



Determinants of Consumer Perceptions towards Value-added Millet Products in Kerala, India

Reshma Vattekkad^{1*}, Surendra Singh Jatav², Pradeesh Kunchu³, Mohandas Vallamala Krishnankutty⁴ and Manikandan Krishnan¹

¹Department of Economics, The Gandhigram Rural Institute- DTBU, Dindigul, Tamil Nadu, India,

²Department of Economics, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, India

³Department of Commerce, Government College Chittur, Palakkad, Kerala, India

⁴Department of Economics, Government Victoria College, Palakkad, Kerala, India

*Corresponding author email id: reshma.p.manickath@gmail.com

HIGHLIGHTS

- This study examines determinants of consumption of value-added millet products.
- Study findings show that consumer perception varied according to demographic features.
- The SEM model states that the determinants have a significant impact on the perception of consumers, except price.

ARTICLE INFO

Keywords: Kerala, Millet, Perception, Structural Equation Model, Value-added product.

<https://doi.org/10.48165/IJEE.2025.61416>

Citation: Vattekkad, R., Jatav, S. S., Kunchu, P., Krishnankutty, M. V., & Krishnan, M. (2025). Determinants of consumer perceptions towards value-added millet products in Kerala, India. *Indian Journal of Extension Education*, 61(4), 96-100. <https://doi.org/10.48165/IJEE.2025.61416>

ABSTRACT

The paper examines determinants affecting the consumption of value-added millet products among consumers in Kerala, India. Using multi-stage sampling, 326 samples were collected from three districts of Kerala state in India, namely, Trivandrum, Palakkad, and Malappuram in December 2023. The study employed t-tests and one-way ANOVA to investigate the potential impact of socio-economic characteristics on consumer perception of value-added millet products. The structural equation model (SEM) was employed to analyse the determinants, like nutritional value, price, package quality, flavour, and media exposure, on consumer behaviour to buying millet products. Consumer perceptions vary according to demographic features such as gender, age, marital status, area of residence, and income. The SEM model states that all five determinants have a significant impact on the perception of consumers except price. With an unstandardized coefficient of 0.59, the “nutritional benefit” determinant had the strongest positive influence on consumer perception, while with an unstandardized coefficient of -0.023, price had a negative influence on the perception of consumers. The results imply that to increase the acceptance of value-added millet products, initiatives to promote millet consumption should concentrate on enhancing nutritional knowledge, taste, flavour, quality of production, and cost reduction.

INTRODUCTION

Millets are essential plant genetic sources capable of helping underprivileged farmers in dry, barren, marginal, and impoverished lands, particularly in Asia and Africa, achieve food security (Gupta et al., 2017; Zehra et al., 2025). It is a viable and promising crop for ensuring the food and nutritional security of the future

generation, given its broad tolerance to diverse agro-ecological contexts, superior nutritional characteristics, and exceptional agronomic qualities as a staple food (Gyawali, 2021). Millets have the following health benefits: (i) Lowering the chances of hypertension and cancer, and (2) The high concentration of antioxidant content lowers oxidation stress, prevents obesity, and lowers the probability of getting diabetes (Prajapati et al., 2023).

At the global level, India ranks first in millet production by producing more than 170 lakh tonnes (GoI, 2021). This accounts for 80 per cent of Asia's overall production and around 20 per cent of global production. Though the production area of millets decreased by 56 per cent between 1950–55 and 2015–20, the productivity of millet rose by 228 per cent due to the adoption of high-yielding varieties of seeds (GoI, 2021).

Due to these health and nutritional advantages, consumers widely prefer millets (Platel, 2013). For instance, calcium content is highest in finger millet (348 mg/100 g), which prevents osteoporosis. Because of a higher iron concentration, pearl millet and barnyard millet can help pregnant women with anaemia satisfy their iron requirements. Fox millet, on the other hand, has the most significant concentrations of zinc (4.1/100 g) and iron (2.7/100 g) (Platel, 2013). pearl millet contains free lipid content with a typical range of 5.6–7.1 per cent and bound lipids ranging from 0.57–0.90 per cent. Adding bajra flour in bakery products is a useful strategy to increase the consumption of carbohydrates and iron in the human diet (Singh et al., 2020). Sensory attributes of breakfast cereal (made up of pearl millets) were highly acceptable and had a bowl life of 3 min (Kumari et al., 2019).

