ORIGINAL ARTICLE

Nutrition Transition- A Study of Millet Consumption Pattern Across Three Generations of Indian Families

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CITATION

Pradhan R, Kaur L, Sobti AK. Nutrition Transition- A Study of Millet Consumption Pattern Across Three Generations of Indian Families. Journal of the Epidemiology Foundation of India. 2025;3(2):120-129.

DOI: https://doi.org/10.56450/JEFI.2025.v3i02.004

ARTICLE CYCLE

Received: 17/06/2025; Accepted: 21/06/2025; Published: 30/06/2025

ABSTRACT

Introduction: Millets, traditional grains of India, are gaining renewed attention due to their nutritional benefits and climate resilience. This study aims to assess the millet consumption patterns among three generations in 200 families living together in Chandigarh to understand dietary shifts and strategies for millet revival in modern diets. **Methodology:** The study was conducted on 200 families (600 respondents) residing together in Chandigarh (U.T.), India, Data was collected using a purposive sampling method and an interview-based questionnaire. The questionnaire explored millet consumption frequency, preferred cooking methods, reasons for consumption, and awareness of millets' nutritive value. **Results:** 41% of grandparents, 16% of parents, and 6% of children consumed millets for over 5 years. A significant association ($\chi 2 = 341.365$, $p = 0.0001$) indicates older generations have a longer history of millet consumption. Traditional eating practices influenced consumption across groups (35.5% grandparents, 37.5% parents, 42.0% children). Grandparents and parents predominantly consumed millets as chapatis, while children preferred millet-based cookies and cakes. Awareness of millet nutrition was high (96.5% grandparents, 94.5% parents). Declining intake was attributed to alternative grains (91.5% grandparents, 83.0% parents, 64.0% children). **Conclusion:** Despite strong awareness, millet consumption has declined across generations, particularly among youth, highlighting the need for innovative dietary integration to improve health and nutritional security.

KEYWORDS

Millets; Nutritive Value; Cereals; Dietary Patterns; Food Habits

INTRODUCTION

Millets have been a cornerstone of Indian agriculture Known for high proteins, dietary fiber, vitamins, and minerals such as calcium, iron, and zinc (Jacob et al., 2024; Balkrishna et al., 2023; Sharma et al., 2024). Additionally,

millets are resilient crops, environmentally sustainable and ideal for regions prone to climate variability (Agarwal, 2024).

Despite these advantages, millet consumption in India has significantly declined over the past few decades. Factors contributing to this trend include the Green Revolution, which emphasized rice and wheat production, the convenience of polished grains, and the shift toward more urbanized lifestyles that favour processed and ready-to-eat foods (Nelson et al., 2019; Kane-Potaka et al., 2021). This decline is particularly concerning given the rise in lifestyle-related diseases such as diabetes, obesity, and cardiovascular ailments, conditions that millets are known to help mitigate.

Chandigarh, with its urbanized yet culturally rooted households, offers a unique setting to study dietary transitions across generations.

Aims and Objectives:

- To assess millet consumption patterns across three generations in Chandigarh households.
- To examine knowledge and awareness regarding the nutritional value of millets.
- To analyse practices and preferred cooking methods of millet consumption.
- To identify factors influencing the decline or continuation of millet use across generations.

Material & Methods

Study Type and Study Design: The study employed a mixed-methods approach,. These families were selected purposively to ensure representation of three distinct generations (grandparents, parents, and children) living within the same household. This design facilitated an in-depth exploration of generational differences in dietary practices.

Study Setting: The study was carried out in Chandigarh (U.T.), India, an urban center with diverse households representing a mix of traditional and modern lifestyles.

Study Population: The study population included families residing in Chandigarh with at least three generations (grandparents, parents, and children) living together in the same household.

Study Duration: The study was conducted over a period of six months (June 2024 to November 2024).

Sample Size Calculation: A total of 200 families (600 respondents) were included using purposive sampling. Sample size was based on feasibility and the requirement of capturing three-generation households for adequate representation.

Inclusion Criteria:

- Families with 3 generations living together.
- Residents of Chandigarh.
- Willing to give informed consent.

