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Unveiling the determinants of nutri-cereal purchase decision using the extended version of the theory of planned behavior

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Introduction: The growing emphasis on nutrition security and sustainable food systems has renewed policy and market interest in nutri-cereals (millets) as vital components of healthy, climate-resilient diets in India and worldwide. Despite their well-recognized nutritional, environmental, and agronomic advantages, and sustained institutional efforts, such as awareness campaigns and processing incentives, nutri-cereal consumption among Indian consumers remains limited and irregular. This persistent gap between policy intent, consumer awareness, and actual purchasing behavior accentuates the need for a deeper behavioral understanding of the factors influencing consumer decision-making in this domain. Against this backdrop, the present study aims to propose, test, and validate a comprehensive theoretical framework (Extended version of TPB) to examine the determinants shaping the purchase behavior of nutri-cereal-based foods among consumers.

Methodology: Study adopts a quantitative research design and employs a structured survey to capture consumer behavioral determinants. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to analyze the proposed relationships and to assess both direct and indirect effects among key behavioral constructs. In addition, the Garrett ranking technique was applied to prioritize consumer-driven promotional strategies from the consumer's perspective, thereby complementing the behavioral model with actionable insights.

Results: The findings reveal that while environmental awareness does not translate into purchasing intention and actual buying behavior, other behavioral determinants, such as health consciousness, consumer attitude, perceived price fairness, perceived behavioral control, and social influence, play a significant role in shaping purchase intention. Purchase intention, in turn, acts as a critical mediator linking these determinants to actual purchase behavior, highlighting the importance of intention-driven interventions. Also, the prioritization of consumer-driven strategies highlights the role of product diversification, culinary adaptation, and institutional integration for habit formation and targeted promotional efforts in fostering sustained consumption of nutri-cereal-based foods.

Discussion: The validated framework and strategies offer valuable insights into consumer motivations and barriers, providing an evidence-based foundation for designing targeted marketing and communication policies. These insights are particularly relevant for policymakers, marketers, and health advocates seeking to enhance the adoption, commercialization, and sustained purchase and consumption of nutri-cereal-based foods in alignment with national nutrition and sustainability goals.

KEYWORDS

consumer behavior, health consciousness, nutri-cereal based food, PLS-SEM, purchase intentions, sustainable food systems, theory of planned behavior

1 Introduction

Feeding a growing population with safe, nutritious, and sustainable food is one of the defining challenges of our time. Transforming the agri-food system, therefore, is critical not only for ensuring food security and nutritional security but also for sustaining livelihoods and conserving biodiversity. As population pressures intensify, food systems are expected to deliver higher productivity alongside nutritional adequacy, while simultaneously addressing the triple burden of malnutrition–hunger, micronutrient deficiencies, and obesity (FAO, 2018). However, the prevailing overreliance on a narrow range of staple crops has heightened vulnerability to climate shocks, pest outbreaks, and nutritional imbalances, threatening the long-term resilience of global food systems (FAO, 2019; IPCC, 2022; Pingali, 2012). As climate change intensifies, ensuring sustainable food and nutrition security increasingly requires a shift toward climate-resilient crops along with greater consumer acceptance and demand for foods derived from such systems (David et al., 2011; Ansari, 2025). Against this backdrop, nutri-cereals, traditionally known as millets, have re-emerged as vital crops due to their nutritional richness, adaptability to semi-arid environments, and low ecological footprint (Devi et al., 2014; Saleh et al., 2013). Domesticated over 10,000 years ago, millets are rich in micronutrients, gluten-free, and beneficial for managing non-communicable diseases, such as diabetes, obesity, and cardiovascular disorders (Chandra et al., 2016; Shukla et al., 2025). India, which contributes nearly one-third of global millet production, occupies a central position in the global revival of these climate-resilient grains (Paschapur et al., 2021; MoAFW-GOI, 2023).