As far as Kerala government's initiatives for millet consumption and production encouragement are concerned, the Kerala government implemented a campaign known as the "millet village" scheme to boost millet cultivation in 2017–18 (Government of Kerala, 2017). Similar initiatives are also intended to be implemented in other districts (Mohan et al., 2021). Kerala is actively expanding its millet production. Kerala exported 364.57 Metric Tonnes of millets to the world in the fiscal year 2021–2022, placing it tenth among Indian states. In addition to producing millets, such schemes aimed to start sourcing, packaging, labelling, distribution, and promotion of value-added millet products (APEDA, 2022; Yadav & Usha, 2022).

Despite the importance given to millet by the government of Kerala, there is a lack of understanding among the customers, mainly due to significant discrepancies among millet cultivators, customers, suppliers, and researchers. Hence, it is important to educate consumers about the benefits of switching to millet over staples like wheat and rice (Sreeni, 2023). In this context, it is necessary to examine those components that affect consumer behaviour towards millet products.

METHODOLOGY

The area of the present investigation is Kerala. This descriptive study is qualitative, cross-sectional, correlational, and non-experimental. The research population consists of all the consumers

of millet products in Kerala. A multi-stage random sampling approach was employed to choose a sample of consumers. For this, Kerala was split into the north, central, and south zones. In the second phase, a district is randomly chosen from each zone, such as Trivandrum from the south zone, Malappuram from the north zone, and Palakkad from the central zone. Data has been collected from 326 respondents in December 2023.

The questionnaire consists of two sections. The first part focused on the demographic details of the consumers, whereas the second section consisted of 27 statements under the six sub-sections, such as "nutritional benefit", "price", "packaging and quality", "taste", "media exposure", and "perception of the consumer". A descriptive examination was carried out to explain the demographic features of the respondents. In order to investigate whether the demographic features of the consumers affect the attitude of respondents towards millet consumption, a t-test and a one-way ANOVA were employed. SEM was employed to examine the influence and impact of five primary elements on respondents' perceptions of value-added millet products. SEM is a multivariate data analysis method for analysing complex relationship among constructs and indicators. To check the sufficiency of the sample chosen, the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity (BTS) were conducted before factor analysis. The results are shown in Table 1. The KMO value for the current investigation is 0.889. "To test the hypothesis that the correlation matrix is an identity matrix," one applies BTS (Tucker & LaFleur, 1991). With 64.24 per cent of the total variance retrieved, the Bartlett's test of sphericity was significant ($\chi^2 = 4534.209$, $p < 0.000$). The Kolmogorov-Smirnov test (K-S test) and the Shapiro-Wilk test (S-W test) were applied to check whether the sample data is normally distributed or not. Using the traditional Cronbach Alpha (CA) model developed by Cronbach (1951), an effort was made to assess its reliability. Commonly, an Alpha score that ranges from 0.7 to 0.8 is suitable; more than 0.8 is desirable. It can be inferred that Cronbach Alpha for all the variables is greater than 0.8, which means items in each group are consistent.

RESULT

Variations in the consumer perceptions based on demographic characteristics

To determine whether there is any difference in the perception of consumers towards value-added millet products based on gender, a t-test was employed. Table 1 shows the findings of the 't' test. As the p-value obtained is greater than 0.05, we accept the null hypothesis (H_0). As a result, the perception of consumers towards millet products is not affected by gender.

Table 1. Independent Samples Test

Variables	Levene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	
Gender (independent variables)	Equal variance assumed	0.948	0.331	-0.459	324	0.647	-0.10531	0.22955
Perception (Dependent variable)	Equal variance not assumed	-	-	-0.462	322	0.644	-0.10531	0.22785

Source: Field Survey Data, 2023

A one-way ANOVA was employed to determine the variations in the perceptions of consumers based on their “age”, “place of residence”, “marital status”, “educational level”, and “level of income”. The results of the analysis are displayed in Table 2. From the Table 2, we can infer that there are significant variations or significant differences in the perception of consumers towards the value-added products of the millet based on the five demographic factors discussed above, since the p-value is less than 0.01. This was in line with the findings of other studies such as Meng et al., (2021); Reddy & Patel (2023); Ojha et al., (2025); Pradhan et al., (2025).

Effects of factors on consumer perception towards value-added millet products

In order to examine the effect of variables such as “nutritional benefit”, “price”, “packaging quality”, “taste”, and “media exposure” on the perception of consumers towards value-added millet products, an SEM utilising AMOS was conducted. Confirmatory factor analysis (CFA) has been undertaken before SEM. The result of CFA shows the model is properly fitted, as indicated by the CMIN/DF value of 2.002 (Figure 1). In this case, the CFI value is 0.927, which is higher than 0.90 indicating a perfect fit. In addition, it is determined that the root mean square residuals (RMR) have a value of 0.0252 and the root mean square error of approximation (RMSEA) has a value of 0.0396, which is below the threshold limit of 0.08 as considered adequate by Hair et al., (2006). Figure 1 shows the CFA model.