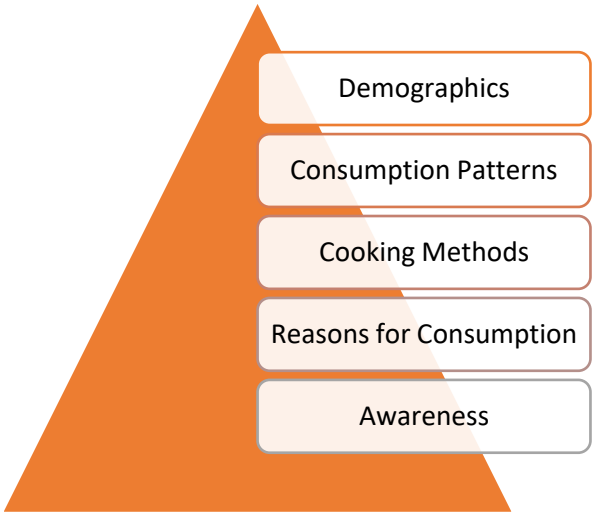
Exclusion Criteria:

- Families with fewer than three generations.
- Those unwilling to participate or provide complete information.
- Non-residents of Chandigarh.

Strategy for Data Collection:

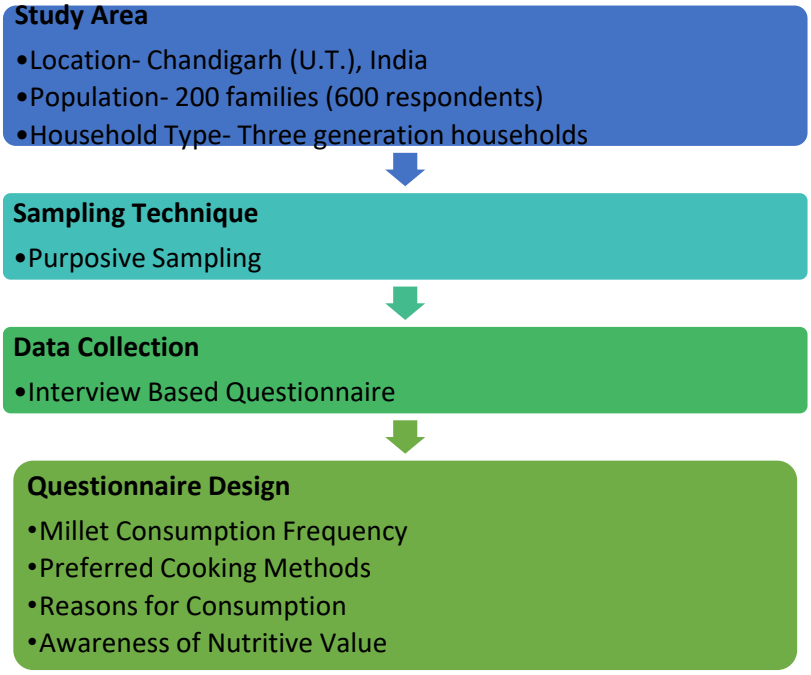
- **Sampling Technique:** A purposive sampling method was utilized, focusing on households with multi-generational living arrangements to capture diverse perspectives within the same family unit.
- **Research Tool:** A structured interview-based questionnaire served as the primary tool for data collection. Pretesting on a small subset of families ensured clarity, reliability, and suitability of the questions.
- **Interview Administration:** Interviews were conducted face-to-face over a period of two months. Trained enumerators visited participants' homes to collect accurate data and address any ambiguities.

Questionnaire Structure: The questionnaire was organized into five thematic sections:



Ethical Considerations and Informed Consent: The study adhered to ethical research standards. Participation was voluntary, and informed consent was obtained from all respondents. Data confidentiality and anonymity was strictly maintained.

Data Analysis: Quantitative data was processed using SPSS statistical software, employing chi-square tests to uncover significant differences in patterns and preferences among generations.



Findings and Discussion

The study comprised 600 respondents from 200 families residing in Chandigarh, representing three generations living in the same household. In terms of age distribution, the mean age of the grandparents' generation (Generation-1) was 68.5 years (range: 55–80 years), with the majority falling in the 66–75 years age group (34.5% males, 38.5% females). The parents' generation (Generation-2) had a mean age of 39.4 years (range: 25–52 years), where 21.5% of males were above 40 years, while 51% of females were 40 years or younger. The children's generation (Generation-3) had a mean age of 13.9 years (range: 10–17 years), with 16.5% of boys

between 13–15 years, whereas 21.5% of girls were in the 10–12-year age group. These findings reflect a multi-generational household structure, where dietary habits, including millet consumption, are likely influenced by familial traditions and generational preferences.

Gender distribution across the three generations was relatively balanced, with males and females being nearly equal in number. However, in the parents' generation, the proportion of females (61.5%) was higher than males (38.5%), possibly reflecting a higher representation of homemakers who traditionally oversee food choices in Indian households.