Policy momentum has further strengthened this resurgence through initiatives, such as the Government of India's *National Millet Mission* and the United Nations' declaration of 2023 as the *International Year of Millets*, which have elevated millets as “smart foods” that advance both human and planetary health (FAO, 2023; Bhatt and Ansari, 2025). This renewed institutional emphasis is reflected in recent production trends of 2024–2025 reported by the Third advance estimates. DES & DAFW states a substantial rise in India's nutri-cereal (Shree Anna/Millets) production to approximately 180–186 lakh tons, cultivated across 128–170 lakh hectares, with an average yield of about 1,400 kg/ha. Research institutions, like ICAR-IIMR, are developing value-added millet-based technologies that bridge traditional grains with fast-paced urban lifestyles. The government is also trying to strengthen backward linkages among corporate entities, agri-startups, and Farmer-Producer Organizations (FPOs), thereby enhancing value-chain integration (Rao, 2025). Beyond market mechanisms, the government is shaping effective public state-level interventions, such as millet-promotion initiatives in Karnataka, Odisha, and Chhattisgarh; dedicated retail outlets; e-commerce platforms; and integration into the Public Distribution System (PDS). This growing demand for convenience, nutritional security, and lifestyle-compatible foods has the potential to generate a strong “demand-pull” across the millet value chain (Dayakar Rao et al., 2021; Sudhagar and Sagayanathan, 2025).

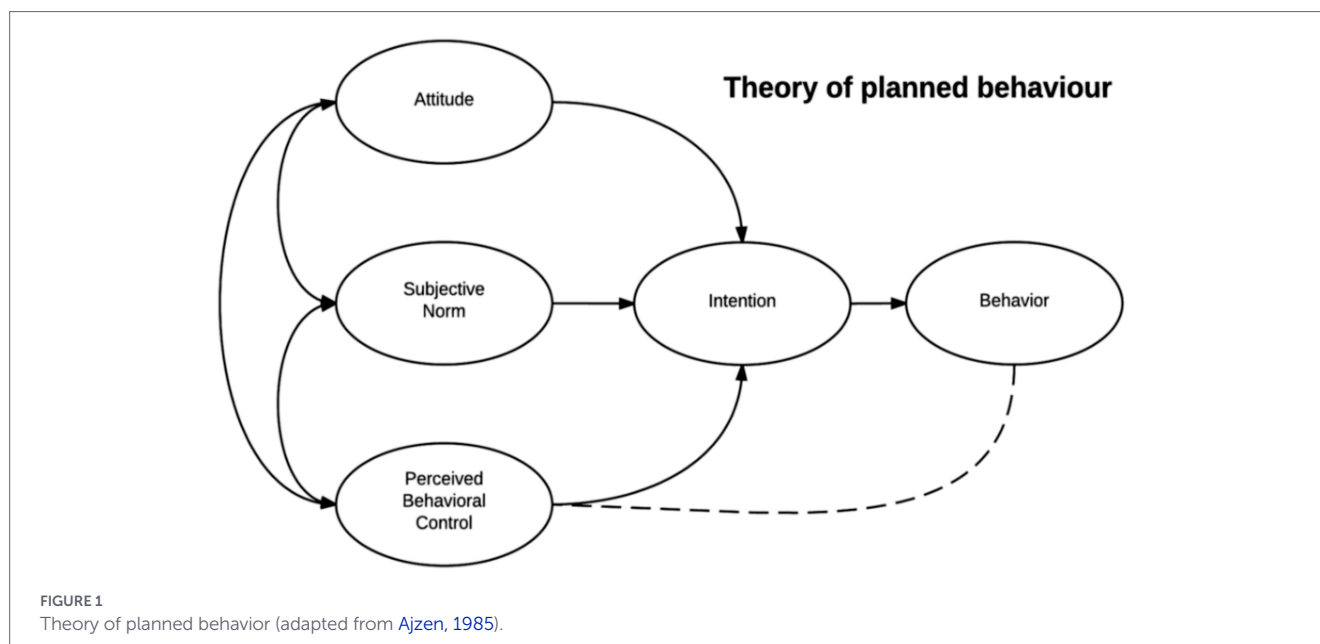
Despite these advancements, millet purchase and consumption in India remain sporadic and limited, even within regional markets (NITI Aayog and WFP, 2022). This persistent disconnect between supply-side expansion and demand-side uptake underscores the importance of understanding purchase behavior, especially among near-urban populations, whose evolving preferences increasingly shape food markets. Therefore, translating positive perceptions into consistent purchasing behavior requires understanding consumers' psychological and behavioral drivers (Raju and Rukmani, 2022; Shah et al., 2025). Existing literature suggests that constructs such as health consciousness, attitude, subjective norms, price perception, and perceived behavioral control play a crucial role in shaping purchase intentions (Zayed et al., 2022; Paul et al., 2016; Yadav and Pathak, 2017). Yet, empirical studies integrating these determinants into a holistic behavioral framework for nutri-cereal purchase are scarce. Building on these gaps, the present study develops and empirically tests an integrated psychological model that examines the relationships among environmental awareness, health consciousness, consumer attitude, price perception, subjective norm, perceived behavioral control, and market communication in influencing purchase intention and actual purchase behavior. Specifically, it investigates (a) the direct and indirect effects of these determinants, (b) the mediating role of purchase intention, and (c) actionable insights for policymakers and industry stakeholders to strengthen consumer engagement and promote the consumption and production of nutri-cereals in India.

