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Zonal disparity in awareness and consumption of millets in urban households of Punjab

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Abstract

The present study examines zonal disparities in awareness and consumption of millets among urban households across Punjab's three socio-cultural zones: Majha, Doaba and Malwa. Using a descriptive survey design, data were collected from 300 respondents through structured interviews. The study investigated awareness levels, consumption pattern, factors influencing millet consumption and constraints in millet consumption. Findings revealed that awareness about millets particularly their types, nutritional and environmental benefits which was highest in Majha, followed by Doaba and lowest in Malwa. However, consumption pattern did not directly align with awareness levels. Malwa reported the highest consumption despite its lower awareness, suggesting that factors beyond knowledge such as cultural and health motivation played a significant role. Barnyard millet emerged as the most consumed variety with processed forms like *dalia* being preferred across all zones. Religious practices especially in Majha, were the leading reason for millet consumption. Common constraints included cultural preference for wheat and rice, lack of culinary knowledge etc. The study highlights the need for targeted awareness campaigns, culinary trainings and improved market access to enhance millet consumption in urban areas of Punjab.

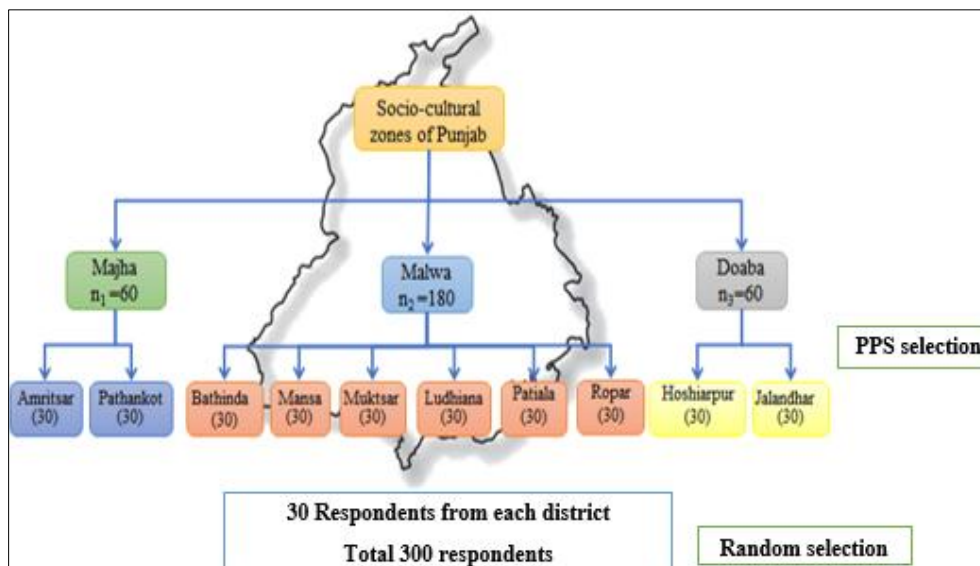
Keywords: Millets, awareness, consumption, socio-cultural zones, urban households

Introduction

Millets, traditionally a staple food in dry regions deeply involved in dietary practices of both urban and rural communities (Amrutha *et al.*, 2024) ^[2]. Millets are grown across 17 million hectares in India, contributing 18 million tonnes to the nation's food supply about 10% of total grain production (Dayakar *et al.*, 2017) ^[1]. Millets are among the earliest crops domesticated by humans for food and are now grown in 131 countries around the world. In regions of Africa and Asia, they serve as a primary food source for nearly 59 million people (Rai *et al.*, 2023) ^[11]. Millets are recognised as smart crops and are often referred to as "pioneers of evergreen revolution" (Sangappa *et al.*, 2023) ^[5]. These nutrient-dense grains are rich in protein, fiber, B vitamins, and essential minerals like calcium, iron, and magnesium, offering significant health benefits such as improved blood sugar control, heart health, and support for thyroid and digestive health (Prasanthi and Sireesha, 2023) ^[9]. Millet typically contains 10–12% protein and offers a better balance of essential amino acids compared to wheat or corn. However, it has less than half the amount of lysine—an essential amino acid—when compared to high-quality protein sources like meat (Mishra *et al.*, 2019) ^[4]. ICRISAT coined the term "Smart Food" to describe millets, emphasizing their all-around advantages: they are beneficial for health, the environment, and farmers. Millets earn the

