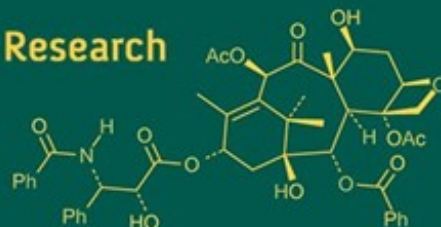


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Consumer awareness of GI tagged Kuttiattoor mango and its associated factors: Evidence from Kerala, India

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ABSTRACT

This paper examines a highly relevant yet overlooked dimension of Intellectual property rights in agriculture: the gap between legal acquisition of a Geographical Indication (GI) tag and its market recognition. The Kuttiattoor mango is an indigenous cultivar from northern Kerala protected under the GI registry, yet legal protection does not automatically guarantee market recognition. This study analysed consumer awareness of its GI status and identified the factors associated with it. Primary data were collected via multi-stage purposive sampling from 170 consumers across core production (Kannur district, $n = 120$) and major external consumption (Kozhikode district, $n = 50$) hubs using the mall-intercept method. Data were analysed using bivariate chi-square (χ^2) tests, Cramér's V, and a multivariate binary logistic regression model optimised with Average Marginal Effects (AMEs). Bivariate analysis revealed a critical information gap: only 36.47% of consumers were aware of the mango's GI status, and baseline literacy was sharply localised, dropping from 49.17% in Kannur to a mere six per cent in Kozhikode. The logistic regression model ($LR \chi^2 = 61.47$, $p < 0.001$, McFadden $R^2 = 0.276$) identified age, family structure, occupation, education, and source of purchase as the primary determinants of awareness. Significantly higher odds of awareness were recorded among consumers aged 41–50 years ($OR = 3.184$) and those from joint families ($OR = 4.110$). Crucially, immediate retail environments emerged as the most powerful predictors; procurement through Farmer Producer Organisations (FPOs) ($OR = 8.404$) and roadside vendors ($OR = 10.552$, $AME = 0.3253$) increased the probability of awareness compared to traditional retail outlets. Counterintuitively, highly educated demographics and self-employed individuals exhibited significantly lower probabilities of GI awareness. The lower level in consumer awareness may compromise the signalling function of the GI status as a source of product differentiation. To bridge this information asymmetry and optimise market benefits, policy interventions should strengthen FPO-led "GI Experience Corners," implement certified roadside vendor branding schemes, mandate packaging traceability, and launch targeted digital marketing campaigns in external consumption hubs.

Keywords: Geographical indication, Intellectual Property Right, Chi -square analysis, Cramer's V, Binary logistic regression, Average marginal effects, Product differentiation

1. Introduction

Kuttiattoor mango is an indigenous table-purpose mango variety of Kannur district in Kerala. The uniqueness of Kuttiattoor mango is associated with its varietal characteristics such as early flowering, orange-yellow flesh and skin, excellent taste and flavour, and polyembryonic nature. The environmental conditions of its cultivation area, which include a tropical climate with high summer temperatures, heavy southwest monsoon rainfall, and well-drained acidic soils, contribute to this distinctiveness. Hence, Kuttiattoor mango received GI status in 2021 (Geographical Indications Registry, 2021) [1]. Geographical Indications (GIs) identify products whose qualities, reputation or other characteristics are associated with a particular geographical origin. For agricultural commodities, GI recognition can contribute to product differentiation by communicating geographical identity, traditional characteristics and authenticity to consumers.

The effectiveness of GI protection in the marketplace depends not only on legal recognition but also on consumers' knowledge and recognition of the GI identity. Consumer awareness is therefore essential for the GI label to communicate product identity and value effectively in the market. Consumer awareness and understanding of geographical indications can influence how consumers perceive certified products and their purchasing decisions, while limited knowledge of certification can reduce the effectiveness of quality labels as sources of product information (Sampalean *et al.*, 2021) [2]. The use of geographical quality labels has also been associated with consumers' beliefs about product quality and their interest in information concerning product quality and origin (Verbeke *et al.*, 2012) [3]. Market benefits of GI certification may be limited when consumers do not recognise or understand the GI identity of the product

Previous studies on GI-tagged agricultural products have highlighted variations in consumer awareness and recognition. Consumer awareness of protected-origin labels was examined, with the findings underscoring the importance of consumer knowledge is critical for understanding and recognising certification schemes (Goudis *et al.*, 2021) [4]. Limited consumer awareness of the GI status, benefits, and certification of the Kanyakumari Matti Banana was reported, revealing the urgent need for targeted education (Rogan *et al.*, 2024) [5]. Awareness of GI-tagged agricultural commodities was found to vary with socio-demographic characteristics such as age, gender, and marital status, while consumers generally possess a limited understanding of the GI concept and its significance (Sanjaya *et al.*, 2022) [6].

