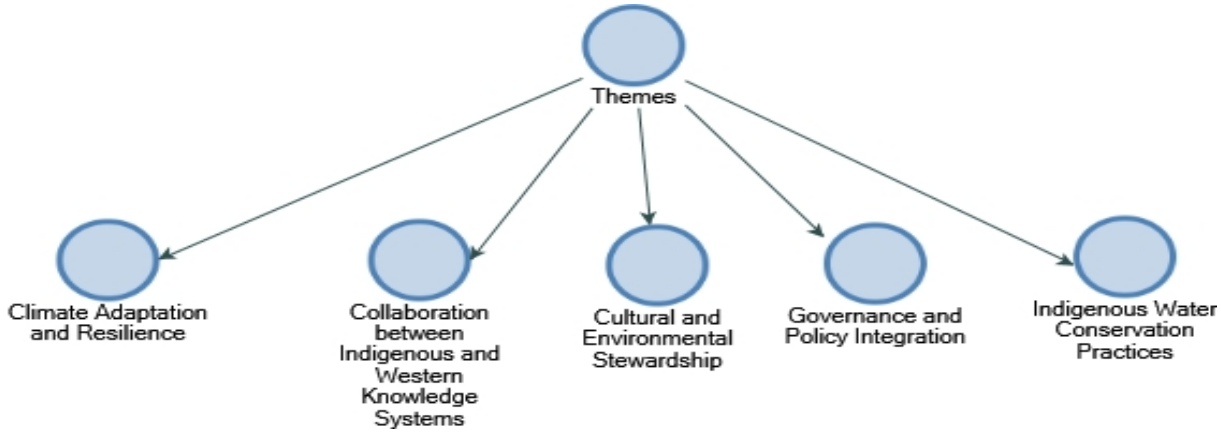

Figure 3: **Figure 3.** The five main themes identified in the systematic literature review

Table 2 presents the key themes identified in the reviewed literature, including Indigenous water conservation practices, climate resilience strategies, governance integration and cultural stewardship, along with supporting

references. These themes serve as the analytical foundation for the study and are explored in detail under their respective headings.

Table 2. Summary of key themes identified from reviewed literature

Theme	Description	References
Indigenous water conservation practices	Traditional methods such as rainwater harvesting, soil terracing and natural water management developed by indigenous communities to sustainably manage water resources in drought-prone regions. Soil and water conservation practices such as contour ploughing and mulching enhance soil moisture retention, crucial for agriculture in arid regions.	Rawat et al., 2023 Tamagnone, Comino, & Rosso, 2020
Climate adaptation and resilience	Indigenous communities cultivate drought-tolerant crops, reducing reliance on irrigation and enhancing food security. Integrating trees with crops improves microclimates and water retention, aiding adaptation to changing climate conditions.	Aklan et al., 2023 Tamagnone, Comino, & Rosso, 2020 Tamagnone, Comino, Rosso, et al., 2020
Governance and policy integration	Indigenous governance models emphasize collective decision-making in water resource management, promoting sustainable use. Integrating IKS into formal water policies faces obstacles, including lack of recognition and institutional support.	Huang et al., 2021 Gadgil et al., 2021
Cultural and environmental stewardship	Cultural beliefs assign sacred status to certain water bodies, leading to their protection and sustainable management. Indigenous practices are rooted in a deep respect for nature, fostering conservation and responsible resource use.	Rawat et al., 2023 Mazzocchi, 2020
Collaboration between indigenous and Western knowledge systems	Combining IKS with scientific methods enhances water management strategies, leveraging the strengths of both systems. Collaborative efforts between indigenous communities and researchers lead to more effective and culturally appropriate water management solutions.	Loch & Riechers, 2021 Adade Williams et al., 2020

5 Findings from the Literature Review

5.1 Theme 1: Indigenous water conservation practices

Indigenous communities have long relied on rainwater harvesting, stone terracing, and natural water management systems to improve water availability and reduce soil erosion (Rawat et al., 2023; Tamagnone, Comino & Rosso, 2020). These techniques, which are well-suited to semi-arid environments, ensure efficient water retention and sustainable land management. However, they do not completely align with the FBWP due to limitations in piped infrastructure. These initiatives exemplify aspirations for equitable and sustainable water access and could inform local strategies that complement traditional systems in developing areas. Nonetheless, their wider implementation is hindered by institutional challenges (Leonard et al., 2023), high labour demands, limited scalability, and modest short-term financial returns. Moreover, gaps in technical and financial resources impede the systematic documentation and validation of these practices (Mishra et al., 2021). For instance, in Limpopo, homestead ponds are utilized for rainwater collection and storage, thus reducing reliance on municipal water supplies (Budeli, 2021). However, the management of such systems is crucial to prevent health risks, such as mosquito breeding. A context-sensitive approach that integrates hybrid solutions—supporting both piped water access and traditional, decentralized systems could significantly enhance water security in low-income communities. Indigenous strategies for water conservation provide a decentralized, community-based model of water use that is particularly suitable for meeting the needs of un-serviced informal settlements. Incorporating models of water management that reflect indigenous water conservation practices into FBWP consumption models could strengthen sustainability and equity of service delivery.

5.2 Theme 2: Climate adaptation and resilience

Indigenous communities have historically adapted to climate variability through practices such as drought-resistant cropping, agroforestry, and soil moisture retention. These approaches have allowed them to reduce reliance on irrigation. Crops like sorghum and millet, which require minimal water, have been cultivated in regions experiencing prolonged dry spells, thereby ensuring consistent food availability and promoting sustainable land use (Aklan et al., 2023). Agroforestry systems, which integrate trees with crops, contribute to soil stabilisation, regulate microclimates and enhance moisture retention, ultimately improving resilience to irregular rainfall (Tamagnone, Comino & Rosso, 2020).

Despite these advantages, the shift away from traditional wisdom due to modern advancements has significantly impacted the continued use of these adaptable practices (Brondízio et al., 2021). Current regulations often favour Western farming methods, which can marginalise indigenous farming alternatives and reduce their incorporation into national climate change strategies (Gadgil et al., 2021). A critical challenge is the insufficient transfer of intergenerational knowledge, as younger generations may not receive adequate exposure to traditional water conservation and climate adaptation techniques (Nelson, 2011). Numerous studies indicate that the diminishing interest in traditional farming practices among rural youth is significantly contributing to this disruption (Rawat et al., 2023; Tamagnone, Comino & Rosso, 2020). As younger generations increasingly pursue urban migration or educational opportunities, they often disengage from essential agricultural practices such as soil moisture retention, terracing, and rain-fed cultivation.

Additionally, the influence of modern water supply systems, such as piped municipal water provided under the FBWP, is perceived as more accessible and reliable than traditional methods like roof-based rainwater harvesting or constructing stone bunds for runoff management. While contemporary infrastructure enhances convenience, it also inadvertently diminishes the perceived necessity and importance of traditional techniques. This significant generational shift highlights the critical need for knowledge preservation initiatives and hybrid approaches that integrate IK into modern systems in ways that are highly relevant and culturally significant for younger populations. To ensure the continuity of Indigenous climate adaptation strategies, it is essential to develop documentation programs in collaboration with universities and indigenous elders. Such efforts will create structured knowledge repositories that facilitate policy inclusion and long-term preservation. Implementing these measures will enhance community resilience and guarantee that customary

ecological practices are recognized and integrated into national climate adaptation policies. Indigenous practices enhance climate resilience through drought-resistant cropping methods and techniques that retain soil moisture. This provides options for scalable solutions that may help to strengthen the delivery of FBWPs in critically water-stressed and climate-vulnerable communities.

5.3 Theme 3: Governance and policy integration

Governance and policy integration are essential for ensuring sustainable water management, particularly within the context of South Africa's FBWP. This policy allocates each household a monthly supply of 6 kilolitres of piped water at no cost, after which a graduated tariff structure is implemented, leading to progressively higher charges for additional consumption (Whittington & Nauges, 2020). In this regard, indigenous practices such as utilizing stored rainwater for non-potable purposes such as laundry or garden irrigation, fostering community-based water-sharing norms, and adhering to water-use restrictions rooted in cultural traditions can assist households in minimizing their dependence on piped water supply and remaining within the free allocation. These practices enhance household-level water efficiency and result in significant financial savings for many low-income families. Therefore, incorporating IK into various FBWP frameworks can achieve both ecological and economic objectives, provided that these practices are adapted to specific piped water systems and supported through robust community engagement.

Indigenous governance structures emphasize community involvement and resource stewardship, enabling communities to manage water equitably and sustainably (Gadgil et al., 2021; Huang et al., 2021). By including indigenous water conservation practices within the FBWP, it offers a potential avenue to encourage community-level sustainable water-use options that aim to mitigate policy challenges to conservation (Ferrara et al., 2023) and promote sustainability through community-based initiatives. However, effective integration requires careful examination of social and cultural environments with a focus on supporting responsible use behaviour and not simply developing a policy (Nguyen-Thi-Kim et al., 2024). Ecological citizenship theory provides a valuable framework for this activity (Wells et al., 2021). The theory frames a person or community as an accountable environmental agent who takes personal initiative, and takes action, to follow through out of a sense of ecological duty (Brand-Correa & Steinberger, 2017). To apply the ecological citizenship framework means linking communities to practices that emphasize responsibility for sustainable water conservation. Systematically building IKS into the FBWP would enhance cross-cultural understanding, facilitate behaviour change associated with ecological citizenship, enhance knowledge sharing between indigenous practitioners and policymakers, and include genuine community engagement within sustainable water governance as outlined by the theory (Brand-Correa & Steinberger, 2017; Ferrara et al., 2023). Fragmented policy frameworks are a key barrier to integrating IKS into FBWP. Enhanced normative and institutional support of hybrid governance could provide new opportunities for inclusive water delivery service that recognizes customary systems of use.

5.4 Theme 4: Cultural and environmental stewardship

A crucial factor in indigenous water preservation is the integration of cultural and ecological stewardship, particularly through community-led preservation guidelines for sacred water areas. Many indigenous groups hold deep respect for these water sites, viewing them as integral to their cultural beliefs, which fosters strong commitments to their protection. For example, in Venda, South Africa, specific cultural beliefs serve to protect certain springs, thus preventing pollution and overuse (Mazzocchi, 2020; Rawat et al., 2023). These sacred protections function as effective ecological management systems, ensuring the sustainable management of water resources.

However, ongoing urban development and construction projects frequently encroach upon these sacred locations, leading to conflicts between indigenous conservation practices and development initiatives (Ludwig & El-Hani, 2020). Ignoring the cultural significance of these sites in policy-making has undermined the effectiveness of indigenous conservation efforts and has limited the application of traditional ecological knowledge for achieving sustainable water management (Castleden et al., 2017). To align closely with the objective of incorporating IK into the FBWP for sustainable water conservation, it is essential to formally

recognize sacred water sites within national conservation policies. Establishing legal protections for these vital water resources could enhance community involvement in water management, protect vulnerable ecological areas, and encourage greater indigenous participation in sound resource stewardship. The importance of water resources within Indigenous cultural systems supports conservation practices consistent with FBWP's aims. However, the technical focus of the programme often overlooks the ethical and spiritual reasons for local water stewardship.

5.5 Theme 5: Collaboration between indigenous and Western knowledge systems

A crucial element in achieving sustainable water management within South Africa's FBWP is promoting collaboration between IKS and Western scientific methodologies. The integration of indigenous conservation practices with contemporary hydrological models has the potential to improve water conservation outcomes, as demonstrated in the Eastern Cape, where co-designed rainwater harvesting systems have successfully combined traditional engineering techniques with scientific hydrology, enhancing both efficiency and sustainability (Adade Williams et al., 2020). However, prevailing Western-centric research frameworks often do not adequately recognize IKS, resulting in policy gaps that inhibit its formal incorporation into national water strategies (Leonard et al., 2023). Additionally, institutional barriers frequently hinder local Indigenous communities from actively contributing to scientific research, which marginalises their valuable ecological insights. McAllister et al. (2023) highlight that the integration of IKS with hydrological science can lead to the development of sustainable and culturally relevant water conservation frameworks. To bridge this divide, universities and research institutions must engage in partnerships with Indigenous experts, ensuring equal representation in water governance, research, and policy development. Combining indigenous and scientific approaches can improve relevance and acceptance in the design of FBWP interventions, especially where conventional service models don't provide an adequate service. Institutional acknowledgement of local knowledge is necessary to co-produce solutions.

In reviewing the literature, several common challenges surfaced that could impede the integration of IKS into FBWP. Table 3 provides a summary of the challenges including issues of recognition, institutional support, resource limitations, cultural sensitivity, and the erosion of traditional knowledge.

Table 3. The challenges postulated in various research studies

Challenges	Description	References
Recognition and validation of indigenous knowledge	Indigenous practices are often undervalued in formal water management frameworks, leading to their exclusion from policy and decision-making processes.	Leonard et al., 2023 Moggridge & Thompson, 2021
Institutional and policy barriers	Existing water governance structures may lack mechanisms to incorporate IKS, resulting in policies that do not reflect the needs and practices of indigenous communities.	Brondízio et al., 2021
Resource constraints and capacity building	Limited financial and technical resources hinder the documentation and integration of IKS into broader water management strategies.	Mishra et al., 2021

Continued on next page

Table 3: (Continued)

Challenges	Description	References
Cultural sensitivity and community engagement	Effective integration requires culturally sensitive approaches that respect indigenous values and actively involve communities in the decision-making process.	Ludwig & El-Hani, 2020
Knowledge transmission and preservation	The erosion of traditional knowledge due to modernization and generational shifts poses a risk to the continuity of indigenous water management practices.	Jacob et al., 2024 Nugroho et al., 2023

These challenges highlight the difficulty of operationalising IKS in water service, policy-based delivery programmes of which the FBWP is but one example. Adapting to such challenges involves institutional reform and prioritising capacity building alongside more deliberate and serious engagement with culturally respectful practices and knowledge validation. This aspect of the thematic insight helps the study achieve its purpose by articulating the specific limitations that confer or constrain the potential for the successful incorporation of indigenous practices in South Africa's formal water management systems.

6 Discussion

The review highlights how IKS continue to play a meaningful role in water management for low-income communities, particularly in areas beyond the reach of piped infrastructure. These insights support the study's objective of identifying practical and culturally grounded alternatives to strengthen the FBWP.

Traditional methods such as rainwater harvesting, soil bunding, and communal water sharing remain central to daily survival in many rural and peri-urban settings (Rawat et al., 2023; Tamagnone, Comino & Rosso, 2020). These practices are not only low-cost and effective but also derived from generations of environmental learning, positioning IKS as a resourceful alternative for sustainable water conservation.

IKS also contributes to climate adaptation and resilience by guiding seasonal water planning, promoting drought-resistant crops, and reducing dependency on inconsistent municipal services (Aklan et al., 2023; Tamagnone, Comino, Rosso et al., 2020). These adaptive strategies allow communities to maintain water security in the face of erratic rainfall and rising temperatures.

However, institutional frameworks seldom recognise or engage these knowledge systems. The exclusion of customary governance structures from formal policy processes limits collaboration, despite evidence that hybrid arrangements can improve accountability and community ownership (Gadgil et al., 2021; Huang et al., 2021). This disconnect weakens local agency and reduces the flexibility of state-led interventions.

Further, water management in Indigenous contexts often carries a deep cultural and ethical dimension. Sacred sites, taboos, and rituals around water reflect a spiritual relationship with nature that supports conservation behaviours and social regulation of access (Ludwig & El-Hani, 2020; Mazzocchi, 2020). These values echo the principles of Ecological Citizenship (Dobson, 2003), where stewardship is seen as a moral obligation rather than a policy directive.

Encouragingly, examples of collaboration between indigenous and Western systems are emerging. Studies show that co-designed water interventions, such as community-based rainwater catchment projects in the Eastern Cape, can enhance the sustainability and acceptance of service delivery (Adade Williams et al., 2020; Loch & Riechers, 2021). Such models demonstrate the feasibility of integrative approaches that respect local context while applying technical innovation.

Taken together, these findings suggest that IKS is not a historical oddity but a dynamic system with contemporary relevance. When understood through the lens of ecological citizenship and supported through inclusive governance, IKS can complement the FBWP by offering flexible, community-anchored solutions to persistent water access challenges.

7 Conclusion

This review highlights the potential of indigenous knowledge to address the water conservation challenges in South Africa's FBWP. By incorporating community-led rainwater harvesting, natural filtration, groundwater recharge, traditional governance and sustainable agricultural practices, FBWP can foster a more culturally aligned and sustainable approach to water management. Moving forward, partnerships with indigenous leaders and community organizations will be essential for successful implementation, allowing FBWP to enhance both water security and community resilience.

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Women's Livelihoods in Nigeria After COVID-19

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Abstract

The COVID-19 pandemic adversely affected women's livelihoods in different parts of Nigeria and exacerbated pre-existing gender inequalities. This research sought to assess whether there is a persistent impact of Covid-19 on women's livelihoods in Nigeria. Particular focus is directed to pre-existing socio-economic factors that rendered them severely affected, and how the women are coping with the challenge of recovering from the disaster. The study adopted a qualitative method, interviewing 60 economically active women in the South-West of Nigeria using semi-structured interview guides, 30 from the formal sector and 30 from the informal sector. The findings show a significant disparity between the formal and informal sectors in the effect of the pandemic on women's means of livelihood. Whereas the formal sector units such as industries imposed layoffs and pay cuts, women were cushioned by various labour laws and unemployment benefits to some extent. In contrast, the informal sector, which encompasses activities like trading and small businesses, was severely affected by the government's closures and by disruptions of transnational supply chains. Nevertheless, Nigerian women were resilient in the face of these adversities, as evidenced by their use of social capital and community support networks, such as informal credit schemes and savings groups.

Keywords: Covid-19, Women, Livelihood, Nigeria

1 Introduction

In the year 2020, the COVID-19 pandemic threw the whole world into an unpredictable state of emergency, with countless deaths, joblessness, quarantine, inevitable lockdown, and a global travel ban foisted on everyone as a necessity to combat the pandemic (WHO, 2020). The corona virus disease led not only to a global public health crisis with innumerable deaths, but also to a generalized economic depression (Aragona et al., 2020). The virus generated a maelstrom of difficulties that the people had never faced before and had no idea on how to overcome them (WHO, 2020). These created fear and mounting anxiety among the people due to the novelty of the crisis and uncertainty as to when the situation would return to normal, and the dread of impending doom (Bwire, et al., 2022).

For women worldwide, the corona virus impacted their physical health, family, work, and everyday life. The pandemic impacted not only industries such as catering and tourism, but many factories were forced to shut down (Bwire et al., 2022). Many low-income women who are financially dependent on these jobs were faced with unemployment (Aragona et al., 2020). The United Nations (2021a,b) asserted that women working in low-wage work, women working in the informal sector, and those running small businesses were hit the hardest. Maria Hertzberg, a humanitarian and disaster risk consultant for the Asia Pacific region of UN Women, said, "Crisis always exacerbates gender inequality." The British Broadcasting Corporation (BBC) hinted that corona virus had spread rapidly throughout Africa, and women, including medical staff, scientists, researchers, and housewives, play an important role in slowing the pandemic.

The corona pandemic caused most elementary and high schools to shut down, forcing many working-class women to take time off to care for their children, greatly affecting their work and productivity (Bwire, et al., 2022; UN, 2020). Kindergartens, elementary schools, junior high schools, and senior high schools worldwide cancelled classes (UN, 2021). Many schools postponed the start of the academic year. This forced many women to take leave to stay at home with their children, affecting their right to work. Married

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women in Nigeria traditionally bear excessive family responsibilities, and the corona crisis made women feel depressed (Central Bank of Nigeria, 2020). In most families, men are the mainstay of the family's economy, so they cannot take leave. Therefore, women must take leave to care for their children at home. For this reason, many companies' crisis-related layoffs focused on female employees (Chang, 2020). To make matters worse, the pandemic affected women physically, psychologically, economically, socially, and politically (Arndt, et al., 2020). Women of all socio-economic classes were affected negatively in this situation. It is undeniably true that life in the pandemic period entailed a significant change in how people work, think, interact and communicate with each other around the globe (Goldin, 2022). It taught the world "new normal" ways of life through social distancing and disrupting human relationships, which are sure to linger on for quite a while (Ozili, 2021; Rasul, et al., 2021). It also taught the world a lesson about the valuelessness of human life and the fragility of human life (Konokkara, 2020). Insidiously, the pandemic led the world to a paradigm shift in people's behaviour and attitudes.

The pandemic brought lockdowns and travel restrictions which were necessary to tackle the pandemic and curb its spread (Anyanwu et al., 2020). Nevertheless, the lockdown upset people's daily routines, putting especially women in a critical financial predicament (Cucinotta & Vanelli, 2020). A substitute normalcy of surviving in a state of consistent panic and fear came into place, with women being asked to live in this uncertainty and unpredictability that was anticipated to last for a long period at the inception of the pandemic (Cucinotta & Vanelli, 2020). An array of novel practices emerged as part of rigorous mitigation efforts, such as household quarantining, social distancing, vigilant sanitization, hand washing, facemasks, and avoidance of public transportation, public gatherings, etc. (Rasul et al., 2021). As time passed and the circumstances worsened, the pandemic slowly unmasked its harsh reality. When women started grasping the truth about the current situation, which was assumed to last for an indefinite length of time, it affected them excessively.

Adapting to this pandemic risk and dealing with the fear of contracting the virus was highly exhausting and not doable by all (Rasul, et al., 2021). Though, it was not fear of contracting the virus but the many restrictions imposed by governments and especially the economic upheavals that were the main sources of stress. Working-class women workers were the worst victim of this lockdown. Those who ended up without job due to the lockdowns lost the income on which they survived (Ozili, 2021). They could no longer meet their needs and their families' daily needs. Women generally were found to be the most vulnerable among the working class to this economic fallout (Nanda, 2020), although women belonging to all classes were affected. It also exposed women working in the informal sector to the blatant distinctiveness that exists in the socio-economic and healthcare sector (Aragona et al., 2020). It is well known that the perils of sickness and death depend very much on "social location, such as social class, race, age, gender, geographic location, and ability" (Rasul, et al., 2021). The mental strain on ordinary women was massive, caused not only by the pandemic as such but by the many restrictions that came with it.

Women in Nigeria already faced significant challenges in accessing decent work and economic opportunities, with a gender pay gap of 36% and a higher likelihood of working in the informal sector, where they lack social protection and are vulnerable to economic shocks (World Bank, 2021). During the pandemic, women in Nigeria had to deal with increased caregiving responsibilities, which further impacted their ability to participate in the labour market and access economic opportunities (Ozili, 2021). The female labour force participation rate in Nigeria was 50.5% in Q3 2020, compared to 55.4% for men, with a higher unemployment rate of 34.2% for women in Q4 2020, compared to 31.4% for men, as reported by the National Bureau of Statistics (NBS, 2020). Additionally, gender-based violence increased during and after lockdowns, which has been labelled the "shadow pandemic" by the United Nations (2021a), threatening the livelihoods and lives of women (Rasul et al, 2021). Women in Nigeria, who were already disproportionately affected by poverty, unemployment, and gender-based discrimination, experienced significant challenges during the pandemic. Pandemic-related disruptions to supply chains, trade, and production affected women's livelihoods in both formal and informal sectors.

Hence, as the country transitions to a post-COVID-19 era, there is uncertainty for women regarding their livelihoods and economic opportunities. It is thus essential to investigate and explore the livelihood of women in post-COVID-19 Nigeria to understand the extent of the impact of the pandemic on women's

economic empowerment and well-being. This study particularly investigates the post-COVID-19 women's livelihoods regarding income, economic opportunities and overall well-being, explores differences between the formal and informal sectors, examines the role of government policies in mitigating or aggravating the adverse effects of COVID-19 on women, and explores the coping strategies women adopt and their effectiveness in sustaining their livelihoods in post-COVID-19. Finally, the study also assesses the women's challenges in accessing financial and other resources to support their livelihoods post-COVID-19.

2 Methodological approach

Given the objective of this study which is to assess the impact of the pandemic on post-Covid livelihoods and coping strategies in Nigeria, a qualitative approach was adopted. First-hand accounts were collected to reveal how macro-system shocks can materialize in micro-level disruption (Merriam & Tisdell, 2015). Interactive qualitative interviews are best suited to comprehend the significance the participants attach to their coping methods and the difficulties they still encounter (Ravitch & Carl, 2019). This is consistent with Tracy's (2024) argument that flexible, collaborative procedures place participant experiences above researcher interpretations, making qualitative methods beneficial for underrepresented communities or minorities.

The study population consisted of women from the South-West geopolitical zone in Nigeria, namely Lagos, Oyo, Ogun, Osun, Ondo, and Ekiti states. The South-West zone is one of the six geopolitical zones in Nigeria and is home to several major cities including Lagos, the largest city in Nigeria and the country's economic hub. Lagos and the other states in the South-West zone are significant contributors to Nigeria's economy and, therefore, have been greatly affected by the COVID-19 pandemic. The choice of this population for the study is also practical and feasible, as the South-West geopolitical zone is easily accessible and has a large population, making it possible to recruit a diverse sample of participants. The study was conducted in the post-pandemic period, following the Nigerian government's lifting of the nationwide lockdown on September 25, 2020, which marked the transition into a new phase of managing the pandemic's aftermath. The research explicitly addresses the "post-COVID-19" impacts, focusing on the economic and social ramifications for women after the initial crisis had subsided.

Only women within the age bracket of 18 to 65 were included to ensure that the study can provide insights into the experiences of working-age women who are vulnerable to the economic impact of the pandemic. Moreover, including women over 65 or under 18 will raise ethical concerns. The sample size required for a qualitative study can vary depending on the research question and the nature of the data being collected. However, a sample size of 60 respondents is generally considered adequate for a qualitative study (Guest et al., 2020). Thus, the study's sample size is limited to 60 women.

The researcher used a quota sampling technique. Quota sampling can be defined as a non-probability sampling technique that involves creating a sample that matches the characteristics of a defined target population based on specific quotas for each characteristic (Babbie, 2016). Using this technique, the researcher was able to recruit 30 women each from the formal and informal sectors of the economy to allow for comparisons. Ten women, five from the formal and another five from the informal sector were selected from each of the six south-west states (Lagos, Oyo, Ogun, Osun, Ondo, and Ekiti state). The women from the formal sector were selected through the professional network, including those working in the banking sector, education, health, and telecommunication. Those from the informal sector were selected through local communities and marketplaces.

A variety of data-gathering methods were used including focus groups, observations, interviews, document and material analysis. These techniques collect non-numerical data to evaluate and study participants' meaning and subjective reality (Carl & Ravitch, 2021). During interviews, researchers provided questions to participants and recorded their answers (Creswell & Creswell, 2017). Benefits include obtaining in-depth, first-hand accounts and conducting comprehensive follow-up inquiries. Interviews, as noted by Carl & Ravitch (2021), allow for the acquisition of in-depth human narratives and the probing of answers beyond the surface level, which is appropriate for elucidating repercussions in both the formal and informal sectors. Women were able to describe their experiences in their own words in a semi-structured approach with

open-ended questions. Follow-up questions were used to get further information or clarity (DeJonckheere & Vaughn, 2019). After the disruption of economic activities, questions about income, opportunities, coping mechanisms, and obstacles encountered in several areas of life were woven together to reveal rich qualitative data that traced how more significant shocks spiralled into personal doubts.

3 Results

This section presents the thematic analysis of the women's descriptions. The aim of these interviews was to be able to reflect on the women's livelihoods in Nigeria's formal and informal sectors post COVID-19. The analysis considered the specific implications of the pandemic's consequences which encompass economic, financial and social development aspects including emotional wellbeing/welfare as well as the women's health status with emphasis on factors associated within both formal and informal economies.

3.1 Economic impact of COVID-19 on women's livelihoods

The COVID-19 pandemic adversely impacted the occupational status of women in Nigeria, leading to economic dislocation with financial uncertainty, as well as long-term consequences for employment arrangements with small businesses and opportunity availability. For women, particularly those in the informal sector, work had become increasingly precarious during the COVID-19 pandemic, with unparalleled of lost income and economic vulnerability for many Nigerians. As Kabeer et al. (2021) highlighted, tourism, where women account for over 70% of employees, collapsed in many poorer developing countries globally and the sector showed practically complete stagnation. This rings true also in Nigeria, where a great number of women are working in these easily dispensable service sectors. The initial impact of lockdown measures on the livelihoods of women was brutal. One participant said:

> *As a trader and artisans, the lockdown and movement restrictions had my business stalled with no means of income. (Participant R)*

This is not an isolated experience but symptomatic of a wider trend in Nigeria and other developing nations. The United Nations (2020) reported that female informal employment, for example, surpassed 90% in Sub-Saharan Africa and 74% in South Asia, compared to only 18% in OECD member nations. This high rate of informal employment means that many women in Nigeria lack access to unemployment benefits or other forms of social protection that could help mitigate the economic shock of the pandemic. As another respondent noted:

> *The effects on women in the informal sector, especially traders and artisans as well as domestic workers, is worse than those suffered by professionals, with a huge drop in their income earning abilities coupled with access to social safety nets being limited. (Participant III)*

This is in line with Ozili (2022), who concluded that major restriction-of-movement orders largely cut off Nigeria's huge informal economy from livelihood opportunities, and opportunity for earnings and jobs. Pre-existing gender inequalities were further exacerbated by the economic consequences of the pandemic for women in Nigeria. Kabeer et al. (2021) reported that women in poor countries faced increased job insecurity and deeper economic contractions due to the pandemic than men. This was partly due to increased baseline gender disparities in emerging market labour force participation and remuneration, with women filling more informal occupations with low salary and few social safeguards.

The financial crisis women were facing during the pandemic was immense. Compared to pre-Covid, over 11 million more Nigerians were earning less than the minimum wage according to World Bank (2020). This was expected to hit women especially hard, who were already the financially precarious gender before COVID-19 arrived. According to Ozili (2022), the price rise of vital commodities such as rice, beans, flour and bread by over 15% left household finances stretched. Because women frequently manage the family budget, including food purchasing, they were affected more directly by these higher costs. The pandemic

also laid bare inequalities in digital finance access, as the existing pre-pandemic gaps further widened. The reviews of Rohwerder (2020) and Hidrobo et al. (2022) point out that lockdown-related mobility restrictions and reduced access erased two decades of gains towards gender equality in areas such as bank account ownership and digital financial transactions for women. It was expected that the backsliding on financial inclusion would have long-term implications for the economic power of women in Nigeria. The experience of income disruption and financial insecurity was not uniform for all women in Nigeria. As a participant put it:

> *Individuals in the formal sector generally have greater protections like labour laws and UI benefits included as part of their contract; informal workers usually don't. (Participant G)*

This observation underlines the distinction between formal and informal sector workers, showing that workers in the precarious situation typical of women are more at risk of long-run effects on economic outcomes. This economic instability had ripple impacts on other parts of the women's lives. For instance, Omobowale et al. (2022) reported that even before the epidemic, 28 per cent of women had suffered abuse, but grassroots organisations reported an over 300 per cent rise of cries for help when victims were stranded at home during lockdown. The economic pressures brought about by the pandemic likely contributed to this increase in domestic violence. However, when women were locked down at home with their abusive husbands and following a call to shut down physical contact centres (GBV service providers), on-the-ground NGOs witnessed over three times the usual number of emergency calls. This rise in domestic violence which was a direct consequence of the pandemic has no doubt been exacerbated by economic pressures. The impact of income disruption was particularly severe for women entrepreneurs and small business owners. As one participant described, "With movement restrictions and closed markets, we cannot sell our farm products, a rainy season puddle under the scorching sun" (Participant B). This vivid description illustrates the immediate and severe impact of lockdown measures on small-scale businesses run by women.

Furthermore, the COVID-19 pandemic led to significant changes in employment status and job security for women in Nigeria, with far-reaching consequences for their economic well-being and social status. Kabeer, et al. (2021) observed that confinement regulations in underdeveloped countries effectively eliminated informal incomes from market selling, domestic labour, and gig services for women. This observation is particularly relevant to Nigeria, where a large proportion of women rely on these types of informal employment. The impact on women's employment in Nigeria has been severe and multifaceted. A participant opined:

> *Most Nigerian women operate as traders, artisans, food vendors, and micro-entrepreneurs in the informal sector. This sector was devastated by the lockdowns, disrupted supply chains, shrinking consumer demand, and other crisis fallouts. With little to no savings or safety nets, many of these women's livelihoods were pushed to the brink. (Participant G)*

This highlights the precarious position of women in informal employment and the multiple factors that have contributed to their economic vulnerability during the pandemic. The changes in employment status and job security for women in Nigeria mirror trends observed in other countries. Etheridge et al. (2020) noted that in UK, women experienced steeper labour force exits than men, losing 3 million jobs by April 2020 amidst mass lockdown as female-majority leisure/hospitality and education took major hits while recovering slowly.