label "Good for you" because they are rich in essential nutrients like iron, zinc, calcium, protein, and dietary fiber—nutrients particularly important for women and children, who often face deficiencies. They are "Good for the planet" thanks to their low environmental impact and ability to support climate change adaptation and mitigation. Millets also qualify as "Good for the farmer" since they grow well in hot, arid conditions with minimal water, making them ideal for smallholder farmers. Although people are increasingly aware of the importance of healthy eating, this awareness hasn't translated into higher millet consumption, mainly due to lack of familiarity and preferences for other tastes. Over the past 30 years, millet intake has declined significantly, largely because many remain unaware of its health benefits. This decline has been further driven by urbanization, modernization, and the influence of global food trends. Shifting dietary habits, the convenience of processed foods, and the adoption of Western eating patterns have also contributed to this change. Moreover, millets have long carried the label of being "food for the poor," which has contributed to their decline in popularity compared to more mainstream cereals (Singh and Vemireddy, 2023) ^[14]. With regard to this, the present study was conducted in three socio-cultural zones of Punjab with the objective of investigating awareness and consumption pattern of millets in urban households of Punjab.

Methodology



This study adopted a descriptive survey design to explore millet awareness and consumption patterns among urban households in Punjab, covering the state's three socio-cultural zones: Malwa, Doaba and Majha. Using the Probability Proportionate to Size (PPS) method, selected districts included Amritsar, Pathankot, Hoshiarpur, Jalandhar, Bathinda, Mansa, Muktsar, Ludhiana, Patiala and Ropar. From these districts, thirty households per city were chosen through a combination of convenience and random sampling. A structured interview schedule was developed and pretested in Faridkot to ensure clarity and validity. The

schedule comprised five sections: personal and family profile, awareness of millets, consumption pattern of millets, documentation of millet-based recipes, and constraints to millet use. Variables such as age, education, income, occupation, health status, and family structure were recorded, with awareness measured on a three-point scale. Data collection involved face-to-face interviews, enabling detailed and consistent insights into millet-related knowledge, preferences, and challenges among the sample.

Results

Table 1: Zone wise awareness among respondents about different aspects of millets (n = 300)

