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From the Editor's desk

With warm Greetings it is a pleasure to release the 38th volume, Issue -2 of The Indian Journal of Home Science.

The year 2026 is a remarkable year for The Home Science Association of India. Two major events are organised during this period.

The Home Science Association of India (HSAI) is holding its 36th Biennial Conference on "Innovation to Impact: Harnessing the Potential of Home and Community Sciences for Social Transformation", Organised by College of Community Science (CoCS), Punjab Agricultural University, Ludhiana Under the aegis of Punjab Branch of HSAI from November 26-to 28, 2026.

This year under the Flagship of Academic Initiative of Home Science Association of India (HSAI) an innovative programme has been introduced to promote research culture in the field with the aim to enhance research orientation, critical thinking and presentation skills among the students of Home Science. It is "NAVDISHA- A RESEARCH COMPETITION By HSAI: National Vision for Discovery and Innovation in Home Science and Allied Fields 2026-2027".

The details of both events are available on the website of HSAI. More and more scholars must participate in these events to strengthen the Field of Home Science. To share the valuable researches carried out, the research papers are welcomed to be published in The IJHSc.

Looking forward to increased number of papers contributed for publication,

Prof. Maneesha Shukul

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DOCUMENTATION, STRUCTURAL ANALYSIS AND DIGITAL INTERPRETATION OF ARCHIVAL TANGALIYA TEXTILES FROM LIVING AND LEARNING DESIGN CENTRE, KUTCH

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ABSTRACT

India possesses a rich repository of traditional textile crafts preserved in museum archives; however, systematic analytical documentation of such collections remains limited. *Tangaliya* weaving, a traditional craft of Gujarat, is one such under-documented textile practice. The present study aims to document and analyse archival *Tangaliya* textile samples preserved at the Living and Learning Design Centre (LLDC), Kutch. A total of nine traditional artefacts were selected through purposive sampling from the museum archive and examined using visual, structural, and material analysis methods. Parameters such as fabric count, including ends per inch (EPI) and picks per inch (PPI), yarn composition, motif characteristics, and construction techniques were analysed. The findings reveal significant variation in structural parameters, with EPI ranging from 14 to 26 and PPI ranging from 14 to 21. A transition in material usage from pure *desi* wool to mixed fibres such as cotton, acrylic, and shoddy yarn was observed, along with increasing incorporation of machine-based finishing elements. The study highlights the evolution of *Tangaliya* textiles from traditional handcrafted garments to modified contemporary forms. The research contributes to the preservation of traditional textile knowledge and provides a systematic framework for archival textile analysis. The study further highlights the unique structural integration of ornamentation in *Tangaliya* weaving and demonstrates the significance of digital illustration as an analytical tool for textile documentation.

Keywords: Kutch, LLDC, Structural Analysis, *Tangaliya*, Traditional Weaving,

INTRODUCTION

Traditional textiles represent an integral component of India's cultural heritage and are often preserved in museums and archival repositories. Despite the availability of such collections, systematic analytical studies focusing on textile structure, materials and evolution remain limited (Bhachu, 2004; Chattopadhyay, 2012; Crill, 2015; Gillow & Barnard, 2008).

The Living and Learning Design Centre (LLDC), Kutch, is one of India's prominent craft museums, housing over 10,000 artefacts including textiles, embroidery and weaving traditions (Living and Learning Design Centre, 2023). While extensive documentation exists in descriptive formats there is a lack of scientific textile analysis of archived artefacts particularly for lesser-documented crafts such as *Tangaliya* weaving.

Tangaliya weaving traditionally practiced by the *Dangasia* community of Gujarat is characterized by the insertion of extra-weft yarns forming bead-like dots known as *daana* on warp threads (Mittal & Chhaya, 2019; Map Academy, 2022). Historically, this craft was associated with garments worn by the Bharwad community, especially wraparound skirts used during ceremonial occasions (Government of India, 2020; Singh, 1998). Over time, the craft has undergone significant transformation due to changing market demands, material availability and product diversification (Anjariya & Kola, 2026).

Previous studies and craft documentation primarily focus on cultural narratives, process descriptions, design development and visual representation (Chaudhari & Patel, 2024; Mittal & Chhaya, 2019; Peri et al., 2024; Shah, 2022). However, there is a clear research gap in terms of systematic analysis of structural textile parameters, material composition and comparative study of archival samples. Therefore, the present study aims to document and analyse Tangaliya textile artefacts from the LLDC archive examine their structural and material characteristics, identify variations and evolution in traditional forms and establish a framework for analytical work.

REVIEW OF LITERATURE

Traditional Indian textiles have been extensively studied because of their historical, artistic and socio-cultural significance. Bhachu (2004) discussed the role of traditional textiles in preserving cultural identity and their contribution to regional economies. Chattopadhyay (2012) described the diversity of Indian textile traditions and emphasized the importance of conserving indigenous weaving practices. Likewise, Crill (2015) and Gillow and Barnard (2008) documented India's rich textile heritage and highlighted the significance of museum collections in preserving traditional weaving knowledge. Varadarajan (1983) further emphasized that systematic documentation of traditional textile practices is essential for safeguarding India's craft heritage, while Sharma (2016) highlighted the importance of sustainable preservation and documentation of handloom textiles.

Among the traditional weaving traditions of Gujarat, Tangaliya weaving has attracted increasing academic attention because of its distinctive extra-weft ornamentation. Mittal and Chhaya (2019) documented the weaving process, raw materials, motif formation and traditional production techniques practiced by the *Dangasia* weaving community. Map Academy (2022) described the historical development, design vocabulary, and cultural significance of *Tangaliya* weaving, whereas Gujarat Tourism (n.d.) recognized it as one of Gujarat's important traditional handicrafts. Shah (2022) reported that the craft has experienced gradual decline due to changing socio-economic conditions and emphasized the need for documentation and preservation.

Recent studies have focused on the role of documentation and digital technologies in conserving traditional crafts. Chaudhari and Patel (2024) demonstrated that digitization of *Tangaliya* design practices contributes to preserving traditional knowledge and improving accessibility for researchers and designers. Similarly, Peri et al. (2024) emphasized that systematic documentation and digital archiving support heritage conservation, educational initiatives and sustainable craft development. The Living and Learning Design Centre (2023) has also undertaken extensive documentation of traditional craft collections; however, these archival records remain largely descriptive and provide limited quantitative analysis of structural textile characteristics.

More recently, Anjariya and Kola (2026) examined the transformation of *Tangaliya* weaving from

traditional pastoral garments to diversified contemporary textile products, highlighting the influence of changing market demands and design innovation. Although previous studies have substantially contributed to understanding the historical development, cultural significance, documentation and revival of *Tangaliya* weaving, limited research has focused on quantitative structural analysis of archival museum specimens. Parameters such as ends per inch, picks per inch, yarn composition, construction techniques and digital structural interpretation remain inadequately explored. Therefore, the present study addresses this research gap by integrating archival documentation with systematic structural analysis and digital interpretation of *Tangaliya* textile artefacts preserved at the Living and Learning Design Centre, Kutch.

OBJECTIVES OF THE STUDY

1. To document archival *Tangaliya* textile artefacts preserved at the Living and Learning Design Centre, Kutch.

2. To analyse the structural characteristics of the selected textile samples with respect to fabric dimensions, ends per inch, picks per inch, yarn composition, motif characteristics, construction techniques and finishing methods.

3. To examine variations in structural and material characteristics among the selected archival textile samples.

4. To investigate the evolution of *Tangaliya* weaving from traditional handcrafted textiles to contemporary modified forms based on archival evidence.

5. To evaluate the usefulness of digital illustration as an analytical tool for textile documentation and structural interpretation.

METHODOLOGY

The present study employed a descriptive and analytical case study approach to examine archival *Tangaliya* textile artefacts preserved at the LLDC, Ajarakhpur, Kutch, Gujarat. The methodology incorporated detailed visual analysis of archival *Tangaliya* textiles together with physical measurements and structural examination to document their construction, material composition, motif characteristics and finishing techniques. The research focused on the detailed investigation of selected archival textiles to understand their structural characteristics, material composition, motif features and construction techniques.

A purposive sampling technique was used to select nine *Tangaliya* textile artefacts from the LLDC archive. The selection was based on the availability of traditional samples possessing adequate structural and visual characteristics for detailed examination. Contemporary reproductions and severely deteriorated artefacts were excluded from the study to ensure authenticity of analysis.

The study was conducted during 2025 after obtaining formal permission from the LLDC authorities for access and documentation of archival collections. Each selected archival *Tangaliya* textile artefact was treated as an individual case and examined through detailed visual analysis, direct observation and physical measurement to document its structural and material characteristics. Data

collected included fabric dimensions, ends per inch, picks per inch, yarn composition, colour combinations, motif characteristics, construction methods, and finishing techniques.

Photographic documentation of each artefact was undertaken to record overall appearance, structural details, and design features. In addition, digital illustrations were developed using Adobe Illustrator and CorelDRAW to facilitate detailed interpretation of motif arrangement, pattern structure, and design composition.

Data analysis was carried out through individual case analysis followed by comparative analysis across the nine artefacts. Descriptive statistical measures such as range and frequency distribution were used to summarize structural characteristics, while qualitative interpretation was employed to understand variations in materials, motifs, and construction techniques. The findings were further analysed to identify patterns of continuity and change in traditional *Tangaliya* weaving practices.

The study was limited to nine archival *Tangaliya* textile artefacts available in the LLDC collection and did not include field-based investigation of contemporary weaving communities.

RESULTS AND ANALYSIS

The structural analysis of archival samples is presented in Table 1. The analysis of the nine archival *Tangaliya* samples revealed considerable variation in structural parameters. The fabric density showed that ends per inch ranged from 14 to 26, while picks per inch varied between 14 and 21. This variation indicates the absence of standardization in traditional weaving practices and reflects differences in artisan techniques and intended fabric usage.

In terms of yarn composition, it was observed that five samples were composed entirely of *desi* wool, while four samples exhibited a combination of materials such as cotton, acrylic, and recycled shoddy yarn. This suggests a transition in raw material usage over time influenced by factors such as cost, availability and market demand.

The colour palette used in the *daana* motifs predominantly included rani pink, green, yellow, orange and white, indicating strong adherence to traditional aesthetic preferences. Motif structures were primarily geometric and nature-inspired, reflecting cultural symbolism rooted in the local environment and community practices.

Construction techniques observed in the samples included various methods of joining such as catch stitch, running stitch and herringbone stitch. Finishing techniques ranged from traditional hand embroidery, such as *bavadiyo* stitch, to the incorporation of machine lace and synthetic materials like polyester piping. These findings demonstrate a gradual integration of modern techniques into traditional textile construction.

Representative samples and their corresponding digital illustrations are presented in Figures 1.1 to 9 to demonstrate structural and design characteristics.

Fig. 1.1: Article 1 from Archive of Living and Learning Design Centre

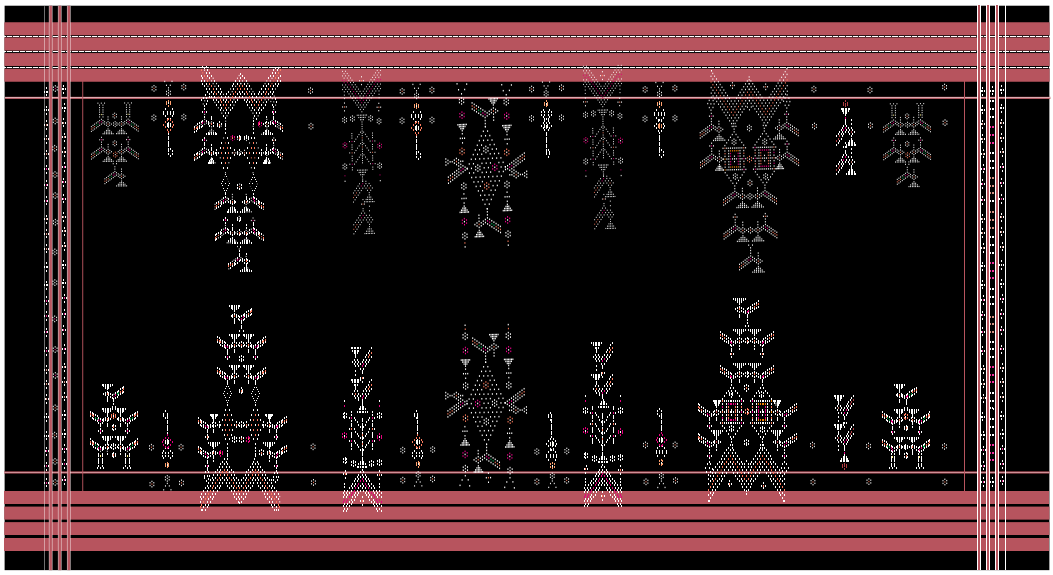

Fig. 1.2: Article 1's Digital Illustration

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur, archive.
Article Name &/Type: *Tangaliyo* – a wraparound skirt.
Article No.: 1491.
Details on the Plate: D.C.O.W code RB/3080/320, *Odhana*, Bharwad, 1491, Rs. 750, 30/04/20210
Sample analysis brief – Visual analysis/first hand analysis: 270 cm x 100 cm , 20 ends per inch, 18 picks per inch, yarns (raw material) were all desi wool(wool collected from local sheep), colours used in *daana* were rani pink, mild green, yellow, orange all dyed wool, The edges were embroidered with *bavadiyo* stitch embroidery, creating a border on all four sides; machine lace and plastic shirt buttons were used to add more embellishment; the edge tips were sewed the piping using digital print polyester fabric, which is typically used by Maldhari men of Kutch, like rumal; two separate pieces were joined using basket stitch from the center to create a single

skirt fabric.

Fig. 2.1: Article 2 from Archive of Living and Learning Design Centre

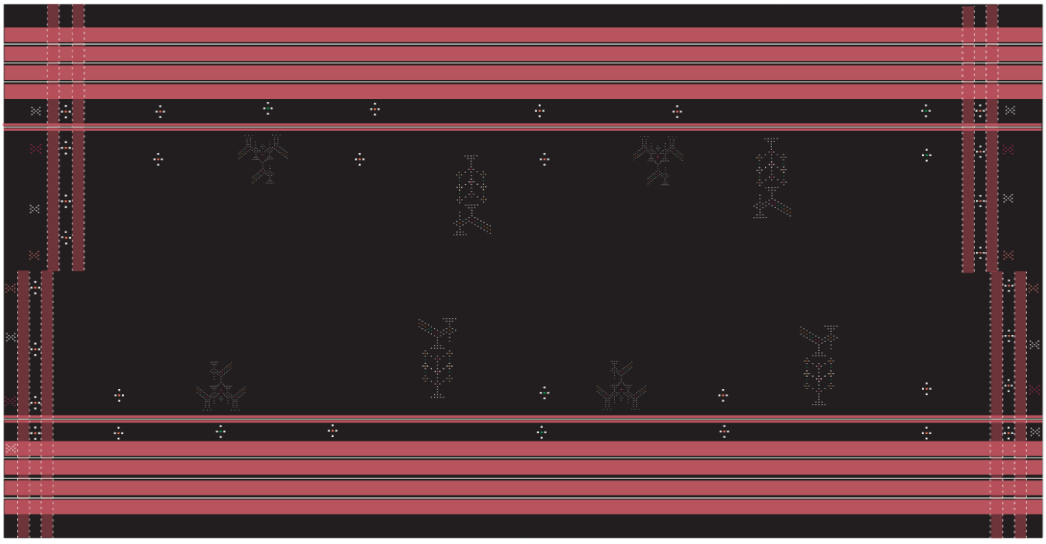

Fig. 2.2: Article 2's Digital Illustration

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur, archive.
Article Name &/Type: *Vellaro* – a wraparound skirt.
Article No.: AT 5392
Details on the Plate: Not available.
Sample analysis brief – Visual analysis/first hand analysis: 246 cm x 106 cm, 20 ends per inch, 20 picks per inch. All of the yarns were made from desi wool, which was gathered from local sheep. The colours used in *daana* were bleached white, rani pink, dark green, and orange. The two parts of the single skirt cloth were joined from the mirrored edge by hand stitching a herringbone stitch, and the edge was also hand stitched using hemming.

Fig. 3.1: Article 3 from Archive of Living and Learning Design Centre

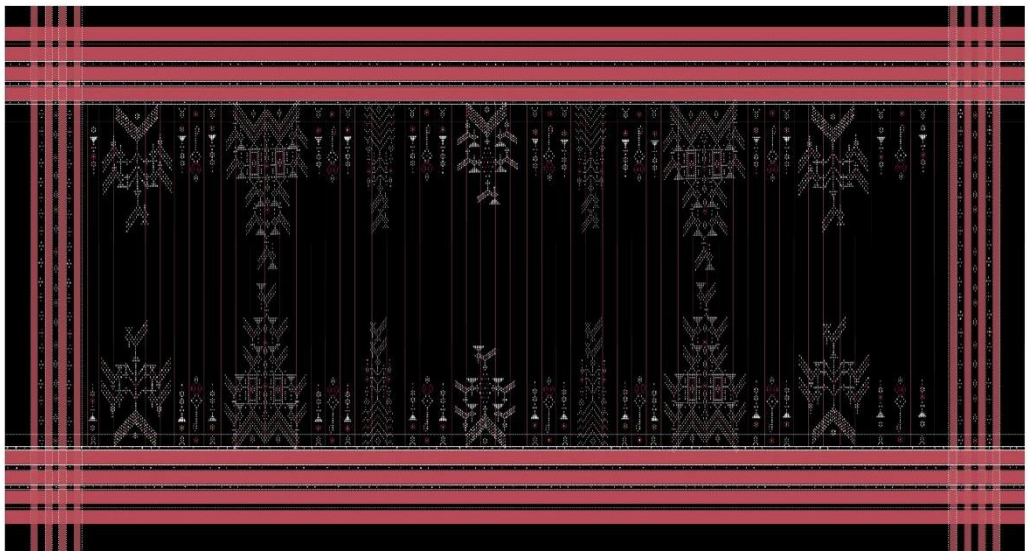

Fig. 3.2: Article 3's Digital Illustration

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur, archive.
Article Name &/Type: *Tangaliyo* – a wraparound skirt.
Article No.: 1492
Details on the Plate: D.C.O.W RB/3081/320, *Odhana*, Bharwad, 1492, Rs. 750, 30/04/2010, Purchased from Rupesh.
Sample analysis brief – Visual analysis/first hand analysis: 271.5 cm x 101.5 cm, 18/19 ends per inch, 14 picks per inch. Desi wool, which was collected from nearby sheep, was used to make all of the yarns. Orange, pale green, rani pink, and bleached white were the colours utilised in *Daana*. The two pieces of the single skirt material were joined from the mirrored edge by hand sewing a catch stitch in maroon wool thread; more adornment was added with machine lace; and the edge tips were sewed the piping using digital print polyester fabric, which is commonly used by *Kutchi Maldhari* men, such as rumal.

Fig. 4: Article 4 from Archive of Living and Learning Design Centre

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur, archive.
Article Name &/Type: *Tangaliyo* – a wraparound skirt.
Article No.: none.
Details on the Plate: no plate.
Sample analysis brief – Visual analysis/first hand analysis: 286 cm x 116 cm. Desi wool was used to make the yarns used for the warp, weft, and *daana*. The yarns were coloured black, white, and maroon, while the *daanas* were coloured white and maroon. Two halves were attached from the mirrored edge by hand sewing a running stitch in pink cotton thread. Although the piece was extremely fragile, it was possible to determine that the fabric structure count was 14 ends per inch and 17/16 picks per inch. The item was in good condition when the museum bought it from the dealer, however there was some little moth damage. It may be from the Surendranagar region based on the motif vocabulary.

Fig. 5: Article 5 from Archive of Living and Learning Design Centre

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur, archive.
Article Name &/Type: *Tangaliyo* – a wraparound skirt.
Article No.: 2548.
Details on the Plate: D.C.O.W, *Odhana*, Rabaari (Peno), 2548, Rs. 1600, 15/06/2014, Heritage Purchase Team.
Sample analysis brief – Visual analysis/first hand analysis: 299 cm x 98 cm, 24 ends per inch, 20 picks per inch. All of the yarns were made from desi wool, which was gathered from local sheep. The colours used in *daana* were bleached white, rani pink, blue, yellow, and orange. The two parts of the single skirt cloth were joined from the mirrored edge by hand stitching a running stitch in green cotton thread, and the edge was also hand stitched using the same thread.

Fig. 6: Article 6 from Archive of Living and Learning Design Centre

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur, archive.
Article Name &/Type: *Tangaliyo* – a wraparound skirt.
Article No.: AT5391
Details on the Plate: Not available.
Sample analysis brief – Visual analysis/first hand analysis: 236 cm x 104.5 cm , 24 ends per inch, 20 picks per inch, black coloured yarns were all desi wool, maroon colored yarns were shoddy yarn, and white coloured yarn is cotton whereas all colours used in *daana* were *rani* pink, dark green, yellow, orange all dyed desi wool, The both end edges were embroidered with *bavadiyo* stitch embroidery, machine laces were used to add more embellishment; the edge tips were sewed the piping using machine sewing with digital print polyester fabric, which is typically used by *Maldhari* men of Kutch, like *rumal* (a handkerchief); two separate pieces were joined using catch stitch from the center to create a single skirt fabric.

Fig. 7: Article 7 from Archive of Living and Learning Design Centre

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur, archive.
Article Name &/Type: *Tangaliyo* – a wraparound skirt
Article No.: 1465
Details on the Plate: D.C.O.W RB/3111/320, *Odhana*, Rabaari-Bharwad, 1465, Rs. 400, 30/04/2010, Purchased from Mahendra Gandalal.
Sample analysis brief – Visual analysis/first hand analysis: 271.5 cm x 101.5 cm, 18 ends per inch, 18 picks per inch. *Desi* wool, which was collected from nearby sheep, was used to make all of the yarns coloured black, maroon, and white. Orange, pale green, rani pink, and lime yellow were the colours utilised in *Daana* created using acrylic yarn. The two pieces of the single skirt material were joined from the mirrored edge by hand sewing a catch stitch in maroon wool thread; more adornment was added with machine lace; and the edge tips were sewed the piping using digital print polyester fabric, which is commonly used by Kutchi *Maldhari* men, such as *rumal*.

Fig. 8: Article 8 from Archive of Living and Learning Design Centre

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur,

archive.
Article Name &/Type: *Tangaliyo* – a wraparound skirt.
Article No.: 2917
Details on the Plate: no details.
Sample analysis brief – Visual analysis/first hand analysis: 291 cm x 104 cm, 26 ends per inch, 21 picks per inch. Soddy yarn coloured black, maroon, and white was cotton. Orange, dark green, parrot green, rani pink, white, and yellow were the colours utilised in *Daana* created using acrylic yarn. The two pieces of the single skirt material were joined from the mirrored edge by hand sewing a catch stitch in maroon shoddy thread; more adornment was added with artificial metallic zari yarn used in warp and weft; and the edge tips were fold and hand sewn

Fig. 9: Article 9 from Archive of Living and Learning Design Centre

Artifact from Collection: Living and Learning Design Centre, Craft Museum – Ajarakhpur, archive.
Article Name &/Type: *Charmaliyo* – a wraparound skirt.
Article No.: none.
Details on the Plate: no plate.
Sample analysis brief – Visual analysis/first hand analysis: 269 cm x 114.5 cm, 24 ends per inch, 19/20 picks per inch, Warp and weft yarns maroon and black coloured Shoddy. white colored yarn was cotton, white yarns used in *daana* were cotton whereas other coloured yarns were acrylic the colours were rani pink, green and orange, two pieces were joined from the mirrored edge using machine sewing to create one full skirt fabric. From the motif vocabulary one can say that it is possibly from Surendranagar region.

Structural Parameters of *Tangaliya* Samples

The structural analysis of archival samples is presented in Table 1.

Table 1: Structural Parameters of *Tangaliya* Textile Samples

Sample No.	Length (cm)	Width (cm)	EPI	PPI	Yarn Composition
1	270	100	20	18	Wool
2	246	106	20	20	Wool
3	271.5	101.5	18–19	14	Wool
4	286	116	14	16–17	Wool
5	299	98	24	20	Wool
6	236	104.5	24	20	Mixed
7	271.5	101.5	18	18	Mixed
8	291	104	26	21	Mixed
9	269	114.5	24	19–20	Mixed

The data indicate that EPI varies between 14 and 26, while PPI ranges from 14 to 21, demonstrating variability in fabric density across samples.

Fabric Density Analysis

Table 2: Range of Fabric Density Parameters

Parameter	Minimum	Maximum
EPI	14	26
PPI	14	21

The variation in fabric density suggests absence of standardization and dependence on artisan skill and intended fabric function.

Yarn Composition Analysis

Table 3: Distribution of Yarn Types

Yarn Type	Number of Samples	Percentage (%)
Pure Wool	5	55.6
Mixed Yarn	4	44.4

The results indicate that traditional samples predominantly used desi wool, while later samples incorporate cotton, acrylic and recycled yarns.

A comparison between earlier and later samples suggests that traditional artefacts predominantly utilized pure wool, whereas recent samples exhibit incorporation of mixed fibers, indicating material transition influenced by economic and market factors.

Motif and Colour Characteristics

Table 4: Common Colours Used in *Tangaliya* Samples

Colour	Frequency
Rani Pink	High
Green	High
Yellow	Medium
Orange	Medium
White	High

Motifs observed were primarily geometric and nature-inspired, reflecting traditional aesthetic and cultural symbolism.

Construction and Finishing Techniques

Table 5: Construction Techniques Observed

Technique Type	Methods Observed
Joining Techniques	Catch stitch, Running stitch, Herringbone stitch
Finishing Techniques	*Bavadiyo* embroidery, Machine lace, Polyester piping

The integration of machine-based elements indicates gradual modernization of traditional textile construction.

Role of Digital Illustrations in Structural Interpretation

The development of digital illustrations enabled enhanced interpretation of *Tangaliya* textile structures. Through vector-based reconstruction, motif arrangements and pattern repeats were analysed more precisely than through direct observation alone. The illustrations revealed consistent geometric alignment in motif placement, which may not be immediately evident in aged or worn textile samples.

Additionally, digital reconstruction allowed identification of proportional relationships between motif size, spacing, and fabric dimensions. This facilitated comparative analysis across samples, highlighting variations in design density and motif distribution.

The use of digital illustrations also aided in distinguishing between traditional and modified design elements. For instance, irregularities in motif placement observed in certain samples could be systematically analysed and interpreted as either artisan-specific variation or later-stage modification. This demonstrates the potential of digital illustration as a standardized analytical tool for textile archive documentation.

DISCUSSION

The findings of this study indicate a clear transition in *Tangaliya* textiles from traditional handcrafted forms to modified contemporary versions. Earlier samples, composed entirely of desi wool, represent the original form of the craft, closely tied to local resources and community practices. In contrast, later samples incorporating cotton, acrylic, and recycled yarn reflect adaptation to changing economic and market conditions.

The variation in structural parameters such as EPI and PPI suggests that *Tangaliya* weaving was historically dependent on artisan skill and did not follow rigid standardization. This variability is a characteristic feature of handmade textiles, where individuality of production is inherent.

The introduction of machine-based finishing and synthetic materials indicates technological influence and a shift towards hybrid production methods. While this enhances durability and market appeal, it also raises concerns regarding the preservation of traditional authenticity.

Culturally, *Tangaliya* textiles were originally associated with specific communities and ceremonial use. However, the decline in traditional garments and the emergence of diversified products such as stoles, sarees and yardage fabrics reflect a shift towards commercialization. This transformation highlights the need for systematic documentation and preservation of traditional knowledge.

CONCLUSION

The present study provides a systematic structural and material analysis of *Tangaliya* textile artefacts from the LLDC archive. The results demonstrate variation in fabric density, yarn composition and construction techniques across samples. The transition from pure wool-based traditional textiles to mixed-material contemporary forms reflect the influence of market dynamics and technological adaptation.

This research emphasizes the importance of moving beyond descriptive documentation towards analytical study of archival textiles. The methodology developed offers a structured framework for future textile archive research and contributes to the preservation and understanding of traditional weaving practices. The integration of structural analysis with digital documentation presents a replicable model for future textile archive research and preservation.

FUTURE SCOPE

The study highlights the potential for reviving traditional *Tangaliya* weaving techniques through sustainable design interventions. Future research may focus on comparative analysis between archival and contemporary *Tangaliya* products and explore the integration of traditional techniques into modern textile applications.

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GENDER, ENTERPRISE, AND RESILIENCE: MAPPING THE SOCIO-CULTURAL AND INSTITUTIONAL BARRIERS FACED BY WOMEN IN DELHI-NCR'S FASHION INDUSTRY

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ABSTRACT

The fashion industry in India presents a paradox for women entrepreneurs; it is widely perceived as a domain of creative belonging, yet it systematically excludes women from the capital, networks, and institutional support that would enable their enterprises to grow. This study investigates the gendered dimensions of entrepreneurial experience among 120 women operating fashion businesses in the Delhi-NCR region. Using a mixed-method design that combines structured surveys with twenty in-depth interviews, the study foregrounds socio-cultural and dual-burden barriers as primary objects of inquiry, rather than treating finance as the sole constraint. Findings, derived through descriptive statistics, Likert-scale scoring, chi-square analysis, and thematic coding, reveal those socio-cultural expectations around gender roles (mean 4.6) and the dual burden of caregiving alongside business management (mean 4.5) rank above financial access (mean 4.3) as the most intensely experienced barriers. A typology of three entrepreneur profiles, necessity-driven, opportunity-driven, and community-embedded, emerges from the qualitative data, each facing a distinct configuration of challenges. Chi-square analysis confirms that barrier intensity differs significantly across entrepreneur types for socio-cultural expectations, caregiving burden, gender scepticism, and mobility constraints. Informal peer networks and family support constitute the primary resilience infrastructure for most participants, partially compensating for the absence of formal support. The study provides policy recommendations targeted at educators, state-level incubation bodies, and women's self-help networks, arguing that sustainable progress for women in fashion entrepreneurship requires reconfiguring the social and institutional environment, rather than merely adding financial instruments.

Keywords: Delhi-NCR, entrepreneurial barriers, fashion enterprise, gender-aware framework, women entrepreneurs

INTRODUCTION

India's fashion industry has transformed from a craft-based sector into a commercially dynamic ecosystem generating employment, exports, and cultural expression. Women have been central to this transformation. In Delhi-NCR, women entrepreneurs have built boutique labels, sustainable apparel lines, and home-based stitching units that testify to considerable creative and commercial energy. However, the mere growth in numbers does not capture the quality and sustainability of these

entrepreneurial journeys. What remains underexamined is whether women are genuinely able to scale their ventures, build professional identities, and access the institutional resources that comparable male entrepreneurs more readily command (Brush et al., 2009).

The Home Science discipline has a long tradition of engaging with women's productive roles in textiles, clothing, and resource management, and increasingly this engagement has extended to entrepreneurship. This study situates itself within that tradition, adopting a gendered lens to examine how women in Delhi-NCR's fashion sector negotiate multiple overlapping constraints. Brush, de Bruin, and Welter's (2009) gender-aware framework provides the conceptual foundation: it argues that women's enterprise creation is embedded within relational networks, family, community, market, and state, that simultaneously enable and constrain entrepreneurial activity.

Existing research has tended to foreground financial access as the defining barrier to women's entrepreneurship in India (Baral et al., 2023; Chhabra et al., 2023). While capital constraints are undeniably significant, this framing risks obscuring socio-cultural and institutional dimensions that often determine whether financial support, when available, translates into sustained growth. The present study deliberately shifts emphasis, treating the dual burden of domestic labour, gender-based professional scepticism, and the gap between policy intent and ground-level reality as coequal objects of investigation. It also introduces an entrepreneur typology, necessity-driven, opportunity-driven, and community-embedded, that recognises heterogeneity within the population that most survey studies flatten. This typological approach offers a more nuanced diagnostic framework that can inform targeted, differentiated support rather than the one-size-fits-all programme design that has characterised most government interventions to date (NITI Aayog, 2023).

The study's significance extends beyond the academic domain. Fashion entrepreneurship in Delhi-NCR involves tens of thousands of women whose creative labour and economic contributions are systematically undervalued in both statistical reporting and policy design. By generating evidence grounded in women's own accounts of their experience, the study contributes to an advocacy base for more responsive institutional arrangements, with its sustained commitment to women's vocational empowerment. (Henry et al., 2015).

OBJECTIVES

1. To document the specific socio-cultural and institutional barriers women encounter in Delhi-NCR's fashion sector, beyond a finance-centred account.
2. To identify distinct entrepreneurial typologies and examine how entry motivation shapes barrier intensity.
3. To examine informal support networks as resilience mechanisms that partially compensate for the absence of formal support.
4. To recommend actionable strategies for educators, incubation bodies, women's networks, and industry stakeholders.

HYPOTHESIS AND DELIMITATIONS

Hypotheses

H01: Barrier intensity does not differ significantly across entrepreneur types (necessity-driven, opportunity-driven, community-embedded) for socio-cultural expectations.

H02: Barrier intensity does not differ significantly across entrepreneur types for the dual burden of caregiving alongside business management.

H03: Barrier intensity does not differ significantly across entrepreneur types for gender-based professional scepticism.

H04: Barrier intensity does not differ significantly across entrepreneur types for mobility and safety constraints.

Delimitations

The study is delimited to women fashion entrepreneurs operating in Delhi, Noida, and Gurugram, and does not extend to other regions of India or to male entrepreneurs for comparison. The sample of 120 participants, 100 survey respondents and 20 interview participants, reflects the scope of a doctoral study and is not intended to be nationally representative. The cross-sectional design captures barrier intensity at a single point in time rather than tracking change over the life of a business. Findings rely on self-reported data collected through structured surveys and semi-structured interviews, which may be subject to recall and social desirability effects.

REVIEW OF LITERATURE

Gender-Aware Frameworks in Entrepreneurship Research

Mainstream entrepreneurship research has historically been built on male-centred models that treat enterprise creation as an individual, market-rational act (Henry et al., 2015). Scholars in the gender and entrepreneurship tradition argue that women's entrepreneurial experiences are fundamentally relational, shaped by household structures, community expectations, and institutional environments that do not treat women and men as equivalent economic actors (Brush et al., 2009). Bullough et al. (2022), examining data across twenty-six countries, confirm that cultural gender role identities significantly moderate the relationship between entrepreneurial intention and actual venture creation, particularly in societies characterised by traditional family structures. In India, where the joint family system shapes women's time sovereignty and mobility, these dynamics are particularly salient for fashion entrepreneurs in metropolitan clusters.

The Dual Burden and Invisible Labour

The co-existence of productive and reproductive labour demands on women, the dual burden, has been extensively theorised in feminist economics. In the entrepreneurship context, Anambane and Adom (2018) document how cultural scripts around femininity and domesticity circumscribe women's participation in activities that visibly compete with caregiving roles. For fashion entrepreneurs, this manifests as an inability to attend trade events, reduced time for strategic planning, and psychological exhaustion that constrains risk-taking. Samantroy and Tomar (2018) find that home-based enterprises are disproportionately chosen by women precisely because they

accommodate domestic responsibilities. However, this accommodation comes at the cost of scale, visibility, and professional recognition. Surangi (2018) further demonstrates that women entrepreneurs perform substantial intellectual and relational labour that remains unrecognised in both family and market settings.

Necessity versus Opportunity Entrepreneurship

A distinction receiving growing attention is that between necessity-driven and opportunity-driven enterprise creation (GEM, 2024). Necessity entrepreneurship, entering business in response to household financial pressure, is associated with lower growth ambition, smaller capital deployment, and higher exit vulnerability (Franczak et al., 2023). In India, a significant proportion of women-led ventures in creative sectors originate from necessity, as women commercialise domestic skills in response to income shocks (Dana, 2000; Baral et al., 2023). A third category, community-embedded entrepreneurship, has been identified in studies that treat social capital and collective action as primary resources (Simba et al., 2023; Ojong et al., 2021). The present study's typological approach draws on all three categories to illuminate how entry motivation shapes the texture of entrepreneurial experience.

METHODOLOGY

Research Design

A mixed-method design combining structured surveys administered to 120 women entrepreneurs with twenty semi-structured in-depth interviews was adopted. This dual architecture enables systematic ranking of barriers through quantitative instruments while foregrounding the personal and contextual dimensions that statistics alone cannot capture. The design reflects the gender-aware framework's insistence that women's entrepreneurship cannot be adequately understood solely through numbers.

Sampling, Data Collection, and Tools of Analysis

Purposive sampling ensured diversity in enterprise type, business age, educational background, and geographic sub-location. The sample included boutique owners, artisanal textile entrepreneurs, sustainable fashion brands, and home-based stitching units across Delhi, Noida, and Gurugram. Survey data were collected from 100 participants; twenty participated in extended interviews of forty-five to sixty minutes. The survey instrument, validated through a ten-participant pilot study, measured seven barrier dimensions on a five-point Likert scale: socio-cultural expectations, dual burden of caregiving, access to formal finance, professional gender scepticism, government scheme awareness and access, mobility and safety constraints, and mentorship availability. Chi-square analysis tested associations between entrepreneur type and barrier intensity. Interview transcripts were analysed through inductive thematic coding in NVivo.

Table-1: Profile of Survey Respondents (n = 100)

Variable	Category	Percentage (%)
Age Group	Up to 25 years	18
	26–35 years	44
	36–45 years	28
	Above 45 years	10

Education	Graduate / Postgraduate	68
	Diploma / Below Graduate	32
Enterprise Type	Boutique / Bespoke Stitching	38
	Online Fashion Brand	28
	Artisanal / Craft-Linked Textile	20
	Sustainable / Ethical Label	14
Entry Motivation	Necessity-driven	46
	Opportunity-driven	34
	Community-embedded	20
Business Age	0–5 years	58
	6–10 years	27
	More than 10 years	15

FINDINGS AND DISCUSSION

Barrier Intensity by Dimension: Likert Scale Rankings

Survey respondents scored seven barrier dimensions on a five-point scale anchored at 1 (not a challenge) and 5 (extremely significant). The resulting hierarchy challenges the finance-first framing dominant in much existing literature, placing socio-cultural and dual-burden factors above financial access.

Table 2: Barrier Intensity Rankings (Mean Scores, 5-Point Likert Scale, n = 100)

Rank	Barrier Dimension	Mean	Std Dev
1	Socio-cultural expectations around gender roles and domestic duties	4.6	0.58
2	Dual burden: caregiving alongside business management	4.5	0.62
3	Access to formal finance and credit	4.3	0.68
4	Gender-based scepticism from vendors, clients, and employees	4.0	0.74
5	Inadequate reach of government support schemes	3.8	0.81
6	Mobility and safety constraints on business travel and networking	3.6	0.87
7	Absence of mentorship and structured peer networks	3.4	0.92

Socio-cultural expectations (mean 4.6) reflect the normative environment within which women entrepreneurs operate. Family members, neighbours, and community peers frequently held implicit views about the appropriateness of women devoting significant time and energy to business ventures, particularly those that require late hours, travel, or public-facing activity. These expectations operated less through active prohibition and more through subtle pressure, informal disapproval, and the absence of practical support that treated the business as a legitimate family priority. This pattern echoes existing research: Bullough et al. (2022) similarly find that such cultural pressures are not

confined to less-educated or lower-income households, but appear with comparable frequency across educational and income levels, confirming their structural rather than incidental character.

The dual burden (mean 4.5) is not merely attitudinal but material. Women described managing school schedules, elderly care, and household provisioning alongside client enquiries, supplier management, and stock procurement. This dual demand introduces chronic interruptions and cognitive load, making long-horizon strategic thinking, the kind that enables business expansion, particularly difficult to sustain (Anambane & Adom, 2018). The problem is compounded during festival seasons, when fashion demand peaks and domestic obligations simultaneously intensify, forcing entrepreneurs to choose between business opportunities and family expectations in ways male counterparts rarely face. Financial access (mean 4.3), though third-ranked, remains significant: women reported that formal lenders routinely demand collateral they rarely possess independently and frequently question business viability on gendered grounds. Many had navigated around this barrier through informal family loans or rotating credit arrangements within peer groups. However, such informal mechanisms carry their own relational costs and impose ceilings on investable capital. Gender scepticism in market dealings (mean 4.0) was consistently noted: vendors quoting higher prices to women buyers, and clients deferring to male family members in negotiations, impose real costs in terms of time, energy, and professional confidence.

Chi-Square Analysis: Entry Motivation and Barrier Intensity

Chi-square tests examined whether barrier intensity differed significantly across necessity-driven, opportunity-driven, and community-embedded entrepreneurs. Results confirm significant associations for socio-cultural expectations (chi-square = 12.74, df = 4, p = 0.013), dual burden (chi-square = 14.39, df = 4, p = 0.006), gender scepticism (chi-square = 10.83, df = 4, p = 0.029), and mobility constraints (chi-square = 11.62, df = 4, p = 0.020). Government scheme access and mentorship availability did not differ significantly across types, confirming that institutional failures are broadly distributed across entrepreneur categories.

Table 3: Chi-Square Test Result — Association Between Entrepreneur Type and Barrier Intensity

Barrier Dimension	χ^2 value	df	p-value	Significance
Socio-cultural expectations	12.74	4	0.013	Significant
Dual burden (caregiving)	14.39	4	0.006	Significant
Access to formal finance	9.21	4	0.056	Marginal
Gender-based scepticism	10.83	4	0.029	Significant
Government scheme access	7.44	4	0.114	Not significant
Mobility and safety	11.62	4	0.020	Significant
Mentorship and peer networks	6.98	4	0.137	Not significant

The Entrepreneur Typology and Resilience Strategies

The qualitative data enabled the construction of three distinct entrepreneur profiles. Necessity-driven entrepreneurs (46%) entered the fashion industry, stitching, embroidery, and basic garment production, in response to a household financial crisis, rarely with formal business planning. Their

key constraint is not primarily capital but the absence of strategic orientation and market knowledge that would allow growth beyond a local clientele. Opportunity-driven entrepreneurs (34%) entered with greater pre-existing assets, design education, professional networks, and brand development capacity, but face persistent gender scepticism in vendor negotiations and the emotional fatigue of constantly establishing business credibility in settings where male entrepreneurs are assumed capable by default. Community-embedded entrepreneurs (20%) operate within and for craft communities, drawing on collective identity and shared knowledge as competitive resources; their ceiling on scale is more pronounced, but mobility constraints are relatively lower (Ojong et al., 2021).

Across all three types, resilience was grounded primarily in informal support. WhatsApp communities of local entrepreneurs provided practical intelligence on suppliers, pricing, and regulatory updates faster than formal channels. Family logistical support, spouses managing household tasks during busy periods, and children helping with packaging constituted invisible productive labour that sustained enterprises without formal recognition. Several respondents had formed informal micro-cooperatives sharing transport, equipment, and customer referrals. These adaptive strategies extend reach within existing constraints but do not dissolve them (Surangi, 2018).

SUMMARY, CONCLUSION, AND IMPLICATIONS

Summary of Findings

The study confirms that the barriers facing women entrepreneurs in Delhi-NCR's fashion sector are not reducible to financial exclusion alone; socio-cultural expectations and the dual burden of caregiving rank as the most intense constraints. Entry motivation shapes the configuration of barriers significantly; necessity-driven entrepreneurs face a different, and in some respects more entrenched, set of challenges than their opportunity-driven or community-embedded counterparts. The typological analysis shows that this difference calls for correspondingly differentiated support: a necessity-driven entrepreneur who entered business without planning or networks needs a different intervention from an opportunity-driven designer navigating gender scepticism in wholesale markets, and a single loan product or digital training workshop cannot serve both equally well. Informal peer networks and family support constitute the primary resilience infrastructure, compensating for formal institutional failures in ways that are individually costly and largely invisible to policy.

Conclusion

Women entrepreneurs in Delhi-NCR's fashion industry are not passive recipients of constraint; they are active negotiators of a social and institutional environment that routinely undervalues their labour. Their resourcefulness in sustaining enterprises despite limited formal support should not be mistaken for institutional adequacy: it reflects the absence of systems that should have supported them in the first place. Meaningful progress depends on recognising women fashion entrepreneurs as a heterogeneous group whose differing entry points and constraints call for differentiated, rather than uniform, support. The discipline is well-positioned to contribute to this shift, with its established strengths in textile education, resource management, and women's vocational development offering a natural foundation for training that prepares graduates for both the creative and the commercial, gendered realities of running a fashion business.

Policy and Practice Implications

At the state level, the evidence argues for a shift from gender-neutral to gender-responsive programme design. Schemes requiring women to visit district offices during daytime hours, present collateral, or complete complex documentation in the absence of advisory support will systematically exclude necessity-driven entrepreneurs who most need assistance. Locally anchored outreach through self-help groups, neighbourhood associations, and trusted community intermediaries offers a more effective delivery mechanism (Chhabra et al., 2023).

Educators and design institutions should embed gender-aware entrepreneurship modules in fashion and textile curricula, addressing negotiation strategies, credit instrument literacy, and awareness of the socio-cultural barriers graduates will encounter. For industry associations and fashion cluster administrators, structural adjustments to the timing and format of trade events, digital-first exhibition options, rotating bazaars in residential neighbourhoods, and shared workspace models co-located with childcare, could meaningfully expand women's market-building access without large capital investment.

Directions for Future Research

Future research should extend the typological framework to other creative sectors, craft, food, and design services, to test cross-sectoral applicability. Longitudinal designs tracking the same cohort over five years would reveal how barriers evolve and which interventions produce durable change. An intersectional analysis incorporating caste, marital status, and migration background would further nuance the typology. Comparative research across Delhi-NCR, Jaipur, and Surat could illuminate how regional culture and infrastructure shape the gender-enterprise relationship in ways no single-city study can capture.

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A STUDY ON THE PREFERENCE OF GEN Z FOR MATERNAL SAREES AS AN INTERGENERATIONAL CLOTHING REUSE PRACTICE

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ABSTRACT

Fashion and textile industry faces several problems associated with the environmental impacts of overconsumption and wastage of textile materials. In this regard, the sustainable use of traditional practices is gaining increasing importance due to its strong cultural roots. In Indian culture, the process of transferring sarees from mothers to daughters is a well-known form of intergenerational reuse, contributing to sustainability without diminishing cultural aspects of garments. Hence, the current research examines the Generation Z preferences concerning their mothers sarees in terms of the concept of intergenerational sustainability. A descriptive design was chosen for the study. To obtain primary data, a structured questionnaire containing demographic information and Likert scale statements (1 = strongly agree, 5 = strongly disagree) about sustainability, emotional connection to maternal garments, adaptability to fashion and preference of mother's sarees was provided to 50 Generation Z individuals aged between 16 and 28 years old. Descriptive statistics were used to describe the obtained results. Furthermore, reliability assessment via Cronbach's Alpha coefficient and analysis of correlation and multiple regression models were applied. According to the results, respondents demonstrate sufficient awareness and positive perception towards maternal sarees. Moreover, there is a high correlation between all mentioned variables except for adaptability to fashion, which correlates weakly with preference for maternal sarees. Regression analysis shows that only sustainability is able to predict Generation Z preference, indicating its high impact on the studied phenomenon. Thus, emotional connection and fashion adaptability, even though they are positively correlated, do not influence preference. Maternal sarees can be treated as sustainable traditional items that contribute to the longevity of clothes, minimize textile waste and preserve emotional bonds. From the Home Science point of view, results stress the importance of considering traditional clothing as an aspect of sustainability.

Keywords: Maternal sarees, Generation Z, Intergenerational clothing reuse, Sustainable Clothing Practices; Fashion Adaptability

INTRODUCTION

The textile and clothing industry is facing growing criticism for the harm it causes to the environment, especially because of excessive consumption and the rising amount of textile waste. In response, there has been a gradual shift towards sustainable practices such as reuse, recycling, and responsible consumption. However, in the Indian context, many of these approaches are not recent developments but are deeply rooted in traditional lifestyles and cultural practices. One such practice

is the intergenerational transfer of sarees, where garments are passed down from mothers to daughters, reflecting a long-standing tradition of extending the life cycle of clothing. Furthermore, research conducted by Sareen (2017) and Das and Dwivedi (2024) indicates that the use of traditional textiles in Indian households has historically contributed to resource conservation and waste reduction. In addition to their practical uses, sarees hold cultural and emotional significance. Studies by Kirthika, Sadhna, and Kumar (2023) and Reddy (2022) highlight that garments handed down through generations carry immense sentimental significance, which strengthens family bonds and shape's personal identity, creating a legacy that is transferred through time. Additionally, Verma (2021) notes that cultural values significantly influence the clothing choices of young Indians. This emotional bond motivates individuals to take care of and pass down their garments, thus reusing their clothes, which fosters sustainable habits. Furthermore, research by Soni and Srivastava (2024) and Lokhande (2025) indicates that historical Indian attire practices have consistently prioritized minimal waste and conscious consumption, aligning well with modern sustainability concepts.

At the same time, the adaptability of sarees into modern designs has enhanced their appeal among younger generations. Kakkar (2025) observes that integrating traditional textile heritage with contemporary fashion enables garments to remain relevant in changing fashion contexts. Similarly, Bokil and Patil (2023) demonstrate that upcycling sarees into new forms not only extends their usability but also promotes creative and sustainable design practices. Singh, Poddar, and Yadev (2022) further note that while Generation Z shows increasing awareness of sustainable fashion, their clothing choices are influenced by a combination of modern trends and cultural values.

Generation Z, often associated with rapidly evolving fashion preferences, is also becoming more conscious of sustainability and ethical consumption. The growing practice of restyling and upcycling traditional garments reflects an effort to balance contemporary fashion with cultural heritage. However, existing research largely examines sustainability and cultural clothing as separate domains, with limited focus on their intersection, particularly in the context of maternal sarees among Generation Z. Therefore, the present study seeks to examine Generation Z's preference for maternal sarees by analyzing the combined influence of sustainability awareness, emotional attachment, cultural values, Family traditions, and fashion adaptability within the broader framework of intergenerational sustainability. In the present study, intergenerational sustainability refers to the practice of passing, reusing, and adapting maternal sarees across generations to promote sustainable clothing consumption while simultaneously preserving cultural heritage, family traditions, and the functional life of garments.

OBJECTIVES OF THE STUDY

- To estimate the level of awareness and sustainability orientation of Generation Z regarding the reuse of maternal sarees as a form of intergenerational sustainable practice.
- To measure the influence of emotional attachment, cultural values and family traditions on Generation Z's preference for wearing their mother's sarees.
- To study the level of fashion adaptability for modern styling and conversion to modern wear and their impact on acceptance of maternal sarees in Generation Z.

This study seeks to fill this research gap by examining maternal sarees as a sustainable clothing practice that also preserves cultural heritage among Generation Z.

HYPOTHESES

Given the objectives of this research, the following hypotheses can be formed:

Null Hypotheses (H_0)

- H_{01}: No significant association exists between sustainability consciousness and Gen Z's preference for their mother's sarees.
- H_{02}: Emotional connection, culture and tradition have no significant effect on Gen Z's choice of their mother's sarees
- H_{03}: Fashion adaptability has no significant association with Gen Z's adoption of their mothers' sarees.

Alternative Hypotheses (H1)

- H_{11}: A significant association exists between sustainability consciousness and Gen Z's preference for their mothers' sarees.
- H_{12}: Emotional connection, culture and tradition significantly influence Gen Z's choice of their mothers' sarees.
- H_{13}: Fashion adaptability significantly influences Gen Z's adoption of their mothers' sarees.

RESEARCH METHODOLOGY

The current study used a descriptive research design to explore Generation Z's interest in maternal sarees as a way to reuse clothing across generations. 50 respondents, aged 16 yrs to 28 yrs, took part in the study. The respondents were chosen through convenience sampling from urban and semi-urban areas to gather a variety of perspectives from different educational and professional backgrounds. Primary data was collected using a structured questionnaire with 25 questions. This questionnaire included multiple-choice questions to gather information about the respondents' demographics, awareness of maternal sarees, usage patterns of the sarees, preferred occasions for wearing them and clothing preferences. The responses were summarized using frequency and percentage analysis. The questionnaire also included 13 Likert-scale statements to gauge respondents' views on maternal sarees. Focus was done on various factors such as emotional and cultural value, knowledge of sustainability, fashion adaptability, and media influence. The responses were recorded on a five-point Likert scale, where 1 meant "Strongly Agree" and 5 meant "Strongly Disagree." The mean score for each area of interest was calculated by averaging the responses related to those statements. A lower mean value indicated stronger agreement and a more positive view of maternal sarees, while a higher mean value indicated disagreement with the statements. The data collected were calculated using descriptive statistics, including frequency, percentage, mean, and standard deviation. Reliability was calculated for the Likert-scale constructs with Cronbach's alpha. Additionally, Pearson's correlation analysis examined the connections between sustainability awareness, emotional and cultural significance, fashion adaptability, and preference for maternal sarees. Finally, multiple linear regression analysis was used to identify the factors that most significantly influenced Generation Z's preference for maternal sarees.

RESULTS & DISCUSSION

Descriptive Statistics

1. Demographic Profile, Awareness and Usage

Table 1: Demographic Variables of Gen Z

Variable	Category	Frequency (n=50)	Percentage (%)
Age (Years)	16 - 20	18	36
	21 -23	22	44
	24 - 26	6	12
	27 - 28	4	8
Educational Qualification	Undergraduate	38	76
	Postgraduate	9	18
	Other	3	6
Area of Residence	Urban	38	76
	Semi-urban	7	14
	Rural	5	10
Occupation	Student	29	58
	Employed	11	22
	Other	8	16
	Self-employed	2	4

Table 1 presents the demographic characteristics of the respondents. The participants represented different age groups within Generation Z. Among them, 36% were aged 16–20 years, 44% belonged to the 21–23 years age group, and 20% were between 24 and 26 years, with the largest proportion falling in the 21–23 years category. Regarding educational qualification, most respondents (76%) were undergraduates, while the remaining 24% were postgraduates. In terms of place of residence, 76% of the respondents were from urban areas, 16% belonged to semi-urban areas, and 8% were from rural areas. With respect to occupation, 58% were students, 22% were employed, 12% were self-employed, and the remaining 8% belonged to other occupational groups. Overall, the sample reflected a predominantly young, undergraduate, urban, and student population, providing an appropriate representation of the target group for the present study.

2. Awareness & Usage of maternal saree

Table 2: Awareness & Usage of maternal saree

Variable	Category	Frequency (n=50)	Percentage (%)
Awareness	Yes	43	86
	No	7	14
Have worn mother's saree	Yes	40	80
	No	10	20
Frequency	Occasionally	22	44
	Rarely	16	32
	Never	7	14
	Frequently	5	10
Occasion Preference	College events	23	46
	Festivals	12	24
	Family Functions	7	14
	Not applicable	5	10
	Casual wear	2	4
	Weddings	1	2
Wedding Preference	Yes	23	46
	Maybe	20	40
	No	7	14

Table 2 showed that 86% of the respondents were aware of maternal sarees, while 80% had used them, indicating a high level of familiarity with the practice. Regarding usage frequency, 44% reported wearing maternal sarees occasionally, whereas 32% reported wearing them rarely, suggesting moderate engagement. Maternal sarees were most preferred for college events (46%) and festivals (24%), while their use for weddings was relatively limited, with 46% responding 'Yes' and 40% responding 'Maybe'. Overall, the findings indicated that awareness and exposure to maternal sarees were high; however, their regular use was found to be more situational than habitual.

3. Mean & Standard Deviation of factors influencing the preferences of Gen Z in wearing maternal sarees.

S.No	Factors	Mean	SD	N
I. Preference & Behavioural Intentions				
1	Preference for Maternal Sarees over New Purchase	2.06	1.15	
2	Willingness to Wear Maternal Sarees for Special Occasions	2.06	1.25	
3	Comfort in Wearing Maternal Sarees in Social Settings	2.1	1.05	
4	Willingness to Recommend Maternal Sarees to Others	1.98	1.08	
II. Emotional & Cultural Significance				
5	Emotional Connection through Wearing Maternal Sarees	1.86	1.18	
6	Perceived Sentimental and Heritage Value of Maternal Sarees	1.86	1.09	
7	Role of Maternal Sarees in Preserving Cultural Traditions	1.94	1.1	
III. Sustainability Perspective				**50**
8	Contribution of Maternal Saree Reuse to Sustainable Fashion	1.86	0.99	
9	Preference for Reuse and Recycling over New Purchases	2.2	1.16	
10	Effect of Saree Transformation on Reducing Textile Waste	1.78	1.06	
IV. Fashion Adaptability				
11	Interest in Transforming Maternal Sarees into Modern Outfits	1.86	1.07	
12	Perceived Suitability of Maternal Sarees for Modern Styling	1.78	0.91	
V. Media Influence				
13	Influence of social media and Celebrities on Maternal Saree Preference	2.56	1.39	

*Table 3 represents the descriptive statistics of the five study constructs based on the average (composite mean) scores of their respective Likert-scale statements. Responses were recorded on a five-point Likert scale, where 1 = Strongly Agree and 5 = Strongly Disagree. Therefore, lower mean scores indicate stronger agreement with the statements.

From **Table 3**, the composite mean scores for Preference and Behavioural Intentions ranged from 1.98 to 2.10, showing that the respondents generally agreed with statements related to wearing, accepting and recommending others to wear maternal sarees. The emotional and cultural factor recorded mean scores between 1.86 and 1.94, suggesting that the respondents recognised the

emotional connect and cultural value associated with maternal sarees. The sustainability perspective reported mean values ranging from 1.78 to 2.20, showing agreement that reusing maternal sarees contributes to sustainable clothing practices and textile waste reduction. Fashion adaptability showed mean scores between 1.78 and 1.86, indicating that respondents accepted the idea of adapting maternal sarees into modern styles. In contrast, the media influence factor recorded a comparatively higher mean score (M = 2.56, SD = 1.39), suggesting that social media and celebrity influence played a relatively smaller role in shaping respondents' preferences.

The standard deviation values, which were close across all constructs, indicate reasonable consistency in the responses. On the whole, the findings suggest that respondents showed higher agreement towards statements related to emotional attachment, sustainability and fashion adaptability than with those in relation to media influence.

RELIABILITY ANALYSIS

Table 4: Reliability Analysis of Constructs using Cronbach's Alpha (n= 50)

S. No	Construct	No. of Items	Cronbach's Alpha (α)	Interpretation
1	Preference	4	0.833	Good
2	Emotional	3	0.872	Good
3	Sustainability	3	0.884	Good
4	Fashion Adaptability	3	0.499	Unacceptable

Fig 4: Reliability Analysis of Constructs using Cronbach's Alpha (n = 50)

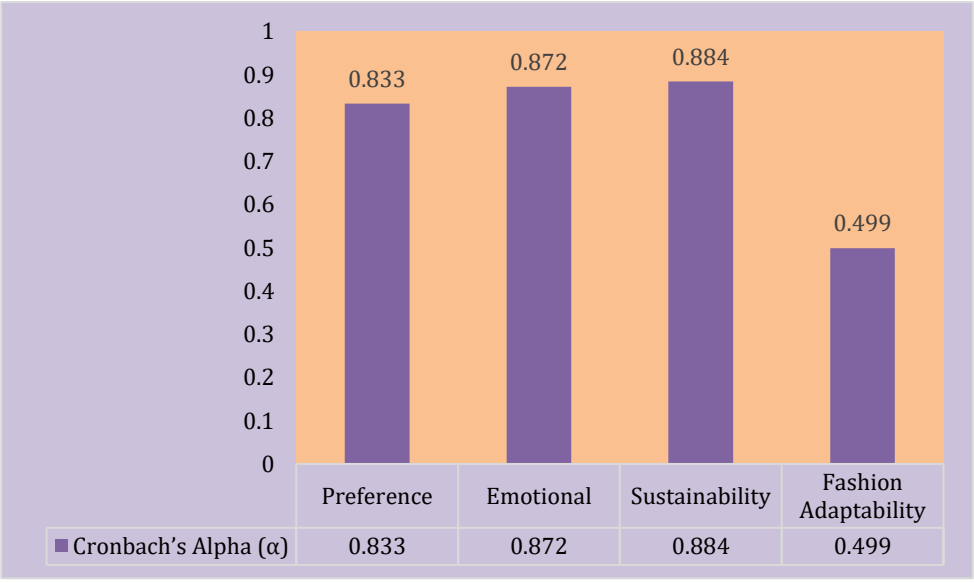


Table 4 and Figure 4 demonstrate the analysis of reliability of the constructs measured through the use of Cronbach's Alpha among 50 survey participants. The results of Cronbach's Alpha

revealed that the Preference construct resulted in a score of 0.833. This indicates high levels of reliability among the questions used to measure behavioral intention towards wearing the maternal saree.

The Sustainability construct demonstrated strong reliability (α = 0.884), indicating that respondents had a uniform understanding of sustainability-related aspects such as reuse and waste reduction. However, the Fashion Adaptability construct recorded a low alpha value (α = 0.499), indicating poor internal consistency. This suggests that the aspects under this construct may not be measuring a single underlying concept effectively and may require revision or refinement.

Overall, the results confirmed that most constructs used in the study are reliable, except for fashion adaptability, which showed inconsistency in responses.