2 Research framework and hypothesis development

2.1 Theoretical underpinnings: the theory of planned behavior

Human behavior, particularly within collective decision-making contexts, is a complex interplay of social, moral, and self-interested motives (Bem and Looren, 1997). To decipher this complexity, robust theoretical frameworks from the behavioral sciences are essential. The Theory of Planned Behavior (TPB), proposed by Ajzen (1985), offers a prominent and validated framework for predicting and understanding volitional behavior. The TPB posits that an individual's behavioral intention is the most immediate antecedent of actual behavior. This intention is, in turn, shaped by three core constructs: (1) attitude toward the behavior (the individual's positive or negative evaluation of performing the behavior), (2) subjective norm (the perceived social pressure from significant others to perform or not perform the behavior), and (3) perceived behavioral control (PBC) (the perceived ease or difficulty of performing the behavior, reflecting past experiences and anticipated impediments) (Figure 1).

While the TPB provides a robust foundation, its primary focus on socio-psychological factors may overlook other salient determinants in specific contexts, such as sustainable food consumption (Ajzen, 1991). To address this limitation and enhance the model's explanatory



power, we extend the TPB by integrating additional constructs identified as critical in the literature on food consumption and pro-environmental behavior.

2.2 The extended TPB model and hypothesis development

This study employs an extended TPB model (Figure 2) to investigate the determinants of purchase intention and subsequent behavior regarding nutri-cereal-based food products in India. The model incorporates the three original TPB constructs—attitude, subjective norm, and PBC alongside four additional constructs: health consciousness, environmental awareness, price perception, and market communication. The following section delineates the theoretical rationale for each hypothesized relationship.

2.2.1 Core TPB constructs

H1: consumers' attitude positively influences purchase intention toward nutri-cereal-based food products.

Attitude toward the behavior measures the degree to which a person has a negative or positive feeling toward his/her performance of the behavior. A well-established premise in marketing is that a favorable attitude toward a product is a strongly predictor of the person's intention to engage with it (Asif et al., 2018; Krishnasamy et al., 2024; Wang et al., 2019). Studies specific to food products consistently affirm that consumer attitude is a pivotal driver of purchase intention (Aitken et al., 2020; Dangi et al., 2020; Zaremohzzabieh et al., 2021).