Awareness about types of millets	Mean±SD			Kruskal Wallis χ^2 (H)
	Majha (n ₁ = 60)	Doaba (n ₂ = 60)	Malwa (n ₃ =180)	
Pearl Millet (<i>Bajra</i>)	2.93±0.36	2.93±0.36	2.90±0.42	0.77 ^{NS}
Sorghum Millet (<i>Jowar</i>)	2.91±0.26	2.93±0.36	2.74±0.66	10.32 ^{**}
Barnyard Millet (<i>Swank</i>)	2.90±0.44	2.93±0.36	2.66±0.73	13.48 [*]
Finger Millet (<i>Ragi</i>)	2.83±0.49	2.65±0.76	2.49±0.82	9.64 ^{**}
Kodo Millet (<i>Kodra</i>)	2.38±0.90	2.18±0.93	1.88±0.95	14.29 ^{**}
Foxtail Millet (<i>Kangni</i>)	2.28±0.88	2.17±0.96	1.71±0.85	22.72 ^{**}
Little Millet (<i>Kutki</i>)	1.85±0.94	1.82±0.97	1.49±0.82	10.74 ^{NS}
Proso Millet (<i>Cheena</i>)	1.52±0.75	1.28±0.58	1.11±0.38	26.49 ^{**}
Overall Mean	2.45	2.36	2.12	
Awareness about nutritive value of millets				
Fiber	2.50±0.77	2.17±0.91	1.56±0.83	55.53 ^{**}
Protein	1.80±0.94	1.80±0.84	1.55±0.82	6.72 [*]
Minerals	Calcium	1.75±0.93	1.97±1.01	2.45 ^{NS}
	Iron	1.93±0.95	2.07±0.92	12.48 ^{**}
	Magnesium	1.60±0.87	1.57±0.83	4.15 ^{NS}
	Potassium	1.60±0.87	1.55±0.83	6.14 [*]
	Zinc	1.60±0.87	1.47±0.83	8.45 [*]
Vitamin B	1.98±1.00	2.13±0.95	1.66±0.91	6.86 [*]
Overall mean	1.84	1.84	1.55	
Awareness about health benefits of millets				
Keeps body warm	2.57±0.83	2.77±0.65	2.13±1.01	24.36 ^{**}
Improves digestion	2.37±0.94	2.63±0.78	2.06±1.00	17.66 ^{**}
Prevents constipation	2.37±0.92	2.47±0.89	1.93±0.99	17.92 ^{**}
Helps in weight management	2.07±0.99	2.00±0.99	1.82±0.98	3.12 ^{NS}
Manage blood sugar level	1.85±0.86	2.07±0.99	1.83±0.97	2.45 ^{NS}
Improves bone health	2.08±1.00	2.10±0.99	1.68±0.94	12.16 ^{**}
Manages blood pressure	1.58±0.85	1.57±0.83	1.57±0.87	0.016 ^{NS}

Detoxify body	1.47±0.85	1.58±0.87	1.52±0.86	0.953 ^{NS}
Improves heart health	1.38±0.78	2.10±0.79	1.32±0.68	2.04 ^{NS}
Overall mean	1.97	2.14	1.76	
Awareness about environmental benefits of millets				
Drought tolerant crop	1.62±0.88	2.38±0.90	1.51±0.84	40.29**
Water efficient crop	1.47±0.81	1.65±0.92	1.54±0.87	1.233 ^{NS}
Short growing cycle of crop	1.50±0.87	1.73±0.94	1.58±0.90	2.56 ^{NS}
Multipurpose use (food, fodder)	1.77±0.93	2.17±0.98	1.58±0.88	17.56**
Reduce greenhouse gas emission	1.42±0.79	1.37±0.78	1.16±0.51	8.03*
Low carbon footprint	1.32±0.70	1.37±0.78	1.13±0.48	7.87*
Biodiversity conservation	1.20±0.58	1.28±0.74	1.08±0.39	8.23*
Overall mean	1.47	1.70	1.36	

Score range: 1-3, *Significant at 5% level, **Significant at 1% level

Data presented in Table 1 revealed that respondents generally showed moderate awareness of various millet types, with Majha displaying slightly higher overall awareness than Doaba and notably more than Malwa. Pearl Millet had high awareness across all zones, while awareness of Sorghum, Barnyard, Finger, Kodo, and Foxtail Millets declined from Majha and Doaba to Malwa, with significant differences. Little and Proso Millets had the lowest awareness, especially in Malwa. These findings highlight regional variations in familiarity with different millets.

Awareness of the nutritive value of millets was higher in Majha and Doaba (mean score: 1.84) compared to Malwa (1.55). Fiber awareness was highest in Majha and lowest in Malwa, showing a significant difference. Similar trends were seen for protein, iron, zinc, potassium, and Vitamin B, with Majha and Doaba consistently scoring higher. Overall, Malwa respondents were less informed, and significant regional differences highlight gaps in nutritional awareness. Respondents from Doaba showed the highest awareness of millet health benefits (mean: 2.14), followed by Majha (1.97) and Malwa (1.76). Significant differences were noted in awareness of benefits such as keeping the body warm, improving digestion, preventing constipation, and supporting bone health, with Malwa scoring notably lower. Awareness of weight management, blood sugar control, and heart health remained low across all zones.