However, evidence specifically examining awareness of the GI status of Kuttiaattoor mango and the factors associated with such awareness is limited. Therefore, the present study was undertaken to assess consumer awareness regarding the GI status of Kuttiaattoor mango and to identify socio-economic and purchasing characteristics associated with consumer awareness. Understanding these factors can help to formulate appropriate consumer communication and marketing strategies for improving recognition of the GI identity of Kuttiaattoor mango.

2. Materials and methods

2.1 Study area and sampling design

A multistage purposive sampling technique was used to select consumers from the study area. Initially, a pilot survey was carried out in the GI-certified production tracts of Kuttiaattoor mango in the Kannur district to gain a clear understanding of its production and marketing. Since Kannur district acts as the primary production and consumption hub, and Kozhikode serves as the main consumption area outside the production zone, these two districts were purposively selected. Based on the pilot survey and stakeholder discussions, the major sales points of Kuttiaattoor mango were identified. The selected study locations included Kuttiaattoor Grama Panchayath, Kannur Corporation, Thalassery Municipality, and Mattannur Municipality in Kannur district alongside Kozhikode Corporation in Kozhikode district. It was observed that Kuttiaattoor mango was sold without any label, tag or code to differentiate it from other similar mango varieties.

Accounting for time and cost constraints, the total sample size was fixed at 170 consumers. Of these, 120 respondents were selected from Kannur district and equally distributed across the Kuttiaattoor, Mattannur Municipality, Kannur Corporation, and Thalassery Municipality. The remaining 50 respondents were selected from Kozhikode Corporation in the Kozhikode district.

The pilot survey identified key points of sale as retailers, wholesalers, roadside vendors, and the single Farmer Producer Organisation (FPO) located in Kuttiaattoor. Consumers were selected using the consumer-intercept approach following a screening process that confirmed their active purchase of the GI product from the point of purchase. Consumers were approached immediately following their purchase at the identified sales points. Primary data were collected using a semi-structured interview schedule covering socio-economic characteristics, purchasing behaviour, and awareness regarding the GI status of Kuttiaattoor mango. Consumer awareness was measured dichotomously by asking respondents if they were aware of the mango's GI status. Respondents answering "Yes" were classified as aware, while those answering "No" were classified as unaware.

2.2 Statistical analysis

Descriptive statistics were used to analyse and describe socio-economic characteristics and awareness. The association between consumer awareness and selected socio-economic and purchasing characteristics was examined using the chi-square test of independence and strength of association using Cramer's V.

The Chi-square test is a non-parametric, distribution-free statistical method used to examine differences or associations between categorical variables measured at the nominal level. (McHugh, 2013) [7].

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where O_{ij} represents the observed frequency, and E_{ij} represents the expected frequency in the i^{th} row and j^{th} column of the contingency table. The expected frequency was calculated as:

$$E_{ij} = \frac{R_i C_j}{N}$$

where R_i represents the row total, C_j represents the column total, and N represents the total number of observations.

Cramér's V is an effect-size measure used to quantify the strength of association between two categorical variables. It is derived from the Pearson Chi-square statistic and standardises the Chi-square value according to the sample size and dimensions of the contingency table. Cramér's V was employed to measure the strength of association between consumer awareness of the GI status and the selected categorical socio-economic characteristics. (Ben-Shachar *et al.*, 2020) [8].

$$V = \sqrt{\frac{\chi^2}{N(k-1)}}$$

where (V) represents Cramér's V, χ^2 represents the Chi-square statistic, N represents the total number of observations, r represents the number of rows, and c represents the number of columns in the contingency table. The classification of the strength of association based on the Cramér's V values is presented in Table 1.

Table 1. Classification of the Strength of Association Based on Cramér's V Values

Cramér's V	Strength of association
0.00–0.10	Negligible / very weak
0.10–0.20	Weak
0.20–0.30	Small
0.30–0.50	Moderate
> 0.50	Strong

Binary logistic regression was employed to identify the factors that can influence consumer awareness about the GI status of Kuttiaattoor mango. The method is appropriate when the dependent variable has two mutually exclusive outcomes. In the present study, consumer awareness was treated as a binary dependent variable and coded as one for consumers who were aware of the GI tag and zero for consumers who were not aware of the GI tag. The general form of the binary logistic regression model was specified as:

$$\ln \left(\frac{P_i}{1 - P_i} \right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki}$$