The disproportionate impact on women's employment is further highlighted by Ozili et al. (2021), who reported that lockdown restrictions imposed beginning in April 2020, in particular, caused Nigerian GDP to decline for the first time in 25 years, with a 1.92 per cent full-year recession reported in 2020 as vital services, construction, hotel, and event industries collapsed. These sectors, which employ a significant number of women, have been slow to recover, leading to prolonged periods of unemployment or underemployment for many women. However, the changes in employment status have not been uniform across all sectors. A participant narrated:

> *Those employed in the formal sector, while facing job losses, pay cuts, and furloughs, at least had some protections in the form of labour laws, unemployment benefits, and formalized modes of recourse. (Participant G)*

This observation highlights the stark contrast between formal and informal sector workers, with those in the informal sector, predominantly women, facing more severe and long-lasting changes in their employment status and job security.

The pandemic also exacerbated pre-existing gender inequalities in employment. Earlier studies like Kabeer et al. (2021) already pointed out that women in poor countries faced increased job insecurity and deeper economic contractions due to the pandemic. This was partly due to increased baseline gender disparities in emerging market labour force participation and remuneration, with women filling more informal occupations with little salary or social safeguards. The changes in employment status and job security have had far-reaching consequences beyond just income loss. As one participant explained,

> *Being a married woman with five children, the burden of unpaid household responsibilities and care work only added to the strain. The closure of schools and the limited access to childcare support during the pandemic meant that I had to devote more time and energy to caring for my family, leaving me with fewer hours to dedicate to my trading business. (Participant AB)*

This quote illustrates how increased care responsibilities during the pandemic further limited women's ability to engage in economic activities, potentially leading to long-term changes in their employment status. This has also been influenced by broader economic trends in Nigeria. Okoh (2020) noted that international oil prices falling below $20 per barrel also significantly impacted trade balances and naira stability, as crude sales supported 90% of foreign revenue. This economic instability has likely contributed to job losses and reduced job security across many sectors, with women often bearing the brunt of these changes.

Additionally, the COVID-19 pandemic and resulting economic downturn had a disproportionate impact on small businesses and women entrepreneurs, who often operate in the more heavily affected sectors. The immediate impact of lockdown measures on small businesses was severe and widespread. As one participant vividly described,

> *With movement restrictions and closed markets, we cannot sell our farm products, or make our daily meals. Like that, our small but important income streams dry up faster than a rainy season puddle under the scorching sun. (Participant B)*

This description illustrates the immediate and severe impact of lockdown measures on small-scale businesses run by women, many of whom operate in the informal sector and rely on daily sales for their income. These challenges were exacerbated by pre-existing structural issues in the Nigerian economy. Ozili (2022) reported that mobility limitations imposed on Nigeria's massive informal economy without social protections have decimated earnings and jobs. This observation is particularly relevant to women entrepreneurs, who often operate in the informal sector and lack access to formal business support mechanisms. Yet, the impact on small businesses has not been uniform across all sectors. As one participant noted,

> *Most Nigerian women operate as traders, artisans, food vendors, and micro-entrepreneurs in the informal sector. This sector was devastated by the lockdowns, disrupted supply chains, shrinking consumer demand, and other crisis fallouts. With little to no savings or safety nets, many of these women's livelihoods were pushed to the brink (Participant G).*

This highlights the particular vulnerability of women-owned small businesses in the informal sector, which often lack the resources to weather extended periods of reduced income.

The pandemic has also exposed and exacerbated existing gender inequalities in entrepreneurship. As Kabeer et al. (2021) reported, women in poor countries faced increased job insecurity and deep economic contractions due to the pandemic. This observation applies not only to employed women but also to women entrepreneurs, who often face greater barriers to accessing credit, markets, and business networks than their male counterparts. The broader economic instability in the country contributed to reduced consumer spending and increased costs for small businesses, many of which are owned and operated by women. These challenges have also had knock-on effects on other aspects of women's lives. As one participant explained,

Being a married woman with five children, the burden of unpaid household responsibilities and care work only added to the strain. The closure of schools and the limited access to childcare support during the pandemic meant that I had to devote more time and energy to caring for my family, leaving me with fewer hours to dedicate to my trading business. (Participant AB)

This illustrates how increased care responsibilities during the pandemic further limited women's ability to focus on their businesses, potentially leading to long-term impacts on their entrepreneurial activities.

In theory, there is the possibility of a pandemic-induced transition to remote work and digitalization for many women entrepreneurs (DeJonckheere, M., & Vaughn, L. M, 2019). However, in Nigeria, limited access to digital infrastructure and technology has meant that many women entrepreneurs have been unable to take advantage of these opportunities, potentially putting them at a competitive disadvantage. This adds to issues with women's access to financial services. Rohwerder (2020) and Hidrobo et al. (2022) observed that lockdown-related mobility limitations and access limits would wipe out two decades of progress in eliminating gender inequalities in areas such as bank account ownership and digital financial transactions for women. This regression in financial inclusion is likely to have long-term consequences for women's ability to start and grow businesses in Nigeria.

The above description paints a picture of how these lockdown measures immediately and most intensely affected the extent to which women were participating in economic pursuits.

Women in the informal sector were more likely to experience immediate adverse economic impacts than those who rely on social protection measures and employer-provided support, though also the latter were not wholly insulated from crisis-related shocks (Elmhirst, 2011). This distinction underscores the gendered power relations and differential access to economic resources and opportunities, explicating how these factors can shape vulnerability as per the FPE framework (Rocheleau et al., 2013). The feministic intersectionality theory further brings out how these women at the crossroads of gender, class and location experience different realities within formal as well as informal employment systems (Carstathis 2016; Crenshaw 2013). The review argument is that women working in the informal sector, naturally poor and living in rural areas or marginalized urban peripheries, were experiencing compounded vulnerabilities that aggravated their economic disadvantages (Agarwal, 2021). Finally, social role theory is also an important critical tool in helping to analyse and evaluate elements of gender with a keen eye. The review emphasizes the normative expectations and cultural constructs of women's social roles related to housework and childcare responsibilities that limited their engagement in wage work or entrepreneurship, particularly in informal sectors, due to the pandemic (Bonvillain, 2020; Rocheleau, et al., 2013).

3.2 Coping strategies adopted by Nigerian women

Nigerian women resorted to a range of coping strategies in response to the economic shocks created by COVID-19 and associated lockdown restrictions. The most dominant and visible emotional coping strategy identified among marginalized Nigerian women during the COVID-19 pandemic was resorting to social capital/community-based networks. This is in line with feminist political ecology principles that stress the integration of women's knowledge of their situation and bottom-up initiatives to combat environmental as well as economic problems (Rocheleau et al., 2013). The reliance on social networks also reflects the gendered nature of environmental rights and responsibilities, as women often have fewer formal rights but greater responsibilities regarding resource management and household survival (Anyanwu, 2020). Informal borrowing from relatives and friends emerged as a crucial lifeline for many women struggling to make ends meet during the pandemic. As one participant from Osun State shared: This testimony highlights how women, particularly those heading households, turned to their social networks for financial support when formal safety nets were inadequate or inaccessible.

The reliance on informal borrowing can be understood through the lens of social role theory, which posits that gender roles and expectations influence behaviour and access to resources (WHO, 2020). In Nigerian society, where women are often expected to prioritize caregiving and domestic responsibilities, their access to formal financial institutions may be limited. Consequently, they turn to informal networks as a more accessible and culturally acceptable form of support. Participation in local saving and credit

associations, commonly known as "esusu" or "ajo" in Nigeria, was another significant coping strategy. These traditional rotating savings and credit associations (ROSCAs) have long been a feature of Nigerian economic life, particularly among women (Rocheleau et al., 2013). During the pandemic, these associations took on renewed importance as formal financial institutions became less accessible or imposed stricter lending criteria. A woman from Lagos State emphasized the importance of these community-based financial systems:

To cope, women have adopted a range of strategies, from diversifying income sources to relying on family and community support networks to accessing informal lending arrangements (Participant I).

This statement underscores the multifaceted approach women took to navigate the economic challenges posed by the pandemic, with community-based financial systems playing a crucial role. The reliance on ROSCAs can be understood through the framework of feminist political ecology, which emphasizes the importance of women's collective action and grassroots organizing in addressing environmental and economic challenges (Braidotti, et al., 1994). These associations not only provide financial support but also serve as platforms for knowledge sharing and mutual empowerment, aligning with the FPE principle of valuing women's situated knowledge and experiences.

Religious and ethnic organisations were also prominent sources of loans for Nigerian women during the pandemic. This strategy can be understood by integrating the perspective of feminist intersectionality theory (Crenshaw, 2013) in understanding women's communication. Often, such loans were provided to women within their religious or ethnic identities. This reveals what level of influence different facets of identity have towards determining economic opportunities and challenges. Their resort to religious and ethnic organisations for financial support further betrays the sociocultural context of Nigerian society at large. It shows that people trust members of their own group but not strangers. Agarwal (2021) even opines that such organizations often occupy the frontline in terms of social safety net provision, a role they however discharge rather haphazardly during moments of crisis. This is a matter of limited resources. The pandemic quickly revealed why such informal support systems are so critical, particularly to women without regular access, if any at all, to formal financial institutions, given societal gender-based discrimination or simply from having no collateral whatsoever. Yet, it must be remembered that as critical as these community-based coping resources may prove to be, they will have some structural limitations. The potential of such community-level coping mechanisms is uncertain, being limited in terms of access and resources. This observation resonates with some criticisms in the feminist political ecology literature that call for more than local case studies to confront political economy and governance issues as central parts of environmental inequality (Elmhirst, 2011).

This reliance on informal networks and community-based coping strategies mirrors the genderedness of economic vulnerability in Nigeria, where women are more likely to be found in lower-status, precarious employment (Arndt et al., 2020). One likely advantage that women enjoy in these informal support networks is a reputation for being more conscientious and more honest than men. They are more likely than men to pay back the small loans they are getting from these organisations. In this case, stereotyping would work in women's favour. Another aspect is that perhaps the shared economic hardship nurtured a sense of solidarity, which is in stark contrast to the greed-driven lending by formal financial institutions. This could be a positive aspect of the Covid experience that perhaps survived the end of the pandemic.

COVID-19 further widened the economic gaps leading to a heavy dependence of women on informal networks for support. This only reinforces why policy responses should focus on the structural inequalities driving women into such precarious economic circumstances. The community-based coping strategies worked well for some but not all women. Although they did provide vital immediate support, their longer-term durability as well as capacity to ameliorate structural injustices were thrown into question. Rania et al., (2014) noted that women's limited household resources and the lack of collateral restrict their access to formal financial services as a coping mechanism against economic shocks.

During the pandemic, awareness was raised about how informal resources were not sufficient to cover all that women do, leaving them unable to buy food and other essentials. However, the continuing reliance on social capital and community-based networks also display Nigerian women's resilience to conflict. Feminist political ecology frameworks, as Elmhirst (2011) points out, make the agency and politics of

women in the face of environmental and economic crises visible. The pandemic saw many instances of women practising referent support and exhibiting their resourcefulness and flexibility when under pressure without giving up or falling apart. That said, it is also important to remember that the responsibility for being resilient should not only be placed on women. As Sultana (2021) opined, we need to rethink these narratives about resilience that often go so far as mystifying who is owed what when they merely reinforce continuity and offer absolution for institutions. The heavy dependence upon informal networks and community-based coping strategies during the pandemic makes a compelling case for stronger formal social protection systems, reinforcing their need for gender sensitivity.

Furthermore, many Nigerian women incorporated income diversification as a major coping strategy in addition to leveraging social capital and community-embedded networks. These perspectives also reflect on what feminist political ecology is looking for, that women respond actively to these conditions (Elmhirst, 2011). Diversifying income can look very different because women of various socioeconomic statuses would have distinct needs and resources. A participant from Lagos explained:

Women have adopted a range of strategies - ranging from diversifying income sources to relying on family and community support networks. (Participant I)

It highlights just how "interdisciplinary" women have become to be able to adapt to an economic landscape caused by the pandemic. Women who were previously only dependent on either market trading or formal employment moved on to look for new ways to make money. As a case in point, some women who lost their jobs were already operating informal enterprises selling stuff from home or doing online commerce. Women have always shown themselves to be remarkably resilient in the face of economic shocks (Rocheleau et al., 2013), and their coping with the pandemic seems consistent with that idea.

The transition to digital space and online entrepreneurship was especially striking. Access to these opportunities was not universal, demonstrating an existing digital divide favouring those fluent in technology and armed with the equipment needed to take advantage. Classically trained women of the city became service-producing entrepreneurs. For instance, when the pandemic led to a sharp spike in demand for face masks, some women with sewing skills raised funds from family groups to produce these. This adaptation demonstrates what Harcourt & Nelson (2015) refer to as women's practical wisdom or creativity in times of adversity. Another strategy that rural women had adopted was agricultural diversification. Some of the tactical responses mentioned by Agarwal (2021) include women farmers moving to diverse crops to mitigate market volatility or supply chain breakdowns. This not only ensured more regular income but also helped support household food security in the face of crisis. Income diversification needs to be acknowledged, but was not easily embraced by all women. Feminist intersectionality theory posited that factors such as class, education and geographic location intersected with gender in ways which structured women's economic opportunities and constraints during the pandemic (Cucinotta & Vanelli, 2020). As an example, urban women with a high level of education may have had more resources than rural women without formal education to change their jobs into remote work or digital entrepreneurship.

Additionally, there was the gendered responsibility for income diversification which resulted in women shouldering most of this burden, reinforcing prevailing norms on roles allocated to men and women. According to social role theory, societal attitudes and norms about the responsibilities of women as domestic task performers play a major role in limiting their scope for economic engagement (Eagly & Wood, 2013). The pandemic made it much worse given that women also had to juggle their domestic affairs on-demand while trying to make ends meet. Income diversification revealed women's resiliency and ability to adjust, but it also showed the fragile financial position of their households. As Rania et al., (2014) contend, women often fail to invest in more stable or profitable economic activities because they have restricted access to capital and formal financial services. Women's access to financial resources and their entrepreneurial energy require support now more than ever in the wake of this pandemic.

Moreover, the COVID-19 pandemic necessitated significant adaptations in business models for many Nigerian women entrepreneurs. One of the most significant adaptations was the shift towards digital platforms and e-commerce. As Anyanwu et al., (2020) note, the pandemic accelerated digital adoption across various sectors. Many women entrepreneurs who previously relied on physical marketplaces or face-to-face interactions with customers pivoted to online sales channels. This shift aligns with what

Harcourt and Nelson (2015) describe as women's contextual knowledge and inventiveness in the face of obstacles. A participant from Lagos shared her experience:

I had to quickly learn how to use social media to promote my products and set up an online ordering system. It was challenging at first, but it helped me reach new customers even during lockdown. (Participant K)

This testimony highlights how women entrepreneurs leveraged technology to adapt their business models, demonstrating resilience and innovation in the face of crisis. However, it is crucial to recognize that the ability to transition to digital platforms was not uniform across all women entrepreneurs. As feminist intersectionality theory suggests, factors such as education level, digital literacy, and access to technology intersected with gender to shape women's ability to adapt their businesses (Cucinotta & Vanelli, 2020). Urban, educated women with access to smartphones and reliable internet connections were better positioned to make this transition than their rural or less educated counterparts. Another significant adaptation was the diversification of product offerings. Many women entrepreneurs expanded their product lines to include essential items that were in high demand during the pandemic. For instance, some women who previously sold clothing or accessories pivoted to producing and selling face masks and hand sanitizers. This adaptation reflects what Elmhirst (2011) describes as women's agency and political engagement in addressing environmental and economic challenges. A participant from Osun State shared:

When sales of my regular products dropped, I started making face masks. It wasn't easy to learn a new skill, but it helped me keep my business afloat. (Participant M)

This testimony underscores the resourcefulness and adaptability of women entrepreneurs in the face of economic shocks. The adaptation of business models also involved changes in operational practices. Many women entrepreneurs had to modify their working hours, delivery methods, and customer interaction practices to comply with COVID-19 safety protocols. As Sultana (2021) argues, these adaptations often placed additional burdens on women, who had to balance these changes with increased domestic responsibilities during lockdowns. It is important to note that while these adaptations demonstrated women's resilience and innovation, they also highlighted existing structural inequalities. As Rania et al. (2014) point out, women's limited access to capital and formal financial services often constrained their ability to invest in the technology or inventory needed to effectively adapt their businesses. This situation underscores the need for policies that enhance women's access to financial resources and support their entrepreneurial endeavours. Moreover, the adaptation of business models often required women to acquire new skills rapidly. As one participant from Lagos noted:

I had to learn how to use online payment systems and manage digital marketing campaigns. It was overwhelming at times, but I had no choice if I wanted my business to survive. (Participant N)

This testimony highlights the additional mental and emotional labour required of women entrepreneurs during the crisis, reflecting what Rocheleau et al. (2013) describe as the multifaceted challenges faced by women in times of economic upheaval. It can be argued that such challenges create economic divisions between those women who can adopt new ways for use both during and after the crisis, and those women who cannot. The adaptation of business models also revealed the importance of social networks and community support. Many women entrepreneurs relied on peer learning and support to navigate the challenges of digital transition and business model adaptation. This aligns with feminist political ecology's emphasis on the importance of women's collective action and grassroots organizing in addressing economic challenges (Braidotti et. al., 1994). However, it is crucial to recognize that while these adaptations helped many women entrepreneurs survive the immediate crisis, they may not be sustainable in the long term without adequate support.

4 Conclusion

The COVID-19 pandemic had a profound and multifaceted impact on women's economic livelihoods in Nigeria, exposing and exacerbating pre-existing gender inequalities while also creating new challenges. This study, based on interviews with 60 women from South-Western Nigeria, reveals a complex landscape of economic disruption, resilience and adaptation shaped by intersecting factors such as education, employment sector, marital status, and caregiving responsibilities. The pandemic's economic impact on women in Nigeria has been severe and disproportionate. Women in the informal sector, who make up a significant portion of the female workforce, were particularly hard hit by lockdowns, movement restrictions, and supply chain disruptions. Many of these women, engaged in petty trading, artisanal work and small-scale businesses, saw their incomes evaporate almost overnight. The lack of social safety nets and limited savings left many vulnerable to acute financial distress. As one participant poignantly described, their "little but crucial income sources go dry before you can say rain in a summer sun puddle."

In contrast, women employed in the formal sector experienced a degree of insulation from the immediate economic shocks. Those with stable employment, particularly in white-collar jobs, benefited from labour protections, unemployment benefits, and the ability to transition to remote work. However, even these women faced challenges, including increased workloads, the blurring of work-life boundaries, and heightened anxiety about job security. The study highlights the critical role of education in shaping women's economic resilience during the crisis. Women with higher levels of education, particularly university degrees, were more likely to be employed in the formal sector and had greater access to job security, stable incomes, and social protections. They also demonstrated higher levels of digital literacy and adaptability, allowing them to pivot to online work or explore new business models. In contrast, women with lower levels of education faced significant barriers in accessing alternative income sources, navigating support systems, and adapting to the changing economic landscape.

However, it is crucial to note that education alone did not insulate women from the pandemic's impacts. Even highly educated women faced challenges, particularly in balancing increased work demands with caregiving responsibilities. The gendered nature of unpaid care work emerged as a significant factor affecting women across education levels and employment sectors. School closures and limited access to childcare support during the pandemic exacerbated the "double burden" of paid work and unpaid care, forcing many women to reduce their economic activities. The intersectionality of various factors including education, employment sector, marital status, and caregiving responsibilities played a crucial role in shaping women's economic experiences during the pandemic. Single mothers, for instance, faced compounded challenges, lacking the spousal support that married women could often rely on. Rural women, particularly those engaged in agriculture and local trade, were severely impacted by movement restrictions and market closures. These intersecting vulnerabilities underscore the need for nuanced, targeted interventions that address the diverse needs of different groups of women.

The pandemic also exposed and widened existing digital divides. Women with greater digital literacy and access to technology were better positioned to adapt to online work and e-commerce opportunities. In contrast, those lacking digital skills or access to technology found themselves further marginalized in an increasingly digital economy. This digital divide often overlaps with educational and urban-rural divides, highlighting the compounding nature of these inequalities. The study reveals significant gaps in social protection systems and support mechanisms for women, particularly those in the informal sector. While the Nigerian government implemented some relief measures, including cash transfer programs and food distribution, their efficacy in reaching vulnerable women was limited. The lack of formal registration systems and limited financial inclusion posed significant barriers to accessing support. This underscores the need for more inclusive and gender-responsive social protection systems that can effectively reach women in both formal and informal sectors.

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Informal Mining and Financing of War in the Democratic Republic of Congo

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Abstract

Over the past three decades, the Democratic Republic of Congo (DRC) has experienced prolonged violence, resulting in the loss of over 12 million lives and widespread displacement. Numerous studies have highlighted the central role of natural resources in fuelling and prolonging conflict in the region. This paper argues that informal mining is a key mechanism through which armed groups sustain violence in the DRC by generating unregulated income and maintaining control over resource-rich territories. The study further contends that targeted reforms and peace-oriented interventions in the informal mining sector could play a transformative role in promoting stability and sustainable peace. Drawing on secondary qualitative data, including audio recordings, YouTube videos, televised news reports and a wide range of online articles, the research captures the voices of miners, affected communities, government representatives, international organisations, and policy experts. The findings demonstrate how informal mining networks both finance conflict and provide livelihood, thereby presenting a dual challenge and opportunity for peacebuilding in the DRC.

Keywords: Artisanal mining, Financing, War, Democratic Republic of Congo, Resource curse

1 Introduction

Natural resources such as oil, timber, water, and minerals are essential sources of income and livelihoods. However, history has shown frequent links between natural resources and conflicts (Humphreys, 2005; Koubi et al., 2014). A possible reason for this is that where government institutions are weak, abundant natural resources can lead to conflicts over control of the resources and to corruption. Valuable natural resources like oil, diamonds, or minerals often become the focus of intense competition among political elites, rebel groups, and local communities, particularly in countries with ethnic divisions like the Democratic Republic of Congo (DRC). Under these conditions, armed groups may fight for control of mines, oil fields, or trade routes, as these are funding their operations. It is an incentive for rebel groups to seize control.

In the DRC, various militias have fought for decades over control of mineral-rich territories to sustain their operations and external powers have sought to secure access to critical materials. When natural resources are poorly shared or ineffectively managed, they can lead to strains and tensions that escalate into conflicts or intensify pre-existing conflict dynamics (Majavu, 2010). When certain groups benefit from resource wealth while others are excluded, it breeds resentment and social unrest. There are many reasons to believe that the relationship between minerals and conflicts is complex and multifaceted, involving various economic, social, and environmental factors (Hunter, 2019). Mineral wealth can play a significant role in exacerbating conflict when armed groups, political elites, or corrupt leaders fight over control of valuable minerals, gold, diamonds, or the tantalum containing mineral coltan. Mineral wealth can be a double-edged sword. In resource-rich but institutionally weak states, such as the Democratic Republic of Congo (DRC), poorly governed resource sectors have historically financed armed groups, prolonged violence, and thereby weakened state legitimacy (Autesserre, 2010). In contrast, where governance structures are strong, transparent, and inclusive, mineral revenues can play a transformative role. They can fund

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critical public goods such as infrastructure, education, and healthcare thereby reducing poverty, addressing grievances, and fostering stability. The difference lies in institutional quality. Good governance ensures that resources are managed for the public benefit rather than for elite enrichment or militia financing. This is evident in countries like Botswana, where prudent management of diamond wealth has contributed to sustained economic growth and political stability. Thus, the potential for natural resources to drive peace depends heavily on how well they are governed and the extent to which institutions promote accountability, inclusiveness, and equitable distribution.

World-wide, countries rich in natural resources tend to experience slower economic growth than resource-poor countries, they have less democracy and worse development outcomes due to governance issues, corruption, and conflicts over resource control (Berman et al., 2017). This relationship between natural resource wealth and conflict is central to the theory of the "resource curse", initially put forward by Paul Collier (Collier & Hoeffler, 2004) who demonstrated a strong connection between mineral wealth and the likelihood of conflict. In particular, countries with abundant oil, minerals, or precious metals are more likely to experience armed conflict, sluggish economic growth, diminished democratic governance, and worse development outcomes than their resource-poor counterparts.

However, it is important to distinguish between the two types of mining that shape the conflict dynamics in the DRC: small-scale "informal" mining, and large-scale mining by international companies. While historically, the DRC's mining sector was dominated by large-scale operations under Belgian rule, this changed during the post-independence period. In 1981, a significant policy shift occurred in the Democratic Republic of the Congo (then Zaire) under President Mobutu Sese Seko. The government reversed parts of its earlier policy of "Zairianisation" **(**the nationalization of foreign-owned businesses and mining operations that had begun in the 1970s). This period had been marked by economic mismanagement, corruption and political instability**,** which undermined investor confidence. As a result, many large international mining companies scaled back or completely withdrew their operations.

The withdrawal of the mining companies left a vacuum that was increasingly filled by small-scale, artisanal miners, setting the stage for the informal mining economy that has since become central to both the livelihoods of local communities and the conflict dynamics in the DRC. Conflict related to mining and involvement of armed groups in extractive activities significantly escalated following the First Congo War in 1996. DRC witnessed a surge in the militarization of mineral-rich areas, where armed factions, including rebel groups and foreign militias, took control of key mining sites to finance their operations. This illicit exploitation of resources such as coltan, gold, and diamond became a major driver of prolonged conflict and human rights abuses in the region (Autesserre, 2012; Global Witness, 2009).

This transition parallels the broader shift from plantation economies to subsistence-oriented peasant farming, which occurred in several African countries after independence. The move from large-scale, corporate mining to informal, small-scale mining can be seen as a shift from state-controlled, professionally managed exploitation to decentralized, often illegal mining activities that exacerbate local conflicts and empower armed groups.

As noted by Berman et al. (2017), mining operations in conflict zones can fuel armed fighting. Unequal distribution of mining revenues can foster grievances among communities, leading to tensions and conflicts. In the DRC, this inequality is particularly pronounced between the major international mining companies and the local populations engaged in informal mining. The former often control vast resources, but their operations frequently contribute little to the local economy, while informal miners are left to deal with poor working conditions, environmental degradation, and violent exploitation by armed groups.

Moreover, just as in the cases of high-value crops like opium in Afghanistan or cocaine in Colombia, the revenues generated by both formal and informal mining activities in conflict zones can make rebellion more feasible. This funding helps insurgents purchase weapons and supplies, sustain their operations, and expand territorial control. For instance, the diamond trade in Sierra Leone and the control of oil fields in Syria and Iraq highlight how natural resources can finance insurgency movements (Berman et al., 2017). Similarly, in the DRC, minerals like tin and coltan are mined and sold by militias, funding cycles of violence and instability (Global Witness, 2009).

In addition to the local actors, foreign actors are often drawn to the DRC's rich natural resources.

These foreign actors may support or oppose rebel groups for their own economic or strategic interests, further entrenching the conflict. For example, Wagner Group mercenaries in Libya have been linked to foreign economic interests tied to oil fields, similar to how foreign-backed mercenaries or corporations in the DRC may engage in resource extraction for profit or geopolitical influence. A study by Autesserre (2012) deconstructs dominant international narratives about the Congo and shows how these have justified ongoing foreign interventions and the involvement of corporate interest in the resource-rich eastern regions. Cuvelier (2013) examines the weak governance of DRC's mining sector, especially in the East, where foreign companies operate under informal agreements with armed actors to access mineral wealth. Berman et al. (2017) explore how mining in Ituri and Kivu has been shaped by armed groups and foreign firms competing for control, resulting in systemic exploitation and indirect support of conflict economies.

It is also important to examine how such resource-driven conflicts can impact peacebuilding efforts. Informal mining in the DRC does not only fuel violence, but can also play a role in peace restoration if properly managed. Policies aimed at regulating and formalizing small-scale mining, while integrating it with efforts to foster state legitimacy and provide alternative livelihoods, can contribute to reducing the conflict and promoting long-term stability. Within existing literature, Junior et al. (2022), Boutilier (2017), and others emphasize the potential of mining to foster peace and development in post-conflict settings. Mining operations, when appropriately regulated, can offer economic opportunities, such as creating jobs and stimulating local economies, thus contributing to stability. In Sierra Leone, for example, small-scale gold mining has been proposed as a means of addressing youth unemployment (Dresse et al., 2021).

This study investigates informal mining and its role in financing war in the DRC, while exploring the complex interplay between resource wealth, conflict, and peacebuilding. Through a deeper understanding of these dynamics, the paper contributes to the ongoing discourse on how natural resources can both exacerbate and mitigate conflict, with a focus on the Democratic Republic of Congo.

2 Understanding conflict in the Democratic Republic of Congo

Understanding the conflict in the DRC requires acknowledging its multifaceted nature and the interplay of historical, economic, political, and social factors. The territory of the present-day DRC was colonized by Belgium in the late 19^{th} century under King Leopold II who exploited the country for its resources, causing immense suffering and death among the Congolese people. Leopold used violent ways to control his subjects and he did not develop the country. The economy was mainly based on the extraction of raw minerals from the mines that were then sent to Belgium for processing and manufacturing. Otherwise, the most common exported natural resources from the Congo were palm oil, wild rubber, ivory and cotton until the 1920s (Olaopa & Ojakorotu, 2016). King Leopold II used concessionary companies to exploit the mineral resources, especially in Kasai and Katanga. These companies used drastic methods to increase production such as killings, forced labour, torture, violence and coercion (Turner, 2013, p. 148).

By the early 1900s, reports of atrocities (killings, mutilations, forced labor, village burnings) by Leopold's concessionary companies had sparked international outrage, especially from missionaries, activists, and the British press. Under this pressure, Leopold was forced to cede control. In 1908, the Belgian Parliament formally annexed the Congo, ending the Congo Free State experiment. The Belgian Congo became the collective responsibility of the Belgian state, no longer Leopold's private enterprise. Governance was centralized under a colonial governor-general and a civil administration run from Brussels. In theory, this was supposed to be more humane and regulated than Leopold's rule.

While extreme atrocities decreased after 1908, forced labour, racial segregation, paternalism and economic exploitation continued. The colonial economy was restructured to favour Belgian interests, with companies like Union Minière du Haut-Katanga (UMHK) dominating copper and cobalt extraction in Katanga, and other corporations controlling rubber, palm oil, and diamonds in Kasai.

After independence, the governance of the country was handed over to the citizens of Congo (now DRC), who had little knowledge about governance. The intention was to ensure continuous exploitation of the resources even after independence. However, almost immediately after independence, on 11^{th} July 1960,

Katanga province which is rich with gold, uranium, copper and cobalt, was declared independent under Governor Moise Tshombe who had close ties to Belgian mining companies. Congo would have lost a huge part of its mineral resources without Katanga. The secession triggered a struggle for power in the recently independent state, with Lumumba suing the UN for intervention to suppress the secessionist movement, but the UN rejected his plea. The country then faced another secession attempt in Kasai which is rich in diamonds. Lumumba then requested military assistance from the Soviet Union who airlifted Congolese troops to invade Kasai. This decision later led to Lumumba's assassination by rebels who were backed by Western powers (Brydges, 2013).

Mobutu ruled with an iron fist from 1965 to 1997, enriching himself and his allies while the country's infrastructure deteriorated. In the First Congo War 1996-1997, Mobutu was overthrown by Laurent-Désiré Kabila with the support of Rwanda and Uganda. This marked the beginning of a series of conflicts (Stearns, 2023; Venugopalan, 2016). The Second Congo War, 1998-2003, opposed a rebel movement, the Rassemblement Congolais pour la Democratie (RCD), and the Congolese government. It involved multiple African nations and various armed groups. It was sparked by Kabila's falling out with his former allies Rwanda and Uganda. It became the deadliest conflict since World War II, causing millions of deaths, primarily from disease and starvation (Bjarnadóttir, 2017).

Despite the official end of the war in 2003, the eastern regions, particularly Ituri, North Kivu and South Kivu, have remained hotspots for conflict. Various militias, including the Allied Defence Forces (ADF, a Ugandan rebel group), Democratic Forces for the Liberation of Rwanda (FDLR) and the March 23 Movement (M23), have perpetuated violence. Combatants, civil society and political elites began to operationalize ethnic identity leading to the exclusion and marginalization of others. This played a significant role in the conflict, often exacerbated by political manipulation and competition for resources (Ntung, 2019). The DRC's vast mineral wealth, including coltan, diamonds, gold and tin, has fuelled conflict as armed groups vie for control of these resources. The illicit trade of these minerals finances militias and perpetuates violence. The conflicts in Congo have not been for political reasons alone; economic factors have played a substantial role. After their 1998 conquest of the eastern DRC, the armies of Rwanda, Uganda and Zimbabwe, with the assistance of Congolese soldiers in the DRC, spent a year looting valuable resources found in the DRC (Venugopalan, 2016:7).

3 Methodological approach

This study employed secondary qualitative data sources. These include audio and video materials shared on YouTube channels as well as TV news posted online and diverse categories of articles available online. The process of reviewing literature started with what the authors knew about civil war in the Democratic Republic of Congo. Different strategies were used by the authors to collect and analyse secondary data. In order to achieve the research objectives, the study relied more on online material, books and journal articles that the authors found through online Google search and the University of KwaZulu-Natal library. The focus was on sources that cover the voices of those in informal mining, communities, local and international organisations, government official statements as well as experts' analysis and official reports (Table 1). Key words appropriate to the topic under study such as informal, mining, financing, war, Democratic Republic of Congo were used in a Google search.