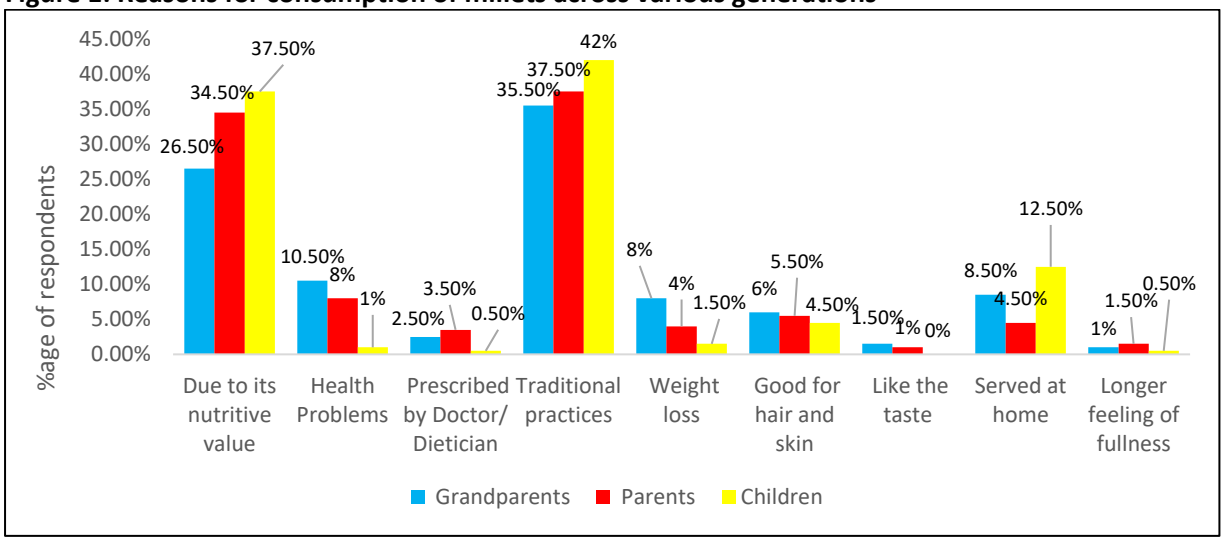
The study found significant generational differences in the initiation of millet consumption (Table 1). 41% of grandparents (n=82) had been consuming millets for over five years. A chi-square analysis revealed a significant relationship between generations and the duration of millet consumption ($\chi 2$ = 341.365, p = 0.0001). This suggests that older generations have a longer history of millet consumption,

Table 1: Distribution of respondents according to when they started consuming millets

	Grandparents n=200	Parents n=200	Children n=200	p-value
Since last 6 months	21 (10.5%)	31 (15.5%)	24 (12.0%)	341.365;
≤ 1 year	34 (17.0%)	34 (17.0%)	45 (22.5%)	.0001*
≤ 5 years	38 (19.0%)	47 (23.5%)	30 (15.0%)	
> 5 years	82 (41.0%)	32 (16.0%)	12 (6.0%)	
Not Yet	25 (12.5%)	56 (28.0%)	89 (44.5%)	
	200 (100%)	200 (100%)	200 (100%)	