where P_i represents the probability that the i^{th} consumer is aware of the GI tag, $1-P_i$ represents the probability that the consumer is not aware, β_0 represents the intercept, $\beta_1, \beta_2, \dots, \beta_k$ represent the regression coefficients, and $X_1, X_2, \dots, X_k$ represent the explanatory variables. (Hosmer *et al.*, 2013)^[9]. Since logistic regression is a nonlinear model, average marginal effects (AMEs) were estimated to express the effects of the explanatory variables on the predicted probability of consumer awareness. Marginal effects provide an intuitive interpretation of logistic regression results by expressing how the predicted probability of a binary outcome changes with a change in an explanatory variable (Norton *et al.*, 2019)^[10]. The overall goodness of fit of the binary logistic regression model was assessed by comparing the fitted model with the intercept-only model. The likelihood ratio (LR) chi-square test was employed to examine whether the explanatory variables jointly improved the model fit over the null model. The deviance and log-likelihood values were used as measures of model fit, while the Akaike Information Criterion (AIC) was used for comparing alternative models fitted to the same data, with lower values indicating better relative fit. McFadden's, Cox and Snell's and Nagelkerke's pseudo-R (Sampalean *et al.*, 2021)^[2] measures were also computed to assess the improvement in model fit relative to the null model.

The explanatory variables included age group, gender, income group, education, occupation, family type, district and source of purchase. Age was categorised into 20–40, 41–50 and above 50 years. Income was grouped into up to ₹40,000 and above ₹40,000 per month. Education was classified as below graduate and graduate and above. Occupation included private, government and self-employed categories. Family type was classified as nuclear and joint, while source of purchase comprised retail outlet, FPO and roadside vendor. Place of purchase was not included separately in the logistic regression model because it represented geographical information overlapping with district. District was therefore retained as the geographical explanatory variable in the multivariate model. Multicollinearity among explanatory variables was assessed using generalised variance inflation factor (GVIF) and tolerance values. Odds ratios (OR), 95% confidence intervals and average marginal effects (AME) were used to interpret the logistic regression estimates.

3. Results

3.1 Socio-economic characteristics of respondents

The socio-economic profile of respondents is given in Table 2. In terms of age distribution, respondents were predominantly concentrated in the 31–40 years cohort, accounting for 46.47% ($n = 79$) of the total sample. This was followed by the 41–50 years age group at 34.71% ($n = 59$). Regionally, while Kannur exhibited a relatively younger sample with 43.33% of respondents falling into the 41–50 age bracket, Kozhikode's second-largest demographic layer was composed of individuals aged over 50 years (36.00%). Gender distribution was heavily skewed toward male respondents, who constituted 83.53% ($n = 142$) of the total aggregate sample, whereas female respondents made up 16.47% ($n = 28$).

Regarding educational attainment, graduates represented the vast majority of the sample, comprising 82.94% ($n = 141$) of the consumers. Occupational data revealed that private-sector employees formed the single largest group at 60.59% ($n = 103$), followed sequentially by self-employed individuals at 17.06% ($n = 29$). Financially, a substantial majority of the participants (61.76%, $n = 105$) fell within the middle-income bracket of ₹20,000–₹40,000 per month. In terms of household structures, nuclear family setups were highly predominant, accounting for 85.88% ($n = 146$) of the total sample compared to joint families (14.12%).

Analysing procurement behaviours, roadside vendors emerged as the primary source for purchasing Kuttiattoor mangoes, representing 60.59% ($n = 103$) of total transactions. Traditional retail outlets served as the second most common channel at 27.65% ($n = 47$), while Farmer Producer Organisations (FPOs) accounted for the remaining 11.76% ($n = 20$). Notably, FPO purchases were exclusive to Kannur (16.67%), as no FPO channels were utilised in Kozhikode.

These baseline distributions are critical, as core socio-demographic indicators—including gender, education, income, and geographical residence—have structurally been shown to govern consumer perceptions and the cognitive processing of food-label parameters during active market transactions (Ali *et al.*, 2009)^[11]. Furthermore, isolating these underlying descriptive frequencies justifies the deployment of multivariate frameworks like binary logistic regression, which relies on categorical demographic variability to accurately model shifting consumer awareness levels (Singh *et al.*, 2021)^[12].