After extensive examination of the literature, a theoretical knowledge gap was identified from this literature search. In this respect, the authors saw the need to provide a nuanced theoretical approach to the study of the role of informal mining in financing war in the Democratic Republic of Congo. The study employed qualitative methods. Polit & Beck (2004) argue that qualitative research emphasises the holistic and dynamic aspects of the human experience and it endeavours to capture the objective. This technique was used to explore the role of informal mining in financing war in the Democratic Republic of Congo because it provides outstanding analysis of secondary data sources and theoretical insights that cannot be quantified. According to Bryman (2012), qualitative research aims to discover hidden ideas, gain new insights, and increase knowledge of problems that are not clearly understood.

Table 1: Indicative list of YouTube news channels reporting on mining and financing war in DRC.

Platform	Subscribers	Mining and financing war (URL)	Year	Views	Comments
BBC NEWS Africa	1.39M	https://www.youtube.com/watch?v=tEOmI5bc3HU	2022	87,401	341
VAO Africa	202K	https://www.youtube.com/watch?v=hRyc0FnNZFk	2023/2024	280,816	441
We Love Africa	599K	https://www.youtube.com/watch?v=D2xPd2_xIuM	2024	91K	510
ARTE, tv	418K	https://www.youtube.com/watch?v=0fILNxosR0Q	2024	190K	223
TRT Africa	341K	https://www.youtube.com/watch?v=AJTedufEZjM	2023	1.6K	1

Note. Subscriber, view and comment counts are shown as displayed on YouTube at the time of capture. Abbreviations: K $= 10^3$, M $= 10^6$. URLs may wrap. Data as of 17 July 2024.

In addition, thematic analysis was then used to analyse the available literature. Based on the diversity of social media platforms, data collection was conducted manually through a technique of identifying the relevant sources using keywords. Data were collected in early March 2024 and those in French were all translated into English. While ethical principles must be observed in any research undertaking involving human subjects, researchers need to seek the informed consent of the participants whose data are used. There is, however a lack of consensus regarding the ethical question of whether one must seek informed consent when using social media data, as that data is publicly available on social media platforms. Because of these concerns and potential biases, researchers' well-reasoned judgment was required when using social media as a data source. Each source of information was carefully considered as to whether it was restricted by its producer. However, no restriction applied to any of the sources used in this study. All sources were publicly available.

4 Results

This study aims to explore and examine the role of informal mining in financing war in the DRC, and also the possible contribution that informal mining can make in restoring peace to this war-ravaged nation. This section provides the findings of the study and centres around two key variables. These include, first, the role of minerals in war in the Democratic Republic of the Congo and second, the possible contribution of informal mining to restoring peace in the DRC. It is worth mentioning that informal mining is analysed through the broader perspective of mining in the DRC.

4.1 Informal mining and war financing in the Democratic Republic of Congo (DRC)

The Democratic Republic of Congo (DRC) is a country endowed with vast natural resources including biodiversity, timber, and minerals such as coltan, cobalt, copper, diamonds, gold, and tin. These resources are essential for various global industries, including electronics and renewable energy. Despite this abundance, the DRC remains one of the poorest countries in the world, suffering from significant infrastructure deficits and an economy heavily dependent on agriculture and forestry. This paradox, of wealth in natural resources coupled with widespread poverty, is often referred to as the "resource curse" (Biayi et al., 2022).

In the DRC, control over lucrative resources like minerals has been a central driver of conflict. Various armed groups compete for control over these valuable resources, and this struggle has been exacerbated by both local and international interests. The DRC possesses the world's largest coltan reserves and significant

cobalt deposits, accounting for 70% of the world's known cobalt reserves. Yet, the DRC has not reaped the benefits of these resources. As Nobel Peace Prize laureate Wangari Maathai stated before her passing, "When we look at the conflicts in Africa, it's always about the resources" (TRT Africa, see Table 1).

Violent conflicts tied to the exploitation of the DRC's natural resources have burdened the country for decades. Kinyua (2017) asserts that external forces have deliberately fueled conflicts by supplying armed groups with weapons, further destabilizing the country. The exploitation of minerals such as tin, tungsten, tantalum, and gold has been linked to the funding of rebel groups, turning war into a profitable activity with international investors involved (Hanai, 2021). While these resources benefit armed groups and corrupt actors, they are not particularly attractive to major multinational mining companies, which focus on large-scale investments in exchange for concessions from the government.

Importantly, the DRC has seen a shift in the mining sector over the past several decades. During the Belgian colonial era, the mining industry was dominated by large, foreign-owned companies, but after independence, small-scale "informal" mining began to take over, particularly in conflict-prone regions. This shift mirrors the broader transition in many African countries from plantation economies to subsistence farming, as control over resources shifted from large corporations to local communities (Parker & Vadheim, 2017). While large companies are primarily interested in securing access to valuable mining concessions from the government, they are less inclined to engage with artisanal mining activities, which they view as too fragmented and risky.

Small-scale mining, however, remains deeply entrenched in the conflict. Armed groups control mining sites, extort local miners, and smuggle minerals across borders to fund their operations. This situation has led to the involvement of international actors who profit from the illicit mineral trade. The BBC reported on the illicit movement of gold in DRC, with revenue flowing to armed groups that destabilize the region (BBC News Africa, 2023). These armed groups smuggle minerals such as gold across borders into Uganda and other neighbouring countries (Anderson, 2023). Reports from Cuvelier and Raeymaekers (2002) and Global Witness (2005) have highlighted the complicity of European companies in the illegal coltan trade, as well as the involvement of Rwandan actors in smuggling operations.

Investigations by the UN Panel of Experts have shown that armed groups control artisanal mining sites, engaging in illegal extraction and smuggling to finance their activities (Hanai, 2021). This ongoing struggle for control has made it exceedingly difficult to manage the country's resources in ways that benefit the public (Kalombo, 2022).

Despite efforts by the international community to address these issues, the situation remains dire. Both diplomatic and military interventions have failed to stop the violence. International legal frameworks, such as the United Nations' efforts to protect natural resources during armed conflicts, have proven ineffective in preventing the exploitation of the DRC's mineral wealth (del Congo, 2020). The presence of foreign troops, such as those deployed by the United Nations Mission in the DRC (MONUSCO), has been met with criticism. Some DRC residents argue that these forces, despite their peacekeeping mandate, are complicit in fueling the conflict, as they are perceived to have their own interests in the country's resources (VOA Africa, 2023).

The DRC government, which relies heavily on revenue from mineral concessions, is unlikely to profit from small-scale artisanal mining or smuggling activities. Instead, the government seeks large-scale investments from multinational companies. However, companies are reluctant to operate in conflict zones, fearing the instability that requires heavy protection. This creates a paradox: The DRC's vast resources could, in theory, be an incentive for both the government and foreign actors to eliminate armed groups and restore peace. However, peace has not materialized, and the actors benefiting from the current chaos continue to fuel the conflict.

Olanrewaju et al. (2020) argue that natural resources have historically been instruments of war and will likely continue to play this role in the future. Rebel and political groups compete with the government for control of high-value minerals, which can easily be smuggled and traded for arms (Mhandu & Mugambiwa, 2021). In the eastern DRC, areas controlled by rebels are relatively peaceful, as the rebels depend on continuous mineral production for illegal distribution (Krauser, 2020). This pattern of exploitation has become deeply entrenched in the region's political economy.

4.2 Efforts to address the resource curse in the Democratic Republic of Congo

International efforts to address this issue have often been criticized for their failure to halt the flow of illicit resources. The U.S. Government Accountability Office has reported on how armed groups profit from the production and sale of minerals to the international market (Anderson, 2023). At the same time, neighbouring countries such as Uganda and Rwanda benefit from the smuggling of the DRC's gold, as reported by Matthysen et al. (2013).

The DRC's resource wealth has paradoxically fueled conflict rather than development. The transition from colonial-era large-scale mining to small-scale, informal mining has played a critical role in shaping the conflict dynamics. While multinational corporations are not interested in small-scale artisanal mining, they are keen on securing government concessions for large-scale operations. However, they are deterred by the ongoing violence and instability. This creates a situation where both the DRC government and foreign actors have an incentive to restore peace, yet the conflict continues to rage, fuelled by the greed of armed groups, corrupt officials, and illicit trade networks.

The solution to the DRC's resource curse lies in the dismantling of these networks and the creation of stable, transparent systems that can manage the country's wealth in a way that benefits its people. Until that happens, the cycle of conflict and exploitation will persist, and the vast mineral wealth of the DRC will remain a source of contention rather than a driver of prosperity.

4.3 Role of mining and peacebuilding in the Democratic Republic of Congo (DRC)

The term 'peacebuilding' first emerged in the 1970s through the work of Johan Galtung, who called for the creation of peacebuilding structures to promote sustainable peace (Issifu, 2016: 11). The concept of peacebuilding has different definitions across various departments, institutions, schools, agencies, and scholars (Issifu, 2015). For instance, Call and Cousens (2007) defined peacebuilding as actions undertaken by international or national actors to institutionalize peace, understood as the absence of armed conflict (negative peace). Peacebuilding refers to a process that seeks to prevent the onset, escalation, continuation, or recurrence of conflict and violence in societies. It involves a variety of activities aimed at promoting social, economic, and political development, as well as fostering a culture of peace, justice, and reconciliation (Hussain & Gbadeyan, 2024). Strategies for conflict prevention may include early warning systems, mediation, and dialogue, as well as efforts to improve governance, reduce poverty, and promote human rights (Akpan & Ekpenyong, 2020).

Several studies have indicated that mining can generate peace dividends at the local and national level and contribute to the economic growth that supports the underlying socio-economic conditions needed for peace (Eshun, 2020). Eshun further elaborates that mining involves a range of activities such as working in partnership with local communities, providing socially sensitive investments, developing relationships with employees, customers, and their families, as well as involvement in activities that promote environmental conservation and the development of sustainable livelihoods (Eshun, 2020). Mining can play a significant role in restoring peace by contributing to economic growth and reconstruction efforts. In post-conflict settings, mining can provide a source of internal revenue to spur economic development. However, it is essential to address governance weaknesses and suppress illicit mining and smuggling of minerals to ensure that mining contributes positively to peacebuilding efforts (Tjoetra et al., 2024).

The study by Paarlberg-Kvam (2021) focuses on corporate and state-level extractive actors operating on an industrial scale and provided cases of countries such as Peru, Sierra Leone, Guatemala, Liberia and, more recently, Afghanistan, where mining restores peace after war, for example, by providing new sources of income, jobs, and improved infrastructure. It even helps meet basic needs and opens the country's economy to foreign investment. Additionally, formalizing artisanal and small-scale mining (ASM) can be prioritized as part of peacebuilding and post-conflict reconstruction processes, contributing to the realization of sustainable development based on peace, justice, and strong institutions (Ankenbrand et al., 2021). It is important to consider the implications of the Business for Peace research agenda, as it may socialize businesses into contributing to peacebuilding but also elevates companies to legitimate authorities, despite their limitations as peacebuilders. There are many reasons to believe that a socially inclusive approach

to mining with stronger environmental regulations and increased community participation can balance economic benefits with sustainable peacebuilding.

However, a clear distinction must be made between small-scale "informal" mining and the operations of large-scale multinational mining companies in the DRC. Historically, during Belgian colonial rule, mining in the DRC was dominated by large international companies, with extraction largely controlled by foreign actors. After independence, particularly during periods of conflict and instability, small-scale artisanal and informal mining emerged as a significant economic activity, especially in the eastern regions of the DRC.

This historical shift from major multinational companies to small-scale, informal mining in the DRC is crucial when analysing the dynamics of peacebuilding and economic recovery. While large multinational mining corporations contribute substantial revenues to the national economy, the informal mining sector though economically significant$_{\text{has}}$ often been linked with poverty, weak governance, and instability. Informal mining operations typically lack proper regulation, leading to issues such as illegal mining, environmental degradation, and the funding of armed groups.

In the DRC, as demonstrated earlier, all areas of development are affected by protracted conflict. Unemployment, poor infrastructure, revenue erosion, social disintegration, corruption, and weak governance are dominant features of the DRC's social, economic, and political landscape. Considering the importance of mining in the reconstruction process, there are many reasons to believe that, if used effectively, responsible mining can generate significant revenue and create job opportunities. A report by Statista (2024) shows how the global mining industry contributes significantly to GDP in many countries, with a total value of over $2.1 trillion in 2023. The World Bank (2022) shows how in developing nations, mining contributes 10-25% of total export earnings. Globally, mining employs over 20 million people and supports over 100 million jobs through services and supply chains (International Labour Organisation, 2003). This economic development can provide a stable livelihood for local communities, reducing poverty and decreasing the likelihood of conflicts over resources. In addition, mining projects often lead to the development of infrastructure such as roads, schools, and hospitals. This improved infrastructure can benefit local communities and contribute to overall stability by enhancing access to essential services. Taxes and royalties from mining operations can be used to fund community development projects, education, and healthcare. Effective management of these funds can contribute to social stability and peace.

Furthermore, involving local communities in decision-making processes and ensuring they benefit from mining activities can help build trust and reduce tensions. Participatory approaches to mining can empower communities and foster cooperation between members of different communities, as most conflict is rooted in competition over control of access to minerals. Mining companies can support or facilitate conflict resolution and peacebuilding initiatives. By addressing grievances, promoting dialogue, and working with local and national authorities, companies can help mitigate tensions. Responsible mining practices require strong governance and transparency. Implementing and supporting initiatives for better governance can reduce corruption and promote the rule of law, contributing to a more stable and peaceful environment. Supporting and promoting legal and ethical mining practices can help combat illegal mining and related violence. By ensuring that mining activities adhere to legal standards, it is possible to reduce conflicts associated with illegal operations.

It is important to note that for these positive outcomes to be realized, mining activities must be managed responsibly, with a focus on sustainability, community welfare, and ethical practices. This means avoiding scenarios where mining exacerbates existing conflicts or leads to new forms of violence. Collaboration with local communities, government agencies, and international organizations is essential to ensure that mining contributes to peacebuilding rather than undermining it.

5 Conclusions

The aim of this study is to explore and critically examine the multifaceted role of informal mining in financing the ongoing conflict in the Democratic Republic of the Congo (DRC), as well as the potential contributions informal mining could make to restoring peace in a war-torn region. By analysing the findings, it becomes clear that natural resources, particularly mining, have been central to perpetuating and intensifying the prolonged conflict in the DRC. Competition over both domestic and global demand for natural resources has led to the emergence of numerous armed groups, with natural resources especially minerals serving as their primary source of financing.

In a context marked by extreme poverty, insufficient economic opportunities, and inadequate governance, informal mining has become a critical means of self-enrichment for local communities and armed groups alike. This informal sector, often operating outside the realm of regulation, is perceived as a way for individuals and factions to gain wealth, power, and influence. Consequently, violence has been employed as a strategy to maintain control over mining operations, protect valuable resources, and enforce dominance over rival factions and local populations.

The study also highlights the role of weak governance structures in the DRC which, coupled with pervasive corruption, further exacerbates the situation. The lack of effective state control, along with the involvement of external actors driven by the desire to exploit the country's mineral wealth, has contributed to the prolongation of the conflict. This combination of local and international actors, each with their own economic and political interests, continues to fuel violence and instability.

Given this complex dynamic, it is evident that informal mining, while a critical driver of conflict, also presents an opportunity for peacebuilding efforts. The study contemplates the potential for transforming informal mining into a tool for stability and peace by instituting better regulation, creating economic opportunities that are less reliant on exploitation, and promoting more inclusive governance frameworks. However, any such transformation would require addressing the underlying issues of poverty, corruption, and external interference that currently enable the ongoing conflict.

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Nutritional Status and Dietary Diversity among Adolescents in Rural Koraput, India

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Abstract

Adolescent nutrition is vital for healthy growth, preventing health complications and breaking the cycle of malnutrition. In India, addressing this issue is crucial, as studies indicate a high prevalence of stunting and undernutrition among adolescents. This study aims to assess the nutritional status and dietary diversity patterns among rural adolescents in Koraput district, Odisha, India. A cross-sectional study was conducted among 305 adolescents aged 10–19 years. Body Mass Index (BMI) was calculated using WHO Anthro-Plus, and dietary patterns were assessed via a 24-hour recall method following FAO (2010) guidelines. Underweight was present in 56.1% of these adolescents. There was no significant difference in BMI between males and females. The Individual Dietary Diversity (IDD) score of most individuals ranged from 5 to 8, and the mean IDD score was 6 out of 12. The IDD score had a positive and statistically significant correlation with BMI. The study revealed that both BMI and IDD are influenced by inadequate dietary diversity and limited food choices. This highlights the need for interventions to promote healthy nutrition and ensure overall growth.

Keywords: Nutritional assessment, Dietary diversity, Adolescents, Body mass index, Dietary score, Malnutrition

1 Introduction

Nutritional assessment helps to discover and treat dietary deficiencies, imbalances, and other nutritional issues that may harm health. Nutritional assessment and therapy are effective ways to break the cycle of malnutrition and nutritional deficits (Kesari & Noel, 2022). Rapid physical, mental, and physiological growth during adolescence requires proper diet and care. Adolescent undernutrition can cause stunted growth, immune system weakness, anaemia, and cognitive impairment (Ersado et al., 2023).

Individual Dietary Diversity (IDD) is a measure for the variety and quality of an individual's food over a specified time period and can be used to assess dietary adequacy. Studies found that the use of nutrition screening and assessment in the community setting resulted in reduced healthcare costs by preventing or treating malnutrition-related complications (Reber et al., 2019). In India, the National Family and Health Survey uses adult nutritional status cutoffs to estimate undernutrition and overnutrition in the 15–19 age range. According to NFHS-5 (2021) data, in Odisha, 36% of women aged 15–19 years have a BMI below 18.5, while 6.4% of females and 32.9% of males in the same age group are overweight or obese. Adolescent nutrition in Odisha has remained poor for decades, with minimal signs of improvement. According to the International Institute for Population Sciences (2021), approximately 23.2% of girls aged 15–19 years in the state have a BMI below the normal range, reflecting widespread undernutrition. Dietary deficiencies are also evident, as only 45% of adolescents reported making an effort to consume iron-rich foods daily.

Monitoring trends in undernutrition and dietary diversity is crucial for evaluating the effectiveness of past and ongoing programs, as well as for formulating appropriate policies and interventions. While most studies on adolescent nutrition in Odisha have focused either on anthropometric measurements

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or on dietary intake, very few have sought to establish a correlation between the two. According to statistics from the District Nutrition Profile, Koraput district of Odisha, where the present study was conducted, ranks 541 out of 599 Indian districts (Singh, 2022). Moreover, Koraput district, predominantly inhabited by tribal communities, relies mainly on cereal-based diets that lack substantial amounts of fruits, vegetables, animal-source foods, and dairy products, resulting in very low dietary diversity (Nithya & Bhavani, 2018). Malnutrition during adolescence impairs linear growth and sexual maturation, weakens the immune system, reduces cognitive ability, lowers educational performance, and increases the lifetime risk of anaemia, infections, heart disease, and adverse pregnancy outcomes (Black et al., 2013; Patton et al., 2016). These health consequences are further exacerbated by food insecurity, recurrent infections, and structural exclusion among tribal communities in India, perpetuating undernutrition across generations (Ministry of Health ... & ICMR, 2018).

Thus, the current study seeks to determine the nutritional status among rural adolescents in the Koraput district using anthropometric and dietary measurements and the relationship between these two parameters.

2 Methods

2.1 Study design and setting

A community-based cross-sectional study was conducted in five villages of Koraput district, Odisha, a predominantly tribal region characterized by limited access to diversified diets and poor socioeconomic conditions.

2.2 Study population and sample size

A total of 305 adolescents aged 10–19 years (WHO, 2024) participated in the study. Among them, 215 were recruited through schools using class registration lists in collaboration with teachers, while 90 were recruited through door-to-door household visits.

The adequacy of the sample size was established using the single population proportion formula:

$$n = \frac{Z^2 p\,(1-p)}{d^2}, \tag{1}$$

where n is the required sample size, Z is the standard normal deviate at 95% confidence level (1.96), p is the estimated prevalence of undernutrition $(25\%$ based on NFHS-5, Odisha; NFHS-5, 2021), and d is the margin of error (0.05). Based on this calculation, the minimum required sample size was $n = 288$. Considering possible non-response, a total of 305 adolescents were recruited, which was statistically adequate to generalize the findings.

2.3 Inclusion and exclusion criteria

The study included adolescents aged 10–19 years who were permanent residents of the selected villages and available at the time of data collection. Adolescents with visible physical deformities, chronic illness, or acute illness on the day of measurement were excluded to avoid anthropometric inaccuracies.

2.4 Anthropometric Assessment

Height was measured using a portable anthropometric rod with participants standing upright and barefoot, while weight was recorded using a calibrated digital weighing scale with participants in light clothing and without footwear. Height and weight were recorded in cm and kg, respectively. Body mass index (BMI) was calculated and analysed using WHO AnthroPlus software. Nutritional status was classified according to

BMI-for-age Z-scores (BAZ) based on the WHO (2007) growth reference. Severe thinness was defined as $\mathrm{BAZ} < -3\mathrm{SD}$, thinness as $\mathrm{BAZ} < -2\mathrm{SD}$, normal weight as BAZ between $-2\mathrm{SD}$ and $+1\mathrm{SD}$, overweight as $\mathrm{BAZ} > +1\mathrm{SD}$, and obesity as $\mathrm{BAZ} > +2\mathrm{SD}$.

2.5 Dietary assessment

Individual Dietary Diversity (IDD) was assessed using the 24-hour recall method and a questionnaire developed by FAO (2010). The questionnaire covered 12 food groups, and each group consumed within the recall period contributed a score of one point. Based on FAO recommendations, a score of 1–4 was categorized as poor dietary diversity, 5–8 as fair, and 9–12 as good. Although based on a 24-hour recall, consumption patterns were observed to be consistent over time.

2.6 Statistical analysis

Data were first entered in Microsoft Excel and subsequently analyzed using SPSS version 22.0. Descriptive statistics, including mean and standard deviation for continuous variables and frequencies with percentages for categorical variables, were used to summarize the data. Independent-samples t-tests were applied to compare continuous variables such as BMI and IDD between boys and girls, while χ^2 tests were used for categorical variables. The Pearson correlation coefficient was employed to assess the relationship between BMI and IDD. A p-value of less than .05 was considered statistically significant.

3 Results

Koraput is a tribal-dominated area with limited economic opportunities. As shown in Table 1, the mean age of the adolescents was 14.32 years, with a higher proportion in the 15–19-year age group (62.6%). Males constituted 62.9% of the sample. A large majority (86.6%) were students, while only 11.5% worked as daily wage labourers. Educational attainment was mostly up to the secondary level, and substance use such as smoking or tobacco consumption was negligible (<1%).

Table 1: Socio-demographic and lifestyle information, $n = 305$

Variables	**Frequency**	**%**
Gender		
Male	192	62.9
Female	113	37.1
Age (in years)		
10–14	114	37.4
15–19	191	62.6
Mean age (SD)	14.32 ± 2.04	
Educational qualification		
5^{th}–6^{th}	112	36.7
7^{th}–10^{th}	189	62.0
Others (ITI, diploma, intermediate & graduate)	4	1.3
Occupation		
Student	264	86.6
Labourer	35	11.5
Other (potter, driver)	6	1.9

Table 1 (continued)

Variables	Frequency	%
Vices		
Smoking	1	0.3
Tobacco	3	1.0
No substance use	301	98.7

Table 2 depicts the gender-wise distribution of mean height, weight, and BMI among the studied population. The analysis revealed that males had significantly greater mean height, while differences in BMI and weight between genders were not statistically significant.

Table 2: Gender-wise distribution of mean height, weight, and BMI (mean ± standard deviation), with *t* statistic and *p* value for the sex differences

Variable	Total	Female	Male	*t*	*p*
BMI	17.35 ± 2.44	17.66 ± 2.55	17.18 ± 2.30	2.02	0.06
Height	151.30 ± 10.46	149.10 ± 8.50	152.60 ± 11.70	2.85	0.01
Weight	40.27 ± 9.17	39.20 ± 8.10	40.90 ± 9.70	1.56	0.12

Note. Values are mean ± SD. t = Student's t statistic; p = two-tailed p value.

Table 3 depicts the BMI status of the studied individuals. A higher proportion of participants were underweight (56.07%), while 31.8% had a normal BMI. The combined prevalence of overweight and obesity was relatively low, accounting for 12.13% of the total population.

Table 3. BMI status of the adolescents

Table 3: BMI status of the adolescents by sex (counts and percentages).

	Total		Boys		Girls		p-value χ^2
Categories	**No.**	**%**	**No.**	**%**	**No.**	**%**	
Underweight	171	56.1	113	59.5	58	50.4	$0.37\ (3.55)$
Normal	97	31.8	58	30.5	39	33.9	
Overweight	25	8.2	12	6.3	13	11.3	
Obese	12	3.9	7	3.7	5	4.4	

Note. p-values from Pearson's χ^2 test. Totals equal boys + girls by construction.

Figure 1 depicts the BMI distribution of the studied individuals in comparison to the WHO (2007) BMI-for-age reference. The graph of the studied population was shifted to the left, indicating that a higher number of adolescents had lower BMI values compared to the WHO standard. The classification of underweight was based on WHO cut-off values, with adolescents below -2 SD categorized as underweight.

Table 4 presents the distribution of various food groups by gender. Cereals, legumes, nuts, seeds, oils, and fats were staple food items for the studied population, with the main staples consumed daily. Although some dietary differences existed, most fruits, meat, fish, and other seafood were not commonly consumed. To assess gender-based differences in food consumption, a χ^2 test was performed for each food group independently. The overall p value of .28 indicated no significant differences in consumption between males and females.

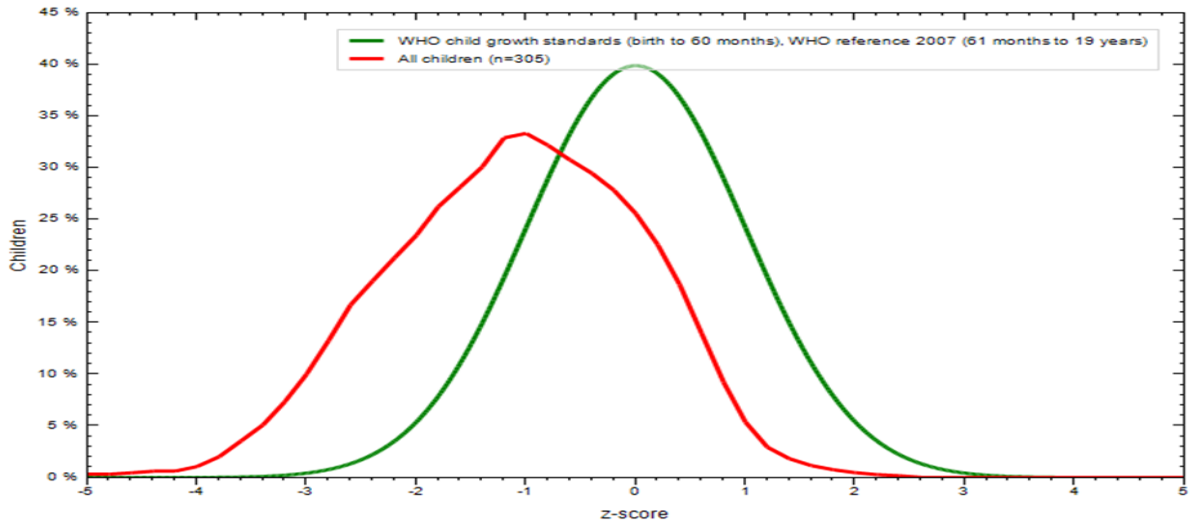

Figure 1: BMI distribution of the studied adolescents compared with the WHO (2007) reference sample

Table 4: Gender-wise distribution of different food groups (n = 305)

Food groups	Total		Female		Male	
	No.	%	No.	%	No.	%
Cereals	305	100	113	100	192	100
White tubers & roots	14	4.6	5	4.4	9	4.7
Vegetables	305	100	113	100	192	100
Fruits	3	1.0	3	2.7	0	0
Meat	11	3.6	1	0.9	10	5.2
Eggs	12	3.9	6	5.3	6	3.1
Fish & other seafood	3	1.0	1	0.9	2	1.0
Legumes, nuts, seeds	291	95.4	111	93.2	180	93.8
Milk & milk products	38	12.5	16	14.6	22	11.5
Oil & fats	301	98.7	111	98.2	190	99.0
Sweets	41	13.4	17	15.0	24	12.5
Spices	303	99.2	113	100	190	99.0

Table 5 presents the gender-wise distribution of IDD scores among the studied individuals. The scores were categorized into three ranges: 1–4 (poor), 5–8 (fair), and 9–12 (good). The results show that the vast majority of individuals had scores within the 5–8 range, indicating moderate dietary diversity, while only a few had poor or good dietary diversity scores. The χ^2 test indicated no significant differences in IDD scores between males and females.

Table 5. Gender-wise distribution of IDD scores among the studied individuals

Table 5: Gender-wise distribution of IDD scores among the studied individuals.

Score range	Total No.	Total %	Female No.	Female %	Male No.	Male %	p-value χ^2
1 to 4 (poor)	7	2.3	1	0.9	6	3.1	
5 to 8 (fair)	297	97.4	111	98.2	186	96.9	0.66 (1.72)
9 to 12 (good)	1	0.3	1	0.9	0	0.0	

Note. Values are counts and percentages. p-value from Pearson's χ^2 test.

Table 6 presents the relationship between mean BMI and IDD scores. For analytical purposes, the IDD scores were dichotomized at a cut-off of 6, which represents the midpoint of the "fair" dietary diversity range (5–8). This cut-off was selected to differentiate individuals with relatively lower dietary diversity from those with relatively higher dietary diversity within the fair category. The correlation analysis showed a significant positive association between IDD and BMI ($r = .33$, $p < .05$). Furthermore, the mean BMI was significantly higher among individuals with IDD scores ≥ 6 compared to those with IDD scores < 6, as indicated by the independent sample t-test.

Table 6: Association of IDD score with BMI

IDD score	Mean BMI ($\pm$ SD)	*t* value (*p*)
< 6	16.4 $\pm$ 2.4	3.18 (0.002)
≥ 6	17.5 $\pm$ 2.4	

4 Discussion

According to the current study, the prevalence of undernutrition among adolescents in Koraput is 56.1%, based on BMI-for-age Z-score classifications. The mean BMI of 17.35 provides further context for understanding the overall nutritional status of the study population. This high number raises concerns about this group's nutritional status and overall health. Individuals who are malnourished, as indicated by being underweight, are at risk of weakened immunological function and stunted growth. Earlier research conducted in rural West Bengal revealed a 52.5% prevalence of undernutrition and stunting (Das et al., 2007). The available literature on adolescent nutrition in Koraput appears limited, and studies specifically focusing on this district are relatively scarce. The prevalence of overweight across Indian adolescents has been reported to range between 2.28% and 21.9%, and obesity between 2.4% and 17.6% (Sharma et al., 2024). These findings suggest that while the prevalence of obesity among Indian adolescents varies regionally, many are at risk of developing obesity-related health problems such as diabetes, heart disease, joint problems, and other chronic disorders in adulthood (Anderson & Durstine, 2019). However, in this study, the prevalence of overweight and obesity was low, which suggests that adolescents in this district are not currently facing the 'double burden of malnutrition' that is observed in many other parts of India.

Tobacco, alcohol, and smoking are prevalent among the adult population of Koraput (Bindhani et al., 2024). In the present study, only 0.33% of adolescents reported smoking and 0.98% reported consuming tobacco. Although the prevalence is relatively low, this stage of life may represent the period when individuals begin experimenting with such habits. Early initiation, even on a small scale, can gradually

progress into addiction in later years, which in turn can negatively influence nutritional status and overall health. Therefore, proper awareness and preventive interventions at school, family, and community levels are essential to discourage the adoption of such risky behaviours during adolescence. Similar studies have revealed that adolescents who smoke or use tobacco often make poor food choices, which can contribute to inadequate nutritional intake (Dowdell & Santucci, 2004).

The present study emphasizes the importance of dietary diversification among adolescents. According to the data, 97.4% of individuals had dietary diversity scores ranging from 5 to 8, indicating moderate dietary diversity. However, targeted interventions and nutrition education may still be useful to improve overall dietary habits (Ekesa et al., 2011). The low dietary diversity observed in this study is likely influenced by economic constraints, as many families cannot afford costlier food items such as meat, fish, eggs, milk, and fruits. Other contributing factors may include intra-familial distribution of food, food taboos, and dietary restrictions, which can all shape dietary intake and food selection among adolescents (Kera et al., 2024). A key recommendation to address this issue is the implementation of poverty alleviation measures. The unexpectedly low consumption of fruits in our study may be linked to seasonal availability.