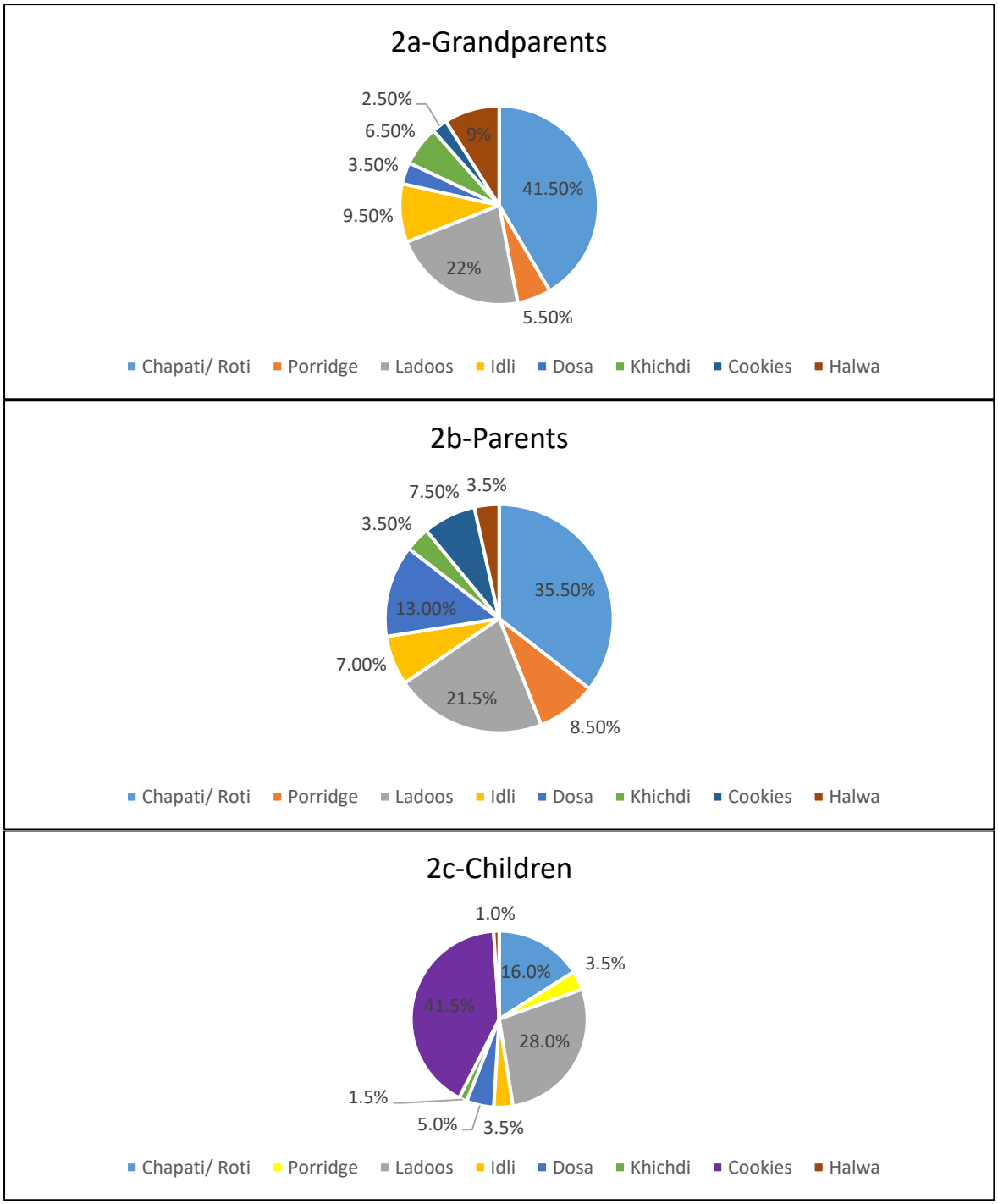
Millet consumption was primarily driven by traditional practices across all generations (Figure 1). A notable proportion of respondents highlighted traditional practices as the reason for millet consumption, with 35.5% of grandparents (n=71), 37.5% of parents (n=75), and 42% of children (n=84) embracing this dietary tradition. Nutritional value was the second major reason, reported by 26.5% (n=53) of grandparents, 34.5% (n=69) of parents, and 37.5% (n=75) of children. Millets were also consumed due to health concerns, though this was significantly more common among older generations compared to younger generations. The younger generation's preference on processed foods may contribute to this shift. This supports the findings of **Anitha et al. (2021)**, which emphasized millets' role in reducing cholesterol, hypertension, and BMI. However, despite the known health benefits, younger individuals are not incorporating them into their diets at the same rate as older generations.

Figure 1: Reasons for consumption of millets across various generations



The most common way of consuming millets differed significantly across generations (Figure 2a, 2b, 2c). Grandparents and parents primarily consumed millets in the form of chapati/roti (41.5% and 35.5%, respectively), followed by ladoos and idli. While children (41.5%) preferred millet-based cookies. Traditional forms like porridge, halwa, and khichdi were more prevalent among grandparents but were significantly less preferred by children. The shift toward processed and ready-to-eat millet products among children reflects modern dietary preferences.

Figure 2: Distribution of respondents according to common form in which millets are consumed by them



A significant portion of respondents, particularly among grandparents (96%) and parents (89%), perceived changes in millet consumption patterns over time (Table 2). However, 58.5% of children did not notice any change. Since, children have not been consuming millets for a long time, they may not be able to report any significant changes. The decline in millet consumption is linked to the increased availability of alternative cereal grains, changing dietary habits, and longer preparation times for millets compared to refined cereals **(Gowda et al., 2022).**

Awareness of the nutritional value of millets was high across all generations (Table 2). 96.5% of grandparents, 94.5% of parents, and 61.5% of children reported being aware of health benefits of millets. However, awareness did not necessarily translate into higher consumption. Previous research **(Kane-Potaka et al., 2021)** indicated a similar trend—89% of participants knew about millet nutrition but rarely consumed them.