Table 2. Socio-economic profile of respondents

Sl. No.	Socio-economic characteristic	Category	Kannur ($n = 120$)	Kozhikode ($n = 50$)	Total Respondents ($N = 170$)
1	Age	20–30 years	4 (3.33)	0 (0.00)	4 (2.35)
		31–40 years	54 (45.00)	25 (50.00)	79 (46.47)
		41–50 years	52 (43.33)	7 (14.00)	59 (34.71)
		> 50 years	10 (8.33)	18 (36.00)	28 (16.47)
		Total	120 (100.00)	50 (100.00)	170 (100.00)
2	Gender	Male	104 (86.67)	38 (76.00)	142 (83.53)
		Female	16 (13.33)	12 (24.00)	28 (16.47)
		Total	120 (100.00)	50 (100.00)	170 (100.00)
3	Education	Illiterate	0 (0.00)	2 (4.00)	2 (1.18)
		Primary	5 (4.17)	2 (4.00)	7 (4.12)
		Higher Secondary	7 (5.83)	9 (18.00)	16 (9.41)
		Graduate	105 (87.50)	36 (72.00)	141 (82.94)
		Postgraduate	3 (2.50)	1 (2.00)	4 (2.35)
		Total	120 (100.00)	50 (100.00)	170 (100.00)
4	Occupation	Private	80 (66.67)	23 (46.00)	103 (60.59)
		Self employed	21 (17.50)	8 (16.00)	29 (17.06)
		Government	15 (12.50)	5 (10.00)	20 (11.76)
		Homemaker	3 (2.50)	5 (10.00)	8 (4.71)
		Other	1 (0.83)	9 (18.00)	10 (5.88)

(continued on next page)

Sl. No.	Socio-economic characteristic	Category	Kannur (<i>n</i> = 120)	Kozhikode (<i>n</i> = 50)	Total Respondents (<i>N</i> = 170)
5	Monthly income	Total	120(100.00)	50 (100.00)	170 (100.00)
		< ₹20,000	4 (3.33)	5 (10.00)	9 (5.29)
		₹20,000–40,000	73 (60.83)	32 (64.00)	105 (61.76)
		₹40,000–60,000	40 (33.33)	11 (22.00)	51 (30.00)
		₹60,000–1,00,000	3 (2.50)	2 (4.00)	5 (2.94)
6	Type of family	Total	120(100.00)	50 (100.00)	170 (100.00)
		Nuclear Family	108 (90.00)	38 (76.00)	146 (85.88)
		Joint Family	12 (10.00)	12 (24.00)	24 (14.12)
7	Source of purchase	Total	120(100.00)	50 (100.00)	170 (100.00)
		FPO	20 (16.67)	0 (0.00)	20 (11.76)
		Roadside vendor	73 (60.83)	30 (60.00)	103 (60.59)
		Retail outlet	27 (22.50)	20 (40.00)	47 (27.65)
		Total	120(100.00)	50 (100.00)	170 (100.00)

Note: Figures in brackets indicate percentage relative to respective column total.

3.2 Consumer awareness of GI status

The consumer awareness of the Geographical Indication (GI) status of the Kuttiaattoor mango is presented in Table 3. Of the 170 surveyed respondents, only 62 (36.47%) were aware of its GI certification, whereas a substantial majority of 108 respondents (63.53%) remained unaware. This low baseline literacy indicates that a considerable proportion of consumers fail to recognise the GI distinction of the Kuttiaattoor mango. Such information asymmetry potentially compromises the strategic utility of the GI tag as a signalling mechanism for product differentiation, thereby diminishing opportunities for market recognition and premium price advantages. This finding aligns with empirical observations by Niranjana *et al.* (2023) [13], who noted that inadequate consumer knowledge regarding the uniqueness and authenticity of origin-protected goods significantly constrains the effective utilisation and economic yield of GI certifications. (Niranjana *et al.*, 2023)[13].

Awareness levels exhibited stark disparities across the two studied districts. Although the Kannur district constitutes the exclusive geographical origin and primary production hub of the Kuttiaattoor mango, less than half of its residents (49.17%, *n* = 59) were aware of its protected status, while 50.83% (*n* = 61) remained completely unaware. In contrast, awareness dropped precipitously in the Kozhikode district, where a striking 94.00% (*n* = 47) of respondents were unaware, and a mere 6.00% (*n* = 3) demonstrated recognition. The moderate literacy observed even within the core production zone indicates that GI branding efforts have not been adequately disseminated locally. This spatial deficit restricts local consumers' capacity to distinguish certified Kuttiaattoor mangoes from conventional, lookalike varieties, thereby diluting the localised economic benefits intended for regional primary producers. These sharp geographical variations confirm that GI awareness is highly localised and heterogeneous across consumer groups, a pattern broadly consistent with the spatial awareness dynamics reported by Das and Dileep (2023) [14].

Table 3. Consumer awareness of the GI status of Kuttiaattoor mango

Sl. No.	Place of purchase	Aware	Not aware	Total
Kannur (<i>n</i> = 120)				
1	Kuttiaattoor Panchayath	16 (53.33)	14 (46.67)	30
2	Mattannur Municipality	18 (60.00)	12 (40.00)	30
3	Kannur Corporation	8 (26.67)	22 (73.33)	30
4	Thalassery Municipality	17 (56.67)	13 (43.33)	30
Kozhikode(<i>n</i> = 50)				
5	Kozhikode Corporation	3 (6.00)	47 (94.00)	50
Total		62 (36.47)	108 (63.53)	170 (100)

Figures in parentheses indicate percentages.