CORRELATION ANALYSIS

5.Pearson correlation matrix

Table 5: Pearson Correlation Matrix of Study Constructs (n = 50)

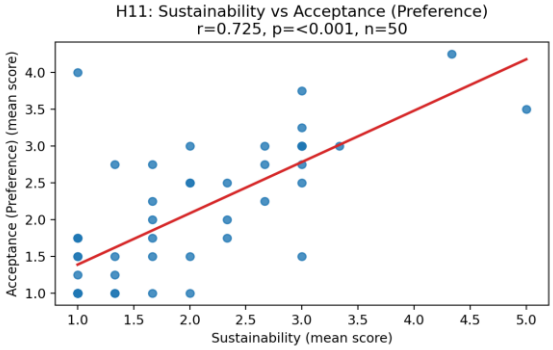
Variables	Sustainability	Emotional	Fashion	Acceptance (Preference)
Sustainability	1.000***	0.771***	0.614***	0.725***
Emotional	0.771***	1.000***	0.463***	0.602***
Fashion	0.614***	0.463***	1.000***	0.403**
Acceptance (Preference)	0.725***	0.602***	0.403**	1.000***

Table 6: Hypothesis Testing Results (α = 0.05)

Relationship Tested	r value	p value	Result
Sustainability ↔ Acceptance	0.725	< 0.001	Significant – H_0 Rejected
Emotional ↔ Acceptance	0.602	< 0.001	Significant – H_0 Rejected
Fashion ↔ Acceptance	0.403	0.004	Significant – H_0 Rejected

Pearson's correlation analysis was performed to examine the relationship between sustainability awareness, emotional attachment, fashion adaptability, and Generation Z's preference for maternal sarees. The construct scores were computed as the average (composite mean) of the respective Likert-scale items, where 1 = Strongly Agree and 5 = Strongly Disagree. The results are presented in Tables 5 and 6, while the relationships are illustrated in **Figure 5 (a), (b) & (c).**

Fig 5: Scatter Plots Showing the Relationship between Sustainability Awareness, Emotional Attachment, Fashion Adaptability, and Generation Z's Preference for Maternal Sarees



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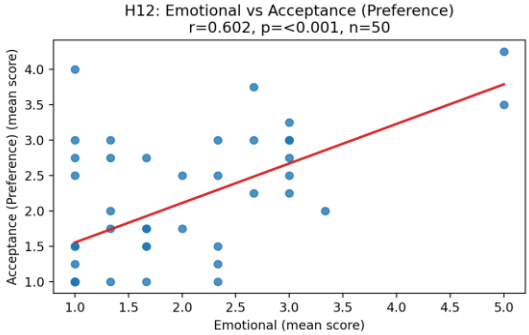
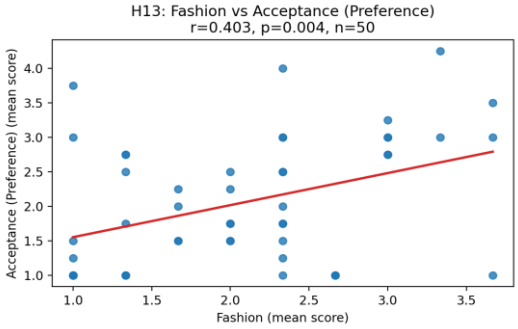
(a)Sustainability Awareness and Preference for Maternal Sarees



(b)Emotional Attachment and Preference for Maternal Sarees



(c) Fashion Adaptability and Preference for Maternal Sarees

The findings indicated a strong positive and statistically significant relationship between sustainability awareness and preference ($r = 0.725$, $p < 0.001$). This suggested that respondents who showed greater agreement with sustainability-related statements were also more likely to prefer maternal sarees. Therefore, Hypothesis H_{11} was accepted, and the corresponding null hypothesis was rejected. Figure 5 (a) showed a clear upward linear trend. Although a few observations were scattered away from the trend line, no extreme outliers were observed, and they did not appear to influence the overall relationship.

A moderate positive and statistically significant relationship was also found between emotional attachment and preference ($r = 0.602$, $p < 0.001$). This indicated that emotional connection, family values, and cultural significance were positively associated with respondents' preference for maternal sarees. Hence, Hypothesis H_{12} was accepted. As shown in Figure 5 (b), the data points generally followed the positive trend line, with a small number of moderately dispersed observations. These points did not substantially affect the correlation.

Similarly, fashion adaptability showed a moderate positive and statistically significant relationship with preference ($r = 0.403$, $p = 0.004$). This finding suggested that respondents who viewed maternal sarees as adaptable to contemporary fashion were more likely to prefer them. Therefore, Hypothesis H_{13} was accepted. Figure 5 (c) displayed a positive linear pattern; however, the points were more widely dispersed around the trend line than in Figures (a) and (b), indicating a comparatively weaker association. A few observations were distant from the regression line, but they were not sufficiently extreme to alter the overall interpretation of the results.

Overall, the correlation analysis showed that sustainability awareness had the strongest relationship with Generation Z's preference for maternal sarees, followed by emotional attachment and fashion adaptability, supporting the study's objectives

Multiple Regression Analysis

Multiple regression analysis was performed to determine the combined influence of sustainability awareness, emotional attachment, and fashion adaptability on Generation Z's preference for maternal sarees. The results are presented in **Tables 7–9.**

Table 7: Multiple Regression Analysis (n = 50)

R	R^2	Adjusted R^2	Std. Error
0.73	0.533	0.503	—

The regression model explained 53.3% of the variation in Generation Z's preference for maternal sarees ($R^2 = 0.533$), while the adjusted R^2 value of 0.503 indicated that the model retained good explanatory power after adjusting for the number of predictors. This suggests that sustainability awareness, emotional attachment, and fashion adaptability together made a meaningful contribution to explaining respondents' preference for maternal sarees.

Table 8: ANOVA for Regression Model

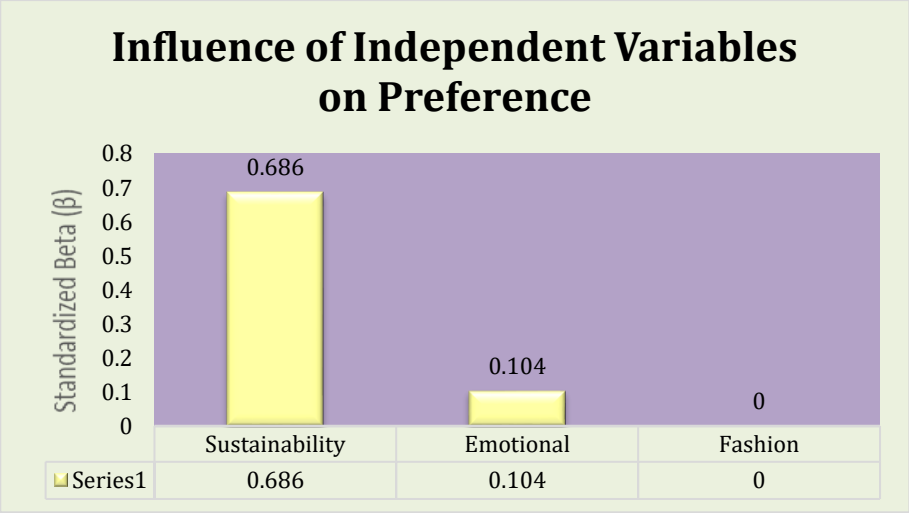
Source	df	F	Sig. (p)
Regression	3	17.523	<0.001
Residual	46		
Total	49		

The ANOVA results showed that the overall regression model was statistically significant (**$F = 17.523$, $p < 0.001$**), indicating that the selected independent variables collectively predicted Generation Z's preference for maternal sarees.

Table 9: Regression Coefficients

Predictor	B	Beta (β)	Sig.
Sustainability	0.659	0.686	0
Emotional	0.096	0.104	0.514
Fashion	-0.077	—	0.604

Fig 7: Bar Chart – Standardized Beta Coefficients



Sustainability shows the highest positive impact, while emotional and fashion factors have minimal influence.

Among the three predictors, sustainability awareness emerged as the strongest and only statistically significant predictor of Generation Z's preference for maternal sarees ($\beta = 0.686$, $p < 0.001$). This finding suggests that respondents who recognised the environmental benefits of reusing maternal sarees were more likely to prefer wearing them. The result supports the view that sustainability has become an important consideration in clothing choices among Generation Z, even when traditional garments are involved.

Although emotional attachment and fashion adaptability showed positive relationships with preference in the earlier correlation analysis, their effects were not statistically significant in the regression model ($p > 0.05$). This indicates that after accounting for sustainability awareness, these variables did not make an independent contribution to predicting preference. Their influence may overlap with sustainability awareness or operate indirectly through sustainable values rather than acting as separate predictors.

Hypothesis Testing

Therefore, Hypothesis H_{11} was accepted, confirming that sustainability awareness significantly influenced Generation Z's preference for maternal sarees. However, Hypotheses H_{12} and H_{13} were not supported in the regression model, as emotional attachment and fashion adaptability did not show statistically significant independent effects.

Overall, the findings indicate that sustainability awareness is the key factor influencing Generation Z's preference for maternal sarees, reinforcing the importance of promoting intergenerational clothing reuse as a sustainable practice.

SUMMARY & CONCLUSION

This study examines the factors influencing Generation Z's preference for maternal sarees, focusing on various aspects such as sustainability awareness, emotional attachment, cultural continuity and style adaptability. The findings from the study indicate that maternal sarees are valued not only as cultural and heritage garments but also as sustainable alternatives to fast-moving fashion. Although awareness regarding the environmental and cultural significance is shown to be high, the actual usage is largely bound to occasion-specific use, especially for ceremonies and milestone events.

Statistical analysis reveals that respondents strongly agree that reusing maternal sarees strengthens emotional connectivity and preserves traditions while also having a good environmental impact. Reliability analysis confirms that the measurement constructs demonstrate acceptable internal consistency. Correlation results show a significant relationship between sustainability, emotional value, fashion adaptability and preference. However, on the other hand, regression analysis indicates that the sustainability awareness factor is the only significant predictor influencing the selection of maternal sarees, while emotional and fashion–related factors do not independently determine preference. Overall, the findings show a shift in Generation Z's clothing choices towards environmentally responsible behaviour.

The study highlights the similarity of intergenerational clothing practices in promoting sustainable consumption. From the perspective of Home Science, this research study emphasizes the intergeneration of cultural values with sustainability education, encouraging innovative approaches to responsible fashion. Overall, maternal sarees represent a meaningful convergence of tradition, emotional value and ecological consciousness in contemporary lifestyle practice.

RECOMMENDATION FOR FUTURE STUDY

A Comparative Study on the Preference for Maternal Sarees among undergraduate, Postgraduate students and first-time employees.

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FABRIC FOOTPRINTS IN URBAN HOSTELS: AN ANALYSIS OF COLLEGE GIRLS' CLOTHING CHOICES AND CONSCIOUS CONSUMPTIONS

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HSAI Membership Number: 09/S-19/LF

ABSTRACT

Clothing, once primarily a tool for protection, has evolved into a key medium for self-expression, social identity and cultural belonging. Among urban college girls, fashion decisions often balance between personal aspiration, peer influence, affordability and sustainability awareness. The present quantitative, descriptive study investigates the relationship between fashion behavior, awareness of sustainable fabrics and fabric footprint among 150 hostel-residing female students in Kolkata. Using a structured questionnaire and multistage stratified cluster sampling, data were analysed using descriptive statistics, chi-square, Friedman, t-tests and proportion z-tests to identify significant associations. Results revealed cotton (88%) as the dominant fabric due to comfort and practicality, while sustainability remained a low-priority factor in purchasing decisions. Although 53% of respondents could distinguish natural from synthetic fabrics, awareness of eco-friendly materials, brands and sustainable fashion terminology was notably poor. Hostel life and peer group exposure significantly influenced fashion experimentation and consumption patterns. Despite high willingness to learn about sustainability, barriers such as limited awareness, higher cost and style constraints persist. Findings underscore the relevance of integrating sustainability education, affordable alternatives and peer-led fashion campaigns to encourage responsible clothing behaviour among young urban consumers.

Keywords: College girls, Consumer behaviour, Fabric footprint, Fast fashion, Hostel life, Sustainable fashion.

INTRODUCTION

Clothing, one of humanity's most fundamental needs, has evolved far beyond its original function of protection against environmental conditions. In contemporary society, clothing serves as a medium of self-expression, identity formation, social communication, and cultural representation. Dress communicates personal values, social status, and group affiliation, thereby influencing interpersonal perceptions and interactions (Davis, 1992; Kaiser et al., 2001). Historically, clothing has also reflected broader socio-economic transformations, illustrating the relationship between fashion, culture, and societal change (Gilbert, 2017).

Fashion has become an integral component of lifestyle, particularly among young adults who use clothing to express individuality and establish social identity. College students represent one of the most fashion-conscious consumer groups because their clothing choices are shaped by peer interactions, social media, digital retail platforms, and rapidly changing fashion trends. The

transition from living with family to independent hostel life enhances autonomy in purchasing decisions while increasing exposure to urban consumer culture and social comparison (Tiggemann & Lacey, 2009).

College-going young women residing in urban hostels constitute a significant consumer segment, as they are highly engaged with fashion trends and digital shopping platforms, making them more susceptible to frequent wardrobe updates (Rahaman, 2025; Wang et al., 2026). Recent studies indicate that Generation Z, despite being increasingly aware of environmental issues, continues to make clothing purchase decisions primarily based on affordability, convenience, aesthetics, and social acceptance rather than sustainability considerations (Rahaman, 2025). This contradiction reflects the challenge of encouraging responsible clothing consumption among young consumers.

The environmental consequences of these consumption patterns have become a global concern. The fashion industry is among the world's most resource-intensive sectors, contributing substantially to greenhouse gas emissions, excessive water consumption, textile waste, and environmental pollution (UNEP, 2019). Consequently, the concept of fabric footprint has gained importance as an indicator of the environmental impact of textiles throughout their life cycle, including fibre production, manufacturing, transportation, use, and disposal (Karthik & Gopalakrishnan, 2014). Although sustainable fashion offers a viable approach to reducing these impacts, its adoption among consumers remains limited.

Existing literature suggests that sustainable fashion consumption is influenced by environmental awareness, perceived product quality, affordability, accessibility, and fashion appeal. While many consumers express positive attitudes towards sustainability, their purchasing behaviour frequently prioritizes price, style, and convenience over environmental responsibility (Wang, 2026). This inconsistency, commonly referred to as the value–action gap, continues to hinder the adoption of sustainable fashion practices among Generation Z consumers (Kochuveetil et al., 2026).

Despite growing international research on sustainable fashion consumption, empirical evidence concerning hostel-residing college students in the Indian context remains limited. Hostel life presents a unique social environment where increased independence, peer influence, financial constraints, and exposure to urban lifestyles shape clothing preferences and purchasing behaviour. Understanding these behavioural patterns is essential for developing educational interventions and institutional strategies that promote responsible clothing consumption.

Against this backdrop, the present study investigates the clothing behaviour of female college students residing in urban hostels in Kolkata, with emphasis on fabric preferences, clothing purchase behaviour, sustainability awareness, conscious consumption practices, and the barriers and motivators influencing sustainable clothing choices. The findings are expected to contribute to the growing literature on sustainable fashion consumption and provide practical insights for educators, policymakers, and the apparel industry.

OBJECTIVES

The main objectives of this study are:

1. To analyse fabric preferences, clothing purchase frequency and spending patterns of female college students.
2. To identify key factors influencing clothing choices, including comfort, price, style and sustainability.

3. To assess awareness of sustainable fashion and eco-friendly fabrics.
4. To evaluate engagement in conscious consumption practices such as reuse, donation and thrifting.
5. To examine the impact of hostel life and urban exposure on clothing behaviour.
6. To identify barriers and motivators influencing the adoption of sustainable clothing practices.

METHODOLOGY

Research Design: The study adopted a descriptive cross-sectional survey design to examine the clothing behaviour, fabric preferences, shopping patterns, and sustainability awareness of female college students residing in urban hostels in Kolkata. A descriptive design was considered appropriate as it enabled the systematic assessment of existing attitudes, preferences, and consumption practices without manipulating respondents' behaviour. The cross-sectional approach facilitated the collection of data at a single point in time, providing a snapshot of current clothing choices and sustainable consumption practices. A quantitative research approach was employed using a structured questionnaire, and the collected data were analysed using appropriate statistical techniques to address the research objectives.

Locale of Study: The study was conducted in Kolkata, West Bengal, one of eastern India's major metropolitan cities and an important centre of higher education. The city attracts students from diverse socio-economic and cultural backgrounds, making it a suitable setting for investigating clothing behaviour and sustainability awareness among hostel-residing female college students.

Sampling: A multistage stratified cluster sampling technique was used to select 150 female students aged 18–25 years. In the first stage, colleges were stratified according to academic disciplines (Arts, Commerce, Science, and Design). In the second stage, students residing in institutional hostels and private paying guest (PG) accommodations were selected as sampling clusters. This approach ensured adequate representation of students from different educational disciplines and residential settings.

Research Instrument: Data was collected using a structured questionnaire comprising 50 items divided into six sections. The questionnaire was developed following an extensive review of relevant literature. Content validity was established through expert evaluation, while reliability was assessed through pilot testing before the final survey to ensure consistency and clarity of responses.

Statistical Tools: The collected data were coded and analysed using Microsoft Excel and SPSS. Descriptive statistics, including frequencies, percentages, and mean scores, were used to summarise respondents' demographic characteristics and clothing behaviour. Inferential statistical techniques were employed to examine relationships and group differences. The Chi-square test was used to determine associations between categorical variables, the Friedman test was applied to rank factors influencing clothing choices, the independent sample t-test compared mean scores between groups, and the Z-test for proportions was used to compare proportions across selected response categories. Statistical significance was determined at the 5% level ($\alpha = 0.05$), with $p < 0.05$ considered statistically significant.

FINDINGS AND DISCUSSION

The study provides a comprehensive understanding of clothing behaviour, sustainability awareness, and consumption patterns among female college students residing in urban hostels in Kolkata. The key findings are summarized as follows:

Demographic Profile: The respondents were predominantly female students below 25 years of age. Most were postgraduate students with moderate monthly shopping budgets. A large proportion belonged to Arts and Humanities disciplines, had 1–2 years of hostel experience, and came from semi-urban or rural backgrounds, reflecting exposure to both traditional and urban lifestyles.

Fabric Preferences and Awareness: Cotton emerged as the most preferred fabric (88%) due to comfort, breathability and practicality. Wool was used seasonally, while synthetic and luxury fabrics had minimal usage (Table-1).

Table-1: Distribution of Respondents on the basis of commonly preferred fabrics while purchasing garments

S.No.	Fabrics*	N	%
a	Cotton	132	88.00%
b	Wool	47	31.33%
c	Silk	17	11.33%
d	Rayon	04	2.66%
e	Polyester	05	3.33%
f	Nylon	03	2.00%
g	Acrylic	04	2.66%
h	Others	02	1.33%

**Multiple Responses*

Fabric choice was primarily influenced by brand reputation, price, and comfort, while sustainability ranked the lowest. Although 53.3% of respondents could differentiate between natural and synthetic fabrics, a substantial 40% lacked this knowledge, indicating limited fabric literacy. Texture sensitivity influenced choices for nearly 70% of students, reinforcing comfort as a key determinant. Despite a reasonable presence of natural fabrics in wardrobes, 20% of respondents were unsure about fabric composition.

Clothing Purchase Behaviour: Shopping behaviour among respondents is depicted in Table 2 and it shows that 36 per cent reported visiting clothing stores or shopping platforms weekly or bi-weekly. However, this does not necessarily indicate clothing purchases on every visit. Many respondents reported browsing, comparing products, or purchasing accessories during these shopping occasions. A higher proportion (25.3%) reported shopping primarily during sales or special occasions, reflecting price-sensitive behaviour. The p-value (0.27) indicates that differences in purchase frequency are not statistically significant, suggesting that no single shopping frequency pattern strongly dominates among the respondents.

Table-2: Distribution of Respondents on the basis of Frequency of Clothing Purchases

S.No.	Particulars	N	%
Shopping Frequency			
a	Weekly	24	16.00%
b	Bi Weekly	30	20.00%
c	Monthly	30	20.00%
d	Once every 2–3 months	28	18.67%
e	Only during special occasions or sales	38	25.33%
Frequency of Clothing Items Purchased			
a	1–2	42	28.00%
b	3–5	66	44.00%
c	6–8	32	21.30%
d	More than 8	10	6.66%

Approximately 44% purchased three to five clothing items per month during periods of active shopping. Although this appears relatively high, purchases may include inexpensive garments, seasonal sales and online discount purchases. The findings therefore indicate moderate rather than excessive clothing consumption. A smaller segment (28%) purchased only 1–2 items, reflecting a more conservative approach, while approximately 28% of respondents reported purchasing 6 or more items monthly, highlighting the presence of fast-fashion consumption tendencies within a notable group. The p-value (<0.001) confirms that these differences are statistically significant, with online shopping as the most preferred mode (41.3%), followed by in-store and hybrid shopping methods.

Analysis of factors influencing clothing purchases revealed that quality (mean score 4.2) was the most important consideration, followed by price (4.0), style/design (3.9), and comfort (3.7). Brand reputation had comparatively lower importance (3.1), while sustainability or eco-friendliness ranked the lowest (2.9), indicating limited prioritization of environmental concerns in purchasing decisions (Table-3).

Table-3: Distribution of Respondents on the basis of factors influencing clothing purchases

S.No.	Factors	1 Not Important	2	3	4	5 Very Important	Mean Score	Rank
a	Price	5	10	28	47	60	4.0	II
b	Brand	18	25	44	40	23	3.1	V
c	Quality	2	6	22	50	70	4.2	I
d	Style/Design	6	12	30	54	48	3.9	III
e	Comfort	7	15	35	52	41	3.7	IV
f	Sustainability/Eco-friendliness	25	32	40	33	20	2.9	VI

Despite purchasing multiple garments, 78% indicated adherence to a self-defined monthly clothing budget. This suggests that respondents attempted to balance fashion consumption through discounted purchases, online sales and affordable brands rather than unrestricted spending. Additionally, 62% preferred purchasing during discounts, and 66.7% engaged in thrift shopping, suggesting a blend of economic considerations and emerging sustainable practices. Furthermore,

social media influence was prominent, with 70% of respondents acknowledging that fashion influencers and bloggers significantly impact their purchasing decisions, thereby shaping trends and consumption behaviour.

Awareness of Sustainable Fashion and Eco-Friendly Fabrics: The findings reveal that awareness of sustainable fashion among respondents is uneven and fragmented. While a portion of students demonstrated moderate understanding of the environmental impacts of textile production, awareness of the environmental consequences of fast fashion remained relatively low, with a mean score of 2.8 on a 5-point scale (Table-4). A substantial proportion of respondents (29.3%) reported very low awareness, followed by 12% with low awareness, while only a smaller segment indicated high (18.7%) or very high (16%) awareness levels. The Chi-square goodness-of-fit test ($\chi^2 = 13.86$, $df = 4$, $p < 0.05$) confirms that awareness levels are not evenly distributed, with a significant concentration in the lower awareness categories.

Alarmingly, conceptual awareness was extremely poor, with only 3.3% of respondents familiar with the terms "sustainable fashion" and "fast fashion," while an overwhelming 96.7% reported no awareness. Similarly, recognition of sustainable clothing brands was critically low at just 1.3%. These findings highlight a major gap in foundational knowledge, suggesting the urgent need for structured awareness initiatives, curriculum integration, and targeted educational programs.

Table-4: Distribution of Respondents on the basis of awareness of environmental impact of fast fashion

S.No.	Awareness Level	N	%	Weighted Score (Awareness × Frequency)	Mean Awareness Score
a	1 (Very Low)	44	29.3%	44	2.8
b	2 (Low)	18	12.0%	36	
c	3 (Moderate)	36	24.0%	108	
d	4 (High)	28	18.7%	112	
e	5 (Very High)	24	16.0%	120	

Knowledge of eco-friendly fabrics was also limited, with a mean score of 2.63 out of 5, indicating overall low-to-moderate understanding (Table-5). The largest proportion of respondents (41.3%) reported being only moderately knowledgeable, while 18.7% were not knowledgeable and 22.7% were only slightly knowledgeable. Very few respondents rated themselves as knowledgeable (12%) or very knowledgeable (5.3%). The Chi-square test results ($\chi^2 = 55.73$, $df = 4$, $p < 0.001$) further confirm that the distribution of knowledge levels is significantly skewed toward lower categories.

Table-5: Distribution of Respondents on the basis of knowledge of eco-friendly fabrics

S.No.	Rating & Meaning	N	%	WS	Mean Score
a	Not knowledgeable (1)	28	18.7%	394	2.63
b	Slightly knowledgeable (2)	34	22.7%		
c	Moderately knowledgeable (3)	62	41.3%		

d	Knowledgeable (4)	18	12.0%		
e	Very knowledgeable (5)	8	5.3%		
The mean knowledge score = 2.63 (on a scale of 1–5).					

In terms of information sources, social media emerged as the dominant channel through which respondents learned about sustainable fashion, whereas formal education, brand communication, and structured learning platforms played a negligible role. Although 61.3% of respondents reported checking clothing labels for sustainability-related information, this awareness did not consistently translate into purchasing behaviour, as the actual adoption of eco-friendly fabrics remained low and uncertain. Overall, the results indicate that while there is some emerging awareness, it is largely superficial and insufficient to drive informed and sustainable consumption practices.

Engagement in Conscious Consumption Practices: The findings indicate a moderate level of engagement in conscious consumption practices—such as reuse, donation, and thrifting—among the respondents. Thrift shopping or purchasing second-hand clothing emerged as the most commonly adopted practice, with 66.7% of respondents reporting participation. This preference was found to be statistically significant ($\chi^2 = 16.67$, $p < 0.001$), highlighting a clear inclination toward thrift-based consumption. Donation and reuse of clothing were also relatively common, suggesting a growing awareness of extending garment life cycles.

Analysis of mean scores further supports these trends, with thrift shopping ranking highest (mean = 3.26), followed by donating clothes (mean = 3.11) and reusing or repurposing old clothing (mean = 3.08). Practices such as repairing or upcycling garments (mean = 3.04) and participating in clothing swap events (mean = 3.03) were less frequently adopted (Table-6).

Table-6: Distribution of Respondents on the basis of engagement in various sustainable practices

S.No.	Response	Mean Score	Rank
a	Reusing or repurposing old clothing	3.08	III
b	Donating clothes to charity or peers	3.11	II
c	Purchasing second-hand or thrifted clothing	3.26	I
d	Participating in clothing swap events	3.03	V
e	Repairing or altering/upcycling clothes	3.04	IV

Disposal behaviour reflected similar patterns, with respondents showing a preference for repurposing and donating garments, although a considerable proportion still resorted to discarding clothing. Overall, while sustainable practices are present among students, they are not consistently followed and appear to be driven more by affordability, convenience, and personal benefit rather than strong environmental consciousness. The relatively lower engagement in organized activities like clothing swaps indicates a need for greater institutional support, awareness programs, and community initiatives to promote wider participation in sustainable consumption practices.

Impact of Hostel Life and Urban Exposure: The findings clearly indicate that hostel life and urban exposure play a significant role in shaping clothing behaviour among respondents. A majority (70%) reported noticeable changes in their clothing choices after moving to hostels. The Chi-square goodness-of-fit test ($\chi^2 = 24.00$, $df = 1$, $p < 0.001$) confirms that this change is

statistically significant, demonstrating that hostel living strongly influences adaptation in clothing behaviour.

Among the factors driving these changes, peer influence emerged as the most dominant (65%), followed by budget constraints (56%) and exposure to diverse cultures (52%). Limited storage space (48%) also contributed to changes, while factors such as laundry facilities showed no impact. The statistical results indicate that these influences are not evenly distributed, with peer interactions and financial considerations exerting significantly greater influence than other factors. This suggests that students' clothing behaviour is largely shaped by social acceptance and economic limitations rather than infrastructural conditions (Table-7).

Table-7: Distribution of Respondents on the basis of factors influencing changes in clothing choices

S.No.	Response	N	%
a	Peer influence	98	65%
b	Exposure to diverse cultures	78	52%
c	Limited storage space	72	48%
d	Laundry facilities	00	00%
e	Budget constraints	84	56%
f	Others	00	00%

Urban exposure further enhanced fashion awareness, with 70% of respondents reporting increased exposure to new trends through markets, malls, and social media platforms. This finding was also statistically significant ($\chi^2 = 24.00$, df = 1, $p < 0.001$), confirming that urban environments play a crucial role in influencing fashion consciousness among hostel students.

Additionally, 63.3% of respondents reported greater experimentation with their personal style after shifting to the city. The Chi-square test ($\chi^2 = 10.66$, df = 1, $p < 0.05$) validates that this increase is statistically significant, indicating that hostel living combined with urban exposure encourages individuality, experimentation, and the exploration of new fashion identities. Overall, these results highlight that both hostel dynamics and urban settings act as key drivers in transforming clothing behaviour among young adults.

Barriers and Motivators Influencing the Adoption of Sustainable Clothing Practices: The results indicate that the adoption of sustainable clothing practices is primarily constrained by a few dominant barriers (Table-8). The most significant barrier reported was lack of awareness (88%), followed by the high cost of sustainable clothing (53.3%) and peer influence favouring fast fashion (37.3%). The Chi-square goodness-of-fit test ($\chi^2 \approx 459.37$, df = 5, $p < 0.05$) confirms that these differences are statistically significant, demonstrating that certain barriers—particularly limited awareness and high cost—are considerably more influential than others. This emphasizes the urgent need for targeted awareness initiatives and more affordable sustainable alternatives to encourage eco-friendly consumption among students.

In addition, style preferences emerged as an important deterrent, suggesting that sustainable clothing is often perceived as less fashionable or less appealing compared to fast fashion options.

Although respondents demonstrated limited awareness of sustainable fashion concepts, they were able to identify factors that would motivate them to adopt sustainable clothing if such options became more accessible. Thus, the identified motivators represent potential facilitators

rather than existing behavioural drivers. Affordable pricing (68%) was the most influential factor, followed by discounts and incentives (61.33%) and the availability of trendy and stylish designs (55.3%). Factors such as environmental concerns and educational initiatives had comparatively lower influence (Table-9).

Table-8: Distribution of Respondents on the basis of barriers to practicing sustainable clothing habits

S.No.	Response	N	%
a	Higher cost of sustainable clothing	80	53.3%
b	Lack of access to thrift/swap events	00	00.0%
c	Time constraints	00	00.0%
d	Perception of second-hand clothes as unhygienic	30	20.0%
e	Limited awareness of sustainable brands or practices	132	88.0%
f	Limited variety/style in sustainable options	00	00.0%
g	Peer influence favouring fast fashion	56	37.3%
h	Others	00	00.0%

From a statistical standpoint, the distribution of responses clearly indicates that economic and aesthetic factors outweigh educational and social motivators. The substantial variation in response percentages (e.g., 68% vs. 11%) suggests a statistically significant preference for affordability and incentives, reinforcing that cost-effectiveness and style are critical drivers in promoting sustainable fashion among students.

Table-9: Distribution of Respondents on the basis of factors encouraging sustainable clothing choices

S.No.	Factors	N*	%	Rank
a	Affordable pricing	102	68.00%	I
b	Trendy and stylish sustainable designs	83	55.33%	III
c	Positive environmental impact	63	42.00%	IV
d	Peer influence promoting sustainability	42	28.00%	VI
e	Educational campaigns or workshops	53	35.33%	V
f	Incentives or discounts	92	61.33%	II
g	Others	17	11.33%	VII

Multiple Responses

CONCLUSION

The present study examined the clothing behaviour, fabric preferences, sustainability awareness, and conscious consumption practices of female college students residing in urban hostels in Kolkata. The findings indicate that clothing choices are primarily influenced by comfort, quality, affordability, and style, while sustainability plays a relatively minor role in purchase decisions. Although cotton was the most preferred fabric and many respondents followed a monthly clothing budget, purchasing behaviour was strongly shaped by fashion trends, social media, and peer influence rather than environmental concerns.

The study also revealed a noticeable value–action gap between environmental awareness and actual clothing consumption. While some respondents practised thrift shopping, garment reuse,

and donation, awareness of sustainable fashion, eco-friendly brands, and the environmental impacts of fast fashion remained limited. Sustainable practices appeared to be driven more by economic considerations and convenience than by environmental responsibility.

Hostel life and urban exposure significantly influenced clothing behaviour by encouraging fashion experimentation and increasing peer interaction. However, limited awareness, the perceived high cost of sustainable clothing, and the popularity of fast fashion emerged as major barriers to sustainable consumption. Respondents indicated that affordable prices, attractive designs, and incentives could encourage greater adoption of sustainable clothing.

Overall, the findings highlight the need for coordinated efforts by educational institutions, policymakers, and the apparel industry to strengthen sustainability awareness among young consumers. Integrating sustainable fashion education into higher education and promoting accessible, affordable eco-friendly clothing can help bridge the gap between awareness and practice, fostering more environmentally responsible clothing consumption.

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ADOLESCENT GIRLS, DIGITAL MEDIA, AND SRH: A STUDY OF CYBER SAFETY AWARENESS AND RIGHTS CONCERNS

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ABSTRACT

Adolescents today are often referred to as "Digital Natives" due to their familiarity with and easy access to Digital Media platforms. The widespread availability and utilization of Digital Media platforms have increased the dependency concerning Sexual and Reproductive Health (SRH) awareness among adolescent girls; however most remain unaware of their rights and responsibilities in assessing these online platforms. Due to deeply ingrained cultural, traditional, and religious norms, SRH have continued to be taboo and a hushed-up topic in Indian families, forcing adolescents to rely on unreliable sources, both online and offline. This study was conducted with 60 adolescent girls 30 form Rural and 30 from Urban area of Jammu, using self-devised questionnaires and interview schedule. The study highlights potential need for Digital Media Literacy, particularly for adolescent girls who remain disproportionately vulnerable to misinformation and unverified online content. The study is based on both empirical findings and review-based data, emphasizing adolescents' access to digital media devices, its utilization in association with SRH, and their awareness of Cyber Safety and Digital Rights. The findings revealed that only a small number of respondents recognized the risks associated with sharing personal information online, while the majority shows limited awareness. P-value ($p=0.0089$) indicates the statistically significant difference in knowledge of rural and urban respondents' concerning Cyber Laws, with rural participants showing significantly lower understanding compared to their urban counterparts. The analysis emphasizes the critical importance of imparting comprehensive knowledge of cyber risks, legal protections, and safe, accountable Digital Media utilization skills to adolescents in the contemporary world.

Keywords: Adolescent Girls, Digital Media, Cyber Safety, Digital Natives, Digital Literacy, Digital Rights, DPDPA 2023, Sexual and Reproductive Health (SRH).

INTRODUCTION

India is a fast-growing youth consumer base for smartphones (Rao & Lingam, 2020), last decade having seen a rapid advancement in digital media devices and applications leading to an increase in frequency and duration of social media engagement (Kosola et al., 2024). There are 253 million Indian teenagers, in the age group of 10 to19 (Ministry of Health & Family Welfare-Government of India, n.d.), the biggest population of teenagers in the world (UNICEF, n.d.). An essential phase of rapid growth, physical, cognitive, and social, adolescence lays foundation for a healthy future influencing their emotions, thoughts, choices, and interactions with their environment they are living (WHO, 2025).

A significant proportion of youth aged 15–29, 87.4% urban (spending 126 minutes) and 73.4% rural (spending 116 minute) engage with Mass Media daily (*Time Use in India Survey 2024, National Statistics Office*) reflecting the deepening integration of Media Consumption among Indian Youth. For many young girls, especially in conservative or underserved settings, digital communication then becomes a vital tool for self-education.

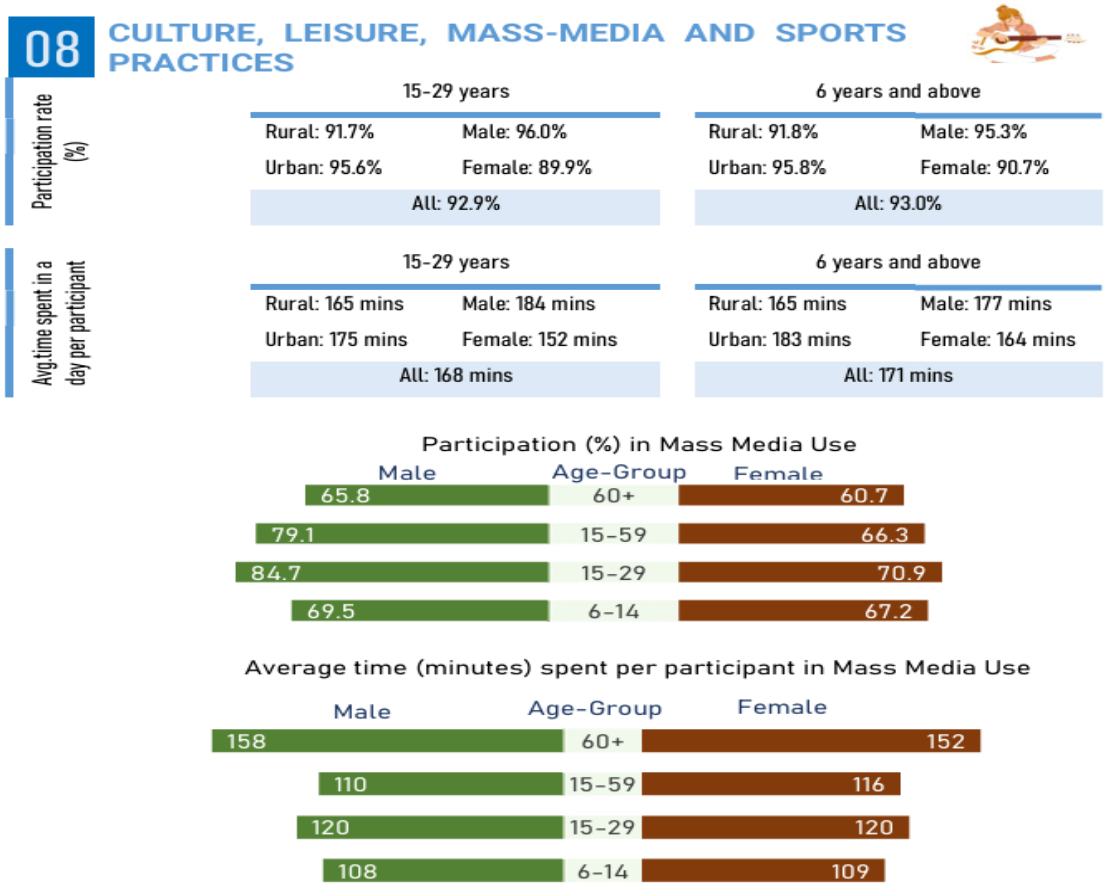

Fig.1: Average time spent per day by adolescents on Mass Media
Sources: National Sample Survey 2025; National Statistics Office Report "Time Use in India, 2024"

Sexual and Reproductive Health (SRH) Concerns of Adolescent Girls

Approximately 1.2 million adolescents pass away yearly, majority from treatable causes (UNICEF, n.d.), such as early and unwanted pregnancies, unsafe sexual behaviours that can result in STIs, HIV, or AIDS, nutritional disorders like malnutrition, anaemia, and obesity, alcohol, tobacco, and drug misuse, mental health issues, physical harm, and violence (Ministry of Health & Family Welfare- GoI, n.d.). In many nations, the disruptions that menstruation causes to life are unthinkable, with the puberty posing significant health risks for Adolescent Girls. An estimated 23 million teenage girls, 15 to 19 years, get pregnant each year, leading to death due to maternal mortality, frequently connected to child marriage (UNICEF, n.d.). The consequences are there for the babies born to these teenage mothers like growth stunting, further impairing their cognitive and physical development and lowers adult productivity (UNICEF, n.d.). Adolescents require information, including age-appropriate comprehensive sexuality education; opportunity to acquire life skills; acceptable,

equitable, appropriate, and effective health services; and safe and supportive environments, to grow and develop in good health (WHO, 2025).

Adolescent Girls access to Digital Media, Safety and Concerns of Digital Environment

Research increasingly indicates that adolescents prefer to use Social Media sites like Facebook, Instagram, Twitter, and others for information related to SRH (Saha et al., 2022). UNESCO committedly helps young people, especially young women, gain the digital skills and confidence to take part in the digital world, aiming to ascertain that females can use technology to express ideas, solve problems, and benefit from new opportunities. Government programs like the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) and National Digital Literacy Mission (NDLM) have helped by training over 63.9 million people many of them females in basic digital skills (Panda, 2025; Viksit Bharat 2027), showing the pathways to their digital inclusion.

Cybercrime, Online Safety and Associated Concerns: Digital empowerment brings not only opportunities but also serious risks, as females and gender-diverse people often become vulnerable to online abuse such as harassment, stalking, and non-consensual sharing of private images. UNICEF (2020) reported that 52% of young women had experienced online harm, with 87% believing it is worsening, and 68% of abuse occurring on social media. Similarly, the UN Broadband Commission (2015) found that 73% of women globally have faced online violence. Limited awareness of privacy settings and digital safety (UNESCO, 2020) further increases vulnerability to exploitation and misinformation, underscoring the urgent need for stronger Digital Literacy. Children between 13 to 20 years are most impacted by Cyber Crime, highlighting the importance of family awareness for prevention (Agarwal & Singhal, 2017). Online spaces often lack proper accountability (Khosla et al., 2023) and online child sexual abuse is a pervasive challenge (Anuragi et al., 2024). National Cyber Crime Reporting Portal has been established by Government of India, managed by the Ministry of Home Affairs and the Indian Cybercrime Coordination Centre (I4C) that offers a platform for reporting Cyber Crimes such as identity theft, online fraud, hacking, and cyberbullying (Cybercrime.gov.in., 2025).

Online Bullying: Adolescents increasingly exposed to digital platforms face "online hate," including cyberbullying, hate speech, and sexual harassment, and the online platforms are being used for persistent conduct intended to frighten or humiliate (UNICEF, n.d.), making the victims feel targeted everywhere, even at home, having long-lasting physical, psychological, and emotional consequences (UNICEF, n.d.).

Cyber Laws: With the emergence of Digital Media, Cyber Laws have been necessitated and are being formulated by the nations to regulate communication technology, especially the Internet or Cyberspace.

- **Protecting Adolescent Girls' Digital Rights and SRH Access under the Digital Personal Data Protection Act (DPDPA), 2023 in India:** Due to limited information sharing on SRH issues in homes and schools, many adolescent girls seek guidance from Digital Media sources, thereby exposing them to risks such as data misuse and online harassment. The DPDPA, 2023 is India's first comprehensive data protection law introduced on August 11, 2023, to address unauthorized usage and potential exploitation of personal information (Malhotra & Malhotra, 2024), marking a pivotal shift in India's data governance, especially for adolescent girls

seeking SRH information online. The Act mandates informed consent, data minimization, and bans behavioural tracking and targeted ads for minors (Government of India, 2023, Sec. 9). It further empowers adolescents as "Data Principals" with rights to access, correct, and erase personal data, supported by a "Consent Manager" for transparent sharing.

Building an inclusive digital environment will require responsible innovation, stronger awareness, and a rights-based approach that ensures both freedom and security for vulnerable groups. The present paper has tried to explore these aspects of Cyber Security among the Adolescent Girls of Jammu.

OBJECTIVES

1. To assess usage of Digital Media among Adolescent Girls of Jammu in context of their Sexual and Reproductive Health (SRH).
2. To assess awareness of Adolescent Girls regarding Cyber Rights, Safety and Digital Media Literacy.
3. To give recommendations for developing Digital Literacy Programs based on findings

METHODOLOGY

The study was conducted on the adolescent girls of Jammu District of JKUT.

Sample: 60 girls in the age group 13 to 18 years, 30 from urban and 30 from rural government schools of Jammu District were selected, using Simple Random Sampling technique.

Criteria for Sample Selection

Place of Residence: Only those who belonged to Urban and Rural area of Jammu, and were residing there since last 20 years were selected.

Education: Only those studying from the classes 7^{th} to $12^{th,}$ were selected.

Digital Media Usage: Only those were selected who were using Digital Media for more than 2 hours per day.

Sampling Technique: Simple random sampling technique was used whereby two Government Higher Secondary and Middle Schools from Urban area and Two Government Schools from the rural area were selected using lottery method from the list available on official website. With permission from authorities, 30 girls from urban and 30 from rural schools were selected amongst those fulfilling the criteria of sample selection who were screened from 7^{th}-12^{th} classes, thus preparing a list, from which the sample was selected using systematic random sampling.

Tools used for data collection:

(i) **Self-Devised Questionnaire:** It was used to assess the knowledge and awareness of adolescent girls regarding Digital Media and its Terminologies, existence of Cyber Laws and Cyber Cells, usage of Digital Media, role of parents and teachers in Online Safety and as Information Providers regarding effective utilization of these platforms etc.

(ii) **Self-Devised Interview Schedule:** It helped in generating background information of respondents' and assess knowledge and sources of information regarding their General, and Sexual and Reproductive Health.

Pretesting: The tools were pretested on 30 adolescent girls, the data for which was collected through visit to urban and rural Government Schools (Higher Secondary and Middle Schools) of Jammu. This sample was excluded from the present analysis. Based on pretesting, required modifications were made and the tools were finalized.

Validity and Reliability of Tools: Reliability was ensured using test–retest method, initially with 15 and later with 30 adolescent girls, confirming stability of responses. Content validity was established through expert evaluation by Home Science faculty, whose feedback was incorporated, while face validity was confirmed through pretesting for clarity and comprehension. Since the study employed mixed-method approach, reliability was further examined across similar items, with Cronbach's Alpha calculated on 19 items giving the result value of 0.876, indicating high internal consistency.

Ethical consideration: Informed consent of adolescent girls was obtained in accordance with the suggestions of the Board of Research Studies, and permission was obtained from the Directorate of School Education, Jammu, as well as the principals of the schools, for conducting the research.

Data Collection: Data was collected in the classrooms with the permission of the principals and help of teachers.

Data Analysis: It was coded and analysed using IBM SPSS version 26.

RESULTS AND DISCUSSION

Table No. 1: Digital Media Devices available at Homes of Respondents

Digital Media Devices at Home	Urban		Rural		Total	
	n=30	%	n=30	%	N=60	%
Smartphone	30	**100**	30	**100**	60	**100**
TV	24	**80**	23	**76.6**	47	**78.3**
Laptop	3	10	1	3.3	4	6.6
Tablet	1	3.3	1	3.3	2	3.3

***Multiple responses**

Table 1 shows that all the respondents had Digital Media devices at their home, including Smartphones, followed by Television. Very few households had laptops and tablets.

Fig 2: Digital Media Devices owned by Respondents

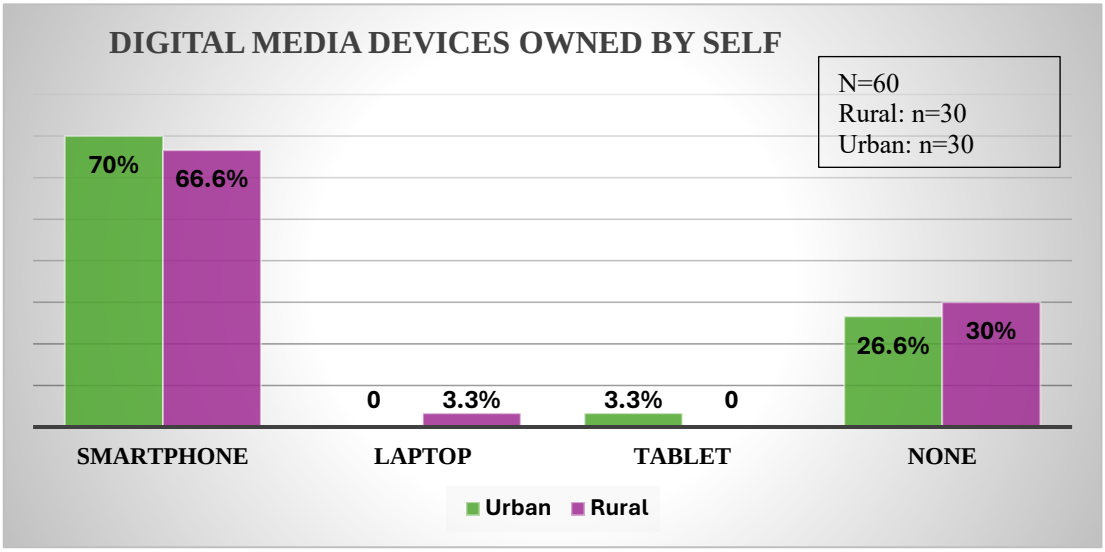

Figure 2 indicates that 70 percent respondents from urban and 66.6 percent from rural areas had their own smartphones, only 3.3 percent in the urban areas owned a tablet, and 3.3 percent in the rural areas owned a laptop.

Table No. 2: Source/Medium used to access Information about General Health

Access Information about General Health	Urban		Rural		Total	
	n= 30	%	n=30	%	N= 60	%
Mother	19	**63.3**	20	**66.6**	39	**65**
Both Parents	11	36.6	9	30	20	33.3
Teachers	6	20	5	16.6	11	18.3
Siblings	-	-	1	3.3	1	1.6
Friends	3	10	4	13.3	7	11.6
Digital Media (Smartphone)	9	30	6	20	15	25

***Multiple responses**

Overall 65 percent (Table 2),63.3 percent from urban and 66.6 percent from rural areas, accessed information concerning their General Health from their mothers, whereas 30 percent urban and 20 percent rural respondents relied on Smartphone for accessing information concerning their general health.

Table No. 3: Medium of accessing Information related to Sexual and Reproductive Health

Accessing Information about SRH	Urban		Rural		Total	
	n=30	%	n=30	%	N=60	%
Mother	13	**43.3**	10	33.3	23	**38.3**
Both Parents	4	13.3	5	16.6	9	15
Teachers	6	20	14	**46.6**	20	33.3
Siblings	3	10	-	-	3	5
Friends	6	20	1	3.3	7	11.6

Digital Media (Smartphone)	14	**46.6**	7	23.3	21	35
None/ Don't know	7	23.3	5	16.6	12	20

***Multiple responses**

Table 3 reveals that the most common source for accessing SRH information were mothers (38.3 percent), teacher's (33.3 percent), and digital media (35 percent). Mother were more frequently cited by 43.3 percent respondents from urban and 33.3 percent respondent from rural areas, and 46.6 percent rural respondents relied upon their teachers. 46.6 percent from urban and 23.3 percent from rural areas depended on Digital Media for the information. It was observed that no respondents reported accessing information from their fathers, indicating that fathers play passive role in providing guidance on SRH health matters due to persistent taboos.

Table No. 4: Awareness about the Terminologies related to Digital Media Safety and Security

Awareness regarding Terms	**Urban**		**Rural**		**Total**	
	n=30	**%**	**n=30**	**%**	**N=60**	**%**
Child Sexually Abusive Material (CSAM)	9	30	5	16.6	14	23.3
Cyber Bullying	6	20	-	-	6	10
Cyber Crime	15	**50**	13	**43.3**	28	**46.6**
Cyber Stalking	6	20	-	-	6	10
Spamming	8	26.6	-	-	8	13.3
Cyber Grooming	1	3.3	-	-	1	1.6
Data Breach	4	13.3	-	-	4	6.6
Dark participation	2	6.6	-	-	2	3.3
Virus	9	30	1	3.3	10	16.6
None	4	13.3	11	36.6	15	25

***Multiple responses**

Respondents were not aware of the most of the terminologies associated with Digital Media Safety and Security (Table 4) though few said that they had heard these terms. In urban areas only 30 percent were aware of Child Sexually Abusive Material (CSAM), 20 percent were aware of Cyber Bullying, but 13.3 percent were not aware of any of above-mentioned terms. In rural areas 16.6 percent were aware of CSAM but 36.6 percent were not aware of any cyber concerns related terminologies.

Table No. 5: Awareness about risks related to sharing Personal Information Online

Aware about risks of sharing personal information online	**Urban**		**Rural**		**Total**	
	n=30	**%**	**n=30**	**%**	**N=60**	**%**
Yes	3	10	8	26.6	11	18.3
No	26	**86.6**	22	**73.3**	48	**80**
Not much	1	3.3	-	-	1	1.6

Table 5 reveals that most of the respondents (80 percent), 86.6 percent from urban areas and 73.3 percent from rural areas, were not aware about the associated risks of sharing personal information on the digital media platforms.

Table No. 6: Do Parents or Teachers discuss about Online Safety?

Discussion about Online Safety	Urban		Rural		Total	
	n=30	%	n=30	%	N=60	%
Always	7	23.3	12	**40**	19	31.6
Sometimes	18	**60**	9	30	37	**61.6**
Never	5	16.6	9	30	14	23.3

Table 6 depicts that only 23.3 percent of respondents' parents and teachers from urban areas and 40 percent from rural areas frequently discussed Online Safety concerns with the respondents.

Table No. 7: Measures used by Adolescent Girls to protect Privacy and Security while using Digital Media

Measures	Urban		Rural		Total	
	n=30	%	n=30	%	N=60	%
Avoid sharing personal details	9	30	6	20	15	25
Use strong password	15	**50**	14	**46.6**	29	**48.3**
Avoid clicking on unknown links	8	26.6	6	20	14	23.3
Remain aware about friend or connection requests	2	6.6	2	6.6	4	6.6
Remain careful about information I share online	5	16.6	4	13.3	9	15
Use secure communication channels or application	-	-	2	6.6	2	3.3
Not Much	12	40	14	46.6	26	43.3

***Multiple responses**

Urban respondents reported (Table 7) higher engagement in protective measures, with 50% using strong passwords and 26.6 percent avoiding unknown links, than rural respondents who showed slightly lower adoption, with 46.6 percent using strong passwords and 20 percent avoiding unknown links. A considerable proportion of respondents in both contexts admitted to practicing "Not Much" (Urban: 40 percent, Rural: 46.6 percent), indicating a general lack of consistent Digital Safety behaviour.

Table No. 8: Awareness about Reporting or Blocking Inappropriate content on the Digital Media Platforms

Aware of reporting or blocking content on the Digital Media platforms	Urban		Rural		Total	
	n=30	%	n=30	%	N=60	%
Yes	21	**70**	13	43.3	34	**56.6**
No	8	26.6	14	**46.6**	22	36.6
Not Sure	1	3.3	3	10	4	6.6

Urban respondents displayed relatively higher awareness (Table 8), with 70 percent showing a stronger orientation toward platform-level safety practices among as compared to 43.3 percent of rural respondents.

Table No. 9: Awareness of Cyber Laws

Aware of cyber laws	**Urban**		**Rural**		**Total**	
	n=30	**%**	**n=30**	**%**	**N=60**	**%**
Yes	8	26.6	1	3.33	9	15
No	22	**73.3**	29	**96.6**	51	**85**
Mean	*1.73*		*1.97*			
SD	*0.450*		*0.183*			
***P value**	***0.0089***					

****P value significant at 0.05 level***

Table 9 shows that 85 percent respondents were not aware about the Cyber Laws, highlighting a pronounced lack of legal literacy in both contexts, though the gap is more severe in rural populations as shown by the statistics (p value ***0.0089)***.

DISCUSSION

This data reveals a critical gap in Digital Safety awareness, especially among rural adolescent girls. Despite increasing reliance on Digital Platforms for education, communication, and accessing sensitive information like SRH, most adolescent girls remain uninformed about Cyber Cell, Cyber Laws and other protective mechanisms. In today's Digital age, awareness of Cyber Cells, user protection laws, and privacy rights is not optional but essential. Due to inability to express, underreporting and the private nature of internet interactions, it is difficult to determine the exact prevalence of child sexual abuse (Anuragi et al., 2024).

As the Internet has emerged as a major information source, Digital Literacy in this context goes beyond education, helps to identify trustworthy and authentic content. The reliance on Digital Media highlights a need for awareness about Digital Rights, Privacy Laws, and Safe Online Practices especially in contexts where misinformation or exploitative content can circulate unchecked. Research indicates that setting limits on Social Media use, combined with adult guidance and dialogue, fosters positive outcomes for adolescents (Wachs et al., 2021). In India, cyber victimization disproportionately affects those aged 13-20, with family awareness often insufficient (Agarwal & Singhal, 2017). Addressing this gap through SRH education and Digital Literacy for adolescent girls is key to advancing health equity and responsible online behaviour. It is the **responsibility of Educational Institutions, Teachers and Parents** to ensure that girls are not only Digitally Literate but also **Digitally Empowered**.

Recommendations for Teachers and Parents: Fostering Safe and Empowered Digital Media Use

1. **Promote Digital Literacy with a Rights-Based Approach**: Teachers and Parents must educate adolescents about their rights under the DPDPA, including consent, data access, and erasure. Age-appropriate materials can be used to explain how their data is collected and how adolescents can protect it.

2. **Encourage Critical Engagement with SRH Content**: Adolescent girls must be guided in identifying credible SRH platforms that comply with privacy norms. Concerning discussions must be encouraged in classrooms and with parents about how to evaluate the trustworthiness of Applications and Websites providing Health information.
3. Parents must encourage **open conversation with adolescent girls about their online experiences** without being judgmental.
4. Parents and teachers **must respect adolescents' need for privacy** while **ensuring they are not exposed to exploitative or harmful content** over Digital Media platforms**.**
5. **Collaboration of Schools with the Health Educators:** Schools should actively collaborate with health educators, medical professionals, and subject experts to design and implement comprehensive educational programmes for adolescents. Such initiatives not only provide accurate and age-appropriate health information but also equip young learners with the critical skills to evaluate online content.
6. **Empower adolescent girls to report online violations and seek redressal:** Teachers and parents should actively make adolescent girls aware of their rights and the importance of reporting any form of online abuse, harassment, or violation they may encounter. Adolescents must be encouraged to speak up rather than remain silent, and guided to use proper grievance mechanisms such as approaching the cyber cell or other legal authorities for help.

CONCLUSION

UNESCO emphasizes empowering young women to shape the digital revolution through creativity, innovation, and informed participation. Technology must be a tool for equity, not exclusion**.** A rights-based, intersectional approach is essential to ensure that digital transformation benefits all, particularly adolescent girls and women in underserved regions. Addressing these disparities is not merely a technological challenge but a socio-political imperative for equitable development. adolescents should be educated about the provisions of the Digital Personal Data Protection Act (DPDPA) and other institutional channels available to them, so they know exactly where to seek redressal in case of data breaches or harmful online experiences. Creating a supportive environment where girls feel heard and protected will empower them to navigate the digital world responsibly and without fear.

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A COMPARATIVE STUDY OF DRUDGERY INVOLVED AND COST BENEFIT ANALYSIS OF MANUAL AND MECHANICAL POPPING OF *MAKHANA*

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ABSTRACT

Post-harvest operation of *Makhana* seeds involves multiple steps to transform it in the easily consumable form. These operations are drudgery prone involving both environmental and physical risks to the workers involved in its processing. Popping of *Makhana* is one of the toughest tasks of post-harvest operation of *Makhana* seeds. Present study was done with the objective to compare the drudgery involved in manual and mechanical popping of *Makhana* seeds. In manual operation, the *Makhana* is roasted at very high temperatures of 250°C to 320°C. Such hot *Makhana* seeds are held by the worker on their palm and then hammering is done with another hand. Higher the temperature, better comes the pops. Furthermore, in manual operations, the worker had to hammer multiple times which caused repetitive stress to them. Altogether, the output was also very less in manual operation. Whereas, in mechanical operation, workers had to just put the heated seeds (obtained from multiple ovens) into the machine and multiple *Makhana* got popped without any hand-held manual effort at the finishing point. The result of RULA analysis of manual *Makhana* popping operation gave the final RULA score of 7 which is the highest score and which recommends investigating and implementing change in the existing work pattern. Whereas, the result of RULA analysis for mechanical popping operation gave the final RULA score of 4 which recommends that further investigation is needed and change may be needed. Although the drudgery is reduced by using a machine, there is still scope of modification in the mode of feeding the seeds into the machine. Along with high drudgery involved in the manual processing of *Makhana*, its cost of production was also high. The findings also depict that efficiency and profit is more in mechanical popping as compared to manual popping. Need is to fully mechanize the *Makhana* popping activities at a faster rate involving low cost so that the health of the workers could not get compromised and industries could install it at nominal cost. Manpower could be utilized in developing the processed food products from *Makhana* for more financial benefit.

Keywords: Drudgery, *Makhana*, Mechanical, Popping, RULA.