Table 2: Generation of respondents showing change in millet consumption over time and awareness about the nutritive value of millets

Generation of Respondents	Yes	No	Chi-square; p-value
Changes in Millet Consumption over Time			
Grandparents	192(96.0%)	8(4.0%)	259.038;
Parents	178(89.0%)	22(11.0%)	.0001*
Children	83(41.5%)	117(58.5%)	
Awareness about the nutritive value of millets			
Grandparents	193(96.5%)	7(3.5%)	
Parents	189(94.5%)	11(5.5%)	34.350;
Children	123(61.5%)	77(38.5%)	.0001*

The following table (Table 3) results indicate significant generational differences in the preferred cooking methods for millet. Traditional methods such as boiling and steaming were significantly more favoured by the grandparents' generation compared to parents and children, with p-values of 0.009 and 0.002, respectively. This suggests that older generations adhere more to conventional cooking styles, which may be linked to cultural preferences and familiarity with millets as staple foods. On the other hand, baking emerged as a significantly preferred method among children ($p = 0.0001$), indicating a shift towards modern food preparation techniques. This aligns with changing dietary habits, where younger individuals are more exposed to commercially available millet-based baked products such as cookies, biscuits, and cakes. In contrast, cooking methods such as shallow frying, deep frying, roasting, and grilling did not show statistically significant differences across generations ($p > 0.05$). This suggests that these techniques are relatively consistent across all age groups indicating liking amongst all generations. Thus, the findings highlight a nutrition transition in millet consumption, with older generations maintaining traditional cooking styles, while younger individuals adopt modern methods influenced by evolving food trends and convenience.

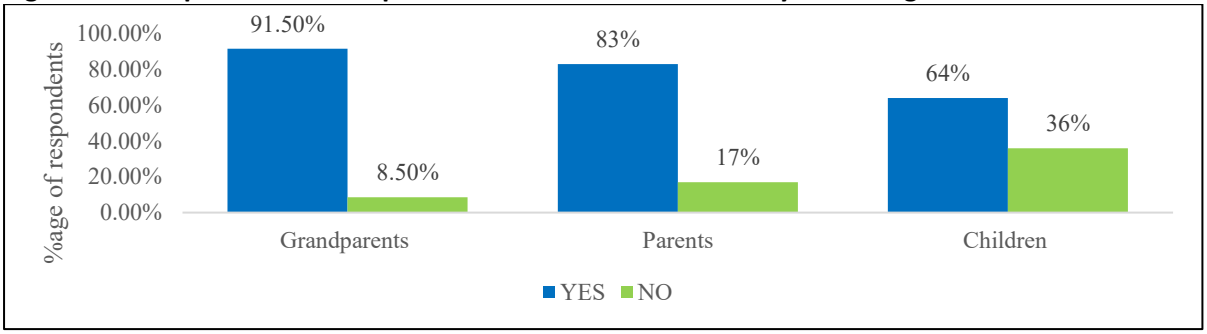
Table 3: Distribution of respondents according to their preferred cooking method for millets

The cooking method preferred for millet	Grandparents N=200 n (%)	Parents N=200 n (%)	Children N=200 n (%)	Chi-square; p-value
Boiling	78 (39.0%)	65(32.5%)	55(27.5%)	9.316; 0.009*
Steaming	52(26.0%)	48(24.0%)	37(18.5%)	12.544; .002*
Shallow Frying	31(15.5%)	36(18.0%)	43(21.5%)	2.909; .234
Deep frying	20(10.0%)	25(12.5%)	29(14.5%)	5.860; .053
Roasting	6(3.0%)	5(2.5%)	9(4.5%)	4.644; .098
Grilling	9(4.5%)	8(4.0%)	7(3.5%)	4.056; .132

Baking	4(2.0%)	13(6.5%)	20(10.0%)	28.647; .0001*

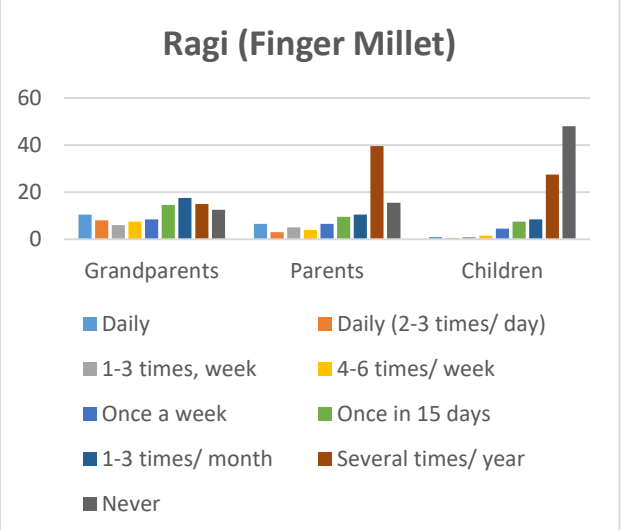
The majority of respondents believed that millet consumption had decreased due to the availability of other grains in the market (Figure 3). 91.5% (n= 183) of grandparents, 83% (n=166) of parents, and 64% (n=128) of children felt that other grains had replaced millets in their diets. Studies by **Kane-Potaka et al. (2021)** confirm that urban respondents in Bengaluru, Kolkata, and Chennai cited millet unavailability and high prices as key barriers to regular consumption. The easy availability and convenience of polished grains, combined with evolving taste preferences, have contributed to this shift.