3.3 Association between selected characteristics and GI awareness

The association between selected characteristics and consumer awareness of the Kuttiaattoor mango is given in Table 4. Bivariate chi-square (χ^2) analysis indicated significant associations between consumer

awareness and age, occupation, source of purchase, district and place of purchase. Monthly Income demonstrated a marginal association at the 10% significance level, whereas demographic attributes such as gender, formal education attainment and family type did not show statistically significant variations.

Table 4. Association between selected characteristics and consumer awareness of Kuttiaattoor mango

Variable	χ^2	p-value	Cramér's V
Age	8.090**	0.0442	0.218
Gender	0.648	0.4207	—
Income	6.886*	0.0756	—
Education	2.864	0.5808	—
Occupation	17.959***	0.0013	0.325
Family type	1.996	0.1577	—
Source of purchase	22.510***	< 0.001	0.364
District	12.811***	0.0003	0.275
Place of purchase	20.148***	0.0005	0.344

*** Significant at 1% level ($p < 0.01$); ** Significant at 5% level ($p < 0.05$); * Significant at 10% level ($p < 0.10$).

Among the significant attributes, the source of purchase established the strongest association with awareness (Cramér's $V = 0.364$), followed sequentially by the specific place of purchase (0.344), occupation (0.325), district of residence (0.275), and age group (0.218). These statistical trends indicate that the immediate structural purchasing context and occupational profiles exert a far more robust influence on GI literacy than conventional baseline demographic indicators like gender or education. These institutional dynamics echo findings in consumer behavioural literature; for instance, distinct supply and retail channels are frequently associated with systematic variations in food-purchasing choices, highlighting the high relevance of immediate retail environments in shaping consumer cognitive awareness and subsequent decision-making processes (Dudziak *et al.*, 2023)^[15].

3.4 Factors associated with consumer awareness: binary logistic regression

The binary logistic regression model was statistically significant based on the likelihood ratio test (LR $\chi^2 = 61.47$, $df = 11$, $p < 0.001$), indicating that the explanatory variables jointly contributed significantly

cantly to explaining variation in consumer awareness compared with the intercept-only model. The model exhibited a log-likelihood value of -80.80 and an AIC of 185.60 . The inclusion of explanatory variables reduced the deviance from a null deviance of 223.07 to a residual deviance of 160.60 (a reduction of 61.47 units), confirming a substantial improvement in model fit.

Model fit indices indicated satisfactory explanatory power: the McFadden pseudo-R (Sampalean *et al.*, 2021)^[2] was 0.276 (falling within the recommended 0.20 - 0.40 range for discrete choice models), while the Cox-Snell and Nagelkerke pseudo-R (Sampalean *et al.*, 2021)^[2] values were 0.303 and 0.415 , respectively. Multicollinearity diagnostics showed no evidence of problematic redundancy. The Generalised Variance Inflation Factor (GVIF) values ranged from 1.11 to 1.68 (well below the threshold of 5), with the corresponding tolerance values between 0.85 to 0.95 (well above the minimum threshold of 0.20).

Table 5. Binary logistic regression estimates of consumer awareness

Variable	β	Odds ratio	95% CI	p-value	AME
Age group: (Ref: 20–40)					
41–50	1.1581	3.184**	1.295–7.828	0.0116	0.1917
> 50	0.4038	1.498	0.347–6.469	0.5886	0.0649
Gender (Ref: Female)					
Male	−0.1885	0.828	0.264–2.596	0.7463	−0.0300
Monthly income: (Ref: Up to ₹40,000)					
Above ₹40,000	0.6289	1.876	0.782–4.496	0.1585	0.1036
Education: (Ref: Below graduate)		1.000	—	—	—
Graduate and PG	−1.1534	0.316 **	0.106–0.937	0.0378	−0.1865
Occupation: (Ref: Private)		1.000	—	—	—
Government	0.1599	1.173	0.310–4.447	0.8140	0.0279
Self-employed	−1.6735	0.188***	0.056–0.631	0.0068	−0.2503
Family type: (Ref: Nuclear)		1.000	—	—	—
Joint	1.4135	4.110**	1.140–14.824	0.0308	0.2246
District: (Ref: Kannur)		1.000	—	—	—
Kozhikode	−0.9664	0.380*	0.135–1.072	0.0674	−0.1551
Source: (Ref: retail outlet)		1.000	—	—	—
FPO	2.1287	8.404**	1.221–57.853	0.0306	0.2838
Roadside vendor	2.3563	10.552***	3.392–32.835	0.0039	0.3253

*** Significant at 1% level ($p < 0.01$); ** Significant at 5% level ($p < 0.05$); * Significant at 10% level ($p < 0.10$).