The analysis of individual dietary diversity, assessed using the 24-hour dietary recall method, revealed that a considerable proportion of participants with lower dietary diversity scores also exhibited BMI values below the normal range (see Table 6). This suggests that the economic constraints that lead to undernutrition also restrict dietary diversity. Ensuring access to a wider variety of nutritious foods could therefore play an important role in improving their overall nutritional status. Similar studies have highlighted the importance of addressing nutritional concerns that extend beyond overweight and obesity (Gittelsohn & Sharma, 2009). In the present study, the predominant dietary pattern consisted mainly of cereals, legumes, nuts, seeds, oils/fats, and vegetables, with relatively lower consumption of fruits, meat, fish, and shellfish. Evidence from other impoverished settings has shown that adolescents are likely to experience malnutrition due to limited access to diverse food groups, particularly protein-rich items such as meat, fish, and milk (Ravula et al., 2024).

Cultural and socioeconomic factors have an impact on people's eating patterns, highlighting the significance of implementing particular nutritional interventions. There is no tradition of vegetarianism among the studied population; rather, they consume one or more varieties of non-vegetarian food items. Studies also revealed that there remains a close relationship between dietary intake and cultural and socioeconomic factors (Li, Y., 2020). According to the present study, all participants consumed cereals and vegetables (100%), while almost all consumed legumes, nuts, and seeds (95.4%) and oils/fats (98.7%). In contrast, the intake of fruits (1%), fish/seafood (1%), and meat (3.6%) was very low. Milk and milk products were consumed by only 12.5% of participants, and eggs by 3.9%. It is noteworthy that there was a gender-based disparity in consumption. For example, fruit consumption was reported only among females (2.7%), while no males consumed fruits. Meat consumption was much higher among males (5.2%) than among females (0.9%). Similarly, females reported slightly higher intake of eggs (5.3% vs. 3.1%) and milk products (14.6% vs. 11.5%). This suggests a potential association with gender-based nutritional requirements or preferences. Possible reasons for this variation include differences in growth rates, body composition, and metabolic needs during adolescence, which may lead to varying dietary preferences and consumption patterns. Additionally, cultural factors such as food taboos prevalent in this tribal region could also contribute to these differences.

Overall, most participants consumed between 5 and 8 food groups, indicating a moderate level of dietary diversity. However, a more quantitative assessment of food intake based on nutrient guidelines would provide a clearer understanding of diet adequacy. Further research is needed to analyse the precise nutrient composition of these diverse meals to evaluate their ability to meet nutritional requirements (Remans, 2011).

5 Conclusion

This study highlights the concerning prevalence of undernutrition among adolescents in rural Koraput, with 56.1% of the studied population classified as underweight. In contrast, the prevalence of overweight and obesity remains relatively low, at 8.2% and 3.9% respectively. The findings suggest that economic constraints and limited access to diverse food groups have contributed to the observed dietary patterns, with most adolescents primarily consuming cereals, legumes, nuts, seeds, oils, and fats, while the intake of fruits, meat, fish, and dairy products is comparatively low. The study also found no significant difference in BMI between males and females, although slight variations in dietary diversity were observed based on gender, which may be influenced by growth-related nutritional needs and cultural food taboos. The Individual Dietary Diversity (IDD) score analysis revealed that 97.4% of adolescents had a moderate level of dietary diversity (scores ranging from 5 to 8). Furthermore, a positive correlation between IDD and BMI was observed ($p < .05$), suggesting that a more varied diet contributes to better nutritional status.

These findings emphasize the urgent need for targeted nutritional interventions focusing on poverty alleviation, dietary education, and improved access to diverse food sources. Future research should explore the long-term impact of existing nutritional programs and develop sustainable strategies to enhance dietary diversity and nutritional adequacy in this vulnerable population. Addressing these challenges is essential for improving adolescent health outcomes and mitigating the long-term consequences of malnutrition in Koraput and similar rural regions of India.

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Gender Differential Item Functioning in Raven's Coloured Progressive Matrices Test (CPM)

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Abstract

This study aimed to reveal differential item functioning (DIF) by gender for the items of Raven's Coloured Progressive Matrices (CPM) test, separately for age groups of 4-6 years, 7-9 years, and 10-12 years. The number of students in the study sample was 2624 including 1190 males and 1434 females, selected from the kindergarten and primary school levels from the states of Khartoum and Gadaref in Sudan. The 36-item Coloured Progressive Matrices (CPM) test was applied, and differential item functioning was analysed on the total sample and for the three age groups using the Mantel-Haenszel method. The number of items that show differential item functioning by gender rose from 8% in the 4-6 years age group (preschool) to 11% for ages 7-9 (primary school) and 32% for the 10-12 years age group. This study concludes with a number of recommendations calling for studies of DIF in intelligence tests of the Raven type in relation to gender and also age and ethnic groups both in Sudan and elsewhere.

Keywords: IQ tests, Differential item functioning, Mantel-Haenszel method, Coloured Progressive Matrices, CPM, Sudan.

1 Introduction

Historically, the study of differential item functioning (DIF) of intelligence tests dates back to 1911. When Binet reviewed the first results on his test, which he had developed to measure mental ability, he noted that the average performance of children from the higher economic classes was much higher than the average performance of children from the lower economic classes (Roever, 2005). He was convinced that there were items in his test that were affected by the social and economic levels of the examined students. Some items of the test were deleted accordingly. The human rights movement in the late sixties and early seventies played a role in highlighting the issue of bias in mental abilities tests. The aim was to achieve justice and equality between individuals in educational and employment opportunities by making tests as free of bias as possible (Conoley, 2003).

The term differential item functioning (DIF) has been used since the beginning of the 1980s to denote the methods and statistical treatments that are used to detect the bias of test items. Differential item functioning is a statistically derived function to express the difference in response to an individual item between two groups at the same ability level. There are those who use the term differential item functioning as a synonym for bias. This, however, is not justified. The term differential functioning in items of a test is used to identify items in which the probability of a correct answer is different between two groups *with the*

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same level of ability, where ability is defined as the ability construct that the test is designed to measure: in technical terms, the average performance on the complete test.

Items with differential functioning can be described as those biased in favour of one group over the other for reasons not related to the ability of individuals only (Camilli & Shepard, 1994). Hambleton and Rogers (1995) described differential item functioning as difference in the probability of the correct answer on an item in different groups of equal ability. Hambleton et al. (1991) argue that differential item functioning is present when the response functions are different in different subgroups. Jensen (1980) defines bias as a systematic error that makes performance on a test better for one group than for another.

Dorans and Holland (1994) distinguished between the concept of bias and the concept of differential item functioning in this way: Differential item functioning in psychometrics is present when the item works differently in one group from the other group, while bias of an item carries social meaning, inequality and equality. Hence, differential item functioning is a prerequisite for considering an item biased, but it is not sufficient for it, in the sense that when an item shows differential performance for a group, then additional procedures are required to decide that the item is biased. Such procedures may include arbitration of that item or an empirical evaluation.

One example of a study of differential item functioning by gender is the study of Gamer and Engelhard (1999) on mathematical performance which confirmed that males score higher in geometry and measurement, while females excel in algebra. A study of Mendes-Barnett & Ercikan (2006) identified sources of DIF and differential bundle functioning for males and females on a Principles of Mathematics exam, showing that males perform better on items that require higher cognitive processes while females were superior in items of mathematical relationships and nominal descriptions. Drina (2007) studied differential item functioning on a ninth-grade mathematics proficiency exam according to gender and region. This study found four items out of 36 with differential item functioning linked to gender, while no region-related differences appeared.

A study of Ryan and Chiu (2001) on the sources of differential item functioning in a mid-western mathematics placement exam indicated that males performed better than females on difficult vocabulary items that need high thinking skills and on geometry, as well as on items that include drawings and pictures. Among studies conducted in the Arab world, Al-Bursan (2013) examined gender-based differential item functioning and found that DIF in favour of males increased as the cognitive level of test items decreased — that is, gender-related differences became more pronounced on lower-level items. This suggests that the complexity and cognitive demands of test items may influence the degree of gender-related DIF observed.

Studies of gender differences in measured general and special abilities (Hyde & Linn, 1988; Hyde et al., 1990; Linn & Petersen,1985; Maccoby & Jacklin, 1974; Voyer et al., 1995) found that boys outperform girls in spatial and mathematical reasoning and on tests measuring quantitative abilities, spatial rotation, spatial relations and visualization, whereas females outperform males in verbal ability. They concluded that there are gender differences in some cognitive abilities. This contrasts with investigations by other researchers (Colom et al., 2000, 2002; Jensen, 1998a), who found a negligible sex difference in general intelligence. This indicates that cognitive gender differences result from differences in specific cognitive abilities, but not from differences in the core of intelligence (Abad et al., 2004). This conclusion was further reinforced by Jensen (1998b), McLaurin et al. (1973) and Paul (1985), who found that there is no gender difference on the total score of the Progressive Matrices (PM) test (Raven et al., 1998), one of the most widely used measures of cognitive ability (g). Males and females obtain similar scores in the PM Test.

Up to date, few studies have applied DIF analysis to interethnic comparisons using Raven's Matrices. Summarizing the results of these studies, there are very few or no significant differences in item functioning related to ethnicity. Rushton et al. (2004) concluded that Matrices tests are ethnically unbiased. The study of Al-Qati (2016) of gender bias of the Wechsler test items for measuring children's intelligence (Saudi version) showed that the ratio of gender-biased items was not high, distributed almost equally, and that the effect of bias on the overall test score was negligible. The study of Al-Bustanji (2004) comparing four procedures for detecting gender-based differential item functioning on a test of specific mental abilities in Jordan showed that differential functioning in general was in favour of males in math and spatial ability, and in favour of females in verbal ability.

When researchers compared the correlation coefficients, reliability and logistic of the Mantel-Haenszel

(MH) method with other models of DIF (Baghi & Ferrara, 1990; Dodeen, 2004; Harris & Carlton, 1995; Kim & Cohen, 1992; Penfield, 2001; Raju et al., 1993), they found that the MH method was the most accurate, easiest to use and most powerful method for detecting differential performance on an item.

The current study is based on these previous studies. The basic conclusion of these studies was: DIF describes differences in the statistical properties of an item between groups of equal ability, determined by factors specific to group membership such as differential opportunities to learn or differences in socialization. While hormonal and other biological differences have been suggested as explanations of gender differences in specific abilities, they are not typically considered to explain gender differences on specific items. The presence of DIF can have serious consequences for the interpretation of test scores for both groups and individuals. One of our observations is that gender differences in item performance reported by various studies were few. However, some indicated that males perform better on mathematics tests than females and there are significant gender differences in special abilities. Such a study has never been performed in Sudan. Our study addresses the following questions:

1) Is there differential item functioning by gender of Coloured Progressive Matrices (CPM) test items in the total sample of the study?

2) Is there differential item functioning related to age in CPM test items?

Methods of detecting differential item functioning depend on the theory on which it is based. There are several methods based on traditional test theory. *Analysis of variance* has been one of the most used methods until the end of the eighties of the last century. It depends on the statistical significance of the interaction of the item score with the group score (Labadi, 2008). The *coefficient of discrimination* is another method used to assess item performance. It involves calculating the correlation between individual item scores and the total test score, then ordering these correlations — either ascending or descending — to compare item performance between high- and low-performing groups (Berk, 1982). Another approach is the *goodness-of-fit method*, which compares the proportion of correct responses across subgroups within the same total test score category, allowing for the identification of items that may function differently among examinees of similar overall ability (Crocker & Algina, 1986). *Logistic regression* treats the item response (correct or incorrect) as the dependent variable and includes the examinee's estimated ability level, group membership, and their interaction as independent variables. The *likelihood-ratio method*, a parametric technique, compares two models to detect differential item functioning (DIF). The first, known as the compact model, includes parameter constraints that assume item characteristics are equal across groups. This is then compared to an augmented model that does not impose those constraints, allowing the parameters to vary between groups. If the comparison between the two models reveals statistically significant differences, this is considered evidence of differential item functioning (DIF), indicating that the item may be biased in favour of one group over another despite equivalent overall ability among individuals (Hambleton et all., 1991).

2 Methods

Table 1: Table 1. Descriptive statistics of the sample

Age	Age range (years)	Females	Males
4–6	Preschool (Kindergarten)	342	372
7–9	Primary stage (Grades 1–3)	701	563
10–12	Primary stage (Grades 4–6)	391	255
	Total	**1434**	**1190**

2.1 Cognitive test

The study utilized the Coloured Progressive Matrices (CPM), a non-verbal intelligence test developed by John C. Raven. The CPM is designed for individuals aged 5 to 11 years, the elderly, and those with moderate to severe learning difficulties. It consists of 36 items divided into three sets (A, AB, B), each containing 12 items. The items are presented on a coloured background to enhance visual appeal and maintain the participant's attention. The CPM is widely used in research and clinical settings to assess non-verbal reasoning abilities.

In Sudan, an adapted version of the CPM was administered to primary school students in Khartoum State by (Al-Khatib et al., 2006a,b, 2021). The sample included 1,683 students, with 57% males and 43% females. The test demonstrated high internal consistency, with stability coefficients ranging from 0.72 to 0.91. The Spearman-Brown reliability coefficient ranged from 0.63 to 0.81, indicating good reliability across subgroups and the total test score. Regarding the consistency of scores, the study found that the scores of different age groups had high correlations between the item score and set score, similarly between the set score and the total score, suggesting that the CPM effectively measures cognitive abilities across various age groups.

The study showed a positive correlation of the test scores with the chronological age of the participants, indicating that older students tended to score higher on the CPM as expected. Discrimination analysis revealed that most items in sets A and AB, as well as the first seven items in set B, effectively differentiated between higher and lower ability groups. The study also established percentile norms for males and females for each item, providing a reference for interpreting individual scores. Based on these findings, the study recommended the use of the CPM for various purposes, including classification and diagnostic assessments.

3 Results

Table 2 shows the Mantel-Haenszel statistic, odds ratio, and p-value (significance) of the Mantel-Hanzel statistic for the thirty-six test items.

Table 2: Table 2. Mantel–Haenszel's method applied to gender for the thirty-six test items, complete sample

Mantel–Haenszel statistic	Significance (p)	Odds ratio	Difference favouring	Is there differential performance?	Item
6.696	0.010	1.270	females	Yes	1
0.226	0.635	0.502	–	No	2
0.603	0.438	0.606	–	No	3
31.465	0.000	1.619	females	Yes	4
0.352	0.553	0.841	–	No	5
0.240	0.624	0.865	–	No	6
1.059	0.303	0.926	–	No	7
1.903	0.168	0.746	–	No	8
2.407	0.121	0.967	–	No	9
0.003	0.956	0.832	–	No	10
1.195	0.274	0.929	–	No	11
4.847	0.028	0.668	males	Yes	12
1.260	0.281	0.883	–	No	13
0.254	0.614	0.720	–	No	14
1.429	0.232	0.924	–	No	15
0.701	0.403	0.900	–	No	16
4.939	0.026	1.029	females	Yes	17

Table 2 (continued)

Mantel–Haenszel statistic	Significance (p)	Odds ratio	Difference favouring	Is there differential performance?	Item
0.000	0.991	0.823	–	No	18
1.038	0.308	0728	–	No	19
3.568	0.059	0.671	–	No	20
1.773	0.183	0.700	–	No	21
1.183	0.277	0.741	–	No	22
0.001	0.970	0.836	–	No	23
10.536	0.001	0.604	males	Yes	24
0.321	0.571	0.865	–	No	25
1.446	0.229	0.993	–	No	26
0.218	0.640	0.865	–	No	27
3.782	0.052	1.003	–	No	28
0.012	0.914	0.834	–	No	29
7.484	0.006	0.627	males	Yes	30
3.145	0.076	0.699	–	No	31
0.102	0.749	0.757	–	No	32
0.137	0.711	0.771	–	No	33
4.222	0.040	0.661	males	Yes	34
7.025	0.008	1.008	females	Yes	35
1.684	0.194	0.679	–	No	36

Table 2 reveals that 8 of the 36 CPM items (22%) showed DIF at a significance level of $p < .05$, equally divided in 4 items (1, 4, 17, 35) favouring females and 4 items (12, 24, 30, 34) favouring males. The effect of DIF on score differences between males and females is negligible.

Applying the method to the three age groups, we obtained the results summarized in Tables 3-5. The number of DIF items increased from 3 items (8%) at age 4-6 years to 4 items (11%) at age 7-9 years and 12 items (33.3%) at age 10-12 years.

Table 3: Table 3. Mantel–Haenszel's method applied to gender for the thirty-six test items, age 4–6 years

Mantel–Haenszel statistic	Signifi-cance (p)	Odds ratio	Difference favouring	Is there differential performance?	Item
1.510	0.219	0.605	–	No	1
0.219	0.640	0.000	–	No	2
0.213	0.645	0.507	–	No	3
1.545	0.214	0.788	–	No	4
7.453	0.006	1.225	females	Yes	5
0.001	0.970	0.733	–	No	6
7.841	0.005	1.162	females	Yes	7
0.007	0.933	0.672	–	No	8
0.002	0.965	0.751	–	No	9
2.082	0.149	0.932	–	No	10
0.320	0.572	0.805	–	No	11

Table 3 (continued)

Mantel–Haenszel statistic	Significance (p)	Odds ratio	Difference favouring	Is there differential performance?	Item
2.507	0.113	0.953	–	No	12
0.002	0.969	0.622	–	No	13
0.330	0.565	0.579	–	No	14
0.123	0.725	0.765	–	No	15
0.471	0.492	0.804	–	No	16
1.774	0.183	0.913	–	No	17
1.210	0.271	0.863	–	No	18
0.060	0.806	0.637	–	No	19
0.112	0.737	0.743	–	No	20
1.641	0.200	0.444	–	No	21
1.046	0.306	0.573	–	No	22
2.477	0.115	0.522	–	No	23
0.198	0.656	0.772	–	No	24
3.541	0.060	0.479	–	No	25
2.653	0.103	0.539	–	No	26
1.920	0.166	0.547	–	No	27
0.026	0.871	0.703	–	No	28
0.317	0.573	0.782	–	No	29
1.989	0.158	0.502	–	No	30
0.002	0.963	0.697	–	No	31
1.162	0.281	0.481	–	No	32
4.056	0.044	0.440	males	Yes	33
3.347	0.067	0.458	–	No	34
1.009	0.315	0.831	–	No	35
1.788	0.181	0.507	–	No	36

Table 4: **Table 4.** Mantel–Haenszel's method applied to gender for the thirty-six test items, age 7–9 years

Mantel–Haenszel statistic	Significance (p)	Odds ratio	Difference favouring	Is there differential performance?	Item
3.623	0.057	0.000	–	No	1
1.207	0.272	0.280	–	No	2
0.408	0.523	0.533	–	No	3
34.957	0.000	1.883	females	Yes	4
0.814	0.367	0.518	–	No	5
0.095	0.757	0.758	–	No	6
2.291	0.130	0.950	–	No	7
0.003	0.955	0.782	–	No	8
0.374	0.541	0.846	–	No	9
0.808	0.369	0.675	–	No	10
2.704	0.100	0.967	–	No	11

Table 4 (continued)

Mantel–Haenszel statistic	Significance (p)	Odds ratio	Difference favouring	Is there differential performance?	Item
1.480	0.224	0.585	–	No	12
0.002	0.961	0.606	–	No	13
0.265	0.606	0.569	–	No	14
0.005	0.945	0.671	–	No	15
1.176	0.278	0.632	–	No	16
2.443	0.118	0.955	–	No	17
0.062	0.803	0.774	–	No	18
4.829	0.028	0.514	males	Yes	19
2.028	0.154	0.579	–	No	20
0.585	0.444	0.838	–	No	21
0.484	0.486	0.837	–	No	22
1.968	0.161	0.930	–	No	23
14.132	0.000	0.434	males	Yes	24
1.250	0.264	0.884	–	No	25
0.748	0.387	0.856	–	No	26
1.690	0.194	0.914	–	No	27
1.691	0.193	0.914	–	No	28
0.000	0.991	0.742	–	No	29
0.042	0.837	0.717	–	No	30
1.477	0.224	0.622	–	No	31
0.007	0.936	0.710	–	No	32
1.693	0.193	0.571	–	No	33
7.335	0.007	0.483	males	Yes	34
0.007	0.931	0.726	–	No	35
2.907	0.088	0.462	–	No	36

Table 5: **Table 5.** Mantel–Haenszel's method applied to gender for the thirty-six test items, age 10–12 years

Mantel–Haenszel statistic	Significance (p)	Odds ratio	Difference favouring	Is there differential performance?	Item
5.481	0.019	1.324	females	Yes	1
0.005	0.943	0.456	–	No	2
0.382	0.536	0.414	–	No	3
1.618	0.203	0.841	–	No	4
0.322	0.571	0.483	–	No	5
0.043	0.835	0.594	–	No	6
4.170	0.041	0.444	males	Yes	7
1.675	0.196	0.536	–	No	8
4.081	0.043	1.028	females	Yes	9
0.132	0.717	0.606	–	No	10
0.223	0.637	0.742	–	No	11

Table 5 (continued)

Mantel–Haenszel statistic	Significance (p)	Odds ratio	Difference favouring	Is there differential performance?	Item
4.745	0.029	0.332	males	Yes	12
1.858	0.173	0.848	–	No	13
0.038	0.846	0.468	–	No	14
0.885	0.347	0.740	–	No	15
1.895	0.169	0.903	–	No	16
0.496	0.481	0.785	–	No	17
8.418	0.004	0.313	males	Yes	18
0.000	0.988	0.649	–	No	19
3.856	0.049	0.428	males	Yes	20
7.330	0.007	0.381	males	Yes	21
4.098	0.043	0.436	males	Yes	22
0.138	0.710	0.742	–	No	23
0.079	0.778	0.693	–	No	24
3.294	0.070	0.983	–	No	25
1.283	0.257	0.821	–	No	26
0.001	0.977	0.592	–	No	27
1.111	0.292	0.834	–	No	28
1.602	0.206	0.515	–	No	29
9.434	0.002	0.368	males	Yes	30
2.348	0.125	0.475	–	No	31
0.364	0.546	0.718	–	No	32
13.073	0.000	1.568	females	Yes	33
1.624	0.202	0.881	–	No	34
16.261	0.000	1.697	females	Yes	35
10.814	0.001	1.545	females	Yes	36

4 Discussion

The first question addressed in our study was: *Is there differential item functioning (DIF) by gender in the CPM test items in the total sample?* Table 2 provides the relevant data and indicates that 8 out of 36 items (22%) displayed DIF. These were evenly split, with four items favouring females and four favouring males. This balanced outcome suggests that, across the 4–12-year age span, there is no consistent item bias favouring one gender over the other.

However, it is important to clarify that these findings do not reflect differences in general intelligence between boys and girls. Rather, they highlight that some individual test items function differently across genders, even when ability levels are held constant. This distinction is crucial: We are examining potential sources of measurement bias, not true gender differences in cognitive ability. As such, our findings align with prior research (e.g., Colom et al., 2000, 2002; Jensen, 1998) that found negligible gender differences in general intelligence. We only assess whether specific items within the CPM may distort the measurement of ability across genders, not whether males or females are inherently more intelligent.

This observation supports the idea that while overall cognitive ability (g) may be equivalent between genders, the manifestation of certain abilities—and consequently, performance on specific test items—may vary. Abad et al. (2004) made a similar point, suggesting that observed gender differences are more likely

to emerge in specific cognitive domains rather than in general intelligence. Our findings are consistent with Al-Qati (2016), who found a relatively low and evenly distributed presence of gender-biased items in the Wechsler test. Likewise, Colom et al. (2000, 2002) found negligible sex differences in intelligence using large adult samples and Spanish versions of WAIS-III. Importantly, these studies and ours do not claim that certain genders perform better overall, but that a few items may favour one gender due to factors unrelated to the underlying construct of general intelligence.

This analysis assumes that the Raven's test measures a unidimensional construct—general intelligence (g). We recognize that this assumption may not fully hold if the test inadvertently taps into multiple cognitive domains with differing gender strengths. In such cases, observed DIF may reflect genuine domain-specific differences rather than bias per se.

Some prior studies, such as Mends & Ercikan (2006), found that males outperform females on items demanding higher cognitive processes. This may be partly explained by gender differences in variability: When standard deviation in test performance is higher among males, a larger proportion of males will be found at the upper tail of the distribution, potentially explaining why they succeed more often on the most difficult items. Gamer & Engelhard (1999) similarly reported that males outperformed females in geometry and measurement tasks, a finding echoed by Rushton et al. (2004). Al-Bustanji (2004) found that DIF in mental ability tests tended to favour males in math/spatial domains and females in verbal domains.

For example, Ryan and Chiu (2001) reported that males outperform females on vocabulary items requiring higher-order thinking, and on visual-spatial tasks. But without knowing whether they controlled for total test performance or latent ability, it is unclear if their findings represent DIF or actual ability differences.

Our findings suggest that the observed DIF could be related to item characteristics. It is plausible that some matrix items require skills more aligned with visualization (which tends to favour males), while others might involve pattern recognition or strategies that may not be strictly spatial, potentially benefiting females. However, quantifying these item features (e.g., verbal versus visual load) is complex and was not within the scope of our study. Future research could explore these dimensions to better understand the sources of DIF in matrix-type tests.

The second research question concerned DIF in relation to age. While this is partially descriptive, a notable trend emerged: The number of DIF items increased with age, particularly in the oldest age group (10–12 years). This may indicate that as children grow older, cognitive abilities become more specialized and differentiated, possibly contributing to increased item-level bias across genders. It may also reflect the onset of puberty and associated hormonal changes that influence cognitive development and gender-differentiated experiences.

Bors & Forrin (1995), Hertzog (1989), and Salthouse (1996) discussed how age-related changes affect the structure of cognitive abilities. However, those works largely focused on aging populations, and their relevance to children must be interpreted cautiously. Nonetheless, our results suggest that gender differences in item performance become more pronounced with age, indicating an age-related increase in item-specific variance rather than in general ability.

This contrasts with findings that suggest increasing general ability with age reduces item-specific variance (e.g., Verhaeghen & Salthouse, 1997), but again, most of those studies focused on aging adults rather than child development. In our study, the developmental trajectory seems to point to increased differentiation and potentially more gender-specific learning experiences or strategies, which in turn may create or amplify DIF.

Our findings are also consistent with Al-Bursan (2003), who reported increases in gender-related DIF at higher developmental levels. This trend may be driven by the interaction of maturing cognitive systems and socially mediated gender-specific experiences, which could influence how children approach and solve certain types of test items.

5 Conclusion

In summary, our study finds no systematic gender bias in the overall CPM scores, but does detect item-level DIF that increases with age. These results underscore the importance of using DIF analysis in test construction and validation, particularly when the goal is to ensure fairness across demographic groups. Future studies should investigate whether item-level DIF in matrix reasoning tasks can be predicted based on verbal, spatial, or strategy-related content, and how such characteristics interact with age and gender during cognitive development

6 Recommendations

1. Conduct item-level cognitive analysis. Future studies should analyse the cognitive demands of individual CPM items (e.g., spatial visualization, pattern recognition, or logical reasoning) to determine whether specific item features predict gender-based DIF. This can help identify whether certain cognitive processes systematically favour one gender over the other.

2. Develop a framework for item content classification. Researchers should develop or adopt a validated framework to categorize CPM items based on their visual, verbal, or abstract reasoning load. This would help quantify and predict sources of DIF and provide clearer guidance for item construction in gender-fair assessments.

3. Apply multiple DIF detection methods. To improve robustness and comparability, future research should use a combination of DIF detection techniques (e.g., Mantel-Haenszel, logistic regression, item response theory-based methods) across different populations and age groups. This would help confirm the presence of DIF and its consistency across methods.

4. Expand research across regions and cultures. Given the context-specific nature of test performance, it is recommended to replicate this study in other regions of Sudan and in other Arab or African countries. This would help determine whether the patterns of DIF observed are culturally generalizable or regionally specific.

5. Investigate age-related cognitive differentiation. The increase in DIF with age suggests the need to study how gender differences in cognitive strategies or experiences develop with age. Longitudinal studies could track when and how these differences emerge and whether they are stable or shift during key developmental periods (e.g., around puberty).

6. Design gender-inclusive test items. Test developers should use findings from DIF analyses to design or modify items to minimize gender bias. Pilot testing items for DIF before they are included in final versions of cognitive ability tests is essential for fairness and validity.

7 Implications of the study

1. Incorporate gender-sensitive educational interventions. If certain cognitive domains show consistent gender differences (e.g., males in spatial tasks, females in pattern-based tasks), educational programs should aim to strengthen underrepresented skills in each gender from an early age to reduce long-term disparities.

2. Collaborate with psychometricians and educational psychologists. Interdisciplinary collaboration can improve the development of more equitable assessments by integrating cognitive theory, psychometric modelling, and classroom-based evidence.

8 Limitations of the study

1. Limited generalizability. The study sample was drawn from a specific geographic and cultural context within Sudan, which may limit the generalizability of the findings to other regions, cultures, or educational systems. DIF patterns may vary in different sociocultural environments.

2. Cross-sectional design. The research design was cross-sectional, which limits the ability to draw conclusions about developmental changes over time. A longitudinal approach would provide stronger evidence for how DIF patterns evolve with age and cognitive development.

3. Absence of Socioeconomic and Educational Background Data. Important contextual variables such as socioeconomic status, parental education, or school quality were not controlled for. These factors might influence test performance and interact with gender or age effects.

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Lengkoano Kamparanga Ritual as a Traditional Disease Prevention Practice in the Ciacia Ethnic Community, Buton Island, Indonesia

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Abstract

Many communities across the world perform rituals to seek protection from threats that can disrupt their lives. On Buton Island, Sulawesi, the Ciacia ethnic group practices the *lengkoano kamparanga* ritual as a traditional means of preventing disease outbreaks. This study explores the ritual's significance as a culturally embedded strategy for protecting community health, maintaining social cohesion, and providing psychological reassurance. A qualitative approach was employed, collecting data through in-depth interviews with 20 knowledgeable informants, participant observations of the ritual, and focus group discussions (FGDs) with community members. Data were analyzed thematically using cultural value frameworks and ethnographic methods to understand local perceptions and practices. Findings indicate that the *lengkoano kamparanga* ritual is performed by offering symbolic items in four cardinal directions, reflecting the community's ancestral knowledge and spiritual beliefs. While rooted in traditional animist practices, the ritual has been adapted over time to coexist with Islamic teachings and modern health concerns, including the COVID-19 pandemic. The ritual not only reinforces communal identity and continuity but also serves as a culturally sanctioned form of risk management, offering emotional and psychological security to villagers. This study contributes to the understanding of indigenous knowledge systems in disease prevention, illustrating how ritual practices function as complementary strategies alongside modern health interventions. It underscores the importance of preserving such cultural practices as part of local wisdom and public health resilience.

Keywords: Ritual, Lengkoano kamparanga, Ciacia ethnic group, Disease prevention, Local wisdom

1 Introduction

Various forms of rituals exist in society, each serving different purposes such as warding off ill omens, preventing diseases, or praying for blessings during agricultural seasons. As Coleman (2013) notes, rituals are not merely symbolic but also forms of action or behavior, making them accessible to all human beings and often closely connected with religious practices. Religion provides a way of multiplying an all-encompassing narrative and differences in situations where people share the same place and time (Beyer, 2007).

Since ancient times, humans have practiced rituals as an integral part of their lives (Alosman & Raihanah, 2022). This notion is grounded in the understanding that human existence is deeply interwoven with ritualistic acts, extending from prenatal ceremonies to funeral rites. These practices illustrate how rituals accompany people across different stages of life, reinforcing unity and cultural identity within families and communities (Alosman & Raihanah, 2022). However, in many parts of the world, rituals face the threat of fading due to the "disenchantment of the world" — a process driven by modern education, urbanization, and a rational-critical mindset that tends to devalue traditional beliefs and practices. While this trend may

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not yet have significantly affected the Ciacia community, the influence of modernization poses a potential risk to the preservation of their ritual heritage in the future.

The Ciacia community in Burangasi Village, South Buton Regency, performs an ancestral ritual known as *lengkoano kamparanga*, aimed at warding off misfortunes or illnesses believed to be signaled by troubling signs. While the ritual may not directly repel omens themselves, it represents a culturally grounded response to perceived threats, reinforcing communal resilience and spiritual balance.

The Ciacia ethnic group, the focus of this research, is an indigenous community located in Southeast Sulawesi, specifically in the southern part of Buton Island. Their culture is noteworthy due to its distinct traditions, many of which have been preserved and passed down through generations. The traditional lifestyle of the Ciacia people reflects a strong adherence to ancestral customs, one of which is the *lengkoano kamparanga* ritual — a cultural practice that serves as a form of disaster mitigation. This ritual provides a sense of spiritual and psychological calm because it is believed to prevent various forms of disaster that might affect the community.