H2: subjective norm positively influences purchase intention toward nutri-cereal-based food products.

It refers to the influence due to opinion of surrounding community and media on individual choice to perform certain behavior or not. The influence of referent groups (e.g., family and friends) is particularly

potent in purchase decisions. Empirical evidence confirms that subjective norms significantly predict purchase intentions for various food products (Rana and Paul, 2017; Wong and Aini, 2017; Shirahatti et al., 2022).

H3: perceived Behavioral control positively influences purchase intention toward nutri-cereal-based food products.

It refers to perceived ease and difficulty to purchase nutri-cereals and its food products, which means whether or not they can carry out a specific behavior and how easy it is to carry out. Consumers are more likely to form a purchase intention if they believe they have the resources, knowledge, and opportunity to execute the behavior. This positive link between PBC and intention has been validated in numerous food consumption contexts (Arli et al., 2018; Kumar et al., 2025; Hasan and Suciarto, 2020).

2.2.2 Additional constructs

H4: environmental awareness positively influences purchase intention toward nutri-cereal-based food products.

It refers to an individuals' understanding of the natural environment and making choices that benefit the ecosystem. Growing concerns about environmental sustainability are shaping purchasing patterns, even in food segments. Consumers who are aware of the ecological benefits of certain agricultural practices (e.g., those associated with many nutri-cereals) are more inclined to purchase such products (Wierzbinski et al., 2021; Maichum et al., 2016; Gupta and Bhardwaj, 2024).

H5: health consciousness positively influences purchase intention toward nutri-cereal-based food products.

Health consciousness, defined as peoples' awareness toward healthiness and wellness attributed to nutri-cereals and its various products. As awareness of the health benefits of functional foods like nutri-cereals

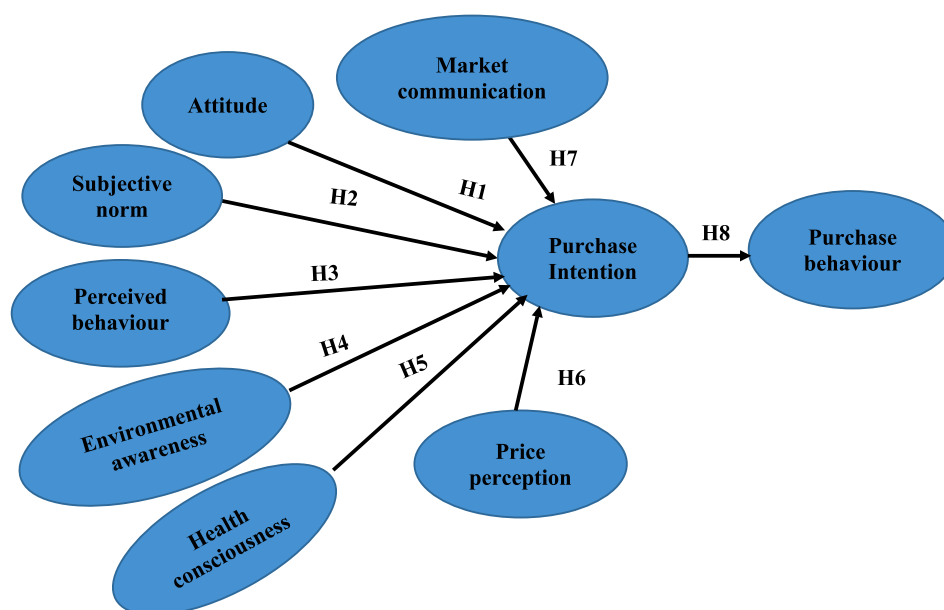


FIGURE 2
Extended version of theory of planned behavior.

grows, consumers are increasingly driven by wellness considerations (Iqbal, 2015; Konuk, 2018; Pampackal et al., 2024).

H6: Price perception positively influences purchase intention toward nutri-cereal-based food products.