Environmental awareness was highest in Doaba (mean: 1.70), followed by Majha (1.47) and lowest in Malwa (1.36), with most respondents falling in the "not aware to somewhat aware" range. Awareness of drought tolerance and multipurpose use was significantly higher in Doaba. Awareness of greenhouse gas reduction, low carbon footprint, and biodiversity conservation was low across all zones but significantly lower in Malwa. No significant differences were found for water efficiency and short growing cycle.

Table 2: Zone wise distribution of respondents according to their Awareness Levels regarding Millets

Levels	Majha		Doaba		Malwa	
	n ₁ = 60		n ₂ = 60		n ₃ =180	
	f	%	f	%	f	%
Low	19	31.66	28	46.66	100	55.55
Medium	21	35.00	13	21.66	50	27.77
High	20	33.33	19	31.66	30	16.66

The data presented in table 2 shows that awareness level regarding millets was highest in Majha, with one-third of respondents having high awareness. Doaba showed mixed levels, while Malwa had the highest proportion of low awareness level (55.55%), indicating a significant knowledge gap in that region.

Table 3: Association of personal and family profile of respondents with awareness level of millets

Occupation	Low f (%)	Medium f (%)	High f (%)	Total f (%)	Association (χ ²)
Homemaker	92 (30.70)	53 (17.70)	5 (1.70)	150 (50.00)	126.95*
Service	22 (7.30)	27 (9.00)	62 (20.70)	111 (37.00)	
Business	18 (6.00)	4 (1.30)	2 (0.70)	24 (8.00)	
Labour	15 (5.00)	0 (0.00)	0 (0.00)	15 (5.00)	
Religion					
Hindu	88 (29.30)	68 (22.70)	57 (19.00)	213 (71.00)	17.41*
Sikh	59 (19.70)	16 (5.30)	12 (4.00)	87 (29.00)	
Health issue					
Diabetes	17 (5.66)	17 (5.66)	15 (5.00)	49 (16.33)	14.68 ^{NS}
Hypertension	10 (3.30)	4 (1.30)	3 (1.00)	17 (5.66)	
Cardiovascular disease	2 (0.66)	9 (3.00)	8 (2.66)	19 (6.33)	
Thyroid disease	11 (3.70)	9 (3.00)	9 (3.00)	29 (9.66)	
No health issue	101 (33.66)	48 (16.00)	37 (12.30)	186 (62.00)	
Family type					
Nuclear	116 (38.70)	64 (21.30)	48 (16.00)	228 (76.00)	3.04 ^{NS}
Joint	25 (8.30)	18 (6.00)	18 (6.00)	61 (20.30)	
Extended	6 (2.00)	2 (0.70)	3 (1.00)	11 (3.70)	

*Significant at 5% level, **Significant at 1% level

The data presented in table 3 indicated that occupation and religion have a significant association with the awareness level of millets among respondents, while health issues and family type do not show any significant relationship. A highly significant association was observed between occupation and awareness level ($\chi^2=126.95^*$). Service respondents exhibited comparatively higher awareness, with a greater proportion falling under the high awareness category, whereas homemakers, business persons and labourers were predominantly concentrated in the low awareness group. Religion was also significantly associated with the awareness level ($\chi^2=17.41^*$). A larger proportion of Hindus showed medium and high levels of awareness

compared to Sikhs, among whom low awareness was more common. In contrast, health status ($\chi^2=14.68$ NS) did not significantly influence awareness, as respondents with various conditions such as diabetes, hypertension, cardiovascular disease, thyroid disorders or no health issues were distributed across different awareness levels without a clear pattern. Similarly, family type ($\chi^2=3.04$ NS) was not significantly associated with awareness level, indicating that respondents from nuclear, joint and extended families had comparable levels of awareness. Overall, occupation and religion play a significant role in determining awareness of millets, whereas health condition and family type do not significantly affect awareness levels.

