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Consumer awareness, consumption pattern and attitude towards minor millet-based functional foods in Chennai, Tamil Nadu

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Abstract

Millet-based functional foods have re-entered urban Indian diets as 'nutri-cereals' following the International Year of Millets (2023) and the Government of India's Shree Anna initiative, yet how urban consumers actually perceive and consume minor millet-based functional foods, and whether this perception differs across demographic groups, has not been well documented for Chennai. This study surveyed 120 consumers drawn equally from six zones of Chennai (T. Nagar, Anna Nagar, Adyar, Sholinganallur, Madhavaram and Porur) using a structured schedule administered between March and June 2026 through a purposive sampling method. Data were analysed using percentage analysis, mean score analysis, five-point Likert scaling, the one-sample t-test, and the chi-square test of independence. Awareness of minor millets was high, with 90.83 per cent of respondents reporting at least a moderate level of familiarity, yet 98.33 per cent could not recall a single specific brand. Consumption was near-universal (98.33 per cent), with 50.84 per cent consuming these products weekly or more often, mainly through supermarkets and hypermarkets. Consumer perception was favourable across all ten Likert statements, ranging from willingness to recommend the products (mean 4.59) to taste and enjoyability (mean 3.75, the lowest yet still positive). The overall mean attitude score of 4.15 was significantly above the neutral midpoint of 3.00 (one-sample t-test, $t = 25.711$, $df = 117$, $p < 0.001$), leading to rejection of the null hypothesis and acceptance of the alternative hypothesis that consumers hold a positive attitude towards minor millet-based functional foods. Chi-square tests of independence found no statistically significant association between familiarity and gender ($\chi^2 = 5.147$, $p = 0.076$) or age group ($\chi^2 = 1.495$, $p = 0.474$), between frequency of consumption and monthly household income ($\chi^2 = 3.742$, $p = 0.442$), or between overall attitude and educational qualification ($\chi^2 = 1.762$, $p = 0.414$). The findings indicate that awareness, consumption and a statistically confirmed positive attitude towards minor millet-based functional foods are broad-based across demographic segments in Chennai, while weak brand recall represents the principal constraint on further market growth.

Keywords: Minor millets, functional foods, consumer awareness, consumption pattern, attitude, one-sample t-test, chi-square test, Chennai

Introduction

The United Nations declared 2023 as the International Year of Millets (IYM 2023) [5], recognising the potential of these ancient crops to address global challenges of food security, malnutrition and climate change, with India championing the resolution as the world's largest millet producer (MoAFW, 2023; FAO, 2023) [5, 3]. The Government of India subsequently designated millets as 'Shree Anna', underscoring their nutritional and strategic importance to Indian agriculture (Economic Survey, 2024) [2]. Minor millets — Foxtail millet (Thinai), Kodo millet (Varagu), Barnyard millet (Kuthiraivali), Little millet (Samai) and Proso millet (Panivaragu) — are valued for their dense micronutrient profiles, high dietary fibre and low glycaemic index, making them scientifically well suited for functional food formulation (Singh and Vemireddy, 2023; FAO/WHO, 2020) [7, 4].

Tamil Nadu is traditionally known as the homeland of minor

millet-based functional foods, producing approximately 2.1 lakh metric tonnes in 2022–23, with cultivation concentrated in Dharmapuri, Namakkal, Salem, Villupuram, Erode, Cuddalore and the Nilgiris (Tamil Nadu Agricultural University, 2023) [9]. Chennai presents a particularly compelling demand-side context: an urban surveillance study reported a national age- and gender-standardised diabetes prevalence of 12.1 per cent (Ramachandran *et al.*, 2001) [6], while South Indian states, including Tamil Nadu, record some of the highest prevalences of lifestyle disease linked to the dietary transition away from traditional whole grains (Sundaresan *et al.*, 2024) [8].

Despite this favourable public health backdrop and the growing presence of minor millet-based functional foods — spanning biscuits, snacks, ready-to-cook mixes, beverages and confectionery — in Chennai's retail ecosystem, earlier studies have flagged persistent demand-side barriers of consumer inertia, price perception and limited product

familiarity that constrain mainstream adoption (Singh and Vemireddy, 2023; Duraisamy and Vasantha, 2019)^[7, 1]. What has remained less clear is whether the awareness, consumption behaviour and overall attitude of Chennai consumers towards these products can be confirmed as statistically positive, and whether these outcomes vary meaningfully across demographic groups such as gender, age, income and education. Addressing this gap is necessary to guide targeted, evidence-based positioning and promotional strategies for minor millet-based functional foods.

Accordingly, this article draws on the two objectives of a larger study that were tested statistically: (i) to analyse the awareness level and consumption pattern of minor millet-based functional foods among consumers in Chennai, and its association with demographic profile, and (ii) to assess consumer perceptions and attitude towards minor millet-based functional foods and test whether this attitude is significantly positive.