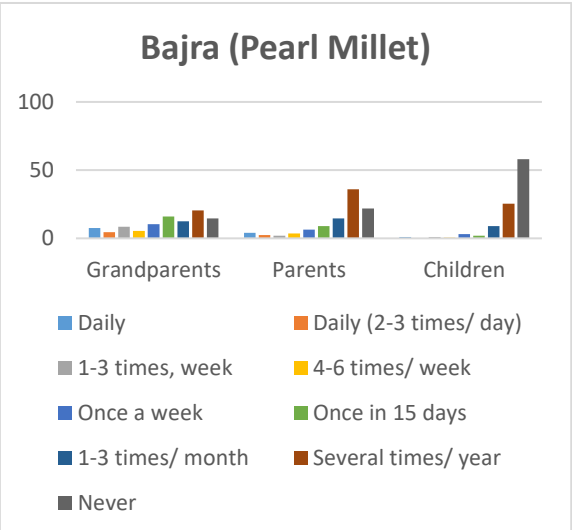
Figure 3: Perception of consumption of millets due to availability of other grains in the market

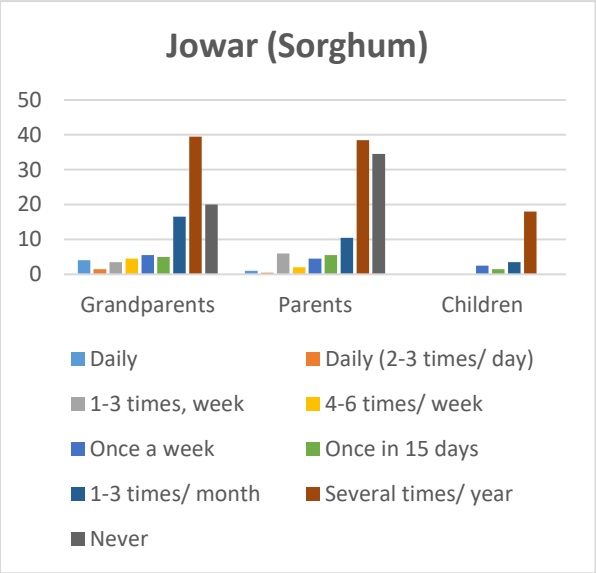


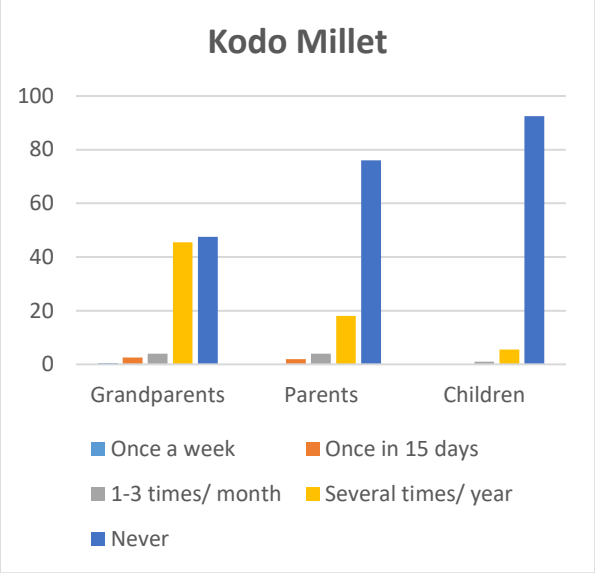
The frequency of millet consumption varied across different types, reflecting generational differences. Ragi (Finger Millet) emerged as a notable choice, with 17.5% of grandparents consuming it 1–3 times a month and 39.5% of parents enjoying it several times annually. While 48% of children had not yet experienced ragi, it presents an opportunity to introduce them to its benefits. Similarly, Bajra (Pearl Millet) and Jowar (Sorghum) remained staples for older generations, though less familiar to children, with 58% and 74.5% of them, respectively, having never consumed these millets. Lesser-known varieties like Kodo, Foxtail, Sanwa, Kuttu, and Rajgira also had minimal exposure among children, with over 90% yet to try them, highlighting the potential for increased awareness and incorporation of these nutritious grains in younger diets.