For the binary logistic regression, some variable categories were recoded to avoid sparse categories. Age was categorised into 20–40,

41–50 and above 50 years. Income was grouped into up to ₹40,000 and above ₹40,000 per month. Education was classified as below

graduate and graduate and above. Occupation included private, government and self-employed categories. Family type was classified as nuclear and joint, while source of purchase comprised retail outlet, FPO and roadside vendor. For each categorical explanatory variable, one category was specified as the reference or base category, and the remaining categories were compared with it. The reference categories were used as the base categories to provide a meaningful and consistent comparison within each variable and to avoid perfect multicollinearity arising from the simultaneous inclusion of all category levels in the regression model. Accordingly, 20–40 years, female, income group of ₹ 40,000 and below, below graduate, private occupation, nuclear family, Kannur district and retail outlets were used as the reference categories for age group, gender, income group, education, occupation, family type, district and source of purchase, respectively. Place of purchase was not included as a separate explanatory variable in the binary logistic regression model as it represented similar geographical information as district. Including both variables in the model could lead to overlapping information and make the interpretation of the results less clear. Therefore, district was included as the geographical explanatory variable to examine the differences in consumer awareness between Kannur and Kozhikode. Place of purchase was considered in the descriptive and bivariate analyses, whereas district was included in the multivariate analysis to avoid duplication of geographical information.

The logistic regression results demonstrated that age, education, occupation, family type, and source of purchase were significant predictors of consumer awareness regarding the GI status of Kuttiaattoor mango. Consumers aged 41–50 years exhibited significantly higher odds of awareness than the 20–40 reference group ($OR = 3.184$, $p = 0.012$). The AME of 0.1917 indicated an estimated 19.17 percentage-point higher probability of awareness within this bracket. Conversely, awareness among consumers older than 50 did not differ significantly from the reference group, implying a nonlinear relationship between age and GI awareness. A similar relationship between age and consumer awareness was reported among Indian consumers, where district variations in food-label awareness were observed across age cohorts (Paliwal *et al.*, 2025)^[16].

Interestingly, higher educational attainment did not translate into greater GI awareness. Consumers with graduate or postgraduate education had significantly lower odds of being aware of the mango's GI status than those in the below-graduate group ($OR = 0.316$, $p = 0.038$; $AME = -0.1865$). This suggests that specialised GI recognition is dependent on target product exposure rather than formal literacy levels. Highly educated groups might also display different purchasing preferences, prioritising processed or premium-marketed mango variants. These dynamics underscore the arguments of Rao *et al.*, (2026)^[17] regarding the specific role of targeted product campaigns over general education. Highly educated groups might also display different purchasing preferences, prioritising processed or premium-marketed mango variants. Similarly, consumer knowledge and purchase willingness were found to influence the acceptance of GI-certified mangoes by Meena *et al.* (2025)^[18].

Occupation also emerged as a vital predictor. Self-employed consumers had significantly lower odds of awareness than private-sector employees ($OR = 0.188$, $p = 0.007$; $AME = -0.2503$), reflecting a 25.03 percentage-point decrease in awareness probability. In contrast, government employees showed no statistical variance from the reference category. A related occupation-based variance was documented by Tejaswi *et al.* (2026)^[19], where professional status significantly dictated market awareness for branded organic products. Finally, family structure was highly influential: respondents from joint families demonstrated substantially higher odds of GI awareness than those from nuclear families ($OR = 4.110$, $p = 0.031$; $AME = 0.2246$), indicating an estimated 22.46 percentage-point increase in probability, likely driven by intra-household information sharing.

The strongest and most consistent association in the model was observed for the source of purchase, mirroring its status as the variable

with the highest Cramér's V in the bivariate analysis. Consumers purchasing through Farmer Producer Organisations (FPOs) exhibited substantially higher odds of awareness than those buying from traditional retail outlets ($OR = 8.404$, $p = 0.031$). The corresponding AME of 0.2838 indicated a 28.38 percentage-point higher estimated probability of awareness. Similarly, consumers purchasing from roadside vendors demonstrated remarkably elevated odds of awareness compared to retail-outlet buyers ($OR = 10.552$, $p = 0.004$), reflecting an AME of 0.3253 (a 32.53 percentage-point increase in probability). These findings highlight how critical the purchasing environment and direct consumer–seller interactions are in communicating a product's specialised identity. This aligns with consumer research by Muça *et al.*, (2022)^[20], which established that localised purchasing channels—such as farmer-direct markets and producer-managed outlets—foster greater trust and explicit product information exchange.