Materials and Methods

The study was conducted in Chennai, Tamil Nadu, purposively selected for its well-developed retail ecosystem for health and functional foods and its high urban prevalence of lifestyle disease. Six zones were selected to capture socio-economic diversity — the urban zones of T. Nagar, Anna Nagar and Adyar, and the peri-urban zones of Sholinganallur, Madhavaram and Porur. A purposive sample of 120 consumer respondents (20 per zone) with prior awareness of, or experience in consuming, minor millet-based functional foods was drawn from modern retail outlets, organic and specialty stores, kirana shops, millet cafés and health and wellness events.

A structured questionnaire, prepared in English with explanations offered in Tamil, was administered through personal interaction between March and June 2026. The instrument captured socio-demographic profile, awareness of minor millets and their product categories, consumption pattern, and consumer perception measured on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) across statements on health value, taste, price, availability, value for money, purchase intention, brand communication and trust. Data were tabulated and analysed in Microsoft Excel using percentage analysis and mean score analysis. To test the hypothesis that consumers hold a positive attitude towards minor millet-based functional foods, a one-sample t-test was used to compare the mean overall attitude score against the neutral midpoint ($\mu_0 = 3.00$) of the five-point scale. Chi-square tests of independence were used to examine whether familiarity, frequency of consumption and overall attitude were associated with gender, age group, monthly household income and educational qualification,

respectively, with categories collapsed where necessary to ensure adequate expected cell frequencies.

Results and Discussion

1.1 Demographic Profile of Respondents

Of the 120 consumer respondents, 52.50 per cent were aged between 21 and 30 years, reflecting a sample dominated by young adults. The gender split was fairly balanced (53.33 per cent male, 46.67 per cent female). A majority were educated to at least undergraduate level (55.84 per cent held an undergraduate or postgraduate degree), and students formed the single largest occupational group (43.33 per cent), followed by private sector employees (21.67 per cent). More than 60 per cent of the sample belonged to middle-income households earning between ₹30,001 and ₹75,000 per month.

1.2 Awareness of Minor Millets and Minor Millet-Based Functional Foods

Awareness of minor millets was high among the selected consumers: 45.83 per cent described themselves as ‘very familiar’ and regular users, and a further 45.00 per cent as ‘somewhat familiar’, together accounting for over 90 per cent of the sample. Ready-to-cook products such as millet noodles, pasta and vermicelli were the most recognised product category (74.17 per cent), ahead of ready-to-eat (61.67 per cent), ready-to-drink (58.33 per cent) and raw/whole-grain formats (52.50 per cent). Social media was the leading source of awareness (42.50 per cent), well ahead of word-of-mouth (30.83 per cent) and professional health advice (20.83 per cent). Notably, despite this high general familiarity, 98.33 per cent of respondents could not name a single specific brand selling minor millet-based functional foods, pointing to a marked gap between category-level awareness and brand-level recall.

1.3 Consumption Pattern

Consumption of minor millet-based functional foods was near-universal, with 98.33 per cent of respondents reporting that they consume such products. Just over half the sample (50.84 per cent) consumed these products weekly or more often, including 9.17 per cent who consumed them daily. Ready-to-cook products were the most widely consumed category (68.33 per cent), closely followed by ready-to-eat and ready-to-drink products (65.83 per cent each) and raw/whole-grain forms (54.17 per cent). Supermarkets and hypermarkets were the leading purchase channel (35.00 per cent), ahead of organic/specialty stores (20.00 per cent). Half the sample spent between ₹501 and ₹750 per month on these products, and 62.50 per cent had been consuming them for less than two years, indicating that this is a comparatively recent dietary behaviour.

Table 1: Association between Demographic Profile and Familiarity / Consumption

Association Tested	Chi-square (χ^2)	df	p-value	Result at 5% level
Gender × Familiarity with minor millets	5.147	2	0.076	Not significant
Age group × Familiarity with minor millets	1.495	2	0.474	Not significant
Monthly household income × Frequency of consumption	3.742	4	0.442	Not significant

(Source: Primary data, n = 120)

None of the three associations tested was statistically significant at the 5 per cent level (all $p > 0.05$). Male and

female respondents showed a broadly similar spread of familiarity levels, familiarity with minor millets did not differ

significantly between consumers up to 30 years of age and those above 30 years, and frequency of consumption was not significantly associated with monthly household income. These results indicate that awareness and consumption of minor millet-based functional foods in Chennai are broad-based rather than confined to any particular gender, age or income segment, consistent with the products' positioning as general-purpose health foods rather than niche items.