INTRODUCTION

The traditional method of makhana popping, also known as gorgon nuts, at high temperature using a wooden mallet is a centuries-old, labour-intensive process that is deeply rooted in the Mithila region of Bihar, India. This intricate technique has been passed down through generations and is historically significant to the rural Mallah community, primarily fishermen, who have managed the harvesting and processing of makhana seeds harvested and collected from fresh water wetland. The

history and traditional process of makhana popping with a wooden mallet can be divided into several key aspects. Makhana (*Euryale ferox* Salisb.) is a wonder nut from the wetland ecosystem of India (Jana et al., 2019). It is a nutrient rich dry pop and an excellent source of plant protein, vitamins and minerals (Jana ana Idris, 2018). Makhana food industry is agro-based and mostly manual operated (Mandal *et al.,* 2010). Its production process generally starts from February (germination) to August/September (harvesting) for processing and subsequent marketing. Bihar is the largest producer of makhana, which contributed 90% of the total production in the world (Jana, 2021). *Makhana* seeds are black coloured with hard cover which pops out into white coloured pearl-like pops. Popping of *Makhana* seeds involve multiple steps to transform it in the easily consumable form. These operations are drudgery prone involving both environmental and physical risks to the workers involved in its processing. Popping of *Makhana* is one of the toughest tasks of post-harvest operation of *Makhana* seeds because it requires handling and beating the hot seeds. This activity is continuous and 3 to 4 seeds are popped manually at a time. Mechanical advancements are approaching in the processing of makhana. Different models are available for popping of the *Makhana* seeds. Farmers are also using some of these machines. Present paper broadly focusses on comparing the overall efficiency of manual and mechanical operation of popping the *Makhana* seeds.

Popping activity of makhana (fox nut / *Euryale ferox*) refers to its ability to expand and puff when heated, producing the edible, spongy white kernels commonly eaten as snacks. But the activity is highly drudgery prone as it is performed by the farmers at a very high temperature and with awkward body postures. To reduce the hazards and increase the work efficiency, technological intervention is highly needed. Various studies prove that technological assistance may significantly reduce the drudgery and increase the output of the activity. The study conducted by Tiwari *et al.* (2023) prove profoundly advantageous in driving the advancement of technology with a thoughtful gender lens, particularly in depicting the distinct obstacles encountered by women engaged in farming activities. By homing in on the distinctive requirements and varied experiences of farm women, strategic utilization of creative and pioneering approaches holds the potential to make a substantial impact in mitigating the physical strains and addressing the prevalent occupational health concerns frequently. In this experiment, to evaluate intensity of drudgery, the Rapid Entire Body Assessment (REBA), a postural analysis tool, is designed to meet the demand for a practical field device for practitioners, particularly attuned to the unpredictable working postures present in health care and similar service sectors. This technically developed postural analysis tool called Rapid Entire Body Assessment (REBA) has been created to address the need for a field tool for practitioners that is specifically sensitive to the unpredictable postures encountered in health care and other service industries. On the other hand, RULA (Rapid Upper Limb Assessment) is a survey method specifically designed for use in ergonomics investigations focused on workplaces where work-related upper limb disorders have been reported (McAtamney and Nigel, 1993). This assessment tool requires no special equipment, making it easily accessible for use in various settings, and it provides a quick yet effective evaluation of the postures of the neck, trunk and upper limbs. Additionally, it assesses muscle function and the external loads experienced by the body during tasks. A structured coding system is employed to generate an actionable list, indicating the level of intervention necessary to mitigate injury risks caused by physical loading on the operator, thus promoting safer work environments.

In the light of this, there is a need to assess the drudgery involved and cost effectiveness of popping the makhana seeds manually as well as using technological so that the effectiveness of the technology could be assessed. Therefore, the present study has been designed with the following objectives:

OBJECTIVES

1. To assess the drudgery involved in manual and mechanical popping of makhana seeds
2. To compare the popping efficiency of manual and mechanical operation
3. To assess the economic benefits of both the techniques

Hypothesis

H_o1: There is no difference in the drudgery involved in manual and mechanical operations
H_o 2: There is no difference in the popping efficiency of manual and mechanical operations
H_o3: There is no difference in the economic benefit of both the techniques

METHODOLOGY

- **Locale**: Local farmers of different locations of Darbhanga district were selected for the study.
- **Sample:** Five Farmers who were directly involved in the post-harvest operation of makhana were selected for the experiment. Detail of farmers are given in table 1.

Table 1: Farmers involved in testing of the machine

Name*	Location
Mahesh Mukhiya	Kapchhahi, Bahadurpur, Darbhanga
Raja Mukhiya	Muhammadpur, Darbhanga
Anil Sahni	Jagdishpur, Darbhanga
Paras Kumar Singh	Benipur, Darbhanga
Raj Kumar	Manigachhi, Darbhanga

*Name has been mentioned here with the consent of the farmer.

- **Tools used:** for conduction the experiment and assessing the drudgery, following tools were used:
  - **Interview schedule:** An interview schedule comprising the personal information and work-related information of the farmers was prepared which helped in collecting the information pertaining to the drudgery involved in popping of makhana seeds.
  - **RULA Worksheet:** Rapid Upper Limb Assessment Worksheet is a postural assessment tools which uses scoring system for evaluating the drudgery of the seated task. RULA scores range from 1 to 7 (Fig 1). Table 2 represent the interpretation of the RULA scores.

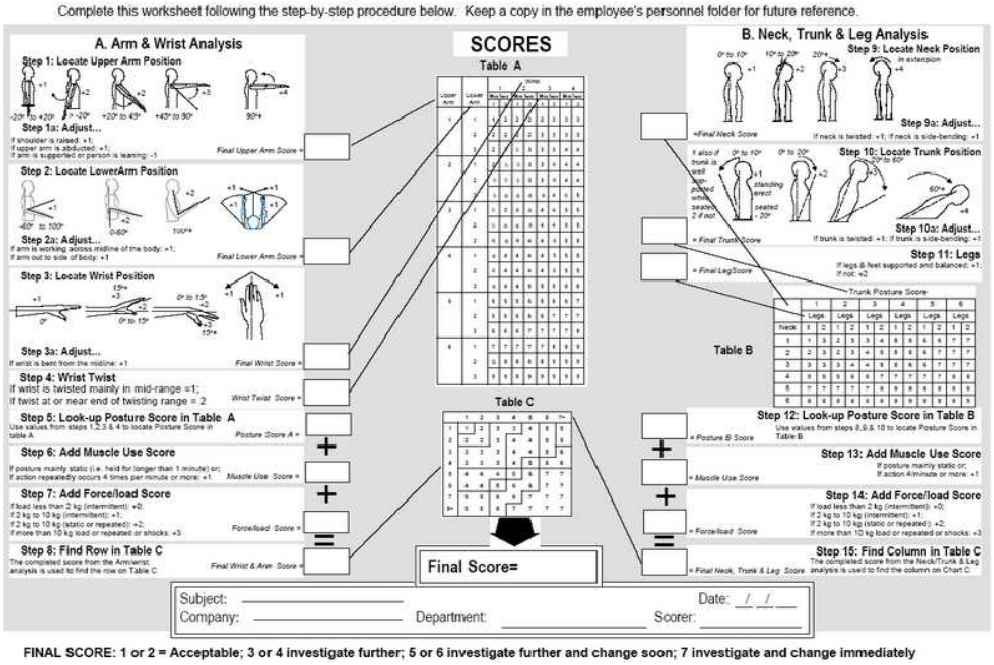

Fig 1: RULA worksheet

Table 2: Interpretation of RULA Score

Score	Interpretation
1 or 2	Acceptable
3 or 4	Investigate further
5 or 6	Investigate further and change soon
7	Investigate and change immediately

❖ **Experimental procedure**

Drudgery assessment: Manual and mechanical both the techniques were observed for 10 minutes in natural work environment and the parameters were recorded. Proper rest gap was given between both the techniques. Table 3 describes the details of the experiment. Experimental procedure adopted is discussed below:

- Popping operation done by the farmers was observed and its photographs and videos were recorded.
- Technique compared: T1=Manual popping without using any machine and T2= Mechanical popping using Adiya Popping Machine (Fig 2) which is a gender-neutral tool allowing both male and female workers to operate it effectively.

Fig 2: Adiya Popping Machine being used by a female farmer

- Both type of operations was observed minutely and its drudgery was assessed subjectively and objectively. Subjective assessment was done by taking the response of the respondents and observing their work posture and work pattern. Whereas, objective assessment was done by using Rapid Upper Limb Assessment (RULA) Worksheet.

Table 3: Experimental techniques adopted for drudgery analysis of makhana popping

Techniques	T1	T2
Detail	Manual popping of makhana seeds using wooden hammer	Popping of makhana seeds using Adiya Popping Machine
Duration of experiment	10 minutes	10 Inutes

Cost benefit assessment: Efficiency of both the operations and economic benefits were also compared for both the techniques. The experimental procedure for cost benefit assessment is discussed below: The popping operation of full day was also recorded to calculate the actual efficiency of the machine and cost-benefit assessment of both the operations.

FINDINGS AND DISCUSSION

Results are presented under two subsections namely drudgery assessment and cost-benefit assessment. Under drudgery assessment, the discomfort faced by worker while performing the popping activity by both the techniques has been presented. Whereas, under cost-benefit assessment the results pertaining to machine testing like efficiency of the machine, output and cost assessment are presented.

Drudgery Assessment

Drudgery involved in popping of makhana seeds using both the techniques was assessed subjectively and objectively. Subjective assessment was done using interview schedule and its results are presented in table 1. In this technique, respondents were asked about various type of drudgery faced by them in popping the seeds. Whereas, objective assessment was done using Rapid Upper Limb Assessment (RULA). Micro motion work analysis system was used to study the posture adopted by them while performing the popping operation. The video recording of activity was prepared and it was analyzed minutely to calculate the RULA Score. It is very clear from the table 3 that RULA score was higher for all the body parts while performing the activity manually. Adiya popping machine helped in reducing the drudgery at all the body parts namely arm, wrist, neck, trunk and leg. But the RULA score suggests that further investigation is needed and change may be needed which may be in the form of more improvised machine.

Table 4 represents the data of subjective drudgery assessment of manual and mechanical popping of makhana. Results represented that almost all the drudgery like touching of hot seeds, stretching of joints while hammering, prolonged flexing of neck and burning/ scorching of palm were eliminated by using the present intervention. Whereas, the drudgery of multiple hand movement was reduced by using the present intervention.

Table 4: Subjective drudgery assessment of manual and mechanical popping of makhana

Drudgery involved in Makhana popping	T1	T2
Touching hot seeds	Present	Eliminated
Stretching of joints while hammering	Present	Eliminated
Multiple movement of hands	Present	Reduced
Prolonged Flexing of neck	Present	Eliminated
Burning/scorching of palm	Present	Eliminated

Table 5 presents the average RULA score of the workers while performing the popping activity with and without technological intervention. Visible reduction in discomfort was experienced after using the Adiya popping machine as the RULA score while popping the makhana seeds manually was 8 and 7 at neck, trunk and leg as well as arms and wrists respectively. The overall RULA score of the activity was also 7 while performing the task manually which suggests "Investigate and change immediately". Whereas, while mechanical popping, the average RULA score of the workers were 5 at arm and wrist as well as 1 for trunk and leg. The average final RULA score reduced from 7 to 4 by using the mechanical intervention which suggests "investigate further". It means that the drudgery has been reduced remarkably but there is need for more improvement in the work pattern so that the overall RULA score comes in the acceptable range of 1-2. Therefore, there is scope for more research and innovation in this area.

Table 5: Objective drudgery assessment of manual and mechanical popping of makhana using RULA Worksheet

Techniques	Body Part Score	RULA score	Interpretation based on final RULA score
T1	Arm and wrist analysis	7	Investigate and change immediately
	Neck, trunk and leg analysis	8	
	Final score	7	
T2	Arm and wrist analysis	5	Investigate further
	Neck, trunk and leg analysis	1	
	Final score	4	

Cost-Benefit Assessment

Fig 3a: Manual Popping being of makhana

Fig 3b: Popping being done by Adiya Popping Machine

Fig 3 a and b show manual and mechanical popping of makhana respectively. Figure shows that final popping was done by one man (institute photo). Selling price of the Adiya popping machine is 2,00,000. Subsidized rate of the machine for the farmer is Rs 40,000. Depreciation loss of the machine is supposed to be 1 percent of the machine cost per day which comes to be Rs 400 /day. Depreciation loss is defined as the consumption of fixed capital i.e. wear and tear cost of the machine.

Results of efficiency (Table 6) portrays that production and income increased from T1 to T2. The popping capacity range for T1 was 120-135 kg/day whereas for T2, it increased to 160-170 kg/day and ultimately the average popping efficiency was 15.90 kg per hour in T1 which increased to 20.60 kg per hour by using the intervention. The working hour for the operation was 8 hour per day.

Table 6: Comparison of efficiency of both the techniques

Techniques	Popping Capacity Range (Seeds Utilized) (Output Range)	Average Popping Capacity (kg /day) (Average Output)	Efficiency Range = Output/Time (Output per hour)	Average popping Efficiency (kg/hr)
T1	120-135 kg/day	127.5	15.00-16.875 kg/hr	15.90
T2	160-170 kg/day	165.0	20.00-21.25 kg/hr	20.60

Source: Author's Calculation

Table 7 presents the income related information with and without using the intervention. It is clear from the table that net income increased from T1 to T2. In T1 the net income was Rs. 24,507 which increased to Rs. 35,949 by using the machine. Depreciation cost of the machine (Rs. 400) is also considered in the income calculation. In terms of manual labour saving, the data represents that by using the machine, the requirement of one worker was replaced by machine. An additional popping option of 5 kg/day was there in T1 which increase 8 times to 40.4 kg/day in T2. The additional popping option implies feeding of roasted nuts into the machine from both sides.

Table 7: Income related information of both the techniques

Treatments	Input (Rs) A	Gross Income (Rs) B	Net Income (Rs) (A-B)	No. of labour involved	Additional Popping option (kg)
T1	2,21,650/-	2,46,157/-	24,507/-	6.0	5.00 kg/day
T2	2,13,320/-	2,49,269/-	35,949/- -400*= 35,549/-	5.0	40.4 kg/day

Source: Author's Calculation

The machine is appropriate for popping in small-scale industries, particularly benefiting rural farmers. By adopting this machine, these farmers can significantly enhance their operations and productivity. This new venture could influence farmers to engage in more extensive cultivation and processing practices. As a result, they would be empowered to diversify their crops and improve the quality of their produce. The activities generated by this increased production would provide farmers with sustainable livelihood security over the long term. With a reliable source of income, rural communities can uplift their living standards and invest in better education and healthcare for their families.

CONCLUSION

Popping of makhana is a tedious and labour-intensive activity requiring considerable effort and attention. This arduous task exposes farmers to various hazardous conditions, including the risk of burns and scorching of their palms, prolonged neck flexing, and joint strain, which can lead to long-term health issues. Technological interventions can significantly reduce both manual labour and

associated hazards. For instance, the Adiya Popping Machine has shown promise in minimizing the manual efforts required for popping makhana seeds. However, even more advanced technology is necessary to further alleviate the drudgery involved. To improve the health and financial stability of farmers, it is essential to promote the mechanical popping of makhana more widely.

SUGGESTION FOR FUTURE RESEARCH

- Similar study can be done for comparing the different available technologies and selecting best technology for the selected area.
- Different tools available for the processing of makhana can be sought and the complete process of makhana processing can be mechanized and drudgery as well as cost-benefit analysis could be done.

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A STUDY ON THE FUNCTIONAL UTILIZATION OF UNDER-STAIR SPACES IN RESIDENTIAL INTERIORS

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ABSTRACT

In residential design, especially in compact homes, space management is a key concern. One area that is often neglected is the space beneath staircases. This area is more often than not left empty or used for basic storage, yet it can be extremely transformative and usable "when designed purposefully." This study investigates the usable potential of under-stair spaces by identifying the existing uses, exploring new ways of designing them, and finding ways of arranging the area that are equally usable and aesthetically viable in everyday life. The study utilizes research through a literature review, case studies, and user surveys, investigating the uses of under-stair spaces and how they can function as practical spaces. Under-stair spaces can function as storage units, working spaces, sitting nooks or other decorative features. The study looks at the user experience regarding these new uses of under-stair space, analyzing the "impact of ergonomics, accessibility, light, and materials." The result is a set of design implications that support effective, user-centric, and visually consistent spatial uses of under-stairs spaces in home interiors. The result represents a good opportunity to introduce a more usable and visually patterned design that benefits homeowners and/or designers by increasing the value of every usable square foot of their homes.

KEY WORDS - Under-stair spaces, Residential interior design**,** Multifunctional design, Compact homes, Space utilization.

INTRODUCTION

In the evolving field of residential interior design, space efficiency has become a key concern, particularly in urban and compact homes where maximizing utility while maintaining aesthetics is essential. Traditionally, under-stair spaces were treated as leftover or dead zones, used only for minimal storage. However, with changing lifestyles and increasing housing constraints, these areas are now recognized for their potential in spatial optimization and multifunctional design (Chen, 2018).

Modern design approaches emphasize creative and functional solutions, transforming under-stair spaces into storage units, seating areas, workspaces, and decorative zones. The integration of modular furniture and flexible design allows adaptability to changing user needs, improving space efficiency and reducing clutter (Asmadi & Romli, 2022; Saied et al., 2024; Husein et al., 2022).

Ergonomics and safety are critical, as under-stair areas are directly influenced by stair geometry. Inconsistent riser and tread dimensions can lead to discomfort and safety risks (Agyefi-Mensah et al., 2022; Arslan & Erkan, 2021), while even minor variations can increase trip hazards (Francksen et al., 2020). Proper headroom, clearance, lighting, and accessibility are therefore essential for usability (Kim, Steinfeld & Weidemann, 2023).

In addition, aesthetic integration plays a vital role in ensuring visual harmony. The use of matching materials, finishes, and concealed storage systems enhances spatial continuity and reduces clutter (Tolstrup & Mama, 2016; Thompson, 2023; Arnab, 2025). Effective spatial planning and circulation further improve user experience by aligning under-stair zones with the overall layout (Nicoll, 2007; Atmodiwirjo, 2025).

Finally, sustainability, cost, and material selection influence long-term usability, with durable, low-maintenance, and modular solutions supporting efficient and sustainable design practices. This study aims to explore such functional, aesthetic, and user-centered approaches to optimize under-stair spaces in compact residential interiors.

OBJECTIVES

1. To explore creative and functional design solutions for making effective use of under-stair zones.
2. To study the role of storage, seating, and multifunctional use in under-stair space planning.
3. To analyze user needs and preferences related to the use of under-stair areas in compact homes.

RESEARCH METHODOLOGY

The study adopts a descriptive research design to examine the use and design of under-stair spaces in residential interiors. A sample of 50 respondents was selected using a convenience sampling method, including individuals living in both apartments and independent houses to ensure diversity in spatial contexts. Primary data were collected through a structured questionnaire consisting of 15 questions covering usage patterns, functional preferences, design approaches, challenges, influences, and satisfaction levels related to under-stair spaces.

The study is guided by clear objectives focusing on exploring creative and functional design solutions, understanding the role of storage, seating, and multifunctional use, and analysing user needs and preferences in compact homes. The collected data were coded and analysed using descriptive statistical tools, specifically frequency and percentage analysis. The findings are presented through tables and charts to provide clarity and facilitate interpretation. This approach enables a systematic understanding of common trends and practical applications of under-stair spaces in contemporary residential design.

RESULTS AND DISCUSSION

Descriptive Statistics

1.Demographic Profile, Awareness and Usage of Under-stair Space

Table 1: Demographic Variables

Variable	Category	Frequency	Percentage (%)
Age	21 -30	25	50
	31 - 40	4	8
	41 - 50	19	38
	51 - 60	2	4
	Above 60	0	0
Educational Qualification	Below High School	3	6
	High School Graduate	8	16
	Diploma/Certification	0	0
	Undergraduate Degree	28	56
	Postgraduate or higher	11	22
Area of Residence	Urban	36	73.5
	Semi-urban	12	24.4
	Rural	2	4.1
Occupation	Business Owner	11	22
	Homemaker	17	34
	Freelancer/Contractor	4	8
	Self-employed	8	16
	Unemployed	2	4
	Retired	2	4
	Other	6	12

Table 1 shows that young people and well-educated individuals make up most respondents (21–30 years, 50%), with undergraduates forming a majority (56%). Most live in urban areas (73.5%), while (24.4%) live in semi-urban areas and (4.1%) live in rural areas. In terms of occupation, homemakers (34%) and business owners (22%) form the largest groups, indicating a mainly urban, young, and educated sample.

2. Ideal or Main Functional Use of Under-Stair Space

Table 2: Ideal or Main functional use of the under-stair space

Variable	Category	Frequency	Percentage (%)
Ideal/Main use	Functional storage	29	58
	Reading nook	4	8
	Home office/workspace	0	0
	Guest Bathroom	2	4
	Display/decorative use	4	8
	Laundry or utility area	4	8
	Prayer room	2	4
	Play area for kids	3	6
	Pet space	2	4

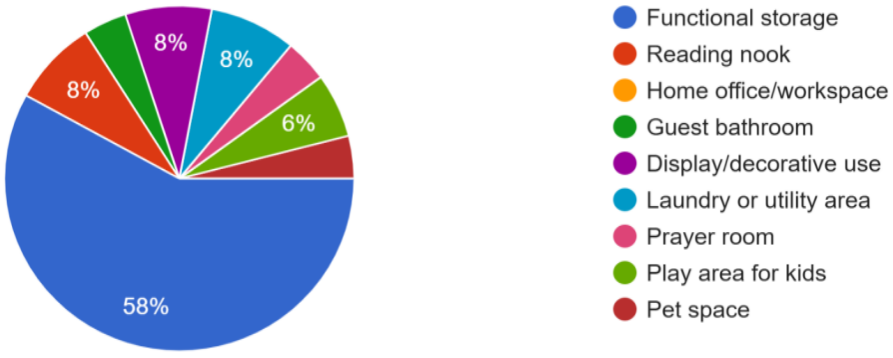

Figure 2: Ideal or Main functional use of the under-stair space.

Table 2 and **Figure 2** reveal that 58% of homeowners, renters, and residents prefer using the under-stair space for functional storage, making it the most common and practical choice. Around 8% each have converted the space into a reading nook, decorative display area, or laundry/utility zone, showing interest in creative and purposeful design adaptations. Smaller percentages use it as a children's play area (6%), a prayer room (4%), a guest bathroom (4%) or a pet space (4%) while no respondents reported using the space for a home office. This indicates that although most residents

use the area for storage, there is growing trend toward transforming under-stair spaces into personal nooks and multi-use areas to maximize functionality and enhance interior design.

3. Key Factors Influencing Design Decisions

Table 3: Key Factors Influencing Design Decisions

Variable	Category	Frequency	Percentage (%)
Key factors influencing design decisions	Functional storage	29	58
	Reading nook	4	8
	Home office/workspace	0	0
	Guest Bathroom	2	4
	Display/decorative use	4	8

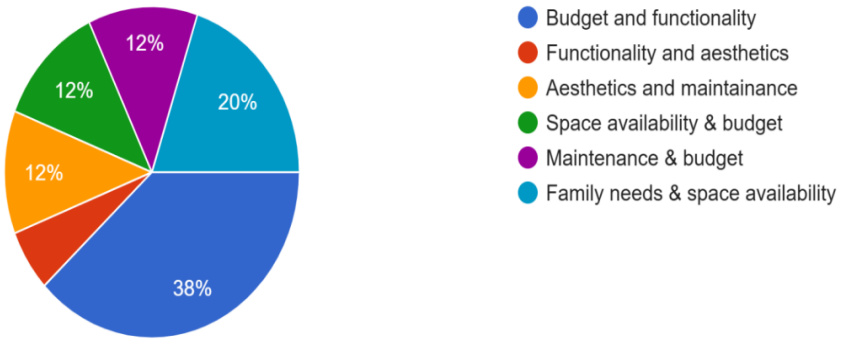

Figure 3: Key Factors influencing design decisions

Table 3 and **Figure 3** show that 38% of homeowners, renters, and residents demand budget and functionality as the primary components influencing the under-stair space design. Fewer than 20% prioritized family needs and space availability. Other groups focused about 12% each on aesthetics and maintenance, space availability and maintenance, and maintenance with budget consideration. Only 6% valued functionality and aesthetics together. This observation indicates that practical aspects such as cost, usability, and maintenance influence design decisions more than purely visual factors. This reflects a balanced yet budget-conscious approach to interior space planning.

4. Estimated Budget for Redesign or Improvement

Table 4: Estimated Budget for redesign or improvement of Under-Stair Space

Variable	Category	Frequency	Percentage (%)
Estimated budget for redesign or improvement	Below ₹5,000	5	10
	₹5,000 - ₹15,000	20	40
	₹15,000 - ₹30,000	8	16
	₹30,000 – 50,000	2	4
	Not planning to spend	14	28

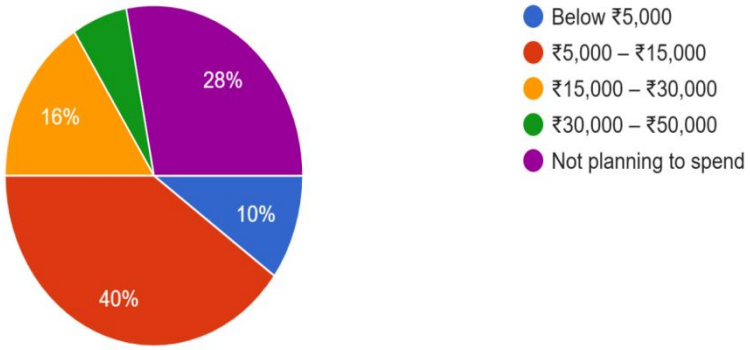

Figure 4: Estimated Budget for redesign or improvement of Under- Stair Space

Table 4 and **Figure 4** show that 40% of homeowners, renters, and residents plan to spend between ₹5,000 to ₹15,000 to utilize under-stair spaces, making this, the level of spending they prefer most. Approximately 16% state they will spend between ₹15,000 to ₹30,000, while 10% want to stay under ₹5,000. Only 6% express a willingness to spend up to ₹50,000, representing the smallest group of spenders. Another 28% do not intend to invest in the modification at all. In general, the findings show that the majority prefer cost-effective functional design solutions, and only few desire higher levels of spending. This confirms that most residents are practical and budget-conscious when utilizing this space.

5. Sources of Design Awareness and Inspiration of Under- Stair Space

Table 5: Sources of design awareness and inspiration of Under-Stair Space

Variable	Category	Frequency	Percentage (%)
Sources of design awareness and inspiration	Social media (Pinterest, Instagram)	23	46
	TV/Home shows	4	8
	Magazines	2	4
	Online blog/websites	2	4
	Friends or family homes	11	22
	Not applicable	8	16

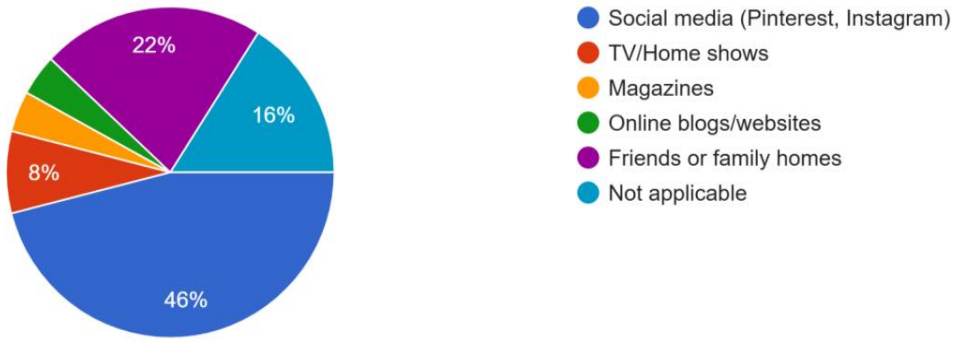

Figure 5: Sources of design awareness and inspiration of Under- Stair Space

According to **Table 5 and Figure 5**, social media sites such as Pinterest and Instagram inspired 46% of respondents who are homeowners, renters, or residents to use under-stair spaces. This source was the most popular inspiration. Approximately 22% of respondents drew inspiration from the homes of friends or family, while fewer found inspiration from TV/home shows (8%), Magazines (4%) or Blogs/online websites (4%). A remaining 16% said this question did not apply to them. This finding indicates that digital platforms and social media exert an increased influence, as they share inspired ideas for creative interior designs and encourage many people to consider using these under-stair spaces for other innovative purposes.

6. Online Search and Inspiration for Design Ideas for Under- Stair Space

Table 6: Online search and inspiration for design ideas for Under-Stair Space

Variable	Category	Frequency	Percentage (%)
Online search and inspiration for design ideas	Yes	24	48
	No	26	52

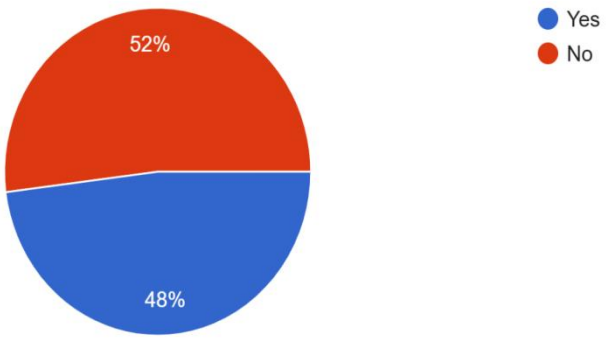

Figure 6: Online search and inspiration for design ideas for Under- Stair Space

Table 6 and Figure 6 show that 52% of participants have searched for ideas or inspiration for under-stair space online, compared to 48% who have not. This highlights a somewhat balanced trend; however, a majority of people search digital platforms for creative ideas. This trend reflects the growing impact of some online media, especially design-related media, which motivates home and building owners to engage and investigate new ideas for these often-underutilized spaces.

SUMMARY & CONCLUSION

The study highlights the growing importance of utilizing under-stair spaces in modern residential interiors, particularly in compact urban homes. The findings reveal that a large majority of respondents actively use under-stair areas, mainly for functional storage, indicating a strong preference for practicality over purely decorative purposes. The demographic profile shows that most users are young, educated, and urban-based, which reflects a higher awareness of space optimization and modern design trends. Although creative uses such as reading nooks, utility zones, and decorative displays are emerging, they are still less common compared to storage-oriented solutions.

The results further emphasize that budget and functionality are the primary factors influencing design decisions, with most respondents preferring affordable improvements within a moderate price range. Social media platforms and personal networks play a significant role in spreading design awareness and inspiring innovative ideas. However, certain challenges such as poor

lighting, accessibility issues, and maintenance concerns continue to affect the effective use of these spaces. Despite this, most users' express satisfaction with their current setups and recognize the importance of including under-stair areas in overall home design.

In conclusion, the study confirms that under-stair spaces hold significant potential for enhancing both functionality and aesthetics when designed thoughtfully. By focusing on user needs, ergonomic considerations, and cost-effective solutions, these often-overlooked areas can be transformed into valuable and efficient components of residential interiors.

SUGGESTIONS FOR FUTURE RESEARCH

1. Cost-Effective Design Strategies for Under-Stair Spaces in Residential Interiors
2. The Role of Under-Stair Spaces in Enhancing Residential Space Efficiency

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MINDFUL DISCONNECTION: AN ANALYTICAL STUDY OF YOUTH'S DIGITAL DETOX PRACTICES IN THE AGE OF SMART TECHNOLOGIES

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ABSTRACT

Excessive use of smart technologies has become a growing concern among youth, influencing their physical, psychological, and social well-being. In today's age of smart technology, digital devices have become an integral part of daily life, especially for young people. The rapid development of artificial intelligence–driven applications, smartphones, and social media platforms has greatly reshaped the way individuals communicate, learn, and spend their leisure time. Although these innovations offer greater convenience and improved access to information, excessive use of digital devices has sparked growing concerns about physical health, mental well-being, sleep patterns, and the quality of social relationships. The present study explores digital detox practices among youth in the age of smart technologies. A descriptive research design was adopted, and data were collected from 250 respondents aged 18–25 years using a structured questionnaire through purposive and snowball sampling techniques. The findings indicated that many respondents were not consistently adopting digital detox practices such as limiting screen time, avoiding device use before sleep, consciously disconnecting from technology, and engaging in offline activities. The results highlight the need for structured interventions to promote healthier digital behavior among youth. Based on the findings, an educational intervention was developed to encourage digital detox practices. The study also emphasizes the supportive role of Artificial Intelligence enabled features, such as screen-time monitoring tools, reminder systems, and personalized feedback mechanisms, in facilitating mindful technology use and improving overall well-being among youth.

Keywords: Digital Detox Practices, Youth, Smart Technologies, Artificial Intelligence, Well-Being

INTRODUCTION

In the contemporary era of smart technologies, digital devices have become an essential component of everyday life, particularly among youth. Rapid advancements in artificial intelligence enabled applications, smartphones, and social media platforms have significantly transformed communication patterns, educational practices, and recreational activities. While these technological developments provide convenience and accessibility, excessive engagement with digital devices has raised increasing concerns regarding physical health, psychological well-being, sleep quality, and interpersonal relationships. Continuous connectivity, personalized content algorithms, and frequent notifications often encourage prolonged screen exposure, making it challenging for young individuals to regulate their technology use effectively (Twenge et al., 2019).

The concept of digital detox has emerged as a practical approach to address the negative consequences associated with excessive digital usage. Digital detox practices involve conscious

efforts to reduce screen time, limit unnecessary digital engagement, avoid device use before sleep, and participate in offline recreational and social activities to maintain a balance between online and offline life. These strategies promote self-control and healthier lifestyle choices by emphasizing conscious disconnection rather than total rejection of technology (Syvertsen & Enli, 2020). In the context of modern smart technologies, Artificial Intelligence can also play a supportive role in encouraging healthier digital behavior through screen-time monitoring features, automated reminders, focus modes, and personalized feedback systems that assist individuals in managing their technology usage patterns more effectively.

Youth represent a particularly vulnerable population due to developmental, academic, and social demands that increase their dependence on digital platforms for communication, entertainment, and information. Irregular digital habits and lack of structured guidance often result in unhealthy usage patterns, highlighting the need to examine digital detox practices among youth. Understanding behavioral patterns related to technology use can provide valuable insights for promoting responsible digital engagement and improving overall well-being in the age of smart technologies.

The increasing integration of smart technologies and AI-driven digital platforms into everyday life has significantly influenced the lifestyle and behavior of youth, leading to excessive screen exposure and dependency on digital devices. Prolonged engagement with technology has been associated with problems such as reduced concentration, sleep disturbances, mental fatigue, and decreased social interaction. Although youth are surrounded by advanced technological resources, many lack awareness and practical strategies to regulate their usage effectively. Understanding digital detox practices among youth is therefore essential to identify behavioral gaps and promote healthier technology engagement. Furthermore, Artificial Intelligence enabled digital well-being tools offer new opportunities to support behavioral change by helping individuals monitor their screen usage, receive reminders, and develop self-control over digital habits. However, limited research has focused on the role of such smart technology features in encouraging digital detox practices among youth. The present study is therefore justified in examining youth digital detox practices within the context of smart technologies and highlighting the importance of structured interventions to enhance well-being and promote balanced digital lifestyles.

Moreover, promoting digital detox practices among youth is important from the perspective of sustainable lifestyle management and overall well-being. Balanced use of smart technologies not only supports mental health and productivity but also improves interpersonal relationships, time management, and quality of daily life. Artificial Intelligence–enabled digital well-being tools provide innovative opportunities to encourage behavioral change by offering personalized insights, usage monitoring, and timely reminders that help individuals regulate their technology habits. However, the adoption of such supportive technological features depends largely on awareness and behavioral readiness among users. Therefore, examining digital detox practices among youth and highlighting the supportive role of AI-driven tools is essential for designing effective interventions that foster mindful technology engagement and promote healthier living patterns in the digital age.

OBJECTIVES

1. To assess the extent of usage of Artificial intelligence enabled smart technologies among youth.
2. To find out the practices followed by the respondents regarding digital detox.

3. To develop an educational module for enhancing the knowledge of the respondents to overcome digital dependency**.**

METHODOLOGY

A descriptive research design was adopted to examine digital detox practices among youth in the age of smart technologies. The study was conducted in Vadodara city, Gujarat, India, and the unit of inquiry comprised youth aged between 18 and 25 years. A sample of 250 respondents was selected using purposive sampling, and participants were further reached through the snowball technique. Data were collected using a structured questionnaire developed in accordance with the objectives of the study. The questionnaire included sections on background information, usage patterns of smart technologies, and digital detox practices of the respondents. Responses related to practices were measured using a three-point continuum scale; Always, Sometimes and Never. The content validity of the tool was established through expert evaluation, and reliability was determined using the split-half method with satisfactory reliability coefficients. The investigator personally collected the data after establishing rapport with the respondents to ensure accurate responses. The collected data were analyzed using descriptive statistical methods to understand the extent of digital detox practices among youth. An educational module was developed to promote practices and encourage healthier digital behavior. The module incorporated guidance on the use of Artificial Intelligence enabled digital well-being features, such as screen-time monitoring tools, reminder systems, and usage feedback mechanisms, to support the adoption of digital detox practices and enhance overall well-being among youth.

FINDINGS AND DISCUSSION

The findings of the study are as follows:

Section: 1 Demographic Profile of the respondents

This section dealt with the demographic profile of the respondents such as; age, gender, educational qualification, occupation and monthly family income.

Table 1: Demographic profile of the respondents

Sr. No.	Personal Information of the Respondent	Respondents (n=250)	
		f	%
1	**Age (in years)**		
	18 - 20	111	44.4
	21 - 22	57	22.8
	23 - 25	82	32.8
	Mean	**21.21**	
	S.D.	**2.18**	
2	**Gender**		
	Male	98	39.2
	Female	152	60.8
3	**Educational qualification**		
	High school	43	17.2
	Diploma	32	12.8
	Graduate	142	56.8
	Post graduate	33	13.2

	Occupation of respondent		
	Student	181	72.4
4	Employed	56	22.4
	Unemployed	13	5.2
	Monthly family income (in ₹)		
	Below ₹10,000	17	6.8
	₹10,001 – ₹25,000	63	25.2
5	₹25,001 – ₹50,000	104	41.6
	Above ₹50,000	66	26.4
	Mean	**36,850**	
	S.D.	**18,363**	

The demographic profile presents the respondents who participated in the research. A total of 250 youth from Vadodara were included in the sample, representing individuals aged between 18 and 25 years. The age distribution showed that 44.4 per cent of the respondents were in the 18–20 years age group, 22.8 per cent of the respondents were between 21–22 years, and 32.8 per cent of the respondents were between 23–25 years. In terms of gender, 60.8 per cent of the respondents were female and 39.2 per cent of the respondents were male. Regarding educational qualification, 56.8 per cent of the respondents were graduates, 17.2 per cent had completed high school. The occupational status indicated that 72.4 per cent of the respondents were students whereas 22.4 per cent were employed, and only 5.2 per cent were unemployed. It was found that 41.6 per cent of the respondents' family income belonged to ₹25,001–₹50,000 income group, followed by 26.40 per cent had family income above ₹50,000, 25.20 per cent of the respondents had between ₹10,001–₹25,000, and 06.80 per cent below ₹10,000.

Section: 2 Extent of Practices of the respondents regarding the digital detox

The following section deals with the practices of the respondents regarding the digital detox. Total 46 statements were asked to the respondents in the 3-point continuum scale in terms of always. Sometimes and never.

Table 2: Distribution of the respondents according to their practices regarding the digital detox. (n=250)

Sr. No.	Practices of the respondent regarding digital detox	Always		Sometimes		Never		Weighted Mean (1-3)
		f	%	f	%	f	%	
1.	Taking deep breaths when feeling stressed due to excessive screen use.	76	30.4	36	14.4	138	55.2	2.25
2.	Taking short breaks to relax the mind during long screen use.	17	6.8	115	46	118	47.2	2.40
3.	Talking to friends or family members to reduce digital overload.	44	17.6	60	24	146	58.4	2.41

4.	Going for a walk to avoid continuous mobile phone use.	40	16	109	43.6	101	40.4	2.24
5.	Using hobbies such as drawing, cooking, or sports to avoid screen use.	68	27.2	82	32.8	100	40	2.13
6.	Planning the day to manage screen time more effectively.	41	16.4	99	39.6	110	44	2.28
7.	Maintaining a balance between online and offline life.	51	20.4	68	27.2	131	52.4	2.32
8.	Replacing social media time with self-care activities.	40	16	82	32.8	128	51.2	2.35
9.	Using mobile phones or laptops only for academic purposes during study hours.	58	23.2	78	31.2	114	45.6	2.22
10.	Avoiding non-academic applications while using digital devices for studies.	45	14.8	81	32.4	124	52.8	2.38
11.	Limiting the time spent on social media platforms.	37	18.8	81	23.6	132	57.6	2.39
12.	Controlling screen time during online gaming.	47	18	59	31.2	144	50.8	2.33
13.	Avoiding binge-watching shows on digital devices.	45	18.8	78	31.2	127	50	2.31
14.	Feeling comfortable staying away from entertainment applications for a day.	47	19.6	78	33.6	125	46.8	2.27
15.	Following healthy posture while using mobile phones or laptops.	49	21.6	84	32	117	46.4	2.25
16.	Avoiding screen use before sleeping for better health.	54	22	80	32	116	46	2.24
17.	Consciously monitoring daily screen time across digital devices.	55	21.6	80	35.2	115	43.2	2.22
18.	Tracking the amount of time spent on social media platforms.	54	24.4	88	31.2	108	44.4	2.20
19.	Consciously reducing screen time during weekends or holidays.	61	22.4	78	34.8	111	42.8	2.20
20.	Consciously reducing screen time spent on OTT or social media platforms.	56	20.8	87	36	107	43.2	2.22
21.	Switching off or silencing notifications to reduce digital distractions.	52	18.8	90	32.4	108	48.8	2.30
22.	Consciously disconnecting from technology to relax the mind.	47	18.4	81	28.8	122	52.8	2.34

23.	Practicing digital detox routines on a regular basis.	46	17.2	72	33.2	132	49.6	2.32
24.	Reducing screen use when experiencing eye strain or fatigue.	43	17.2	83	30.4	124	52.4	2.35
25.	Maintaining proper posture while using digital gadgets.	43	18	76	29.2	131	52.8	2.35
26.	Engaging in offline activities to improve emotional well-being.	45	20	73	28.4	132	51.6	2.32
27.	Feeling relaxed after taking breaks from digital devices.	50	24.4	71	26.4	129	49.2	2.25
28.	Avoiding the use of digital devices during face-to-face interactions.	61	21.2	66	72.4	123	46.4	3.05
29.	Spending quality time with family or friends without using digital gadgets.	53	17.2	181	37.6	116	45.2	2.28
30.	Controlling the urge to frequently check notifications.	43	20	94	32	113	48	2.28
31.	Managing digital communication without disturbing daily routines.	50	15.2	80	41.2	120	43.6	2.28
32.	Disconnecting from digital devices after completing academic tasks.	38	20.8	103	30.4	109	48.8	2.28
33.	Avoiding unnecessary use of digital gadgets without a specific purpose.	52	14.8	76	42	122	43.2	2.28
34.	Limiting the use of multiple digital devices at the same time.	37	21.6	105	32	108	46.4	2.25
35.	Preferring to download study material and read it offline.	54	22	80	33.2	116	44.8	2.23
36.	Being aware of the health effects of excessive screen use.	55	17.6	83	32.8	112	49.6	2.32
37.	Avoiding digital devices before bedtime to relax.	44	20.4	82	26.8	124	52.8	2.32
38.	Focusing on one task at a time to reduce digital stress.	51	17.2	67	30.8	132	52	2.35
39.	Experiencing improved sleep quality when screen exposure is limited.	43	19.2	77	28	130	52.8	2.34
40.	Identifying the reasons for excessive device use and attempting to correct them.	48	18	70	35.6	132	46.4	2.28
41.	Limiting access to certain applications when they become difficult to control.	45	18	89	28.8	116	53.2	2.35
42.	Challenging oneself to stay offline for a few hours.	45	14.8	72	32.4	133	52.8	2.38

43.	Avoiding opening applications that tend to consume excessive time.	37	20.4	81	28.4	132	51.2	2.31
44.	Preferring real-life interactions over screen time.	51	16.8	71	36.4	128	46.8	2.30
45.	Distracting oneself with music, exercise, or creative activities instead of screens.	42	21.6	91	34.8	117	43.6	2.22
46.	Stopping endless scrolling and engaging in hobbies when excessive screen use is noticed.	54	30.4	87	14.4	109	55.2	2.25

The data presented in the above table revealed the practices of the respondents regarding digital detox. The findings indicated that a considerable proportion of respondents were not consistently practicing digital detox behaviors in their daily life. More than half of the respondents never limited time spent on social media (57.60%), never talked to friends or family to reduce digital overload (58.40%), and never consciously disconnected from technology to relax the mind (52.80%). Nearly half of the respondents also never avoided screen use before sleeping (46%), never monitored their daily screen time (43.20%), and never engaged in offline activities to improve emotional well-being (51.60%). The weighted mean scores ranged from 2.13 to 2.41, indicating that respondents only sometimes practiced digital detox activities. Overall, the findings suggest that although some respondents occasionally adopt digital detox strategies, regular practice is limited, highlighting the need for awareness and behavioral interventions to promote healthier digital habits.

Table 3: Extent of practices of the respondents regarding the Digital detox.

Sr. No.	Extent of practices of the respondents regarding the Digital detox	Range of Score	n=250	
			f	%
1.	Low Extent	46-76	129	51.60
2.	Moderate Extent	77-107	112	44.80
3.	High Extent	108-138	09	03.60

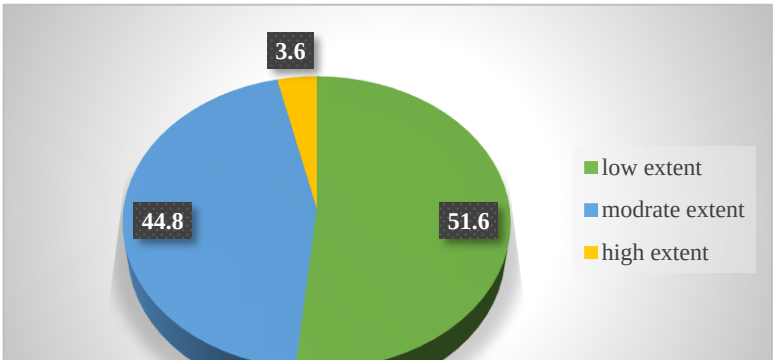

Figure 1 Overall extent of Practices of the respondents regarding digital detox

The data revealed that 51.6 percent of the respondents had a low extent of digital detox practices, followed by 44.8 percent with a moderate extent, while only 3.6 percent showed a high extent of

practices. This indicates that most youth were not actively engaged in consistent digital detox practices, emphasizing the need for improvement in mindful technology use.

Section 3: Development of an Educational Module

Based on the findings of the study, an educational module was developed to promote digital detox practices and encourage balanced technology use among youth. The educational module was prepared in the English language for better understanding of the respondents. The researcher used Microsoft PowerPoint (2024) to develop the booklet. It included information on digital device overuse, early articles on digital dependency published in newspapers, and coping strategies to overcome digital dependency. The educational module was presented to a panel of 8 experts for content verification and grammatical review in the English language. Feedback and suggestions regarding the design of the educational module, grammar, and language were received from the experts, which were taken into consideration for the final development of the educational module. The module included practical coping strategy themes such as **Be Present, Recharge Yourself, Reconnect with Family**, and **Play Outdoor Games** to support mindful disconnection and engagement in offline activities. It also provided guidance on the use of Artificial Intelligence enabled features like screen-time monitoring and reminders to help youth regulate their digital habits and improve overall well-being.

CONCLUSION

The present study highlights the increasing involvement of youth in digital device usage and the comparatively low level of digital detox practices followed by them. The findings indicate that a majority of respondents demonstrated either low or moderate engagement in practices aimed at reducing digital dependency, which may affect their overall well-being. Based on the findings, an educational module incorporating coping strategies such as Be Present, Recharge Yourself, Reconnect with Family, and Play Outdoor Games was developed to encourage mindful technology use. The incorporation of Artificial Intelligence as a supportive approach through monitoring tools, reminders, and feedback mechanisms further supports self-regulation of digital habits. Therefore, promoting AI-supported digital detox practices can serve as an effective strategy to enhance awareness and well-being among youth. This study carries significant implications for multiple stakeholders concerned with youth digital well-being. For educational institutions, it underscores the need to integrate digital detox education into curricula through awareness programs and training, using the developed module as a teaching resource to enhance students' concentration, time management, and academic performance. For youth, the findings offer practical strategies to regulate digital usage, fostering self-control and balanced lifestyle habits. For parents, the study provides guidance to monitor and manage children's screen time, thereby creating a supportive home environment. For NGOs, the module offers a structured approach to conducting community-level awareness campaigns on digital detox. For government bodies, the findings can inform the development of educational policies and digital literacy initiatives. Finally, at the societal level, the study promotes balanced digital usage and contributes to cultivating responsible individuals, ultimately supporting the development of a healthier and more disciplined society. For further research, several directions may be considered. Comparative studies could be conducted across different educational institutions, and the effectiveness of the digital detox module could be tested on varied target groups and regions. Follow-up studies may assess long-term changes in youth digital behavior, while additional modules on digital awareness and responsible technology use could be

developed for student training. Future research could also explore the role of parents and teachers in reinforcing digital detox practices among youth.

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BRIDGING THE GAP: A COMPARATIVE STUDY OF WOMEN'S FINANCIAL KNOWLEDGE, ATTITUDES, AND PRACTICES IN JOINT AND NUCLEAR FAMILIES

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ABSTRACT

Women's financial independence is essential for their decision-making power. Present study compares women from joint and nuclear families regarding their financial knowledge, attitudes, and practices, and examines how these factors relate. A sample of 120 women (60 from each family type) was assessed through a 10-question interview, with data analysed in SPSS. Women from joint families scored higher on knowledge (4.23 vs. 4.10), whereas women from nuclear families had more positive attitudes (17.98 vs. 16.80). Most women in both groups demonstrated high financial knowledge, with only a few at low levels. The results reveal a negative correlation between family type and attitudes, and a positive correlation between knowledge and practices. Attitudes were strongly linked to practices. There was no significant difference in knowledge or practice scores. The regression analysis showed that family structure affects knowledge, attitudes, and practices. Attitudes had a negative association, while practices had a positive one. Women in joint families showed greater knowledge and better financial habits, while Women living in joint families tended to have more financial knowledge and better money habits, while those in nuclear families showed more positive attitudes. This suggests that family dynamics strongly influence how women think about and handle money. The study also points out that encouraging a positive financial mindset at home matters just as much as teaching technical skills for true financial independence.

Keywords: Financial Management, Financial Literacy, Family Type and Household Dynamics

INTRODUCTION

According to the World Health Organisation (2012), a person's quality of life depends on their culture and values, which they use to achieve their life goals, meet expectations, improve the quality of life, and get rid of worries. That is, the quality of life is influenced by an individual's culture, values and standards (Oberoi & Singh, 2025). India is a socially conservative country where the determination of family values and standards plays an important role. A family can be seen as an 'umbrella' whose real value becomes evident only when an individual is plagued by problems, especially during an economic crisis, when family members expect help from one another. Family is where we grow up, learn, agree and disagree, quarrel and compromise, move on with our lives, but whenever we need someone, the same family and siblings stand by us. In today's society, managing the family's financial responsibilities is an important function, whether the family is rich or poor, single or joint. In the current economic landscape, there is no room for rigid planning (Sebayang *et al.,* 2022; Kaban*,* 2024) or for spending models amid rapidly unfolding social and economic changes. Simply, there is a need to make effective use of the funds through proper planning

and budgeting for the household's various expenses. Effective and successful management has shown new ways of achieving the goal despite the limitations of our resources.

The wise use of resources in modern homes not only gives satisfaction but also impacts the development and social well-being of family members. In fact, financial management refers to managing money by taking into account all aspects. At the general level, financial management for corporations and organisations is studied, but it is also important at the family level. Money is considered a symbol of power, control, trust, competence, and more between a husband and wife, since there are no set rules or regulations governing its management. They should learn different ways to manage it effectively through proper discussion on their own (Bourdeaux, 2016). For a strong, stable family, financial planning is very important, as it helps prevent financial distress. (Borden *et al.*, 2004)

It is the women in the family who mainly take care of household chores and fulfil the family's smallest needs. But when it comes to financial management, decisions about family expenses are made by the head of the family and the men. This reflects gender inequality in the family, with women playing a weaker role in decision-making, having less control over resources, and experiencing restrictions on their physical movement. A house becomes a home through the joint efforts of family members (Jain, 2019). Valuing each person's financial contributions, no matter the amount, helps keep the household running smoothly. It also enables both partners to participate in planning for the future, which makes it easier to implement financial plans and succeed (Dew & Stewart, 2012). However, in reality, female counterparts are often not given equal opportunities to make financial decisions for their families. Financial literacy has a strong effect on participation. People with more knowledge are more likely to participate, whereas those with less knowledge may not (Kumar *et al.,* 2023). However, household financial stability relies on collaborative resource management, and significant gaps remain in understanding the extent of women's decision-making power within Indian households. Specifically, empirical research has yet to sufficiently explore how household structure—such as nuclear versus joint family dynamics—impacts women's financial management roles and autonomy. Keeping this in mind, the main goal of this study is to examine how women manage finances in joint and nuclear families.

OBJECTIVE OF THE STUDY

1. To compare the knowledge, attitude, and practices related to financial management among females from joint and nuclear families.
2. To study the correlation between knowledge, attitude, and practices related to females' financial management and family type.

METHODOLOGY

This study was a quantitative, cross-sectional survey to examine how family type affects women's financial knowledge, attitudes, and practices. It involved 120 women randomly selected, with 60 from joint families and 60 from nuclear families. Data were gathered using a primary, self-designed structured interview schedule comprising two main parts: a Socio-Demographic Profile (covering age, education, family type, occupation, living space, family monthly income, and marital status) and a 30-item KAP Financial Management Scale divided equally into three individual domains: Financial Knowledge (10 items), Financial Attitude (10 items), and Financial Practice (10 items). The raw response score ranges were 0 to 10 for Financial Knowledge (scored dichotomously as Yes

= 1, No = 0), 10 to 40 for Financial Attitude (scored on a 4-point Likert scale from 1 = Not Important/Not Confident to 4 = Very Important/Very Confident), and 0 to 30 for Financial Practice (scored on a weighted ordinal scale from 0 = No/Not Sure to 3 = Yes/Regular Action). To systematically evaluate and compare the respondents' levels across each domain, individual scores for Financial Knowledge, Attitude, and Practice were independently categorized into three distinct levels: Minimum (Up to 33), Average (34 to 67), and Maximum (Above 67) with the help of the following formula:

$$\text{Financial Knowledge/attitude/Practice Level} = \frac{\text{Total score obtained}}{\text{Maximum obtainable score}} \times 100$$

Content validity was established through review by a panel of subject-matter experts in Family Resource Management, Economics, and Social Sciences ("I-CVI"≥0.83; "S-CVI/Ave"=0.90). Internal consistency was confirmed using Kuder-Richardson Formula 20 for Knowledge ("KR-20"=0.82) and Cronbach's Alpha for Attitude (α=0.85) and Practice (α=0.81). The effects of family type on individual knowledge, attitude, and practice levels were tabulated and analysed independently using SPSS version 20.

RESULT AND DISCUSSION

Table 1: Demographic profile of female respondents from joint and nuclear families

Variables		Joint family	Nuclear family
Mean age (in years) (Mean ± SD)		34.50±9.65	35.15±10.78
Living space (in percentage)	Urban	66.7% (40)	81.7% (49)
	Rural	33.3% (20)	18.3% (11)
Education	Illiterate	3.3% (2)	3.3% (2)
	Primary	1.7% (1)	1.7% (1)
	Secondary	3.3% (2)	3.3% (2)
	Higher Secondary	5.0% (3)	(8.3%)5
	Graduate	21.7% (13)	16.7% (10)
	Post graduate	41.7% (25)	35% (21)
	Ph.D.	23.3% (14)	31.7% (19)
profession	Unemployed	40% (24)	41.7% (25)
	Government Jobs	28.3% (17)	33.3% (20)
	Self-employed	10% (6)	5% (3)
	Private Job	20% (12)	20% (12)
	Daily wages	1.7% (1)	0
Family Monthly Income	Less than 10,000	16.7% (10)	31.7% (19)
	10,000 to 20,000	13.3% (8)	11.7% (7)
	20,000 to 50,000	33.3% (20)	13.3% (8)
	More than 50,000	36.7% (22)	43.3% (26)
Marital status	Unmarried	13.3% (8)	31.7% (19)
	Married	83.3% (50)	60% (36)
	Divorced	1.7% (1)	1.7% (1)
	Widow	1.7% (1)	6.7% (4)

Table 1 presents the demographic profile of female respondents in joint and nuclear households. The mean age of respondents in joint households was 34.50±9.65 years, while in nuclear households it was 35.15±10.78 years. Among joint households, 66.7% of women live in urban areas and 33.3% in rural areas, while in nuclear families, 81.7% live in urban areas and 18.3% in rural areas.

Among the joint households, 41.7% of women were postgraduates, followed by PhDs (23.3%), graduates (21.7%), higher secondary (5%), secondary (3.3%), primary (1.7%) and 3.3% illiterate. Among nuclear households, 35% of women were postgraduate, followed by 31.7% PhD, 16.7% with bachelor's degrees, 8.3% with higher secondary education, 3.3% with secondary education, 1.7% with primary education, and 3.3% illiterate.

The data also shows that 40% of women in joint families and 41.7% in nuclear families were unemployed. Of these, 28.3% of women in joint families and 33.3% in nuclear families held government jobs. 10% of women in joint families and 5% in nuclear families were self-employed. In both types of households, 20% of women were employed in the private sector. 1.7% of women in joint households worked as daily wage labourers.

Among households with incomes of less than 10,000, the percentage of women in nuclear households (31.7%) was higher than in joint households (16.7%). In the income bracket of 10,000-20,000, 13.3% of joint households were headed by women, compared to 11.7% in nuclear families. In the 20,000-50,000-income bracket, the percentage of women in joint households (33.3%) was higher than in nuclear families (13.3%). Among households with incomes over 50,000, the percentage of women in nuclear households was higher (43.3%) than in joint families (36.7%).

Married women mostly lived in joint families (83.3%), compared to 60% in nuclear families. Unmarried women were more likely to live in nuclear households (31.7%) than those in joint households (13.3%). The distribution of divorced women was nearly equal across the two family types, i.e., 1.7% in each. Widowed women were also found to be more in nuclear families (6.7%) than in joint families (1.7%).

Table 2: Mean scores of knowledges, attitude, and practices regarding financial management of females belonging to joint and nuclear families

Knowledge, Attitude, and Practices (KAP)	Score range	Joint family (Mean ±SD)	Nuclear family (Mean ±SD)
Knowledge	0-10	4.23±1.34	4.10±1.42
Attitude	10-40	16.80±3.25	17.98±1.74
Practice	0-30	11.37±3.50	10.67±3.35

Table 2 shows women's average knowledge, attitudes, and practices in financial management from joint and nuclear families. The results showed that women in joint families had a higher average knowledge score (4.23±1.34) than those in nuclear families (4.10±1.42). However, women in nuclear families had a higher average attitude score (17.98±1.74) than those in joint families (16.80±3.25).

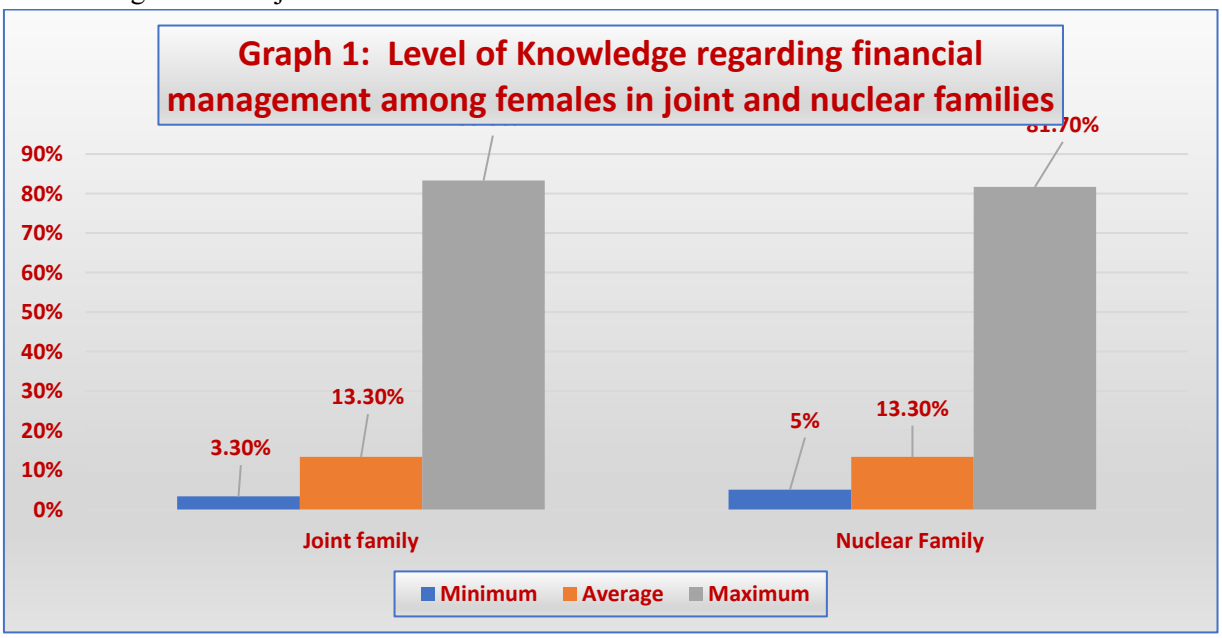
Regarding practices, the score for women in joint families (11.37±3.50) was higher than that for women in nuclear families (10.67±3.35). The findings show that women in joint families tend to have better financial knowledge and skills. This may be because these families share responsibilities and make decisions together. Joint families often include several generations living together, which helps create strong relationships and support systems. When family members share responsibilities like childcare and eldercare, it can boost both emotional support and financial stability. On the other hand, women in nuclear families tend to have more positive financial attitudes,

likely because they have more independence and control over financial choices (Singh & Singh, 2019; Hightower, 2026). However, focusing on individual goals within nuclear families can lead to greater financial stress because economic responsibilities are not shared (Denault, 2009). Also, women in nuclear families may benefit from improved access to financial resources and greater agency over financial decisions, both of which are often essential for long-term stability (Streithorst, 2021; Khalid *et al.,* 2021; Sear, 2021). These findings indicate that improving women's financial inclusion requires developing a more gender-inclusive financial system that addresses both demand- and supply-side barriers women encounter, supported by an inclusive regulatory environment.