Price perception involves how consumers interpret and evaluate the price of a product or service, based on factors like value for money, brand reputation, and market comparisons. When consumers perceive that the health and nutritional benefits of nutri-cereals justify their price, their purchase intention increases (Mirza and Ali, 2017; Zheng et al., 2021; Benhardy et al., 2020).

H7: market communication positively influences purchase intention toward nutri-cereal-based food products.

It refers to the strategies and channels used to advertise and promote nutri-cereals, aiming to raise awareness and encourage their consumption among individuals. Market communication, such as advertising, social media campaigns, and public awareness initiatives, plays a crucial role in shaping consumer knowledge and attitudes (Ihzaturrehman and Kusumawati, 2021). Effective communication can amplify the perceived value of nutri-cereals and stimulate purchase intention (Pauwels et al., 2013; Ruswanti et al., 2019).

2.2.3 The intention-behavior link

H8: purchase intention positively influences purchase behavior toward nutri-cereal-based food products.

Purchasing Intention generally refers to the individuals' readiness to buy nutri-cereals. It is an antecedent of the actual behavior. The foundational premise of the TPB and a substantial body of empirical research affirm that behavioral intention is a robust and reliable

predictor of actual behavior (Lacey et al., 2025; Kumar, 2025; Marie et al., 2009; Morven et al., 2007). Therefore, we hypothesize a direct, positive relationship between the intention to purchase and the actual purchasing behavior of nutri-cereal-based products.

2.2.4 Conceptual model

The proposed theoretical model, illustrating the relationships between the independent variables (attitude, subjective norm, PBC, health consciousness, environmental awareness, price perception, market communication), the mediating variable (purchase intention), and the dependent variable (purchase behavior), is presented in Figure 2.

3 Materials and methods

The study focused on consumers of nutri-cereal-based products in Uttarakhand. The Universe of the study was deliberately taken as Uttarakhand, as the state represents a relevant and analytically appropriate setting for examining nutri-cereal purchase intention and consumer behavior. Uttarakhand is a traditional producer of nutri-cereals, particularly millets, and an active participant in government-led millet promotion initiatives, reflecting both a strong supply base and an emerging demand environment. Empirical evidence supports this choice: among the ten Himalayan states of India, Uttarakhand has the highest area under millet cultivation, followed by Himachal Pradesh (Bhat et al., 2019), and also records the highest millet productivity (1,174 kg/ha), exceeding Tamil Nadu (1,067 kg/ha) and Gujarat (1,056 kg/ha) (Anbukkani et al., 2017). Further, millets have demonstrated notable climate resilience in the state, having survived the 2009 drought in Uttarakhand (Samuel, 2016). These production, productivity, and resilience characteristics, combined with culturally embedded consumption practices,

expanding urban and near-urban markets, and increased availability of value-added nutri-cereal products, create a dynamic consumption landscape. This convergence allows for meaningful assessment of purchase intention, behavioral drivers, and market responses among nutri-cereal consumers, thereby justifying the deliberate selection of Uttarakhand as the universe of the study.

From the Garhwal division, Tehri Garhwal and Pauri Garhwal districts were selected, while Almora and Pithoragarh were chosen from the Kumaon division, as these areas are primarily agrarian and major producers of finger and small millets. One block from each district—a total of four blocks, that is, Narendranagar, Kotdwar, Chaukhutiya, and Munsiyari—was randomly selected. Key and well-known outlets selling nutri-cereals and nutri-cereal-based products were identified in each block with the assistance of local leaders and NGO volunteers (Figure 3).