1.4 Consumer Perception and Attitude

Consumer perception of minor millet-based functional foods was measured across ten statements on a five-point Likert scale. The highest mean score was recorded for 'I would actively recommend millet-based products to my family and friends' (mean = 4.59, S.D. = 0.73), closely followed by 'Millet-based functional foods are highly nutritious and beneficial for health' (mean = 4.57, S.D. = 0.73). Trust in product quality and safety (mean = 4.21) and clarity of brand health-benefit communication (mean = 4.20) also scored highly. The lowest, though still positive, mean score was recorded for 'Millet-based products taste good and are enjoyable to consume' (mean = 3.75, S.D. = 1.19), followed by ease of availability at retail stores (mean = 3.80, S.D. = 1.32) — indicating that taste acceptability and retail availability remain the relatively weaker links in an otherwise favourable perception profile.

1.5 Testing of Hypothesis: One-Sample t-Test for Consumer Attitude

Note that the 2 non-consuming respondents were excluded from the attitude analysis, which is why the one-sample t-test and Table 3 utilize a sample size of $n=118$ while the rest of the paper uses $n=120$. The overall mean attitude score,

computed by averaging the ten perception statements for each respondent, was 4.15 (S.D. = 0.48, $n = 118$), well above the neutral midpoint of 3.00 on the five-point scale. A one-sample t-test was used to test the null hypothesis (H_0 : consumers do not have a positive attitude towards minor millet-based functional foods) against the alternative hypothesis (H_1 : consumers have a positive attitude).

Table 2: One-Sample t-Test for Overall Consumer Attitude Score

Particular	Value
Number of observations (n)	118
Mean attitude score	4.15
Test value (neutral midpoint, μ_0)	3.000
Standard deviation	0.48
t-value	25.711
Degrees of freedom (df)	117
p-value	< 0.001 (exact: 5.845E-50)
Decision at 5% level	H_0 rejected; H_1 accepted

(Source: Primary data)

The calculated t-value of 25.711 ($df = 117$) was statistically significant at the 5 per cent level ($p < 0.001$), providing strong evidence that the mean attitude score is significantly greater than the neutral midpoint. The null hypothesis was therefore rejected and the alternative hypothesis accepted, confirming that the selected consumers in Chennai hold a positive attitude towards minor millet-based functional foods, a conclusion additionally supported by the uniformly favourable mean scores recorded across all ten individual perception statements in Table above.

1.6 Association between Demographic Profile and Overall Attitude

Table 3: Educational Qualification $\times$ Consumer Attitude Group ($n = 118$)

Educational Qualification	High attitude ($\geq$ mean)	Low attitude ($<$ mean)	Total
Up to Higher Secondary / Diploma	22	28	50
Undergraduate	25	21	46
Postgraduate & Above	13	9	22
Total	60	58	118

Chi-square value = 1.762, $df = 2$, p -value = 0.414 (Source: Primary data)

Since the calculated p-value (0.414) exceeds 0.05, the null hypothesis of no association between educational qualification and consumer attitude group was accepted. The positive attitude towards minor millet-based functional foods confirmed by the one-sample t-test therefore appears not to be confined to any particular educational segment but is broadly shared across respondents regardless of educational qualification, reinforcing the finding in Section 1.3 that demand-side receptivity in Chennai is broad-based rather than niche.

Key Observations

Awareness of minor millets is high (over 90 per cent) but does not translate into brand recall, with 98.33 per cent of consumers unable to name a specific brand — the central gap identified by this study.

Consumption is near-universal and, for half the sample, habitual (weekly or more often), concentrated in ready-to-cook and ready-to-eat formats purchased mainly through supermarkets and hypermarkets.

Consumer attitude towards minor millet-based functional foods is not merely favourable in a descriptive sense but statistically confirmed to be significantly positive ($t = 25.711$, $p < 0.001$), providing robust support for continued and expanded market investment in this category.

None of the four chi-square tests of association — covering gender, age group, income and education — returned a statistically significant result, indicating that awareness, consumption and positive attitude are shared fairly evenly across demographic segments rather than concentrated in any one group, and that the addressable market is broad rather than niche.

Conclusion

This study confirms, through formal statistical testing, that Chennai consumers hold a significantly positive attitude towards minor millet-based functional foods (one-sample t-test, $t = 25.711$, $p < 0.001$), built on near-universal awareness (90.83 per cent) and consumption (98.33 per cent). However, this strong demand-side foundation coexists with an almost

complete absence of brand-level recall (98.33 per cent of consumers could not name a single brand), indicating that the principal constraint on market growth is not consumer interest but weak brand visibility. The chi-square tests of independence further establish that familiarity, consumption frequency and overall attitude do not vary significantly with gender, age group, household income or educational qualification, showing that the opportunity for minor millet-based functional foods in Chennai is broad-based rather than confined to a specific demographic niche. Firms seeking to capitalise on this statistically validated positive attitude should therefore prioritise sustained, category-wide brand-building and awareness campaigns — rather than narrowly targeted demographic segmentation — alongside stronger presence in supermarkets and hypermarkets, the channel most frequently used by consumers, to convert existing favourable attitudes into higher and more consistent purchase.

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