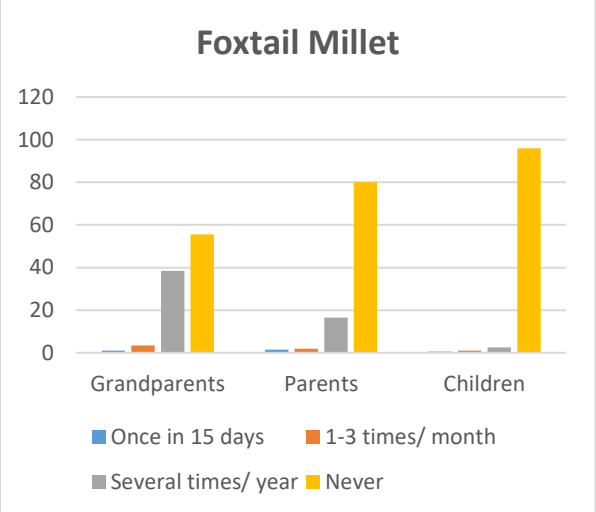
Table 4: Frequency of Millets consumed by all generations

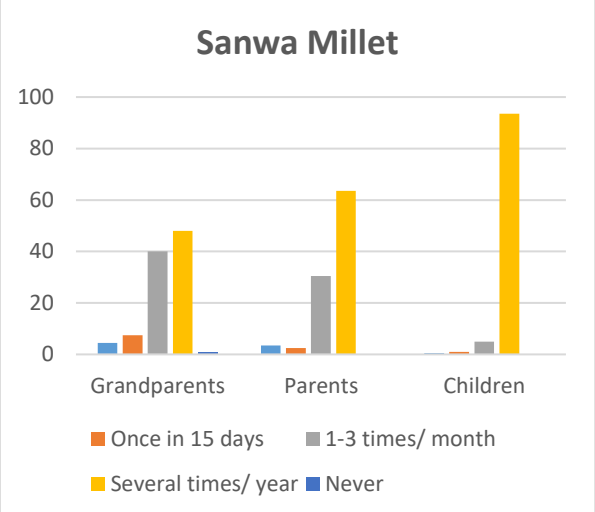


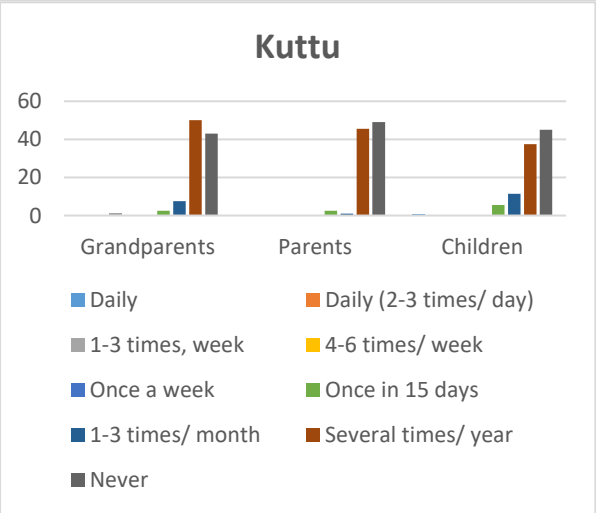


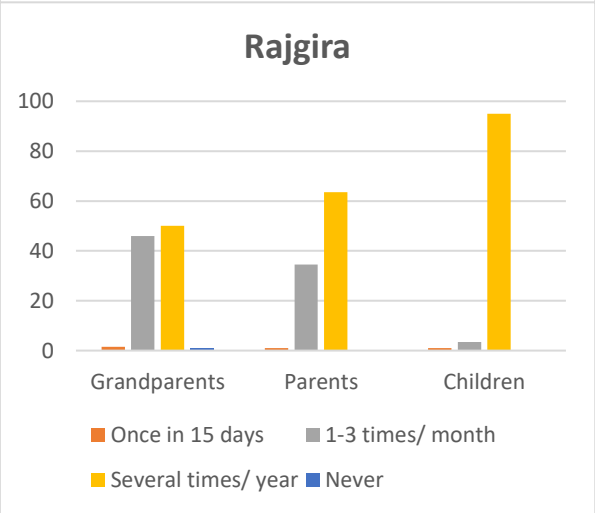












These findings highlight an ongoing nutrition transition, presenting an opportunity to revive traditional grains like millets amidst the growing dominance of refined cereals and processed foods. Similarly, **Kearney (2010) and (OECD et al., 2022)** observed a global shift in dietary patterns, noting a decline in millet consumption in Africa and South Asia, regions that are key producers. This underscores the potential to promote millets as a nutritious and

sustainable food option, aligning with efforts to preserve traditional dietary practices.