Table 4: Zone wise distribution of respondents according to consumption of millets (n =300)

Types of millets consumed		Majha n ₁ = 34		Doaba n ₂ = 40		Malwa n ₃ = 126	
		f	%	f	%	f	%
Barnyard Millet (<i>Swank</i>)		34	100.00	36	90.00	102	80.95
Pearl Millet (<i>Bajra</i>)		4	11.76	24	60.00	84	66.66
Sorghum Millet (<i>Jowar</i>)		3	8.82	24	60.00	36	28.57
Finger Millet (<i>Ragi</i>)		5	14.70	8	20.00	39	30.95
Kodo Millet (<i>Kodra</i>)		4	11.76	6	15.00	19	15.07
Foxtail Millet (<i>Kangni</i>)		4	11.76	6	15.00	15	11.90
Little Millet (<i>Kutki</i>)		4	11.76	6	12.50	4	3.17
Forms of millets consumed							
Unprocessed millets (Whole millets)		1	2.94	0	0.00	23	18.25
Processed form	<i>Dalia</i>	34	100.00	40	100.00	116	92.06
	Flour	7	20.58	24	60.00	90	71.42
	<i>Laddu</i>	4	11.76	5	12.50	16	12.69
	Biscuits	4	11.76	6	15.00	11	8.73
	Bread	4	11.76	6	15.00	10	7.93
Types of millet dishes consumed							
Millet porridge/ <i>dalia</i>		30	88.23	36	90.00	103	81.74
Millet <i>kheer</i>		26	76.47	30	75.00	75	59.52
Millet <i>roti</i>		5	14.70	24	60.00	86	68.25
Millet mixed <i>khichdi</i>		4	11.76	25	62.50	83	65.87
Millet <i>laddu</i>		5	14.70	6	15.00	23	18.25
Millet <i>idli</i>		4	11.76	3	7.50	7	5.50
Millet <i>upma</i>		3	8.23	4	10.00	5	3.96
Seasonal consumption of millets							
Winter season		6	17.64	23	57.5	83	65.87
Summer season		5	14.70	7	17.50	39	30.95
Occasionally (Fasting)		34	100.0	36	90.00	103	81.74
Time of consuming millets							
Breakfast		0	0.00	0	0.00	27	21.42
Lunch		7	20.58	0	0.00	35	27.77
Dinner		34	100.0	39	97.50	112	88.88
Source of procurement of millets							
Market		34	100.00	40	100.00	126	100.00
Online		5	14.70	2	5.00	9	7.14

*multiple response

Based on the data presented in table 4, regarding types of millets consumed among respondents, Barnyard millet was the most widely consumed across all regions, especially in Majha (100%) followed by Doaba (90%) and Malwa (80.95%). Pearl and Sorghum millets were more commonly consumed in Doaba and Malwa, but had low uptake in Majha. Overall, Finger, Kodo, Foxtail, and particularly Little Millet had low consumption across all zones, with Malwa showing the least consumption.

The data clearly indicated a strong preference for processed forms of millets across all regions. Processed forms were

predominant, especially *Dalia* consumed by nearly all respondents in Majha and Doaba followed by in Malwa. Flour was more popular in Doaba (60%) and Malwa (71.42%) than in Majha (20.58%). Other processed forms like *Laddu*, Biscuits, and Bread were consumed by less than 15% of respondents across all regions. Unprocessed millets (whole form) were consumed only in Malwa (18.25%), with negligible or no consumption in Majha and Doaba.

Among various types of millet dishes consumed by respondents, Millet porridge (*Dalia*) was the most common dish across regions, consumed by 88.23% in Majha, 90% in

Doaba, and 81.74% in Malwa. Millet *Kheer*, Millet *Roti*, and Millet *Khichdi* were more popular in Doaba and Malwa than Majha. Doaba showed a notable preference for Millet *Roti* (60%) and Millet *Khichdi* (62.50%), compared to 14.70% and 11.76% respectively in Majha. Dishes like Millet *Idli*, Millet *Upma*, and Millet *Laddu* had very limited consumption across all zones.