Furthermore, the diverse availability of GI products across varied channels (including retail stores) is a vital attribute for consumer convenience (Udayan *et al.*, 2022)^[21]. The physical point of purchase serves as a critical information node. As noted by Costanigro *et al.*, (2025)^[22], consumers derive measurable information value from GI labels in pre-purchase settings, meaning highly visible GI cues at the point of sale directly boost recognition. Consequently, direct marketing stands out as a highly effective tool for improving both the market availability and consumer recognition of authentic GI products (Puranik *et al.*, 2024)^[23]. Ultimately, these structural socioeconomic and environmental pathways are essential to understanding awareness gaps, as similar channel-driven factors have historically dictated consumer literacy regarding food-safety standards and agricultural practices (Mundhe *et al.*, 2024)^[24].

Gender, monthly income, and government occupation were not statistically significant predictors of awareness within the multivariate model, indicating their limited direct influence when other variables are controlled. At the geographical level, consumers from Kozhikode district exhibited lower estimated odds of awareness than those from the core production hub of Kannur district ($OR = 0.380$, $p = 0.067$). This indicates a marginal difference significant at the 10% level, confirming that proximity to the production tract sustains higher baseline product recognition.

4. Conclusion

This study provides empirical evidence of a substantial gap in consumer awareness regarding the broader Geographical Indication (GI) framework and the specific GI status of the Kuttiaattoor mango. While bivariate analysis indicated that baseline awareness varies significantly across study locations based on age, occupation, source of purchase, district, and place of purchase, the multivariate logistic regression model isolated the significant factors associated with awareness. Specifically, age group, education, occupation, family type, and source of purchase emerged as the significant predictors of consumer GI literacy.

A critical takeaway from the econometric analysis is the profound impact of the structural purchasing environment on consumer knowledge. Consumers purchasing mangoes directly through Farmer Producer Organisations (FPOs) and roadside vendors exhibited substantially higher estimated odds of awareness than those patronising traditional retail outlets. This highlights the pivotal role of direct consumer–seller touchpoints in successfully communicating regional product identities.

Ultimately, when macro-level consumer awareness remains low, the intrinsic "signaling function" of a GI certification label is severely compromised. Without adequate consumer education, the label fails to serve as a market differentiator against lookalike varieties, minimising the economic advantages of the legal protection. Bridging this information deficit is therefore essential not only for strengthening product recognition but also for unlocking the economic benefits of the GI status, facilitating a premium price transmission back to the cultivators.

5. Policy implications and recommendations

To transition the Kuttiaattoor mango from a legally protected entity into a commercially viable market brand, targeted multi-stakeholder interventions are essential. Based on the empirical findings, the following policy measures are proposed:

- **Capacity Building for FPOs:** Responsible institutions should financially incentivize and institutionalise FPOs as primary intermediaries. Establishing dedicated "GI Experience Corners" and standardised educational point-of-sale displays within FPO networks can successfully bridge the consumer information gap.
- **Formalising Informal Direct Channels:** Roadside vendors displayed the highest association with consumer awareness, driven by high-engagement, face-to-face consumer-seller interactions. Local administrative bodies (*Grama Panchayats*) should exploit this by introducing a "Certified GI-Vendor Scheme," providing roadside sellers with subsidised, visually uniform, GI-branded kiosks and baseline training to turn informal transit corridors into active regional branding nodes.
- **Traceability Mandates in Mainstream Retail:** Traditional retail outlets currently represent the weakest link in GI communication. Policymakers should implement low-cost trace-and-track mechanisms such as mandatory static QR codes on packaging—across urban municipal markets (e.g., Thalassery, Mattannur). This mitigates information asymmetry, protects the product's premium identity, and prevents counterfeit mangoes from diluting market value.
- **Demographic-Specific Digital Campaigns:** Because younger cohorts (20–40 years) and nuclear households showed significantly lower odds of awareness, marketing strategies must pivot away from conventional print media. State agricultural marketing boards should leverage hyper-localised digital campaigns, social media marketing, and regional culinary festivals to target external consumption hubs like Kozhikode Corporation.
- **Targeted Academic Sensitisation:** Counterintuitively, consumers with graduate and postgraduate education demonstrated a lower probability of GI awareness. Educational directorates and agricultural universities should integrate regional agricultural heritage and intellectual property rights (IPR) frameworks into college curricula and campus food exhibitions to target and capture this premium-seeking consumer demographic.

5. Compliance with ethical standards

Ethical statement

The study involved consumer respondents. Informed consent was obtained from the respondents before data collection, and the information collected was used solely for academic research purposes while maintaining the confidentiality of the respondents.

6. Declaration of competing interest

The authors declare that they have no competing interests.