Discussion

This study explored generational differences in millet consumption among families in Chandigarh, highlighting significant dietary transitions in urban Indian households. Despite high awareness of nutritional and preventive aspects of millet consumption, data reveal a significant generational decline in their consumption, highlighting a gap between knowledge and practice. Grandparents reported the highest frequency and duration of consumption, whereas children had limited or no exposure, reflecting a nutrition transition influenced by modernization and lifestyle changes.

The greater reliance of older generations on millets aligns with traditional dietary practices where coarse cereals were staples in Indian households. Similar patterns have been documented in earlier studies, where millets were associated with cultural identity and subsistence farming systems (Kane-Potaka et al., 2021). In contrast, younger generations displayed a marked preference for processed millet-based products such as cookies and cakes, reflecting an adaptation of traditional grains into modern formats. This mirrors the findings of Gowda et al. (2022), who observed that processing innovations are increasingly shaping consumer acceptance.

Although awareness of millets' nutritive value was high among adults, actual consumption patterns did not reflect this knowledge. This gap between awareness and practice can be attributed to factors such as the easy availability of polished grains, longer cooking times of millets, and perceptions of millets as "poor man's food." Similar inconsistencies have been noted in urban Indian populations, where knowledge of health benefits did not necessarily lead to higher consumption (Anitha et al., 2021).

Cooking methods also revealed generational contrasts. Traditional preparations such as boiling, steaming, porridge, and chapatis were prevalent among grandparents and parents, whereas children favored baked goods. This suggests that modern dietary trends and convenience are redefining millet consumption. Globally, such shifts have been associated with nutrition transition, where traditional foods are replaced with refined or processed alternatives (Kearney, 2010).

The public health relevance of these findings is significant. Millets are known to aid in managing diabetes, obesity, and cardiovascular risk (Anitha et al., 2021). Their decline in consumption, particularly among children, raises concerns in the context of lifestyle diseases. This underscores the need for interventions that integrate millets into daily diets in acceptable formats. Educational programs, school-based initiatives, and millet-based ready-to-eat products could bridge this gap.

Conclusion

The findings emphasize the urgent need to revive millets in contemporary diets to enhance nutritional security and reduce the burden of lifestyle-related diseases. Promoting their integration into appealing, easy-to-prepare products, supported by public health campaigns and enabling policies, can ensure wider acceptance and sustained consumption.

Millets, once a dietary cornerstone, are at risk of being forgotten by younger generations. Reviving their relevance in modern households is not only essential for preserving traditional food heritage but also directly contributes to the United Nations Sustainable Development Goals (SDGs), particularly those related to Zero Hunger (SDG 2), Good Health and Well-being (SDG 3), and Responsible Consumption and Production (SDG 12). Positioning millets within the SDG framework underscores their importance as climate-resilient, nutrient-dense crops that can promote health, sustainability, and long-term food security in urban India.

Recommendation

The findings highlight an urgent need for public health strategies to revive millet consumption, particularly among younger generations. Efforts should focus on developing millet-based ready-to-eat and convenient products

that align with modern urban lifestyles. School- and community-based nutrition education programs can be instrumental in improving awareness and encouraging regular consumption among children and adolescents. Policy interventions, such as including millets in the Public Distribution System, providing subsidies, and incentivizing the food industry to innovate millet-based products, can further support this initiative. Public health campaigns should also emphasize the role of millets in preventing lifestyle-related diseases such as diabetes, obesity, and cardiovascular disorders, thereby reinforcing their importance as a sustainable and health-promoting food option.

Limitation of the Study

The cross-sectional design of the study captures dietary practices at a single point in time and does not reflect long-term changes or seasonal variations in millet consumption. Despite these limitations, the study provides valuable insights into generational dietary transitions in an urban setting.

Relevance of the Study

This study adds to current knowledge by providing empirical evidence of generational differences in millet consumption within urban Indian households. It highlights the gap between awareness and actual dietary practices and underscores the nutrition transition where traditional foods are being replaced by refined grains. The findings can guide policymakers, nutritionists, and food industries in designing interventions to revive millet consumption among younger generations.

Authors Contribution

All authors have contributed equally.

Financial Support and Sponsorship

Nil

Conflict of Interest

There are no conflicts of interest.

Declaration Of Generative AI And AI Assisted Technologies In The Writing Process

The authors declare that no generative AI or AI-assisted technologies were used in the preparation of this manuscript.

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