According to Jackson (2021), disasters are understood as extreme events that disrupt the normal functioning of society. Brundiers (2018) suggests that disasters can act as wake-up calls, drawing attention to vulnerabilities and prompting communities to adopt more sustainable and preventive practices. For instance, the experience of a typhoon might motivate residents to use stronger materials or improved construction methods for future protection. In this context, the *lengkoano kamparanga* ritual reflects a traditional form of disaster awareness and response readiness rooted in local wisdom. Integrating such indigenous practices with modern disaster risk management training could enhance community resilience and provide additional long-term benefits.

The novelty in the present study on the ritual of the lengkoano kamparanga is that it shows how the ritual is carried out to signal to the air princes or spirits that people want peace, not conflict. Furthermore, the ritual is intended to seek help from the spirits of ancestors to protect the village from various disease outbreaks, especially the coronavirus. This illustrates how rituals serve purposes beyond symbolic or ceremonial functions, embedding them within broader systems of belief and community survival strategies. As Owoc (2008) explains, rituals were historically rooted in religious practices. While early rituals may have originated in religious contexts, particularly within indigenous animist traditions or broader spiritual worldviews, their functions have since evolved to encompass multiple dimensions of social, psychological, and cultural significance. Central to many of these practices is the belief in a spirit world, grounded in a dualistic understanding of mind and body, where unseen forces influence the physical world in reciprocal ways. When humans fail to respect these forces, negative consequences are believed to follow.

For example, indigenous peoples of the Andes maintain relationships with sacred non-human entities — ranging from spiritual beings to animals and natural landmarks — through offerings, symbolic gestures, and shared practices. These rituals reflect a worldview in which the human and non-human are fluid and interdependent, with anthropomorphic or spiritual entities believed to respond emotionally to human actions (Ferrari et al., 2021). A similar principle of reciprocity underlies rituals elsewhere. In West Bengal, indigenous communities protect the natural environment through ritual practices conducted in forest sanctuaries known as sacred clumps (Sarkar & Modak, 2022). Healing rituals also express cultural perceptions of illness, health, and treatment that are shaped through intergenerational socialization processes (Satrianegara et al., 2021). In Pakistani Sufi traditions, healing rituals at shrines — believed to connect devotees with saints who intercede for them before Allah — draw their strength not merely from ritual acts such as exorcisms but from the collective participation and enduring faith of thousands of followers over generations (Charan et al., 2020). This highlights a critical dynamic: The strength of such rituals lies in widespread communal belief and participation. Consequently, when external factors such as modern education, state secularization, or urbanization weaken this collective support, the ritual system may collapse if the number of adherents drops below a certain threshold.

Swidler's concept (Manley, 1998) about cultural tools is how to use symbols in ritual strategies to integrate methods, practices, concepts, and beliefs into local culture. Ritual becomes a sacred link between humans and metaphysical powers. Signs are complex realities. We are in a position to know and be able to analyze the origin and meaning of signs and symbols (Doina et al., 2012).

A community performs warding-off rituals to prevent the misfortunes believed to follow certain signs such as natural disasters, epidemics, or other threats. While ill omens themselves cannot be warded off, as they are merely perceived as warnings of impending danger, the ritual serves as a response to such omens, aiming to avert the danger they are believed to foreshadow. People report that not performing the ritual leads to anxiety and psychological discomfort, which can disrupt daily activities. In this way, the ritual offers a sense of protection and emotional reassurance.

Similar practices are also found in Indonesia. For example, communities in Aceh Province perform the tulak bala ritual to ward off calamities and protect against misfortune, reflecting a belief that collective ritual action can safeguard the community from disaster (Maulina et al., 2025). At the international level, a comparable worldview is seen on Tanna Island (Vanuatu), where the local community regards Mount Yasur as an ancestral entity with which they maintain a spiritual connection. An eruption is interpreted not merely as a geological event, but as a sign of the ancestors' anger triggered by human actions. To prevent such an eruption, ritual ceremonies are performed to appease the mountain and restore harmony (Niroa & Nakamura, 2022).

Beyond disaster prevention, rituals in some contexts also function as tools for environmental stewardship and collective memory. According to Antadze and Gujaraidze (2021), rituals are used by the local people of Sveneti, Georgia, to protect the environment and prohibit the exploitation of the environment that can bring disaster. Rituals are not only cultural symbols but also a means of resistance and a political tool. In the suburbs of the foothills of Santiago, Chile, natural disasters are considered events that must be remembered. Therefore, a post-disaster memorialization was held through practices and discourses to prevent future disaster risks (Fuentealba, 2021).

The development of religious beliefs and rituals in Dalmatia, Croatia, shows that the imaginary religious community consists of a set of values and symbols that rely on faith with elements of 'folk magic' to strengthen these beliefs. The apotropaic power (protective magic) of ritual is needed to ward off evil or prevent evil influences, such as misfortune or the evil eye's power (Reed, 2019). Rituals are a fortress and a source of strength, success, health, and well-being that the people who live it believe in. Therefore, it is crucial to analyze the *lengkoano kamparanga* ritual as a way for the Ciacia ethnic community to prevent disasters from entering their village. The worldview — predominantly animist with syncretic influences — shapes their understanding of disasters as spiritual disturbances that must be countered with collective ritual action. This perspective is closely tied to efforts to fortify the village against incidents that can disrupt the life of its people. Disaster mitigation through rituals is an effort to protect the community from various dangers or disasters that can occur at any time. Rituals are a harm reduction technique that can produce beneficial effects for individuals and communities by strengthening bonds between community members (Kohek et al., 2021).

2 Literature review

Disaster mitigation plays a vital role in community preparedness and resilience. A clear understanding of this concept is essential for raising public awareness and fostering proactive attitudes toward disaster risk reduction (Nugraheni et al., 2022). Disaster management itself is a dynamic, integrated, and sustainable process that includes preparedness, prevention, mitigation, emergency response, evacuation, rehabilitation, and rebuilding. Within this framework, mitigation refers specifically to actions aimed at reducing or minimizing potential losses and damage caused by disasters. As Srividhya et al. (2020) emphasize, urgent and coordinated efforts across all aspects of disaster management are necessary to effectively respond to and recover from natural hazards. Similarly, Okubo (2016) defines disaster mitigation as a strategic effort to manage disasters by minimizing their destructive impact before they occur.

Modern disaster management emphasizes scientific and technocratic approaches. For instance, in Bangladesh, mapping of flood-prone areas has guided the construction of shelters to protect vulnerable populations (Uddin & Matin, 2021) while in Zimbabwe, a "build-back-better" strategy has focused on rebuilding safer and more resilient infrastructure after disasters (Dube, 2020). These examples highlight

rational, action-oriented models of disaster preparedness, centered on planning, infrastructure, and risk assessment. However, this "disenchantment of the world" often sidelines spiritual or cultural dimensions that remain vital in traditional communities.

By contrast, traditional disaster mitigation emphasizes ancestral knowledge and ritual practices. Suarmika et al. (2022) describe such practices as accumulations of customary wisdom developed through generations of coping with threats. Bwambale et al. (2022) add that rituals can function as coping strategies, linking social resilience with ecological well-being. Historical experiences also show how disasters reshape community preparedness. In Aceh, the 2004 tsunami initially strengthened community readiness, but subsequent studies revealed a decline due to limited training and weak institutional support (Syamsidik et al., 2021). A similar gap appeared in Uttarakhand, India, where COVID-19 responses were hampered by insufficient community participation, particularly in medical care and psychosocial support (Rautela et al., 2022). These examples reveal a key limitation of purely rational-scientific frameworks: Without cultural meaning or ritual grounding, long-term public engagement is difficult to sustain.

Ritual-based approaches demonstrate how local wisdom contributes to disaster prevention across diverse contexts. Among the Oromo in Ethiopia, forests are believed to be guarded by cosmic agents (ayyanaa) who can bring calamities if the sacred environment is desecrated, leading communities to perform rituals that maintain ecological balance (Mitiku & Hailu, 2017). In Japan, the Danjiri Matsuri of Kishiwada functions as a ritualized form of disaster preparedness, strengthening social capital and fostering collective responsibility (Bhandari et al., 2010). These cases illustrate how rituals not only preserve cultural traditions but also embed disaster awareness into everyday social practices.

The present study builds on this scholarship by focusing on the *lengkoano kamparanga* ritual of the Ciacia people in Southeast Sulawesi. Unlike previous studies that largely explore ecological guardianship (e.g., Oromo), social capital formation (e.g., Japan), or technocratic responses (e.g., Bangladesh, Zimbabwe), the Ciacia case highlights rituals as both spiritual negotiations with ancestral spirits and unseen forces, and practical mechanisms for disaster mitigation, including protection against disease outbreaks such as COVID-19. By situating the Ciacia experience within broader discussions of disaster management, this study contributes a novel perspective on how indigenous ritual practices function as culturally rooted strategies for resilience, complementing and challenging dominant scientific models.

3 Method

3.1 Research design

This study employed a qualitative descriptive method to explore the practice and meaning of the *lengkoano kamparanga* ritual. Both primary and secondary data were used. Primary data were obtained through in-depth interviews, participant observations, and focus group discussions (FGDs). Secondary data were collected from relevant literature, including previous studies, reports, and cultural documents to strengthen the analysis.

3.2 Research site and timeline

The research was conducted purposively in Burangasi Village, Lapandewa District, South Buton Regency, selected for its rich practice of the *lengkoano kamparanga* ritual. Fieldwork was carried out over a six-month period, from September 2020 to February 2021, encompassing observations during the ritual period, interviews, and focus group discussions (FGDs). This timeline ensured that both routine annual ceremonies and emergency adaptations (e.g., COVID-19) were captured.

3.3 Informants

Informants were selected based on their knowledge of and involvement in the ritual. Key participants included traditional leaders — Parabela, Kolaki, Moji, and Waci — and villagers actively participating in the ritual. A purposive snowball sampling strategy was used, starting with recommendations from community leaders and extending through referrals from initial informants until data saturation was achieved. A total of 20 informants participated in interviews and FGDs, representing different roles in the ritual and ensuring a comprehensive perspective.

Table 1: Table 1. Informants, their roles, and responsibilities in the *lengkoano kamparanga* ritual

Informant Role	Number	Responsibilities
Parabela	1	Leading ritual; managing customary land
Kolaki	1	Ensuring community safety
Moji	1	Spiritual affairs; chanting incantations
Waci	1	Public relations; community coordination
Other villagers	16	Assisting in procession; observing ritual rules

Note. Add any explanatory note here if needed.

3.4 Data collection techniques

Data collection involved:

1. In-depth interviews: Semi-structured interviews were guided by Spradley's ethnographic domains — including space, activities, objects, acts, events, time, goals, and social relationships — to capture the ritual's multifaceted cultural and functional meanings.
2. Focus group discussions (FGDs): FGDs were conducted with groups of villagers to explore collective understanding, community roles, and social values embedded in the ritual.
3. Participant observation: Direct observation of the ritual processions, including *porano kamparanga* and *lengkoano kamparanga*, allowed documentation of sequence, timing, leadership dynamics, and communal participation.
4. Secondary data: Literature review of related traditional rituals, disaster-mitigation strategies, and local histories supported triangulation and contextual interpretation.

3.5 Research instruments

- Interview guide: Structured around Spradley's cultural domains and specific questions regarding ritual purpose, timing, procedures, symbolism, and adaptation during emergencies.
- Questionnaire for FGD participants: Designed to gather perceptions of ritual efficacy, community involvement, and social-emotional impacts.
- Observation checklist: Included indicators for ritual timing, order of proceedings, roles of participants, and adherence to prohibitions.

3.6 Data analysis

Data were analyzed using a thematic descriptive approach:

1. Transcription of interviews and FGDs in the Ciacia language and translation into Indonesian.
2. Coding guided by cultural value frameworks, focusing on themes such as disaster mitigation, social cohesion, spiritual beliefs, leadership roles, and adaptive strategies.
3. Triangulation of interview, FGD, observation, and secondary sources to ensure validity and comprehensiveness.
4. Presentation of results descriptively, with tables, figures, and narrative explanations illustrating the ritual's process, meaning, and socio-cultural implications.

3.7 Ethical considerations

The research followed ethical principles, ensuring informed consent, voluntary participation, and respect for local customs. Confidentiality of participants was maintained, and the community was fully briefed on research objectives.

4 Results and Discussion

4.1 Ciacia Ethnic

Buton Island, located off the southeast coast of Sulawesi, is home to various ethnic groups, one of the most prominent being the Ciacia, historically significant as one of the founding communities of the Buton Sultanate. The Ciacia are concentrated along the southern coast of Buton, particularly in Burangasi Village, which serves as the locus of the *lengkoano kamparanga* ritual. Their historical importance — such as the settlement of the first Buton King Wakaka in Wabula and the arrival of the first Islamic missionary, Sheikh Abdul Wahid, in Burangasi — highlights their central role in shaping the island's cultural and religious landscape.

Economically, Ciacia livelihoods are closely tied to their natural environment. Many cultivate corn and cassava or work as fishermen, occupations shaped by the region's coral-reef-dominated coastal geography. These economic activities are highly vulnerable to natural hazards such as storms, failed harvests, and outbreaks of disease. These conditions gave rise to and sustain rituals like *lengkoano kamparanga*, which seek spiritual protection and balance in the face of environmental uncertainty.

The belief system of the Ciacia reflects a syncretism between Islam and ancestral spiritual traditions. While Islam provides religious guidance, ancestral beliefs sustain practices such as invoking spirits during rituals to ensure communal safety. This syncretism directly influences the *lengkoano kamparanga* ritual: Prayers draw on Islamic elements, while offerings and symbolic acts reflect older animist traditions. Together, these dual influences shape both the performance and the meaning of the ritual as a culturally embedded form of disaster mitigation.

Underlying the ritual are broader cultural values that continue to guide Ciacia life: mutual respect, social harmony, reverence for nature, and spiritual balance. These values are not merely abstract ideals but practical principles that foster solidarity and collective action during crises. In the context of disaster risk, they ensure that communities unite to perform rituals, reinforcing both spiritual protection and social cohesion. Such values also act as ethical guidelines for environmental stewardship, reflecting the belief that respecting ancestral spirits and natural forces prevents misfortune.

By situating the *lengkoano kamparanga* ritual within this cultural framework, it becomes clear that the Ciacia's historical identity, livelihood patterns, and syncretic belief system are not background details

but active foundations that shape the ritual's function as disaster mitigation. These interconnections demonstrate how traditional practices remain relevant for community resilience in the face of modern challenges such as environmental change and disease outbreaks.

4.2 The ritual of Lengkoano Kamparanga past

The *lengkoano kamparanga* ritual is a disease-prevention practice inherited from the Ciacia ancestors in Burangasi Village, South Buton Regency. The name comes from the Ciacia language: *lengkoano* means "to deliver", and *kamparanga* means "container", referring to the act of presenting offerings in ritual vessels. Historically, the Ciacia believed that the world was governed by unseen forces whose displeasure could manifest in illness, crop failure, or natural misfortunes. The ritual was therefore established as a means of prevention, an effort to maintain harmony with these forces and avert disaster before it struck.

The origins of the ritual are tied to collective memory of disease outbreaks such as cholera and severe vomiting, which devastated the community in the past. These outbreaks were interpreted not merely as medical crises but as signs of cosmic imbalance or punishment by nature. Similarly, agricultural failures caused by pests like caterpillars or wild pigs reinforced the idea that neglecting spiritual obligations could invite calamity. Thus, the *lengkoano kamparanga* functioned as an early form of preventive disaster strategy, embedding lessons from lived experiences into a ritualized system of collective protection.

Timing plays a crucial role in the ritual's meaning. It is performed once a year during the transitional period between the west and east monsoon seasons, when weather instability with heavy rains, strong winds, and thunderstorms often coincided with outbreaks of disease. By situating the ritual at this liminal environmental moment, the Ciacia demonstrated both ecological awareness and ancestral knowledge, transforming seasonal uncertainty into a socially coordinated act of resilience.

The ritual procedure involves preparing four *kamparanga* containers, each filled with ritual offerings and placed at the four cardinal directions: north, south, east, and west. This reflects the belief that illness or disaster could emanate from any direction; placing offerings in all four ensured comprehensive protection. The act symbolizes both spiritual coverage and geographic vigilance, aligning the community's physical landscape with their cosmological worldview.

Leadership plays a decisive role in the ritual's effectiveness. The Ciacia traditional structure, led by the Parabela (territorial and customary leader) and supported by the Kolaki (guardian of safety), Moji (spiritual advisor), and Waci (liaison to the community), ensures order, obedience, and proper ritual execution. Rather than viewing these roles as bureaucratic functions, the community sees them as guarantees of ritual validity. Without the authority of the Parabela or the guidance of the Moji, the offerings would lose their protective force. In this sense, leadership structures directly reinforce the ritual's role as disaster mitigation, ensuring that knowledge, authority, and communal effort converge in a unified response to threat.

Collective participation is equally central. Decisions regarding the ritual are made through gotong-royong (mutual cooperation), which obliges all members to contribute labor, resources, and presence. This cooperative ethic strengthens social solidarity, meaning that disaster prevention is not an individual act but a communal responsibility, embedding resilience into the very fabric of daily life.

The ritual also illustrates a process of Islamic syncretism. While its origins predate the 16^{th}-century arrival of Islam on Buton Island, the Ciacia community, now entirely Muslim, continues to practice it. Islamic prayers and invocations are incorporated alongside ancestral offerings, reflecting an adaptation rather than a replacement of tradition. This syncretism has arguably helped preserve the ritual, allowing it to remain meaningful within a Muslim community while retaining its original function as a safeguard against calamity. In this way, Islam has not erased the ritual but reframed it, embedding spiritual legitimacy within both ancestral and Islamic cosmologies.

Taken together, the *lengkoano kamparanga* ritual represents more than a cultural relic. It rather is a holistic disaster-mitigation strategy rooted in memory, ecology, leadership, and spirituality. By blending ancestral wisdom with Islamic practice, the Ciacia sustain a tradition that protects against disease and affirms communal identity, demonstrating how indigenous rituals can endure and adapt while continuing to serve vital functions in contemporary life.

4.3 Ritual proceedings

4.3.1 Time

The chief or tribal leader determines the time of the ritual based on astrological forecasting. Auspicious days are another consideration. When the Parabela, the tribal leader, decides to perform *lengkoano kamparanga*, all people should prepare for the ritual.

Generally, *lengkoano kamparanga* is performed twice a year unless emergency situations, such as the spread of diseases, urge people to perform the ritual. As La Hamiru (37 years) states in the interview, such is considered a preventive measure:

> *"When the president in 2020 announced in March that two Indonesians had been exposed to the coronavirus, our parents here immediately discussed performing the lengkoano kamparanga ritual." (Interview, February 15, 2021).*

The interview data above illustrates that *lengkoano kamparanga* has no rigid time schedule, but can be adapted to pressing circumstances. Although there is no direct evidence linking the ritual to modern health crises such as COVID-19, the community's decision to perform the ritual in response to the pandemic demonstrates its adaptability. This shows that traditional practices are not static but remain responsive to contemporary challenges, reflecting how local beliefs continue to provide meaning and collective action even in the face of unprecedented situations.

Lengkoano kamparanga is performed for four days. Incantations (*batata*) in the Ciacia language are chanted when *kamparanga* or the offerings are placed in the Parabela's house. The days of the ritual are called *porano kamparanga*; *porano* means "to place". All offerings are placed in the Parabela's house for four days before being moved to specific areas as determined on the fourth day. The number of days also signifies the number of offerings that will be placed.

4.3.2 Preparation Stage

All materials and instruments of the ritual are prepared in this stage. The day of the ritual has been announced, thus enabling people to prepare everything they need for *lengkoano kamparanga*. People from Bungarasi Village, Bungarasi Rumbia, and Gaya Baru Village will join the ritual.

The tribal leaders will prepare the materials of the ritual as instructed by the Parabela, with the help of the villagers. Usually, people prepare white clothes to complement the instruments of the ritual. All materials can be found in some areas in Bungarasi. This is the list of the materials:

a. *Kecupa kuata* (a long ketupat or diamond-shaped rice cake)

b. *Pangana* (areca nut)

c. *Hapu* (lime betel)

d. *Karoo* (betel leaves)

e. *Kundee Mudea* (reddish, young coconut)

f. *Cikolu manu* (chicken eggs)

g. *Loga-loga* (coins)

h. *Kae hupute* (white clothes)

i. *Kae hudea* (red clothes)

j. *Kappa* (cotton)

k. *Tabako sili katela* (tobacco roll)

l. *Baee* (rice)

m. *Parawata* (bamboo stick)

n. *Kamparanga* (cardboard box)

All the materials mentioned above are placed in a vessel called kamparanga. There are four kamparanga, which will be transported into the four cardinal directions. After preparing all materials, the proceedings of *lengkoano kamparanga* will start under the direction of the Parabela as the tribal chief with the assistance of other leaders of the traditional council. The materials are first checked in the Parabela's house as the center point of the ritual. Such allows the traditional leaders to ensure that all materials are complete.

4.3.3 Ritual Processions

The processions are divided into two: porano kamparanga and *lengkoano kamparanga*. Both processions are inseparable and must be performed in four days. Provided in the following subsections are the details of each procession.

Porano kamparanga

Porano (means to sit) kamparanga is a procession where the offering is placed in the Parabela's house for four days. All materials are stored in four media, which will be inserted to a cardboard box called kamparanga. Incantations (*batata*) are chanted before all offerings are stored in the kamparanga in the Parabela's house for four days. After this procession, the kamparanga is transported to four areas based on the four compass points.

Figure 1. Materials for the *lengkoano kamparanga* ritual. The figure illustrates the ritual materials prepared for the lengkoano kamparanga. These typically consist of agricultural produce, symbolic plants, and other offerings considered essential in the ritual sequence. Each item plays a role in ensuring balance and harmony when distributed into the kamparanga.

Source: La Rudi, 2020

An equal number of each material is placed into each kamparanga. There are no differences in each material's total between one kamparanga and another.

The Parabela is responsible for placing the materials in each kamparanga, ensuring that the four cardboard boxes are ready to be transported. People in the villages are not allowed to make noises that can distract the procession of porano kamparanga. People are also not allowed to:

- make hammer noise

- play musical instruments loudly
- sound any vehicle horns
- scream due to conflicts
- hold celebrations that can be too noisy

The prohibitions above are because kamparanga is, by nature, sacred. Consequently, safeguarding the ritual is a necessity. Noises and other distracting activities disrespect kamparanga because the ritual should be held calmly due to its sacred nature. People participating in the ritual are aware of the prohibitions and adhere to all procession regulations. They remind others when there are any noises and remind people from other villages not to make any distractions as a ritual is taking place. Villagers from outside Burangasi are allowed to participate in the ritual if they wish. Burangasi people do not restrict those who want to get involved in the ritual. However, those people need to follow the rules.

Figure 2. Inserting materials of *Kamparanga* into cardboard box

Source: La Rudi, 2020

People are prohibited to make any noise when the materials are placed into the cardboard box as Jamadi (52), the informant of the present research, explained:

> *"When the materials are placed into kamparanga, people cannot make any noise as we must respect the procession of kamparanga." (interview data, February 18 2021).*

Based on the above data, offerings of kamparanga have meanings that represent the prayers of all villagers. Kamparanga is then stored in the Parabela's house for four days under continuous supervision by married couples. This condition symbolizes responsibility, stability, and the balance of masculine and feminine energies that married couples embody, which are believed to provide harmony and strength to the ritual. Those who are not yet married are not permitted to perform this task, as they are considered not to have reached the stage of life associated with maturity and responsibility. Furthermore, the husband and wife chant incantations, or *batata*, during the procession, while other married couples take turns substituting one another to prevent fatigue and ensure the sacredness of the ritual is maintained throughout the four days.

lengkoano kamparanga procession

On the fourth day, the kamparanga offerings are transported to four designated areas corresponding to the cardinal directions — North, East, South, and West. This phase is called the *lengkoano kamparanga* procession, meaning "to move the offering to other places". The procession typically begins in the morning,

after sunrise, around 9 a.m., which is considered an auspicious time. Morning dew at this time has dried, preventing clothes from getting wet while walking on grass. Importantly, the ritual is carried out regardless of weather conditions, reflecting the community's adherence to ancestral rules over environmental inconvenience.

The Parabela's house functions as the ritual's central point. Whenever a new Parabela assumes leadership, the center of the ritual shifts accordingly for the communities of Burangasi, Burangasi Rumbia, and Gaya Baru, highlighting the ritual's close connection to customary authority. Villagers gather at the Parabela's house to participate in transporting the offerings. Four people, assigned from three sub-villages — Rumbia, Patambara, and Lahilalangi — carry the kamparanga, accompanied by one villager walking in front as a guide. Interestingly, even villagers who are not traditional leaders are sometimes assigned to carry the offerings, emphasizing communal participation and responsibility.

The procession is led by a person carrying a *parang* (traditional machete) to clear paths obstructed by plants or grasses. Kamparanga is carried in a posture akin to holding a flag during a ceremonial event, symbolizing respect and focus. The Parabela and other traditional leaders remain at the Parabela's house, chanting *batata* incantations to ensure the ritual's success in preventing disease outbreaks.

The procession is conducted in complete silence, both by participants and by villagers in nearby houses. This restriction is identical to that observed during the porano kamparanga and serves to maintain the sacred atmosphere and spiritual efficacy of the ritual. Villagers inside houses must refrain from making disruptive noises and, if they wish to join, must follow behind the carriers of kamparanga, demonstrating respect for ritual hierarchy and order.

Upon reaching each designated area, the guide cuts small pieces of wood to construct a base for the offering. Placing the kamparanga on the ground is strictly forbidden, symbolizing the protection and elevation of sacred objects. The white and red flags placed on the front and back sides of the kamparanga, respectively, carry symbolic meaning: White signifies purity and harmony, while red represents protection and vitality, marking the offerings as sacred and powerful in warding off misfortune.

Figure 3. Kamparanga base is being made in the determined area

Source: Documentation by author

After placing the offerings, carriers return to the Parabela's house, followed by accompanying villagers. The Parabela and traditional leaders continue chanting *batata*, praying that the ritual's protective powers are effective. Once all groups return, the community joins in a collective prayer and celebrates with a feast, marking the conclusion of the procession. Traditional leaders, however, remain until they are certain all villagers have returned safely, reflecting the emphasis on order, responsibility, and community cohesion.

The entire four-day series of proceedings — from *porano kamparanga* to the distribution of offerings — is inseparable and continuously performed as one sequence in Burangasi Village. Success relies on strict adherence to rules, cooperation between leaders and villagers, and collective awareness of the ritual's significance. This aligns with Eisenbruch's (2021) view that rituals are believed to ward off ill omens and

provide psychological relief to communities affected by natural disasters. Additionally, the ritual fosters a sense of belonging (Gamba & Cattacin, 2021) and elicits positive emotions, reinforcing social cohesion and resilience (Zermeño & Pirtle, 2021). The silent, orderly, and participatory nature of the procession underscores the interweaving of spiritual, social, and emotional dimensions in disaster-mitigation rituals.

5 Conclusion

The *lengkoano kamparanga* ritual is a disease-prevention practice performed by the Ciacia community in Burangasi Village, South Buton Regency. Historically, it emerged as a response to outbreaks of incurable diseases, reflecting the community's proactive approach to managing unseen threats. Traditional leaders developed preventive strategies, with the ritual serving as a symbolic safeguard against harm. The offerings, or kamparanga, are placed in the four cardinal directions to protect the village, reflecting a deep-rooted cosmological worldview and ancestral knowledge. Historical evidence indicates that this ritual predates the 16^{th} century, prior to the introduction of Islam to the region under Syeck Abdul Wahid.

As a culturally embedded mitigation model, *lengkoano kamparanga* provides the community with psychological reassurance, reinforcing the perception that villagers have taken all possible measures to maintain harmony with spiritual forces and prevent disease outbreaks. Its value lies less in empirical biomedical outcomes and more in emotional, spiritual, and social security. The ritual also illustrates the adaptability of the Ciacia people: During modern health crises such as the COVID-19 pandemic, ritual practices continued alongside contemporary medical interventions, demonstrating a pragmatic integration of traditional and scientific health approaches.

Beyond its local significance, this study highlights the broader role of indigenous rituals in disaster and disease mitigation. Such practices exemplify how traditional knowledge can complement formal disaster risk management frameworks, offering culturally sensitive strategies that enhance community resilience and social cohesion. Policymakers, public health officials, and disaster management agencies may benefit from acknowledging and integrating such culturally grounded practices into local preparedness programs.

However, the study has limitations. The findings are based on qualitative data from a single village, relying primarily on self-report interviews, focus group discussions, and observations. This limits generalizability to other Ciacia communities or regions. Additionally, the study does not include quantitative measures of ritual effectiveness in preventing disease, making empirical validation difficult.

Future research could expand to multiple Ciacia communities or other Indonesian ethnic groups, combining ethnographic and quantitative approaches to better understand the efficacy and social impact of traditional disaster mitigation rituals. Comparative studies with global indigenous practices may also yield insights into integrating ancestral knowledge with formal public health and disaster risk management strategies. Overall, the *lengkoano kamparanga* ritual represents a living example of how cultural heritage, spirituality, and community cohesion can intersect with practical strategies for managing uncertainty and promoting resilience.

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Growth and Nutritional Status of Tribal Preschool Children: An Assessment Based on Body Circumferences

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Abstract

In India, undernutrition is the most prevalent health issue among tribal preschool children. The present study describes growth and nutritional status among tribal preschool children based on mid-upper arm circumferences (MUAC) and head circumference (HC). It utilizes the receiver operating characteristics (ROC) curve to determine cut-off points for body circumferences as a screening tool for growth and nutritional status. The present study surveyed 848 tribal preschool children aged 12-71 months from two districts of West Bengal, India. Undernutrition was assessed using WHO standard reference values of age and sex specific HC and MUAC z scores ($<$ -2SD). The prevalence of undernutrition assessed by MUAC and head circumferences was 35.3% and 60.7%, respectively. The overall undernutrition prevalence is 70.9%, consisting of 45.8% with one type of undernutrition (MUAC or HC) and 25.1% with undernutrition on both measures. Body circumferences showed a higher mean value in healthy children compared to children with nutritional deficiencies, in both boys and girls. Boys had significantly higher mean body circumferences than girls. The study reveals that HC-based nutritional deficiencies are more prevalent than MUAC-based. Assessment of undernutrition using body circumferences and circumference-to-height ratios supports early detection of undernutrition and impaired growth status among tribal preschool children.

Keywords: Tribal nutrition, Preschool children, Growth, Nutrition, Body circumferences, Anthropometry

1 Introduction

In India, child undernutrition is a major health problem, particularly in tribal communities. Globally, malnutrition causes over 3.1 million child deaths annually, with one in every three under-five children being malnourished (Black et al., 2013; IFPRI, 2016). This malnutrition (under- and overnutrition) affects growth potential and future morbidity and mortality risks (Alderman et al., 2003). Undernutrition in India is a significant public health issue, which increases childhood mortality and morbidity (UNICEF, 2019). Under-five (0-5 years age) mortality rates are 34 per 1000 live births in India and 25 per 1000 in West Bengal (UNICEF, 2019). Undernutrition is a significant cause of child mortality in developing countries like India, with nearly half of preschool-aged deaths in low- and middle-income countries attributed to this issue (Black et al., 2013). In West Bengal, previous research indicates that approximately 50% of children experience various forms of undernutrition (Bose et al., 2008).

In India, head circumference (HC) and mid upper arm circumference (MUAC) are utilized in survey and screening programs to diagnose protein-energy malnutrition (Singh & Bisnoi, 2005). HC is a physical indicator of past nutritional status and brain or cognitive development among children (Rumsey & Rapoport, 1983). Neck circumference is a marker of malnutrition that assesses both undernutrition and obesity in children. Other circumferences like chest, thigh, and medial calf are useful indicators of nutritional status, but are rarely used due to lack of a standardized cut-off value. For these reasons, the present study attempts to provide an age- and sex-wise optimal cut-off value for assessing undernutrition among preschool children.

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Preschool children, particularly tribal children, are the most nutritionally vulnerable segment in communities. Preschool children in India are given low priority in both programs and policies (Planning Commission Report, 2007), although they have special nutritional requirements due to their growth and development (WHO, 1995). In India, mainly two government schemes are running to provide supplementary food for preschool children. One is Integrated Child Development Services (ICDS), which provides supplementary nutrition, health checkups, immunization, referral services, health and nutrition education, and preschool education through Anganwadi centers. Another is POSHAN Abhiyaan, which aims to reduce stunting, undernutrition, anemia, and low birth weight for children. A study in West Bengal found that only 47.3% of under-five tribal preschool children used ICDS services (Ray et al., 2000), highlighting the lack of access to food provided by Anganwadi centers, a trend that has been observed in other studies (Behera et al., 2024). A previous study in West Bengal observed that most parents are engaged in agricultural work during the day, limiting their time with their children. In general, grandmother and elder sister or brother take care of the child, including feeding them (Mahapatra et al., 2020). This is a serious gap, because ICDS is meant to be the backbone of nutrition support for preschool children in India.