Millet consumption peaked during the winter, particularly in Malwa (65.87%) and Doaba (57.5%), while Majha had minimal seasonal consumption in winter (17.64%) while summer consumption remained low across all zones, with the highest in Malwa (30.95%). But in contrast to summer season, occasional consumption particularly during fasting was common in all regions, with 100% in Majha followed by 90% in Doaba and 81.74% in Malwa.

Dinner was the most common time for millet consumption across all zones, with over 97% of respondents in Majha and Doaba and 88.88% in Malwa consuming millets at night. Lunch consumption was observed more in Malwa (27.77%) and Majha (20.58%), but not at all in Doaba. Breakfast consumption was only reported in Malwa (21.42%).

The market was the primary source of millet procurement across all zones (100%). Online purchases were minimal, with the highest in Majha (14.70%) and lowest in Doaba (5.00%).

Table 5: Zone wise distribution of respondents according to their levels of millet consumption

Consumption Level	Majha		Doaba		Malwa	
	n ₁ = 34		n ₂ = 40		n ₃ =126	
	f	%	f	%	f	%
Low	28	82.35	24	60.00	68	53.96
Medium	4	11.76	11	27.50	45	35.71
High	2	5.88	5	12.50	13	10.31

The data presented in table 5 indicated that low millet consumption was most prevalent in all regions, especially in Majha (82.35%), followed by Doaba (60%) and Malwa (53.96%). Malwa had the highest proportion of respondents at medium and high level of consumption, suggesting relatively greater millet intake compared to the other zones.

Table 6: Association of personal and family profile of respondents with consumption of millets

Occupation	Low f (%)	Medium f (%)	High f (%)	Total f (%)	Association (χ^2)
Business	19 (6.30)	5 (1.70)	0 (0.00)	24 (8.00)	28.08*
Homemaker	102 (34.00)	39 (13.00)	9 (3.00)	150 (50.00)	
Service	49 (16.30)	39 (13.00)	23 (7.70)	111 (37.00)	
Labour	10 (3.33)	5 (1.70)	0 (0.00)	15 (5.00)	
Religion					
Hindu	114 (38.00)	67 (22.30)	32 (10.70)	213 (71.00)	19.33*
Sikh	66 (22.00)	21 (7.00)	0 (0.00)	87 (29.00)	
Health issue					
Diabetes	21 (7.00)	19 (6.30)	9 (3.00)	49 (16.33)	14.19 ^{NS}
Hypertension	9 (3.00)	6 (2.00)	2 (0.70)	17 (5.66)	
Cardiovascular disease	5 (1.66)	6 (2.00)	8 (2.66)	19 (6.33)	
Thyroid disease	17 (5.66)	11 (3.70)	1 (0.30)	29 (9.66)	
No health issue	119 (39.66)	48 (16.00)	19 (6.30)	186 (62.00)	
Family type					
Nuclear	139 (46.30)	69 (23.00)	20 (6.70)	228 (76.00)	7.54 ^{NS}
Joint	33 (11.00)	16 (5.30)	12 (4.00)	61 (20.30)	
Extended	8 (2.70)	3 (10.00)	0 (0.00)	11 (3.70)	

*Significant at 5% level, **Significant at 1% level

The results in table 6 revealed that occupation and religion have a statistically significant association with millet consumption, while health issues and family type do not show significant association. A significant relationship was observed between occupation and millet consumption ($\chi^2=28.08$, $p < 0.05$), indicating that consumption levels vary across occupational groups. Homemakers constituted the largest proportion of respondents (50%), followed by those in service (37%), business (8%) and labour (5%). Higher levels of millet consumption were more evident among service employees and homemakers, whereas respondents engaged in business and labour reported no high consumption. Similarly, religion showed a significant association ($\chi^2=19.33$, $p < 0.05$), with Hindus (71%)

demonstrating higher levels of millet consumption compared to Sikhs (29%), among whom no respondent reported high consumption. In contrast, health issues ($\chi^2=14.19$ NS) and family type ($\chi^2=7.54$ NS) were not significantly associated with millet consumption. Although respondents with certain health conditions such as diabetes and cardiovascular disease reported varying levels of consumption, these differences were not statistically significant. Likewise, despite nuclear families forming the majority (76%), family structure did not significantly influence millet consumption patterns. Overall, findings suggest that socio-demographic factors like occupation and religion play a more important role in determining millet consumption than health status or family type.