Table 3: Level of knowledge, attitudes, and practices regarding financial management among females in joint and nuclear families.

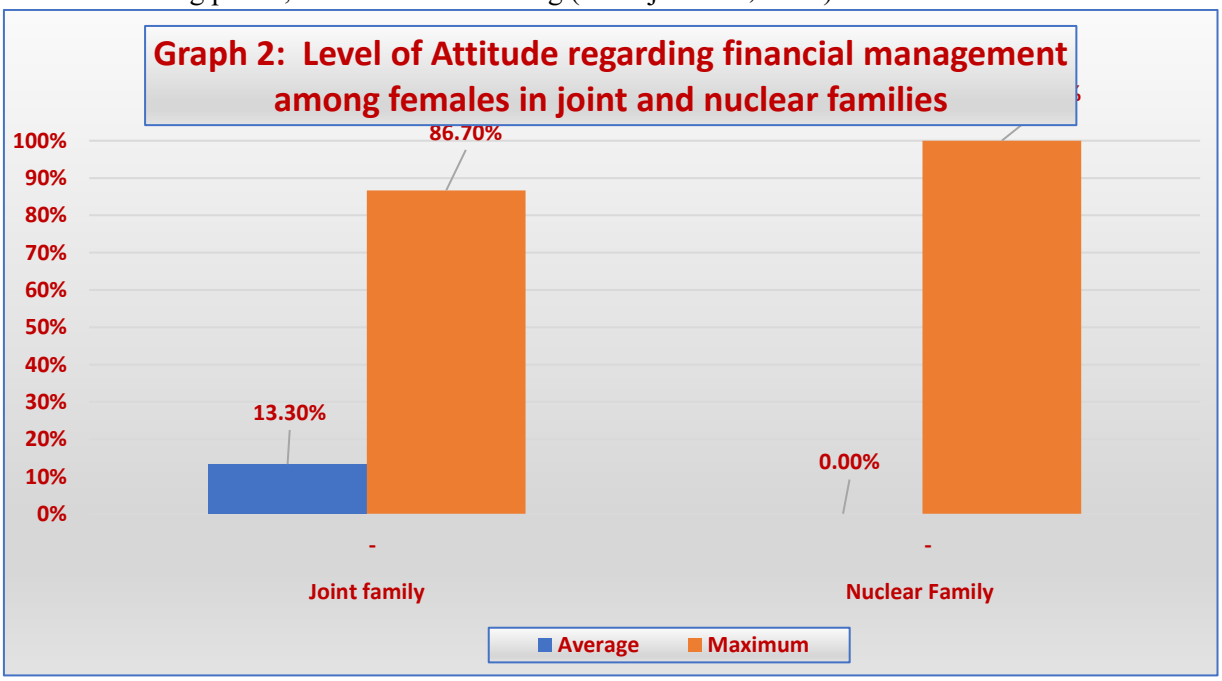
Variables	Level of Knowledge, Attitudes, and Practices (KAP)	Minimum (up to 33%)	Average (34%-66%)	Maximum (Above 67%)
Joint family	Level of Knowledge	3.3% (2)	13.3% (8)	83.3% (50)
	Level of Attitude	-	13.3% (8)	86.7% (52)
	Level of Practice	6.7% (4)	26.7% (16)	66.7% (40)
Nuclear family	Level of Knowledge	5% (3)	13.3% (8)	81.7% (49)
	Level of Attitude	-	-	100% (60)
	Level of Practice	6.7% (4)	38.3% (23)	55% (33)
Categorization raw score ranges for each KAP domain are as follows: Knowledge (Total = 10): Minimum = 0–3, Average = 4–6, Maximum = 7–10 Attitude (Total = 40): Minimum = 10–13, Average = 14–26, Maximum = 27–40 Practice (Total = 30): Minimum = 0–10, Average = 11–20, Maximum = 21–30				

Table 3 shows the level of knowledge, attitudes, and practices regarding financial management among women in joint and nuclear families.

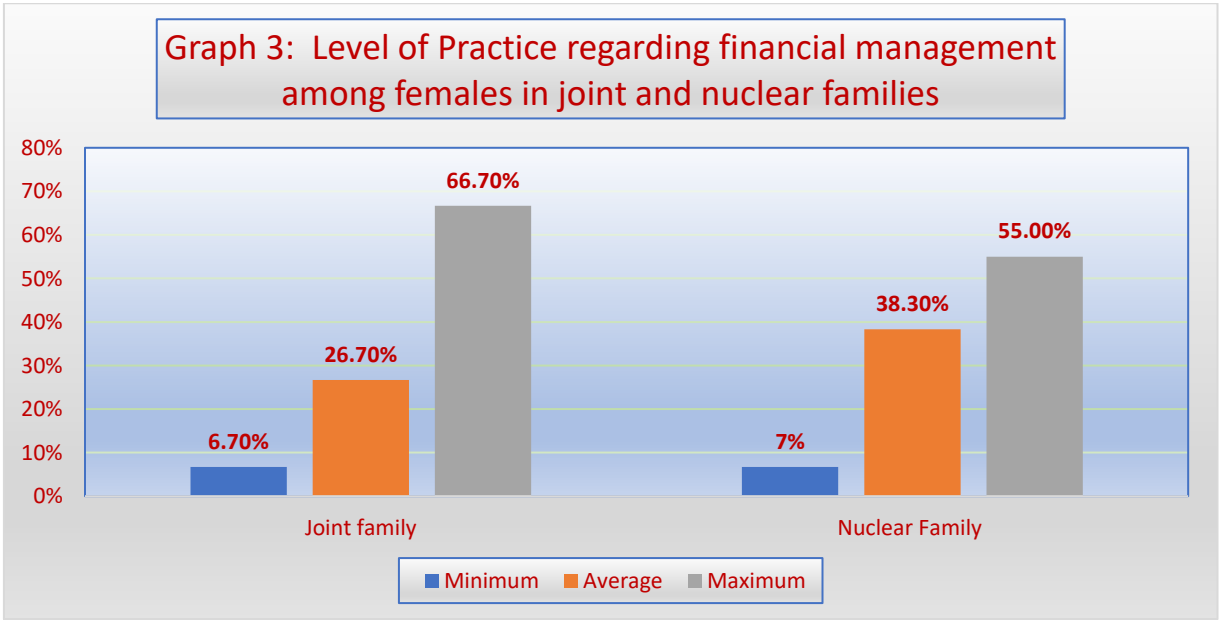


It was evident from Graph 1 that 83.3% of women in joint families and 81.7% of women in nuclear families had the maximum level of knowledge of financial management. At the same time, 13.3% of

women in joint and nuclear families had an average level of knowledge, while 3.3% of women in joint families and 5% of women in nuclear families had the lowest level of knowledge. Higher level of knowledge in both joint and nuclear family females might be due to the increased financial literacy, decision-making power, and overall well-being (Banerjee *et al.,* 2022).



The table also shows that all women in nuclear families exhibited the highest level of attitude towards financial management. It might be because, in nuclear families, women are often the sole managers of the household budget (Debnath, 2015). Without the controlling influence of other family members typical in joint households (Deschênes *et al.,* 2020), they must develop a higher level of financial literacy and a proactive attitude toward savings and spending. In contrast, 86.7% of wome)n in joint households displayed the highest attitude towards financial management, while 13.3% had an average attitude (Graph 2).



Women in joint families showed higher levels of financial management practices (66.7%) than women in nuclear families (55%). These results suggest that the collective effect and shared resources can lead to financial stability and a better quality of life (Grevenstein *et al.,* 2019). A joint household often acts as a training ground for resource optimization (Kim *et al.,* 2017). Meanwhile, the average level among women in nuclear families (38.3%) exceeded that of women in joint families (26.7%), which might highlight a more consistent baseline involvement necessitated by independence. The lowest level of financial management practice in women from both groups was 6.7% (Graph 3).

Table 4: Correlation between family type (joint and single) and knowledge, attitudes, and practices related to financial management.

Variables	Family Type	Knowledge	Attitude	Practice
Family Type	1	.037	-.223*	.102
Knowledge	.037	1	.071	.222*
Attitude	-.223*	.071	1	.321**
Practice	.102	.222*	.321**	1
* The correlation is meaningful at the 0.05 level (two-tailed).				
** Correlation is meaningful at the 0.01 level (two-tailed).				

Table 4 shows the correlation between family type (joint and single) and knowledge, attitudes, and practices related to financial management. The findings suggest a negative correlation (-0.223*) with the family type approach, indicating that joint families tend to have a less positive attitude towards financial management. It might be due to the fact that moving from a nuclear to a joint family structure is associated with a decrease in proactive financial attitudes. Knowledge has a positive correlation to practices (0.222*), indicating that higher knowledge is associated with better financial practices. Notably, attitudes are strongly and positively correlated with practices ($r = 0.321^{**}$, $p < 0.001$), indicating that positive attitudes are closely associated with improved financial practices. These correlations are significant at the 0.05 and 0.01 levels, indicating reliable relationships between these factors. Research shows that cultural beliefs and traditional gender roles still influence how families manage their finances. Women in nuclear families tend to have more financial independence, while those in joint families may face limits because of patriarchal decision-making. Despite a shared acknowledgement of the importance of women's financial involvement, systemic barriers persist, leading to discrepancies between willingness and actual participation in financial decisions (Padmaja & Rajakumar, 2022). The financial management dynamics in nuclear and joint families can significantly differ, influencing women's financial behaviours and decision-making processes. In nuclear families, individuals often prioritise their own financial management, which may lead to improved budgeting, savings, and financial independence due to less shared economic responsibility than in joint families (Lewis, 2025; Powell, 2021).

This focus on individual financial management can empower women within these households to take more control over their financial decisions and practices. Conversely, joint families typically provide economic stability through shared resources and responsibilities, which can buffer financial stress (Lewis, 2025; Debnath, 2015). However, a shared financial environment may also dilute individual financial agency, potentially affecting women's financial literacy and confidence. The structure of the family unit can influence the financial literacy levels of its members,

with women in nuclear families potentially having greater financial independence and control compared to those in joint families, where decision-making may be more collective and patriarchal.

Table 5: Mean differences in knowledge, attitudes, and practices related to financial management among women from joint and nuclear families.

Variables		Mean	Levene's Test (F)	Significance	mean difference	t-test	Significance (df)
Knowledge	Nuclear	4.13±1.346	0.257	0.61	-0.100	0.407	0.685 (118)
	Joint	4.23±1.345					
Attitude	Nuclear	17.98±1.742	10.95	0.001	1.183	2.482*	0.015 (90.2)
	Joint	16.80±3.256					
Practice	Nuclear	10.67±3.353	0.08	0.778	-0.700	-1.118	0.266 (118)
	Joint	10.37±3.503					

Table 5 shows the mean differences in knowledge, attitudes, and practices regarding financial management among women from joint and nuclear families. The findings show no significant difference in the financial knowledge of women in joint families (4.23±1.345) and in nuclear families (4.13±1.346). Attitudes towards financial management differed significantly between women in nuclear families (17.98±1.742) and those in joint families (16.80±3.256) at the 0.05 significance level. No significant differences were found between women from joint families (10.37±3.503) and women from nuclear families (10.67±3.353) in financial management practices. Mean differences in attitudes related to financial management among women from joint and nuclear families reflect varying degrees of financial literacy and decision-making autonomy based on their familial structures that are impacted by cultural and socio-economic factors on women's financial behaviours and empowerment, particularly in contexts where traditional gender roles still prevail. Recognizing these differences is important for creating interventions that support women's financial independence and decision-making. Studies show that women in joint families often have less say in financial matters because of strong patriarchal traditions and shared responsibilities across generations. On the other hand, women in nuclear families usually have more freedom and flexibility, which helps them take a more active role in financial discussions and decisions (Mitra and De, 2024; Streithorst, 2021). These differences show how family structure can affect women's confidence and ability to manage finances. Education level and socio-economic status are also key factors in shaping women's financial knowledge and independence.

Table 6. Multiple regression analysis predicting family type (combined vs. nuclear) (n = 120)

Predictor	B	Standard Error	B	t	P-value
Constant	2.102	0.319	---	6.59	<0.001
Knowledge	0.006	0.034	0.015	0.170	0.866
Attitude	-0.0.191	0.018	-0.285	-3.038	0.003*
Practice	0.028	0.014	0.191	1.985	0.049*
Model Summary					
Statistics		Value			
Correlation coefficient (R)		0.289			
Fixation coefficient (R2)		0.084			

Adjusted Determination Coefficient (Adjusted R2)	0.060
F Value (3,116)	3.528
P-value	0.017
Standard Error of Estimate	0.487

Table 6 presents a multiple regression analysis predicting family type (joint vs. nuclear) and its impact on women's financial management knowledge, attitudes, and practices (KAP) scores. The regression analysis revealed a statistically significant model ($F = 3.528$, $p = 0.017$), indicating that family structure is a significant predictor of women's financial management KAP scores. Notably, attitudes emerged as a significant negative predictor ($\beta = -0.285$, $p = 0.003$), suggesting that women in joint families have less positive attitudes towards financial management. In contrast, practice was a significant positive predictor ($\beta = 0.191$, $p = 0.049$), indicating that family structure positively influences women's financial management practice. Knowledge could not significantly predict the KAP score ($p = 0.866$), suggesting that external factors, such as education and social networks, may play a greater role in shaping financial knowledge. The present model shows an 8.4% variation in the KAP score ($R^2 = 0.084$), indicating that family structure plays a minor but important role in shaping women's financial attitudes and practices. The cognitive abilities of women, particularly their financial knowledge and decision-making skills, play a crucial role in financial management practices, and women must begin acquiring financial knowledge well before significant life changes, such as widowhood, to manage wealth effectively (Hsu, 2016; Chenji *et al*., 2023)

CONCLUSION

This study shows a clear difference in financial outcomes between joint and nuclear families. Women in joint families tend to have stronger technical knowledge and practical skills, while those in nuclear families have more positive financial attitudes. The results suggest that joint families encourage shared learning, but nuclear families help women develop the independence needed for a proactive approach to finances. To fully empower women, it is important to combine the support and shared experience of joint families with the independence found in nuclear families. As India's society changes, it is important to understand how culture and family structure affect economic behaviour. Including women in financial decisions is not just a personal milestone; it is a key step for family stability and fairness in society. Recognizing the strengths of each family type is the first move toward a safer and more inclusive financial future for everyone.

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THE GREEN EQUATION: KNOWLEDGE, ATTITUDES, BEHAVIOURS, AND PERCEPTIONS ABOUT ENVIRONMENTAL STUDIES AMONG COLLEGE STUDENTS

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ABSTRACT

At a time when environmental challenges are increasingly urgent, understanding how young people engage with them is essential. This study examined undergraduate students' environmental knowledge, attitudes, and behaviours, while also exploring their perceptions about the Environmental Studies (EVS) curriculum. Using a quantitative approach, data were collected from 135 students through a self-constructed questionnaire adapted from established scales. Findings revealed moderate environmental knowledge. While many students reported engaging in individual pro-environmental practices, especially resource conservation, participation in community or civic initiatives was limited. Attitudes toward the environment were largely positive, indicating a readiness to support sustainability efforts. However, despite recognizing the importance of EVS, a significant proportion of students perceived the curriculum as theoretical. There was a clear preference for more experiential, application-oriented learning, supported by suggestions for field-based activities, real-life examples, and interactive pedagogies. These findings offer valuable insights for educators, curriculum designers, and policymakers seeking to strengthen environmental learning in India.

Keywords: Environment Education, EVS, Curriculum, Pro-environmental Behaviours, Higher Education

INTRODUCTION

The world is undergoing transformation particularly in environmental aspects, sparking local, national, and international dialogues driven by concern, anxiety, and distress over widespread environmental degradation (Hogenboom, 2019). In this context, it is imperative to examine knowledge, attitudes, and pro-environmental behaviours of undergraduate students, who emerge as potentially proactive citizens, at a significant milestone, to contribute as current and future change-makers.

Environmental awareness is regarded as a precursor to responsible environmental attitudes and behaviours (Burgos-Espinoza et al., 2024; Lasso de la Vega, 2004). Scholars emphasize the interrelationship between knowledge, attitudes, and action, noting that well-informed individuals

develop concern and translate it into meaningful behavioural change (Vladova, 2023; Jaime et al., 2023; Hadler et al., 2022; Arshad et al., 2021). Thus, pro-environmental behaviour emerges through a process in which awareness shapes attitudes, and attitudes guide actions (Bhatia & Dippo, 2020). This study examined these variables among college students as outcomes of Environmental Studies education while also exploring their perceptions about the EVS curriculum.

REVIEW OF LITERATURE

Teenagers and youth hold the potential to act as agents of change in society (Geneva Environment Network, 2024; Baldwin, Pickering, and Dale, 2022). Kumar (2023) reiterated that through education and practical experiences, young people can be equipped with tools needed to care for the environment while being sustainable producers and consumers (UNICEF India, 2023; Palupi & Sawitri, 2018).

Knowledge, attitudes, and behaviours are widely conceptualized as interrelated constructs in environmental education research. Foundational models such as the Knowledge–Attitude–Behaviour (KAB) framework propose that knowledge shapes attitudes, which then influence behaviour (Kollmuss & Agyeman, 2002; Hines, Hungerford, & Tomera, 1987). Although knowledge alone may not reliably predict pro-environmental behaviour, it remains a prerequisite for informed decision-making and engagement (Frick, Kaiser, & Wilson, 2004). Empirical studies among university students often report moderate environmental knowledge, generally positive attitudes, but inconsistent behavioural outcomes (Arshad et al., 2021; Varoglu et al., 2017).

Environmental attitudes are considered a mediating factor between knowledge and behaviour. Bamberg and Möser (2007) demonstrated that pro-environmental behaviour is significantly influenced by attitudes, personal norms and perceived behavioural control. Similarly, Liu, Teng, and Han (2020) found attitudes and behavioural intentions play a crucial role in translating knowledge into action.

Studies on pro-environmental behaviours among undergraduate students indicate that engagement is stronger at the individual level (e.g., conserving resources, recycling) than at the collective or civic level (Ertz et al., 2016; Vicente-Molina et al., 2013). Civic participation, however, reflects deeper environmental responsibility and is often influenced by experiential learning and institutional support (Steg & Vlek, 2009). This emphasizes the role of educational environments in shaping awareness and opportunities for action.

In the Indian context, after many years of efforts, Environmental Studies (EVS) was mandated at all educational levels to promote environmental awareness and responsibility (Ghosh & Dutta, 2019). While this ensured widespread exposure, several studies observed that the subject is often delivered in a predominantly theoretical manner (Thapa, 2021; Bhatia & Dippo, 2020; Bharucha, 2005). Research emphasizes that knowledge acquisition is most effective when supported by experiential, participatory, and context-based approaches (Palmer, 1998). However, there is limited empirical evidence on whether the current EVS curriculum effectively fosters knowledge, attitudes and behaviours it intends to promote. Students' perceptions of the curriculum are critical in this regard. Despite policy directions advocating experiential learning, there remains a paucity of research examining how students view the EVS curriculum and whether its current structure at the Undergraduate Level justifies pedagogical or content-based revisions.

SIGNIFICANCE OF THE STUDY

Given the limited empirical evidence on the effectiveness of Environmental Studies at the undergraduate level in India, this study addresses an important gap by examining students' environmental knowledge, attitudes, pro-environmental behaviours, and perceptions of the curriculum. The findings would provide insights into the outcomes of EVS education and identify areas for curriculum and pedagogical enhancement to better promote environmental responsibility among future citizens.

OBJECTIVES

The objectives of the study were to:

a) assess undergraduate students' basic awareness of environmental issues;
b) examine students' attitudes toward environmental concerns;
c) investigate students' pro-environmental behaviours; and
d) explore students' perspectives about Environmental Studies (EVS) curriculum.

METHOD

This research was quantitative in nature and used a self-constructed questionnaire, which included items from the 19-item Environmental Knowledge Test (EKT-19) (Player et al., 2023); the Knowledge and Attitude Questionnaire (Mukhopadhyay, 2018); the Environmental Attitudes, Knowledge, and Awareness (AKA) questionnaire (Lasso de la Vega, 2004); and the Pro-Nature Conservation Behaviour Scale (ProCoBs) (Barbett et al., 2020).

A self-constructed instrument was developed because no comprehensive scale in the Indian context could be located, which adequately measured environmental attitudes and Pro-environmental behaviours. Existing instruments, largely developed in other countries, included terminology (e.g., HVAC systems, trams) that were not relatable to Indian students or were context-specific (Lasso de la Vega, 2004). For example, although the EKT-19 is a concise knowledge measure, some items (e.g., ecological niche) do not reflect foundational knowledge in the Indian curriculum. Likewise, the ProCoBs scale included behaviours (e.g., hedge trimming during breeding season, voting for conservation-focused candidates) that are not representative of typical student practices in India. In addition, some instruments were excessively lengthy; for example, Mukhopadhyay's (2018) questionnaire comprised 150 items, making it impractical for this study. To address these limitations, a contextually appropriate questionnaire was developed comprising four sections (see Figure 1).

Section I (Knowledge) assessing basic environmental concepts to gauge students' current knowledge and retention from earlier education. Section II (Pro-environmental Behaviours) measuring frequency of engagement on a 5-point Likert scale (1 = Never to 5 = Very Often), further divided into five subscales as seen in Figure 1. Higher scores meant more frequent engagement. Section III (Attitudes Toward Environment) 20 statements rated on a 5-point Likert scale (Strongly Agree to Strongly Disagree), including 10 positive and 10 negative items; negative items were reverse scored. Section IV assessed perceptions of the EVS curriculum through five statements examining its importance, interest in further learning, theoretical versus practical orientation, and applicability of knowledge. Responses were recorded on a Likert scale (agreement, disagreement, or

uncertainty). The questionnaire concluded with an open-ended question to allow participants to express views and provide reflective closure to the survey.

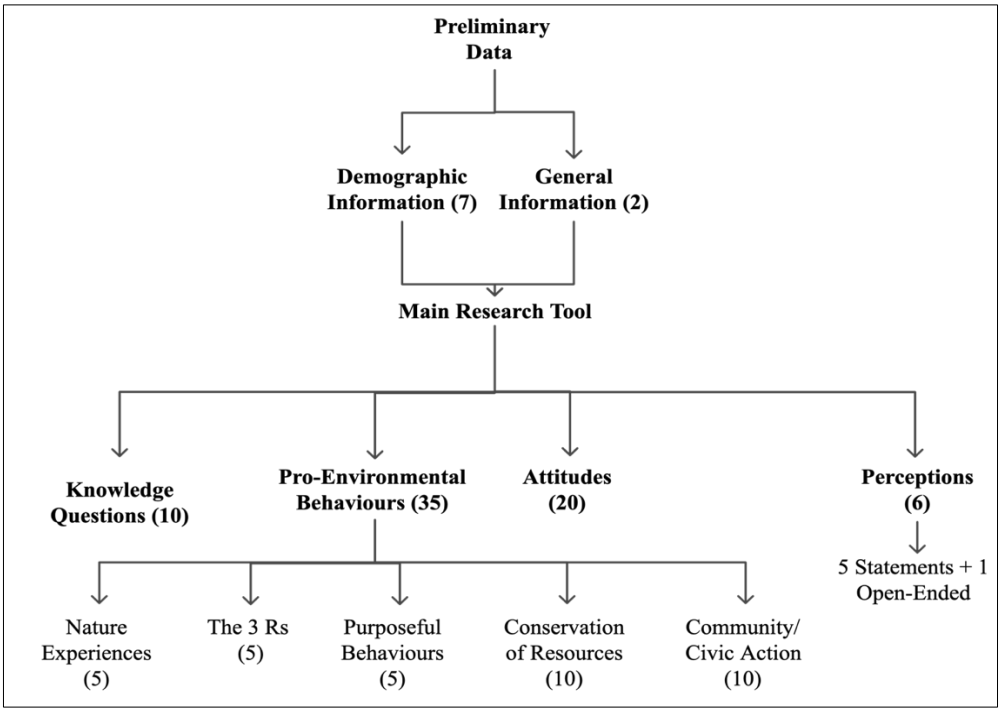

Figure 1: Details of the Research Tool (Questionnaire)

Sample

Undergraduate students who completed at least one semester of an EVS course were considered. Out of 160 students, 14 declined to participate and 146 completed the questionnaire. After excluding 11 incomplete responses, the final sample comprised 135 students.

Data Analysis

Data were analysed using descriptive and inferential statistics. Descriptive findings are presented as frequencies, percentages, and mean scores where appropriate, while the Independent Samples *t*-test examined gender differences. Qualitative responses were analysed thematically and supported with verbatim excerpts. Reliability was assessed for the "Environmental Attitudes" and "Pro-environmental Behaviour" scales, as these items were adapted from established standardized instruments.

Validity and Reliability

As the Attitudes Toward the Environment (ATE) and Pro-environmental Behaviour (PEB) scales were reworded to suit the Indian context, their validity and reliability were assessed. Face and content validity were established through expert review by two environmental specialists and two associate professors, whose feedback informed the final instrument. The validated questionnaire comprised the ATE and PEB constructs. Reliability, assessed using Cronbach's Alpha, was high for both the PEB Scale ($\alpha = 0.924$) and the ATE Scale ($\alpha = 0.832$).

RESULTS

Characteristics of participants are summarized to give a demographic overview. These are followed by the main results of the study, which are cited based on the order of objectives.

Demographic Characteristics

Participants comprised 57% females and 43% males, with 71% from urban areas. The mean age was 19.71 years (SD = 1.68) (Figure 2). Monthly family income (Figure 3) indicated that most participants belonged to lower-middle and upper-middle-class families.

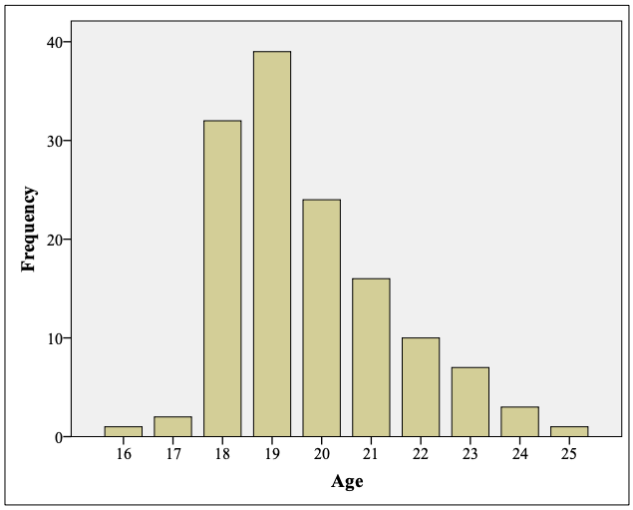

Figure 2: Age

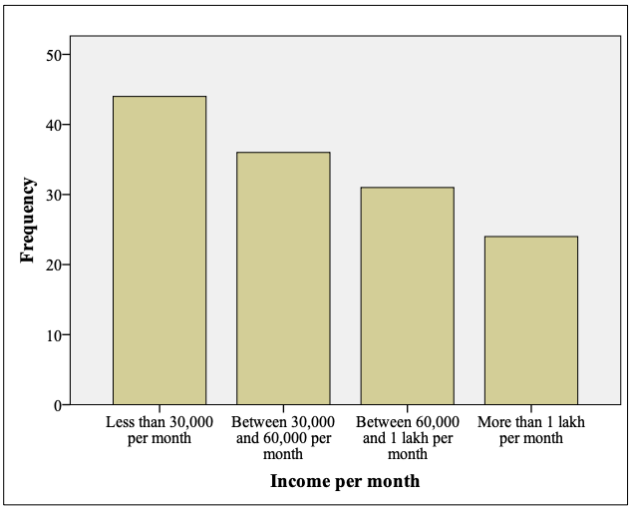

Figure 3: Monthly Family Income

Status of College having a Club working for Environment

A majority of participants (71.4%) reported their college having an environment club (see Figure 4), while 28.6% were unaware of its existence. Only about 32% indicated membership in the club.

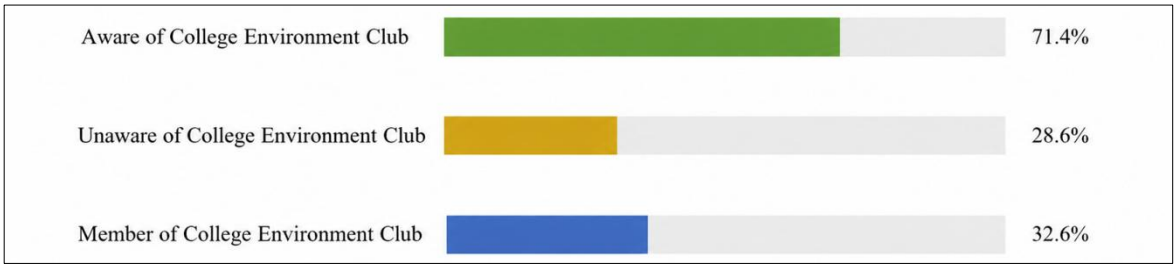

Figure 4: Awareness of, and Membership in, College Environment Club

Environmental Knowledge

The mean knowledge score was 6.59 out of 10, reflecting a moderate level of environmental awareness. Most students (83.7%) showed highest accuracy on the item identifying the household appliance contributing most to an individual's carbon footprint, followed by the greenhouse gas most responsible for global warming (79.3%). In contrast, fewer students correctly answered items related to waste management, particularly materials difficult to recycle (51.1%) and hazardous waste

(43.7%), indicating gaps in knowledge not fully addressed through theoretical instruction. A summary of scores per item is presented in Table 1. No significant gender differences were observed.

Table 1: Mean Scores on Questions Testing Basic Knowledge of Environmental Issues

Question Topic	Correct Answer	Accurately Answered	
		n=135 (f)	(%)
Household appliance increasing carbon footprint the most *(Sustainability)*	Air Conditioner	113	83.7
Greenhouse gas most responsible for global warming (*Climate Change)*	Carbon Dioxide	107	79.3
Practice extremely essential before treatment of any waste *(Waste Management)*	Segregation	100	74.1
Biodiversity hotspot in India *(Ecology)*	The Western Ghats	98	72.6
Biggest groundwater pollutant in India *(Pollution)*	Agricultural Pesticides	88	65.2
Gas most responsible for depletion of ozone layer *(Climate Change)*	Chlorofluorocarbon	85	63.0
Practice which does not reduce air pollution *(Pollution)*	Using a branded car	85	63.0
Form of renewable energy *(Sustainability)*	Geothermal energy	85	63.0
Most difficult to treat/recycle *(Waste Management)*	Mixed wet & dry waste	69	51.1
Not classified as hazardous waste *(Pollution)*	CDs/DVDs	59	43.7

Pro-environmental Behaviour

Participants reported the frequency of engaging in activities across five areas: Nature Experience (time in nature, curiosity to explore nature directly or vicariously); 3 R's (reducing consumption, recycling, reusing resources); Pro-environmental Behaviours (waste segregation, refusing plastic bags, growing plants); Conservation of Resources (using public transport, switching off appliances, limiting air conditioner use); Community/Civic Activities (participating in campaigns, clean-up drives). All items were rated on a 5-point Likert scale (1 = Never to 5 = Very Often). Higher scores indicated greater engagement. Mean scores (presented in Table 2) indicate average involvement in the first three subscales, higher involvement in the conservation of resources, and lower involvement in community/civic activities. This suggests greater engagement in individual-level behaviours than community-level participation. No significant gender differences were observed.

Table 2: Mean Scores on Pro-environmental Behaviours

Sub-Scales	Number of Items	Cronbach's Alpha	Mean Score (N=135)	Standard Deviation	Interpretation of Mean Score
Nature Experiences	5	.710	14.61	3.612	Average Involvement
Reduce, Recycle, Reuse	5	.642	15.22	4.184	Average Involvement

Purposeful Pro-environmental Behaviours	5	.684	14.47	4.450	Average Involvement
Conservation of Resources	10	.846	35.59	8.086	Higher Involvement
Community/Civic Activities	10	.913	26.74	9.278	Lower Involvement
Total	**35**	**.924**	**106.62**	**22.926**	

Attitude toward Environment

The Attitude Toward Environment scale comprised 10 positive and 10 negative statements. Positive items were rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), while negative items were reverse scored. Scores ranged from 20 to 100. Scores above 75 indicated highly positive attitude. The mean score was 77.60 (SD = 11.89), indicating most students (65.9%) held highly positive environmental attitude (see Figure 5). Inferential analysis (t-test) showed significant gender differences (t = 2.799, p = .006), with girls (m = 80.03) scoring higher than boys (m = 74.38).

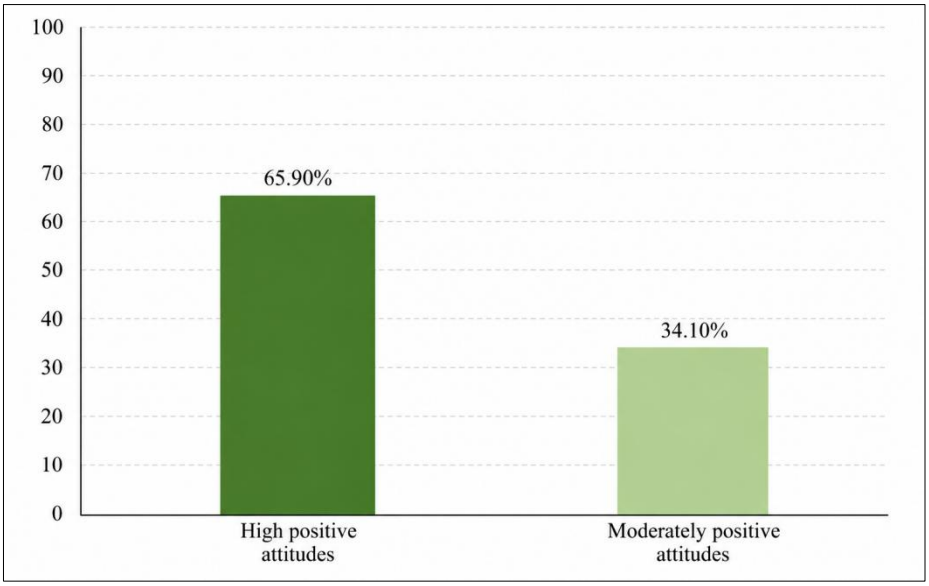

Figure 5: Attitude toward the Environment

Perceptions about EVS Curriculum

Students shared their views about the EVS curriculum. Majority (81.4%) opined that they wanted to know how to implement their learnings in their life, and would like more practical activities (77.7%). A majority (79.2%) perceived EVS as being as important as all the other subjects they studied. Sixty percent were interested in learning more in relation to EVS, while 54% thought the EVS syllabus was theoretical (see Table 3).

Table 3: Perceptions/Opinions about the Environmental Studies (EVS) Curriculum

Statement	Agree		Not Sure		Disagree	
	(f)	**(%)**	(f)	**(%)**	(f)	**(%)**
I would like to know how to implement what I learn in EVS in my daily life	110	**81.4**	5	**3.7**	20	**14.8**
EVS is as important to me as other subjects I study in College	107	**79.2**	7	**5.1**	21	**15.5**
I would like to do some practical activities related to EVS	105	**77.7**	8	**5.9**	22	**16.2**
I am interested in learning more in the subject on EVS	81	**60**	17	**12.5**	37	**27.4**
I think the syllabus of EVS is very theoretical	73	**54**	19	**14**	43	**31.8**

**Multiple responses obtained*

To further explore perceptions, students were asked to share opinions or concerns (if any) related to the EVS curriculum they studied. Only 55 out of 135 (i.e. 40.7%) students expressed their views. Their comments were grouped categorically based on similarity and conceptual linkages.

A recurring theme, raised by 15 students, was the need for more practical activities in EVS. One student opined, *"I wish there were more practical classes"*, while another said, *"there should be more practical things done while teaching like students can conduct programmes to increase people's awareness. It's more fun to do things like this."*

Five students emphasized the need to learn how environmental concepts could be applied in daily life. For example, *"Teach practical methods…instead of just talking about the problem; no use saying things are bad and need to be fixed, without teaching us how."* Another student expressed, *"Studying EVS is interesting but it could be more interesting if we could implement it. The knowledge focuses on large scale problems (but) if small steps towards change can be taught, it would make it much easier for us to practice these in our life."*

One student commented on what should *not* be done: *"…no more poster making for awareness cause people just copy and paste stuff."* Six students highlighted the need for more field-based activities. In one student's words, *"I understand importance of awareness, but we can't be just sitting at desks talking. Make us do activities at least few times a month - plant trees, clean the streets, show us how power plants and wind mills work, take us to garbage treatment sites to see how it's done. Without this, all we study are things we already (theoretically) know about."*

Two students felt the syllabus was outdated and repetitive. One explained, *"The syllabus needs an upgrade. We've been listening to a lot of the things repeatedly through our school years. As older kids we will definitely get bored with the same issues we already know."*

Two Commerce students described the syllabus as *"too vast, science-oriented and theoretical."* Another student felt that complex terminology made the subject harder to remember, although good teaching helped students understand.

The opinions expressed in addition to those above, are listed in Table 4.

Table 4: Other Opinions about the Environmental Studies (EVS) Curriculum

Theme	Frequency	Example
Nature of Syllabus/ Pedagogy	3	*"The syllabus is outdated and not practical."*
	3	*"It must be interesting and relevant to our life so we can use it."*
	2	*"Without environment there will be no life. There should be compulsion for all to learn this subject."*
	2	*"The syllabus feels repeated from earlier years."*
	1	*"It's a subject which should have more practical than theory."*
	1	*"How Science subjects have experiments, this should also have experiments and teach us to do things."*
Place	2	*"EVS should be taught outdoors."*
	1	*"We need to be exposed to and explore the environment we see around us."*
Concerns	1	*"Countries at war are destroying everything. Who is to blame?"*
	1	*"We use firecrackers, cause pollution, generate so much waste. Festivals pollute land and water. How to solve this?"*

DISCUSSION

Students demonstrated an average level of environmental knowledge, with the lowest mean scores obtained on items related to waste management. Similarly, Indracanti et al. (2023), Moody-Marshall (2022), and Hicks and Sadler (2022) reported moderate to low knowledge among undergraduates, while Emiru and Waktola (2017) found sub-optimal knowledge levels in Ethiopia and the U.S.A. In contrast, Ahmad et al. (2015) reported high knowledge levels among Malaysian students, though focused mainly on sewerage treatment. Overall, findings across studies suggest that environmental knowledge is more often moderate than high, indicating the need for continuous awareness opportunities among students and the public. Although environmental issues are addressed through curricula and activities such as Clubs and NSS, the field's breadth means that only those with personal interest tend to have higher knowledge. Knowledge is considered a precursor to pro-environmental attitudes and behaviours (Burgos-Espinoza, 2024; Varoglu, et al., 2017) and remains a key component of intervention programmes. However, Liu et al. (2020) noted that knowledge alone does not directly translate into behaviour, with attitude and behavioural intentions acting as mediating factors.

Students reported moderate engagement in pro-environmental behaviours, including in-nature activities, recycling, refusing plastic, waste segregation, conserving resources, and participating in societal clean-up efforts. Participation in local civic/community initiatives was comparatively lower. Similar findings were reported by Ekwesaranna et al. (2025). This may reflect limited awareness of local initiatives or lower interest and commitment. Ekwesaranna et al. (2025) suggested that local, immersive, action-based educational strategies can enhance engagement and support sustained pro-environmental behaviour.

Overall, students exhibited a positive environmental attitude, indicating a willingness to protect natural resources and adopt sustainable practices. Liu et al. (2020) found that environmental attitude significantly influenced behavioural intentions and pro-environmental behaviours, while Varoglu et al. (2017) reported a moderate effect.

Some participants expressed concerns about the largely theoretical nature of the EVS paper and preferred more practical, application-oriented content. A few also indicated interest in outdoor and experiential learning. These responses support findings by Ekwesaranna et al. (2025) and align with the NEP 2020's emphasis on experiential education. However, implementation depends on curriculum design and pedagogy. Further research is needed to examine these aspects and interrelationships.

CONCLUSIONS

While students possess moderate environmental knowledge and largely positive attitude, these may not consistently translate into sustained or community-level pro-environmental behaviours. Engagement appears stronger at the individual level, with comparatively limited participation in civic initiatives. Students highlighted the theoretical nature of Environmental Studies, expressing a need for more practical, relevant, and action-oriented learning experiences. These insights point to the need for a shift in environmental education being more experiential, contextual, and application-focused to bridge the gap between knowledge, attitude, and behaviour.

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FASHION ACROSS GENERATIONS: A COMPARATIVE STUDY OF FASHION PREFERENCES AMONG GENERATION Z AND GENERATION X

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ABSTRACT

The study examines how Generation Z's fashion choices vary from those of previous generations, emphasizing their uniqueness, knowledge of sustainability, and digital influence. In order to draw attention to differences in priorities and values, it also contrasts Gen Z with Gen X. (born 1997 & 2012). By using surveys and comparative analysis, a quantitative method was employed. Gen Z's fashion preferences were found to be significantly influenced by social media sites like Instagram and Pinterest. While Gen X places a higher value on comfort, durability, and quality, Gen Z prefers fashionable, eco-friendly, and expressive apparel influenced by digital culture and celebrities. Despite their differences, both generations are becoming more conscious of fashion sustainability.

Keywords: Consumer behaviour, Digital culture, Fashion sustainability, Fashion preference, Gen Z, Gen X, Microtrends, Media influence, and Self-expression.

INTRODUCTION

Generation X (born between 1965 and 1980) experienced economic uncertainty and the rise of digital technology, shaping them into independent and brand-loyal consumers who value practicality, quality, and durability over advertising. They prefer long-lasting clothing from trusted brands and prioritise quality and comfort in their purchasing decisions. Rana, M. R. I., & Lee, H. (2026) noted that although Gen X now shops through both online and offline channels, they remain loyal to familiar brands while comparing products across platforms.

In contrast, Generation Z (born between 1997 and 2012) is highly tech-savvy due to early exposure to smartphones and the internet. They have strong purchasing power, high consumer expectations, and view fashion as a means of self-expression and individuality (Laksono et al., 2026). To meet these expectations, the fashion industry increasingly focuses on inclusivity and innovation. Gen Z embraces diverse styles such as streetwear, Y2K, gender-fluid fashion, and athleisure, while valuing body positivity and multicultural influences.

Social media strongly shapes Gen Z's fashion preferences. According to Paria, K. (2026), platforms such as Instagram and fashion influencers significantly influence Gen Z's purchasing behaviour, with micro-influencers playing an important role through styling content.

Microtrends, driven by algorithms, influencers, and viral content, spread rapidly via social media but lead to overconsumption and environmental waste as consumers quickly discard products that fall out of style. Elsa Claesson and Elin Egelbäck Starud (2025) found that many users unconsciously adopt microtrends through algorithm-driven platforms such as TikTok, purchasing trending items and later discarding them when trends change.

According to research, Gen X emphasizes comfort, quality, and durability, but Gen Z is affected by celebrity culture and microtrends. The adaption of Gen X to algorithm-driven fashion trends is still not widely understood. The purpose of this study is to examine the fashion habits of the two generations, specifically with regard to sustainability, purchasing choices, and trend acceptance.

Vincenzo Miccichè Speciale (2024) found that although Gen Z generally has positive attitudes towards sustainable fashion, many struggle to consistently translate these attitudes into purchasing behaviour. In contrast, Bharti Motwani (2024) reported that Gen X places greater importance on brand reputation and product quality than sustainability. Limited awareness, higher perceived prices, and a lack of trusted sustainable brands were identified as key barriers to purchasing sustainable fashion.

PLATE 1: Gen X Fashion

Source: https://the-ethos.co/gen-x-designers-holding-fashion-accountable/

PLATE 2: Gen Z Fashion Trend

Source: https://www.printful.com/blog/gen-z-fashion

PLATE 3: Sustainable Fashion

Source: https://ecoideaz.com/expert-corner/emerging-business-opportunities-in-sustainable-fashion/

SIGNIFICANCE OF THE STUDY

- To understand the differences and similarities in fashion preferences between Generation Z and Generation X.
- To help fashion designers and retailers develop products suitable for different generations.
- To provide useful information for students and future researchers in the field of fashion.

OBJECTIVES

- To study and compare the fashion preferences of Gen Z and Gen X.
- To analyse the influence of social media and culture on the fashion preferences of Gen Z and Gen X.
- To examine the perception of sustainability among both the generations.

HYPOTHESIS

Ho: There is no significant difference between the Gen z and Gen x with respect to their fashion preferences, choices, and attitudes towards fashion

H1: There is a significant difference between the Gen z and Gen x with respect to their fashion preferences, choices, and attitudes towards fashion

METHODOLOGY

A comparative descriptive research design was used in the study to examine Generation Z and Generation X's fashion preferences. The research objectives and literature review served as the foundation for the development of a structured questionnaire. Multiple-choice and five-point Likert scale items were used to measure fashion preferences, shopping habits, color preferences, fashion individuality, motivational factors, gender identity, cultural influences, sustainability, and perceptions of microtrends. The research guide examined the questionnaire to determine its content validity.

Convenience sampling was used to gather primary data from 90 respondents in Chennai (45 members of Generation Z and 45 members of Generation X). Participants were chosen based on their availability and willingness to participate within the constraints of time and resources. The results are restricted to the chosen sample, despite the fact that this strategy allowed for effective data

collecting. All respondents gave their informed consent, participation was entirely voluntary, and the study's confidentiality and anonymity were upheld.

OPERATIONAL DEFINITIONS

Fashion Preferences

Fashion preferences encompass an individual's choices related to clothing styles, colors, shopping behaviors, and the influencing factors behind clothing selection. These preferences illustrate personal tastes shaped by lifestyle, age, culture, and current fashion trends. The study assessed fashion preferences by analyzing respondents' clothing choices and purchasing habits. (Hur et al., 2023)

Shopping behaviour

Purchasing behavior encompasses how people choose to buy clothes as well as their preferences for online, in-store, or hybrid shopping methods. (Rossolov et al., 2021).

Self-expression

Self-expression involves using clothing and fashion to convey personality, identity, and individual style. (Vingilyte & Khadaroo, 2025)

Cultural Influence

Cultural influence encompasses the effects of cultural background, traditions, popular culture, and media on individuals' fashion preferences. (Sasikala, 2025)

Microtrends

Microtrends are brief fashion trends that rapidly gain popularity via social media and digital platforms, impacting consumers' clothing choices. (Hall, 2025)

Sustainability

Sustainability in fashion involves environmentally and socially responsible practices, including the selection of eco-friendly clothing, ethical production methods, and waste reduction through responsible consumption. (Braun, 2012)

FINDINGS AND DISCUSSION

This chapter deals with the analysis and interpretation of the data collected from the 90 respondents and the same has been presented below.

Most Comfortable Clothing Type:

Respondents were asked to rate their comfortable clothing types and the percentage analysis have been made to know the most comfortable type and the same has been presented below.

Table: 1 Comforting Clothing Types

S.No	ATTRIBUTES	Gen Z		Gen X	
		Freq	%	Freq	%
1	Oversized streetwear or loungewear	26	58	9	20
2	Fitness wear or athleisure	6	13	5	11
3	Well-fitted basics and denim	22	49	6	13
4	Cultural or vintage pieces	8	18	30	67
5	Formal, structured clothing	21	47	18	40

Table 1 represents that for Gen Z, Comfort preferences differ between generations. Gen Z favors oversized streetwear (57.8%), well-fitted basics (48.9%), and formal wear (46.7%). In contrast, Gen X finds cultural/vintage pieces (66.7%) most comfortable, followed by formal wear (40%). While Gen Z embraces both formal and casual styles, Gen X prioritizes heritage and structure, valuing cultural attire over trendy options. The findings are consistent with Fan (2018) and Omelchenko (2024), which reported that younger consumers prefer casual and comfortable clothing, whereas older consumers value quality, durability, and traditional styles.

Respondent Shopping Preferences:

The table -2 represents the frequency distribution of the shopping preferences of the Gen Z and Gen X customers.

Table: 2 Shopping preferences

S.No	ATTRIBUTES	GEN Z		GEN X	
		Freq.	%	Freq.	%
1	Online – through influencer/social media links	1	2.2	0	0.0
2	Online – browsing apps or brand websites	5	11.1	1	2.2
3	In-store – to check quality and fit	17	37.8	17	37.8
4	Mixed – depending on convenience	21	46.7	24	53.3
5	I rarely shop for clothes	1	2.2	3	6.7

Table 2 shows that both Gen Z and Gen X prefer a mixed shopping approach. Among Gen Z, 46.3% prefer both online and in-store shopping, while 37.8% favour in-store shopping to check fit and quality, and 11.1% prefer online shopping. Similarly, 53.3% of Gen X prefer a mixed approach, 37.8% choose in-store shopping, and only a small percentage rely solely on online shopping. Overall, both generations value the convenience of combining online and offline shopping, but Gen Z is more

inclined toward online shopping due to their greater familiarity with digital platforms. The findings support Rana (2020), who found that consumers increasingly use both online and offline shopping channels based on convenience and product evaluation.

4.3. Colour Preferences:

The following chart represents the frequency distribution of the shopping preferences of the Gen Z and Gen X customers.

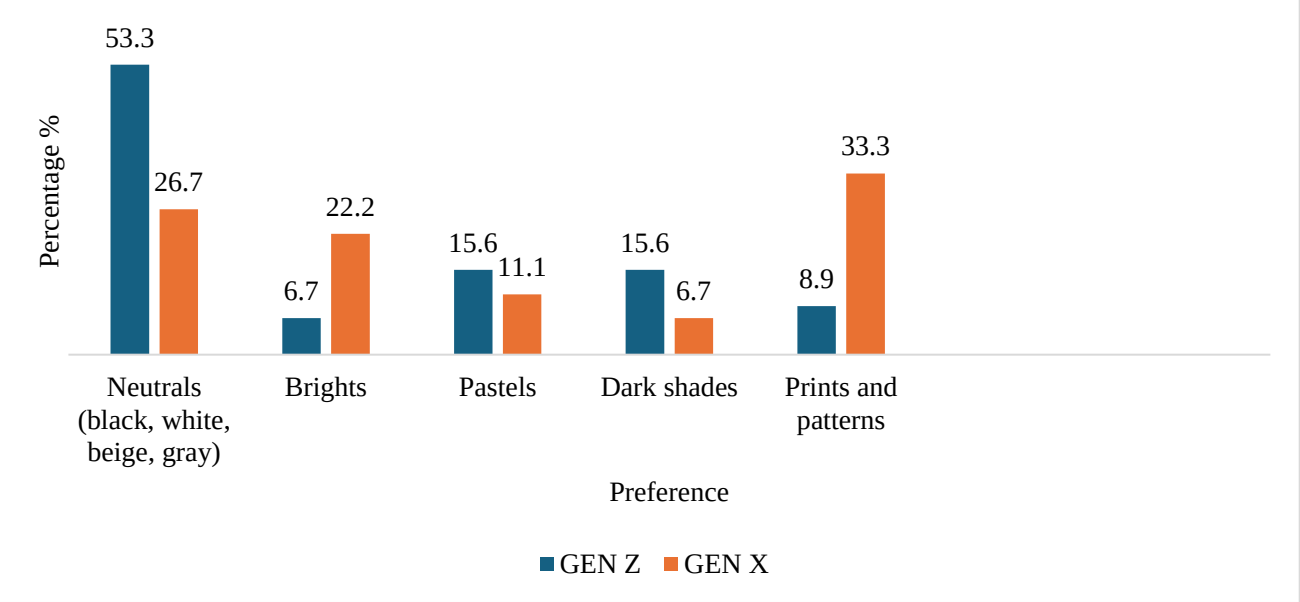

Figure: 1 COLOUR PREFERENCES

Figure 1 shows, Gen Z prefers neutral colors (53.3%) for their versatility and minimalism, while also favoring pastels and dark shades (15.6% each). In contrast, Gen X favors prints and patterns (33.3%), with neutrals (26.7%) and bright colors (22.2%) following. Overall, Gen Z leans towards adaptable and subtle colours, while Gen X prefers bolder and more expressive styles.

4.4. Fashion that used to represent individuality:

The frequency analysis has been made to find the Gen Z and Gen X fashion choice which expresses their individuality and the same has been presented in table-3.

Table: 3 Fashion and Individuality

S.no	ATTRIBUTES	GEN Z		GEN X	
		Freq.	%	Freq.	%
1	I create custom or DIY pieces	2	4.4	1	2
2	I remix trends with my own twist	12	26.7	5	11
3	I stick to classic looks	9	20.0	23	51

4	I dress based on moods/phases	19	42.2	8	18
5	I don't consider fashion for self-expression	3	6.7	8	18

Table 3 shows differences in fashion as self-expression between Gen Z and Gen X. Among Gen Z, 42.2% dress according to their mood, and 26.7% remix trends to express creativity and individuality. In contrast, 51.1% of Gen X prefer classic styles, while fewer use fashion for self-expression. Overall, Gen Z views fashion as a tool for individuality, whereas Gen X favours timeless and conventional styles. ZhiYu, Q. (2023), who noted that Gen Z uses fashion for self-expression, while older generations prefer traditional styles.

Motivational factors towards fashion Decision:

The frequency analysis has been made to find the motivational factors which impact their decision towards fashion and dressing and the same has been presented in table-4.

Table: 4 Motivational factors towards fashion Decision

NO.	ATTRIBUTES	GEN Z		GEN X	
		Freq.	%	Freq.	%
1	Expressing who I am or how I feel	14	31.1	0	0.0
2	Being on trend or socially relevant	2	4.4	2	4.4
3	Comfort and practicality	22	48.9	38	84.4
4	Quality and durability	5	11.1	4	8.9
5	Price and affordability	2	4.4	1	2.2

Table 4 shows that comfort and practicality are the most important factors influencing fashion choices for both generations. Among Gen Z, 48.9% prioritise comfort and functionality, followed by self-expression (31.1%) and quality and durability (11.1%), while only a small percentage consider price or trends. Similarly, 84.4% of Gen X prioritise comfort and practicality, with fewer respondents valuing quality and durability, and only a minority influenced by price or trends. Overall, both generations prioritise comfort, but Gen Z places greater importance on self-expression than Gen X.

Social media influence

Gen Z is moderately influenced by social media, with 44.4% using it primarily for fashion inspiration rather than purchases. In contrast, 42.2% of Gen X are seldom influenced, with 26.7% using it only for ideas. While Gen Z engages more with digital platforms, they emphasize individuality; Gen X relies more on personal preferences. These findings are consistent with Dewani and Nagaych (2024), noting the impact of social media and influencers on Gen Z's fashion choices and purchasing behavior.

Perceived fashion in terms of gender identity:

The table -5 represents how the Gen Z and Gen-X have perceived the fashion in terms of gender identity.

Table: 5 Perceived Fashion in terms of gender identity:

S.No	ATTRIBUTES	GEN Z		GEN X	
		Freq.	%	Freq.	%
1	Fashion is gender-fluid	10	22.2	3	6.7
2	Mixed, but some items still gendered	19	42.2	16	35.6
3	I wear what I like regardless of gender	10	22.2	3	6.7
4	Prefer traditional gender norms	2	4.4	19	42.2
5	Haven't thought about it	4	8.9	4	8.9

Table 5 shows a clear difference in attitudes towards gender-fluid fashion between Gen Z and Gen X. Among Gen Z, 42.2% believe fashion can be fluid but that some items remain gender-specific, while 22.2% feel fashion should be unrestricted by gender and another 22.2% wear what they like regardless of gender. In contrast, 42.2% of Gen X prefer traditional gender-based fashion, and 35.6% believe fashion can be mixed but with some gender-specific items. Overall, Gen Z is more open to gender-fluid fashion and self-expression, whereas Gen X largely follows traditional gender norms. The findings are consistent with Lu (2024), which reported that Generation Z is more accepting of inclusive and gender-fluid fashion, whereas Generation X generally follows traditional fashion norms.

Influence of Culture on Fashion style:

It is important to analyse whether the culture has an impact on Gen Z and Gen-X fashion style. The following table -6 represents the frequency distribution of the same.

Table: 6 Influence of Culture on Fashion style

S.No	ATTRIBUTES	GEN Z		GEN X	
		Freq.	%	Freq.	%
1	K-pop/Anime fashion	13	28.9	0	0.0
2	Western/global pop culture	28	62.2	3	6.7
3	Traditional/local cultural heritage	19	42.2	36	80.0
4	Mix of two cultures (Indo-Western, etc.)	26	57.8	22	48.9
5	No cultural influence	11	24.4	2	4.4

Table 6 illustrates how cultural influences on fashion vary by age. Gen X mostly favors traditional attire (80%) that expresses cultural values, whereas Gen Z is more influenced by Western/pop culture

(62.2%) and favors fusion styles (57.8%). Gen Z is more likely than Gen X to have self-made styles and K-pop/anime influences. Overall, Gen Z is more experimental and trend-driven, whereas Gen X favours traditional and culturally rooted fashion. The findings support Lu (2024), which emphasized that Generation Z is influenced by global and multicultural trends, while Generation X remains more connected to traditional cultural values.

Perception about the micro-trends:

Microtrends are temporary fashion trends that gain popularity through the internet and social media. They contribute to environmental waste due to factors like frequent clothing purchases, the pressure to buy new styles, a lack of personal style, and challenges related to body image and mental health. The following chart represents the perception about the Gen Z and Gen X respondents towards the micro-trends.

Table 7: Perception about the micro -trends

S.No	ATTRIBUTES	GEN Z		GEN X	
		Freq	%	Freq	%
1	Environmental waste and overconsumption	13	28.9	5	11.1
2	Pressure to keep buying	10	22.2	13	28.9
3	Loss of personal style	8	17.8	8	17.8
4	Impact on mental health/body image	6	13.3	3	6.7
5	No issue with microtrends	8	17.8	16	35.6

Table 7 shows that Gen Z is more concerned about the negative effects of microtrends than Gen X. Among Gen Z, 28.9% identify environmental waste and overconsumption as the main issue, followed by pressure to keep buying new trends (22.2%). Additionally, 17.8% worry about losing their personal style, while another 17.8% see no issues with microtrends. In contrast, 35.6% of Gen X respondents do not perceive any problems with microtrends, although 28.9% acknowledge pressure to stay relevant through purchases and 17.8% are concerned about losing their sense of style. In general, Gen Z is more aware of the negative impacts of microtrends on society and the environment than Gen X is. The findings demonstrate that The evaluation of microtrends varies by generation, with Gen Z viewing them critically as contributing to environmental waste and consumerism, while Gen X is less concerned, highlighting a generational gap in eco-consciousness.