3.1 Sample size

To assess the adequacy of the sample size for PLS-SEM, an *a priori* power analysis was conducted using G*Power. The F-test family with linear multiple regression was selected, assuming a medium effect size ($f^2 = 0.15$), a significance level of 0.05, a desired statistical power of 0.80, and a maximum of seven predictors in the structural model. Based on these parameters, the minimum required sample size was estimated to be approximately 103 respondents, as depicted in the graph. Also, following Stevens' (1996) recommendation of at least 10–15 respondents per construct, a minimum sample size of 120 was required. Thus, the final sample of 120 respondents therefore exceeds this threshold, indicating that the study has adequate statistical power to detect meaningful effects. Respondents were selected using convenience sampling from among individuals visiting these outlets for the purchase of nutri-cereals. From each block, 30 such consumers were approached at shops, organic marts, bakeries, and NGO or government outlets dealing in nutri-cereal products (Figure 4).

3.2 Research instrument

A quantitative research approach was employed using a structured questionnaire developed from previously validated sources (Zayed et al., 2022; Wang et al., 2019; Chu, 2018; Mainardes et al., 2017; Petrescu et al., 2017) with minor modifications, whereas the purchase behavior construct was self-developed based on the study context and refined through expert consultation to ensure content validity. Constructs and their corresponding indicators were measured on a five-point Likert scale ranging from “1 = Strongly Disagree” to “5 = Strongly Agree.” The items, along with the constructs are mentioned in Table 1. After this, a pre-test with 40 current Nutri-cereal consumers was conducted to ensure clarity and reliability; necessary wording adjustments were made accordingly. Pre-test responses were excluded from the final dataset to avoid bias.

Data analysis was performed using SmartPLS, applying Partial Least Squares Structural Equation Modeling (PLS-SEM) to test and validate the research hypotheses. PLS-SEM was chosen for its suitability in handling small sample sizes and complex models. This second-generation, causal-predictive technique is widely used for theory development in exploratory research, emphasizing model prediction and the examination of relationships among latent variables (Henseler et al., 2009; Sarstedt et al., 2021).

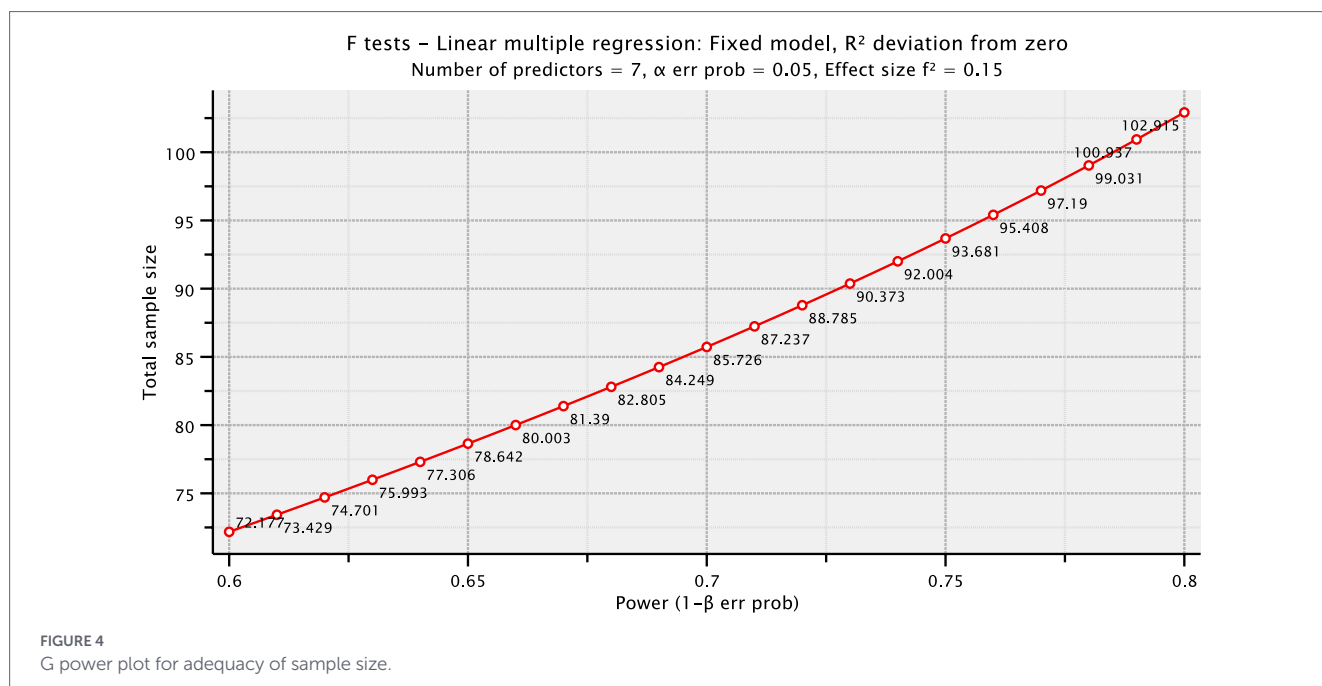
SEM = measurement model (confirmatory factor analysis) + Structural model (Path analysis or regression): A two-stage approach, as described below, was used to evaluate PLS-SEM results.