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References

1. Geographical Indications Registry, Government of India. Kuttiaattoor Mango (Kuttiaattoor Manga), Application No. 660, Certificate No. 383. Intellectual Property India; 2021.
2. Sampalean NI, Rama D, Visentin G. An investigation into Italian consumers' awareness, perception, knowledge of European Union quality certifications, and consumption of agri-food products carrying those certifications. *Bio-Based and Applied Economics*. 2021;10(1):35–49.
3. Verbeke W, Pieniak Z, Guerrero L, Hersleth M. Consumers' awareness and attitudinal determinants of European Union quality label use on traditional foods. *Bio-Based and Applied Economics*. 2012;1(2):213–229.
4. Goudis A, Skuras D. Consumers' awareness of the EU's protected designations of origin logo. *British Food Journal*. 2021;123(13):1–18.
5. Ashik Rogan VS, Dhamodaran T, Selvarani G, Senthilnathan S, Prabakaran K. Awareness level of Geographical Indication on Kanyakumari Matti Banana. *Journal of Experimental Agriculture International*. 2024;46(8):843–848.
6. Sanjaya K, Sridevi G. Consumers' awareness and preferences for GI tagged agricultural commodities: Empirical evidence from a consumer survey. *Empirical Economics Letters*. 2022;21(Special Issue 2):249–256.
7. McHugh ML. The Chi-square test of independence. *Biochemia Medica*. 2013;23(2):143–149.
8. Ben-Shachar MS, Lüdtke D, Makowski D. effectsize: Estimation of effect size indices and standardized parameters. *Journal of Open Source Software*. 2020;5(56):2815.
9. Hosmer DW Jr, Lemeshow S, Sturdivant RX. *Applied Logistic Regression*. 3rd ed. Hoboken, NJ: John Wiley & Sons; 2013.
10. Norton EC, Dowd BE, Maciejewski ML. Marginal effects—Quantifying the effect of changes in risk factors in logistic regression models. *JAMA*. 2019;321(13):1304–1305.
11. Ali J, Kapoor S. Understanding consumers' perspectives on food labelling in India. *International Journal of Consumer Studies*. 2009;33(6):724–734.
12. Singh NK, Rathod HS, Alagawadi MV. Factors affecting consumer awareness towards camel milk using binary logistic regression. *The Journal of Research ANGRAU*. 2021;49(4):113–121.
13. Niranjana DA, Jha SK, Dominic DM, Maiti S, Kadian KS. Constraints in Geographical Indication Authorized User Registration and Usage: Experts and Producers Perspective. *Indian Journal of Extension Education*. 2023;59(2):128–131.
14. Das D, Dileep MR. Geographical Indication and Tourism: A Study on the Awareness, Factors Influence, and the Scope of GI Tagging in Kerala as a Rural Tourism Development Tool. *International Journal of Hospitality and Tourism Systems*. 2023;16(4):25–34.
15. Dudziak A, Stoma M, Ośmialska E. Analysis of consumer behaviour in the context of the place of purchasing food products with particular emphasis on local products. *International Journal of Environmental Research and Public Health*. 2023;20(3):2413.
16. Paliwal BK, Phogat P, Mudassir M, Kumar J, Wan M. Impact of age and educational qualifications on food label awareness: A study of edible oils and fats in India. *Nutrition*. 2025;134:112727.
17. Rao KM, Baliga V, Rodrigues CG, Rajaram M. Consumer behaviour towards geographical indication products in emerging economies: a systematic literature review using TCCM-ADO framework. *Cogent Business & Management*. 2026;13(1):2630424.
18. Meena BL, Khan SA, Srivastava V. Assessing consumers' knowledge and purchase willingness for GI-certified Malihabadi Dussehri mangoes. *International Journal of Agricultural and Statistical Sciences*. 2025;21(1):39–45.
19. Tejaswi C, Kodali S, Vijaya Lakshmi V, Sudhakar C. Factors affecting consumer awareness regarding organic red-gram dal of commercial brands: A logistic regression analysis. *Archives of Current Research International*. 2026;26(8):108–122.

20. Muça E, Pomianek I, Peneva M. The role of GI products or local products in the environment—Consumer awareness and preferences in Albania, Bulgaria and Poland. *Sustainability*. 2022;14(1):4.
21. Udayan P, Achari VV. Consumer Preference Towards Geographical Indication (GI) Products – A Conjoint Analysis. *South India Journal of Social Sciences*. 2022;20(2):8-18.
22. Costanigro M, Dubois M, Gracia A, Cardebat JM. The information value of geographical indications. *Food Policy*. 2025;130:102769.
23. Puranik A, Bagwan A, Kulkarni R. Consumer perception about Geographical Indication certified products: An empirical study. *Journal of Oriental Institute*. 2024;73(3):1053-1085.
24. Mundhe BL, Rathod KS, Chaudhari SP, Landge SP, Kadam MM, Badhe SR, Huke VG. Study on food safety awareness and its correlation with socioeconomic factors of consumers in Nagpur city, Maharashtra. *International Journal of Advanced Biochemistry Research*. 2024;SP-8(2):445-449.

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