Perception of Sustainable fashion

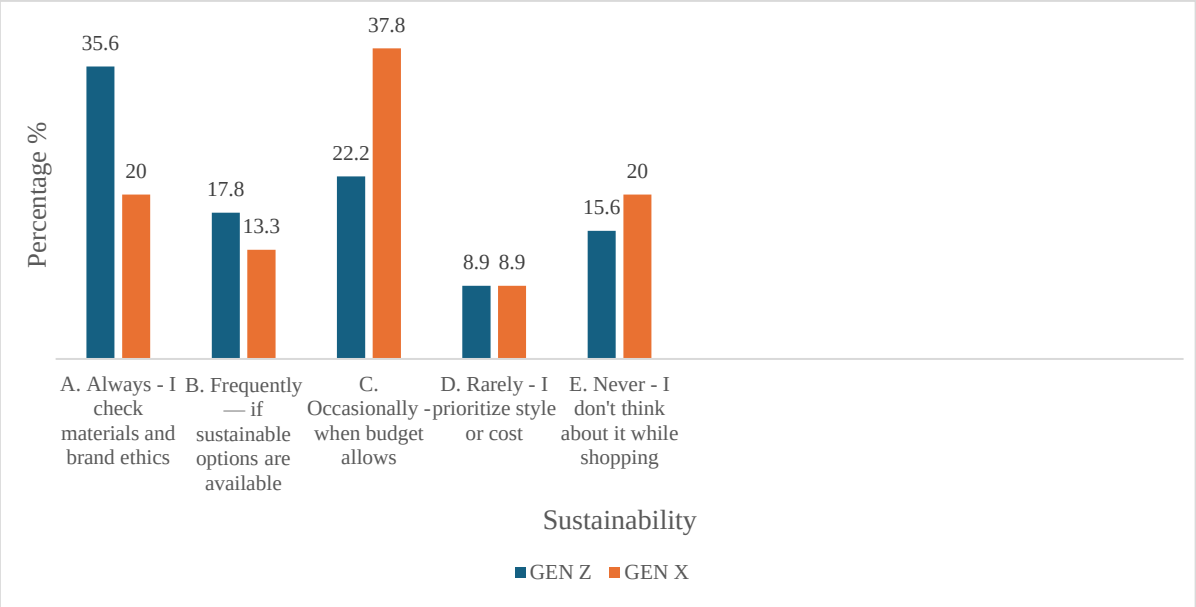

Figure: 2 Sustainability

Figure 2 shows that Gen Z is generally more eco-conscious than Gen X. Among Gen Z, 35.6% always check materials and brand ethics, while 22.2% consider sustainability when their budget allows and 17.8% only when sustainable options are available. In contrast, most Gen X respondents (37.8%) consider sustainability only occasionally and based on budget, while 20% always consider it and another 20% never do. Overall, Generation Z shows a greater commitment to sustainable fashion and awareness of environmental impacts compared to Generation X, who prioritizes budget and style over sustainability. Research indicates that Gen Z is less cost-sensitive when choosing sustainable clothing, making them more inclined to consider sustainability in their purchasing decisions. The findings indicate that Generation Z is more aware of sustainable fashion, while Generation X prioritizes brand quality and shows less awareness of sustainability, aligning with the studies by Miccichè Speciale (2024) and Motwani (2024).

Difference between Gen Z and Gen X with respect to Fashion preferences:

The independent sample t test has been used to analyse and understand the Gen Z and Gen X fashion choices and identifying the differences and similarities in terms of their approach towards fashion.

Ho: There is no significant difference between the Gen z and Gen x with respect to their fashion preferences, choices, and attitudes towards fashion

H1: There is a significant difference between the Gen z and Gen x with respect to their fashion preferences, choices, and attitudes towards fashion

Table 8: Difference between the Gen Z and Gen X: Independent Sample t test

Variables	Classification	t	Sig.
Shopping Criteria	Gen Z	0.130	.728
	Gen X		
Degree of influence	Gen Z	4.678	.043**
	Gen X		
Adaption	Gen Z	.032	0.862
	Gen X		
Cultural Influence	Gen Z	5.420	0.048**
	Gen X		
Dressing Styles for occasions	Gen Z	.167	0.694
	Gen X		

** - Significant at 5% level

It is inferred from the above t table that, there is a significant difference the Gen z and Gen x with respect to the dressing style for the occasion degree of influence and the cultural influence towards fashion since the p value is less than .05. Additionally, it is observed that there is no significant difference between the Gen z and Gen x with respect to the shopping criteria, adoption and dressing styles and occasions. Hence, the H1 hypothesis was rejected.

Inference: Based on the score, it is also inferred that both the

- Both Gen Z and Gen X frequently make their purchasing decisions on comfort.
- While Generation X is more likely to rely on recommendations from friends and personal preferences, Generation Z looks to search engines for idea.
- While Generation X prefers to change only when well informed, Generation Z is steadily changing its preferences.
- While Generation X is more influenced by traditional and regional cultural heritage, Generation Z is more influenced by Western and international pop culture.
- While Generation X favors comfortable, acceptable, and understated clothing, Generation Z carefully selects each appearance to fit the theme or feel of the occasion.

SUMMARY

This survey emphasizes how different generations have different opinions about fashion. Influenced by social media, Gen Z places a high value on self-expression, inclusion, and originality. They also prefer a gender-neutral approach and tend to ignore conventional social or gender standards. They value sustainability and are aware of current trends. Gen X, conforms to societal standards, appreciates bold, classic styles, and finds solace in conventional, structured apparel. Although Gen

Xers are less knowledgeable about environmental challenges and microtrends, their understanding could cause changes in their purchasing habits if they interact with these trends.

CONCLUSION

The study concludes that there are clear differences between both the generations in terms of their preferences, choices, mindset. While both generations prioritize comfort, Gen Z is more influenced by social media and microtrends leading to trend driven fashion choices. Gen X adopts a more practical approach and prefers long lasting trends. Overall, the study highlights that fashion consumption is shaped by generational values where Gen Z seeks individuality and Gen X prioritizes consistency.

IMPLICATIONS

- Fashion brands can develop targeted marketing strategies for different generations
- Designers can develop garment that fuse both comfort and practicality
- Brands should produce sustainable clothes that fit the trend to reduce the negative effect of microtrends

FUTURE RESEARCH

- To increase accuracy and generalization, future studies may use a bigger and more varied sample. Studies comparing customers in urban and rural areas can be carried out to investigate how geography influences fashion choices.
- Research can examine other generations, such as Gen Alpha and Millennials, for a more thorough comparison.
- Researchers can investigate the impacts of new digital trends such as online purchasing habits, virtual fashion, and AI styling tools.

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STUDY ON AWARENESS OF KASHMIRI DECORATIVE AND WEAVING CRAFTS AND ITS APPLICATION IN INTERIOR DESIGN OF LIVING ROOM

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ABSTRACT

Kashmiri decorative and weaving crafts are an important part of the region's cultural heritage, developed through traditional skills and local materials. However, their use in modern interior design is declining. The present study aimed to assess the awareness of Interior Design students regarding Kashmiri decorative and weaving crafts and their application in living room spaces. The data were collected using a structured questionnaire and analyzed through frequency, percentage, and weighted mean. The findings revealed that most students had low to moderate extent of knowledge regarding both decorative craft (70.00%) and weaving craft (53.04%). The study highlights the need to promote awareness and encourage the use of these crafts in interior design to support sustainability and cultural preservation.

Key words: Kashmiri Decorative Crafts, Kashmiri Weaving Crafts, Interior Design, Living Room Design, Student Awareness.

INTRODUCTION

Traditional Interior design is based on the culture, traditions, local materials, and lifestyle of a region, reflecting its identity and traditional practices. It supports sustainability by using locally available resources and craftsmanship technique (Rashdan & Mhatre, 2022). In this context, decorative and weaving crafts play a significant role in interior design by enhancing aesthetic appeal, adding cultural richness, and supporting eco-friendly practices (Thappa et al., 2022).

Kashmir is widely known for its rich traditional arts and crafts, which reflect its cultural identity and skilled craftsmanship. Among these, decorative crafts such as papier-mâché art, leather work craft, and copperware hold a special place due to their intricate detailing, artistic value, and functional use in interior spaces (Rathe & Rajeshwari, 2023). Papier-mâché art is characterized by delicate hand-painted motifs, vibrant colours, and a smooth varnished finish, making it suitable for decorative items like vases, trays, boxes, and wall panels (Sharma, 2024). Similarly, copperware craft involves skilled techniques such as hammering, engraving, and embossing to create aesthetically appealing utensils, lamps, and decor items that enhance the traditional look of interiors. Leather craft is also significant for its bold colours, detailed embroidery, and hand-painted designs, which are commonly used in wall decor, furnishings, and accessories (Tiwari, 2023). These decorative crafts play a significant role in enhancing interior spaces by adding texture, depth, and visual richness. Their intricate designs and handcrafted nature create strong focal points and contribute to a warm and culturally enriched

ambience (Kim & Heo, 2021). Moreover, these decorative and weaving crafts support sustainable design as they are handmade, eco-friendly, and use local materials, reducing environmental impact. Their use in modern interiors helps preserve cultural heritage, support artisans, and create meaningful design spaces (Patel, 2024).

The living room is an important space in a house, used for relaxation, social interaction, and welcoming guests. It often reflects the lifestyle and preferences of the users. Therefore, it is a suitable space to express cultural values through design. The use of decorative and weaving crafts in living room interiors helps to improve the overall look and comfort of the space. These crafts add colour, texture, and a traditional feel, while also supporting local artisans and preserving their skills (Sharma & Patel, 2018). However, even though Kashmiri decorative and weaving crafts are rich and diverse, many interior design students have limited knowledge about them. Their understanding of the materials, techniques, and use of these crafts in interiors is still low. This may be because more focus is given to modern design trends and there is less exposure to traditional crafts in education. Therefore, this study aims to examine the awareness of interior design students regarding Kashmiri decorative and weaving crafts and to explore their application in living room interior design. While Many past studies talk about the history of Kashmiri artisans and how they make their crafts. However, there is very little research showing whether modern interior design students actually know about these crafts or understand how to use them. Furthermore, no studies could be found that show real, practical examples of how to take traditional Kashmiri designs and put them into modern living room layouts. This study fills that gap by measuring what students know and showing a real 3D design layout to bring these traditional crafts into modern homes.

REVIEW OF LITERATURE

The region of Kashmir is characterized by its cold climate, mountainous surroundings, and strong cultural background. The interior design of this region has developed according to the local climate and living conditions, using materials like wood and stone to create spaces that are comfortable and suitable for the environment. Among the traditional crafts of Kashmir, decorative crafts such as papier-mâché, leather work, and copperware, along with weaving traditions like willow wicker and Kani weaving, are important. These crafts reflected skilled workmanship and are used in interiors for both decoration and daily use.

Research in India showed that the use of locally available materials such as stone, wood, clay, and terracotta supports the development of sustainable designs (Jayasudha et al., 2014; Avinaash et al., 2024). Traditional design features like courtyards, wooden ceilings, and handmade furniture improve comfort and usability in homes (Chadalavada et al., 2017; Khatri & Kushagra, 2024). These studies also highlight the importance of preserving traditional crafts and including them in modern interior design (Patel, 2024; Sharma, 2024). Decorative crafts like papier-mâché and copperware enhances the aesthetic value through detailed work, while weaving crafts like wicker and Kani provide both use and visual appeal. Research from other countries also showed that traditional design plays an important role in expressing cultural identity and promoting sustainability (Sonia & Mwituria, 2020; Ibrahim, 2021). The use of handmade decorative elements and natural materials improves environmental comfort and the overall experience of users (Saputri & Alimin, 2021; Rashdan & Mhatre, 2022). Adding such traditional crafts into modern interiors improves both aesthetic quality and functional (Formolly & Saraei, 2024; Jetto & Yildirim, 2025).

In general, decorative and weaving crafts play an important role in making interiors sustainable, useful, and culturally rich. However, very few studies focus on the use of Kashmiri decorative and weaving crafts in interior design, especially in living room spaces. Therefore, this study aims to explore the integration of vernacular art and crafts into modern interior spaces, particularly in living room design.

OBJECTIVES

1. To collect relevant information on Kashmiri decorative and weaving crafts.
2. To assess the awareness level of Interior Design students regarding Kashmiri decorative and weaving crafts.
3. To propose a Modern living room Design by incorporating Kashmiri decorative and weaving crafts.

DELIMITATION

1. The study was limited to selected Kashmiri decorative and weaving crafts
2. The application of these crafts was restricted to modern living room interior design only.

METHODOLOGY

Research Design: A descriptive research design was considered most appropriate method to asses the extent of respondents knowledge regarding Kashmiri vernacular art and crafts for the study. It was conducted in Vadodara, Gujarat, among students from the Faculty of Family and Community Science, The Maharaja Sayajirao University of Baroda.

Sample and Sampling Technique: A total of 230 Interior Design students pursuing UG and PG in Bsc. (Hons.) ID (HPP), Bsc. (Hons.) ID (GIA), PGDHI were selected. A purposive sampling technique was used to intentionally select students from interior design field. Only those who gave consent were included.

Inclusion Exclusion Criteria: Interior Design students who agreed to participate were included, while students from the Hospitality Management specialization were excluded.

Data collection Procedure: The data were collected using a structured questionnaire consisted of two sections: Background Information and Extent of Knowledge regarding Kashmiri decorative and weaving crafts. The Background Information section included details such as age, gender, educational qualification, type and size of family, and native place. The second section assessed respondents' knowledge using a 3-point Likert scale (Aware, Undecided, and Unaware). The total scores were calculated based on assigned values, and the range was determined by subtracting the minimum score from the maximum score and dividing it into three equal intervals to classify the knowledge levels into low, moderate, and high. The questionnaire was further divided into two subsections: the first focused on decorative crafts of Kashmir, including papier-mâché (10 statements), leather craft (5 statements), and copperware (6 statements), while the second covered weaving crafts such as willow wicker (5 statements) and Kani weaving (8 statements). The tool was validated by experts to ensure accuracy and relevance. A pilot study was conducted to test reliability, and the Cronbach's alpha value of 0.901 indicated high internal consistency. Data were collected during November to December 2025.

Statistical Techniques: The data were analyzed using frequency, percentage, and weighted mean.

Ethical approval: The Ethical approval was obtained from Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Science, The Maharaja Sayajirao University of Baroda (Approval No.: IECHR/FCSC/M.Sc./10/2025/34). And all respondents were given informed consent form for explaining purpose of study. Only those who gave consent were included.

RESULTS

Section I: Background Information of the Respondents

This section dealt with information regarding the background information of the respondents. It includes details regarding age (in years), gender, educational level, type of family, family size, and native place of the respondents.

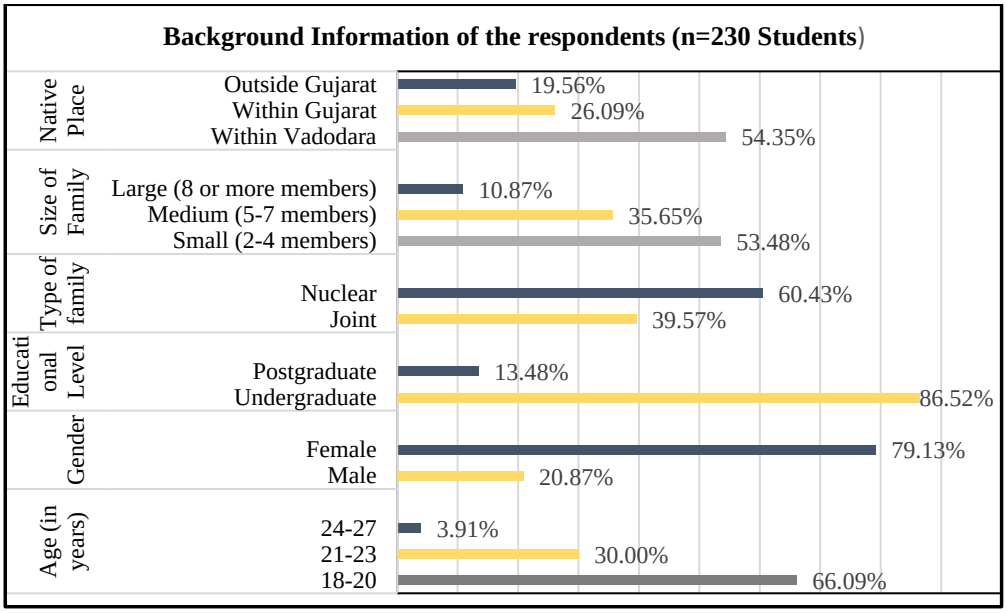

Figure 1: Frequency and percentage distribution of the respondents according to their Background Information

The background information of the respondents presented in Figure1, revealed that respondents were aged between 18 and 27 years with a mean age of 19.98 years, with standard deviation of 1.77. with the majority belonging to the 18–20 years age group. Most respondents were female (79.13%) and undergraduate students (86.52%). The data revealed that more than half belonged to nuclear families (60.43%). The data also revealed that the majority of respondents were from Vadodara City (54.35%) followed by other parts of Gujarat (26.09%) and outside the state (19.56%).

Section II: Extent of Knowledge of the respondents regarding Decorative Crafts

Section A: This section examined the extent of Knowledge of Respondents Regarding different Decorative Craft of Kashmiri.

1. Extent of Knowledge of the respondents regarding Papier Mache Art

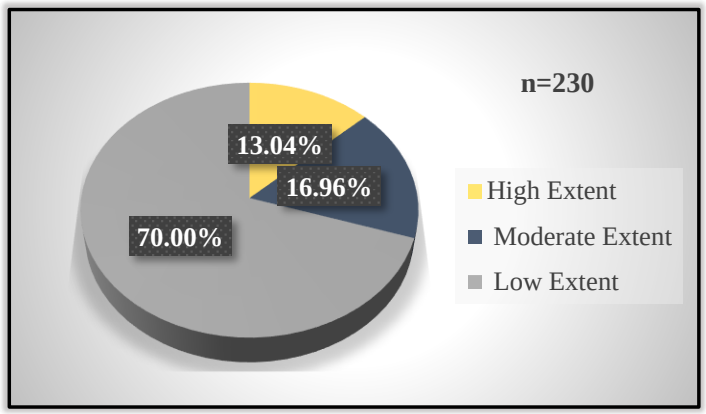

Figure 2: Extent of Knowledge of the respondents regarding Papier Mache Art

The data presented in Figure-2 indicated that the majority of respondents (70.00%) had a low extent of knowledge, followed by 16.96% who had a moderate extent of knowledge, and only 13.04% who had a high extent of knowledge. An in-depth analysis of papier-mâché art was done using 10 statements, the findings revealed that 71.30 per cent of the respondents were unaware that Papier Mache art has GI (Geographical Indication) tag from Kashmir followed by 70.00 per cent of the respondents were unaware that Papier Mache products are lightweight. The data also revealed that 69.12 per cent of the respondents were unaware that Papier Mache has gold and silver detailing for decoration. ????

2. Extent of Knowledge of the respondents regarding Copperware Craft

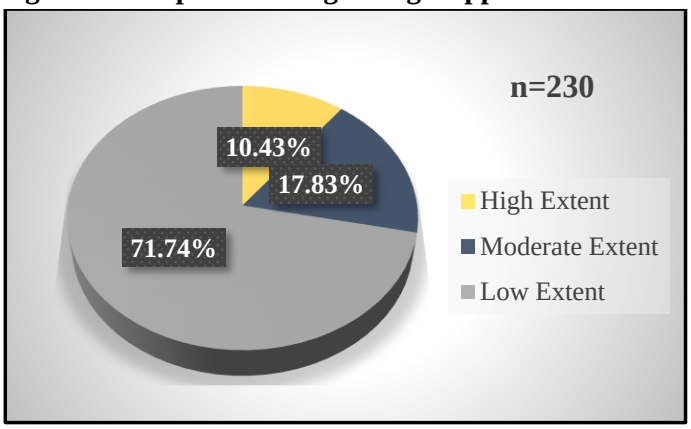

Figure 3: Extent of Knowledge of the respondents regarding Copperware Craft

The data presented in Figure3 indicated that most respondents (71.74%) haD a low extent of knowledge, followed by 17.83% with a moderate extent of knowledge**,** and only 10.43% with a high extent of knowledge regarding Copperware craft. An in-depth analysis of Copperware Craft, was done using 6 statements, the findings revealed that 68.26 per cent of the respondents were unaware that copperware has floral and geometric patterns engraved on it followed by, 62.18 per cent of the respondents were unaware that Copperware crafted by skilled artisans.

3: Extent of Knowledge of the respondents regarding Leather Craft.

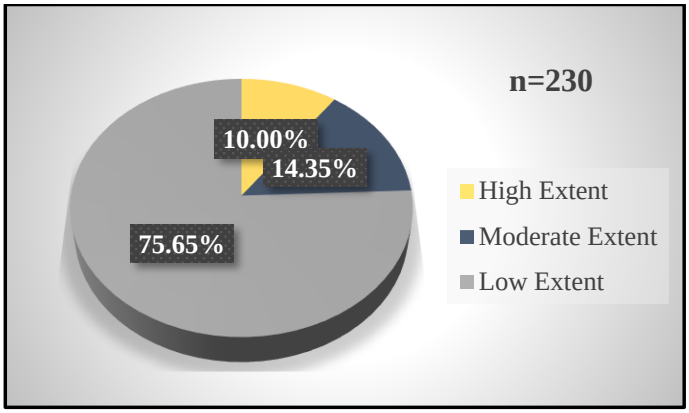

Figure 4: Extent of knowledge of the respondents regarding Leather Craft

The data presented in Figure 4 indicated that most respondents (75.65%) had a low extent of knowledge, followed by 14.35% with a moderate extent of knowledge**,** and only 10.00% with a high extent of knowledge regarding the Leather craft. An in-depth analysis of Copperware Craft, was done using 5 statements, the findings revealed that 74.78 per cent of the respondents were unaware that leather craft products are used for decoration and furniture followed by, 71.74 per cent of the respondents were unaware that Leather Craft is hand painted with bold colours.

A. Extent of Knowledge of the respondents regarding Decorative Craft of Kashmir

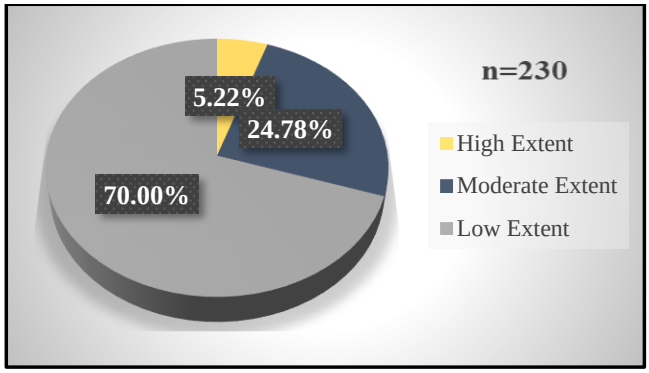

Figure 5: Extent of Knowledge of the respondents regarding Decorative Craft of Kashmir

The data presented in the Figure 5 indicated that 70.00 per cent of the respondents had a low extent of knowledge, followed by 24.78 per cent who had a moderate extent of knowledge**,** while only 5.22 per cent of the respondents had a high extent of knowledge regarding Decorative craft of Kashmir. An in-depth analysis of papier Mache art (10 statements), Copperware craft (6 statements), and Leather craft (5 statements), covering various aspects such as GI tag, interior applications, and construction techniques was done.

Section B: This section examined the extent of Knowledge of Respondents Regarding different Decorative Craft of Kashmiri.

1: Extent of Knowledge of Respondents regarding Willow Wicker Craft

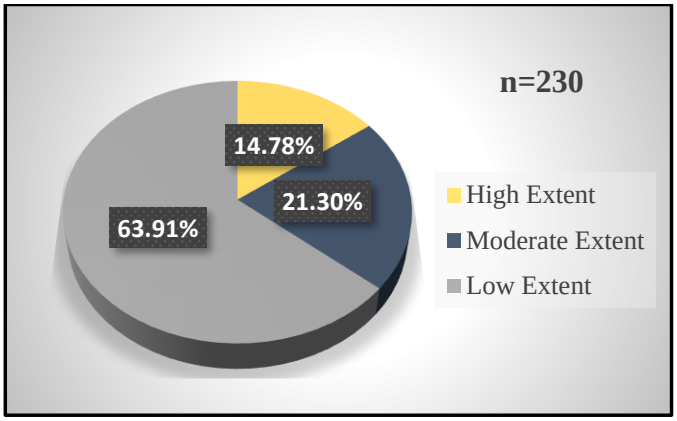

Figure 6: Extent of knowledge of the respondents regarding Willow Wicker Craft

The data presented in Figure 6 indicated that 63.92 per cent of the respondents had a low extent of knowledge, followed by 21.30 per cent with a moderate extent of knowledge**,** and 14.78 per cent with a high extent of knowledge regarding the Willow Wicker craft. An in-depth analysis of Willow Wicker craft was done using 5 statements. The findings revealed that 61.30 per cent of the respondents were unaware that Willow wicker products are made using thin willow sticks, followed by 55.65 per cent of the respondents were unaware that Willow wicker items are lightweight.

2: Extent of Knowledge of the respondents regarding Kani Art

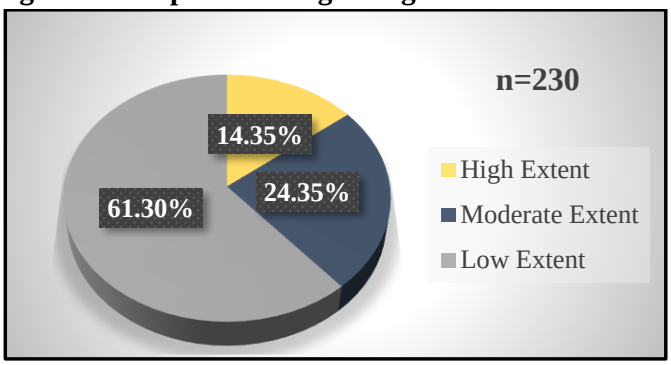

Figure 7: Extent of Knowledge of respondents regarding Kani Weaving craft

The data presented in Figure 7 indicated that 61.30 per cent of the respondents had a low extent of knowledge, followed by 24.35 per cent with a moderate extent of knowledge, and 14.35 per cent with a high extent of knowledge regarding the Kani Weaving craft. An in-depth analysis of Willow Wicker craft was done using 8 statements. The findings revealed that 65.22 per cent of the respondents were unaware that Kani Weaving Craft are traditional hand-woven shawls of Kashmir, followed by 61.30 per cent of the respondents were unaware that Kani Weaving Craft is woven using wooden needles called Kani. The data also revealed that 53.48 per cent of the respondents were unaware that it mainly uses floral and paisley patterns.

B: Extent of Knowledge of the respondents regarding Weaving Craft of Kashmir

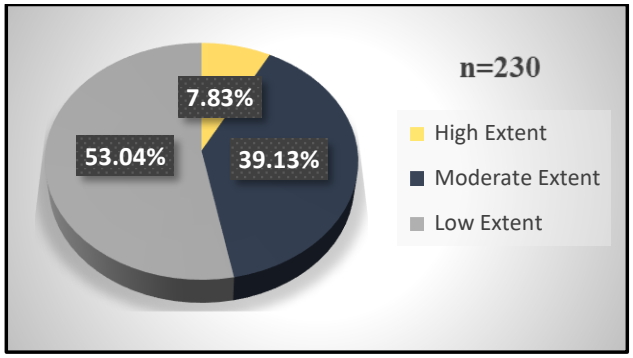

Figure 8: Overall Extent of Knowledge of the Respondents regarding Weaving Craft of Kashmir

The data presented in the Figure 8 indicated that 53.04 per cent of the respondents had a low extent of knowledge, followed by 39.13 per cent with a moderate extent of knowledge, and 7.83 per cent with a high extent of knowledge regarding the Weaving craft. An in-depth analysis of Willow Wicker craft (5 statements) and kani weaving craft (8 statements), covering various aspects such as GI tag, interior applications, and construction techniques was done. The findings for both Papier-Mâché and Copperware show a similar pattern. Although these Kashmiri crafts are an important part of India's cultural heritage, most of the students had limited knowledge about them. This may be because interior design education gives greater importance to modern design styles and provides less exposure to traditional arts and crafts. The findings suggest that increasing awareness of these eco-friendly and unique crafts through education can encourage future interior designers to use them in modern interiors. This will help create sustainable and culturally rich spaces while also supporting the livelihood of local artisans.

Development of Living room Designs using Kashmiri Art and Crafts

A modern living room design was developed by using Kashmiri decorative and weaving crafts based on the research findings. The aim was to create a space that reflects cultural identity while maintaining modern comfort and functionality. The designs were prepared using 2D (AutoCAD 2021) and 3D (SketchUp 2021 with V-Ray) tools. Different decorative and weaving crafts were applied in interior space like walls, furniture, and decor to achieve a balanced combination of traditional beauty and modern design.

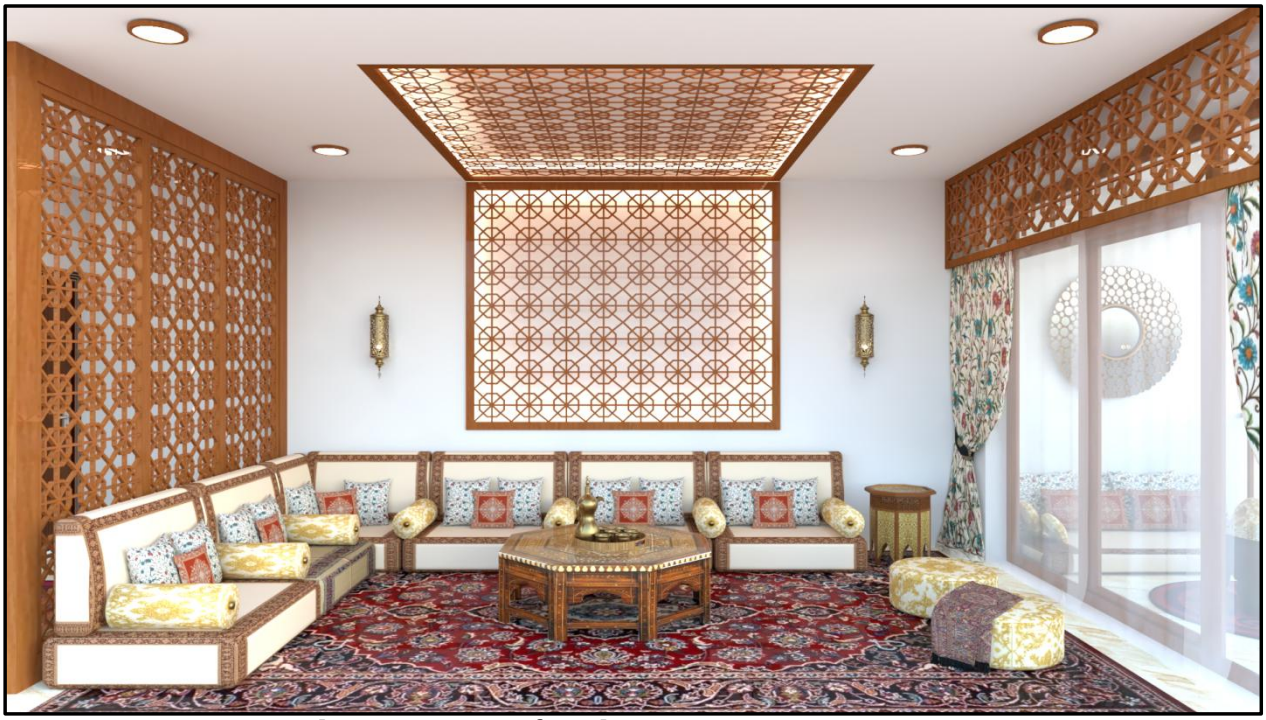

Plate 1: 3D View of Modern Living Room Design

As illustrated in Plate 1, Kashmiri decorative and weaving crafts were thoughtfully integrated into the living room design to enhance both visual appeal and cultural significance. Each craft was carefully positioned in different elements of the space to create a balanced and meaningful interior. Papier-mâché art was used in decorative items such as vases, bowls, and also on tabletops of centre and side tables. The use of bright colours, fine hand-painted details, and floral patterns added vibrancy and artistic richness to the living room, making the space more lively and visually attractive. Copperware was incorporated through both functional and decorative elements such as lamps, mirrors, and traditional tea sets. Copper lamps provided warm lighting, creating a cozy and inviting atmosphere. Mirrors with copper frames enhanced wall décor and helped reflect light, making the space appear more spacious and brighter. The placement of copper tea sets on table added a traditional touch and highlighted the cultural essence of Kashmir. Willow wicker items were included as wall hangings, and plant holders. These were placed near windows, on wall and in the balcony, to introduce a natural and eco-friendly element. The lightweight and handwoven nature of wicker added simplicity, warmth, and a handcrafted feel to the space. Kani shawls, representing weaving crafts, were used as soft furnishings by draping them over low seats in living room and balcony. This added comfort while introducing intricate woven patterns and traditional motifs. These shawls enhanced the overall look by adding layers, texture, and a strong cultural identity. Overall, the use of these Kashmiri decorative and weaving crafts in various elements of the living room, such as furniture, walls, and decor, helped in creating a space that was visually rich, culturally meaningful, and comfortable for everyday use.

CONCLUSION

The study highlights that Kashmiri traditional crafts are an important part of India's cultural heritage. However, the findings show that interior design students have limited knowledge about these crafts. This may be because interior design education focuses more on modern design styles and gives less

attention to traditional arts and crafts. The study also shows that incorporating Kashmiri crafts into modern interiors can create unique, sustainable, and culturally rich living spaces.

This study is significant because it identifies the gap in students' knowledge of Kashmiri traditional crafts. Understanding this gap can help in preserving these valuable crafts, many of which are gradually declining. It also emphasizes that educating future interior designers about these crafts can support the conservation of cultural heritage while encouraging their use in contemporary interior design.

The findings have practical implications for interior design education. Colleges can introduce Kashmiri crafts through classroom teaching, workshops, exhibitions, and practical design projects. Such learning opportunities can encourage students to use these traditional crafts in their future work. This will not only support local artisans by creating more employment opportunities but also promote sustainable and culturally meaningful interior spaces.

The study also has certain limitations. The research was conducted among students from only one university, so the findings may not represent students from other institutions or regions. In addition, the study focused on selected Kashmiri crafts. Future research can include a wider range of traditional crafts from different states and different woodwork techniques and involve participants from different universities to provide broader insights.

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WORKLOAD AND ITS IMPACT ON HEALTH AND NUTRITIONAL WELL-BEING OF WORKING WOMEN IN MUZAFFARPUR TOWN

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ABSTRACT

Working women today are strong-headed, passionate about their work, and capable of juggling multiple responsibilities. However, this multitasking is adversely affecting their health and nutritional well-being. This study aimed to examine the workload of working women and its impact on their health and nutritional well-being. The study used a descriptive and analytical research design. A total of 100 working women, aged 20 to 65 years and engaged in government, semi-government, and private employment, were selected as the study population. Statistical techniques such as percentages, averages, standard deviation, chi-square test, tables, and graphs were used to assess the impact of workload on the health and nutritional status of the respondents. The results revealed that most of the women (70%) had a sedentary lifestyle and did not engage in regular physical exercise. About 42% were overweight (23–24.9 kg/m²), and 18% were classified as obese (>25 kg/m²). The respondents had adequate caloric (2018 ± 315 kcal) and protein intake (56.6 ± 19.8 g). However, the intake of visible fat (37.5 ± 9.8 g) was significantly higher than recommended. In contrast, the intake of fibre (21.04 ± 8.5 g), vitamin C (28.0 ± 5.44), calcium (400 ± 44.28), and iron (17.8 ± 4.5) was below the recommended. Additionally, 45% of the respondents relied on online food delivery systems, and 20% skipped breakfast. A majority of working women (45%) fell under the high workload category. Overall, working women experience a wide range of health problems, reflecting the impact of workload and dual responsibilities.

Keywords: Health status, Nutritional status, Workload, Working women

INTRODUCTION

Globalization and liberalization increased the opportunities for education and employment for Indian women. Now, the women also working outside like men and looking after the household work. Working women are a fine example of people who do double-shifts. Not only do they have their homes and families to look after, but also workplace, colleagues and bosses.

According to the Periodic Labour Force Survey (PLFS), women's work participation rate (WPR) in India increased from 22% in 2017–18 to 40.3% in 2023–24; however, society has not changed fast enough to support this shift. Men still mostly follow traditional roles and do not share

much of the household work. As a result, women have to manage both their jobs and household responsibilities. This double burden, along with the demands of their work, negatively affects their health. According to the National Family Health Survey-4 (2015–16), this "multi-tasking" has led to poor health among women, especially in terms of nutrition. Many women have low levels of Vitamin D, calcium, and iron. Poor diet and a sedentary lifestyle are the main reasons for this. Lack of essential nutrients can lead to various physical and mental health problems.

Hazards Of Multi-Tasking

Maintaining a balance between professional and household responsibilities has always been a challenge for working women. Ensuring a safe and nutritious diet, adequate sleep and a regular exercise regimen are things that working women find hard to maintain. One of the most common patterns noticed amongst majority of working women is: skipping breakfast due to the usual morning rush, nibbling on snacks entire afternoon and finally feasting to a heavy dinner. This vicious cycle is a recipe for disaster. It is important to prioritise daytime meals and snacks to regulate hunger hormones. Second factor is stress eating, because of the obvious pressure that comes from both sides: home as well as work. This makes it very easy to reach out for a quick food fix. Food rich in sugar, salt and fat are the preferred comfort foods because they give an instant high. However, the high is soon followed by a crash, guilt, fear, more stress and overproduction of cortisol that leads to fat storage (Coutinho, 2018).

Nutritional Well-Being of Workwomen

According to the National Family Health Survey-4 (2015–16), about 50% of women aged 15 to 49 in India are anaemic. In urban areas, the prevalence is even higher, with 54% of women suffering from anaemia. One of the main reasons is the lack of essential micronutrients in their diet, which can lead to various physical and mental health problems. In addition to undernutrition, overweight and obesity are also growing concerns among women. Furthermore, NFHS-4 reported that about 20% of women are overweight or obese. This percentage is higher in urban areas (31%) compared to rural areas (15%) (Outlook ,2019).

There is no room for energy slumps when one has to manage kids, a husband, parents, colleagues and bosses. Nutritionally, energy slumps can be due to crab heavy meals, overeating, caffeine crashes, nutrition deficiencies (iron, magnesium, vitamin B12), low hemoglobin, dehydration, et cetera. Women are prone to being anaemic and is one main reason of lethargy. Drinking another cup of coffee to beat that slump is not an answer because excess caffeine will only end up in adrenal fatigue, dehydration, hindered nutrient absorption, disturbed gut health and circadian rhythm (Coustinho,2018).

Health Problems Faced by Working Women

A survey titled "multi-tasking seriously affecting corporate women's health" was conducted by the Associated Chamber of Commerce and Industry on the occasion of International Women's Day (March 8, 2014). The survey included 2,800 corporate women employees from 120 companies across 11 sectors.The results showed that 75% of these women had some kind of health problem, and this was seen at all levels of work, from junior to senior positions. The survey was carried out in

major cities like Ahmedabad, Bangalore, Chennai, Delhi, Hyderabad, Jaipur, Kolkata, Lucknow, Mumbai, and Pune.It was found that 78% of the women suffered from lifestyle-related, chronic, or acute diseases. These included problems like obesity, depression, back pain, diabetes, high blood pressure, high cholesterol, and heart and kidney diseases. About 42% had lifestyle diseases, 22% had chronic diseases, and 14% were suffering from acute illnesses (The Hindu, 2014).

Hormones play a major role in women's health and well-being. The hormonal changes that take place due to stress can pave way for many other health problems like improper thyroid function, infertility, loss of libido, insulin resistance, IBS, autoimmunity and even cancer. Stress can even change food behaviour and the way food gets digested, thereby further aggravating the condition. There are so many women who have learned to live with acidity and constipation, because of their unhealthy eating habits. This is dangerous because it creates a perfect environment for cancer cells to breed. Good nutrition can help reduce many of these health problems, including the symptoms of PMS and Menopause. Women must ensure they are taking sufficient calcium, potassium and magnesium in their diet as well as keep a check on their acidity to prevent osteoporosis and bone related disorders in the longer run (Coutinho,2018).

SIGNIFICANCE OF STUDY

The present study is significant as it highlights the growing challenges faced by working women in balancing professional and household responsibilities. With the increasing participation of women in the workforce, understanding the impact of workload on their health and nutritional status has become essential. This study will help in identifying the major health and nutritional problems associated with excessive workload among working women. It provides valuable insights into how dual responsibilities affect their physical and mental well-being. The results of present study will be useful for policymakers, health professionals, and researchers in designing effective strategies and interventions to improve the health and nutritional well-being of working women. It can also create awareness among women regarding the importance of maintaining a healthy diet and good lifestyle despite their busy schedules.

OBJECTIVES

To study the workload of working women and its impact on their health and nutritional status.

METHODOLOGY

Research plan

The study used a descriptive and analytical research design, to understand how workload affects the health and nutritional well-being of working women.

Area of study

The study was conducted in Muzaffarpur Town, Bihar, which provided a suitable setting due to the increasing participation of women in various occupations.

Study population

The study population included working women between 20-65 years of age, engaged in government, semi- government and private employment.

Sample size and Sampling technique

A total of 100 working women from different sectors were selected using a random- cum-subjective sampling technique.

Methods of data collection

Data were collected using both principal and secondary sources.

Principal data

Data on basic health indicators (BMI, self-reported health issues, etc.) and dietary habits (using 24-hour recall method) were collected through structured questionnaires prepared in Google Forms. The use of an online survey method facilitated quick dissemination and collection of responses.

Secondary data

For secondary data, a variety of studies assessing the health and nutritional issues of working women were critically reviewed. The author manually checked reference lists and documents published by well-known organizations. Relevant research articles were also reviewed.

Analysis of data

The data collected were subjected to statistical analysis using measures such as percentages, average and standard deviation, along with tabular and graphical presentation. To find the association between workload and health problem among the study population, a Chi- square test was used.

RESULTS AND DISCUSSION

General profile of working women

General profile of working women has been presented in table- 1

Table -1: General profile of working women

	Particulars	Working women (n=100)	
		Frequency	Percentage
A.	Age (Years)		
	20-35	29	29
	36-50	51	51
	51-65	20	20
B.	Education		
	Matric and Intermediate	15	15
	Graduate	45	45
	Post graduate & above	40	40

C.	Occupation		
	Government Service	70	70
	Semi Government (Bank/LIC)	15	15
	Private Job	15	15

The data reveal that the majority of the working women (51%) belonged to the age range of 36 to 50 years, followed by 29% in the age range of 20 to 35 years, while 20% were in the 51 to 65 years category similar to the finding of Salwathura and Ahmed (2023). This indicates that most respondents were in their middle age group, which is generally associated with higher work and family responsibilities. With regard to educational status, a large proportion of respondents were graduates (45%), followed by postgraduates and above (40%), while only 15% had education up to matric and intermediate level. This shows that the study population was relatively well-educated. In terms of occupation, the majority of respondents (70%) were engaged in government services, while 15% each were employed in semi-government and private sectors. This indicates that most respondents had stable employment, which may influence their lifestyle and health status.

Lifestyle of working women

Table -2: Lifestyle of working women

	Particulars	Working women (n=100)	
		Frequency	Percentage
A.	Activity		
	Sedentary	100	100
	Moderate	-	-
	Heavy	-	-
B.	Exercise		
	Yes	-	-
	No	100	100

Table 2 shows the lifestyle pattern of the subjects. It is evident that 100% of the women had a sedentary lifestyle, and none were involved in moderate or heavy physical activity. Furthermore, all respondents (100%) reported that they did not engage in any regular exercise. This indicates a lack of physical activity, which may contribute to different health problems such as obesity, hypertension, and fatigue. The sedentary nature of work, combined with lack of exercise, reflects an unhealthy lifestyle pattern among working women. Idris et al. (2021) also reported in their study that lack of physical activity and a sedentary lifestyle are the main risk factors for developing metabolic diseases among working women.

Anthropometric Indices

Table -3: Anthropometric indices of working women

	Particulars	Working women (n=100)	
		Frequency	Percentage
A.	Height (in cm)		
	145-149	25	25
	150-155	40	40
	156-160	35	35
B.	Weight (Kg)		
	45-54	20	20
	55-64	45	45
	65-74	35	35
C.	BMI (kg/m^2)		
	<18	-	-
	18.0-22.9	40	40
	23-24.9	42	42
	>25.0	18	18

Table 3 reflects anthropometric indices of respondents which includes height, weight and body mass index (BMI). The height distribution shows that 40% of the respondents had a height between 150–155 cm, followed by 35% in the range of 156–160 cm, and 25% between 145–149 cm, indicating that most women had an average height range. In terms of weight, the majority of respondents (45%) fell in the 55–64 kg category, followed by 35% in the 65–74 kg group, and 20% in the 45–54 kg range. This suggests that a significant proportion of women had moderate to higher body weight. The BMI classification reveals that none of the respondents were underweight. About 40% had normal BMI (18.0–22.9 kg/m^2), while a larger proportion, 42%, were overweight (23–24.9 kg/m^2), and 18% were classified as obese (>25 kg/m^2) (Srilakshmi, 2018). Similarly, Salwathura and Ahmed (2023) carried out a study in Sri Lanka and observed that 38% of the women were overweight (23–24.9 kg/m^2) and 13% fell under the obese category (>25 kg/m^2).

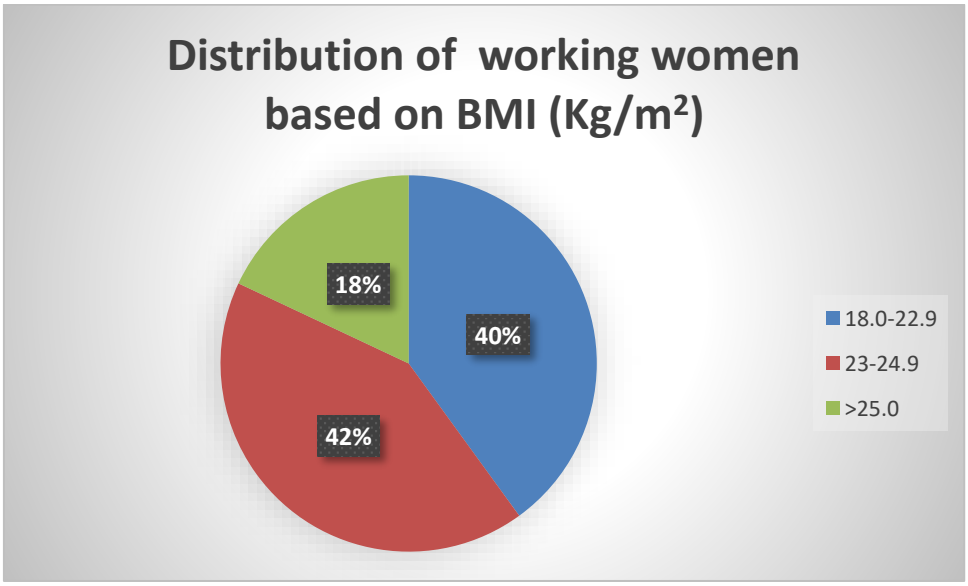

Figure- 1: Distribution of the respondents according to BMI (Kg/m^2)

Nutrients intake by working women

Table - 4: Daily intake of nutrients by working women

Nutrients	Intake mean ± SD	RDA * (ICMR/NIN)**	% RDA
Energy(Kcal)	2018 ± 315	1660	121.5
Protein (g)	56.6 ± 19.8	46	123.0
Total Fat (g)	57.3 ±16.82	-	-
Visible fat (g)	37.5 ± 9.8	20	187.5
CHO(g)	298.8 ± 68	100-130	298.8- 229.8
Dietary Fibre(g)	21.04 ± 8.5	25	84
Vitamin C(mg)	28.0 ± 5.44	65	43
Ca(mg)	400 ± 44.28	1000	40
Fe (mg)	17.8 ± 4.5	29	61.3

*Recommended Dietary Allowances

** ICMR/ NIN 2020

The data presented in Table 4 reveal the daily nutrient intake of working women in comparison with the recommended dietary allowances (RDA). The mean energy intake (2018 ± 315 kcal) was found to be higher than the RDA (121.5%), indicating adequate caloric consumption among the respondents. Similarly, protein intake (56.6 ± 19.8 g) was also above the recommended level (123 %), suggesting sufficient protein consumption. However, the intake of visible fat (37.5 ± 9.8 g) was significantly higher than the recommended level (187.5%), indicating excessive fat consumption, which may increase the risk of lifestyle-related diseases. Mishra and Gehlot (2020) also reported in their study that the mean energy intake of respondents was 1526.54±419.69 kcal and the mean protein intake was 50.55±16.37g. They further reported that 30.4 % of working women were consuming fat in excess of the recommended dietary allowance (RDA).

In contrast, fibre intake (21.04 ± 8.5 g) was considerably lower than the recommended level (84%), reflecting inadequate consumption of fruits, vegetables, and whole grains. Similarly, the intake of essential micronutrients such as vitamin C (43% of RDA), calcium (40% of RDA), and iron (61.3% of RDA) was below the recommended dietary allowances, indicating potential nutritional deficiencies among the respondents.

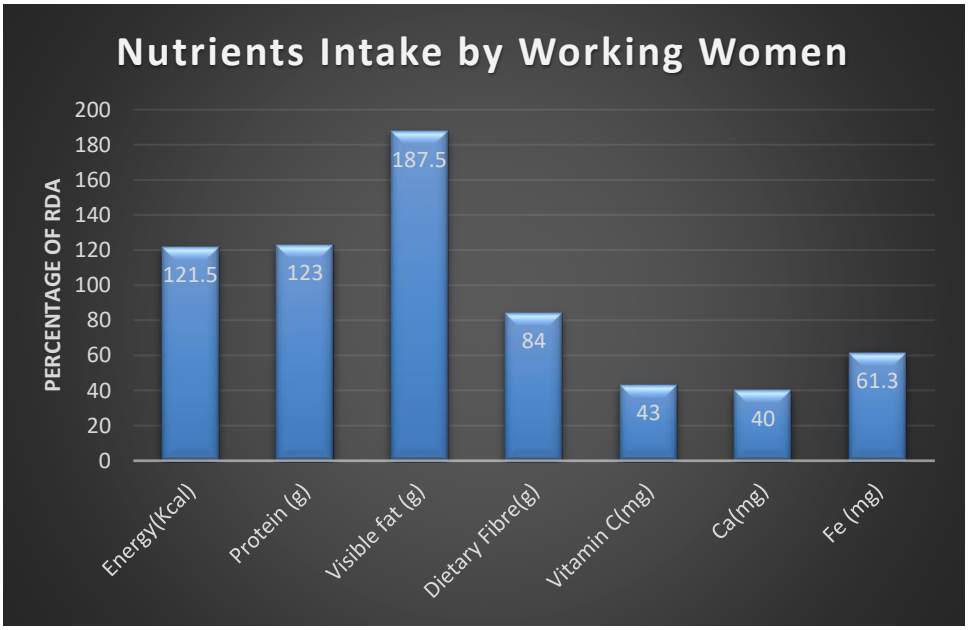

Figure- 2: Mean daily intake of nutrients by working women

Dietary patterns of working women

Table -5: Dietary patterns of working women

Dietary Habit	Working women (n=100)	
	Frequency	Percentage
Skipping Breakfast	20	20
Irregular Meal Timing	35	35
relied on online food delivery platforms	45	45
Balanced diet intake	10	10

Table 5 presents the dietary habits of working women. The findings reveal that a considerable proportion of respondents follow unhealthy eating patterns. About 45% of the women relied on online food delivery systems, due to time constraints. These foods are often high in fat, salt, and calories and regular consumption is linked to obesity, hypertension, depression, and reduced work efficiency. Salwathura and Ahmed (2023) conducted a study in Sri Lanka and reported that 50% of working women consumed ready to eat food one to three times per week. Around 35% of the respondents reported irregular meal timing, which may negatively affect metabolism and overall health. Additionally, 20% of women skip breakfast, which is a matter of concern as breakfast is considered essential for maintaining energy levels and proper metabolic functioning (Hindustan

Hindi Newspaper; 2021). Only 10% of the respondents reported consuming a balanced diet, highlighting a significant gap in nutritional awareness and healthy eating practices among working women. This indicate that majority of working women have poor dietary habits, which may contribute to nutritional deficiencies and various health problems. Idris et al. (2021) also observed in their study that unhealthy eating practices such as skipping breakfast, frequent snacking and eating fast food are some risk factors for developing metabolic diseases among working women.

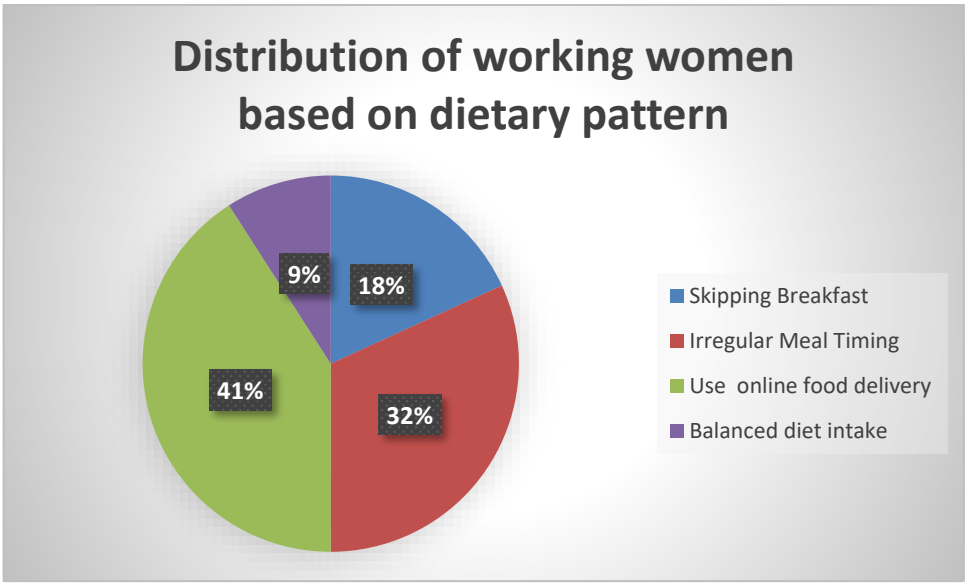

Figure- 3: Distribution of working women according to their dietary pattern

Workload of working women

Table -6: Distribution of respondents by workload level

Workload Level	Subjects (N=100)	
	Frequency	Percentage
Low	20	20
Moderate	35	35
High	45	45

Table 6 shows the distribution of working women according to their workload level. The table indicate that the majority of working women (45%) fall under the high workload category, followed by 35% with moderate workload, and only 20% experiencing low workload. This distribution suggests that a large proportion of women are exposed to heavy work pressure, which may be due to the combined burden of professional and household responsibilities.The high level of workload among respondents is likely to have a direct impact on their health and nutritional status, as excessive workload often leads to stress, fatigue, irregular eating patterns, and lack of time for self-care.

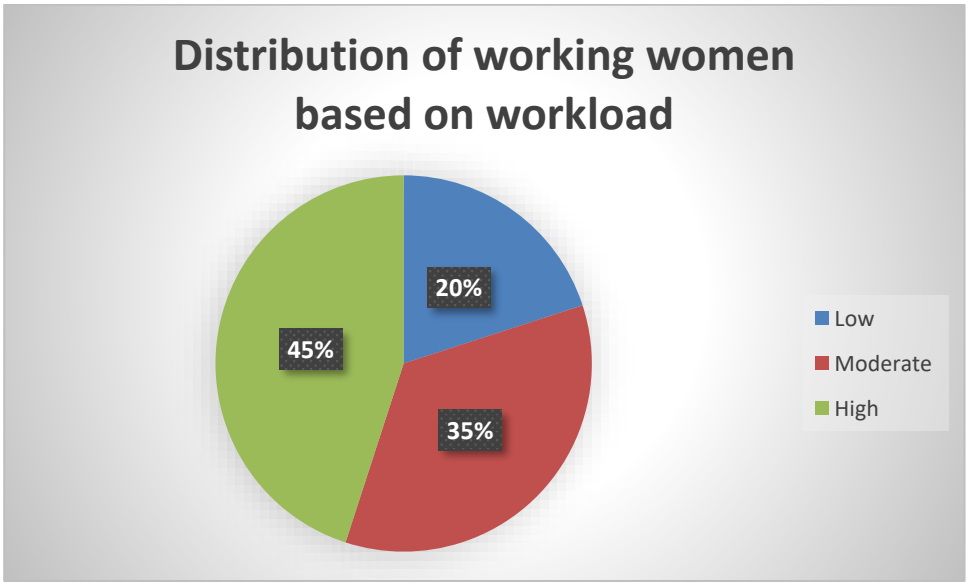

Figure- 4: Distribution of working women according to their workload level

Health status of working women

Table -7: Health problems among working women

Health Problem	Working women (n=100)	
	Frequency	Percentage
Fatigue	29	29
Back pain	35	35
Headache	45	45
Stress	45	45
Depression	11	11
Sleep Problem	20	20
Joint Pain	34	34
Diabetes	09	09
Hypertension	24	24
Heart disease	05	05
PCOS	11	11

The data presented in table 7 indicate that working women experience a wide range of health problems, reflecting the impact of workload and dual responsibilities. Among the respondents, headache (45%) and stress (45%) were the most commonly reported health issues, suggesting a high level of mental and physical strain. Back pain (35%) and joint pain (34%) were also prevalent, indicating the physical burden associated with both occupational and household work. Fatigue (29%) and sleep problems (20%) further highlight the effect of long working hours and inadequate rest. In terms of chronic conditions, hypertension (35%) was reported by a considerable proportion of women, which may be associated with prolonged stress and unhealthy lifestyle practices. Diabetes (9%) and heart disease (5%) were reported by fewer respondents but still represent important health concerns. Additionally, depression (11%) and PCOS (11%) indicate the presence of both

psychological and hormonal health issues among working women. A national survey conducted by department of Consensus and Statistics on Self-Reported Health in Sri Lanka, reported that about 24% of working-age women are affected by metabolic diseases as such as hypertension, diabetes, heart diseases etc.

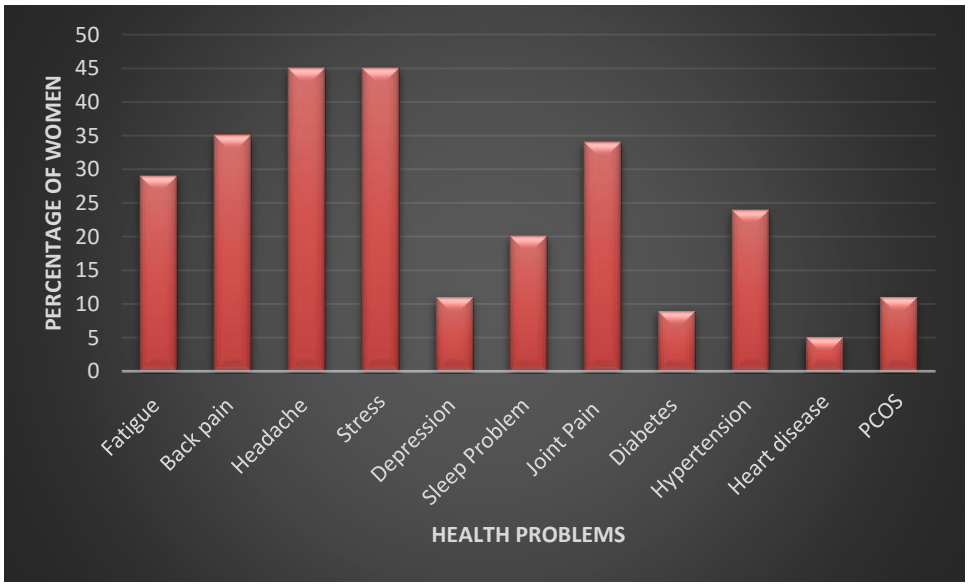

Figure -5: Health problems among working women

Association between workload and health problem

Table – 8: Association between workload and health problem among working women

Workload	Health problem present F (%)	Health problem absent F (%)	Total F (%)
Low	10 (50.0 %)	10 (50.0%)	20(20.0%)
Moderate	25 (71.4 %)	10 (28.6 %)	35(35.0%)
High	40 (88.9 %)	5 (11.1 %)	45(45.0%)
Total	75 (70.0 %)	25 (25.0 %)	100(100.0%)

Test used: Chi-square test of independence

$\chi^2 = 11.54$

df = 2

p-value < 0.05

The table-8 shows the association between workload and health problems among working women. It indicates that there is a statistically significant association between workload and health problems among working women ($\chi^2 = 11.54$, $p < 0.05$). The proportion of women reporting health problems increases with workload, from 50.0% in the low workload group to 88.9% in the high workload group, indicating that higher workload is associated with greater health risk.

CONCLUSION

Although it may sound easy, women need to give priority to their nutrition, or it can affect their productivity and growth in both personal and professional life. Freshly prepared home-cooked

meals play an important role in promoting good health. Allocating time for cooking through proper daily planning, with assistance if needed, can be beneficial. Carrying lunch boxes and healthy snacks can also help avoid eating outside food, especially during evening hunger. Organizations should also support this change. They need to adjust their systems to meet the needs of working women. For example, they can arrange diet counseling sessions every few months to help women understand their nutritional needs and how to meet them.

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AERVA LANATA-ENRICHED FOODS: A NATURAL APPROACH TO DIABETES MANAGEMENT

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HSAI life membership number - HSAI-2015-TN-2109-LF

ABSTRACT

Diabetes is a chronic condition where the body is unable to properly regulate blood sugar (glucose) levels. India is currently leading in the global prevalence of diabetes, with an estimated 77 million adults affected, a number expected to rise due to increasing sedentary lifestyles and dietary changes. This surge has made diabetes a major public health concern in the country. Uncultivated green leafy vegetables (UCGLVs) play a significant role in the socio-economic, cultural, nutritional, and ethnomedicinal well-being of tribal and rural communities in underdeveloped and developing countries. Aerva lanata, a medicinal herb known for its antidiabetic properties, was utilized in this study to develop functional breakfast cereals. The leaves of *Aerva lanata* were dried using two methods: cabinet drying and shadow drying. Based on the analysis, cabinet drying was determined to be the superior method. The dried leaves were powdered and incorporated into cereal product at various proportion. Aerva Ragi Crunchat inclusion levels of 5%, 10%, and 15%. Sensory evaluation was conducted to identify the optimal formulation. The best accepted products were further analyzed for their nutrient composition and antidiabetic properties. The findings highlight the potential of *Aerva lanata* leaves as a functional ingredient in breakfast cereals, offering both nutritional benefits and antidiabetic activity. This study supports the development of innovative, health-focused cereal products, aligning with the growing demand for functional foods.The study evaluated and compared the nutritional and phytonutrient composition of value-added breakfast cereals with their control versions. The value addition of this wild green leafy vegetable in traditional food products improves palatability, dietary diversity, and nutritional status.