Structural equation model results

Table 3 demonstrates the model fit summary of SEM, which indicates that the computed p-value is 0.013, which is below the threshold limit of 0.05, but the issue has been resolved by the CMIN/DF value of 4.684, which denotes an acceptable fit. With a chi-square value of 26.964 (df = 14), the construct measurements showed acceptable model fit statistics. The current dataset shows

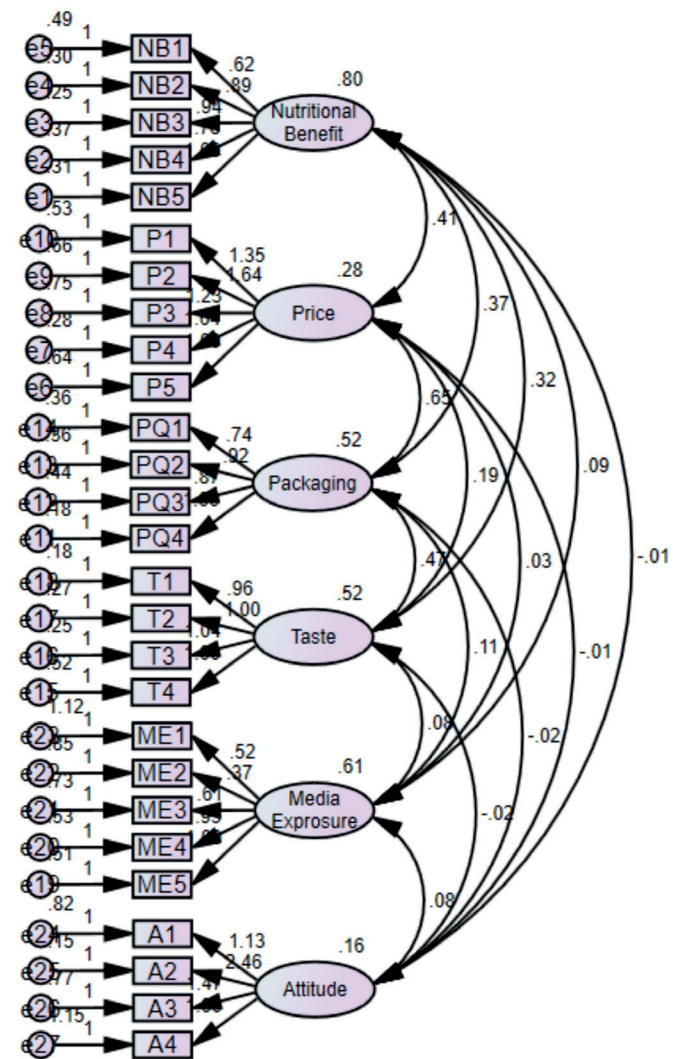


Figure 1. Confirmatory factor analysis
Source: Field Survey Data, 2023

Table 2. Result of ANOVA

Source	Perception (Dependent Variable)	Sum of Squares	df	Mean Square	F	Sig.	Hypothesis and Results
Age	Between Groups	95.359	17	5.609	8.634	0.000	Reject H_{0b}
	Within Groups	200.757	309	0.650			Age does influence the consumer perceptions.
	Total	296.116	326				
Area of residence	Between Groups	147.509	17	8.677	7.823	0.000	Reject H_{0c}
	Within Groups	342.736	309	1.109			Area of residence does influence the consumer perceptions.
	Total	490.245	326				
Academic qualification	Between Groups	174.489	17	10.264	9.408	0.000	Reject H_{0d}
	Within Groups	337.114	309	1.091			Educational qualification does influence the consumer perceptions.
	Total	511.602	326				
Marital Status	Between Groups	159.884	17	9.405	8.571	0.000	Reject H_{0e}
	Within Groups	339.052	309	1.097			Marital Status does influence the consumer perceptions.
	Total	498.936	326				
Income	Between Groups	116.406	17	6.847	5.004	0.000	Reject H_{0f}
	Within Groups	422.867	309	1.369			Income does influence the consumer perceptions.
	Total	539.272	326				