In population-based studies, the anthropometric measurements used most frequently as indicators of undernutrition are low height for age, low weight for age and low weight for height, but low HC for age or low MUAC for age are rarely used (WHO, 1995). Very few studies addressed the nutritional status by using body circumferences among tribal children (Mondal, 2019; Tigga et al., 2016). Only some of these studies focus on West Bengal (Giri et al., 2018; Mahapatra, 2021; Maiti et al., 2012; Mandal & Bose, 2010). We assess undernutrition in preschool children through stunting, underweight, wasting, and thinness, using age- and sex-wise height, weight, and BMI. Similarly, we can assess undernutrition by using different circumferences. In the case of circumferences, only HC and MUAC have standard cut-off values provided by WHO. We cannot assess undernutrition from other circumferences due to lack of cut-off values.

2 Methods

2.1 Study design and participants

The present study was conducted on tribal preschool children aged 12–71 months. Three blocks were studied; these are Nayagram block, the most populated tribal block in the Jhargram district, and its nearest two blocks (Dantan I and Keshiary) of Paschim Medinipur district. This study focused on the most populous Santal and Bhumij tribes, which belong to the Austro-Asiatic (Munda) speaking tribes of West Bengal. The present study included children from agriculture-related households, excluding physically challenged children, those who failed inclusion criteria, and parents unwilling to participate.

The present study included 13 villages (Amda, Bhadra, Bhumijsai, Dudhe budhe, Dakshindiha, Joykrishnapur, Julko, Junbalda, Kamarchowki, Kanpur, Salbani, Sarisa, Talbandh) from the Keshiary block, 8 villages (Antri, Bahalia, Beldiha, Borah, Dhuriya, Manikara, Markandapur, Uchudiha) from the Dantan-I block, and 15 villages (Barpat, Begunadahi, Bhaliaghati, Gulfa, Hasimpur, Jadukatha, Jagannathpur, Jarka, Kadokatha, Khanamuri, Marapada, Pungiri, Singdhui, Talakuldihi, Tufuria) from the Nayagram block. We conducted the research from April 2018 to March 2019. The 2011 Census reported a population of 17,598 in Nayagram block, with 41.01% of preschool children belonging to tribal peoples. The Keshiary block had 16,984 children under five, with 34.25% of scheduled tribes. The Dantan I block had 20,209 children aged 0-5, with 16.38% belonging to tribal peoples. In the three blocks combined, the total number of tribal children was 16,169 (Census, 2011). The study used stratified random sampling to select 848 under-five children from Santal and Bhumij ethnic groups, with 95% confidence level, 50% population proportion, and a 3.3% margin of error.

2.2 Anthropometric data

The anthropometric measurements were conducted in accordance with standard procedures (Lohman et al., 1988). The departmental ethics committees provided the ethical clearance, and the study adhered to the Declaration of Helsinki's ethical guidelines (Touitou et al., 2004). Three kinds of anthropometric measurements were taken from each participant: height, weight, and several body circumferences. Weight was measured using digital weighing scales. The standing height was measured using an anthropometric rod, and the recumbent length was measured using an infantometer. Circumferences were measured using a measuring tape. The study participants provided six types of body circumferences (head circumference, neck circumference, mid upper arm circumference, chest circumference, thigh circumference, medial calf circumference) and six types of circumferences to height ratios (head to height ratio, neck to height ratio; mid upper arm circumference to height ratio; chest to height ratio; thigh to height ratio; medial calf to height ratio).

2.3 Assessments of undernutrition

The current study utilized the WHO 2006 guidelines to evaluate undernutrition using low HC for age (HCAZ) and low MUAC for age (MUACZ) z score (WHO, 2006). The WHO (2006) guidelines were used to calculate the Z-scores for two indices, with undernutrition defined as a value more than two standard deviations below the median (i.e., Z-score $<$ -2 SD) (WHO, 1995). The Z score was determined using the standard equation: Z score$= \frac{X - Median\ of\ WHO,\ \ 2006}{SD\ of\ WHO,\ \ 2006}$

'X' indicates the observed value of circumference. The study identified single and dual types of undernutrition, with single-undernourished children presenting with only one deficiency (HC or MUAC) and dual-undernourished children presenting with both. Low MUAC in children indicates poor nutritional status, while low head circumference indicates inadequate brain development, impacting their growth and development.

2.4 Statistical analysis

The data were analysed with SPSS version 27.0. The descriptive statistics were used to determine the statistical significance of group differences. This study used the Receiver Operating Characteristic (ROC) curve to predict the most notable parameter for dual types of undernutrition and determine the cut-off values.

3 Results

Tables 1 and 2 present the mean age- and sex-wise body circumferences and the differences in the circumference-to-height ratio. All body circumferences increased with increasing child age, and significant differences were observed ($p < .001$). However, mean values of circumference to height ratio decreased with increasing child age. In the case of body circumferences, boys show higher mean values than girls except for thigh circumference. Sex differences were statistically significant except for medial calf circumference. In circumference to height ratios, the chest, thigh, and medial calf show statistically significant sex differences.

Table 1: **Table 1.** Age wise mean body circumferences and circumferences to height ratios (mean ± SD) among the participants.

Anthropometric variables	12–23 ($n = 205$)	24–35 ($n = 179$)	36–47 ($n = 140$)	48–59 ($n = 180$)	60–71 ($n = 144$)	F test
Head circumference (HC)	43.41 ± 1.69	45.23 ± 1.64	46.08 ± 1.56	47.02 ± 1.43	47.18 ± 1.75	168.50^{***}
Neck circumference (NC)	20.44 ± 1.01	21.31 ± 1.16	21.73 ± 1.09	22.02 ± 0.96	22.31 ± 0.99	88.91^{***}
Mid upper arm circumference (MUAC)	12.53 ± 0.74	13.50 ± 0.85	13.52 ± 0.91	13.80 ± 0.92	13.87 ± 0.83	81.05^{***}
Chest circumference (CC)	42.93 ± 2.13	45.40 ± 2.37	46.97 ± 2.43	48.37 ± 2.16	49.20 ± 2.78	203.13^{***}
Thigh circumference (TC)	21.21 ± 1.55	22.13 ± 1.87	23.65 ± 2.10	24.50 ± 2.06	24.91 ± 2.01	123.35^{***}
Medial calf circumference (MCC)	15.69 ± 1.11	16.82 ± 1.15	17.63 ± 1.25	18.42 ± 1.37	18.76 ± 1.24	187.57^{***}
Head to height ratio (HHtR)	$0.582 0 \pm 0.03$	$0.539 5 \pm 0.03$	$0.501 0 \pm 0.03$	$0.475 3 \pm 0.02$	$0.451 3 \pm 0.02$	769.68^{***}
Neck to height ratio (NHtR)	$0.274 1 \pm 0.02$	$0.254 2 \pm 0.02$	$0.236 1 \pm 0.01$	$0.222 5 \pm 0.01$	$0.213 3 \pm 0.01$	542.17^{***}
MUAC to height ratio (AHtR)	$0.168 0 \pm 0.01$	$0.155 6 \pm 0.01$	$0.146 8 \pm 0.01$	$0.139 4 \pm 0.01$	$0.132 6 \pm 0.01$	352.04^{***}
Chest to height ratio (CHtR)	$0.575 4 \pm 0.03$	$0.541 3 \pm 0.03$	$0.510 2 \pm 0.03$	$0.488 5 \pm 0.02$	$0.470 4 \pm 0.03$	439.76^{***}
Thigh to height ratio (THtR)	$0.284 4 \pm 0.02$	$0.263 0 \pm 0.02$	$0.256 6 \pm 0.02$	$0.247 8 \pm 0.02$	$0.238 2 \pm 0.02$	129.26^{***}
Medial calf to height ratio (MCHtR)	$0.210 3 \pm 0.01$	$0.200 5 \pm 0.01$	$0.191 4 \pm 0.01$	$0.185 9 \pm 0.01$	$0.179 3 \pm 0.01$	163.02^{***}

Note. $* p < .05$, $** p < .01$, $*** p < .001$.

Table 2: Age-wise mean body circumferences and circumference-to-height ratios (mean ± SD) among the participants.

Anthropometric variables	12–23 ($n = 205$)	24–35 ($n = 179$)	36–47 ($n = 140$)	48–59 ($n = 180$)	60–71 ($n = 144$)	F test
Head circumference (HC)	43.41 ± 1.69	45.23 ± 1.64	46.08 ± 1.56	47.02 ± 1.43	47.18 ± 1.75	168.50^{***}
Neck circumference (NC)	20.44 ± 1.01	21.31 ± 1.16	21.73 ± 1.09	22.02 ± 0.96	22.31 ± 0.99	88.91^{***}
Mid upper arm circumference (MUAC)	12.53 ± 0.74	13.50 ± 0.85	13.52 ± 0.91	13.80 ± 0.92	13.87 ± 0.83	81.05^{***}
Chest circumference (CC)	42.93 ± 2.13	45.40 ± 2.37	46.97 ± 2.43	48.37 ± 2.16	49.20 ± 2.78	203.13^{***}
Thigh circumference (TC)	21.21 ± 1.55	22.13 ± 1.87	23.65 ± 2.10	24.50 ± 2.06	24.91 ± 2.01	123.35^{***}
Medial calf circumference (MCC)	15.69 ± 1.11	16.82 ± 1.15	17.63 ± 1.25	18.42 ± 1.37	18.76 ± 1.24	187.57^{***}
Head to height ratio (HHtR)	$0.582 0 \pm 0.03$	$0.539 5 \pm 0.03$	$0.501 0 \pm 0.03$	$0.475 3 \pm 0.02$	$0.451 3 \pm 0.02$	769.68^{***}
Neck to height ratio (NHtR)	$0.274 1 \pm 0.02$	$0.254 2 \pm 0.02$	$0.236 1 \pm 0.01$	$0.222 5 \pm 0.01$	$0.213 3 \pm 0.01$	542.17^{***}
MUAC to height ratio (AHtR)	$0.168 0 \pm 0.01$	$0.155 6 \pm 0.01$	$0.146 8 \pm 0.01$	$0.139 4 \pm 0.01$	$0.132 6 \pm 0.01$	352.04^{***}
Chest to height ratio (CHtR)	$0.575 4 \pm 0.03$	$0.541 3 \pm 0.03$	$0.510 2 \pm 0.03$	$0.488 5 \pm 0.02$	$0.470 4 \pm 0.03$	439.76^{***}

Table 2 (continued)

Anthropometric variables	12–23 ($n = 205$)	24–35 ($n = 179$)	36–47 ($n = 140$)	48–59 ($n = 180$)	60–71 ($n = 144$)	F test
Thigh to height ratio (THtR)	0.2844 ± 0.02	0.2630 ± 0.02	0.2566 ± 0.02	0.2478 ± 0.02	0.2382 ± 0.02	129.26^{***}
Medial calf to height ratio (MCHtR)	0.2103 ± 0.01	0.2005 ± 0.01	0.1914 ± 0.01	0.1859 ± 0.01	0.1793 ± 0.01	163.02^{***}

Note. $* p < .05$, $** p < .01$, $*** p < .001$.

Table 3 shows the prevalence of undernutrition based on two types of circumferences among the tribal preschool children. Overall, MUAC and HC-based undernutrition was 35.3% (boys: 34.4 and girls: 36.1%) and 60.7% (boys: 59.3 and girls: 62.2%), respectively. Most of the children had one type of undernutrition (45.8%). Only 25.1% were undernourished on both measures, MUAC and HC. On both measures, girls experienced a marginally higher prevalence of growth and nutritional deficiencies than boys, but differences were not statistically significant. Figure 1 represents the HC and MUAC based growth and nutritional status among the studied tribal preschool children. The frequencies of undernutrition were 35.6% for HC only, 10.2% for MUAC only, and 25.1% for both conditions.

Table 3: Table 3. Sex-wise growth and nutritional status indicators among the studied preschool children. Numbers with percent in parentheses.

	Growth and nutritional status	Overall	Boys	Girls	χ^2
HC-based	Undernutrition (< -2 SD Z score)	515 (60.7%)	255 (59.3%)	260 (62.2%)	0.75^{NS}
	Normal (-2 SD to $+2$ SD)	333 (39.3%)	175 (40.7%)	158 (37.8%)	
MUAC-based	Undernutrition (< -2 SD Z score)	299 (35.3%)	148 (34.4%)	151 (36.1%)	0.27^{NS}
	Normal (-2 SD to $+2$ SD)	549 (64.7%)	282 (65.6%)	267 (63.9%)	
Types of nutritional deficiencies	Both HC and MUAC normal	247 (29.1%)	133 (30.9%)	114 (27.3%)	1.39^{NS}
	One type of undernutrition (HC or MUAC)	388 (45.8%)	191 (44.4%)	197 (47.1%)	
	Both types of undernutrition (HC and MUAC)	213 (25.1%)	106 (24.7%)	107 (25.6%)	

Note. NS = not statistically significant at $p < .05$.

The body circumferences and circumferences to height ratio differences observed between healthy and undernourished children are shown in Table 4. Normal or healthy children of both sexes showed higher mean values in height and weight and significant differences (except girls' height) observed. Six types of circumferences showed a higher mean value in healthy children compared to nutritional deficiencies children, with significant differences observed in both boys and girls (p= <0.001). In both boys and girls, all circumference to height ratio shows statistically significant differences from normal to undernourished children (except head circumference to height ratio in boys).

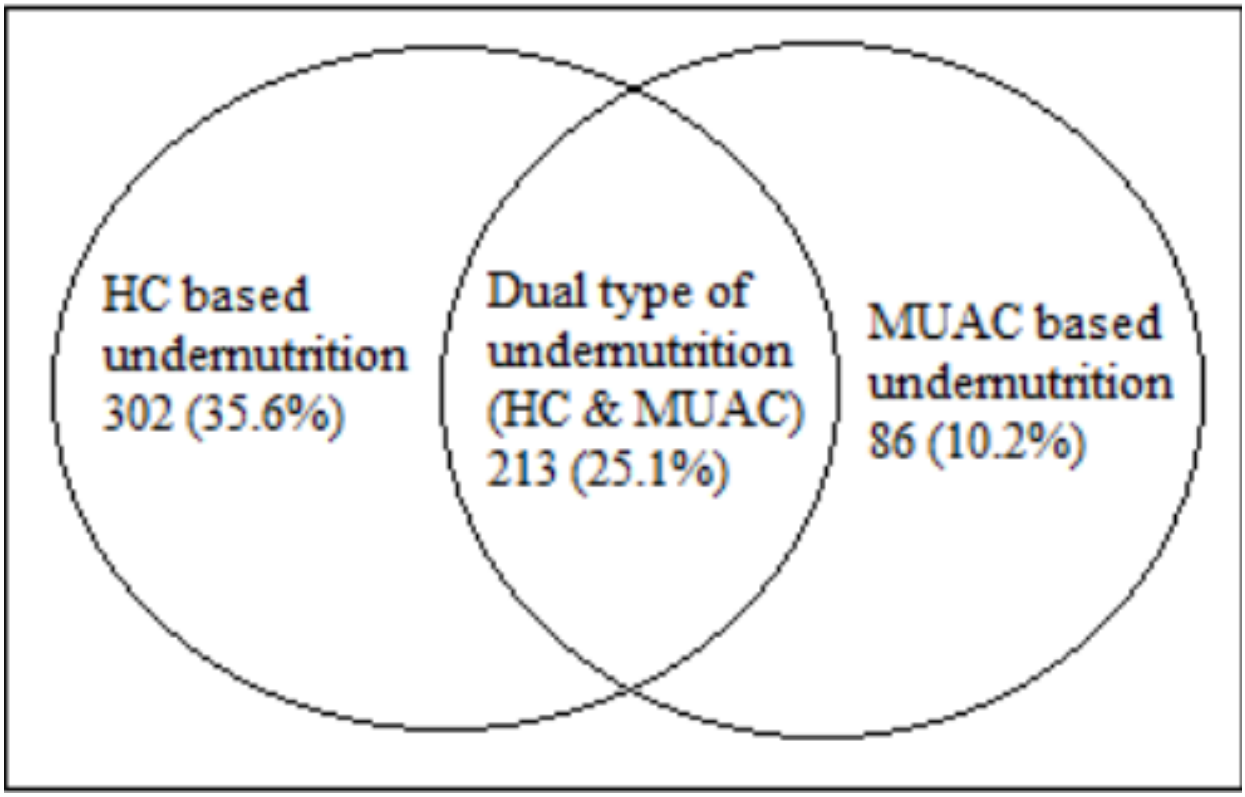

Figure 1. Mid upper arm circumference and head circumference-based growth and nutritional status among the studied tribal preschool children

Table 4: Nutritional status and sex-wise circumference differences among the studied preschool children.

Anthropometric textbfvariables	**Sex**	**Normal** (B = 133; G = 114)	**One type of undernutrition**[a] (B = 191; G = 197)	**Dual type of undernutrition**[b] (B = 106; G = 107)	**F test**
Height					
	Boys	94.36 ± 11.38	88.60 ± 11.72	87.62 ± 11.37	13.13***
	Girls	89.47 ± 12.55	89.40 ± 11.66	89.66 ± 10.41	0.02^{NS}
Weight					
	Boys	13.28 ± 2.88	11.41 ± 2.84	10.53 ± 2.55	31.61***
	Girls	12.01 ± 3.24	11.37 ± 2.90	10.60 ± 2.29	6.71***
Head circumference (HC)					
	Boys	47.84 ± 1.45	45.65 ± 1.97	44.67 ± 2.09	95.55***
	Girls	46.34 ± 1.75	44.91 ± 2.03	44.47 ± 1.61	32.07***
Neck circumference (NC)					
	Boys	22.21 ± 1.15	21.71 ± 1.18	20.99 ± 1.05	33.44***
	Girls	21.79 ± 1.32	21.27 ± 1.15	20.78 ± 1.05	20.44***
Mid upper arm circumference (MUAC)					
	Boys	14.07 ± 0.77	13.46 ± 0.85	12.49 ± 0.60	125.70***

Table 4 (continued)

Anthropometric variables	Sex	Normal (B = 133; G = 114)	One type of undernutrition[a] (B = 191; G = 197)	Dual type of undernutrition[b] (B = 106; G = 107)	F test
	Girls	13.69 ± 0.99	13.31 ± 0.92	12.42 ± 0.69	60.35***
Chest circumference (CC)					
	Boys	48.39 ± 3.11	46.58 ± 3.18	45.11 ± 2.97	33.50***
	Girls	46.67 ± 3.63	46.08 ± 2.93	44.70 ± 2.82	11.76***
Thigh circumference (TC)					
	Boys	23.78 ± 1.99	22.89 ± 2.11	21.80 ± 1.87	28.47***
	Girls	23.88 ± 2.61	23.58 ± 2.60	22.55 ± 2.44	8.36***
Medial calf circumference (MCC)					
	Boys	18.05 ± 1.52	17.24 ± 1.52	16.43 ± 1.39	34.93***
	Girls	17.90 ± 1.73	17.46 ± 1.74	16.81 ± 1.60	11.50***
Head to height ratio (HHtR)					
	Boys	.5132 ± 0.05	.5222 ± 0.06	.5163 ± 0.05	1.17^{NS}
	Girls	.5258 ± 0.06	.5090 ± 0.05	.5011 ± 0.05	6.45**
Neck to height ratio (NHtR)					
	Boys	.2380 ± 0.02	.2484 ± 0.03	.2426 ± 0.02	6.23**
	Girls	.2472 ± 0.03	.2409 ± 0.03	.2341 ± 0.02	6.96***
MUAC to height ratio (AHtR)					
	Boys	.1509 ± 0.02	.1539 ± 0.02	.1443 ± 0.01	11.58***
	Girls	.1549 ± 0.02	.1506 ± 0.01	.1397 ± 0.01	34.14***
Chest to height ratio (CHtR)					
	Boys	.5175 ± 0.05	.5314 ± 0.05	.5202 ± 0.05	3.99*
	Girls	.5275 ± 0.05	.5207 ± 0.04	.5026 ± 0.04	9.15***
Thigh to height ratio (THtR)					
	Boys	.2544 ± 0.03	.2612 ± 0.03	.2516 ± 0.03	4.56*
	Girls	.2691 ± 0.03	.2653 ± 0.02	.2524 ± 0.02	17.59***
Medial calf to height ratio (MCHtR)					
	Boys	.1927 ± 0.02	.1964 ± 0.02	.1893 ± 0.02	5.47**
	Girls	.2017 ± 0.02	.1965 ± 0.01	.1883 ± 0.01	24.25***

Notes. [a]One type of undernutrition indicates either HC- or MUAC-based undernutrition only. [b]Dual type indicates both HC- and MUAC-based undernutrition. NS = not statistically significant $p < .05$. $* p < .05$, $** p < .01$, $*** p < .001$.

[a]One type of undernutrition = Children suffered nutritional deficiencies either MUAC based or HC based; [b]Dual type of undernutrition = Children suffered in both MUAC and HC based nutritional deficiencies.

Tables 5 and 6 and the ROC curve (Figure 2) identify the most effective circumferences for predicting dual types of undernutrition. Boys aged 24-35 months have the highest AUC value (0.964), whereas girls aged 48-59 months have the highest AUC value (0.955) of MUAC. The analysis of twelve parameters indicated that, MUAC is the best predictor for the risk of dual types of child undernutrition in boys and girls. In the 12-23-month age group, girls show a higher AUC value in all parameters (except NHtR). In the 24-35-month-old age group, the AUC value fluctuated from parameter to parameter. In the 36–47-month age group, boys show a higher AUC value in all parameters (except thigh circumference, AHtR, and THtR). In the 48–59-month age group, girls show a higher AUC value in all parameters (except head circumference,

HHtR). In the 60–71-month age group, boys show a higher AUC value in all parameters (except HHtR, NHtR, and MCHtR).

Table 5: ROC analysis by age group for predicting dual undernutrition among girls.

Variables	Age (M)	AUC	Sig	95% CI	Gini index	Cutoff	Sens	Spe
Head circumference								
	12–23	.845	.000	.762–.928	.690	42.75	.938	.322
	24–35	.744	.000	.638–.850	.489	44.75	.870	.424
	36–47	.711	.000	.597–.826	.423	45.90	.920	.469
	48–59	.793	.000	.702–.885	.587	46.55	.897	.417
	60–71	.850	.000	.753–.947	.700	46.90	1.00	.393
Neck circumference								
	12–23	.708	.008	.553–.862	.416	19.45	.500	.161
	24–35	.769	.000	.649–.888	.537	20.85	.739	.288
	36–47	.666	.014	.533–.799	.332	21.45	.680	.429
	48–59	.840	.000	.756–.925	.680	21.45	.793	.200
	60–71	.751	.000	.622–.880	.503	22.25	.857	.446
Mid upper arm circumference								
	12–23	.952	.000	.912–.991	.903	11.90	.938	.092
	24–35	.933	.000	.884–.983	.867	12.65	.957	.186
	36–47	.945	.000	.892–.998	.890	13.10	.960	.102
	48–59	.955	.000	.918–.993	.911	13.45	.931	.167
	60–71	.899	.000	.828–.970	.798	13.55	1.00	.196
Chest circumference								
	12–23	.808	.000	.688–.928	.616	41.95	.813	.241
	24–35	.829	.000	.741–.917	.658	44.70	.870	.339
	36–47	.826	.000	.731–.921	.652	45.75	.760	.245
	48–59	.799	.000	.709–.890	.599	48.35	.931	.467
	60–71	.693	.010	.547–.839	.385	49.10	.929	.446
Thigh circumference								
	12–23	.813	.000	.707–.918	.625	20.75	.813	.287
	24–35	.761	.000	.652–.870	.522	21.65	.696	.271
	36–47	.780	.000	.673–.887	.560	23.90	.800	.265
	48–59	.732	.000	.625–.840	.465	24.70	.724	.367
	60–71	.621	.169	.449–.792	.241	24.75	.571	.321
Medial calf circumference								
	12–23	.783	.000	.681–.885	.566	15.35	.813	.368
	24–35	.827	.000	.725–.929	.654	16.45	.783	.186
	36–47	.787	.000	.684–.890	.574	17.25	.760	.245
	48–59	.800	.000	.704–.896	.600	18.65	.793	.333
	60–71	.629	.111	.470–.789	.259	19.65	.929	.661
HHtR								
	12–23	.701	.002	.576–.827	.402	.5956	1.00	.667

Table 5 (continued)

Variables	Age (M)	AUC	Sig	95% CI	Gini index	Cutoff	Sens	Spe
	24–35	.564	.349	.429–.700	.129	.5327	.565	.373
	36–47	.408	.178	.275–.542	−.184	.5218	.880	.837
	48–59	.602	.124	.472–.731	.203	.4543	.345	.133
	60–71	.636	.108	.470–.803	.273	.4522	.714	.429
NHtR								
	12–23	.596	.258	.430–.763	.193	.2512	.313	.069
	24–35	.606	.124	.471–.741	.211	.2583	.783	.576
	36–47	.498	.981	.362–.635	−.003	.2308	.480	.367
	48–59	.677	.002	.563–.791	.354	.2243	.897	.533
	60–71	.603	.301	.408–.799	.207	.2078	.571	.286
AHtR								
	12–23	.853	.000	.770–.937	.707	.1639	.938	.287
	24–35	.869	.000	.778–.961	.738	.1494	.783	.136
	36–47	.797	.000	.690–.903	.593	.1477	.960	.347
	48–59	.870	.000	.794–.945	.739	.1367	.862	.200
	60–71	.776	.001	.612–.939	.551	.1251	.571	.054
CHtR								
	12–23	.713	.001	.586–.839	.425	.5764	.875	.517
	24–35	.705	.002	.576–.835	.410	.5238	.652	.271
	36–47	.632	.065	.492–.773	.264	.4944	.480	.163
	48–59	.683	.004	.559–.807	.366	.4757	.517	.200
	60–71	.536	.712	.346–.725	.071	.4566	.429	.196
THtR								
	12–23	.770	.000	.670–.870	.540	.2861	.938	.448
	24–35	.722	.000	.603–.841	.444	.2721	.913	.542
	36–47	.678	.006	.550–.806	.357	.2608	.680	.327
	48–59	.692	.001	.579–.805	.384	.2618	.931	.533
	60–71	.573	.387	.407–.740	.147	.2488	.786	.482
MCHtR								
	12–23	.763	.000	.657–.868	.525	.2067	.875	.333
	24–35	.759	.000	.634–.884	.518	.1899	.565	.102
	36–47	.674	.007	.549–.800	.349	.1909	.720	.347
	48–59	.769	.000	.665–.873	.538	.1889	.828	.350
	60–71	.559	.495	.390–.727	.117	.1828	.643	.464

Notes. Sig = significance; CI = confidence interval; AUC = area under the curve; Sens = sensitivity; Spe = specificity. HHtR = Head to height ratio; NHtR = Neck to height ratio; AHtR = Mid upper arm circumference to height ratio; CHtR = Chest to height ratio; THtR = Thigh to height ratio; MCHtR = Medial calf to height ratio.

Table 6. Age wise ROC analysis of twelve types of circumferences for predicting dual type of undernutrition (growth faltering and nutritional deficiencies) among the studied girls

Table 6: ROC analysis by age group for predicting dual undernutrition among girls.

Variables	Age (M)	AUC	Sig	95% CI	Gini index	Cutoff	Sens	Spe
Head circumference								
	12–23	.845	.000	.762–.928	.690	42.75	.938	.322
	24–35	.744	.000	.638–.850	.489	44.75	.870	.424
	36–47	.711	.000	.597–.826	.423	45.90	.920	.469
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	60–71	.850	.000	.753–.947	.700	46.90	1.00	.393
Neck circumference								
	12–23	.708	.008	.553–.862	.416	19.45	.500	.161
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	60–71	.751	.000	.622–.880	.503	22.25	.857	.446
Mid upper arm circumference								
	12–23	.952	.000	.912–.991	.903	11.90	.938	.092
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	48–59	.955	.000	.918–.993	.911	13.45	.931	.167
	60–71	.899	.000	.828–.970	.798	13.55	1.00	.196
Chest circumference								
	12–23	.808	.000	.688–.928	.616	41.95	.813	.241
	24–35	.829	.000	.741–.917	.658	44.70	.870	.339
	36–47	.826	.000	.731–.921	.652	45.75	.760	.245
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	36–47	.780	.000	.673–.887	.560	23.90	.800	.265
	48–59	.732	.000	.625–.840	.465	24.70	.724	.367
	60–71	.621	.169	.449–.792	.241	24.75	.571	.321
Medial calf circumference								
	12–23	.783	.000	.681–.885	.566	15.35	.813	.368
	24–35	.827	.000	.725–.929	.654	16.45	.783	.186
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	48–59	.800	.000	.704–.896	.600	18.65	.793	.333
	60–71	.629	.111	.470–.789	.259	19.65	.929	.661
HHtR								

Table 6 (continued)

Variables	Age (M)	AUC	Sig	95% CI	Gini index	Cutoff	Sens	Spe
	12–23	.701	.002	.576–.827	.402	.5956	1.00	.667
	24–35	.564	.349	.429–.700	.129	.5327	.565	.373
	36–47	.408	.178	.275–.542	−.184	.5218	.880	.837
	48–59	.602	.124	.472–.731	.203	.4543	.345	.133
	60–71	.636	.108	.470–.803	.273	.4522	.714	.429
NHtR								
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	36–47	.498	.981	.362–.635	−.003	.2308	.480	.367
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	36–47	.797	.000	.690–.903	.593	.1477	.960	.347
	48–59	.870	.000	.794–.945	.739	.1367	.862	.200
	60–71	.776	.001	.612–.939	.551	.1251	.571	.054
CHtR								
	12–23	.713	.001	.586–.839	.425	.5764	.875	.517
	24–35	.705	.002	.576–.835	.410	.5238	.652	.271
	36–47	.632	.065	.492–.773	.264	.4944	.480	.163
	48–59	.683	.004	.559–.807	.366	.4757	.517	.200
	60–71	.536	.712	.346–.725	.071	.4566	.429	.196
THtR								
	12–23	.770	.000	.670–.870	.540	.2861	.938	.448
	24–35	.722	.000	.603–.841	.444	.2721	.913	.542
	36–47	.678	.006	.550–.806	.357	.2608	.680	.327
	48–59	.692	.001	.579–.805	.384	.2618	.931	.533
	60–71	.573	.387	.407–.740	.147	.2488	.786	.482
MCHtR								
	12–23	.763	.000	.657–.868	.525	.2067	.875	.333
	24–35	.759	.000	.634–.884	.518	.1899	.565	.102
	36–47	.674	.007	.549–.800	.349	.1909	.720	.347
	48–59	.769	.000	.665–.873	.538	.1889	.828	.350
	60–71	.559	.495	.390–.727	.117	.1828	.643	.464

Notes. Sig = significance; CI = confidence interval; AUC = area under the curve; Sens = sensitivity; Spe = specificity. HHtR = Head to height ratio; NHtR = Neck to height ratio; AHtR = Mid upper arm circumference to height ratio; CHtR = Chest to height ratio; THtR = Thigh to height ratio; MCHtR = Medial calf to height ratio.