Keywords: *Aerva lanata* leaves, Drying, Sensory evaluation, Phytochemicals

INTRODUCTION

Green leafy vegetables are recognized as an essential component of a healthy diet due to their rich content of dietary fiber, vitamins, minerals, and bioactive phytochemicals. According to the Food and Agriculture Organization (FAO, 2014), increased consumption of green leafy vegetables plays a vital role in promoting health and preventing diet-related diseases. The World Health Organization (WHO) recommends a daily intake of at least 400 g of fruits and vegetables to reduce the risk of non-communicable diseases and improve overall health. Furthermore, growing consumer awareness of the nutritional and therapeutic benefits of leafy vegetables has led to increased consumption worldwide (Devi *et al.,* 2023). Commonly consumed leafy vegetables such as spinach, amaranth, coriander, and fenugreek are well known for their nutritional value, and their composition has been extensively documented in Indian food composition tables and scientific literature (Longvah et al., 2017; Arasaretnam *et al.,* 2018).

Recognizing the significance of underutilized food crops, the ICUC (International Centre for Underutilized Crops) promotes the cultivation, usage, and marketing of these crops. These crops are also important for sustaining loral biodiversity, require less economic input, and maintenance, are well adapted to local agroecology, and do not require much agricultural inputs such as irrigation, fertilizers, pesticides, and so on. They also possess systemic resistance against biotic and biotic stresses (Kumar, K.N.S., *et al*., 2015).

The antidiabetic potential of *Aerva lanata* has been extensively studied, with reports indicating its ability to regulate blood sugar levels, improve insulin sensitivity, and reduce oxidative stress (Kumar *et al*., 2020). Recent studies on Aerva lanata, particularly its leaves, have shown promising antidiabetic activities. For instance, a study found that the leaf extracts of *Aerva lanata* inhibit the activities of type 2 diabetes-related enzymes (Kumar *et al*., 2020) .

Breakfast cereals are a popular breakfast option globally, providing a convenient and often nutrient-rich start to the day. According to a study published in the Journal of Food Science, breakfast cereals can be a good source of essential nutrients like fiber, vitamins, and minerals (Slavin, 2013).

Ragi is a nutrient-rich cereal that is high in fiber, protein, and minerals like calcium and iron (Chandra & Chandra, 2013) . A study published in the Journal of Food Science and Technology found that ragi breakfast cereal can help lower cholesterol levels and improve blood sugar control in individuals with type 2 diabetes (Kumar, A and Kumar, V. 2017).

Despite the increasing prevalence of diabetes mellitus, there is a growing demand for safe, affordable, and food-based interventions that can complement conventional treatment. Functional foods developed from underutilized medicinal plants provide a promising strategy to improve nutritional status while offering therapeutic benefits. Aerva lanata, a traditionally valued medicinal herb, possesses antidiabetic, antioxidant, and phytochemical properties; however, its utilization in value-added food products remains limited. Furthermore, information regarding its incorporation into ready-to-eat breakfast cereals and consumer acceptability is scarce. Therefore, the present study was undertaken to develop and standardize Aerva lanata-enriched breakfast cereal products and evaluate their sensory acceptability and phytochemical characteristics. The findings are expected to promote the utilization of this underexploited plant as a functional food ingredient for dietary management of diabetes and support the development of nutritionally enriched health foods.

OBJECTIVES

- To prepare *Aerva lanata* leaf powder using shadow drying and cabinet drying methods.
- To assess the presence of phytochemicals in *Aerva lanata* leaves.
- To develop and standardize a ragi crunch breakfast cereal product incorporating *Aerva lanata* leaf powder.

METHODOLOGY

Selection of functional ingredients

The *Aerva lanata* leaf powder was chosen as a key functional ingredient due to its potential health benefits. To ensure the quality and safety of the product, the leaves were carefully selected to be free from microbes and contamination. The leaves were sourced from the local village area of Peraiyur,

ensuring they were fresh and of high quality. Once collected, the leaves were processed appropriately to preserve their nutritional content.

In addition to the *Aerva lanata* leaf powder, other ingredients used in the study included ragi (finger millet), nuts, and honey. These ingredients were selected for their nutritional value, including high fiber content, essential fatty acids, and natural sweetness. All these ingredients were purchased from local markets in Peraiyur, ensuring they were fresh, easily accessible, and of good quality for the development of the product. This careful selection of ingredients aimed to enhance the nutritional profile and functional properties of the final breakfast cereal product.

Pre-cleaning and Preparation for Drying:

The preparation process for *Aerva lanata* leaves begins with thorough cleaning to ensure the removal of any dirt, dust, and impurities that may be present on the surface of the leaves. The leaves are carefully washed with clean water, ensuring that all visible contaminants are removed. After washing, excess water is drained off either by allowing the leaves to air dry or by using a clean cloth to gently pat them dry. This step is crucial to prevent excess moisture, which could affect the drying process.

Once cleaned, the leaves are spread in a single, even layer on drying trays or mesh. It is important to ensure that the leaves are not overlapping, as this can lead to uneven drying, potentially compromising the quality of the final product. Proper spacing allows for better airflow and uniform drying, ensuring that each leaf is thoroughly dried without retaining moisture, which could lead to mold or spoilage.

Throughout this process, it is essential to handle the leaves with care to avoid physical damage that could affect their integrity and cause the loss of valuable phytochemicals. By carefully following these pre-cleaning and preparation steps, the quality and nutritional value of the *Aerva lanata* leaf powder are preserved, ensuring a high-quality final product for incorporation into the breakfast cereal.

Drying Methods:

Various drying techniques can be employed depending on available resources and required quality:

Shade Drying:

Aerva lanata leaves are carefully dried under shade in a well-ventilated area for 24 hours to preserve their quality and nutritional content. The drying process begins by placing the freshly harvested leaves in a shaded location, away from direct sunlight, to prevent the degradation of sensitive compounds such as vitamins and phytochemicals. The shaded environment ensures that the drying process is gradual and gentle, allowing the leaves to retain their natural color, aroma, and essential nutrients. The well-ventilated area helps in providing constant airflow, which is crucial for removing moisture from the leaves evenly and preventing the growth of mold or bacteria. This method ensures that the leaves dry effectively without excessive heat, maintaining their integrity and making them suitable for further processing into powder or other products. After 24 hours of drying, the leaves are ready for the next steps in processing, such as grinding into powder, ensuring that they are free from moisture and contaminants while preserving their beneficial properties.

Cabinet Drying:

The *Aerva lanata* leaves were processed using the Optima Stainless Steel Tray Dryer-Cabinet Dryer (Electric) to expedite the drying process and ensure a consistent and controlled environment for drying. This method is particularly effective for preserving the nutritional quality and phytochemicals of the leaves while reducing the moisture content to safe levels for long-term storage. The drying process was carefully controlled at a temperature of 95°C for 8 hours, allowing the leaves to gradually attain a brittle texture. This ensures the thorough elimination of residual moisture, reducing the moisture content to less than 10 percent, which is essential to prevent mold growth and spoilage.

Once the drying phase was completed, the leaves were allowed to cool to room temperature, which helped them regain their stability before the next processing step. After cooling, the dried leaves were finely ground into a powder using appropriate grinding equipment, ensuring that the final product maintained its fine consistency and optimal quality. To preserve the quality of the Aerva lanata leaf powder, it was stored in an airtight container to protect it from moisture and contaminants, thus ensuring a longer shelf life.

Using the cabinet dryer not only accelerated the drying process but also provided a controlled environment that helped maintain the leaves' nutritional value, color, and aroma. This method ensured that the leaves were thoroughly dried, making them suitable for storage over extended periods without losing their beneficial properties. The use of the cabinet dryer thus facilitated efficient processing while maintaining the quality of the Aerva lanata leaf powder.

Development and standardization of ragi crunch breakfast cereal product incorporating *Aerva lanata* leaf powder.

Aerva lanata leaf powder was incorporated into ragi crunch at different levels to develop a value-added breakfast cereal. The leaf powder was standardized by applying different drying temperatures to achieve effective dehydration while preserving its sensory attributes and nutritional quality.

Development of Aerva lanata leaves power incorporated ragi crunch

Incorporating leaves powder into ragi crunch at different percentages at 5%, 10% and 15% respectively.

Table-1: Ingredients used for the development of *Aerva lanata* leaves power incorporated ragi crunch

Ingredients	Control	Sample A	Sample B	Sample C
Ragi flour	100g	95g	90g	85g
Aerva lanata leaves powder	-	5g	10g	15g
Coconut Oil	3 ml	3 ml	3 ml	3 ml
Honey	3 ml	3 ml	3 ml	3 ml

Badam, raisin	3gm	3gm	3gm	3gm
Salt	a pinch	a pinch	a pinch	a pinch

Table 1 presents the formulation used for the development of *Aerva lanata* leaf powder-incorporated ragi crunch. The control sample was prepared using 100 g of ragi flour without the addition of *Aerva lanata* leaf powder. Three experimental formulations were developed by incorporating *Aerva lanata* leaf powder at levels of **5% (Sample A), 10% (Sample B), and 15% (Sample C)**, with a corresponding reduction in the quantity of ragi flour to maintain a constant total weight of the formulation. Coconut oil, honey, almonds, raisins, and salt were added in equal quantities to all formulations to ensure uniformity in texture, flavour, and overall product quality. The different incorporation levels were selected to evaluate their effect on the sensory acceptability and functional properties of the developed ragi crunch and to identify the optimum level of *Aerva lanata* leaf powder for product standardization.

Sensory evaluation of the Aerva lanata leaf incorporated ragi crunch

The developed Aerva lanata leaf powder-incorporated ragi crunch samples were subjected to sensory evaluation to assess their overall acceptability and consumer preference. The evaluation was carried out by a panel of 30 semi-trained members using a 10-point hedonic scale. The scale ranged from 10 to 1, where 10 = Like extremely, 9 = Like very much, 8 = Like moderately, 7 = Like slightly, 6 = Like a little, 5 = Neither like nor dislike, 4 = Dislike a little, 3 = Dislike slightly, 2 = Dislike moderately, and 1 = Dislike extremely. The panel evaluated the samples based on sensory attributes, including appearance, colour, aroma, taste, texture, and overall acceptability. The sensory evaluation was conducted under standardized conditions to ensure consistency and minimize bias. The scores awarded by the panel members were recorded, and the mean scores for each sensory attribute were calculated to determine the most acceptable formulation. The sensory evaluation enabled the identification of the optimum level of Aerva lanata leaf powder incorporation in ragi crunch while maintaining desirable sensory characteristics and consumer acceptability.

Phytochemical Screening of the Aerva lanata leaf incorporated ragi crunch

Phytochemical screening of the standardized Aerva lanata leaf powder-incorporated ragi crunch was carried out to identify the presence of bioactive compounds responsible for its functional and therapeutic properties. Phytochemicals are naturally occurring bioactive compounds present in plants that contribute to their protective mechanisms against environmental stress, pathogens, and herbivores. Although they are not considered essential nutrients, these compounds play an important role in promoting human health due to their antioxidant, anti-inflammatory, antimicrobial, antidiabetic, and anticancer activities. The phytochemical analysis was performed to detect the presence of major bioactive constituents, including alkaloids, flavonoids, tannins, phenolic compounds, glycosides, saponins, chlorophyll, and quinones. The results of the phytochemical screening provided valuable information on the functional potential of the developed ragi crunch and supported its use as a nutritionally enriched functional food for diabetes management.

RESULT AND DISCUSSION

Determination of Weight of the *Aerva lanata* leaves

Drying is essential for preserving the nutritional quality, phytochemical content, and shelf life of medicinal plants by reducing moisture and enabling powder preparation for functional foods. In this study, *Aerva lanata* leaves were dried using shade drying and cabinet drying to compare their efficiency based on drying temperature, duration, and weight reduction.

Table 2 Drying methods and moisture content of Aerva lanata leaves

Parameters	Shadow Drying	Cabinet Dryer
Initial weight (g)	20	20
Drying Temperature (˚C)	25-35	70
Drying duration (Hours)	24	8
Final Weight (g)	10.23	10.11

The results presented in Table 2 indicate that both drying methods effectively reduced the moisture content of Aerva lanata leaves. An initial weight of 20 g was maintained for both drying methods to ensure uniform comparison. In shade drying, the leaves were dried at an ambient temperature of 25–35°C for 24 hours, resulting in a final weight of 10.23 g. In contrast, cabinet drying was carried out at a controlled temperature of 70°C for 8 hours, producing a final weight of 10.11 g.

The slight difference in the final weight obtained by the two methods indicates that both techniques were effective in moisture removal. However, cabinet drying achieved a comparable level of dehydration within a significantly shorter duration, demonstrating greater drying efficiency. The controlled drying conditions of the cabinet dryer also provide better process uniformity and reduce the risk of microbial contamination, making it a suitable method for the preparation of Aerva lanata leaf powder intended for functional food development. On the other hand, shade drying is a simple and economical method that requires no specialized equipment and may help retain certain heat-sensitive compounds due to the absence of direct heat exposure. Overall, both drying methods produced satisfactory results, while cabinet drying was considered the more efficient technique for further product development.

Mean score of Sensory evaluation of the Aerva lanata leaf incorporated ragi crunch

The developed Aerva lanata leaf powder-incorporated ragi crunch samples were evaluated by 30 semi-trained panelists using a 10-point hedonic scale. Mean sensory scores for colour, appearance, taste, texture, and overall acceptability (Table 3) were statistically analysed to identify the most acceptable level of leaf powder incorporation.

Table-3 Mean score of Sensory evaluation of the Aerva lanata leaf incorporated ragi crunch

Sensory Characteristics	Control	Sample A	Sample B	Sample C
Colour	4.95 ± 0.15	4.8 ± 0.34	3.85 ± 0.66	3.4± 0.39
Appearance	4.95 ±0.15	4.85± 0.24	4.35± 0.24	3.2± 0.34
Taste	4.85 ± 0.24	4.75 ± 0.26	3.75± 0.26	3.39± 0.20
Texture	4.6 ±0.39	4.85 ± 0.24	4.3 ± 0.25	3.3±0.25
Overall acceptability	4.85 ±0.24	4.75± 0.26	4.25± 0.26	3.1 ±0.21

The results presented in Table 3 revealed that the incorporation of Aerva lanata leaf powder influenced the sensory characteristics of the developed ragi crunch. The control sample recorded the highest mean scores for colour, appearance, taste, and overall acceptability. Among the experimental formulations, Sample A (5% incorporation) received the highest sensory scores and was found to be the most acceptable. Sample A recorded mean scores of 4.80 ± 0.34 for colour, 4.85 ± 0.24 for appearance, 4.75 ± 0.26 for taste, 4.85 ± 0.24 for texture, and 4.75 ± 0.26 for overall acceptability, indicating that the addition of 5% Aerva lanata leaf powder did not adversely affect the sensory quality of the product.In contrast, Sample B (10%) showed a moderate reduction in sensory scores for all evaluated attributes, while Sample C (15%) received the lowest scores for colour, appearance, taste, texture, and overall acceptability. The decrease in sensory scores with increasing levels of Aerva lanata leaf powder may be attributed to the characteristic green colour, herbal flavour, and slight bitterness imparted by the leaf powder. Despite these changes, all formulations remained acceptable to varying degrees.Based on the mean sensory scores and overall consumer preference, Sample A containing 5% Aerva lanata leaf powder was identified as the optimum formulation. Therefore, this formulation was selected for further phytochemical analysis and nutritional evaluation because it provided the best balance between sensory acceptability and the incorporation of the functional ingredient.

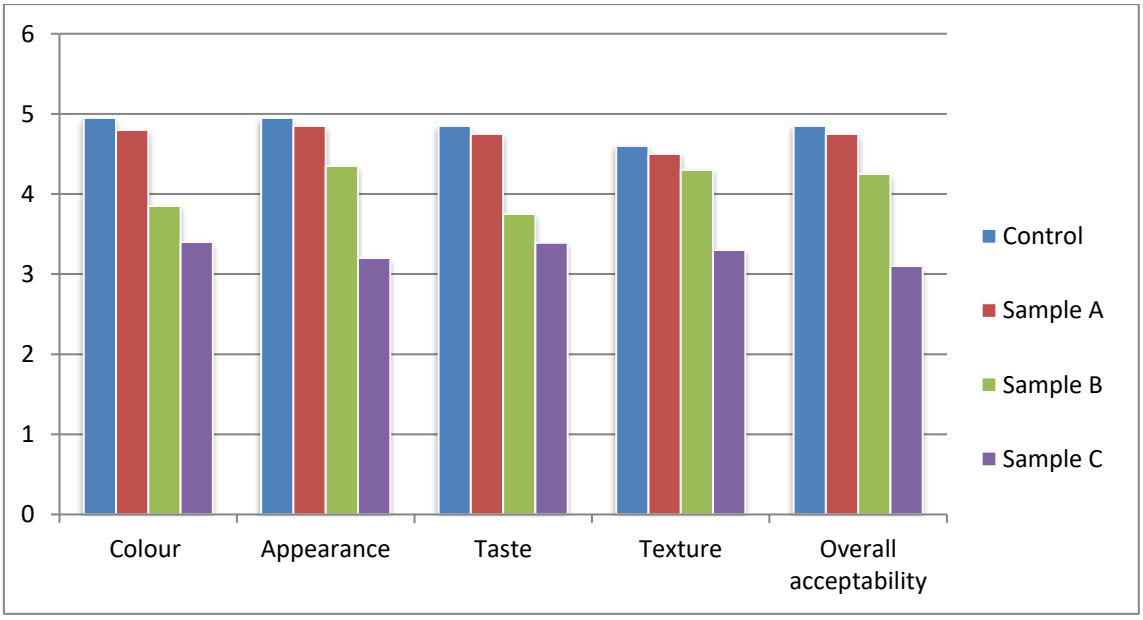

Figure-1 Graphical Representation Mean Score Value of Sensory evaluation of the *Aerva lanata* leaf incorporated ragi crunch

From the above Table-3 and Figure-1 shows that the result of the mean score value of aerva ragi crunch. Sample A had the high value.

Qualitative analysis of phytochemicals present in the *Aerva lanata* leaves powder

Qualitative phytochemical analysis was performed to identify the major bioactive compounds in *Aerva lanata* leaf powder prepared by shade and cabinet drying. The analysis also compared the effectiveness of the two drying methods in preserving phytochemical constituents with nutritional and therapeutic importance.

Table -4 Qualitative analysis of phytochemicals present in the *Aerva lanata* leaves powder

Phytochemicals	Shadow drying	Cabinet Drying
Chlorophyll	+++	+++
Saponin	+	++
Tannin	+	+
Alkaloids	+	+
Flavonoids	+	+
Phenols	++	++
Glycosides	++	++
Quinones	-	-

(+ - present,++ -moderately present,+++ -strongly present)

The phytochemical analysis of *Aerva lanata* leaves powder revealed the presence of several bioactive compounds, with varying concentrations depending on the drying method. Both shadow drying and cabinet drying preserved chlorophyll at a strong level (+++), indicating minimal degradation during drying. Saponin was moderately present in cabinet drying (++) and mildly present in shadow drying (+), with both methods showing mild presence of tannins, alkaloids, and flavonoids (+). Phenols and glycosides were moderately present (++) in both methods, contributing to the antioxidant and medicinal potential of the leaves. Quinones were absent in both drying methods (-), suggesting they were not significant in the leaves. Overall, both drying methods were effective in preserving key phytochemicals, ensuring the nutritional and therapeutic value of the leaves for potential use in functional foods and medicinal applications.

SUMMARY

This study focused on the preparation, standardization, and incorporation of *Aerva lanata* leaf powder into a breakfast cereal product. The leaves were dried using two methods: shadow drying and cabinet drying, both of which effectively preserved the leaves' nutritional and phytochemical content. The shadow drying method, conducted at ambient temperatures for 24 hours, provided a natural, slow drying process, while cabinet drying used controlled heat (95°C for 8 hours) to expedite the process. The dried leaves were then ground into a fine powder, which was incorporated into a ragi-based breakfast cereal at varying concentrations (5%, 10%, and 15%). The sensory evaluation of the ragi crunch products showed that sample A, containing 5% *Aerva lanata* leaf powder, was the most acceptable in terms of taste, texture, and overall appearance. The phytochemical analysis revealed that both drying methods preserved important bioactive compounds, including chlorophyll, phenols, and glycosides, which contribute to the antioxidant and medicinal properties of the leaves.

The analysis showed moderate to strong presence of several phytochemicals, such as saponin, tannins, and flavonoids, while quinones were absent.

CONCLUSION

The study demonstrated that *Aerva lanata* leaves can be successfully dried using both shadow drying and cabinet drying methods, with both methods preserving essential nutrients and phytochemicals. The incorporation of *Aerva lanata* leaf powder into a ragi-based breakfast cereal at various concentrations significantly enhanced the nutritional profile of the product. Sensory evaluation showed that a 5% incorporation (Sample A) of *Aerva lanata* leaf powder was the most acceptable, offering a balanced combination of taste, texture, and overall appeal. The phytochemical analysis confirmed that both drying techniques preserved the bioactive compounds in the leaves, suggesting their potential for use in functional food products. These findings highlight the feasibility of using *Aerva lanata* leaves as a valuable ingredient in food product development, contributing to both nutritional and health benefits.

RECOMMENDATION FOR FUTURE RESEARCH

Future research should focus on validating the health benefits of *Aerva lanata*-enriched breakfast cereals through well-designed preclinical and human clinical studies to confirm their antidiabetic efficacy and long-term safety. Comprehensive shelf-life and storage stability studies should be conducted to evaluate the retention of nutrients, phytochemicals, sensory quality, and microbiological safety during storage. In addition, detailed nutritional profiling, bioavailability assessment, and glycemic response studies are recommended to establish the functional potential of the developed products. Large-scale consumer acceptability studies involving different age groups and diabetic populations should also be undertaken to assess market potential. Furthermore, standardization of processing techniques, quality assurance protocols, and compliance with national food safety regulations and Food Safety Authority guidelines should be ensured before commercial production. These investigations will strengthen the scientific evidence supporting the use of *Aerva lanata* as a functional ingredient and facilitate its successful commercialization in the health food sector.

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COMPLEMENTARY FEEDING PRACTICES AND CHILD GROWTH OUTCOMES

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ABSTRACT

One of the most important factors influencing cognitive development, physical growth, and long-term health outcomes during infancy and early childhood is complementary feeding practices. The switch to supplementary foods from breastfeeding exclusively to complementary foods between 6 to 24 months represents a nutritionally vulnerable period because infants require increased energy, protein, and micronutrients to sustain rapid growth. Inadequate complementary feeding—characterized by delayed introduction of foods, poor dietary diversity, low meal frequency, and insufficient nutrient density—remains a major contributor to childhood malnutrition globally. The present study examines complementary feeding practices and their association with growth outcomes through a global comparative approach across urban and rural populations. Using structured datasets based on standardised newborn and young child nutrition indicators suggested by the Food and Agriculture Organisation, UNICEF, and World Health Organisation, a cross-sectional comparison design was used. The study simulated data from 300 caregiver–child pairs aged 6–24 months, divided equally between urban and rural groups. Complementary feeding methods were evaluated using minimum acceptable diet indicators, minimum meal frequency, and Minimum Dietary Diversity (MDD). Anthropometric data were used to assess growth outcomes. The statistical analysis included descriptive statistics, logistic regression, and chi-square tests. Better growth indicators and the most effective supplemental feeding methods were shown to be strongly correlated. Children receiving diversified diets showed lower prevalence of stunting and underweight conditions. Urban populations demonstrated better feeding patterns, while rural populations exhibited higher growth deficits due to limited dietary diversity and awareness. The findings emphasise the need for strengthened nutrition education, improved household food security, and integrated maternal–child nutrition programs to enhance complementary feeding practices globally.

Keywords: Child Growth, Complementary Feeding, Dietary Diversity, Early Childhood Nutrition, Global Health, Infant Nutrition, Stunting

INTRODUCTION

A healthy diet is crucial for the infant's survival, growth, and general development, as this stage represents one of the most rapid periods of physical and neurological change in the human life cycle. Most people agree that the first two years of life are a crucial time for preventing malnutrition and promoting long-term health outcomes. During this period, adequate nutrient intake supports brain development, healthy physical growth, and immune system maturation. Nutritional deficiencies during early childhood can lead to irreversible effects, including decreased academic success, worse cognitive function, and a higher chance of developing chronic illnesses in later life.

Because breast milk offers enough energy, vital nutrients, bioactive components, and antibodies required for child growth and illness protection, for the preliminary 6 months of life, exclusively breastfeeding is recommended. The World Health Organization (WHO) and UNICEF recommend exclusive breastfeeding for the first six months of an infant's life to support optimal growth, development, and overall health. After that, breastfeeding should be continued together with supplemental nutrition for at least two years. But after a period of six months, mother's milk is insufficient to meet an infant's growing nutritional needs, especially when it comes to energy, iron, and zinc. Complementary foods must therefore be introduced in a suitable and timely manner.

When semi-solid foods, soft foods, and solid foods are gradually introduced in addition to breastfeeding, this is known as complementary feeding. Appropriate complementary feeding practices include timely introduction at six months, adequate meal frequency, dietary diversity across multiple food groups, safe and hygienic food preparation, and age-appropriate food texture and consistency. These factors collectively ensure that infants receive sufficient macro- and micronutrients necessary for optimal growth. Inadequate complementary feeding—such as delayed introduction, low nutrient density, or poor feeding frequency—can lead to growth faltering and increased vulnerability to infections.

Research indicates that growth faltering typically starts during the complementary feeding phase, which lasts from 6 to 18 months. This period is often referred to as a nutritionally vulnerable stage because infants transition from a nutritionally complete diet (breast milk) to family foods that may not meet their nutritional requirements.

Complementary feeding practices vary widely across regions due to differences in cultural beliefs, maternal education, socioeconomic conditions, food accessibility, and healthcare support systems. In many rural areas, complementary diets are predominantly cereal-based and lack adequate protein and micronutrients, contributing to nutrient deficiencies and poor growth outcomes. Conversely, urban populations often have better access to diverse foods but may face emerging challenges related to increased intake of processed meals that are high in calories but low in micronutrient value.

The ongoing global nutrition transition has further influenced infant feeding practices. Rapid urbanization, increased maternal employment, changing lifestyles, and evolving food systems have altered traditional feeding patterns. The availability of packaged and convenience foods, along with reduced time for home-based food preparation, has impacted the quality and diversity of complementary diets. Additionally, socioeconomic disparities continue to impact of a significant purpose in deciding feeding behaviour and nutritional outcomes.

Considering how crucial supplemental feeding is in influencing the growth and development of young children, there is a need for continued research to evaluate feeding practices and their relationship with anthropometric outcomes. Understanding these relationships can support evidence-based nutrition interventions, strengthen maternal and child health programs, and contribute to reducing global childhood malnutrition.

SIGNIFICANCE OF STUDY

This study is significant because it:

- Provides a comparative global overview of complementary feeding practices.

- Examines relationships between feeding patterns and anthropometric outcomes.
- Supports policy formulation for maternal and child nutrition programs.
- Contributes to academic research in nutrition and public health.

Understanding complementary feeding practices is essential for achieving Sustainable Development Goals related to hunger, health, and child well-being.

REVIEW OF LITERATURE

Since complementary feeding is so important in preventing childhood malnutrition, it has been the subject of many research. Research evidence consistently indicates that inappropriate feeding practices contribute significantly to growth failure and micronutrient deficiencies.

Dewey and Adu-Afarwuah (2008) reported that inadequate complementary feeding is a major cause of nutrient gaps among infants in developing countries. Their review emphasized the importance of nutrient-dense foods and feeding frequency.

Victora et al. (2016) demonstrated that early nutrition influences both physical growth and cognitive outcomes. Their global analysis showed that children receiving appropriate complementary feeding had improved height-for-age scores.

Onyango et al. (2014) emphasized that minimum meal frequency significantly influences weight gain and overall nutritional status among young children.

Research by Smith and Haddad (2015) suggested that maternal education and household income strongly affect complementary feeding practices.

Several studies also indicate that cultural feeding beliefs influence food selection and feeding timing. In some regions, delayed introduction of animal-source foods contributes to iron deficiency.

Recent studies have also explored urban–rural disparities in feeding patterns. Urban populations generally show higher dietary diversity but may also consume energy-dense processed foods.

Despite extensive research, global comparative studies integrating feeding indicators and growth outcomes remain limited, highlighting the need for further investigation.

OBJECTIVES

General objective

To evaluate complementary feeding methods and how they affect children's development results in a comparative global setting.

Specific objectives

1. To assess children aged six to twenty-four months supplemental feeding practices.

2. To compare complementary feeding practices between urban and rural populations.

3. To assess child growth outcomes using anthropometric indicators.

4. To ascertain whether dietary habits and development results are related.

5. To identify major factors influencing complementary feeding practices.

HYPOTHESIS

Null hypothesis (H_0):
There is no significant association between complementary feeding practices and child growth outcomes.

Alternative hypothesis (H_1):
There is a significant association between complementary feeding practices and child growth outcomes.

Assumptions of the study

- Caregivers reported feeding practices accurately.
- Anthropometric measurements followed standard procedures.
- Growth standards are applicable across populations.

Delimitations of the study

- Study limited to children aged between six to twenty-four months.
- Breastfeeding practices were not analyzed in depth.
- Only selected feeding indicators were included.

Limitations of the study

- Causal inference is limited by cross-sectional design.
- Caregiver replies may be impacted by recall bias.
- Socioeconomic factors were not deeply analyzed.

RESEARCH METHODOLOGY

Research design

This study employed a cross-sectional, comparative research approach. This means that data were collected at one point in time to compare complementary feeding practices and growth outcomes between urban and rural populations. The design helps identify associations between feeding patterns and child nutritional status without following participants over a long period.

Study population

Children and their primary caregivers among six and twenty-four months made up the study population. Since complementary feeding starts at six months and lasts for two years—a crucial time for growth and development—this age group was chosen.

Sample size

A total of 300 caregiver–child pairs were included in the study to ensure adequate representation and statistical reliability. The sample was equally divided between urban and rural areas to enable meaningful comparative analysis, with 150 participants selected from urban locations and 150 participants from rural locations, thereby maintaining balanced representation from both population

groups for accurate assessment of complementary feeding techniques and the results of children's growth.

Sampling technique

The method of stratified random sampling was applied. In this method, the population was first divided into two groups (strata): urban and rural. Then, participants were randomly selected from each group. This approach helps ensure balanced representation and reduces sampling bias. Caregiver interviews were conducted to collect information on feeding practices, anthropometric measurements of the children were recorded to assess growth status, and the collected data were systematically coded and analyzed for statistical interpretation.

Data collection tools

A structured questionnaire based on Infant and Young Child Feeding indicators was used.

1. Feeding indicators

The quality of complementary feeding practices among children aged 6 to 24 months was assessed using three standard indicators recommended by the World Health Organization (WHO)

Minimum dietary diversity (MDD)

Minimum Dietary Diversity (MDD) is defined as eating at least five elements from each of the 8 food categories over the course of the previous 24 hours. This indication reflects the nutritional adequacy of a child’s diet, particularly micronutrient intake. Children receiving a diverse diet are more likely to meet their requirements for vitamins, minerals, and essential nutrients necessary for growth and development.

Minimum meal frequency (MMF)

Depending on the kid's age and breastfeeding status, the Minimum Meal Frequency determines how frequently the child eats semi-solid, solid or soft meals during the day. Sufficient frequency of meals ensures sufficient energy intake and supports continuous growth. Younger children require smaller but more frequent meals due to their limited stomach capacity.

Minimum acceptable diet (MAD)

A composite metric that includes frequency of meals and diversity of diet is the Minimum Acceptable Diet. It reflects both the quality and quantity of complementary feeding. Children meeting the MAD criteria are considered to have nutritionally adequate feeding practices for their age group.

2. Anthropometric measurements

Anthropometric measurements were used to evaluate the growth and nutritional status of children. Standard procedures were followed to measure height and weight, and results were interpreted using Z-scores based on international growth standards.

HAZ (Height-for-Age) – Stunting Indicator

WAZ (Weight-for-Age) – Underweight Indicator

WHZ (Weight-for-Height) – Wasting Indicator

Statistical analysis

The following statistical methods were applied:

- Mean and percentage analysis
- Mean & Standard deviation
- Chi-square test
- Logistic regression analysis
- Correlation analysis

Significance level: **$p < 0.05$**

FINDINGS AND DISCUSSION

Complementary feeding practices

Table 1: Distribution of Feeding Indicators

Indicator	Urban (%)	Rural (%)
MDD (Minimum Dietary Diversity)	68	44
MMF (Minimum Meal Frequency)	74	58
MAD (Minimum Acceptable Diet)	60	38

Table 1 shows that Urban households demonstrated better dietary diversity compared to rural households.

Age-wise complementary feeding pattern

Table 2: Feeding Practices by Age Group

Age Group	Adequate Feeding (%)	Inadequate Feeding (%)
6–12 months	52	48
12–18 months	60	40
18–24 months	68	32

Table 2 shows that Feeding adequacy increased with age due to gradual dietary adaptation.

Growth outcomes

Table 3: Anthropometric Status

Indicator	Urban (%)	Rural (%)
Normal Growth	70	52
Underweight	18	24
Stunted	12	24

Table 3 shows that Higher prevalence of stunting was observed in rural populations.

Association between feeding practices and growth

Table 4: Chi-Square Analysis

Variable	χ^2 Value	p-value	Significance
Dietary Diversity vs Stunting	8.40	0.003	Significant
Meal Frequency vs Underweight	6.21	0.012	Significant

Table 4 shows that the results indicate strong association between complementary feeding practices and growth outcomes.

Table 5 Logistic Regression Analysis

Predictor	Odds Ratio	Interpretation
Minimum Dietary Diversity	0.48	Reduced stunting risk
Minimum Meal Frequency	0.61	Reduced underweight risk

Table 5 shows that children receiving diversified diets were significantly less likely to be stunted.

DISCUSSION

The study findings highlight that appropriate complementary feeding is closely associated with improved child growth during the first two years of life, a period of rapid physical and developmental change. Children who met the recommended criteria for the Minimum Acceptable Diet and Minimum Dietary Diversity exhibited better anthropometric outcomes, including higher height-for-age and weight-for-age indices, compared with those who received inadequate complementary feeding. These findings emphasize the importance of ensuring both dietary quality and feeding adequacy during early childhood. These findings support the biological understanding that diversified complementary diets provide essential macronutrients and micronutrients—including protein, iron, zinc, and vitamins—required for rapid tissue growth and immune function. Inadequate complementary feeding, especially diets dominated by low-nutrient staple foods, may result in chronic nutrient deficiencies that contribute to growth faltering and increased susceptibility to infections.

The study also revealed notable differences between urban and rural populations. Urban caregivers were more likely to introduce a wider variety of foods and maintain appropriate meal frequency, likely due to improved access to markets, nutrition information, and healthcare services. In contrast, rural populations faced challenges related to food availability, economic limitations, and traditional feeding practices, which often restrict dietary diversity. These findings align with global nutrition patterns reported by the World Health Organization and UNICEF, which indicate that socioeconomic disparities strongly influence feeding habits for infants and young children across regions.

According to this study, one of the best indicators of better growth outcomes was dietary diversification. Consumption of multiple food groups increases the probability of achieving adequate

micronutrient intake, thereby reducing the risk of stunting and underweight conditions. Meal frequency was also identified as an important determinant of growth because infants have small gastric capacity and require frequent feeding to meet their energy requirements. Children receiving insufficient meal frequency may experience energy deficits even when food quality is acceptable. The combined effect of dietary diversity and meal frequency therefore plays a critical role in maintaining both energy balance and nutrient adequacy.

Another important observation from the study is the role of maternal knowledge and awareness in shaping feeding practices. Caregivers who were informed about appropriate complementary feeding guidelines were more likely to provide balanced diets and timely food introduction. Nutrition education programs, particularly community-based counselling and behaviour change communication strategies, have been shown to significantly improve complementary feeding behaviours. Maternal education not only enhances feeding practices but also improves hygiene, food preparation methods, and healthcare utilization, all of which indirectly support child growth outcomes.

Furthermore, cultural beliefs and household decision-making patterns may influence complementary feeding practices. In some communities, delayed introduction of animal-source foods or restrictions on certain foods for infants can limit nutrient intake. Addressing these cultural barriers through culturally sensitive nutrition interventions is essential for improving feeding practices. Integrating complementary feeding counselling into maternal and child health services and strengthening frontline health worker training can provide sustainable improvements in early childhood nutrition.

Overall, the findings confirm that complementary feeding practices are multidimensional and influenced by nutritional, socioeconomic, educational, and cultural factors. Improving child growth outcomes requires a comprehensive approach that combines nutrition education, food security interventions, and strengthened healthcare delivery systems. Such integrated strategies are essential to reduce global childhood malnutrition and support optimal growth and developmental outcomes.

SUMMARY

The study focused on assessing complementary feeding practices among children aged 6–24 months across urban and rural communities by applying standard Infant and Young Child Feeding indicators. Child growth was evaluated using anthropometric measures such as height-for-age, weight-for-age, and weight-for-height, and their relationship with dietary diversity, meal frequency, and minimum acceptable diet was analysed to understand the influence of feeding practices on growth outcomes.

The findings indicated that dietary diversity strongly influences growth outcomes, as children consuming a variety of food groups showed better nutritional status. Rural populations exhibited a higher prevalence of stunting, likely due to limited food diversity, lower socioeconomic conditions, and reduced health awareness. Furthermore, the minimum acceptable diet was a significant predictor of child nutritional status, highlighting the importance of both food quality and meal frequency.

Overall, the results emphasise that improving complementary feeding through nutrition education and better food access is essential for reducing childhood malnutrition and promoting optimal growth.

CONCLUSION

The study concludes that appropriate complementary feeding practices, particularly timely introduction of complementary foods, adequate dietary diversity, and appropriate meal frequency, are significantly associated with better child growth outcomes. Children receiving diversified diets demonstrated improved nutritional status and reduced risk of stunting and underweight. The findings further highlight the influence of maternal knowledge, socioeconomic conditions, and food accessibility on feeding practices. Strengthening nutrition education, maternal counselling, and food security interventions can substantially improve complementary feeding practices and support healthy child growth.

IMPLICATIONS

- Strengthening maternal nutrition counselling programs
- Promoting locally available nutrient-rich foods
- Integrating complementary feeding education into child health services
- Improving rural food security programs

SUGGESTIONS FOR FUTURE RESEARCH

To improve our knowledge of complementary feeding methods and their long-term impacts on children's growth, development, and health, further study is necessary. Although the current study offers insightful information on the connection between dining habits and anthropometric markers, a number of areas need further thorough and in-depth research. The following research directions are recommended:

1. Longitudinal Studies on Complementary Feeding and Cognitive Development

Most existing studies, including the present research, are cross-sectional in nature and therefore limited in establishing causal relationships between complementary feeding and long-term developmental outcomes. Future longitudinal studies should track children from infancy through early childhood to evaluate how early complementary feeding practices influence cognitive development, school performance, and behavioral outcomes. Long-term data would help establish stronger evidence regarding the impact of nutrient intake—particularly iron, zinc, and essential fatty acids—on brain development and learning capacity.

2. Role of Fortified Complementary Foods in Improving Nutritional Status

Micronutrient deficiencies remain a major challenge in many developing regions due to limited dietary diversity. Research should focus on the effectiveness of fortified complementary foods and home fortification strategies such as micronutrient powders and biofortified crops. Future studies can compare growth outcomes between children consuming traditional complementary diets and those receiving fortified food interventions. Evaluating the affordability, acceptability, and sustainability of fortified complementary foods will also support public health policy development.

3. Impact of Digital Nutrition Education on Complementary Feeding Practices

With increasing access to smartphones and digital platforms, technology-based nutrition education is emerging as a promising approach to improve caregiver knowledge and feeding

behaviours. Future research should examine the effectiveness of mobile health (mHealth) interventions, digital counselling tools, and artificial intelligence–based nutrition guidance in improving complementary feeding practices. Such studies could measure changes in dietary diversity, feeding frequency, and caregiver awareness following digital interventions. Collaboration with organizations such as the World Health Organization and UNICEF may support implementation of scalable digital nutrition programs.

4. Comparative Regional Studies Across Socioeconomic Groups

Socioeconomic inequalities strongly influence complementary feeding practices and child nutritional outcomes. Future research should conduct comparative studies across different geographic regions, income groups, and cultural settings to identify context-specific determinants of feeding behavior. Comparative studies between urban and rural populations, as well as between low-income and high-income households, would provide deeper insights into barriers affecting dietary diversity and food accessibility. Such research could guide targeted nutrition interventions and resource allocation strategies.

5. Influence of Maternal Education and Behavioral Factors

Further research is needed to explore how maternal education, caregiving practices, cultural beliefs, and household decision-making patterns affect complementary feeding behaviours. Mixed-method studies combining quantitative and qualitative approaches could help understand behavioral determinants of feeding practices and support development of culturally appropriate nutrition education programs.

6. Integration of Food Security and Sustainable Diet Approaches

Future research should also look at how complementary feeding methods relate to sustainable diets, agricultural diversification, and family food security. Understanding how locally available foods can be utilized to improve nutrient intake will help create cost-effective and sustainable feeding models, particularly in resource-limited settings.

Overall, expanding research in these areas will contribute to stronger evidence-based methods to enhance supplemental feeding practices and reducing childhood malnutrition globally.

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AWARENESS AND CONSUMPTION PATTERNS OF MILLETS AMONG COLLEGE GIRLS IN MUZAFFARPUR DISTRICT OF BIHAR

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ABSTRACT

Millets are nutrient-dense grains with a great capability for addressing food insecurity and malnutrition. They have a nutritional profile comparable to major cereals like wheat and rice. Millets are also excellent sources of phytochemicals, micronutrients, and dietary fiber. This study aims to evaluate the level of awareness about Millets, their dietary benefits, and their role in traditional diet and to determine the depth of knowledge about different types of Millets, their culinary uses, and potential health implications in college-going girls in Muzaffarpur district of Bihar. A sample of 252 adolescent girls (aged 16–21) from various socioeconomic backgrounds was surveyed using a cross-sectional design to assess their knowledge, consumption frequency, and the factors influencing Millet intake. The study indicates that the majority (53.2%) of respondents had less knowledge about Millets, with only 34.1% recognizing specific types like finger Millet (ragi) and maize. Furthermore, information regarding millets is mainly acquired through informal channels, with 38.5% relying on family or friends and 23.4% on cultural or traditional knowledge, indicating a gap in formal institutional education. Despite the low awareness, 53.6% of respondents consume Millets primarily for health benefits, and 21.0% are motivated by weight management. However, Millet consumption remains limited, with 50.8% of participants consuming it only on special occasions. The study highlights that socioeconomic factors, availability, and convenience influence Millet consumption. The results of this study underscore the need for targeted nutritional campaigns to raise awareness and promote Millets as a sustainable and healthy dietary option in the region.

Keywords: Adolescent girls, Awareness, Dietary patterns, Health benefits, Millet consumption

INTRODUCTION

Dietary quality is crucial for preserving physical well-being, promoting health and development, and maximizing genetic potential. To address widespread food poverty and malnutrition, it's important to examine dietary quality.

Millets have recently had a tremendous surge in India, particularly with the designation of the National Year of Millets (2018), followed by the International Year of Millets (2023). This is due to their various benefits, namely, production (short duration, low water usage, and climate resilience), consumption (nutrition and health), and ecological (carbon neutral) (*Sendhil et al., 2023*). To achieve the ambitious Sustainable Development Goals (SDGs) for 2030 regarding the elimination of malnutrition, dietary paradigms must shift toward highly nutritious and sustainable crops. Historically, agricultural initiatives such as the Green Revolution heavily subsidized and prioritized

the production of high-yielding varieties of fine cereals like rice and wheat. This policy shift inadvertently caused a drastic decline in the farming of indigenous millets, severely reducing regional dietary diversity. Reversing this historical trend requires strategic measures to reintroduce these nutrient-dense, climate-resilient grains back into the mainstream food basket to replace less nutritious refined cereals (Kane-Potaka et al., 2021).

Millets come in a variety of small-seeded varieties, including pearl Millet (Pennisetum glaucum), finger Millet (Eleusine coracana), kodo Millet (Paspalum scrobiculatum), proso Millet (Panicum miliaceum), foxtail Millet (Setaria italica), little Millet (Panicum sumatrense), and barnyard Millet (Echinochloa frumentacea). They are classified as coarse cereals, with maize (Zea mays), sorghum (Sorghum bicolour), oats (Avena sativa), and barley (Hordeum vulgare). Millets encompass a diverse group of small-seeded grasses, such as pearl, finger, and foxtail millets. Historically, in arid and semi-arid regions of India, indigenous populations have relied heavily on these hardy crops. They have functioned not only as a primary source of human sustenance but also as a critical component of agricultural resilience, providing dependable animal fodder and broad livelihood security in challenging climatic conditions (Saleh et al., 2013).

Millets are of vital significance in the day-to-day living of the people of Bihar. In the areas where Millets are grown, these grains serve as the staple food and are instrumental in the presentation of various traditional foods and drinks such as idli, dosa, papad, and chakli, as well as porridge, bread, baby food, and snacks. This is encouraging since it means there is a large market for Millet and Millet products within Bihar. Even though Millets are used to prepare a variety of local traditional foods in most homes including India, unfortunately, the absence of meaningful industrial applications makes it difficult to establish a market linkage between this market and the Millet farmers, thereby restricting the market development. Other limitations in Millets broader market can be traced to the poor performance of various value chain links in Bihar (Kumari et al., 2023)

Epidemiological studies indicate that modern educational campuses frequently expose adolescents to highly detrimental dietary landscapes. As documented by Bassi et al. (2021), student populations are disproportionately surrounded by accessible, heavily marketed nutritional options characterized by excessive sodium, refined sugars, and lipid content (HFSS foods). This toxic food environment is particularly pervasive within institutional cafeterias and nearby commercial vending spaces, actively undermining healthy dietary development. Globalisation has led to lifestyle changes, including changes in eating habits and preferences. Poor nutrition and unhealthy eating habits are frequently associated with poor health consequences, including mortality, morbidity, and a higher prevalence of chronic diseases such as hypertension, cardiovascular disease, and diabetes. Anaemia is a critical public health problem among girls aged 10-14, particularly in eight states, including Jharkhand (Bassi et al., 2021; Prashanthi et al., 2022).

OBJECTIVES

- To assess the Socio-economic background of the respondents
- To examine the depth of knowledge about different types of Millets, their culinary uses, and potential health implications.
- To determine how often college-going girls consume Millet, either as a staple or as an occasional food.

HYPOTHESES

- The majority of college going girls lack basic knowledge about the different types of millets and their health benefits
- Millet consumption occurs mostly on an occasional basis rather than as a daily dietary habit.

METHODOLOGY

This study employed a descriptive cross-sectional survey design targeting 252 college-aged girls (aged 16–21 years) enrolled in M.S.K.B. College, a constituent unit of B.R.A. Bihar University, in the Muzaffarpur district of Bihar. The college was selected due to its diverse student body across various academic disciplines. Primary data was obtained using a structured questionnaire. The survey instrument consisted of four core sections: demographic and socio-economic profiling, an assessment of nutritional literacy regarding millet varieties, identification of the main sources of information on millets, and an evaluation of consumption frequencies and culinary preferences. Descriptive statistics, including frequencies and percentages, were utilized to analyze and interpret the data.

RESULT AND DISCUSSION

Table 1. Socioeconomic distributions of the participants (N=252)

Income group	Frequency	Percentage
< ₹15,000/month	77	30.6
₹15,000-₹30,000/month	146	57.9
> ₹30,000/month	29	11.5
Total	**252**	**100**

Table 1: This result shows that out of 252 respondents, 30.6% belonged to the low-income group (<₹15,000/month), 57.9% to the middle-income group (₹15,000-₹30,000/month), and 11.5% to the high-income group (>₹30,000/month).

Middle-income group (57.9%): This majority group might show moderate awareness of Millets. Their consumption pattern might depend on affordability and local availability.
Low-income group (30.6%): With fewer financial resources, respondents might have had limited awareness of Millets. Millets were part of their traditional diet or available through local government initiatives.
High-income group (11.5%): Girls might have had greater exposure to health trends, including awareness of Millet as a nutritious food option.

Table 2. Knowledge of College Girls regarding different types of Millet (N=252)

SL.no.	Response	Frequency	Percentage
1.	Buckwheat Millet, Pearl Millet (bajra), Sorghum Millet (jowar)	32	12.7
2.	Only specific types like Finger Millet (Ragi), maize	86	34.1
3.	Less knowledge	134	53.2
	Total	**252**	**100.0**

Table 2: It shows that the majority 53.2%, had less knowledge of the Millets, indicating a major gap in awareness within this population. Among the remaining respondents, 34.1% were aware of finger Millet (ragi) and maize, suggesting moderate recognition of these specific grains. Meanwhile, only 12.7% were aware of multiple Millet types, including buckwheat Millet, pearl Millet (bajra) and sorghum Millet (jowar).

This data highlights the requirement for increased educational outreach and awareness programs about Millets, particularly given their nutritional benefits. The greater percentage of respondents lacking knowledge suggests that Millet consumption patterns might be limited due to unfamiliarity. By raising awareness, it could potentially increase Millet consumption, especially given the affordability and health benefits of these grains.

Table 3. Sources of Information on Millet (N=252)

Information Channels	Frequency	Percentage
Family or Friends	97	38.5
Cultural or Traditional Knowledge	59	23.4
Social Media or Television	51	20.2
Institution	25	9.9
Health Professionals	12	4.8
Books or Magazine	8	3.2
Total	**252**	**100.0**

Table 3: Shows the main sources from which college girls acquired information regarding millets. Most of the college girls depended mainly on their immediate social circles and heritage, with 38.5% mentioning family or friends as their main source of information, closely followed by 23.4% who got their awareness from cultural or traditional knowledge. This highlights that millet awareness in this area is primarily passed down through generational and household practices rather than formal education.

A moderate number of the respondents (20.2%) gained their information via social media or Television, reflecting the growing influence of digital media and recent national campaigns promoting millets. Conversely, formal and institutional sources ranked the lowest. Only 9.9% named their Institution as a primary source, 4.8% learned from health professionals, and a mere 3.2% relied on Books or Magazines. This data highlights a significant gap in formal nutritional education within

the academic curriculum and suggests that integrating millet awareness programs directly into institutional settings and clinical counselling could greatly enhance nutritional literacy among adolescents.

Table 4. Opinion and preferences of the Respondents on consumption and their consumption pattern (N=252)

Variables	Particular	Frequency	Percentage
Awareness of Millet consumption	Totally awareness	33	13.1
	Certain awareness	75	29.8
	Less awareness	144	57.1
Frequency of Millet consumption	Once in a week	69	27.4
	Once in a month	55	21.8
	Occasionally	128	50.8
Preference Millet-based food products	Roti	92	36.5
	Snacks (sweet corn chat, etc.)	71	28.2
	Sweets (ladoo, halwa, etc.)	45	17.9
	Porridge	27	10.7
	Bread	12	4.8
	Beverages	5	1.9

Table 4: Shows the awareness of Millet consumption, the majority (57.1%) of respondents mentioned that they had less knowledge of Millet's benefits. A smaller portion, 13.1%, were fully aware of Millet consumption, while 29.8% had some knowledge about it. This indicated a major knowledge gap that could affect Millet adoption in daily diets.

As for the frequency of Millet consumption, 50.8% of respondents consumed Millets only on special occasions. This was followed by those who consumed it once a week (27.4%) and once a month (21.8%). This suggested that Millet was not yet fully integrated into their regular diet and was often reserved for occasional use.

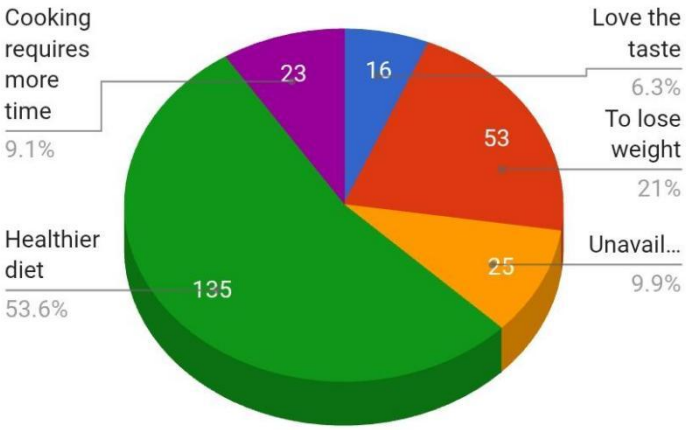
In terms of preference for Millet-based food products, 36.5% of respondents favored roti, followed by 28.2% who preferred snacks like sweet corn chat, and 17.9% consumed sweets such as ladoo and halwa. Porridge, bread, and beverages accounted for smaller proportions at 10.7%, 4.8%, and 1.9% respectively.

In conclusion, awareness of Millet consumption among college-going girls in Muzaffarpur was low. There was a possibility for increasing Millet consumption by enhancing awareness and promoting diverse Millet-based products in their daily diet.

Table 5. Factors Influencing Millets Consumption

Factors	Frequency	Percentage
Healthier diet	135	53.6
Love the taste	16	6.3
To lose weight	53	21.0
Unavailability of Millet foods	25	9.9
Cooking requires more time	23	9.1
Total	**252**	**100.0**

Table 5: Shows the majority (53.6%) of respondents consumed Millets for a healthier diet, reflecting growing health consciousness and awareness of Millet's nutritional benefits. Another 21.0% of respondents indicated Millet consumption was driven by a desire to lose weight, showcasing Millets' appeal as a weight management food. However, only 6.3% of respondents cited taste as a reason for consuming Millet, indicating that taste was not a major motivator. Additionally, practical barriers such as the unavailability of Millet foods (9.9%) and the perception that cooking required more time (9.1%) discouraged Millet consumption among some respondents.



In summary, while health benefits were a primary driver of Millet consumption, challenges like availability and preparation time hindered more widespread adoption, reflecting the need for greater access and convenience.

CONCLUSION

The study highlighted a gap in nutritional literacy regarding millets among college-aged girls in the Muzaffarpur district of Bihar. Despite the rich nutritional profile and historical significance of millets in traditional Indian diets, most of the college girls demonstrated a lack of fundamental awareness about different varieties of Millets. However, there was a promising inclination towards millet consumption driven by health consciousness and weight management among those who did incorporate it. To bridge this gap, targeted nutritional education and community outreach programs are essential. By enhancing the convenience, diverse culinary applications, and accessibility of millets, educators and policymakers can help integrate these climate-resilient and nutrient-dense grains into the regular diets of college going girls, thereby supporting better health benefits and regional nutritional security.

LIMITATIONS

- The study was limited to college-going girls, and the results may not be generalizable to other populations.
- The study focused on a single district, limiting the geographic scope of the findings.

SUGGESTIONS FOR FUTURE RESEARCH

- Studies can also be carried out on how Specific nutritional education campaigns might raise long-term awareness and daily consumption among adolescents.
- Assess the consumption patterns and awareness levels of other population segments such as male college students, school-aged children, and the elderly.
- Evaluating the development and market acceptance of convenient, innovative millet-based processed foods and beverages to overcome preparation barriers.

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AWARENESS OF COLLEGE GIRLS TOWARD CALCIUM AND VITAMIN D FOR GOOD BONE HEALTH: A STUDY OF PATNA DISTRICT, BIHAR

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ABSTRACT

Present study aimed to assess awareness of college girls toward calcium and vitamin D for bone health. The study was conducted in three blocks of Patna district namely Patna Sadar, Bihta and Naubatpur. Two colleges from Patna Sadar and one college from Bihta and one college from Naubatpur block were selected purposively. 150 female students at graduation and post-graduation level were selected from each college. Selection of respondents had been done through purposive convenience sampling. Thus, total sample size comprised of 600 respondents. Results of the study showed that 77.33% respondents were aware of essentiality of calcium for good bone health and more than 60.0 % were aware of the fact that with increasing age, weakening of bones was a common problem found among women. Further 52 % respondents had awareness on essentiality of vitamin D for healthy and strong bone. 36.83 % respondents had awareness about vitamin D was necessary for calcium absorption in the body and 31.67 % were aware of vitamin D deficiency in adults lead to osteomalacia. Further 25.67 % respondents had awareness on osteomalacia which led to softness of bones**.** It was also evident that only 18.0 % respondents were aware about incidence of osteoporosis became high in post-menopausal stage. Findings of the study showed that 26.5 % respondents had high awareness level on calcium and vitamin D for good bone health and two thirds had low to moderate level awareness.

Key words: Awareness, bone health, essentiality, post-menopausal,osteomalacia,osteoporosis

INTRODUCTION

Poor bone health has now become a common problem among the female population. The problem has not affected only Indian women but is spread all over the world. Severity of the problem can be observed through the data recently shared by WHO. It has been reported that around six crore people in India have osteoporosis and 80.0 % of them are women (WHO). Further the report also exposed that the peak incidence of osteoporosis in India occurs 10 – 20 years earlier than in western countries. Global data indicate that 20.0% of women with a hip fracture die within one year of the fracture and 50.0 % of them never regain their functional independence (The New Indian Express ,2023).

Undoubtedly poor bone health of women has been emerging as a community nutritional problem. Though the problem is widespread but yet to be accepted as community problem. Causal factors of poor bone among women are numerous but most of the researches unfurl lack of awareness toward calcium and vitamin D and inadequate intake of calcium and vitamin D as noticeable. There

are some other reasons also which include faulty dietary habits, reduction of estrogen, thinner bones of women compared to male, excess intake of salt, lack of exercise etc. But, unawareness toward calcium and vitamin D is the core reason of poor bone health.

Furthermore, findings of various researches disclose that most of the studies have been conducted with specific group population like pharmacy, dental, medical students. Again, very few studies were carried out at regional level specially in Bihar. Conducting studies at college level will help in raising awareness of the target group towards calcium and vitamin D in early ages. Thus, awareness in early years of life of female population will lead to good bone health and reduce incidence of poor bone related complications in later stage of life.

Need Of the Study

Review of past studies demonstrate that most of the work have been done for specific target groups and the area of study was very specific. Main areas of work include awareness and knowledge on osteoporosis and their management. Very limited studies have been conducted on awareness toward calcium and vitamin D with special context to women bone health. Again, these researches have been mostly carried in other parts of the country and very less work was done in Bihar . Therefore, this topic was chosen for the study and carried out at college level.

OBJECTIVES OF THE STUDY

1. To study the socio-demographic profile of the respondents under study.
2. To assess awareness of the respondents toward calcium and vitamin D for good bone health.
3. To examine association between awareness level on calcium and vitamin D and selected socio-demographic variables.

HYPOTHESIS

H1: Significant association exists between awareness toward calcium and vitamin D and selected socio demographic variables.

REVIEW OF LITERATURE

Chintham et al.(2025) made their investigation on “Exploring Women’s Knowledge of Nutrition and Bone Health :A Preventive Focus on Osteoporosis” .Findings of the study revealed a significant knowledge gaps in certain domain .The report documented that 37.0% respondents knew calcium rich food sources .Furthermore, the study finds significant association (p=.001) between awareness levels and several demographic factors including age, educational status ,occupation, socioeconomic background diet type and family history of osteoporosis.

Taha, M. (2023) studied awareness of vitamin D deficiency among the general population in Al Qunfudhah,Saudi Arabia and reached to conclude that adults had acceptable knowledge about vitamin D depressed level but older participants had less. Further, findings showed a strong correlation between knowledge level of the respondents and their educational level.

Silpa, P. & Nanthini, T. (2020) in their study Knowledge on Importance of Calcium and Vitamin D among Menopausal Women discovers that majority of the menopausal women's had moderate level of knowledge 38 (63.3%), 18 (30%) had inadequate level of knowledge and very less number of the menopausal women's had adequate level of knowledge 4 (6.7%). There was statistically significant association at the level of $p < 0.001$ between the level of knowledge with demographic variable as age, monthly income of family and Source of information about Vitamin D and calcium role in menopause has significant association at the level of $p < 0.05$.

Nida, Nowreen and Reqaya, Hameed (2019) made assessment on awareness regarding the importance of vitamin D and prevention of its deficiency among female undergraduate medical students . The study reported that there were some gaps in awareness about vitamin D, its benefits and management of deficiency among female medical students.