Source: Primary Data, 2023

Table 3. Summary of SEM fit

Indices	Value
Chi-square value	26.964
Degree of Freedom	14.000
P value	0.013
Chi-square value/DF	4.684
Goodness of Fit Index	0.936
Adjusted Goodness of Fit Index	0.961
NFI	0.976
CFI	0.945
Root Mean Square Residuals	0.006
Root Mean Square Error of Approximation	0.076
TLI	0.971
PNFI	0.658
PCFI	0.530

Source: Field Survey Data, 2023

an acceptable model fit as per Hair et al., (2010); Hu & Bentler (1999) perfect fit because the trucker-lewis index (TLI) value is 0.971, the adjusted goodness of fit index (AGFI) value is 0.961, and the goodness of fit index (GFI) value is 0.936, all of which have a value greater than 0.90 as suggested by Byrne (1994) & Hair et al., (2006). Further, the values of the root mean square residuals and root mean square error of approximation (RMSEA) are 0.006 and 0.076, respectively, both of which are less than the cutoff of 0.08 (Hair et al., 2006), indicating a perfect fit.

DISCUSSION

The t-test results revealed that both genders shared similar perceptions and awareness levels regarding their nutritional benefits, price, quality, and availability. This is due to shared cultural food habits and equal exposure to media and health campaigns. A higher level of education is also a reason, as most respondents (96.32%) qualify for graduation or more. This aligned with the investigation findings of Jayawardana et al., (2020) & Mohan et al., (2021). Mohan et al., (2021) conducted the study to identify the variables influencing millet purchasing behaviour. Their findings indicated that there is no variation in the perception of consumers towards millet consumption based on gender, as they analysed factors such as “perceived value”, “essential nutrients”, and “healthy life”. Meanwhile, Jayawardana et al., (2020) found no variations in perceptions of consuming millet among genders. However, there were significant variations in the awareness between males and females about finger millet as a source of nutrients.

The one-way ANOVA result revealed that the perception of respondents varies based on the demographic variables such as “age”, “place of residence”, “marital status”, “level of education”, and “level of income”. In the case of “age”, there is significant variation in the perception of millet products, as younger consumers may prefer modern, ready-to-eat products. At the same time, middle-aged groups were often more health-conscious and adopt millets for their nutritional benefits. On the other hand, older consumers may have stronger traditional linkages and familiarity with millet-based foods. These generational differences in perception, lifestyle, and consumption priorities explain the variation in perceptions toward millet products. According to Meng et al., (2021), older people consume millet more than others, mainly due

to millet’s higher nutritional quality and health benefits. Furthermore, the study was conducted by Jayawardana et al., (2020) to assess the knowledge and perception towards finger millet products in Sri Lanka. They found that all the respondents in the age groups 71–80 and 81–90 preferred consuming finger millet. It indicated that the age-wise variation towards millet products and the higher preference of older people towards them. At the same time, in terms of “educational qualification” and “residing place”, there was no significant variation in the preference towards finger millet (Jayawardana et al., 2020), which was contradictory to our findings. This finding of Jayawardana et al., (2020) was rejected by Kebakile et al., (2003). Kebakile et al., (2003), in their research on people’s consumption behaviour towards sorghum, a type of millet in Botswana, revealed that respondents with higher levels of education often correlated with reduced daily sorghum intake. One possible explanation for the decrease in sorghum preference as educational attainment increases is the various meal programmes offered at various school levels (Kebakile et al., 2003).

CONCLUSION

The study discovered that all five elements under study had a considerable impact on customers’ perceptions, with “nutritional benefits” having the strongest and most positive influence. The present study has identified some future directions as expansion of the sample consumer, and undertaking research in other regions of India can give more generalisability and more understanding about the perception of consumers towards millet products. Long-term studies can be undertaken to have a more comprehensive idea of the attitude of consumers towards millet products. As perception is more of a qualitative phenomenon, new insights can be generated by complementing both quantitative and qualitative data through focus group discussions or interviews, which provide a deeper understanding.

DECLARATIONS

Ethics approval and informed consent: Informed consent was sought from the respondents during the course of the research.