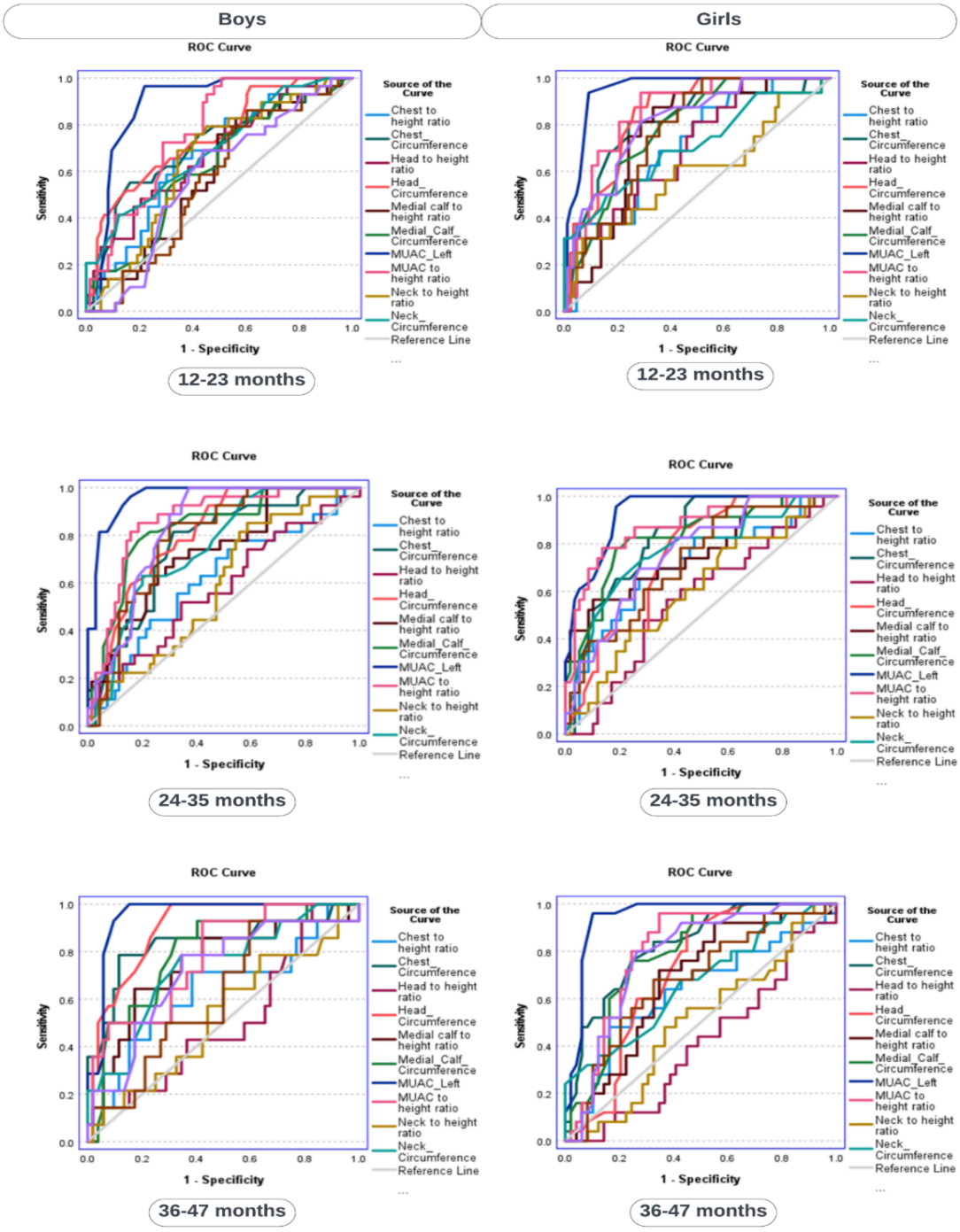

Figure 2a. Age and sex wise ROC curve by using twelve types of parameters for predicting growth faltering and nutritional deficiencies (Part 1)

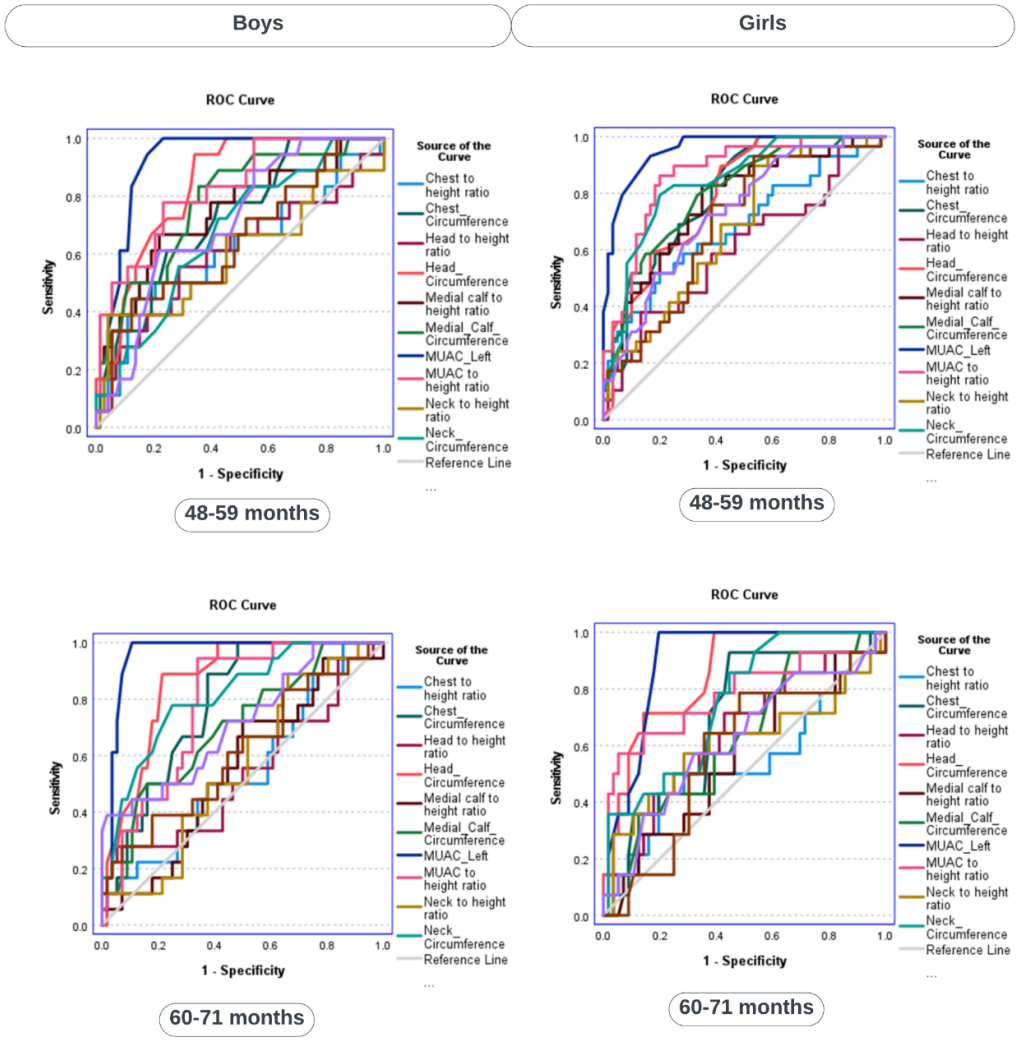

Figure 2b. Age and sex wise ROC curve by using twelve types of parameters for predicting growth faltering and nutritional deficiencies (Part 2)

Undernutrition is a significant global issue, causing 3.1 million child deaths annually, 45% of them in children under five years of age (UNICEF, 2018). A previous study reported that chronic undernutrition in children causes slower cognitive development, major health problems later in life, and reduced life expectancy (Scrimshaw, 1997). The current study found that boys have higher age-adjusted mean body circumferences than girls, with the exception of thigh circumferences. Differences between the sexes were statistically significant, except for medial calf circumferences. Similarly, a previous study in Midnapore town reported that boys had higher mean HC values than girls (Maiti et al., 2012). Many previous studies reported similar findings (Mandal & Bose, 2010; Mondal, 2019).

The present study observed that all body circumferences increased with increasing child age, but the circumference to height ratios decreased with increasing age. Earlier studies had observed that HC increases with age in both sexes (Maiti et al., 2012; Mondal, 2019), and the MUAC value also increases with age (Biswas et al., 2010).

The present study shows that growth and nutritional deficiencies are very common among the studied

tribal children, with 70.9% being undernourished; this includes 45.8% who have one type of undernutrition (MUAC or HC) and 25.1% who are undernourished by both measures. Furthermore, the present study indicates that only HC-based undernutrition is 35.6%, only MUAC-based undernutrition is 10.2%, and 25.1% of children suffer from both (Figure 1). Girls experienced marginally higher prevalence of growth and nutritional deficiencies than boys on both measures, but the differences were not statistically significant. Also some previous studies had indicated that girls experience slightly higher rates of undernutrition than boys, as per HC (Maiti et al., 2012; Mandal & Bose, 2010; Mondal, 2019; Tigga et al., 2016) and MUAC (Biswas et al., 2010). Girls in many tribal and rural communities tend to experience slightly higher undernutrition than boys due to a combination of biological, social, and cultural factors. Biologically, girls may have different growth and fat distribution patterns that make deficiencies more visible through indicators like MUAC and HC. Socially and culturally, gender bias in intra-household food distribution, preferential care for boys, and lower healthcare-seeking behaviour for girls often result in poorer dietary intake and delayed treatment of illness.

Normal or healthy children of both sexes show higher mean values in height, weight, and six types of body circumferences than undernourished children, with statistically significant differences observed (except girls' height). In both boys and girls, all circumference to height ratio shows statistically significant differences between normal and undernourished children (except head circumference to height ratio in boys).

Compared to twelve parameters, the present study concludes that MUAC is the best indicator for the risk of growth and nutritional deficiencies in boys and girls. A previous study reported that MUAC is a valuable tool for screening and estimating undernutrition prevalence in preschool children, with a sensitivity and specificity (Joseph et al., 2002) making it a good predictor of child mortality compared to weight for height (Briend & Zimicki, 1986). MUAC has been proposed as the most effective, simple, cost-effective, and acceptable anthropometric parameter for evaluating childhood malnutrition (Myatt et al., 2006). The previous study reveals that MUAC $<$ 11.5 cm or WHZ $<$ -3 is crucial in identifying under-five children at risk of mortality (Sachdeva et al., 2016). Early detection of childhood malnutrition not only improves overall health outcomes, but also minimizes future financial burden (Klanjsek et al., 2019).

4 Limitations

The present study, had some limitations, due to its cross-sectional nature and its small sample size in a small geographical region. Therefore, the results cannot be generalized to the entire state or country. The study design was such that it could not reveal any correlation between socioeconomic factors, mortality, morbidity, and undernutrition based on various parameters.

5 Recommendation

The present study found that undernutrition is a major issue among tribal children and a barrier to their growth and brain development. In India, two main government schemes, the Integrated Child Development Services (ICDS) and POSHAN Abhiyaan, are currently operating to provide supplementary food for preschool children. So, there is an urgent need for strengthening existing nutrition schemes, a requirement for regular monitoring of growth indicators, a quality assessment of food distribution, and timely interventions to address gaps. Ensuring community participation, capacity building of Anganwadi workers, and introducing digital tools for real-time monitoring can improve accountability and efficiency. Also needed are programs to raise parents' awareness of their child's growth and development, nutritional requirements and health. This study also provides cut-off values which can be used in future studies of tribal children.

6 Conclusion

The present study indicates that head circumference (HC)-based nutritional deficiencies are more prevalent than mid-upper arm circumference (MUAC)-based nutritional deficiencies among tribal preschool children. While low MUAC reflects a high prevalence of undernutrition, low HC indicates inadequate brain growth and development, thereby underscoring the multifaceted impact of malnutrition. The use of circumference-to-height ratios further provides critical insights into the proportional growth and development of children. By comparing twelve anthropometric parameters, MUAC emerged as the most reliable predictor of dual forms of child undernutrition across both sexes. It will aid in the early detection of undernutrition among tribal preschool children.

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Declaration of conflicting Interests: The authors declare that there is no conflict of interest in publishing this paper.

Ethical approval: The institutional ethical review board of Vidyasagar University's Department of Anthropology provided formal ethical approval. Verbal informed consent was obtained from all participants prior to data collection.

Author contributions: BM collected the data, analysed the data, prepared the first draft of the manuscript, and formatted the manuscript for submission as well. KB supervised the study and reviewed the manuscript.

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Does Body Composition Influence Foot Anthropometry? A Study among the Lodha Population of Paschim Medinipur, West Bengal, India

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Abstract

Healthy human feet are essential for supporting body weight. The present study is among the limited research that attempts to assess the multivariate relationship between body composition measures and foot anthropometric variables of the Lodha population, a particularly vulnerable tribal group of Paschim Medinipur district, West Bengal. The present cross-sectional study was conducted on Lodha males (228) and females (215) aged 18 years and above. All variables were obtained by following standard procedures. Canonical Correlation Analysis (CCA) was performed using SPSS version 26.0. The canonical correlation coefficient between body composition and foot anthropometric variables was .939 and .898 ($p \leq .001$) for males and females, which explained 80.23% and 72.85% of the total variance, respectively. Cross-loading values of Canonical Correlation Analysis revealed that among males, height, weight, body mass index (BMI), body fat percentage, and visceral fat level were the most important predictors of all the breadth and girth measurements of the foot. Among females, all body composition measures were highly important predictors of girth measurements of the foot. The findings of the present study will aid in raising awareness concerning foot health and contribute new knowledge to public health.

Keywords: Foot anthropometry, Body composition, Foot health, Multivariate relationship, Canonical Correlation Analysis (CCA), Lodha population

1 Introduction

Human feet bear the entire weight of the body and stabilize it in contrasting postural and environmental conditions (Murley et al., 2009; Saltzman et al., 1995). To provide its dual functions of weight bearing and ambulation, the human foot is highly evolved and structurally unique (Jahss, 1982). For example, specialized structures, such as the fat pads of the foot, particularly those in the heel, arch, and metatarsal head regions, are designed to provide cushioning to the underlying bones and shock absorption for the whole body (Cavanagh, 1999; Denoth, 1985). These structures protect against the high-ground reaction forces that are generated during walking and other forms of daily activities (Mickle et al., 2006), and the longitudinal arch is the component most responsible for absorbing and dispersing these forces in the feet (Bhatia et al., 2010). Individual weight is an important determinant in the development of distinct foot types since the main purpose of an arched foot is to distribute the load from body weight to different sections of the foot during different stages of the walk cycle (Arthi et al., 2018; Hillstrom et al., 2013). The feet constitute the body's foundation and the final link in the kinetic chain during human locomotion, and a healthy foot structure is crucial for efficient posture and ambulation (Riddiford-Harland et al., 2011;

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Rosenbaum & Becker, 1997). Any alteration from normal or healthy foot structure can influence the gait and lead to different injury patterns (Vangara et al., 2016).

Excessive body mass has been proven to significantly affect foot morphology as it places a greater biomechanical strain on the skeletal and soft tissues (Bhattacharjee & Goswami, 2017, 2019; Chatha & Mohammad, 2020; Domjanić et al., 2013; Morrison et al., 2018). As a result, the shape and function of an obese and overweight adult's foot vary from that of a healthy-weight individual, resulting in alterations in morphology, soft tissue features, and functional capabilities (Dowling et al., 2001; Hills et al., 2001; Price & Nester, 2016; Riddiford-Harland et al., 2011). Furthermore, foot pain was noted as a typical condition in overweight and obese individuals due to increased body weight and stress exerted on the feet.

Obesity is closely linked to flatfoot deformity, pronated dynamic foot function, and higher plantar pressures during walking (Butterworth et al., 2012; Domjanić et al., 2013; Krishnan & Pawar, 2017; Tanamas et al., 2012). Studies have established that being overweight or obese as defined by the body mass index (BMI) probably has detrimental consequences on the foot, most likely due to the increased mechanical loading on the lower limbs (Birtane & Tuna, 2004; Butterworth et al., 2012, 2014; Domjanić et al., 2013; Hills et al., 2001; Morag & Cavanagh, 1999; Tománková et al., 2015; Wearing et al., 2004). A rise in BMI brought on by an increase in body fat mass leads to the collapsing of the arches as it causes a greater force to be applied across the sole (Alcántara et al., 2002; Butterworth et al., 2014; Vijaykumar et al., 2016; Wearing et al., 2004). Chatha and Mohammad (2020) and Zhao et al. (2020) discovered a positive correlation between BMI and forefoot area, forefoot and instep girth, rearfoot width, instep height, and arch height index. Wearing et al. (2004) found that weight, BMI, fat-free mass, fat mass, and percent fat mass significantly correlated with the total area as well as forefoot, midfoot, hindfoot, and toe area, as well as arch index. Adolescents with high body fat and low muscle mass percentages had significantly lower medial longitudinal foot arches (Wyszyńska et al., 2020), and the arch height index was lowest in the lower BMI group (Wearing et al., 2004).

Studies conducted on the influence of being underweight on foot morphology and structure are scanty. Several studies revealed that underweight children and adults have high-arched (*pes cavus*) as well as low-arched feet (*pes planus*) (Alimuddin et al., 2020; Pathan et al., 2022; Ripka et al., 2017; Vijaykumar et al., 2016; Woźniacka et al., 2013), which have been linked to foot pain, disabilities, and lower extremity injuries (Burns et al., 2005; Tong & Kong, 2013), but the etiology is still unknown. BMI and body fat composition each have been found to have a significant negative relationship with the shape of foot arches (Alimuddin et al., 2020). Thus, an abnormal lack of body mass (thinness) can cause deviation from normal foot structure and is likely to cause changes in basic motor activities such as gait and postural balance, leading to various injuries (Tojo et al., 2018; Vangara et al., 2016).

The morphology of the human foot also varies significantly due to the combined effects of heredity, ethnicity, geographic locations, lifestyle, climatic factors, physical activities, as well as nutritional factors (Abledu et al., 2015; Addai et al., 2018; Adelakun et al., 2019; Ikpa et al., 2019; Krishan, 2008; Mansur et al., 2020; Oberoi et al., 2006; Rahman et al., 2014; Ukoha et al., 2013; Vangara et al., 2019). Besides, infants, children, and adults have different foot structures (Arthi et al., 2018), and BMI does not give precise information regarding body fat amount and distribution because it is not a direct measure of body fat (Conus et al., 2007; Evans et al., 2006; Güven et al., 2009; Pietrobelli & Tatò, 2005; Romero-Corral et al., 2008; Wyszyńska et al., 2020).

Thus, there is a lack of evidence to support the degree of relationship between body composition measures such as body fat mass and foot morphology parameters, inducing an acute need for data on adults (Butterworth et al., 2014). In terms of the nutritional status of the Indian tribal community, the overall sex-specific prevalence of chronic energy deficiency revealed that both tribal females (52.0%) and males (49.3%) were in critical nutritional stress (extremely low BMI), with females faring worse (Das & Bose, 2015); a situation particularly pronounced among the Lodhas, a particularly vulnerable tribal group (PVTG) mostly found in the forest-covered areas of Paschim Medinipur district of West Bengal, India (Bepari et al., 2015; Bisai et al., 2014). The Lodhas belong to the Austro-Asiatic linguistic group, speaking the Mundari language (Bepari et al., 2015; Bisai et al., 2008; Panda & Guha, 2015). Being Austro-Asiatic language speakers, they belong to the Ancestral Austro-Asiatic (AAA) genetic component (Basu et al.,

2016). Traditionally, they were forest dwellers who lived in the dense forest, exploiting various forest products and hunting wild animals, but now they have started cultivating either as owners or as agricultural labourers and are also engaged in hunting, fishing, and non-agricultural activities. However, their economy is still based mainly on collecting minor forest products (Bisai et al., 2014; Panda & Guha, 2015).

Thus, it is vital to investigate the relationship between foot morphological characteristics and body composition measures among adult tribal populations in India. A complete assessment of such a relationship is indispensable, as changes in body composition govern deviation from normal foot morphology, which affects gait and causes injuries. Therefore, this cross-sectional study aims to assess the multivariate relationship between body composition measures and foot anthropometric variables of the adult Lodha tribal population of Paschim Medinipur district, West Bengal.

2 Materials and methods

2.1 Study area and study participants

The present cross-sectional study was conducted among the adult Lodha population of Paschim Medinipur district, West Bengal, India. Based on numerical dominance and ethnic homogeneity, Tarafbarpanda Mouza of Kashipur Gram Panchayat, under Narayangarh Block of Kharagpur sub-division, has been selected as the study area for the present study. Participants were purposively recruited from three villages, namely Karangabera, Raspata (Taraf Dakshin), and Uttarpara (Taraf Uttar). A total of 443 Lodha participants (228 males and 215 females) aged 18 years and above were identified by a door-to-door survey from the selected villages of Paschim Medinipur district, West Bengal, India. Participants who fulfilled the following criteria were selected: 1) adult males and females (aged 18 years and above, since foot anthropometric parameters does not typically stabilize until adulthood is reached, and by the age of 20 years the foot achieves its adult and fixed measurements), apparently healthy and not reported to be pregnant, not having any foot deformities, genetic disorders, endocrine, or neurological disorders, 2) Participants, their parents and grandparents (both paternal and maternal side) belonging to the above-mentioned ethnic group and residing in the area of study since birth (Alabi et al., 2017; Oria et al., 2017). The purpose of the research was explained, and informed consent was obtained from the participants. Participation in the study was voluntary. The study was approved by the Institutional Ethical Committee for Biomedical and Health Research, University of Calcutta (Ref No. CUIEC/02/31/2022-23, Dated-05.01.2023)

2.2 Methods of data collection and data types

Socio-demographic data

A pre-tested structured schedule was used to collect socio-demographic data using an interview method. It included the age of the participants at the time of the interview, sex, birthplace, and ethnicity. Besides, the ethnicity and birthplace of parents and grandparents were also obtained. The ethnicity of the participants was ascertained by collecting the surnames of their parents and grandparents. They were also asked to recollect and report any history of exogamous (outside community) marriages on both sides of their families. Additionally, they were asked if they, their parents, grandparents, and prior generations had lived in the area of study since birth. Later, these facts were cross-checked with the acquaintances of the participants or elderly individuals residing in the respective villages.

Set 1: Age and body composition measures (Independent variables)

The participants' age was an independent variable in the analysis, as it potentially influences both body composition measures and foot anthropometric variables. The participants' age was initially inquired and those who couldn't recollect their age were questioned further by referring to landmark events such as age at marriage, the gap between marriage and first childbirth, and the age of the first child, which were later

cross-checked by family members of the participants and were requested to present the written records of their date of birth.

Body weight (kg), body mass index (kg/m^2), body fat percentage, skeletal muscle percentage, and visceral fat level were recorded from the Omron Body Composition Monitor (HBF-212) following the standard technique provided in the instruction manual. Height was measured with a stature meter following standardized protocol (Lohman et al., 1988). The participants were made to stand erect and barefoot with light clothing. Each measurement was taken twice to ensure the reliability of the instrument.

Foot anthropometric variables (Dependent variables)

Foot anthropometric variables listed in Table 1 were measured on both feet following the standard protocol (Parham et al., 1992). All measurements were measured nearest to 0.1 cm. To avoid technical errors and increase accuracy, three successive measurements were obtained, and the average value of the measurements was calculated.

Table 1: Table 1: Description of foot anthropometric measurements of the participants

Sl. No.	Variables	Landmarks	Sources	Instruments
Height measurements				
1.	Medial malleolus height	Medial malleolus landmark	Parham et al. (1992)	Martin's sliding caliper
2.	Lateral malleolus height	Lateral malleolus landmark		
3.	1st Toe height	–		
4.	Ankle height	Ankle landmark		
Breadth measurements				
1.	Bimalleolar breadth	Medial and lateral malleolus landmark	Parham et al. (1992)	Martin's sliding caliper
Circumference/ Girth measurements				
1.	Ankle circumference	Ankle level landmark	Parham et al. (1992)	Steel tape
2.	Heel-ankle circumference	Dorsal junction of foot and leg		
3.	Calf girth	Calf level landmark		
4.	Instep girth	Instep girth landmark		
5.	Ball girth	Metatarsale tibiale and metatarsale fibulare	Lee et al. (2015)	

2.3 Statistical analysis

Descriptive statistics were computed for each variable. Pearson's correlation analysis was performed between age, body composition measures, and foot anthropometric variables to understand the bivariate relationship. Canonical correlation analysis (CCA), a multivariate statistical model, was performed to understand the relationship between two sets of variables. The first set consists of age and body composition measures (independent set), i.e., height, body weight, Body Mass Index, body fat percentage, skeletal muscle percentage, and visceral fat level. The second set consists of foot anthropometric variables (dependent set), i.e., lateral malleolus height, medial malleolus height, 1st Toe height, ankle height, bimalleolar breadth, ankle circumference, heel-ankle circumference, calf girth, ball girth, and instep girth.

The CCA algorithm creates a canonical function based on standardized function coefficients of the observed independent (predictor) and dependent (criterion) variable sets that maximize the correlation

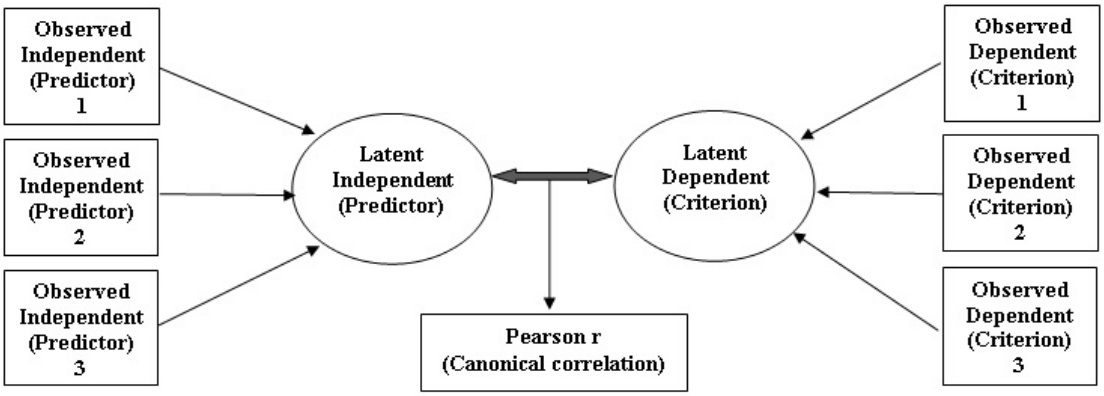

Figure 1: An illustration of a canonical correlation analysis with 3 independent (predictor) and 3 dependent (criterion) variables from the 1st function. Canonical correlation analysis is a simple Pearson's correlation (r) between two latent variables, also known as canonical variates, generated by the linear combination of the observed data.

between the two canonical variates (latent predictor and criterion variate) (Fig. 1). Furthermore, CCA creates as many functions as there are variables in the smaller variable set; each function is independent (orthogonal) from the others, which means that each set of latent variates will be perfectly uncorrelated with all other latent variates from other functions, representing various relationships between the sets of dependent and independent variables. The loadings of the individual variables differ in each canonical function and represent variables' contributions to the specific relationship under investigation (Green, 1978; Hair et al., 2004; Sherry & Henson, 2005; Stewart & Love, 1968).

Hair et al. (1998) proposed three criteria for choosing the important functions: (i) level of significance: The most widely used test for significance is the F statistic of each function (Bartlett, 1941); (ii) magnitude of the canonical correlation; and (iii) redundancy index which provides the amount of variance of one canonical variate (dependent or independent) statistically explained by the other canonical variate. As canonical variates represent the observed independent and dependent variables, the redundancy index measures the ability of a set of independent variables to explain the variation in the set of dependent variables.

To determine the relative importance/contribution of each original/observed variable in the data sets to each function, three methods have been proposed: (i) *Canonical weights (standardized canonical function coefficients)*. These weights are applied to the observed scores in Z-score form to yield the canonical variates, which are correlated to yield the canonical correlation. Weights are derived to maximize this canonical correlation, which is directly analogous to beta weights in regression analysis. (ii) *Structure coefficient (canonical loadings) (r_s)*. This is the bivariate Pearson correlation between the canonical function score (canonical variate) and the observed variable of its own set. The interpretation of canonical loadings is the same as the interpretation of factor loadings in factor analysis. (iii) *Canonical cross-loadings*. This is the bivariate correlation of a canonical variate with the observed variable of the opposite set. As the canonical weights, analogous to regression weights, are unstable and vulnerable to multicollinearity, most of the literature recommends the use of canonical loadings and cross-loadings to evaluate the relationship between original variables and canonical variates. Variables that are highly correlated with a canonical variate should be considered more important when deriving a meaningful interpretation of the related canonical variate (Hair et al., 1998; Shafto et al., 1997; Thompson, 1991). In the present study, variables with loading values (structure coefficient, r_s) $\geq |0.45|$ (Sherry & Henson, 2005) were considered to be most useful in the model. All statistical analyses were performed using Statistical Package for Social Sciences version 26.0 (SPSS Inc., Chicago, IL), with a significance level set at $p \leq 0.05$ (two-tailed).

Table 2 represents the descriptive statistics of body composition measures (Set 1) and foot anthropometric variables (Set 2) across sex. The mean age was slightly higher in males than in females. Males were

taller, heavier, with greater skeletal muscle percentage and visceral fat level than females. Females were found to have a higher body fat percentage than males. Male feet were higher and broader than female feet. Bilateral asymmetry among the foot anthropometric variables was prevalent as mean values of left and right feet differed in both males and females. The left foot had a higher mean lateral malleolus height, ankle circumference (in both males and females), and ankle height (in males) than the right foot. Mean values for left and right calf girth in males and ankle height in females were similar.

Table 2: Descriptive statistics of age, body composition measures (Set 1), and foot anthropometric variables (Set 2) of the adult Lodha population

		Males (n = 228)				**Females** (n = 215)			
		Mean	**SD**	**95% CI** *Lower*	**95% CI** *Upper*	**Mean**	**SD**	**95% CI** *Lower*	**95% CI** *Upper*
Age and Body Composition measures (Set 1)									
Age (years)		42.50	15.24	40.51	44.49	41.57	14.55	39.62	43.53
Height (cm)		158.90	6.29	158.08	159.72	147.95	5.86	147.16	148.73
Body weight (kg)		49.49	7.54	48.50	50.47	42.40	8.09	41.32	43.49
Body Mass Index ($\mathrm{kg/m^2}$)		19.55	2.42	19.24	19.87	19.33	3.19	18.90	19.76
Body fat (%)		18.29	5.19	17.61	18.97	26.11	6.58	25.22	26.99
Skeletal muscle (%)		36.19	3.82	35.69	36.69	28.56	2.65	28.20	28.91
Visceral fat level		4.09	2.92	3.71	4.47	2.97	2.39	2.65	3.29
Foot anthropometric variables (Set 2)									
Lateral malleolus height (cm)	Left	6.50	.57	6.43	6.58	5.91	.50	5.85	5.98
	Right	6.45	.56	6.37	6.52	5.77	.49	5.70	5.83
Medial malleolus height (cm)	Left	7.58	.55	7.51	7.65	6.83	.49	6.76	6.89
	Right	7.76	.60	7.68	7.84	6.95	.48	6.88	7.01
Ankle height (cm)	Left	12.41	.96	12.28	12.53	10.89	.97	10.76	11.02
	Right	12.38	.98	12.25	12.51	10.89	.97	10.76	11.02
1st Toe height (cm)	Left	2.16	.21	2.13	2.12	1.96	.22	1.93	1.99
	Right	2.30	.27	2.26	2.33	2.03	.29	2.00	2.07
Bimalleolar breadth (cm)	Left	6.77	.35	6.73	6.82	6.04	.46	5.98	6.10
	Right	6.91	.36	6.86	6.96	6.16	.45	6.09	6.22
Ankle circumference (cm)	Left	19.41	1.59	19.21	19.62	18.06	1.54	17.85	18.27
	Right	19.33	1.62	19.12	19.54	18.01	1.55	17.80	18.22
Heel–Ankle circumference (cm)	Left	31.15	1.58	30.94	31.36	28.75	1.49	28.55	28.94
	Right	31.34	1.51	31.15	31.54	28.94	1.48	28.75	29.14
Calf girth (cm)	Left	30.08	2.33	29.78	30.39	28.07	2.74	27.70	28.44
	Right	30.16	2.35	29.85	30.47	28.03	2.73	27.66	28.40
Ball girth (cm)	Left	23.87	1.31	23.70	24.04	21.49	1.22	21.33	21.66
	Right	23.86	1.36	23.69	24.04	21.56	1.22	21.39	21.72
Instep girth (cm)	Left	23.04	1.25	22.88	23.20	20.48	1.22	20.32	20.65
	Right	23.15	1.28	22.98	23.32	20.63	1.18	20.48	20.79

Note. SD = Standard deviation; CI = Confidence interval.

Table 3 shows that there was a significant positive correlation between the variables of Set 1 (body composition) and Set 2 (foot anthropometry) among Lodha males and females, except for age and skeletal

muscle percentage. Among males, the largest correlation was found between height and bimalleolar breadth, between age, body weight, body mass index (BMI), body fat percentage, visceral fat level, and calf girth, between skeletal muscle percentage and 1st toe height. Among females, the largest correlation occurred between age and ankle height, between height and heel-ankle circumference, between body weight, body mass index (BMI), body fat percentage, skeletal muscle percentage, visceral fat level, and calf girth. These results show that the two sets of variables are correlated with each other in both males and females.