Table 7: Zone wise distribution of respondents according to factors influencing consumption of millets

Factors	Majha		Doaba		Malwa	
	n ₁ = 34		n ₂ = 40		n ₃ =126	
	f	%	f	%	f	%
Religious purpose	34	100.00	37	92.50	104	82.53
Traditional food in family	12	35.29	31	77.50	70	55.55
Health benefits	5	14.70	23	59.50	66	52.38
Culinary variety	4	11.76	16	51.61	58	46.03
Nutritional value	5	14.70	11	27.50	55	43.65
Medical advice by doctors	8	23.52	4	10.00	39	30.95
Taste	5	14.70	6	15.00	20	15.87
Weight management goals	3	8.82	5	12.50	21	16.66
Dietary Preferences	0	0.00	1	2.50	21	16.66

*multiple response

Data from table 7 indicates that religious purpose was the leading reason for millet consumption across all zones especially in Majha (100%) followed by Doaba (92.50%) and Malwa (82.53%). Doaba respondents were more influenced by traditional practices (77.50%), health benefits (59.50%),

and culinary variety (51.61%), while Malwa showed a broader mix of factors, including nutrition and medical advice. Overall, cultural reasons dominated in Majha, whereas health and dietary motivations were more prominent in Doaba and Malwa.

Table 8: Zone wise distribution of respondents according to constraints that hinder consumption of millets

Constraints	Majha		Doaba		Malwa	
	n ₁ = 60		n ₂ = 60		n ₃ = 180	
	f	%	f	%	f	%
Personal constraints						
Time consuming cooking	13	21.60	9	15.00	33	18.33
Lack of culinary knowledge and skill	15	25.00	10	16.66	27	15.00
Cooking complexity	8	13.33	4	6.66	38	21.11
Costlier and not affordable	10	16.66	13	21.66	25	13.88
Lack of awareness	12	20.00	15	25.00	20	11.11
Personal health issue	14	23.33	8	13.33	16	8.88
Tasteless/Dislike for taste	3	5.00	7	11.66	15	8.33
Cultural constraints						
Cultural preference for rice and wheat	33	55.00	26	43.33	95	52.77
Influence of western trends in food	7	11.66	8	13.33	19	10.50
Storage constraints						
Lack of knowledge of storage	25	41.66	33	55.00	90	50.00
Short shelf life	25	41.66	30	50.00	85	47.22
Moisture management	12	20.00	8	13.33	45	25.00
Pest infestation	7	11.66	10	16.66	30	16.66
Marketing constraints						
Lack of availability and accessibility	20	33.33	23	38.33	75	41.66
Lack of detailed labelling on packets	12	20.00	15	25.00	20	11.11

*multiple response

Data from table 8 revealed that the major constraints to millet consumption were cultural preference for rice and wheat (nearly half of the respondents) and storage-related issues, comparatively more in Doaba and Malwa. Personal barriers like lack of culinary skills, cooking complexity, and health concerns were more reported in Majha (nearly one fifth of the respondents). Limited availability was a key marketing issue, especially in Malwa (41.66%). Overall, constraints varied by region but common constraints were cultural habits, storage limitations, and accessibility challenges.