Conflict of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare that during the preparation of this work, thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

Publisher’s note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors, and the reviewers. Any product/ process or technology that may be evaluated in this article, or a claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

REFERENCES

- APEDA. (2022). *E-catalogue for export of millets and value added products Kerala*. https://apeda.gov.in/milletportal/files/Kerala_Millet_Value_Added_Products_Catalogue.pdf

- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.
- GoI (2021). *Agricultural Statistics at Glance 2021*. Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India. <https://desagri.gov.in/wp-content/uploads/2021/07/Agricultural-Statistics-at-a-Glance-2021-English-version.pdf>
- Government of Kerala. (2017). *Millet Village*. Scheduled Tribes Development Department. Retrieved January 26, 2024, from <https://www.stdd.kerala.gov.in/millet-village>
- Gupta, S. M., Arora, S., Mirza, N., Pande, A., Lata, C., Puranik, S., Kumar, J., & Kumar, A. (2017). Finger millet: A “Certain” crop for an “Uncertain” future and a solution to food insecurity and hidden hunger under stressful environments. *Frontiers in Plant Science*, 8, 1-10.
- Gyawali, P. (2021). Production trend, constraints, and strategies for millet cultivation in Nepal: A study from review perspective. *International Journal of Agricultural and Applied Sciences*, 2(1), 30- 40.
- Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). *Multivariate data analysis* (6th ed.). Pearson Prentice Hall, Upper Saddle River, pp 35-40.
- Jayawardana, S. A., Samarawickrama, D. S., Samarasekera, J. K., Hettiarachchi, G. H., & Gooneratne, M. J. (2020). Consumer awareness and preference towards finger millet in Sri Lanka. *Asian Food Science Journal*, 18(3), 34-44.
- Kebakile, M., Mpotokwane, S., Motswagole, B., Faria, M. L., Santo, P., Domingues, M., & Saraiva, C. (2003). *Consumers perception towards sorghum food in Botswana*. Retrieved from <http://afripro.org.uk/papers/Paper12Kebakile.pdf>.
- Kumari, R., Singh, K., Singh, R., Bhatia, N., & Nain, M. S. (2019). Development of healthy ready-to-eat (RTE) breakfast cereal from popped pearl millet. *Indian Journal of Agricultural Sciences*, 89(5), 877-881.
- Meng, L., Hairong, D., Shuo, C., Yina, Y., & Guomei, Z. (2021). Study on influencing factors of millet product consumption behavior of residents in Hebei province-based on the perspective of planned behavior theory. *IOP Conference Series: Earth and Environmental Science*, 792(1), 012004.
- Mohan, A. R., George, A., & George, G. (2021). Consumer perception and factors influencing consumption of millets. *Journal of Tropical Agriculture*, 59(2), 177-182.
- Ojha, K. P., Pragati, S., Samreen, F., Babli, R., Paramjeet, K., Pragya, O., & Abhishek, K. Y. (2025). Millet adoption in Bundelkhand, U.P.: Traditional vs. Emerging crops trends. *Indian Journal of Extension Education*, 61(3), 137-141.
- Platel, K. (2013). Millet flours as a vehicle for fortification with iron and zinc. *Handbook of Food Fortification and Health*, pp 115-123.
- Pradhan, S. K., Akkamahadevi, N., Ashok, K., & Soumik R. (2025). Perception of paddy farmers on climate change in western Odisha, An ANN Model integration. *Indian Journal of Extension Education*, 61(3), 1-6.
- Prajapati, B. K., Kumar, M., Rawat, D. K., Prajapati, s. K., & Kumar, Y. (2023). Minor Millet: Distribution, Health Benefit and Strategies for Enhancing the Productivity of Millets. *Current Agricultural Trends*, 2(9), 1-5.
- Reddy, R., & Patel, D. (2023). A study on consumers’ awareness and preference towards millets and its products in Vizianagaram district, Andhra Pradesh, India. *Asian Journal of Agricultural Extension, Economics & Sociology*, 41(6), 9-16.
- Singh, R., Nain, M. S., & Manju (2020) Nutrient analysis and acceptability of different ratio pearl millet (*Pennisetum glaccum* (L.) R. Br.) based biscuits. *Indian Journal of Agricultural Sciences*, 90(2), 428-30.
- Sreeni, K. R. (2023). Millet village Attappady, Kerala: Choice for healthy food consumption, food security, livelihood, income and employment. *Food Science and Nutrition*, 9(1), 1-7.
- Tucker, M. L., & LaFleur, E. K. (1991). Exploratory factor analysis: a review and illustration of five principal components decision methods for attitudinal data. *Southwest educational research association annual meeting*, San Antonio, TX.
- Yadav, A., & Usha, S. (2022). Prevalence of food consumption and diversification among people having lifestyle diseases. *Indian Journal of Extension Education*, 58(1), 161-165.
- Zahra, N., Muhamma, Kh. S., Asma, S., Nimra, J., Ayesha, R., & Vaneeza, I. (2025). Millets for global food security. *Journal of Nutrition and Food Processing*, 8(2), 1-8.