Table 3. Pearson's correlation between foot anthropometric variables and body composition measures, including age, among Lodha males and females

		Age (years)	HT (cm)	BW (kg)	BMI (kg/m^2)	BFP (%)	SMP (%)	VF
					Males			
LMH (cm)	Left	-.098	.505**	.413**	.186**	.063	.084	.167*
	Right	-.041	.476**	.426**	.221**	.083	.039	.231**
MMH (cm)	Left	-.123	.457**	.369**	.164*	-.008	.143*	.126
	Right	-.042	.493**	.373**	.144*	.005	.056	.126
AH (cm)	Left	.112	.461**	.227**	-.012	-.078	.017	.026
	Right	.122	.457**	.227**	-.010	-.071	.001	.029
1st TH (cm)	Left	.131*	.182**	.376**	.342**	.313*	-.184**	.350**
	Right	.134*	.206**	.392**	.344**	.348**	-.176**	.367**
BM (cm)	Left	-.065	.557**	.486**	.246**	.139*	.104	.238**
	Right	-.066	.541**	.522**	.300**	.150*	.075	.294**
AC (cm)	Left	-.182*	.279**	.464**	.390**	.218**	.123	.369**
	Right	-.201*	.280**	.464**	.389**	.216**	.134*	.363**
HAC (cm)	Left	.021	.540**	.659**	.464**	.299**	-.064	.494**
	Right	-.007	.552**	.663**	.461**	.289**	-.043	.474**
CG (cm)	Left	-.270**	.411**	.875**	.815**	.549**	-.005	.729**
	Right	-.259**	.375**	.859**	.817**	.553**	-.009	.728**
BG (cm)	Left	-.113	.460**	.604**	.450**	.294**	.016	.435**
	Right	-.109	.464**	.580**	.419**	.268**	.020	.409**
IG (cm)	Left	-.163*	.449**	.656**	.523**	.291**	.045	.481**
	Right	-.193**	.466**	.647**	.501**	.278**	.071	.455**
					Females			
LMH (cm)	Left	-.060	.439**	.282**	.109	.123	-.069	.061

Table 3 (continued on next page)

		Age	HT (cm)	BW (kg)	BMI (kg/m^2)	BFP (%)	SMP (%)	VF
MMH (cm)	Right	-.074	.359**	.270**	.128	.139*	-.096	.071
	Left	-.098	.408**	.309**	.148*	.115	-.068	.121
AH (cm)	Right	-.100	.396**	.373**	.229**	.167*	-.112	.183**
	Left	.256**	.236**	-.002	-.118	-.031	.057	-.140*
1st TH (cm)	Right	.241**	.243**	.033	-.080	-.006	.035	-.111
	Left	.111	.095**	.297**	.285**	.288**	-.280**	.269**
BM (cm)	Right	.038	.208**	.331**	.272**	.309**	-.286**	.262**
	Left	.123	.379**	.311**	.174*	.237**	-.205**	.179**
AC (cm)	Right	.144*	.345**	.352**	.236**	.295**	-.256**	.226**
	Left	-.166*	.374**	.644**	.553**	.434**	-.366**	.485**
HAC (cm)	Right	-.180*	.406**	.671**	.568**	.458**	-.388**	.511**
	Left	.080	.598**	.645**	.444**	.487**	-.414**	.406**
CG (cm)	Right	.062	.620**	.658**	.448**	.480**	-.407**	.418**
	Left	-.105	.342**	.861**	.811**	.695**	-.634**	.704**
BG (cm)	Right	-.121	.335**	.859**	.812**	.689**	-.626**	.703**
	Left	-.002	.356**	.455**	.338**	.316**	-.262**	.294**
IG (cm)	Right	-.022	.351**	.477**	.365**	.331**	-.274**	.333**
	Left	-.015	.350**	.537**	.434**	.392**	-.339**	.380**
	Right	-.036	.356**	.534**	.427**	.389**	-.334**	.375**

Table 4 shows the result of canonical correlation analysis (CCA) between two sets, set 1-age and body composition measures, and set 2-foot anthropometric variables, among Lodha males and females. The full canonical correlation analysis process was restricted to extracting seven orthogonal (uncorrelated) functions because the independent set contained a maximum of seven variables.

Table 4: Canonical correlation analysis of foot anthropometric variables and body composition measures, including age, among the Lodha population.

Can. func.	Eigen value	Variance (%)	Cum. variance (%)	Can. corr.	Squared can. corr.	Wilks statistic	F value	p value
Males								
1	7.086	80.23	80.23	.939	.882	.033	6.463	.000
2	1.113	12.60	92.83	.726	.527	.266	2.658	.000
3	.285	3.23	96.06	.471	.222	.561	1.389	.012

Can. func.	Eigen value	Variance (%)	Cum. variance (%)	Can. corr.	Squared can. corr.	Wilks statistic	F value	p value
4	.197	2.23	98.48	.406	.165	.722	1.024	.427
5	.078	0.88	98.29	.269	.072	.864	0.642	.971
6	.051	0.58	98.87	.220	.048	.931	0.500	.988
7	.022	0.25	100	.148	.022	.978	0.331	.989
Females								
1	4.185	72.85	72.85	.898	.806	.058	4.816	.000
2	1.017	17.71	90.56	.710	.504	.301	2.231	.000
3	.246	4.28	94.84	.444	.197	.606	1.118	.221
4	.166	2.89	97.73	.377	.142	.756	0.818	.850
5	.066	1.16	98.89	.248	.061	.881	0.519	.997
6	.046	0.80	99.69	.210	.044	.939	0.414	.998
7	.019	0.30	100	.135	.018	.982	0.259	.997

Note. Can. func. = canonical function; Cum. variance = cumulative variance; Can. corr. = canonical correlation.

Males: In the 1st function, the canonical correlation (R_c) between Set 1 and Set 2 variables was found to be .939. The 2nd and 3rd functions had canonical correlations of .726 and .471. The 4th, 5th, 6th, and 7th functions had even lower canonical correlations. The squared canonical correlation (R_c^2) denotes the proportion of variance (i.e., variance-accounted-for effect size) shared by the two canonical variates. As the canonical variates represent the observed independent and dependent variables, R_c^2 also indicates the amount of shared variance between the two variable sets, which is directly equivalent to the R^2 effect in multiple regression (Sherry & Henson, 2005). The 1st squared canonical correlation coefficient (1st function) (R_c^2) revealed that the two canonical variates derived from Set 1 and Set 2 linearly share 88.2 % of the variance (shared variance). In the 2nd function, the two canonical variates derived from Set 1 and Set 2 linearly share 52.7 % of the variance. The 3rd function revealed that the two canonical variates linearly share 22.2% of the variance. Similarly, the shared variances between Set 1 and Set 2 in functions 4, 5, 6, and 7 were lower, and all of them lacked statistical significance. Interestingly, the 1st canonical function explains 80.23% of the total variance (derived from eigenvalue). The 2nd function deals with the residual variance of the first one, i.e., 12.60%. The 3rd function deals with 3.23% of the total variance. The remaining variance of 3.94% is shared between the other functions. Only the first three canonical functions made a statistically significant contribution to the model ($p < .05$). The first three canonical functions had larger effect sizes (R_c^2) and had larger cumulative contributions of the first three pairs of canonical variables (functions 1, 2, and 3), which accounted for 96.06%.

Females: In the 1st function, the canonical correlation (R_c) between Set 1 and Set 2 variables was found to be .898. The 2nd function had a canonical correlation of .710. The 3rd, 4th, 5th, 6th, and 7th functions had lower canonical correlations that did not reach conventional statistical significance. 1st squared canonical correlation coefficient (1st function) (R_c^2) revealed that the two canonical variates derived from Set 1 and Set 2 linearly share 80.6 % of the variance (shared variance). In the 2nd function, the two canonical variates derived from Set 1 and Set 2 linearly share 50.4 % of the variance (shared variance). The 1st canonical function explains 72.85 % of the total variance (derived from eigenvalue). The 2nd function deals with the residual variance of the first one, i.e., 17.71 %. The remaining variance of 9.4% is shared between the other functions. Only the first two canonical functions made a statistically significant contribution to the model ($p < .001$).

Table 5 shows the redundancy index for independent and dependent canonical variates of the chosen functions (Function 1 and Function 2 in both sexes and Function 3 in males).

Table 5: Redundancy analysis for canonical correlation analysis: proportion of variance explained

Can. var.	Males				Females			
	Set 1 by self	Set 1 by Set 2	Set 2 by self	Set 2 by Set 1	Set 1 by self	Set 1 by Set 2	Set 2 by self	Set 2 by Set 1
1	.416	.365	.341	.299	.532	.429	.316	.255
2	.129	.068	.180	.095	.122	.062	.117	.059
3	.342	.076	.035	.008	–			

Note. Can. var. = canonical variable

In males, the 1st function had higher indexes of redundancy for the independent variables (.365) and the dependent variables (.299) than the 2nd function (.068 and .095, respectively) and the 3rd function (.076 and .008, respectively). In females, the 1st function has higher indexes of redundancy for the independent variables (.429) and the dependent variables (0.255) than the 2nd function (.062 and .059, respectively). The 2nd function in both sexes and the 3rd function in males had no practical significance, even though they were found to be statistically significant (Hair et al., 2004). The redundancy analysis reduces the multiple significant functions into a single relevant function, further simplifying the interpretations of the interrelationship between two sets of variables. The loadings and cross-loadings of Function 1 have been investigated in detail. Fig. 2a and Fig. 2b represent scatterplots between the scores of the first pair of canonical variates (Function 1) of males and females, depicting a strong correlation between the two canonical variates.

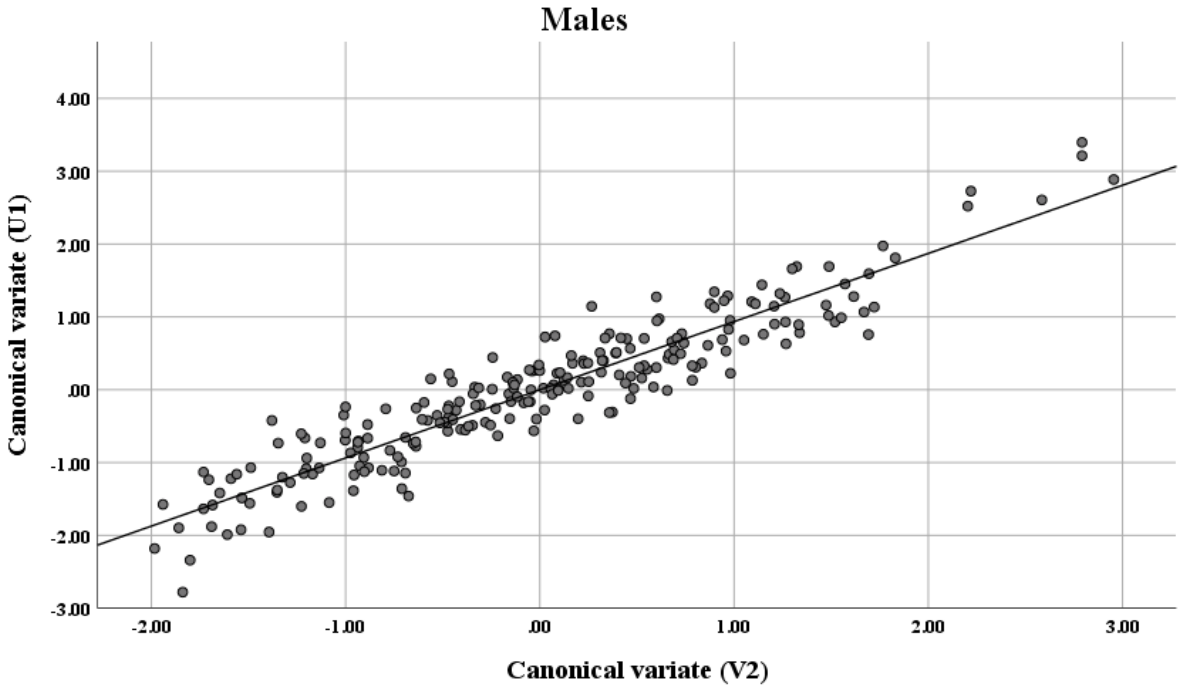

Figure 1a: Scatterplot between the scores of the first pair of canonical variates (Function 1) of males

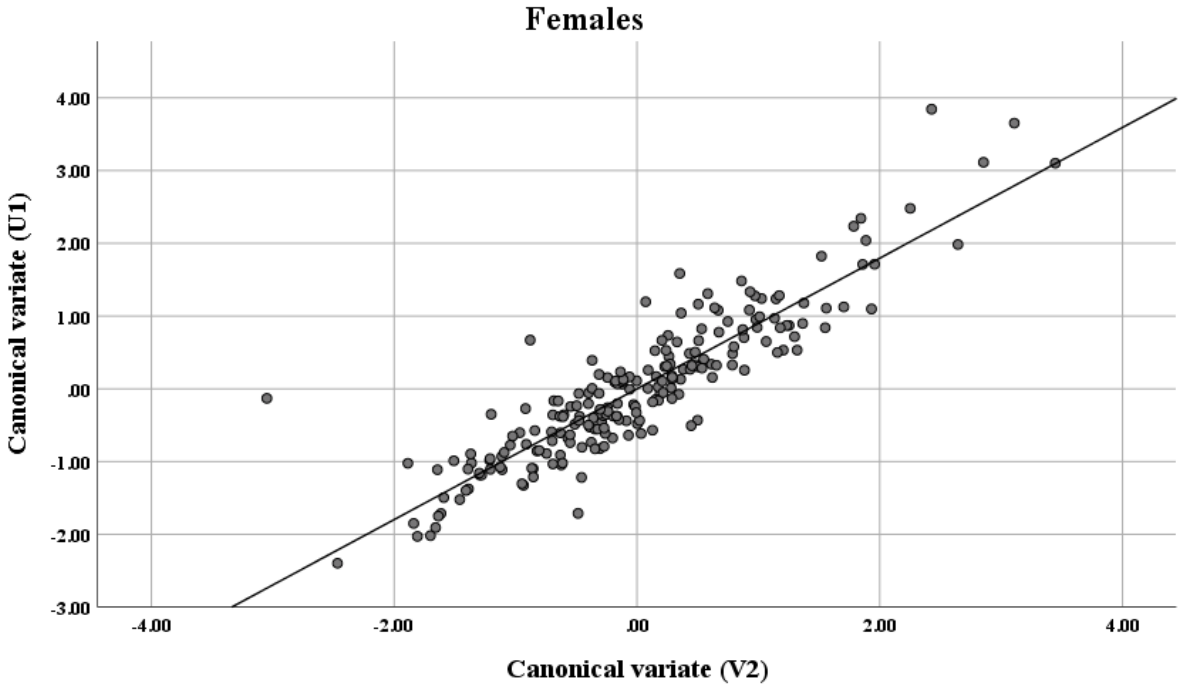

Figure 1b: Scatterplot between the scores of the first pair of canonical variates (Function 1) of females

Table 6: Loadings (structure coefficients) and cross-loadings of the variables for the 1st canonical function among Lodha males and females

		1st Canonical Function					
		Males			Females		
		Loadings	Squared loadings	Cross loadings	Loadings	Squared loadings	Cross loadings
Set 1: Age and Body Composition measures (Independent set)							
Age (years)		-.277	.080	-.259	-.111	.012	-.099
HT (cm)		.469[a]	.219	.439	.490[a]	.240	.440
WT (kg)		.953[a]	.908	.892	.994[a]	.988	.893
BMI (kg/m^2)		.874[a]	.764	.818	.889[a]	.790	.799
BFP (%)		.576[a]	.332	.539	.775[a]	.601	.697
SMP (%)		-.001	.000	-.001	-.694[a]	.481	-.624
VF		.784[a]	.615	.734	.780[a]	.608	.700
Set 2: Foot anthropometric variables (Dependent set)							
LMH (cm)	Left	.409	.167	.383	.328	.107	.295
	Right	.418	.175	.391	.313	.098	.281
MMH (cm)	Left	.370	.134	.346	.355	.126	.319
	Right	.338	.114	.316	.429	.184	.385
AH (cm)	Left	.168	.028	.157	.005	.000	.005
	Right	.163	.027	.153	.045	.002	.041
1st TH (cm)	Left	.382	.146	.357	.322	.104	.290

		1st Canonical Function					
		Males			Females		
		Loadings	Squared loadings	Cross loadings	Loadings	Squared loadings	Cross loadings
	Right	.414	.171	.388	.363	.132	.326
BM (cm)	Left	.520[a]	.270	.487	.342	.117	.307
	Right	.546[a]	.298	.511	.390	.152	.350
AC (cm)	Left	.556[a]	.309	.521	.729[a]	.531	.655
	Right	.558[a]	.311	.522	.757[a]	.573	.680
HAC (cm)	Left	.675[a]	.456	.632	.721[a]	.520	.648
	Right	.680[a]	.462	.637	.735[a]	.540	.660
CG (cm)	Left	.987[a]	.974	.924	.962[a]	.925	.865
	Right	.975[a]	.951	.913	.962[a]	.925	.864
BG (cm)	Left	.653[a]	.426	.611	.514[a]	.264	.462
	Right	.623[a]	.388	.583	.539[a]	.291	.484
IG (cm)	Left	.712[a]	.507	.666	.604[a]	.365	.543
	Right	.707[a]	.499	.662	.601[a]	.361	.540

Note. [a] Loading (structure coefficient, r_s) $\geq .45$ (Sherry & Henson, 2005). Abbreviations: HT—Height, WT—Body weight, BMI—Body mass index, BFP—Body fat percentage, SMP—Skeletal muscle percentage, VF—Visceral fat level, LMH—Lateral malleolus height, MMH—Medial malleolus height, AH—Ankle height, 1st TH—1st toe height, BM—Bimalleolar breadth, AC—Ankle circumference, HAC—Heel-ankle circumference, CG—Calf girth, BG—Ball girth, IG—Instep girth.

Table 6 presents the loadings (structure coefficients) and cross-loadings of the variables for the 1st canonical function among Lodha males and females.

Males: The loadings of the body composition variables in the 1st canonical function revealed that except for age and skeletal muscle percentage, most other body composition measures including height, weight, BMI, body fat percentage, and visceral fat level had high canonical loadings, exceeding |0.45|, Thus, they made the most important contribution to the first canonical variate of their own set (Set 1: independent set). In the second set (Set 2, dependent set), loadings of the foot anthropometric variables on the 1st canonical function revealed that bimalleolar breadth, ankle and heel-ankle circumference, calf, ball, and instep girth loaded most strongly on the first canonical variate of their own set. This conclusion was primarily supported by the squared loadings (squared structure coefficient, r_s^2), which describe the amount of shared variance between the identified significant observed variables and their own canonical variate (Sherry & Henson, 2005). The loadings of the significant variables of the independent set (body composition) and dependent set (foot anthropometry) had the same sign (positive), indicating that they had a positive relationship (Figure **3a**).

The cross-loading values revealed that weight, height, BMI, body fat percentage, and visceral fat level had high correlations with the canonical variate of foot anthropometric variables. These identified significant variables had a higher shared variance with the set of dependent variables (foot anthropometry). From the dependent set, bimalleolar breadth, ankle, and heel-ankle circumference, calf, ball, and instep girth exhibited high correlations with the canonical variate of the opposite set and were highly influenced by the changes in the independent variables (body composition). The variables with higher loading on their own canonical variate also had higher cross-loadings. The signs of cross-loadings of the identified variables from both sets are positive, depicting a positive relationship. Therefore, the malleolar and girth region of the foot was wider among taller and heavier males with higher body fat percentage and visceral fat, and slenderer among shorter and thinner males with lower body fat percentage and visceral fat.

Females: The loadings of the body composition variables for the 1st canonical function revealed that, except for age, all the body composition measures had high canonical loadings exceeding |0.45|,

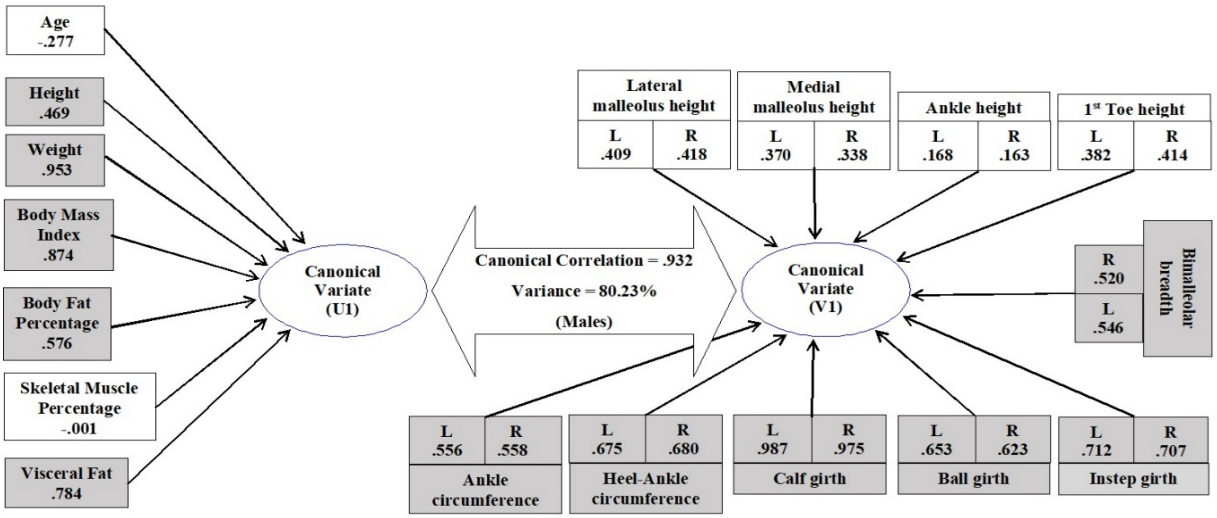

Figure 3a: Relationship between body composition and foot anthropometric variables among adult Lodha males based on loading values (structure coefficients)

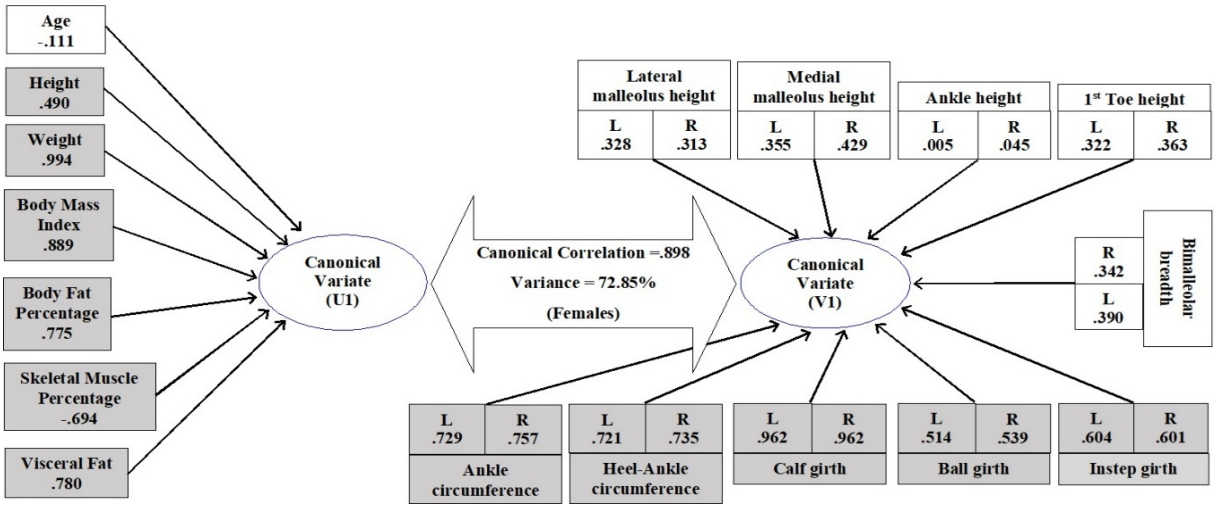

Figure 3b: Relationship between body composition and foot anthropometric variables among adult Lodha females based on loading values (structure coefficients)

and made a significant contribution to the first canonical variate of their own set (Set 1: independent set). Loadings of the foot anthropometric variables for the 1st canonical function revealed that ankle and heel-ankle circumference, calf, ball, and instep girth were the variables that contributed most to the first canonical variate of their own set (Set 2: dependent set). High values of squared loadings (r_s^2) supported this conclusion. The loadings of the significant variables of the independent set (body composition) and dependent set (foot anthropometry) had a positive sign, indicating a positive relationship, except for the loading of skeletal muscle percentage, which displayed a negative sign, indicating a negative (inverse) relationship (Figure **3b**).

The cross-loadings revealed that all the body composition measures had a high correlation with the canonical variate of the opposite set. From the dependent set, ankle and heel-ankle circumference, calf, ball, and instep girth exhibited a high correlation with the canonical variate of the opposite set. The variables with higher loading also had higher cross-loading values. Except for skeletal muscle percentage, the sign of cross-loading values of all the identified variables from both sets was positive. Thus, height, weight, BMI, percent body fat, and visceral fat level were positively correlated, and skeletal muscle percentage was negatively correlated with ankle and heel-ankle circumference, calf, ball, and instep girth. Therefore, the girth region of the foot was wider among taller and heavier females with higher body fat percentage and visceral fat, and a lower skeletal muscle percentage, and slenderer among shorter and thinner females with lower body fat percentage and visceral fat and a higher skeletal muscle percentage.

3 Discussion

The present study, the first of its kind, assessed a multivariate relationship between body composition measures and foot anthropometric variables of the adult Lodha population using Canonical Correlation Analysis (CCA). Males were found to be taller, heavier, and have higher percentages of skeletal muscle and visceral fat than females. Females were found to have larger percentages of body fat than males. This confirms that women have proportionally more fat mass and males have more muscle mass (Schorr et al., 2018). Females typically accumulate adipose tissue around the hips and thighs. In contrast, males are more likely to accumulate adipose tissue around the trunk and abdomen (Bredella, 2017), as evidenced by higher visceral fat level in males in the present study.

When foot anthropometric variables were compared between males and females, it became apparent that males have larger feet with larger width, girth, and circumferential dimensions than females. This is consistent with the prior research that males have considerably longer, wider, and higher feet than females (Baba, 1974; Chaiwanichsiri et al., 2008; Hong et al., 2011; Krauss et al., 2008; Lee & Wang, 2015; Luo et al., 2009; Wunderlich & Cavanagh, 2001; Zhao et al., 2017). Males experience a longer growth phase of bone, including higher bone metabolism and mineralization due to high levels of testosterone. As a result, male bones are heavier and more robust in structure than female bones. These size differences in the bones of males and females are consequently represented in the anthropometric dimensions of the foot, resulting in larger foot dimensions in males (Addai et al., 2018; Bindurani et al., 2017; Ibeabuchi et al., 2018; Kadu & Yadav, 2020; Rahman et al., 2014).

When compared to other populations, ethnic disparities in dimensions of foot anthropometric variables were also observed. The medial malleolus height of adult Lodha males was found to be greater than the foot height (analogous to the medial malleolus height in the present study) of Santhal and Bengalee males (Ahmed et al., 2015). Similarly, Japanese and Taiwanese females had lower sphyrion height and fibular sphyrion height (analogous to medial and lateral malleolus height in the present study) (Lee et al., 2015) than the Lodha females in the present study. Similar findings had been reported by Hajaghazadeh et al. (2018) among North Iranian males. Mean 1st toe height among males of the North American population (Hawes & Sovak, 1994) was found to be lower than in the present study, but the opposite was reported by Lee & Wang (2015) among Japanese adults. Thus, Lodha males and females had taller feet than North American males, Santhal and Bengalee males, and Japanese and Taiwanese females, but shorter feet than Japanese adults.

Girth measurements were found to be higher among North Americans (Hawes & Sovak, 1994), Japanese and Taiwanese (Lee & Wang, 2015; Lee et al., 2015), Malay, Chinese, and Indians (Shariff et al., 2018) and North Iranians (Hajaghazadeh et al., 2018) than among the adult Lodha males and females of the present study, and lower among Japanese adults (Zhao et al., 2017). Furthermore, Lodha women were found to have smaller calf girth than Maasai and Korean women (Choi et al., 2014, 2015). Thus, the Lodha population of the current research exhibits a taller and slenderer foot shape than the majority of the populations across the globe. Such significant foot shape variation can be explained through genetic background, selective adaptation to various climatic zones or geographical regions, livelihood practices, and lifestyle factors (shoe-wearing habits), i.e., going barefoot or habitually or daily using different footwear (Ashizawa et al., 1997; Choi et al., 2015; Kouchi, 1998; Kusumoto et al., 1996; Oria et al., 2017).

Foot morphology also varies due to body weight and nutritional and socioeconomic status (Kouchi, 1998, 2003). Lodhas, the particularly vulnerable tribal group of Paschim Medinipur, are socioeconomically underdeveloped and have critical nutritional conditions (Bepari et al., 2015; Das & Bose, 2015), as illustrated in Table 2. Thus, slenderer foot shape among Lodhas could be intricately linked to nutrition and socioeconomic conditions that contribute to the development of the unique foot morphology among Lodhas.

In the present study, height showed the highest significant positive correlation with bimalleolar breadth (in males) and heel-ankle circumference (in both males and females). Height was also found to be significantly positively correlated with the majority of the foot anthropometric variables. Similar findings had been established by Singh & Phookan (1993), Tobias et al. (2014), and Ibeabuchi et al. (2020). Otherwise, body weight, BMI, body fat percentage, and visceral fat level exhibited the highest significant positive correlation with calf girth across both sexes, and skeletal muscle percentage showed the highest significant negative correlation with calf girth exclusively in females. This conclusion was reinforced by the findings of other investigations (Bonnefoy et al., 2002; de Lucena Ferretti et al., 2023; Durga et al., 2022; Khadivzadeh, 2002; Portero-McLellan et al., 2010). Calf girth is sensitive to muscle mass and body fat as it reflects whole body muscle mass as well as skeletal mass in addition to subcutaneous fat and fat-free mass (Baumgartner et al., 1995; González-Correa et al., 2020; Jonathan et al., 2013; Maeda et al., 2017; Slemenda, 1990; Tsai & Chang, 2011). Thus, the higher the muscle mass and body fat, the wider the foot. Body weight and BMI were significantly positively correlated with most of the foot anthropometric variables. This outcome was consistent with Ashizawa et al. (1997), Domjanić et al. (2013), and Chatha & Mohammad (2020).

Very few studies have examined the influence of being underweight on foot morphology, leaving a significant research void. The prevalence of flat feet among underweight males and females was reported as 24.83% and 36.36%, respectively (Vijaykumar et al. 2016). Ripka et al. (2017), Alimuddin et al. (2020), and Pathan et al. (2022) established the prevalence of high arch and flat arch among underweight participants. Thus, the underweight population has been found to have diminished and falling arches, which is a deviation from normal foot structure, but the etiology of such instances is unknown. Underweight populations are also vulnerable to gait problems and injury, as a serious lack of body mass can induce divergence from normal foot anatomy as well as alterations in fundamental motor functions like gait and postural balance, which can lead to various injuries (Tojo et al., 2018; Vangara et al., 2016). Because the nutritional status of the Indian tribal community is critical (Das & Bose, 2015), and no studies have focused on how body composition shapes foot morphology in ethnic populations of India, the present study focuses on the composite effect of body composition on height, width, and girth measurements of the foot among the Lodha population.

In the CCA analysis, the model depicted that, in males, the most significant predictors of bimalleolar breadth, ankle and heel-ankle circumference, calf, ball, and instep girth were height, weight, BMI, body fat percentage, and visceral fat level. Similarly, in females, the most significant predictor of ankle and heel-ankle circumference, calf, ball, and instep girth was found to be weight, height, BMI, body fat percentage, skeletal muscle percentage, and visceral fat level. Positive cross-loading values indicated that foot shape, particularly the malleolar region (in males) and girth region (both in males and females), was wider among taller and heavier participants with higher body fat percentage, and the shape was slenderer among shorter and thinner participants with lower body fat percentage. The results of several studies indirectly supported these findings (Güven et al., 2009; Price & Nester, 2016; Tománková et al., 2015; Zhao et al., 2017). No studies

linking skeletal muscle percentage and visceral fat level to foot morphology parameters have been reported so far in adults. The present study's findings are the first to address these relationships. Skeletal muscle percentage in females exhibited a significant negative correlation, and visceral fat level in both males and females exhibited a significant positive correlation with the majority of the foot anthropometric measures.

CCA analysis reported that the malleolar and girth region of the foot was wider among males with higher visceral fat, and slenderer among males with lower visceral fat. Furthermore, females with a lower percentage of skeletal muscle and more visceral fat had a wider foot girth, and the converse was observed among females with a higher percentage of skeletal muscle and less visceral fat. Skeletal muscle accounts for 40% of the total body weight (Kim et al., 2016), and visceral fat accounts for 10% of total body fat (Kadir & Mokodompis, 2023; Pausova, 2014). Ghosh & Malik (2010) reported that Santhal female labourers engaged in back-breaking work are lean to fat but muscular, whereas males were found to be lean and muscular. Lodha males and females engage in substantial agricultural and non-agricultural activity, resulting in a lean and muscular body shape. This is also evident from the foot anthropometric measurements of the present study.

The present study has some limitations. It was restricted to a single homogeneous ethnic population. So, findings cannot be generalized. Collecting data on the prevalence of foot-related symptoms could have made the study more extensive.

4 Conclusions

The present study of the adult Lodha population is among the limited studies that assessed the relationship between body composition measures and foot anthropometric variables using multivariate analysis. Height, weight, body mass index (BMI), body fat percentage, skeletal muscle percentage, and visceral fat level significantly shape the height, breadth, and girth of the foot. Any divergence from normal foot anatomy is likely to affect basic motor functions, leading to various ailments such as foot pain, loss of postural balance, and gait problems. Thus, raising awareness concerning foot health and addressing foot shape and dimension issues in adult tribal populations is crucial. Furthermore, India is a multi-ethnic country, and studies focusing on assessing the multivariate relationship between body composition measures and foot anthropometric variables in different ethnic groups will enable more sensitive comparisons between populations and establish population-specific standards. It is firmly believed that the findings of the present study will also contribute new knowledge to public health. To make generalizations, conducting research among diverse populations from different geographical locations is pertinent.

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Availability of data: The data sets analysed in the present study were collected for a doctoral dissertation. The authors would like not to publish the data for public access, as the doctoral degree has not yet been awarded.

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