Nayana et al.(2014) conducted a research on planned teaching program creates awareness regarding prevention of Vitamin-D and Calcium deficiency in children. The findings concluded that the planned teaching programme was effective in altering the knowledge of the mothers of under five children. Awareness campaigns can be conducted on regular basis with more emphasis on Vitamin D and Calcium deficiency and its prevention.

Uddin et.al.(2013) designed and conducted a study to establish a basic understanding on the level of gap of knowledge and awareness regarding importance of calcium and vitamin D among pharmacy students at undergraduate level in Bangladesh .Findings of the research reached at conclusion that lack of awareness and insufficient knowledge of the essentiality of these two nutrients are assumed to cause health complications among people of Bangladesh.

RESEARCH METHODOLOGY

The present study was conducted in three blocks of Patna district, Bihar. These blocks were namely Patna Sadar, Bihta and Naubatpur and selected purposively . Four government colleges, two from Patna Sadar , one college from Bihta and one from Naubatpur block under rural area were selected purposively . 150 female students at undergraduate and postgraduate level from each college were selected through purposive convenience sampling technique. Thus total sample size comprised of 600 respondents. Data was collected through pre tested self structured schedule . Schedule consisted of 11 questions on socio-demographic characteristics and 11 questions for awareness on essentiality of calcium and vitamin D for good women bone health. 1 score was fixed for 'yes' which was the correct option and 0 score was assigned for 'no' , 'don't know' and 'no response.' Thus maximum score obtained by the respondents on awareness was 11. Awareness level was graded as low ,moderate and high according to the score attained by the respondents. Score 0-3 ,4-7 and 8-11 were designated as low, moderate and high level respectively.

FINDINGS AND DISCUSSION

Table – 1: Socio-demographic profile of the respondents

Socio-demographic variables	frequency (n=600)	Percentage(%)
Age(years)		
19-20	273	45.50
21-22	182	30.33
≥ 23	145	24.17
Religion		
Hindu	537	89.50
Muslim	62	10.33
Christian	01	0.17
Social category		
General	288	48.00
Backward caste	216	36.00
Scheduled caste	94	15.67
Scheduled caste	02	0.33
Respondent's Education Level		
Graduation	446	74.33
Post graduation	154	25.67
Family type		
Nuclear	295	49. 17
Joint	305	50. 83
Family size(members)		
3-5	205	34.17
6-8	225	37.50
≥9	170	28.33
Respondent's mother educational Level		
No formal education	218	36.33
Matriculation	232	38.67
Intermediate	104	17.33
Graduation or higher	46	7.67
Respondent's father educational Level		
No formal education	80	13.33
Matriculation	163	27.17
Intermediate	186	31.00
Graduation or higher	171	28.50

Occupation of respondent's mother		
Home makers	462	77.00
Farming and allied activities	49	8.17
service	65	10.83
Business	24	4.00
Occupation of respondent's father		
Farming and allied activities	273	45.50
service	141	23.50
Business	186	31.00
Monthly income of the family(Rs)		
Upto30,000	348	58.00
30,000-50,000	156	26.00
50,000-100000	75	12.50
≥100000	21	3.50

Table 1 demonstrated that 45.50 % respondents aged between 19 to 20 years and 30.33 % fall under 21 to 22 years while 24.17 % respondents were either 23 years old or more . Further religion wise data showed that 89.50 % respondents were Hindu ,10.33 % belonged to Muslim community and only 0.17 % respondents belonged to Christian community. Data pertaining to social categories disclosed that respondents belonged to general ,backward , schedule caste and schedule tribe constituted 48.0 %, 36% and 15.67 % and 0.33 % respectively .Thus all the social categories had representation in the study sample but majority belonged to general category followed by backward and scheduled caste respectively.

Education level of respondents revealed that 74.33 % respondents were at graduation level while 25.67 % were doing post graduation. Family background of the respondents depicted that 49.17 % respondents had nuclear family and 50.83 % belonged to joint family. Thus there was a slight difference in percentage of respondents belonging to nuclear and joint families.

Data pertaining to family size depicted that 37.50 % respondents belonged to the family having 6-8 members, 34.17 % respondents' family size composed of 3-5 members and rest 28.33 % respondents' families had 9 or more than 9 family members.

Data related to respondent's mother education level explained that 38.67 % respondents' mothers had matric level education followed by 36.33 % having no formal education while 17.33 % mothers were intermediate pass. However only 7.67 % respondent's mothers were graduate or above. Data showing educational level of respondents' father disclosed that 13.33% fathers had no formal education , 27.17 % had matric level education and 31.0% fathers pursued intermediate level education. However, 28.50 % fathers were either graduate or above.

Thus, mothers with gradation and above represented very less proportion however the figure was comparatively higher in case of fathers. More than one fourth respondents' fathers were graduate or above.

Data showing respondents' mother occupation revealed that 77.0 % mothers were housewives followed by 10.83 % , 8.17 % and 4.0% who were service holders ,engaged in farming and allied activities and doing business respectively .

Further 45.50 % fathers were engaged in farming and allied activities, 23.50 % were service holders and 31 % respondent's fathers had business . Again, family monthly income of respondents showed that 58.0 % respondent's families had monthly income up to Rs 30,000 , 26.0 % families' monthly income was found between Rs 30000- Rs 50000 and 12.5 % families' monthly income was between Rs 50000-Rs 100000. Moreover only 3.5 % respondent's families had monthly income more than Rs 100000.

Table -2.1: Awareness of respondents on calcium and vitamin D for good bone health (n=600)

Particulars	yes		no		Don't know		No response	
	f	%	f	%	f	%	f	%
Calcium is essential for healthy bone	464	77.33	23	3.83	76	12.67	37	6.17
With increasing age weakening of bones is a common problem found among women	372	62.00	48	8.00	132	22.00	48	8.00
If body does not get calcium as per the requirement, then your body takes calcium from the bones which makes the bones weak	181	30.17	120	20.00	255	42.50	44	7.33
If calcium deficiency continues for a long period, bone becomes brittle and incidence of frequent& multiple bone fracture increases	253	42.17	91	15.17	205	34.17	51	8.50
Calcium deficiency leads to a disease called osteoporosis	270	45.00	33	5.50	203	33.83	94	15.67
Incidence of osteoporosis becomes high in post-menopausal stage	110	18.33	57	9.50	350	58.33	83	13.83
Vitamin D is essential for healthy and strong bone	357	59.50	46	7.67	160	26.67	37	6.17
Vitamin D necessary for calcium absorption in the body	221	36.83	118	19.67	229	38.17	32	5.33
Vitamin D deficiency in adults leads to osteomalacia	190	31.67	27	4.50	312	52.00	71	11.83
Onset of osteomalacia leads softness of bones	154	25.67	27	4.50	345	57.50	74	12.33
Both calcium and vitamin D are essential for healthy and strong bone	339	56.50	5	0.83	227	37.83	29	4.83

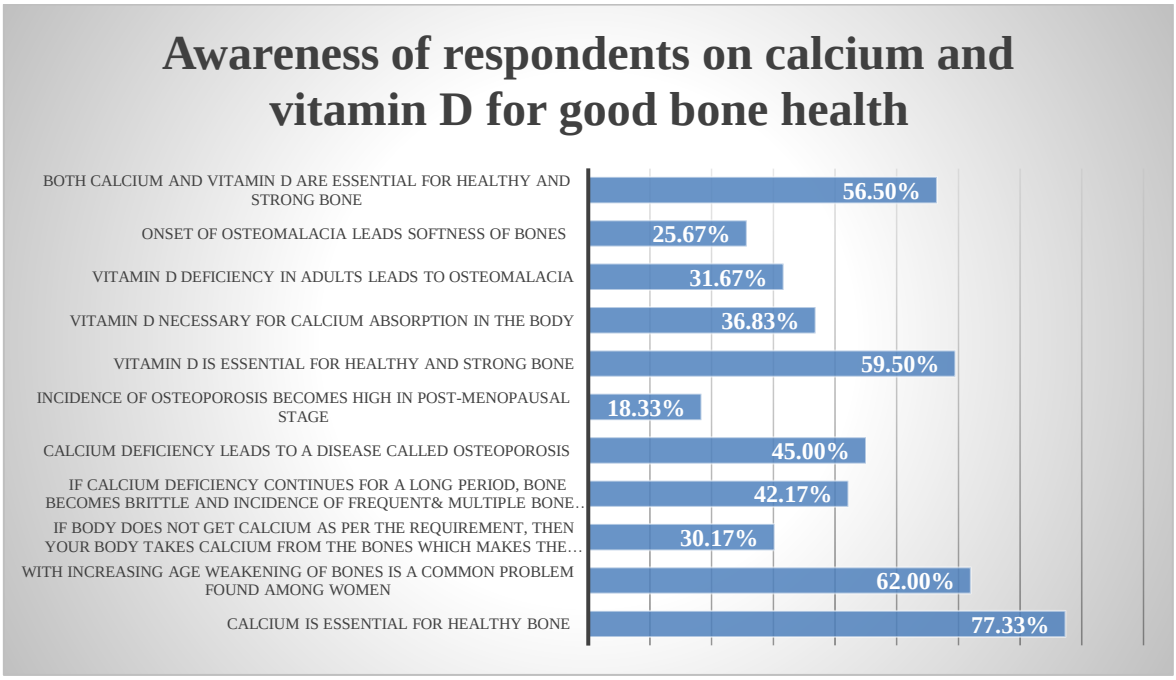

Fig.1

Perusal of Table 2.1 showed that 77.33 % respondents answered 'yes' if asked calcium is essential for healthy bone but 3.83 % respondents answered 'no'. However 12.67 % respondents said 'don't know' and 6.17 % respondents didn't reply . While answering the question 'With increasing age weakening of bones is a common problem found among women', 62.0 % respondents answered 'yes' , 8 % said 'no' and 22 % respondents replied 'don't know' .However rest 8 % respondents didn't give any response.

When respondents were asked 'If body does not get calcium as per the requirement, then your body takes calcium from the bones which makes the bones weak' , 30.17 % respondents said 'yes' , 20 % answered 'no' and 42.5 % respondents replied don't know while 7.33 % respondents had not answered .

In another question 'If calcium deficiency continues for a long period, bone becomes brittle and incidence of frequent& multiple bone fracture increases' ,42.17 % responses were 'yes' 15.17 % answers were 'no' and 34.17 % respondents answered 'don't know'. However no responses had been recorded from 8.5 % respondents.

Again above table also exhibited that only 45 .0% respondents knew that calcium deficiency leads to osteoporosis while 5.5 % respondents said no .Moreover 33.83 % respondent answered ' do not know' and 15.67 % respondents didn't answer.

'Incidence of osteoporosis becomes high in post-menopausal stage' answering this question , only 18.33 % respondents replied 'yes',9.5 % respondents said 'no' while 58.33 % respondents answered 'don't know' and no answer was recorded from 13.83 % respondents .

Further 59.5 % respondents' replies were 'yes' when asked vitamin D is essential for healthy and strong bone ,7.67 % answered no and 26.67% respondents said don't know. However 6.17 % respondents didn't reply. In another question, vitamin D necessary for calcium absorption in the body ,only 36.83 % respondents answered 'yes' followed by 19.67% who said 'no' and 38.17 % replied don't know .However remaining 5.33 % respondents didn't reply .

Further 31.67 % respondents replied 'yes' when asked vitamin D deficiency in adults leads to osteomalacia , 4.50 % respondents' answers were 'no'. But, 52.0 % respondents' replies were don't know and rest 11.83 % respondents didn't give any response . Again onset of osteomalacia leads to softness of bones , only 25.67 % respondents said 'yes' ,4.5 % answered 'no' while 57.50 % responses were do not know and 12.33 % respondents had not answered.

Both calcium and vitamin D are essential for healthy and strong bone ,only 56.50 % respondents' responses were 'yes', 0.83 % answered 'no' ,37.83 % said do not know and 4.83 % respondents had not replied .

Table -2.2: Awareness level of respondents toward calcium and vitamin D for bone health

N=600

Awareness Level	Score Range(0-11)	Respondents(f)	Percentage(%)
Low	0-3	223	37.17
Moderate	4-7	218	36.33
High	8-11	159	26.50

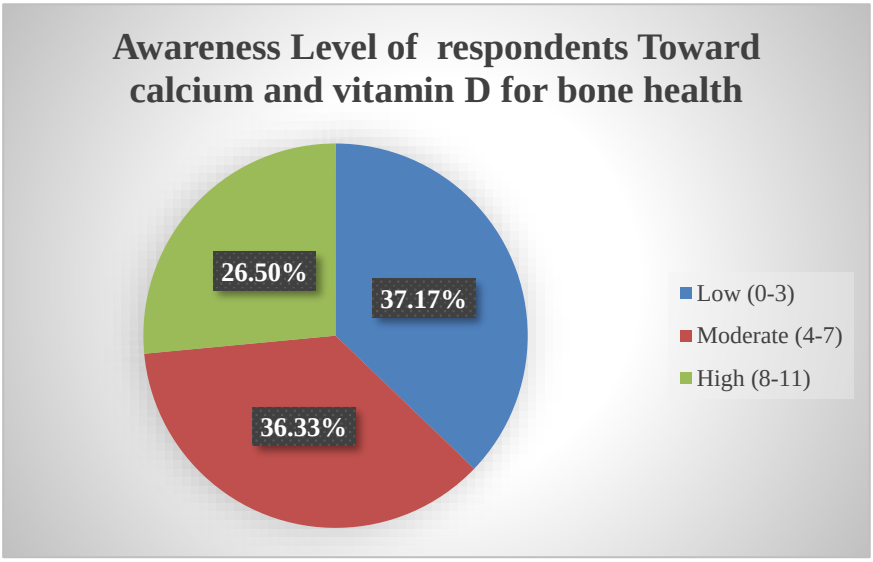

Fig.2

Table 2.2 exhibited that 37.17 % respondents had low level of awareness followed by 36.33 % respondents having moderate level awareness and rest 26.50 % respondents had high level of awareness on calcium and vitamin D for bone health.

Thus, only one fourth respondents had high level awareness.

Table -2.3 : Sources of awareness on calcium and vitamin D for bone health

N=600

Particulars	frequency	Percentage(%)
Calcium is essential for good bone health		
i. Family Members	25	4.17
ii Teacher/textbook	289	48.17
iii. Social media	96	16.00
iv. no response	190	31.67
Vitamin D is essential for healthy bone		
i. Family Members	8	1.33
ii. Teacher/textbook	207	34.50
iii. Social media	141	23.50
iv. no response	244	40.67
Both calcium and vitamin D are essential for healthy and strong bone		
i. Family Members	36	6.00
ii. Teachers/ Textbook	176	29.33
iii. Social Media	121	20.17
v. no response	267	44.50

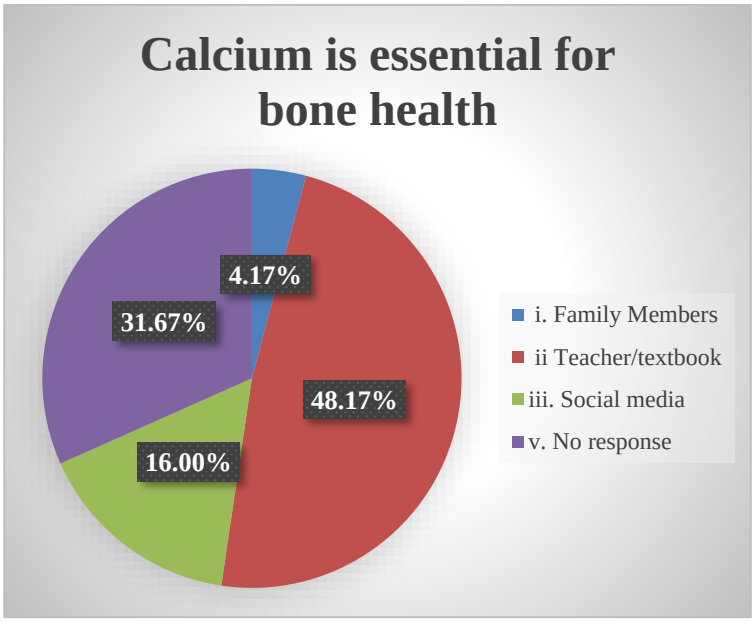

Fig.3

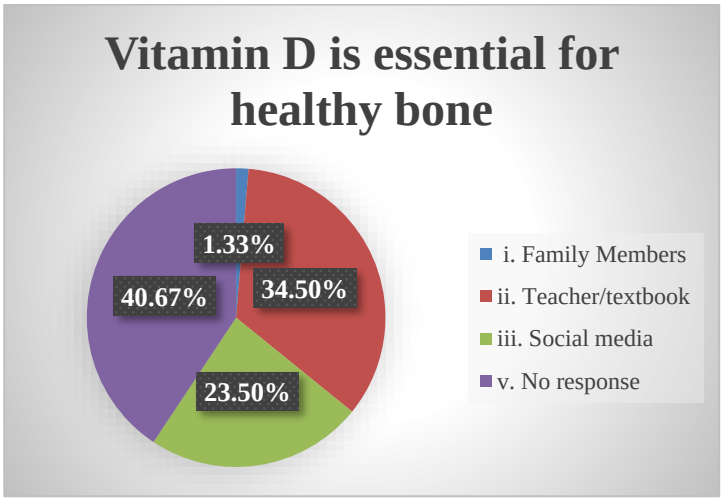

Fig.4

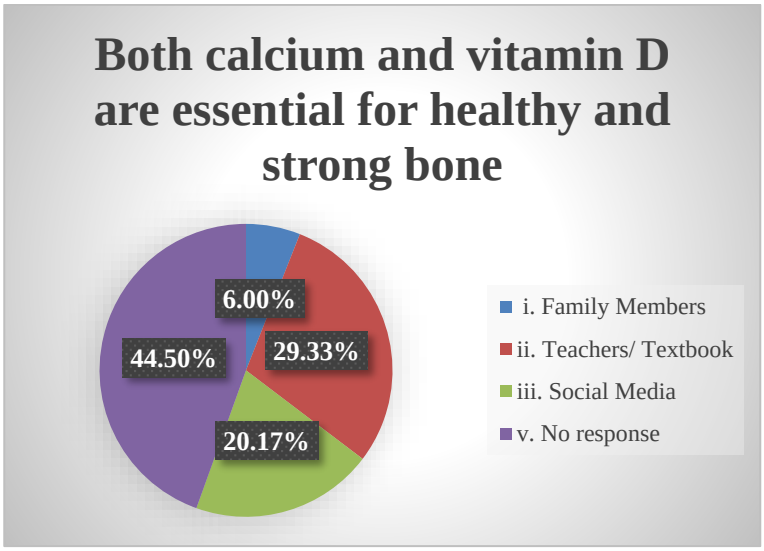

Fig.5

Table 2.3 outlined that 48.17 % respondents' source of awareness on calcium were teachers/textbook followed by 16.0 % whose source of awareness was social media and 4.17 % respondents get aware through family members. However 31.67 % respondents din't disclose their source.

Furthermore 34.5 % respondents reported that their source of awareness on vitamin D were teachers/textbooks followed by 23.5 % respondents whose source of awareness was social media and only 1.33 % respondents get informed through their family members . Further 40.67% respondents didn't' disclose their source .

Respondents who showed awareness on essentiality of both calcium and vitamin D for healthy and strong bone, 29.33 % respondents admited that their sources of information were teachers /textbook followed by 20.17 % respondents whose source of information was social media and only 6.0% respondents get aware through family members. However 44.50 % respondents didn't disclose their

sources .

Similar results had been found in the study which showed that students get familiar about calcium and vitamin D from their teachers (48.9%) and textbooks (32.8%) (Uddin et al. (2013).

Table- 3.1: Association Between Awareness Level on Calcium and Vitamin D and Socio-Demographic Variables

N = 600

Variables	category	High	moderate	low	p-value
Age Group	19-20	57 (9.5%)	110 (18.3%)	106 (17.7%)	.001
	21-22	40 (6.7%)	68 (11.3%)	74 (12.3%)	
	≥23	62 (10.3%)	40 (6.7%)	43 (7.2%)	
Caste	General	74 (12.3%)	114 (19%)	100 (16.7%)	.215
	Backward Caste	64 (10.7%)	68 (11.3%)	84 (14%)	
	Scheduled Caste	21 (3.5%)	34 (5.7%)	39 (6.5%)	
	Scheduled Tribe	0 (0%)	2 (0.3%)	0 (0%)	
Educational level of the respondent	Graduation	84 (14%)	177 (29.5%)	185 (30.8%)	.001
	Post graduation	75 (12.5%)	41 (6.8%)	38 (6.3%)	
Respondent's mother educational Level	Graduation or higher	23 (3.8%)	13 (2.2%)	10 (1.7%)	.001
	Intermediate	36 (6%)	43 (7.2%)	25 (4.2%)	
	Matric	60 (10%)	86 (14.3%)	86 (14.3%)	
	No formal education	40 (6.7%)	76 (12.7%)	102 (17%)	
Occupation of respondent's mother	House wife	120 (20%)	174 (29%)	172 (28.7%)	.137
	Farming & Allied activities	8 (1.3%)	13 (2.2%)	24 (4%)	
	Service	24 (4%)	21 (3.5%)	20 (3.3%)	
	Business	7 (1.2%)	10 (1.7%)	7 (1.2%)	
Monthly Income of the Family	Up to 30000	72 (12%)	127 (21.2%)	149 (24.8%)	.001
	30000-50000	49 (8.2%)	61 (10.2%)	46 (7.7%)	
	50000-100000	25 (4.2%)	24 (4%)	26 (4.3%)	

	>100000	13 (2.2%)	6 (1%)	2 (0.3%)	
Locality of the college	Rural	55 (9.2%)	106 (17.7%)	139 (23.2%)	.001
	Urban	104 (17.3%)	112 (18.7%)	84 (14%)	

Table 3.1 summarized association between awareness level of the respondents on calcium and vitamin D and selected socio-demographic variables . Significant associations was observed with age group (**p**=.001), educational level of the respondents (p=.001), respondent's mother educational level(p=.001), monthly income of the family (p=.001) and locality of the college (p=.001) while insignificant association were found with caste(p=.215) and mother's occupation (p = .137). Higher percentage of respondents studying in colleges situated in urban localities had high level awareness than respondents studying in colleges of rural localities. Elghazaly et al.(2024) in their study also discovered that gender, nationality and academic grades were significant factors affecting the awareness level on vitamin D deficiency among medical students.

SUMMARY AND CONCLUSIONS

Thus, it may be concluded that more than 50.0 % respondents were aware of i. calcium is essential for healthy bone ii. with increasing age weakening of bones is a common problem found among women iii. **v**itamin D is essential for healthy and strong bone iv. both vitamin D and calcium are important for healthy and strong bone but less than 50.0 % respondents are aware of i. if calcium deficiency continues for a long period, bone becomes brittle and incidence of frequent& multiple bone fracture increases ii. calcium deficiency leads to a disease called osteoporosis and even less than one third of respondents are aware of the following facts i. if body does not get calcium as per the requirement, then body takes calcium from the bones which makes the bones weak ii incidence of osteoporosis becomes high in post-menopausal stage iii. vitamin D is necessary for calcium absorption in the body iv. vitamin D deficiency in adults leads to osteomalacia v. onset of osteomalacia leads softness of bones **.**Further only 26.67 % respondents had high level of awareness and two thirds respondents had low and moderate level of awareness. Findings of the study again revealed that teachers /textbooks were the major sources of awareness toward calcium and vitamin D and social media was the second source of information for the respondents.

Furthermore Significant associations were observed with age group, educational level of the respondents , respondent's mother educational level, monthly income of the family and locality of the college (p=.001) while insignificant association were found with caste and mother's occupation .

IMPLICATIONS OF THE STUDY

Present study will draw attention of other researchers in the concerned areas. It will also helpful in recommending corrective measures to raise awareness and knowledge of college girls toward calcium vitamin D. Raised awareness toward calcium and vitamin D would make them more con-

scious towards calcium and vitamin D intake and bring desirable changes in dietary behaviour of the population and further it will produce positive effects on female bone health .

Acknowledgement

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REVISITING ANTHROPOMETRIC PARAMETERS OF TRANSGENDER INDIVIDUALS: EVIDENCE FROM NATIONAL CAPITAL TERRITORY OF DELHI

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ABSTRACT

Nutritional status of transgender of National Capital Territory of Delhi has not been studied yet although many research has been done on mental health of community. The present study was conducted to explore the nutritional status and anthropometric parameters of community against reference man and women value given by NIN. The objective is to study nutritional status of the community so that standard value may be created in future research. A descriptive study was conducted among 261 transgender of 17-60 years age group selected through snowball sampling belonging to different NGOs situated at several location of NCT Delhi. The demographic details were collected during self-structured questionnaire and anthropometric tool were used to assess nutritional status. The data was analyzed using SPSS 23.0 version. The highlighting result was maximum percentage of obese belongs to 35& above years of age group usually due to low physical activity, hormone intake. The waist hip ration predicts 86.2% at health risk. With increasing visibility there is a need of improved dietary recommendations and particular reference value as for Male and Female.

Keyword: Height, Weight, Waist- Hip Ratio, BMI, Transgender

INTRODUCTION

Transgender is an umbrella term used to describe individuals of any age whose gender identity differs from the sex assigned at birth or does not conform to conventional male and female gender roles. India, known for its rich cultural heritage, has a long historical presence of transgender individuals dating back to ancient times.[9,26] They are referred to by different names across regions, such as “Khusra” in Punjab, “Kojja” in Telugu, “Hermaphrodite” in English, “Hijras” in Bengali, and are commonly known as “Kinnar” or “Chhakka” across India.[7,16]

Until 2011, the transgender community remained largely unrecognized by the cisgender population, and their health status was significantly overlooked. The first official census in 2011

recorded approximately 4.88 lakh individuals identifying as a third gender. However, it provided limited data, highlighting only a 43% literacy rate compared to the national average of 74%, indicating a scarcity of comprehensive information on this community.[8,19,22,26]

In the current era of development goals, particularly under SDG 5 (Gender Equality), which emphasizes equal opportunities for all, transgender individuals continue to face discrimination, stigma, and social exclusion in multiple aspects of life, including education and employment.[15,17]Lack of equality, restricted access to education, and socio-economic marginalization often compel many individuals in the community to engage in informal occupations such as begging, toli/badhai, and sex work. The resulting lifestyle, influenced by psychological distress, gender dysphoria, and limited employment opportunities, often leads to poor health behaviours such as smoking, alcohol and substance use, physical inactivity, and inadequate nutrition.[9,25,29]

Nutritional status is a key indicator of health and plays a crucial role in determining the overall well-being of individuals and communities. It is assessed through body composition measures, including fat mass and fat-free mass, which reflect the balance between nutrient intake, body reserves, and physiological losses. Body Mass Index (BMI) and Waist–Hip Ratio (WHR) are widely used indicators for evaluating nutritional status. BMI helps classify individuals as underweight, overweight, or at risk of obesity, while WHR provides insight into fat distribution and associated risks for cardiovascular diseases.[11,18,24,32] Quality of life is closely linked to adequate nutrition and physical activity, both of which contribute to reducing the risk of chronic diseases and improving overall health.[11]

Obesity, characterized by excessive body fat accumulation, has emerged as a growing public health concern in India, even as undernutrition continues to persist. Major contributing factors include poor dietary patterns, increasing age, and sedentary lifestyles with low levels of physical activity. BMI remains a fundamental and widely used measure to assess obesity-related risk, although it has certain limitations. Therefore, WHR serves as an additional indicator to better evaluate body fat distribution, particularly abdominal obesity within populations.[4,21,31]

Modern health development approaches emphasize holistic well-being, focusing not only on the absence of disease but also on achieving optimal physical, mental, and social health. While the National Family Health Survey (NFHS) provides extensive data on various population groups, it still lacks specific information on the nutritional status of transgender individuals.[18,24]

This gap highlights the need for focused research on this community. Monitoring nutritional status becomes especially important for transgender individuals undergoing hormone therapy, as changes in body composition and weight require careful assessment through anthropometric measurements. The present study does not aim to diagnose disease conditions but rather focuses on evaluating and improving physical fitness by examining anthropometric variables among transgender individuals.

JUSTIFICATION OF STUDY

Transgender community do not have specific consideration in Reference Value of Man and Women provided by NIN, India. Due to low visibility sparse of data available on health care system but government is doing appreciable work to improve on every phase of transgender. Lack of studies on dietary behaviour, nutritional intake and nutritional assessment methods and reference in

community. Food is a source of comfort and a way to cope up with social-suffering and ultimately nutritional status is directly influenced by food intake of an individual.[2]

OBJECTIVES OF STUDY IN POINTS

To assess and understand the BMI and waist -hip ratio among transgender individuals in National Territory of India and evaluate their applicability against existing anthropometric norms

SPECIFIC OBJECTIVES:

1) To determine the distribution of BMI Categories among transgender individuals.
2) To assess waist- hip ratio pattern and associated health risk levels.
3) To compare observed anthropometric values with standard male & female cut off.

METHODOLOGY

Research Design: This is survey research based descriptive research design to study nutritional status mapping of Transgender.

Locale of the Study: The National Capital Territory of Delhi, India was purposively selected as study locale. NCT Delhi is a major metropolitan area and offer high visibility of Transgender community with 4,213 population.

Sampling: In total 261 Transgender were selected through snowball sampling technique from Non-Government Organization located at different location in NCT Delhi.

Data Collection: The data was collected in a Scheduled Interview in person through self-structured questionnaire from May 2024 to November 2025.

Research Tools: Anthropometric measurements were done to evaluate nutritional status of the respondents using Digital Weighing Machine, Stadiometer, Non-stretchable Inch tape.

Statistics: Statistical analysis was done though SPSS 23.0 Version. Parametric test Anova was done to compare the mean. Further descriptive statistics was done study various variables of this study.

Ethical Approval: The study has been ethically approved by Ethical committee of Banaras Hindu University Validate with the Ethical Reference No. I. Sc./ECM-XVIII/2024-25 on 13.04.2025. Further, written consent duly signed by respondents were recorded.

RESULT AND DISCUSSION

Table No.1 Descriptive statistics of respondents

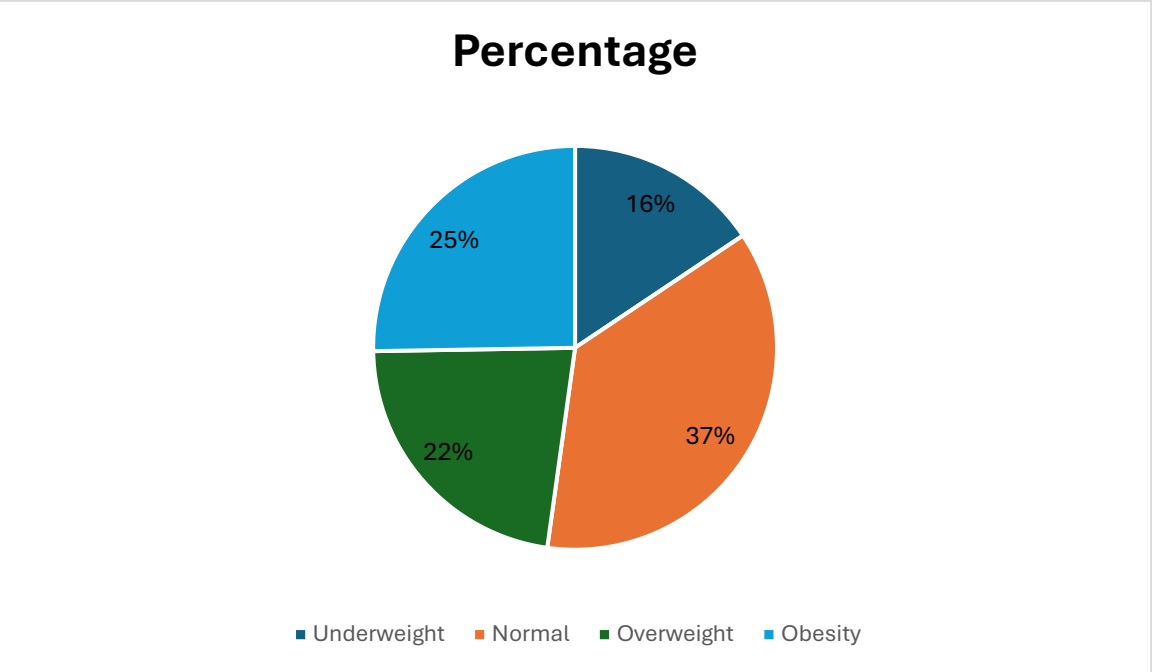
Variables	Cases (n=261)	Percent (%)
Gender		
Transman	12	4.6
Transwomen	249	95.4
Age		
17-45	254	97.3

46-60	07	2.7
Occupation		
Unemployed	25	9.6
Elementary	131	50.2
Other (Government/ Non-Government)	105	40.22
Education		
Low	82	31.41
Medium	107	40.99
High	72	27.58
Socio-Economic Status		
Lower	17	6.5
Upper Lower	140	53.6
Lower Middle	50	19.2
Upper Middle	54	20.7

Table no. 1 represents the demographic details of the respondents with maximum respondents being young below 45 years in age group of 17-45 years. With Increasing age, the percent of transgender decrease might be due to high suicidal rate among them and these finding are consisting with previous studies The result is consistent with previous finding, they considered factors life psychological stress, anxiety, depression and rejection by family major responsible factors to attempt suicide. Medium education was the highest degree attained by 40.99 percent which included High school and Intermediate following 31.41 % attaining lower level (Illiterate, primary, middle school) of education and 27.58 % attaining High level (Graduation and professional degree) of education. Similar reports have been found from Bangladesh study reporting highest percentage attaining primary education while lowest from graduation level.[9,14,20] Due to rejection, inner conflict of gender, socio-economic constrain they are not able to continue higher studies and bullying by peer group is the main reason behind low status of education.

The study finds 50.2 % individuals forced to choose elementary occupation and 40.22 % indulge in Government and Non-Government jobs and remaining 9.6 % were unemployed which highlights the worst situation of transgender which was similar to previous studies in India and other countries, due to negative environment faced by transgender at workplace due to their gender expression, discrimination therefore were bind to choose sex work, begging and dancing, Red light bagging as elementary occupation and few working as outreach worker, peer educator in NGOs.[13,28]

Fig No.1 Distribution of respondents according to their Body Mass Index



The **fig no. 1** shows 37%, 25%,23% and 16% as normal, obesity, overweight and underweight, respectively. The sample having 23.14± 4.48as Mean value of BMI which depicts population having normal BMI. The data is contradictory with previous study of 2021 which showed the highest percentage of population having 42.4% as obese and less were found normal.[3]

Table No. 2: Distribution of anthropometric variables among different type of gender

Gender	No.	Anthropometric Variables					
		Height		Weight		BMI	
		Mean	SD	Mean	SD	Mean	SD
Transman	12	158.72	10.70	56.02	9.4	22.25	3.24
Transwomen	249	166.11	6.86	64.03	13.54	23.17	4.52
Total	261	165.77	7.22	63.67	13.47	23.13	4.47
df= 259		t=3.536, P<0.01		t=2.024, P<0.05		t=0.695 P>0.05	

Table no. 2 finds the difference in average height, weight and BMI which was observed as 158.72cm, 56.02 and 22.5 respectively for Transman and 166.11cm, 64.03kg and 23.13 respectively for transwomen which is not consistent with reference man and women given by NIN as marked in above **table no. 3** and significant difference between transman and transwomen was observed in height and weight with p value less than 0.01 and 0.05 respectively. Many research claim the increased weight and BMI in Transwomen group is due to poor dietary habits and sedentary lifestyle.[9] This might be the reason, but the range is very well specified if they are

considered according to their biological sex, transwoman were man and transman as women as the physical structure of body is usually according to sex but no specific clear understanding of gender dysphoria is identified although studies claim biological sex, hormonal disbalance, gene expression, physical deformities and psychological reason for gender non-confirmatory to assigned sex .[1]

Table No. 3: Anthropometric variables according to NIN

Gender	Variable	Reference Value by NIN (2020)
Man	Height Weight	167-172 cm 65kg
Women	Height Weight	152-160cm 55kg

Table no. 3 shows the standard reference value for man and women as given by National Institute of Nutrition. The table value has been used to compare the result of transman and women.

Table No. 4 Frequency of respondents taking hormone therapy

Variable	Frequency	Percentage
Taking Hormone Therapy	52	20.0
No hormone Therapy	209	80.0

Table no. 4 finds that 20% of transgender taking or taken hormone therapy to affirm their gender while 80% were not taking. The percentage of those taking less therapy was mainly due to lack of medical facility and knowledge in the particular treatment. In India medical fertility improving well in hormone treatment for gender affirmation and well appreciated still lack of knowledge, socio-cultural beliefs restrain transgender to take therapy from authorised clinics and self-medication and other treatment they considered as hormone therapy and might not be worthful for them.[27] Those who taking Hormone therapy usually include after puberty and that does not bring much changes Height is usually affected by testosterone if hormone therapy given before puberty might bring some change.[5] According to Endocrine Society Guideline (2017) it is found hormone therapy does not bring changes in anthropometric parameter (height and weight) although induce secondary sex characteristics in a time period.[12]

Table no. 5 Distribution of respondents Body Mass Index according to their age status

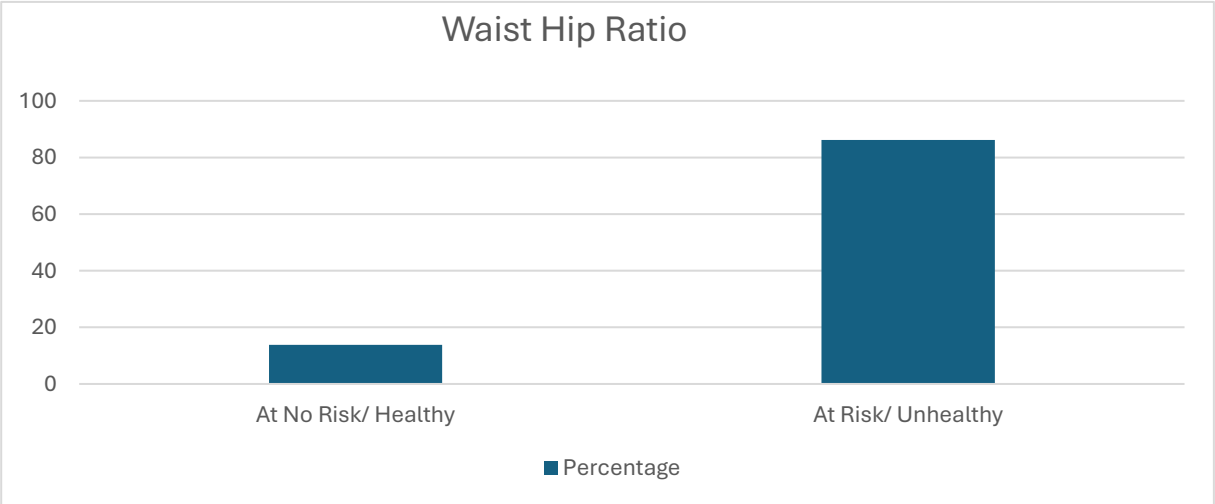
Level	Age							
	<25		25-34		35 & above		Total	
	N	%	N	%	n	%	n	%
Underweight	29	21.8	07	8.0	03	7.3	39	14.9
Normal	49	36.8	33	37.9	09	22.0	91	34.9

Overweight	31	23.3	15	17.2	10	24.4	56	21.5
Obesity	24	18.0	32	36.8	19	46.3	75	28.7
Total	133	100.0	87	100.0	41	100.0	261	100.0
Mean ± SD	21.91± 3.79		23.81 ±4.20		25.66± 5.67		23.14±4.48	
F= 13.692, P<0.01, sig pairs = (1vs2,3) (2vs3)								

Above **table no. 5** shows distribution of nutritional status (BMI) according to age group, 25-34 age group shows maximum percentage (37.9) were having normal BMI, following < 25 years age group (36.8%), 35 & above age group having least (22.0%) within their group. Obesity was highest in 35& above years age group having 46.3 %within this group and least (18%) were in below 25 years of age group. Age is significantly($p<0.01$) affecting nutritional status.

Age is significantly studied in previous years research and has been considered as contributing factors as the age is increasing obesity rate is increasing possible reason are poor sedentary like, high alcohol consumption, smoking, tobacco consumption, and low physical activity with increased age.[10,23]

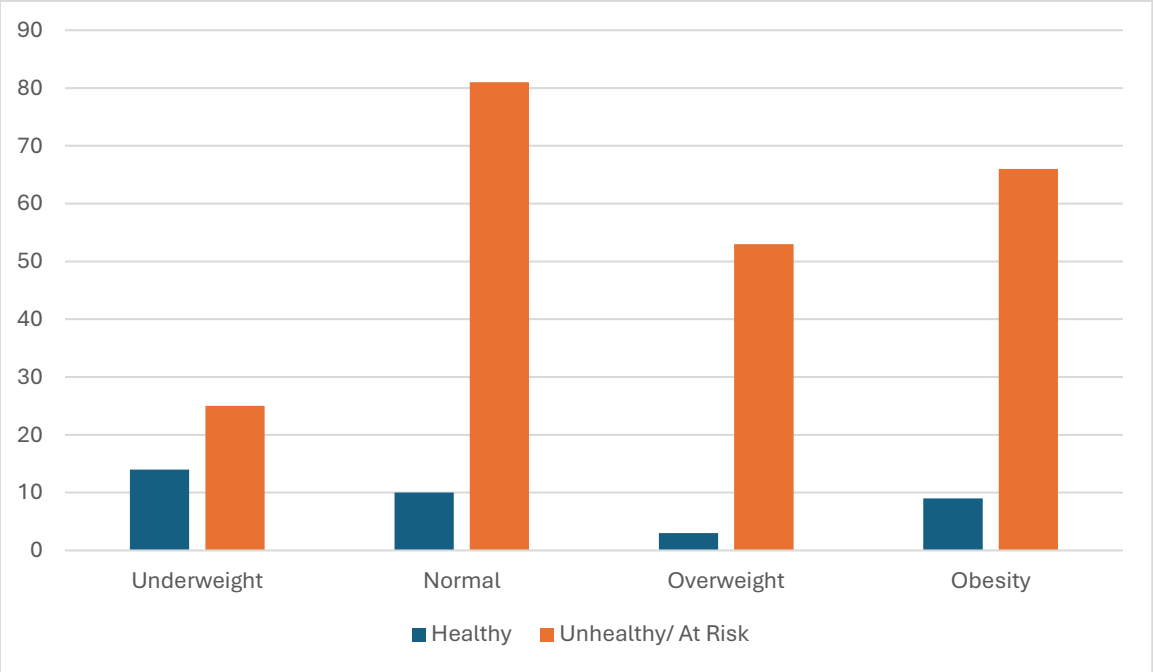
Fig No. 2: Distribution of respondents according to their Wait Hip Ratio



Mean ± SD	0.91±0.05
Range	0.70-1.24

Fig2. Show percentage of population at risk or unhealthy, waist hip ratio measures the central obesity among respondents. While only 13.8% were healthy. The maximum percentage of unhealthy population is distributed in all group of BMI i.e., Underweight, Normal. Overweight and Obesity. The mean Wasit hip ration value is 0.91 just above base value as compared to standard value i.e. 0.9, while female WHR is 0.85.

Fig No. 3: Distribution of waist–hip ratio (WHR) risk categories across different BMI groups



The clustered bar chart **figure no.3** shows the distribution of **waist–hip ratio (Health risk categories) across different BMI groups**. The findings show that higher percentage of population in all BMI categories are unhealthy **or at risk of developing central.** Among individuals with **normal BMI**, the majority were still classified as having an unhealthy WHR (approximately 80%), while only a small proportion were within the healthy range (around 10%). Similarly, in the **overweight and obesity categories**, maximum percentage of participants exhibited an unhealthy WHR, indicating a higher risk of central obesity. Even among **underweight category showed the similar distribution but the** difference was less pronounced compared to other BMI groups. WHR is a parameter to study obesity related CVD. The maximum percentage of unhealthy WHR might be due to Hormone Therapy, Lifestyle changes, Psychosocial stress as these findings are consistent with previous studies. Studies revealed that those taking hormone therapy or medicine show changes in body fat distribution, especially abdominal region in Transgender Community. There was paucity of data on clear vision of hormone therapy, very less percent taking and usually from local medical shops.[6,30]

CONCLUSION

Transgender individual visibility is increasing after been recognized in 2011 census but major research have been done in field of mental and psychological health, less studies done to understand particular nutritional requirement for transgender specific to their physical body requirement. Struggling with gender identity create a barrier for individual development and preferring transition therapy requires specific guideline which is lacking in India. Anthropometric parametric are usually observed according to their sex birth, possible reason those taking hormone therapy need to be clearly studied and puberty is major responsible factor for bringing changes in physical parameter but in India usually those taking hormone therapy is after puberty, therefore transman was matching with reference value of standard female and similarly for another group as defined by NIN. Also, there is no mention of Transgender individual in NFHS so they also need to

be researched so that specific group can be included in guideline, also therapeutic guideline to be designed specific to body changes in hormone therapy and anthropometric changes should also be monitored.

Suggestion: In future studies can be done on large sample size to have clear understanding to anthropometric measurement standards among transgender and how they differ from cisgender. The National Institute of Nutrition and Indian Council of Medical Research has focused on biological sex distribution for nutrient requirement and reference parameters of anthropometric measurements. The future studies can contribute to inclusion of Transgender in National Family Health Surveys in India, making visibility to vulnerable group.

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SUPPLEMENTING IRON FORTIFIED WHEAT FLOUR BASED FOOD ITEMS: ACCEPTANCE, COMPLIANCE AND PREFERENCE – IS THE YOUNG GENERATION READY?

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ABSTRACT

Children and women of reproductive age worldwide are at risk of anemia, in both developed, as well as developing nations, with prevalence still on the rise globally. The World Health Organization and Food and Agriculture Organization guidelines have advocated four main approaches – nutrient supplementation, food fortification, nutrition education, and dietary diversification, for the prevention and control of micronutrient deficiencies. Food fortification is thought to be the most efficient and cost-effective of the four techniques. It is seen as a very sustainable approach globally to address micronutrient deficiencies and promote public health, and also being regarded as a potential solution for combating iron deficiency anemia, with very little behaviour change required for implementation. The inclusion of iron fortified foods in the diet is more feasible and acceptable as compared to consumption of iron supplements. Public awareness regarding the prevention and control of iron deficiency anemia by incorporating iron fortified foods in daily diets is very much needed. Assessing the acceptability of the fortified food items is equally important. Hence, this study was designed with the primary objective of evaluating the acceptance, compliance and preference of iron fortified wheat flour-based food items supplemented in the diet of the young generation of Higher Education Institution. In all 28 youth were given food products using 50g of fortified wheat flour (9 food items) for a period of four weeks. The results revealed a very positive attitude of the young generation towards the supplemented iron fortified food items, with majority of them demonstrating very good compliance and acceptance. Use of the iron fortified wheat flour-based food items in the future also was indicated, along with willingness to spend slightly more for these products. Thus, there is a need to devise advocacy strategies to promote the use of iron fortified products.

Keywords: Acceptance, Anemia, Compliance, Iron Fortified Wheat Flour

INTRODUCTION

Iron deficiency anemia has been prevalent globally since ages, negatively impacting the health of a significant number of people that primarily includes preschool children, school age children, adolescent girls, pregnant women and lactating mothers (Bathla & Arora, 2022). The progress made for reduction in anemia among the reproductive age women globally, regionally, and in almost all nations, is inadequate with regard to meeting the World Health Assembly target to bring down the prevalence of anemia to half by the year 2030. It is necessary to have an improved understanding of the context-specific bases of anemia and to develop multisectoral interventions that effectively address these reasons (Stevens et al., 2022). A low-cost solution that has the potential to combat malnutrition worldwide is food fortification. Research on food

fortification has demonstrated beneficial outcomes in terms of economic, social, and environmental aspects as well as the prevention and management of micronutrient deficiencies in vulnerable groups, particularly women and children (Olson et al., 2021).

Millions of individuals worldwide suffer from micronutrient deficiencies, which have an adverse effect on mental and physical development and lower productivity. Food fortification research has demonstrated encouraging outcomes in preventing and controlling malnutrition, especially in high-risk populations like women and children. In addition to approaches like nutrient supplementation, biofortification, and consuming a balanced and diversified diet, fortification is a useful and affordable way to lower micronutrient deficits. Ensuring that processed foods have important micronutrients and are well suited for human consumption is crucial for both developed and developing nations (Chaudhary et al., 2025).

For billions of people globally, food fortification is a crucial public health strategy that efficiently bridges the gap between inadequate diets and sufficient nutrition. Iodized salt, cereals enriched with folic acid, and dairy products fortified with vitamin D have all shown noteworthy results over the past century, in lowering micronutrient deficits, preventing birth abnormalities, and improving physical and cognitive development. These successes highlight the affordability, scalability, and ability of fortification to passively supply nutrients to different population groups. Moreover, foods enriched with nutrients are becoming more sustainable and effective owing to further developments in food fortification technologies (Ashraf, 2025). Iron insufficiency is an issue globally. Dietary supplementation with iron-fortified foods is more feasible and widely accepted than therapeutic iron supplementation. A high degree of public awareness and on-going product and process innovation are necessary to prevent iron deficiency through the widespread use of iron-fortified foods (Man et al., 2022).

OBJECTIVES OF THE STUDY

1. To assess the acceptance, compliance, and preference of iron fortified wheat flour-based regional food items, after supplementation in the daily diet of university students.
2. To understand the likelihood and readiness of the students for using iron fortified food items on a regular basis, for the prevention and management of iron deficiency anemia.

METHODOLOGY

Iron fortified wheat flour was procured from the open market, using an online platform. Commonly consumed wheat flour-based food items were identified for supplementing in the daily diet, and iron fortified wheat flour-based recipes were then standardized. A total of nine regional recipes were developed, replacing regular non-fortified wheat flour with iron fortified wheat flour. All the other ingredients remained the same as in the original recipes. The nine recipes shortlisted for supplementation were roti, khakhra, masala thepla, methi thepla, farsi puri, methi puri, namkeen sakarpara, sukhdi, and sheero. Each recipe incorporated 50g of iron fortified wheat flour along with other standard ingredients. The iron content in regular wheat flour, fortified wheat flour, and reported after nutrient analysis of the fortified wheat flour is given below:

Iron in Regular Wheat Flour (mg/100g)	Added Iron After Fortification (mg/100g)	Total Iron in Iron Fortified Wheat Flour (mg/100g)	Total Iron Reported After Lab Analysis (mg/100g)
4.0mg	**1.8mg**	**5.8mg**	**9.05mg**

The comparison of the iron content in the nine traditional wheat flour-based recipes with and without iron fortified wheat flour is given below:

Sr. No.	Wheat Flour Based Traditional Recipes	Iron Content Using 50g Regular Wheat Flour (mg)	Iron Content Using 50g Fortified Wheat Flour (mg)
1.	Roti	2.0mg	2.9mg
2.	Khakhra	2.0mg	2.9mg
3.	Masala Thepla	2.0mg	2.9mg
4.	Methi Thepla	2.9mg	3.8mg
5.	Farsi Puri	2.0mg	2.9mg
6.	Methi Puri	2.6mg	3.5mg
7.	Namkeen Sakarpara	2.2mg	3.1mg
8.	Sukhdi	2.0mg	2.9mg
9.	Sheero	2.0mg	2.9mg

The female students from different departments of the Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India, were enrolled for the supplementation trial. Every day, for a period of four weeks, the students (N=28) consumed any one of the nine-iron fortified wheat flour-based food items, on a rotation basis. Their feedback regarding acceptability, compliance, and their preference of the iron fortified food items was recorded at the end of the four-week period using a semi-structured questionnaire. Written informed consent was taken from the students prior to enrolment in the study. Ethical clearance was also obtained for the study from the Institutional Ethics Committee for Human Research (No.: IECHR/FCSc/Ph.D./10/2023/08). The data collected was subjected to appropriate statistical analysis and reported in terms of frequency and percentage.

FINDINGS AND DISCUSSION

The students enrolled for the supplementation trial belonged to all levels of higher education, ranging from first year of college to the doctoral level. The Iron Fortified Wheat Flour (IFWF) based food items were to be consumed by all participants daily for four weeks. At the end of the trial, their perception regarding compliance to daily consumption of the IFWF based food items, future use of fortified food items, and acceptance, likes, and dislikes was documented.

With regard to compliance, more than three fourth of the students (78.6%) reported consuming the IFWF based food items completely for 25-28 days, signifying more than 90 percent compliance with the fortified food item. The other less than one fourth of the students (21.4%) reported being able to consume the IFWF based food items completely for 22-24 days, signifying 80 to 90 percent compliance (Fig.-1). These results point towards good level of acceptance for the fortified food items considering none of the students had consumed IFWF based food items earlier.

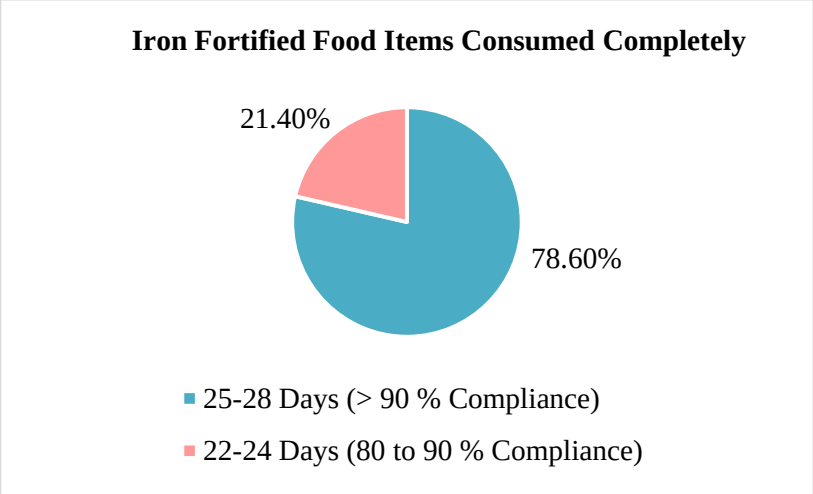

Figure 1: Iron Fortified Wheat Flour Based Food Items Consumed Completely by Students

The opinion of the participants about their likes and dislikes, and their preference for each of the nine IFWF based food items was elicited using a 5-point Likert scale. It was revealed that methi puri, and masala thepla prepared from IFWF were the food items liked very much by 67.9% and 64.3% of the students respectively. The next iron fortified items in line were methi thepla, and namkeen sakarpara liked very much by equal proportion (60.7%) of the participants. About half of the participants reported liking the plain roti (served with a vegetable preparation) and farsi puri very much (Table-1). Traditional sweet preparations such as sukhdi and sheero were liked very much by around one third of the students, and liked slightly, also by about one third of the students. There were also few students who reported disliking sukhdi and sheero, not because of any of the sensory properties of these fortified food items per se, but because of aversion to these traditional sweets right from the beginning.

Table 1: Preference of Iron Fortified Wheat Flour Based Food Items (N %)

Sr. No.	Food Item	Liked Very Much N (%)	Liked Slightly N (%)	Neither Liked nor Disliked N (%)	Disliked Slightly N (%)	Disliked Very Much N (%)
1.	Roti (N=28)	16 (57.1)	7 (25.0)	4 (14.3)	1 (3.6)	0 (0)
2.	Khakhra (N=28)	2 (7.1)	17 (60.7)	2 (7.1)	6 (21.4)	1 (3.6)
3.	Masala thepla (N=28)	18 (64.3)	8 (28.6)	2 (7.1)	0 (0)	0 (0)
4.	Methi thepla (N=28)	17 (60.7)	10 (35.7)	1 (3.6)	0 (0)	0 (0)
5.	Farsi puri (plain) (N=28)	14 (50.0)	13 (46.4)	1 (3.6)	0 (0)	0 (0)
6.	Methi puri (N=28)	19 (67.9)	7 (25.0)	1 (3.6)	1 (3.6)	0 (0)
7.	Namkeen sakarpara (N=28)	17 (60.7)	9 (32.1)	2 (7.1)	0 (0)	0 (0)

8.	Sukhdi (N=28)	10 (35.7)	9 (32.1)	5 (17.9)	4 (14.3)	0 (0)
9.	Sheero (N=27)	10 (37.0)	9 (33.3)	4 (14.8)	3 (11.1)	1 (3.7)

*Figures in parentheses indicate percentage

The preference for khakhra was found to be the least, evident from the fact that only 2 students (7.1%) out of the total participants reported liking khakhra very much, while about two third of the students liked it slightly, and about one fourth of the students disliked it. The low preference for khakhra was because it was plain, devoid of any spices (except salt) and methi leaves, and not because they had been prepared using iron fortified wheat flour, as stated by the students in their feedback. It was very motivating to see that traditional food items made from wheat flour, like masala thepla, methi thepla, farsi puri, methi puri, and namkeen sakarpura were liked by more than 90% of the students. Some of the students even started referring to the namkeen sakarpara as 'crackers' owing to their textural properties, indicating a strong likelihood of acceptability of these typical recipes incorporating iron fortified wheat flour, by the younger generation. On similar lines, Govender et al., (2019) also found foods prepared from Provitamin A biofortified crops to be culturally acceptable and familiar, as perceived by the participants, who also suggested modifications for higher acceptability.

An attempt was also made to understand the perception of the college students about the effect of consuming IFWF based food items on their normal dietary pattern, and their attitude regarding the consumption of such food items in the future. When asked about whether or not the consumption of IFWF based food items had altered their daily dietary routine and reduced the frequency of eating outside food, nearly half of the participants responded in the affirmative, as shown in Fig.-2. Around two third of the participants reported having replaced one of their meals, either lunch or evening snacks, with the fortified food items. These findings probably indicate that the consumption of fortified food items may have contributed atleast to some extent, to the reduced frequency of eating out, as normally during week days, college students tend to consume some food items from outside either during the lunch hour or later in the evening. Impact evaluation specifically in this regard needs to be carried out in the future. Puri et al., (2022) in their sensory trial for evaluating the acceptability of fortified salt observed that future study on the impact of knowledge and awareness, on the acceptability of multiple fortified salt is crucial, particularly in large-scale trials. They found that there have been little investments and interventions to educate consumers about fortified foods, and there hasn't been enough consumer research in this field.

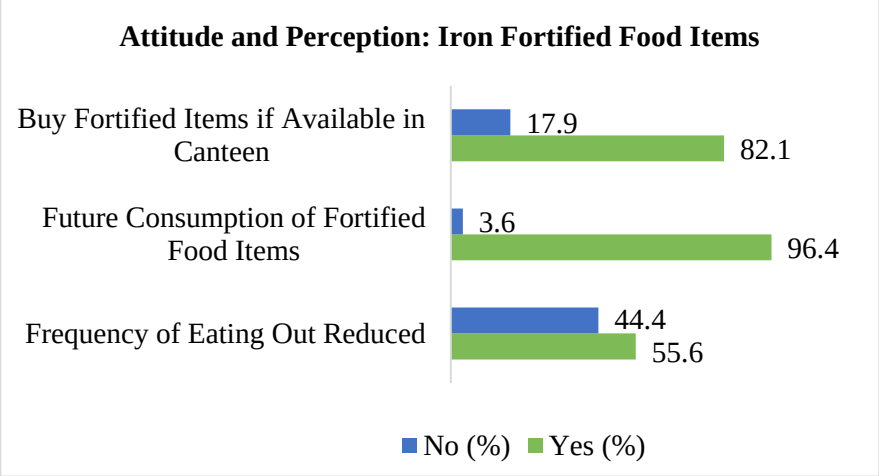

Figure 2: Attitude and Perception Related to Iron Fortified Wheat Flour Based Food Items

Information was also elicited from the students regarding their willingness and keenness to consume food items prepared from IFWF in the future. The responses obtained were quite encouraging as majority of the students (96.4%) showed eagerness and replied positively with respect to consuming IFWF based food items in the future also. When asked about the reasons for wanting to consume iron fortified wheat flour-based food items in the future, almost half of the participants (46.4%) mentioned good health as one of the primary motives for future consumption. Around 32% of the participants specifically mentioned improvement in hemoglobin levels and iron status as the reason for desiring to consume IFWF based food items in the future, whereas the remaining 18% of the participants were ready to consume iron fortified flour-based items in the future because they found the items to be similar to those prepared from regular wheat flour. These findings suggest a very positive perspective of the young generation towards fortified food items. According to Ryland et al., (2018), the motivation participants have for eating healthy, the age of the participants, the quantity and frequency of the fortified product use and the location of consumption are all potential factors that can influence acceptability. The perceived advantages for health and well-being, favourable and pleasant taste, cost savings, and cultural compatibility were the main drivers of fortified bouillon cube use as observed in a randomized household level intervention in northern Ghana, which looked at the initial levels and long-term shifts in perceptions and acceptance throughout the trial (Kyereh et al., 2026).