Discussion

The study found that Pearl millet (*Bajra*) was the most well-known millet, followed by Sorghum (*Jowar*) and Barnyard millet (*Swank*). Consumption patterns varied based on regional and cultural practices. Overall, respondents had moderate awareness of millet varieties, with Majha showing

slightly higher awareness than Doaba and Malwa. Notable differences in millet knowledge across zones highlighted regional disparities in familiarity. These results align with the studies by Prashanthi *et al.*, (2022) ^[10], who observed that more than half of the participants were familiar with millets, and Rizwana *et al.*, (2022) ^[12], who also noted a high level of millet awareness among respondents. The study revealed limited awareness of millets' nutritional and health benefits among respondents. Calcium was the most recognized nutrient, followed by fiber, iron, and Vitamin B, with zinc being the least known. Respondents from Majha and Doaba had higher awareness than those from Malwa. Most participants knew millets help with body warmth and digestion, but fewer were aware of their role in detoxification, blood pressure management, and heart health. These findings contrast with Sood, (2024) ^[15], who reported higher nutritional awareness. The study found low overall awareness

of millets being environment friendly, with respondents from Doaba being more informed than those from Majha and Malwa. Hussain *et al.*, (2024) ^[3] also linked declining millet cultivation to limited awareness about millets among people. Regional variations in awareness- Majha showing higher familiarity than Doaba and Malwa may be explained by the differences in family education levels, income groups and family types noted in respected zones.

The study found that most respondents were consuming millets, with the highest consumption reported in the Malwa zone, followed by Doaba and Majha. These results align with the findings of Rizwana *et al.*, (2022) ^[12], who noted that although many respondents were aware of millets, only 62.70 per cent were actually consuming them. The data showed that millet was most often bought in the form of *Dalia*, followed by flour. Among the dishes, millet porridge or *dalia* was the most popular, with millet *kheer*, *roti*, and mixed millet *khichdi* also commonly consumed. Similarly, Krishnamurthy *et al.*, (2024) ^[6] found that porridge/*dalia* was the preferred millet dish. Millet consumption was highest during the winter months, especially in the Malwa and Doaba regions. Millet consumption peaked during winter season particularly in Malwa and Doaba which is in line with the findings of Sharma *et al.*, (2024) ^[13] who similarly observed that most respondents favoured consuming millets seasonally, while about one-fourth supported incorporating them throughout the year. The higher consumption of millets in Malwa, despite lower awareness, may be attributed to cultural practices and seasonal preferences. Additionally, the higher proportion of nuclear families and homemakers in these regions, who are the primary decision-makers in household food preparation, could also influence seasonal dietary choices such as millet porridge during winters.

The study found that a major constraint to millet consumption was the cultural preference for rice and wheat, particularly in the Majha zone which is aligned with study conducted by Pathak *et al.*, (2023) ^[8]. In the Doaba zone, storage issues such as limited knowledge of proper storage techniques and short shelf life were prominent. Marketing challenges, including poor availability, limited accessibility, and inadequate labelling of millet products, were most notable in the Malwa and Doaba zones. These findings align with studies by Maruthanayagam *et al.*, (2023) ^[7], which reported low millet consumption due to family food habits, limited availability, and high prices. However, Sharma *et al.*, (2024) ^[13] found that most respondents did not view millet storage as a major issue, as they found it easy to store in airtight containers.

Highlights

- The study explored zonal disparities in awareness and consumption of millet in urban households of Punjab.
- The study explored the zone wise disparities in millets awareness in terms of its types, nutritive value, health and environment benefits in Punjabi urban households
- The study identified the factors influencing millet consumption in urban households of Punjab.
- The study identified the constraints that hinder millet consumption in urban households of Punjab

Conclusion

The study examined millet awareness and consumption in

Punjab's urban areas, finding highest awareness in Majha but highest consumption in Malwa. Barnyard millet was the most popular, mainly eaten as processed *dalia*. Cultural, seasonal, and religious factors influenced consumption, while barriers included preferences for rice and wheat, cooking and storage challenges, and limited market access. The study calls for improved education, marketing, and support to increase millet use.

In conclusion, there are encouraging chances to promote millets as a component of a sustainable and healthful diet, even though awareness and consumption of millet in Punjab's metropolitan areas varies greatly by location. A good change toward higher millet use can be facilitated by addressing storage and marketing challenges, improving consumer education, providing culinary direction, and clearing up cultural misconceptions. Through focused initiatives, special attention should be paid to raising awareness in Malwa and transforming high awareness in Majha into increased consumption.

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