Also, very interestingly, around 80% of the participants indicated their willingness towards choosing to buy food items prepared from fortified ingredients, if made available in the college or hostel canteen, even at a slightly higher price. Similarly, a systematic review highlighting the evidence related to acceptance and adoption of bio-fortified staple yields in low income and middle income nations in terms of sociocultural determinants, sensory attributes, marketability, and consumer acceptance, stated that from a sensory and sociocultural viewpoint, these crops are generally favourably received, and the consumers are prepared to pay a (minimal) premium rate for the bio-fortified crops compared to the varieties that are not bio-fortified (Talsma et al., 2017)

All the recipes developed using fortified flour are traditional recipes and provided an additional approximately 2 mg of iron/recipe. On long run continuous intake of such acceptable

food items in the daily diet may go a long way to improve the iron status of the population at large. Looking into the cost and the ease of preparation, we feel that the fortified food products need to be advocated to sensitise the public.

CONCLUSION

The prevalence of iron deficiency anemia is on the rise despite several strategies for prevention and control. It is vital to devise a sustainable solution that is both, feasible and acceptable. Food fortification has come across as a promising long-term strategy that is easy to implement, and requires minimal behaviour modification. This study was designed to evaluate the possibility of college students using iron fortified wheat flour routinely in their diet for improved iron and haemoglobin status. Students' opinion regarding the consumption of iron fortified wheat flour-based food items indicates a positive outlook towards the food fortification approach for combating iron deficiency anemia. A high level of compliance to the consumption of iron fortified wheat flour-based food products by the students was found in this study. Acceptance of fortified foods was also evident from the fact that majority of the students approved of the fortified food items based on traditional recipes. Willingness to consume iron fortified wheat flour-based food items even in the future was observed, with readiness to spend little extra than the regular food items, if available in the canteens of their college or hostel. Thus, the results of the present study clearly indicate that there is a great scope in terms of compliance and acceptance for the use of iron fortified wheat flour-based food items in the management of iron deficiency anemia. There is a need to advocate the use of fortified wheat flour food products at micro and macro levels to strengthen the fortification programs of the country.

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A STATISTICAL INVESTIGATION ON PATTERNS AND MEDICAL CAUSES OF MATERNAL DEATHS IN A NORTHEAST STATE OF INDIA

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ABSTRACT

Maternal mortality is the only vital indicator which shows the greatest disparities between developed and developing countries. Reducing maternal mortality is one of the key components in international development goal. The objectives of the study were to find out the patterns and significant change of medical causes of maternal deaths in Sikkim during 2000 to 2012. The study was a descriptive and secondary based study. Maternal deaths reported during 2000 – 2012 published by the Births and Deaths Cell, Government of Sikkim was used for data analysis. A total number of 174 medically certified causes of deaths (MCCD) of maternal deaths were registered during 2000 to 2012. There were 73 registered medically certified causes of deaths (MCCD) related to maternal deaths during the year 2007 and 2012based on International Classification of Diseases (ICD-10 Code). Direct causes of maternal deaths were higher than the indirect causes of deaths. It was observed that direct causes accounted for 66 (90.41%) deaths while the indirect obstetric causes contributed7 (9.59%) deaths to total registered maternal deaths. The first five leading single direct causes of maternal deaths were observed to be postpartum haemorrhage 22 (30.1%), pregnancy induced hypertension 10 (13.7%) followed by eclampsia 9 (12.3%), ectopic pregnancy 6 (8.2%) and abortion 4 (6.15%). The first three leading causes accounted for 62.12% to the total direct causes of deaths. Anaemia and jaundice contributed 71.43% and 14.29 % to the total indirect obstetric causes of deaths accounted for 85.71%) deaths during the years 2007 to 2012.

Keywords: Maternal death, Direct obstetric causes, Postpartum haemorrhage, Anaemia

INTRODUCTION

Childbirth is a very crucial life event for women**.** It is well established that women's experiences at the time of giving birth are central to their own and their families' health and well-being (Bayes S et al., 2008). "The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause

related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes" (WHO, The World Health Report 2005). The maternal mortality ratio (MMR) is one of the most effective common indicators about the magnitude of maternal mortality. It is a progress indicator for Millennium Development Goals (MDGs) target 5 which aims at reducing the ratio by three quarters over 1990–2015, implying an average annual rate of reduction of 5.5 % (UN Millennium Development Goals, 2005). It also highlights the quality of provisions and activities for both maternal and child safety as well as child health care and resident's health status of the any society. It is the only indicator that shows the largest disparities between developed and developing countries (WHO, The World Health Report 2005). According to a report of (Trends in Maternal Mortality: 1990 to 2010, 2012), developing countries account for 99% of the global maternal deaths while only 1% occurred in developed countries. The MMR in developing countries was 240 deaths per 100,000 live births while in developed countries it was 16 per 100,000 live births, (Trends in Maternal Mortality: 1990 to 2010, 2012). Pregnant women die every two minutes because of severe bleeding during childbirth, high blood pressure, infections and unsafe abortion. This statistic highlights the denial of women's rights to safe motherhood in many parts of the world, particularly in low-resource countries where 99% all maternal deaths occur ((WHO, The World Health Report, 2005). Dying as a result of pregnancy or childbirth is about one in six in the poorest parts of the world compared with about one in 30 000 in Northern Europe. Such a discrepancy poses a huge challenge to meeting the fifth Millennium Development Goal to reduce maternal mortality ratio at 109 by 2015 globally (Ronsmans and Graham, 2010).

The MMR of India has declined from 398 in 1997-1998 to 327 in 1999-2001, further to 301 in 2001-2003 and from 254 in 2004-2006 to 212 in 2007-2009 (RGI, 2011). Another survey report, National Family Heath Survey (NFHS-3) showed that MMR had not changed significantly from 424 (95% C.I: 324-524) in 1992-1993 (NFHS-1) to 540 (95% C.I: 428-653) in 1998-1999 (NFHS-2) (NFHS-3, IIPS, Mumbai, 2007).The Millennium Development Goals (MDGs) have set India to achieve the target of achieving 200 maternal deaths per 100000 live births by 2015 (RGI, Maternal Mortality in India: 1997-2003 ,Trends, Causes and Risk Factors, 2006).

According to the National Family Health Survey -3 (NFHS-3, 2005-2006: Sikkim) report, mothers who had at least 3 antenatal care visits for their last birth in Sikkim increased from 44.1 percent in NFHS-2 to 69.4 percent, institutional deliveries from 31.5 percent to 49.0 percent, total fertility rate came down to 2.0 from 2.8, 48.5% mothers received post-natal care from doctor/nurse/LHV/ANM/other health personal within 2 days of delivery for their last birth. The report also stated that 55.8 per cent of births were assisted by a doctor/nurse/LHV/ANM/Other health personal which was 35.1 percent in NFHS-2 (NFHS-2, 1998- 99: Sikkim). Thus, the finding of this study can be helpful in monitoring the specially targeted programmes and policies of maternal health care provided by the government in the state.

OBJECTIVES OF THE STUDY

The objectives of the study were to study the patterns and significant changes of medical causes of maternal deaths in Sikkim during 2000 to 2012.

Null hypothesis - There were no significant changes in medical causes of maternal death in Sikkim during the study periods.

Methodology - The study was a descriptive and secondary based study. All the registered maternal deaths based on Medically Certified Cause of Deaths (MCCD) during 2000 to 2012 and registered pregnancy related deaths recorded from 2007 to 2012 were selected using universal sampling techniques. Data were extracted from the various annual statistical reports on registration of births and deaths in Sikkim published by Births and Deaths Cell, Government of Sikkim. Data was analyzed by using frequencies, percentages and proportions. The Chi- square test for trends in proportion (Cochran – Amritage test) was used to test the change over time for causes of maternal deaths.

FINDING

Table 1 showed the causes of maternal mortality in Sikkim during 2000 to 2012. A total number of 174 medically certified causes of deaths (MCCD) of maternal deaths were registered during 2000 to 2012. The first leading cause of maternal deaths was found to be complication related to pregnancy and child birth and puerperium 76 (43.68%). Sixteen of them (9.20%) had not stated about the cause of deaths and 19 (10.92%) were not elsewhere classified during this period. Seven registered maternal deaths (4.02%) were related due to other accidents. Deaths due to cancer, paralysis, chronic liver diseases and cirrhosis contributed 6 (4.45%) each to total maternal deaths. Nine (5.17%) maternal deaths were found to be due to anaemia. Deaths due to bronchitis and asthma, heart diseases and heart attack, tuberculosis accounted 4 (2.3%) each to total registered maternal deaths. There were 2 (1.15 %) each of maternal deaths who died due to abortion and jaundice. Deaths due to accidental deaths, certain condition as birth injury , slow growth of foetus and premature, diabetes mellitus , meningitis ,rabies , typhoid fever and paratyphoid accounted 1(0. 57%) to total registered medically certified cause of deaths. Only five main causes of maternal deaths where the absolute frequency was more than five were used in data analysis for finding the statistically significant during this period. Other causes of deaths even though more than the absolute frequency 5 were not included in the analysis as their specific cause were not found in the report.

Table no.: 1 Year wise distribution of causes of maternal deaths (Medically certified cause of death during 2000 to 2012)

Cause of deaths	Total	Percent (%)
Abortion	2	1.15
Accidental burn	1	0.57
Anemia	9	5.17
Bronchitis and Asthma	4	2.30
Cancer	6	3.45
Cerebrovascular (Paralysis)	6	3.45
Certain condition as birth injury, slow growth of fetus and premature	1	0.57
Chronic Liver diseases and Cirrhosis	6	3.45
Complication related to pregnancy and child birth and Puerperium	76	43.68
Diabetes Mellitus	1	0.57
Heart Diseases and Hearth Attacks	4	2.30

Meningitis	1	0.57
Pneumonia	3	1.72
Jaundice	2	1.15
Not stated	16	9.20
Other Accidents (not elsewhere classified)	7	4.02
Others not elsewhere classified	19	10.92
Rabies	1	0.57
Transport accidents	3	1.72
Tuberculosis	4	2.30
Typhoid fever and Paratyphoid	1	0.57
Ulcer of stomach and Duodenum	1	0.57
Total	**174**	**100.00**

Table no.: 2 Percentage distributions of 5 top causes of maternal mortality in during 2000 to 2012

Cause of deaths	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**	P
Anemia	11.11	11.11	22.22	0	0	0	22.22	11.11	0.00	0	11.11	11.11	0	9	NS
Cancer	16.67	0	0	0	0	0	0.00	16.67	50.00	0	0.00	16.67	0	6	< 0.001
Cerebrovascular (Paralysis)	0	0	33.33	0	0	0	0.00	16.67	0.00	33.33	0.00	16.67	0	6	< 0.01
Chronic Lever diseases and Cirrhosis	0	0	16.67	0	0	0	0.00	33.33	0.00	33.33	16.67	0.00	0	6	< 0.01
Complication related to pregnancy and child birth and Puerperium	0	9.211	2.632	3.947	9.21	5.26	9.21	3.95	11.84	7.89	10.53	5.26	21.05	76	<0.001
Total	**1.942**	**7.767**	**6.796**	**2.913**	**6.80**	**3.88**	**8.74**	**7.77**	**11.65**	**9.71**	**9.71**	**6.80**	**15.53**	**103**	

Table no. 2 showed the percentage distribution of causes of maternal deaths in Sikkim during 2000 and 2012 which was based on International Classification of Diseases, Tenth Revision, (ICD - 10 Code developed by World Health Organization (WHO). It showed that there were significant change in maternal deaths due to complication related to pregnancy and child birth and puerperium, cancer, paralysis, and chronic liver diseases and cirrhosis ($P < 0.01$) while no significant change was observed in the cause of deaths due to anaemia. ($P > 0.05$) in the study. Hence, the null hypothesis that there is no significant change in cause of maternal deaths has been rejected in the study.

There were 73 registered pregnancies deaths based on ICD -10 Code during the year 2007 and 2012. Table no. 3 showed the distribution of top 5 direct causes of pregnancy deaths. The study found that 66 (90.41%) were due to direct causes of maternal deaths while the indirect causes contributed 7 (9.59%) to total registered deaths during the study periods. The first four leading single causes of direct maternal deaths were observed to be postpartum haemorrhage 22 (30.1%), pregnancy induced hypertension 10 (13.7%) followed by eclampsia 9 (12.3%), and ectopic pregnancy 6 (8.2%). There were 4 (6.15%) maternal deaths due to abortion in the study.

Table no.: 3 Distribution of top 5 direct causes of maternal deaths based on International Classification of Diseases (ICD -10 Codes, Major Cause Group, XV: Pregnancy, Childbirth and the Puerperium (O00-O99)) during 2007 to 2012)

Rank	Direct cause of maternal deaths	Frequency	Percent to total deaths (%)	Cumulative Percent(%)
1	Postpartum haemorrhage	22	33.85	33.85
2	Pregnancy induced hypertension	10	15.15	49.00
3	Eclampsia	9	13.85	62.85
4	Ectopic pregnancy	6	9.09	71.94
5	Abortion	4	6.15	78.09
6	Other direct causes	15	22.72	100.81
	Total	**66**	**100.81**	

Table 4 showed the distribution of top indirect cause of maternal deaths in Sikkim during 2007 to 2012. The study found that the indirect causes contributed 7 (9.59%) to total maternal death during the study periods. Maternal death due to anaemia and heart disease contributed 71.43% and 14.29 % respectively to the total indirect cause of maternal deaths. These two indirect causes contribute 85.71% to total maternal deaths. There was one case of death due to jaundice during the years 2000 to 2012.

Table no.: 4 Distribution of top indirect cause of maternal deaths in Sikkim based on ICD -10 code during 2000 to 2012

Indirect cause of maternal deaths	Number of maternal deaths	Percent to total deaths (%)	Cumulative Percent
Anaemia	5	71.43	71.43
Dilated cardiomyopathy (Heart disease)	1	14.29	85.71
Pregnancy with jaundice	1	14.29	100.00
Total	**7**	100.00	

DISCUSSION

It was observed in the present study that 33.85% of maternal mortality was caused by haemorrhage, making it the primary cause. Pregnancy induced hypertension leads to 15.15% of maternal deaths, followed by eclampsia (13.85%), ectopic pregnancy (9.09%), and abortion (6.15%). Our finding that postpartum haemorrhage was the leading cause of deaths was consistent with other studies conducted in different part of India and other countries (Say L et al., 2014; Hoj (1997), Khan et al., (2006), Gupta et al., (2010), Asamoah et al., (2011). A report by the WHO (1994) summarises the direct obstetric caused leading to maternal mortality around the world. Around 80% of maternal deaths are due to direct causes that is obstetric complication of pregnancy, labour and puerperium to intervention or incorrect treatment and 20 % are due to indirect causes, (WHO, 2005, 2012). The major causes of maternal deaths in India according to sample registration system (SRS, 2001 – 2003) survey report was haemorrhage (39%), sepsis (11%), hypertension (5%), obstructed labour (5%), abortion (8%) and other condition (34%).

In the present study direct obstetric cause of deaths was higher (90.41%) than the indirect cause of maternal deaths (9.59%). The study by Kale and Costa (2009) found that direct obstetric causes corresponded to 77% of the maternal deaths. A study of Geubbels, E (2010) in Malawi found that direct cause of maternal contributed to the maximum number of maternal deaths and the most common cause were sepsis, haemorrhage and obstructed labour.

The study of Atrash (1990) found that thrombotic pulmonary embolism, pregnant induced hypertension complication, postpartum haemorrhage, and infection were the main cause of maternal deaths in United States during 1976 to 1986. A study conducted by Bano et al., (2011) in Pakistan found that eclampsia, post-partum haemorrhage and sepsis caused 23, 13, and 13 maternal deaths out of 108 maternal deaths found during the study period. A study conducted by Bhattacharya et al., (2008) in India found that maternal deaths due to direct causes accounted for 82.09% of total deaths and hypertensive disorder 36% and haemorrhage 30%, sepsis 20% were the main direct causes of maternal deaths. Paul et al., (2011) highlighted that out of the total maternal deaths, direct causes were responsible for 76.7%. A study of Puri et al., (2011) on maternal mortality in an urban tertiary care hospital of north India found that the analysis revealed that 55.39% of deaths are due to direct obstetrics causes, 40% due to indirect obstetrics causes and 4.61% due to unrelated causes.

In the present study 9.59% of deaths were related to indirect cause of deaths such as pre-existed diseases of the pregnant women or disease acquired during pregnancy which are not related to direct obstetric causes but make more complicated and aggravated by the physiological changes during pregnancy. Maternal anaemia affects about half of pregnant women. Pregnant adolescents are more prone to anaemia than older women, and they often receive less care, (Park, 2013). Anaemia (19%) was not only the leading cause of deaths but also an aggravated factor in haemorrhage, sepsis. (RGI, Maternal Mortality in India, 2006). Study of Rajaram et al., (2005) on determinants of maternal mortality in a hospital in south India found that causes of death were hepatitis (5.8%), heart disease (4.7%), and severe anaemia (2.3%) which can be contributed as indirect causes. A study conducted by Gupta et al., (2006) on maternal mortality in seven districts of Uttar Pradesh--an ICMR task force study found that a total of 286 maternal deaths anaemia and jaundice (17.4%) were the most prevalent indirect causes of maternal deaths. Study of Agarwal et al., (2007) in an urban slum area of Delhi found the 27 (38.6%) of maternal deaths were due to indirect causes and anaemia was the main cause of death. Bhattacharya et al., (2008) highlighted that out of the total maternal deaths malaria 9% and anemia 7% were most common indirect causes of maternal deaths. Study of Paul et al., (2011) showed anaemia as the leading indirect cause, resulting in almost 13% of maternal deaths. The reasons for maternal death can be contributed to many factors like utilization of maternal health care facilities and provisions during the time of pregnancy, childbirth process and postnatal periods. Many studies revealed that maternal care services utilization was associated with social, economic, cultural and geographical factors, (Duong, et al., 2004; Thind et al., 2008; Kamal , 2009).

SUMMARY, CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS OF THE STUDY

Summary: There were significant changes in the patterns of causes of maternal deaths in the state except anaemia during the study periods. The first leading causes of maternal deaths were found to be related to complication related to pregnancy and child birth and puerperium (43.93%) followed by Others not elsewhere classified (10.91%) based on MCCD. The three major medical cause of maternal deaths based on ICD-10 Code were found to be postpartum haemorrhage 22 (30.14%), pregnancy induced hypertension 10 (13.70%) and eclampsia 9 (12.33%). There were significant changes in mortality in all causes of among the causes of maternal deaths due to complication related to pregnancy and child birth and puerperium, cancer, paralysis, and chronic liver diseases and cirrhosis ($P < 0.01$). There were 7 indirect causes of maternal deaths in which anaemia contributed 5 (6.9%) followed by one case each of heart disease and jaundice.

CONCLUSION

It was observed that complication related to pregnancy, others not elsewhere classified and not stated about the cause of deaths contributed the maximum number of registered maternal deaths during the study periods. Direct obstetric cause of deaths was higher than the indirect cause of maternal deaths in the state. The study had found a significant change in medical causes of maternal death in the state which may due to the changing life style of women's and utilization of health services and health facilities, poor transportation, and geographical location. It is important to give awareness programme about the utilization of maternal health care services provided at health centres as it would help to reduce the incidence of maternal mortality in the state.

IMPLICATIONS

The study is based on hospital data certified by medical doctors about the causes of maternal deaths. The study provides information on disease prevalence, patterns of maternal mortality in the state. When it is monitored over a long period of time it may able to assist in assessing changes in disease and deaths patterns among the pregnant women thus helping the health planner in the state to re –order their priority while making programme and policies related for maternal health in the state.

RECOMMENDATIONS

As the present study was a descriptive based on secondary data, the study did not reflect the causes for unregistered maternal deaths in the state. Community – based and prospective cohort studies are needed to find out the causes of deaths at grassroots level and to evaluate the impacts of national and state programmes related to maternal benefits schemes. Multi- centric studies in different districts will help to understand the true burden of maternal deaths in the state.

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TIFFIN VS. NON-TIFFIN: HOW LUNCH CHOICES AFFECT SCHOOL KIDS' CONFIDENCE AND MEMORY

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ABSTRACT

School children's emotional and cognitive development is influenced by various factors, including their dietary habits and school routines. This study compares the levels of **confidence** and **memory** between Tiffin feeder and Non-Tiffin feeder school children. A total of 60 students aged 13–14 years (30 Tiffin feeder and 30 Non-Tiffin feeder) participated in this study, with data collected using standardized confidence and memory tests. Results indicated no significant difference in confidence between the two groups, but a notable difference was observed in memory performance, with Tiffin feeder children scoring higher. These findings suggest that while school routines related to meal provisions may not directly influence confidence, they do have a measurable impact on cognitive performance. This study provides valuable insights for educators and policymakers, emphasizing the need for balanced nutrition and routine interventions in promoting children's cognitive development.

Keywords: Confidence, Memory, School children, Tiffin feeder, Non-Tiffin feeder, Cognitive development

INTRODUCTION

The development of children during their school years is a multidimensional process integrating physical growth, cognitive functioning, emotional regulation, and social adaptation. Education has traditionally been measured through academic performance, but contemporary research emphasizes that the foundations of learning extend far beyond grades or test scores. Among the many psychological factors influencing a child's learning journey, confidence and memory are considered two of the most essential. Confidence represents a child's belief in his or her own capabilities, shaping how that child responds to challenges, engages in social situations, and adapts to changing academic demands. Memory, conversely, is the bedrock of cognition, determining how information is encoded, stored, and retrieved, forming the basis for learning, problem-solving, and creativity. Both confidence and memory are malleable traits shaped by biological predispositions, familial influences, educational environments, and, significantly, nutritional and lifestyle factors—making

them highly relevant to school children, who are particularly sensitive to their daily routines, including dietary practices.

Confidence in children has been widely studied within the framework of self-efficacy, as conceptualized by Albert Bandura in his work on social cognitive theory. Self-efficacy is more than mere self-esteem; it refers to the conviction that one can successfully organize and execute courses of action required to achieve goals. In educational contexts, this translates to a student's willingness to attempt challenging tasks, persist through failure, and actively participate in academic and extracurricular activities. Children with high self-efficacy are more likely to set ambitious goals, demonstrate resilience, and develop leadership qualities. Those with low confidence often avoid challenges, withdraw from participation, and internalize failures, leading to long-term academic and emotional consequences. Confidence is influenced by verbal encouragement from teachers and parents, observational learning from peers, and direct experiences of success or failure. However, the indirect role that nutrition and daily routines play in shaping this confidence remains underexplored. A child who consistently feels fatigued, hungry, or emotionally unsettled due to irregular nutrition may be less likely to display self-assurance in academic or social contexts.

Memory, as a cognitive construct, has been the subject of psychological inquiry for more than a century. Classic models such as the Atkinson-Shiffrin multi-store model have emphasized the processes of sensory memory, short-term storage, and long-term retrieval, while later theories, including Baddeley's working memory framework, have provided more nuanced understandings of the executive functions that regulate attention, processing, and recall. In the classroom, memory is evident not only in rote learning—such as memorizing multiplication tables—but also in integrating new knowledge with prior understanding and applying learned skills to novel contexts. Memory performance is influenced by both internal and external variables: biological factors such as age and neurological health are central, but environmental inputs like nutrition, sleep, and structured routines are equally crucial. For school children, whose brains are undergoing rapid development, access to consistent, nutritious meals provides the glucose, vitamins, and minerals necessary for optimal neural functioning. Deficiencies in nutrients such as iron and iodine are associated with lower memory scores and impaired concentration, while diets rich in protein and complex carbohydrates support sustained cognitive performance.

Nutrition is not merely a biological input but also a psychosocial experience interacting with a child's daily routines. In India, school meal practices differ widely, ranging from children who bring meals prepared at home—commonly called Tiffin—to those who rely on meals provided by schools or government programs, known as Non-Tiffin feeding. The Tiffin system, rooted in Indian cultural traditions, is often associated with parental care and individualized nutrition tailored to the child's tastes, fostering not only physical nourishment but emotional security through the association of food with home and family. Non-Tiffin feeding systems, including institutional arrangements like the Mid-Day Meal Scheme, represent collective efforts to ensure food accessibility regardless of socio-economic background. While these programs address hunger and food insecurity, the meals are standardized and may lack the personalization and nutritional variety of home-prepared Tiffins.

The differences between Tiffin and Non-Tiffin feeding are not merely logistical but potentially psychological. Children who bring Tiffins may perceive themselves as more connected to their families, experiencing continuity between home and school that contributes to emotional stability and confidence, and may benefit from meals aligned with individual preferences, reducing stress

around eating. Non-Tiffin feeders, while assured of meal access, may face uncertainty regarding food quality, cultural appropriateness, or stigma associated with government-provided meals. These differences raise critical questions about how meal practices affect children's nutritional status as well as their emotional confidence and cognitive performance, particularly memory.

The link between nutrition and cognitive functioning has been widely established in research across psychology, education, and public health. Grantham-McGregor and colleagues (2007) documented that malnutrition and irregular eating patterns contribute to reduced concentration, slower cognitive processing, and lower academic achievement in children from developing countries. In the Indian context, Patel et al. (2014) found that structured school meal programs could reduce aggression and anxiety while improving classroom engagement. These studies affirm that food access and quality are inseparable from educational outcomes. Yet the specific comparison between Tiffin and Non-Tiffin feeding systems, particularly regarding confidence and memory, has received little direct attention. Most existing studies emphasize nutritional outcomes—such as caloric intake, stunting, or anemia—or broad behavioural indicators like attentiveness or hyperactivity, leaving the psychological dimensions of confidence and memory largely unintegrated into the discussion.

From a theoretical perspective, the relationship between nutrition, confidence, and memory can be understood through multiple lenses. Bandura's self-efficacy theory provides a psychological explanation of how children's beliefs in their capabilities are shaped not only by direct experiences but also by physiological states. A child who is well-nourished and physically energetic is more likely to interpret their bodily state positively, thereby reinforcing their sense of efficacy. Similarly, Piaget's theory of cognitive development underscores the role of environmental interaction in shaping intellectual growth, while Vygotsky emphasizes the importance of social and cultural contexts in learning. In this framework, the provision of meals—whether Tiffin or Non-Tiffin—can be seen as a socio-cultural practice that influences cognitive processes like memory and emotional constructs like confidence. From a biological perspective, the functioning of memory systems, including the hippocampus and prefrontal cortex, is heavily dependent on adequate nutrition, suggesting that food routines may have direct neurological implications.

The present study explores the relationship between school meal practices and children's confidence and memory, comparing Tiffin and Non-Tiffin feeder school children aged 13–14 years in Bidapur, Mirzapur, India. This age group is significant as a transitional stage where children prepare for greater academic demands, identity formation, and social independence—confidence becomes critical for engagement and risk-taking in learning, while memory becomes indispensable for mastering complex academic concepts.

The rationale for this study lies in both its academic and practical contributions. Academically, it fills a notable gap in the literature by addressing the underexplored link between feeding systems and psychological outcomes in school children. While numerous studies have examined the nutritional aspects of school meals, relatively few have extended the discussion to confidence and memory. Practically, the study has implications for parents, educators, and policymakers. For parents, the findings may guide decisions about whether to provide home-prepared Tiffins or rely on school-provided meals. For educators, understanding the link between meal routines and learning outcomes may inform classroom practices and student support strategies. For policymakers, the evidence can contribute to the design of school meal programs that not only meet nutritional requirements but also support emotional and cognitive development.

A growing body of research underscores the pivotal role nutrition plays in shaping cognitive functioning and emotional well-being among children and adolescents. Rather than serving merely as biological fuel, food exerts psychological influence, modulating self-efficacy, mood, and cognitive processes. Adolescence, marked by neurological growth and identity formation, is especially sensitive to these influences, as dietary habits, peer dynamics, and belief systems intersect.

Central to these dynamics is self-efficacy—an individual's belief in their capacity to execute behaviours needed to manage prospective situations, grounded in Bandura's social-cognitive theory (Bandura, 1997). Higher dietary self-efficacy among adolescents aligns with healthier food choices, increased fruit and vegetable intake, and lower consumption of energy-dense snacks (O'Brien et al., 2021). Fitzgerald et al. (2013) demonstrated that self-efficacy positively predicted healthy dietary patterns among Irish adolescents, while peer pressure toward unhealthy eating correlated with poorer nutritional choices.

Social influences—especially peer and parental support—shape adolescents' food choices, often moderating the link between confidence and behaviour. In India, nutrition-related knowledge, attitudes, and self-efficacy significantly predicted adolescents' dietary behaviours, suggesting enhancing self-belief could be key to health interventions (Kumar et al., 2019). Among younger students in Title I schools in the United States, self-efficacy emerged as a stronger predictor than knowledge of healthy behaviour, especially amid socio-economic challenges (Nicklas et al., 2015).

Self-efficacy's influence extends to a broader range of health-related actions. Motivation, both autonomous and controlled, mediates the relationship between self-efficacy and behaviour; autonomous motivation—driven by personal values—aligns more robustly with healthy habits than motivation driven by external pressure (García-García et al., 2023). Self-determination theory further clarifies this: individuals experiencing competence and social support are more likely to internalize healthy behaviours, reinforcing self-regulation and sustained engagement (Ryan & Deci, 2000).

Nutrition's impact also reaches cognitive realms. Proper intake of macronutrients is critical for memory, attention, and executive control; proteins supply amino acids like tyrosine and tryptophan, precursors to neurotransmitters that improve memory function and cognitive flexibility (Benton, 2010). Deficiencies in iron, iodine, and vitamin B12 have been linked to impaired concentration, reduced working memory, and slower cognitive processing (Grantham-McGregor et al., 2007).

At the school level, structured meal programs such as breakfast initiatives show measurable cognitive and psychological benefits. Students participating in school breakfast programs demonstrate higher standardized test scores, better concentration, improved mood, and reduced lateness and absenteeism (Hoyland et al., 2009), implying that consistent access to nutritious meals supports physical health, emotional stability, and learning readiness.

The interplay between nutrition, self-efficacy, and cognition is especially salient across adolescence. While direct literature linking all these domains remains limited, several strands of evidence converge: nutrition supports the biological substrate of cognition, self-efficacy shapes motivation and fosters healthy choices, and structured meal environments enhance both dietary quality and educational outcomes. In communities facing food insecurity, interventions that bolster

self-efficacy may yield disproportionate benefits, both behaviourally and cognitively (Nicklas et al., 2015).

Despite this evidence, gaps remain. Most studies explore nutrition's direct cognitive effects or influence on behaviour, rarely connecting them to emotional constructs such as confidence. How personalized eating contexts, like bringing a Tiffin from home, versus impersonal institutional meals affect self-efficacy, mood, and memory remains an open frontier.

In conclusion, psychological literature affirms that nutrition acts through multiple pathways: neurological, motivational, and social. Self-efficacy emerges as a powerful mediator linking nutritional knowledge and motivation to behavioural change, while nutritional adequacy supports cognitive domains critical for academic success. Future research should close this conceptual loop, investigating how meal contexts influence both confidence and cognitive performance in culturally meaningful ways.

OBJECTIVES

- To compare the **confidence levels** between Tiffin feeder and Non-Tiffin feeder children.
- To evaluate and compare **memory performance** between Tiffin feeder and Non-Tiffin feeder children.
- To examine whether school meal routines (Tiffin vs. Non-Tiffin) contribute to differences in cognitive and emotional development.

HYPOTHESES

- There will be no significant difference in **confidence** between Tiffin feeder and Non-Tiffin feeder children.
- There will be a significant difference in **memory** performance between Tiffin feeder and Non-Tiffin feeder children.

METHODOLOGY

Participants

The sample consisted of 60 students aged 13–14 years, with 30 students in each group: 30 **Tiffin feeder** children and 30 **Non-Tiffin feeder** children. All participants were enrolled in a school in Bidapur, Mirzapur, India, with an equal gender distribution (30 male and 30 female students). The mean age of the Tiffin feeder group was 12.26 years, while the mean age of the Non-Tiffin feeder group was 12.36 years.

Tools

1. **Confidence Test** – A 10-item standardized scale assessing children’s self-assurance in various areas, including school performance, social interactions, and emotional regulation. Scores range from 1 (low confidence) to 4 (high confidence).

2. **Memory Test** – A 20-item memory recall test where children were presented with a list of words to memorize and recall after a short period. Each correct recall was scored as 1 point, with a maximum score of 20.

RESEARCH DESIGN

The present study employed a quantitative comparative cross-sectional research design to examine the differences in confidence and memory between Tiffin feeder and Non-Tiffin feeder school children. The independent variable was the type of school meal practice (Tiffin & Non-Tiffin feeder), while the dependent variables were confidence and memory. A total of 60 school children aged 13–14 years participated in the study, with 30 students in each group. This research design was appropriate for investigating the association between school meal practices and the cognitive and psychological outcomes of school children while maintaining the natural educational setting.

PROCEDURE

Data were collected in classroom settings with appropriate supervision. The **Confidence Test** was administered first, followed by the **Memory Test**. Responses were scored, and the data were analysed using **t-tests** to determine the mean differences between the Tiffin and Non-Tiffin feeder groups at a significance level of 0.05.

RESULTS

Confidence: Tiffin Feeder scored lower (M= 30.03) in comparison to Non Tiffin (M= 31.1) on Confidence. Mean and Variance has been shown on Table-8 and It's Graphical presentation were shown in Figure-8. Furthermore, These data were submitted to t stat. Results not reach at significant level (p = 0.17). t stat score are shown in Table-8.

Table-8: Mean and Variance as function of Confidence in Tiffin Feeder and Non Tiffin Feeder

	Mean	Variance	Df	t Stat	p-value
Group1	30.03	14.93			
			58	-0.96	0.17
Group2	31.1	22.23			

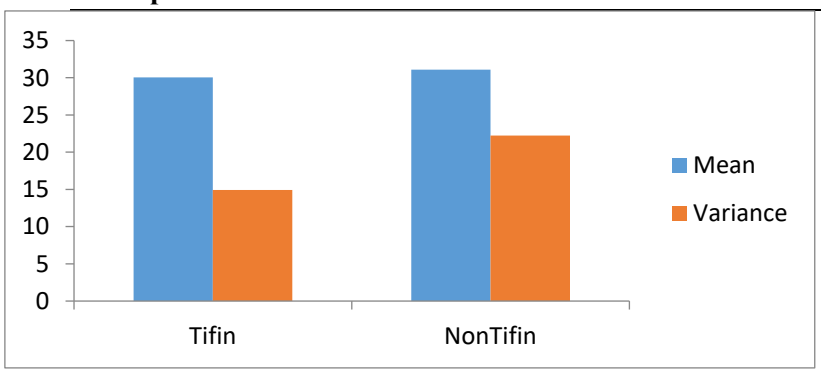

Figure -8: Mean and Variance as function of Confidence in Tiffin Feeder and Non Tiffin Feeder.

Confidence Levels

The mean confidence score for the **Tiffin feeder** group was 30.03, while the **Non-Tiffin feeder** group scored slightly higher, with a mean of 31.1. However, this difference was not statistically significant ($p = 0.17$). Both groups showed relatively high confidence levels, suggesting that school meal provisions may not significantly affect children's self-assurance in their academic or social abilities.

Memory Performance

Memory: Tiffin Feeder scored lower (M= 12.93) in comparison to Non Tiffin (M= 11.03) on Memory. Mean and Variance has been shown on Table-9 and It's Graphical presentation were shown in Figure-9. Furthermore, These data were submitted to t stat. Results reach at significant level (p = 0.04). t stat score are shown in Table-9.

Table-9: Mean and Variance as function of Memory in Tiffin Feeder and Non Tiffin Feeder

	Mean	Variance	Df	t Stat	p-value
Group1	12.93	14.20			
			58	1.77	0.04
Group2	11.03	20.24			

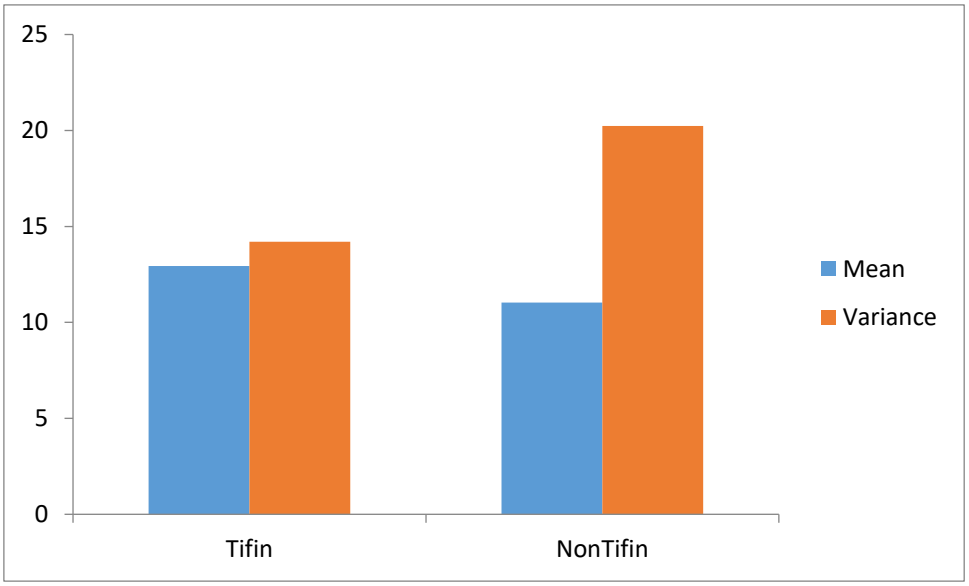

Figure -9: Mean and Variance as function of Memory in Tiffin Feeder and Non Tiffin Feeder.

In contrast, memory performance differed significantly between the two groups. The **Tiffin feeder** children scored higher (M = 12.93) on the memory recall test compared to the **Non-Tiffin feeder** children (M = 11.03), with a significant difference ($p = 0.04$). This indicates that Tiffin feeder children, who have regular access to meals brought from home, perform better on tasks requiring recall and concentration.

DISCUSSION

The present study provides a nuanced understanding of the relationship between school meal practices and children's psychological as well as cognitive outcomes. While confidence levels did not differ significantly between Tiffin and Non-Tiffin feeder groups, memory performance showed a marked difference, with Tiffin feeder children demonstrating superior recall. This finding requires a careful interpretation in light of developmental psychology, nutritional science, and educational research.

One important implication of the results is that confidence, as a psychological construct, may not be as sensitive to nutritional and meal routine differences as memory is. Confidence is shaped by a multitude of environmental and social influences, including parental support, peer relationships, classroom climate, and personal achievement experiences (Bandura, 1997). Children may derive their sense of self-assurance more from success in academic tasks, social acceptance, or family encouragement than from whether they consume Tiffin or Non-Tiffin meals. In this context, the lack of significant variation in confidence between groups is not surprising. It aligns with previous research suggesting that self-efficacy is more heavily influenced by interpersonal and socio-emotional factors than by nutrition alone (Ryan & Deci, 2000).

In contrast, memory is a cognitive function directly dependent on biological processes and neurological efficiency, both of which are strongly influenced by nutrition. Adequate intake of glucose, vitamins, and minerals ensures the optimal functioning of brain regions such as the hippocampus and prefrontal cortex, which are central to encoding and retrieving information (Benton, 2010). The higher performance of Tiffin feeder children in memory recall tasks may reflect the greater consistency, balance, and personalization of home-prepared meals compared to school-provided alternatives. In Indian households, Tiffin preparation is often tailored to children's dietary preferences and nutritional needs, and this personalization likely translates into better satiety and improved attention in class. Non-Tiffin feeders, while benefiting from the government's Mid-Day Meal Scheme, may not experience the same nutritional adequacy or psychological comfort associated with familiar home-cooked food.

The psychosocial dimension of Tiffin practices also deserves consideration. Bringing food from home represents a tangible connection to the family and may foster a sense of security and continuity during the school day. This emotional link could reduce stress and improve concentration, thereby indirectly boosting cognitive functions such as memory. Conversely, Non-Tiffin feeders may occasionally experience stigma, uncertainty about food quality, or lack of familiarity with the meals provided, which could subtly impair attention and memory performance. Previous work in school psychology suggests that emotional states—particularly anxiety or discomfort—can interfere with working memory capacity, as attentional resources are diverted away from task performance (Grantham-McGregor et al., 2007).

Another important point relates to the cultural context of India. Food in Indian society is deeply intertwined with identity, tradition, and family bonding. Tiffin feeding therefore represents not merely a nutritional input but also an expression of care and parental involvement. Such psychosocial factors may explain why Tiffin feeders performed better cognitively, even though the observed differences in confidence were not significant. Research by Patel et al. (2014) further supports this idea, showing that structured, predictable meal routines reduce anxiety and behavioral issues, thereby freeing cognitive resources for academic engagement.

The findings of this study are also consistent with international evidence highlighting the role of structured school meals in improving cognitive outcomes. For example, Hoyland et al. (2009) showed that breakfast consumption significantly enhanced attention and memory among school-aged children. Similarly, Nicklas et al. (2015) reported that children with consistent access to nutritious meals demonstrated better recall and concentration than those with irregular eating patterns. The present study extends this evidence by distinguishing between personalized, family-prepared meals and institutionally provided meals within the Indian context, thereby offering a culturally relevant perspective.

Nevertheless, while the findings regarding memory are statistically significant, they should be interpreted cautiously due to the relatively small sample size. The study included only 60 participants, which limits the generalizability of the results. Moreover, it is possible that unmeasured factors such as parental education, socio-economic status, or home environment contributed to the observed differences. For instance, families who send Tiffin may also be more involved in their child's overall academic and emotional development, which could confound the results. Similarly, children in the Non-Tiffin group may come disproportionately from disadvantaged backgrounds, where multiple stressors impact both nutrition and cognitive outcomes. Future research should employ larger, more diverse samples and control for these variables to strengthen the robustness of findings.

Finally, the study's results carry practical implications for educators and policymakers. The fact that memory—a critical foundation for learning—appears to benefit from Tiffin feeding suggests that policies promoting balanced and individualized nutrition could enhance academic outcomes. Schools should ensure that institutional meals are not only sufficient in quantity but also culturally appropriate, nutritionally balanced, and psychologically comforting. Parents, too, should be made aware of the link between meal routines and cognitive performance, encouraging them to provide home-prepared meals where feasible.

CONCLUSION

This study concludes that **memory** performance is significantly influenced by school meal routines, with Tiffin feeder children performing better on memory tests than Non-Tiffin feeder children. However, **confidence** levels did not show a significant difference between the two groups. These findings underscore the importance of meal provision in cognitive development and suggest that future interventions should focus on ensuring that all children, regardless of their meal status, have access to nutritious food that supports their learning and emotional well-being.

LIMITATIONS AND FUTURE DIRECTIONS

A key limitation of this study is the relatively small sample size, which may limit the generalizability of the findings. Additionally, future research could explore other variables influencing **confidence** and **memory**, such as parental involvement, school environment, and individual differences in dietary habits.

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CHILD-REARING PRACTICES AMONG THE ZELIANGRONG COMMUNITY FROM NORTHEAST INDIA IN DELHI

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ABSTRACT

The study "Child-Rearing Practices among the Zeliangrong Community from Northeast India in Delhi" was undertaken to explore caregiving patterns, cultural transmission, and adaptation strategies among Zeliangrong families raising young children in Delhi. The study focused on cultural identity and transmission, parental roles and family dynamics, health and nutrition, education and cognitive development, discipline and behaviour, emotional and social development, adaptation to urban life, the role of the Zeliangrong community in Delhi, challenges faced by families, and future aspirations for children. Participants included 21 Zeliangrong families residing in Delhi with children between 0–6 years of age. In Northeast Indian communities such as the Zeliangrong, child socialization is deeply embedded in cultural traditions and intergenerational knowledge transmission (Ghosh, 2018). However, migration to metropolitan cities like Delhi has introduced new pressures, including nuclear family structures, individualism, and limited extended family support (Singh, 1995). Urbanization has altered parenting priorities, particularly in relation to education and socialization. Studies on northeastern tribal communities in urban India indicate that while families attempt to retain traditional values, urban influences such as formal schooling and modern lifestyles increasingly shape child-rearing practices (Nath, 2013). This study aims to examine how migration and urbanization impact the child-rearing practices of the Zeliangrong community residing in Delhi. It seeks to explore how parents negotiate cultural preservation while adapting to urban demands of better educational and employment opportunities. Data were collected through semi-structured interviews conducted with parents and primary caregivers to understand their lived experiences of raising children in an urban environment. The findings indicate that families make conscious efforts to preserve their cultural identity through language, storytelling, moral teachings, and participation in church and community gatherings, which continue to serve as important spaces for social interaction and identity reinforcement. However, parents expressed concern over the declining use of the native language due to the dominance of English and Hindi in educational and social contexts. Parental roles reflected a blend of traditional values and adaptive practices, characterized by strong emotional bonding, emphasis on respect, and collective responsibility. Health and nutrition practices combined traditional remedies with modern medical treatment, while education was viewed as central to children's future mobility and cognitive growth. Families reported challenges such as limited living space, financial pressures, reduced outdoor play opportunities, and emotional isolation. Despite these constraints, they demonstrated resilience by adjusting their parenting strategies while striving to sustain their cultural roots. The findings emphasize the need for culturally sensitive support systems to assist indigenous families in urban settings.

Keywords: Child-rearing, Cultural transmission, Northeast, Urban migration, Zeliangrong community.

INTRODUCTION

Child-rearing is the process of social, emotional, and cultural upbringing of children within a community (Super & Harkness, 2002). In indigenous communities, child-rearing practices are largely collectivist and community-oriented, emphasizing respect, discipline, cooperation, and learning from elders. Child development involves several interdependent dimensions, including social, emotional, cognitive, and motor development, along with health and nutritional status. As noted by McDevitt and Ormrod (2002, p. 541), culture is central to making a community meaningful to children. Over the past three decades, significant shifts have occurred in how parents perceive their children, with greater recognition of the importance of balanced and thoughtful parenting. Child-rearing practices are now widely acknowledged in the behavioral sciences as essential for holistic growth and development. However, variations in parenting approaches continue across families, regions, and communities (Dube, 2002). Parenting in indigenous cultures is reflective of cultural norms and expectations. Such communities often emphasize cooperation, shared responsibility, and collective caregiving (Rogoff, 2003). Vygotsky's (1978) theory of socialization highlights learning as a social process, which aligns with indigenous practices where children learn through observation and participation. Similarly, Bronfenbrenner's (1979) ecological systems theory explains that child development is influenced by interconnected systems

The Zeliangrong People

The Zeliangrong people, traditionally associated with Makuilongdi, are presently distributed across Assam, Manipur, and Nagaland. The community consists of three subgroups—Zeme, Liangmai, and Rongmei (Samson, 2004). The term "Zeliangrong" was formed by combining the names of these subgroups, reflecting shared ethnic, linguistic, and cultural origins. Their languages belong to the Tibeto-Burman family, specifically the Bodo-Naga subgroup (Grierson, 1903). Despite dialectal variations, the community maintains strong ethnic cohesion.

Child-Rearing in the Indian Context

Research on child-rearing in India has drawn from both traditional philosophical frameworks and empirical studies using Western theoretical models (Krishnan, 1998). Traditional Indian thought views the child as sacred and emphasizes developmental stages guided by samskaras (rites), gunas (temperament), and ashrama dharma (life stages). Mothers are typically primary caregivers, while fathers assume roles as providers and disciplinarians (Krishnan, 1998). Studies have shown that Indian child-rearing practices vary significantly based on socio-economic status, caste, rural-urban context, and regional differences (Rohner & Chaki-Sircar, 1987; Saraswathi & Dutta, 1987; Sharma, 1996). Seymour (1971) observed that Indian children are often not encouraged toward early independence compared to Western contexts, with prolonged breastfeeding, delayed toilet training, and extended physical closeness. Krishnan (1998) highlights that research on Indian child-rearing remains limited and insufficiently addresses subcultural diversity. This study contributes empirical evidence by focusing on one such subculture—the Zeliangrong community.

Similar Studies in the Indian Context

Chaudhary (2013) emphasizes hierarchy, collectivism, and respect for elders in Indian parenting. Saraswathi and Dutta (2010) describe Indian parenting as warm yet structured. Kumar and Sharma (2015) report that urban families blend traditional values with modern aspirations. Chopra (2016) notes strong community involvement in rural parenting, while Raghunathan et al. (2019) demonstrate socio-economic influences on parenting priorities.

Child-Rearing Across Cultures

Global studies indicate that modernization and globalization are reshaping collective parenting traditions (Gaskins et al., 2020). The World Health Organization (2021) recommends exclusive breastfeeding for six months, and Victora et al. (2016) report its long-term cognitive benefits. Contemporary research also emphasizes play (Ginsburg, 2007) and nurturing environments (Shonkoff & Phillips, 2000) as essential for development.

Impact of Modernization on Child-Rearing

Urban migration has contributed to the rise of nuclear families, weakening extended support systems. Chaudhary (2013) and Arnett (2002) highlight how globalization and technology introduce new values, often creating generational gaps. Chatterjee (2014) notes similar transformations among Zeliangrong families in urban settings.

Interaction with External Institutions

Government programs, NGOs, and religious institutions influence contemporary child-rearing (Narayanan & Hatfield, 2019). Religious conversion in parts of Northeast India has also affected values related to discipline and authority (Joshi & Little, 1996).

Obstacles in Traditional Child-Rearing

Migration, economic pressures, and evolving gender norms challenge traditional caregiving structures (Saldanha, 2017; John & Radhakrishnan, 2016; Thounaojam, 2018).

Transformation in Traditional Practices

Zeliangrong childcare historically relied on extended family systems and oral traditions (Devi, 2009; Samson, 2004). Urban exposure has led to greater emphasis on formal education, structured discipline, and biomedical healthcare (Chopra, 2016; Verma, 2010).

OBJECTIVES

- To explore the child-rearing practices of the Zeliangrong community residing in Delhi

METHODOLOGY

The participants comprised 21 family units having children in the age group from birth to 6 years, from Delhi/ NCR region. The Zeliangrong consists of three different tribes i.e the Zeme, Liangmai and Rongmei. An equal number of families from the three tribes the Zeme, Liangmai and Rongmei (seven each) each making it a total of 21 families were part of the study.

Sampling Strategy

For sample selection, a purposive sampling technique was first used, followed by snowball sampling, where participants were approached based on recommendations from earlier participants.

Locale of the Study

The study was conducted in Delhi. Most of the Zeliangrong families were spread across different parts of the city, mainly in West Delhi (Dwarka) and South Delhi (Kishangarh). Therefore, most participants were from these areas, although a few families from Central Delhi and North Delhi (Burari) were also included. Since snowball sampling was used, participants often recommended nearby families, which made it easier and more convenient for the researcher to collect data.

RESEARCH DESIGN

This study adopted a **qualitative research design** to explore the child-rearing practices of the Zeliangrong community residing in Delhi. An exploratory qualitative approach was considered appropriate because the study sought to gain an in-depth understanding of parents' and caregivers' lived experiences, caregiving practices, cultural values, and the adaptations they make while raising children in an urban setting. Data were collected through **semi-structured interviews** with primary caregivers. The interviews and discussion transcripts were analyzed using **thematic analysis**, enabling the identification of recurring themes related to cultural identity, caregiving practices, discipline, education, health, and adaptation to urban life.

RESULTS AND DISCUSSIONS

Caregiving Roles and Responsibilities

The caregiving roles among Zeliangrong families reflect a dynamic interplay between traditional expectations and modern adaptations. While many families continue to uphold conventional caregiving structures, with mothers as the primary caregivers, there is also a growing shift toward shared responsibilities, shaped by work demands, family structure, and urban pressures. A majority of respondents such as Ms. Fin, Ms. Arin and thirteen others highlighted that mothers continue to take the lead in caregiving, nurturing, and discipline, largely because they spend more

time at home. Fathers acknowledge their limited involvement due to work obligations but emphasized the importance of emotional understanding and mutual respect between both parents. Extended family support, in these cases, is limited, and caregiving tends to remain within the nuclear unit. However, 10 families, especially those with both parents working or with more flexible routines, reported a more balanced distribution of caregiving tasks. Ms. Lung describes an arrangement where she, a home-based tutor, and her husband, a teacher, alternate caregiving duties depending on their schedules. Their situation is further supported by cousins and a younger brother who help supervise the children, particularly with studies. Similarly, Ms. Eve and Mr. Giang shared that they do not follow rigid gender roles, instead dividing responsibilities based on availability. Though their caregiving is largely self-managed, occasional assistance from extended family—like nephews or siblings—is welcomed. Ms. Grace's narrative reflects a modern, equitable partnership where both parents are equally involved in day-to-day childrearing and decision-making. While she and her husband handled early caregiving independently, visiting maternal relatives now provide occasional help, and grandparents, especially from her side, offer emotional support during visits. The father's active role, according to her, symbolizes a conscious effort toward balanced parenting in a nuclear setting. Some families adapted further due to specific circumstances. Ms. Aring, part of a dual-earner household with two children, admits that without a nanny, it would be nearly impossible to manage childcare. While both she and her husband share responsibilities by taking turns, the presence of external help is essential to ensure the children's well-being. Distinctly, in families with children who have special needs, caregiving becomes significantly more complex and demanding. Ms. Helene, whose child has multiple disabilities, describes her role as the primary caregiver, supported occasionally by her husband and two close relatives. The caregiving routine includes carefully regulated outings, feeding assistance, and thrice-weekly physical therapy sessions at a government center. Financial constraints prevent them from seeking private care, making public healthcare services critical to their caregiving strategy. Her experience illustrates the emotional, physical, and logistical weight borne by caregivers in such situations. Finally, Mr. Cam's account reaffirms the traditional caregiving model but adds nuance by recognizing the mother's meticulous role in planning and executing daily routines. Though his work limits his involvement, he expresses a deep appreciation for his wife's caregiving efforts and supports where possible. While traditional gender roles persist in many homes, others are actively negotiating new forms of shared responsibility, adapting to the challenges of urban life. Whether through internal family cooperation, external support, or reliance on public services, these families demonstrate resilience and a willingness to evolve in their caregiving practices. Gaskins, Reese, and others (2020) discuss how contemporary parenting styles are influenced by both tradition and modern societal pressures.

Figure 1: Child being traditionally put to sleep by grandmother (back-carrying)

Health, Nutrition, and Physical Development

A significant majority of 12 families reported relying primarily on modern medical facilities for their children's health needs. Government-employed parents, such as Ms. Aring, benefitted from state-provided healthcare access and reimbursements, easing the financial burden. Similarly, Mr. Cam noted the family's preference for private hospital services due to workplace-linked healthcare benefits. Despite this shift toward modern medical services, 11 families reported following a hybrid model of healthcare. Traditional home remedies like ginger, turmeric, and honey were still used to treat minor ailments such as colds and digestive issues. Minor illnesses were first addressed at home, and medical consultation was sought if symptoms persisted, reflecting the coexistence of ancestral knowledge with modern resources. Traditional medicine, once a necessity in native settings, is now viewed by some respondents as outdated or less reliable, suggesting a generational shift in trust toward modern medicine. Nutritional practices reflected a balance between tradition and urban convenience. Many families continued preparing rice-based traditional meals while adapting to the availability of vegetables and groceries in Delhi. Weekly markets were appreciated for affordability and variety. However, access to specialized infant nutrition or supplements was limited or infrequent among a few families. Physical development concerns were particularly evident in families with

children with special needs. Ms. Helene described her efforts to create a supportive home environment using therapy tools, despite challenges such as tantrums, irregular sleep, and dietary adjustments. Financial instability also shaped healthcare decisions for some families, who relied on informal borrowing in times of medical need. These findings align with Raghunathan et al. (2019), who suggest that easy access to health information encourages adoption of evidence-based practices, accelerating shifts from purely traditional caregiving methods.

Education and Cognitive Development

A common concern voiced by 11 families centered on the burdensome nature of formal schooling in Delhi, particularly in the early years. Parents described heavy school bags, long hours, and developmentally inappropriate expectations. Many held high aspirations for academic success, especially in professional fields. In contrast, some parents appreciated child-centric curricula that emphasized holistic development over rote learning. Others rejected early academic competition and instead prioritized creativity, comfort, and moral upbringing. Developmentally Appropriate Practice (DAP) and Vygotsky's Zone of Proximal Development (ZPD) help explain why some parents prefer guided participation rather than structured academic pressure. A clear divide emerged: while some families aspired toward competitive academic achievement, others prioritized emotional grounding and moral character.

Discipline and Behavior

Disciplinary approaches varied significantly. A number of families reported combining verbal correction with occasional mild physical discipline, particularly during early childhood. However, physical punishment was generally described as sparing and situational. In contrast, several parents emphasized empathetic and reflective discipline strategies such as dialogue, reflection, and explanation of consequences. Some consciously avoided replicating harsh disciplinary practices from their own childhoods. Urban exposure, awareness of children's rights, and peer discussions appeared to foster more emotionally responsive approaches. These findings resonate with Saraswathi & Dutta (2010), who observed that Indian parenting often blends warmth with structured expectations. Bandura's Social Learning Theory is reflected in how parents replicate or consciously modify disciplinary patterns from their upbringing.

Community and Cultural Support

The church emerged as the most significant support system, functioning as a space for moral guidance, peer interaction, and ethnic reinforcement. Sunday school, storytelling, music, and cultural programs help children remain connected to their identity. Community-led initiatives such as cultural days and indigenous libraries further support cultural awareness. However, participation levels varied, with some families reporting limited engagement due to time constraints or lack of local cultural groups. These findings support Krishnan's (1998) observation that child-rearing and socialization are deeply interconnected in Indian contexts.

Challenges and Adaptations

Urban life introduced several stressors, including limited open spaces, economic pressures, pollution, and emotional isolation. Parents reported increased screen time, structured routines, and

intensified supervision. Migration disrupted extended family support systems, increasing caregiving burdens. Some experienced cultural alienation and subtle discrimination. Financial strain influenced family planning decisions. Parents of children with special needs described additional emotional and logistical challenges but also acknowledged better access to medical facilities in Delhi. These findings resonate with Chopra (2016), who highlighted the central role of community involvement in traditional rural child-rearing.

Future Aspirations for Children

Aspirations reflected pragmatic optimism and cultural humility. Most parents hoped for better educational opportunities and improved quality of life for their children. While some emphasized academic excellence and professional success, others prioritized intrinsic motivation, moral development, and spiritual grounding. Families with children with disabilities focused primarily on stability, dignity, and care rather than conventional achievement.

Cultural Identity and Transmission

Urban living has significantly affected cultural transmission. Many parents expressed concern over the declining use of their native dialect due to the dominance of English and Hindi. While children often begin speaking their mother tongue in early years, fluency diminishes with school exposure. Parents attempt to sustain cultural continuity through storytelling, lullabies, festivals, and periodic visits to their native villages. However, time constraints and nuclear family structures limit cultural engagement. Language barriers have also strained intergenerational bonding. Vygotsky's Sociocultural Theory explains how reduced social interaction within extended networks weakens the transmission of cultural tools such as language.

Figure 2: Children playing outdoors

CONCLUSION

This study examined how Zeliangrong families—an indigenous minority community residing in urban Delhi—navigate child-rearing, cultural preservation, and caregiving during early childhood (birth to six years). The findings reveal that parenting practices within these families reflect a dynamic negotiation between cultural continuity and urban adaptation. Despite structural constraints such as limited outdoor spaces, financial strain, reduced kinship support, and increased digital exposure, parents demonstrate remarkable resilience and intentionality in nurturing emotionally secure and developmentally supportive environments. Traditional caregiving patterns, particularly maternal centrality, remain prominent, yet urban living has encouraged shared responsibilities and greater flexibility in parenting roles. Cultural preservation emerged as both a conscious priority and a growing concern. Many parents expressed anxiety over the gradual erosion of native language and traditions due to immersion in Hindi- and English-dominated school environments. While storytelling, food practices, church participation, and village visits are used to sustain cultural continuity, urban time pressures and nuclear family structures restrict consistent intergenerational transmission. A particularly poignant insight came from a visiting grandmother who expressed sadness over her inability to bond deeply with her grandchildren due to language barriers, illustrating the emotional dimensions of cultural shift. Health and nutrition practices reflected a pragmatic hybrid model, where traditional home remedies coexist with trust in modern healthcare systems. Similarly, disciplinary practices revealed a tension between aspirations toward empathetic parenting and the practical stresses of urban life, which sometimes result in more restrictive or corrective approaches. Parental aspirations reflected a complex interplay between cultural values and urban opportunity structures. While many parents emphasized educational achievement and upward mobility, others prioritized moral grounding, faith, humility, and emotional well-being. These findings align with ecological perspectives of development, highlighting how parenting goals are shaped through interactions between family values and broader social systems. Overall, Zeliangrong families in Delhi are not passively assimilating into urban culture; rather, they are actively reconstructing parenting practices in ways that integrate traditional identity with modern realities.

Their lived experiences bring forth the need for culturally responsive frameworks that recognize both resilience and vulnerability within migrant indigenous communities.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future research could benefit from engaging a larger and more diverse sample of Zeliangrong families, drawn from a wider range of urban and rural settings, allowing for a deeper understanding of how geographical location and socio-cultural context shape child-rearing practices within the community. In addition, adopting a longitudinal approach would offer valuable insight into how these child-rearing practices, patterns of cultural transmission, and parenting approaches

shift and evolve as children move beyond early childhood into later stages of development, thereby offering a more comprehensive picture of the Zeliangrong family experience over time.

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