Stage 1: Measurement model evaluation or outer model evaluation. The testing of the measurement model is done through reliability and validity.

Step1: Examining the indicator reliability: Loadings above 0.70 indicate that the constructs explain more than 50% of the indicator's variance, demonstrating that the indicator exhibits a satisfactory degree of reliability.



FIGURE 3
Map illustrating the study area.



Step 2: Assessment of the constructs' internal consistency reliability: It measures whether several items that are proposed to measure the same general construct produce similar scores. It is measured by the Cronbach alpha method and the composite reliability-rho A method to establish internal consistency; the value of two tests should not be less than 0.6 (rho_A > 0.60, Cronbach alpha > 0.60).

Step 3: Examining the convergent validity: It is the assessment to measure the level of correlation of multiple indicators of the same construct that are in agreement. To establish convergent validity, the average variance is extracted, i.e., AVE ≥ 0.50.

Step 4: Assessing discriminant validity: It refers to the extent to which the constructs actually differ from one another empirically. It also measures the degree of differences between the overlapping constructs. The discriminant validity can be evaluated by using Fornell & Larcker criterion and Heterotrait–Monotrait (HTMT) ratio of correlation.

Stage 2: *Structural model estimation and evaluation*: The thumb rule of evaluating the structural model: first, if the measurement characteristics of constructs are acceptable, then continue with the assessment of the structural model results. Second, path estimates should be statistically significant and meaningful. The hypothesis was tested through the bootstrapping method. Initially, the model fitness test was conducted, and then further steps were taken into consideration.

Step 1: Assess the structural model for collinearity issues using VIF. Probable (i.e., critical) collinearity issues when VIF ≥ 5. Possible collinearity issues when VIF ≥ 3–5 ideally show that VIF < 3.

Step 2: Assess the significance and relevance of the structural model relationship by checking the significance of the path coefficient.

Step 3: Assess the level of the coefficient of determination (R square) value, which should be near 1; more than 0.75, substantial explanatory power; 0.50 is moderate; and 0.25 has weak explanatory power.

3.3 Strategies for promoting Nutri-cereal from a consumer perspective

While interviewing consumers to assess behavioral determinants, a few selected strategy statements derived from the literature were

simultaneously presented to the same consumer respondents to ensure internal consistency. This integrated approach enabled respondents to cognitively link their beliefs, motivations, and constraints with practical promotional actions. As a result, the assessment captured not only *why* consumers intend to purchase nutri-cereals but also *which strategies* they perceive could be most effective in facilitating that behavior in the future to other consumers. This step involves identifying the priority strategies that are precisely aligned with the consumer's perspectives. It helps identify the most influential and feasible actions based on consumers' key behavioral determinants. This ensures efficient use of resources and maximizes the likelihood of translating intention into sustained nutri-cereal consumption.

The study found six key strategies for promoting nutri-cereals-based foods, which align with framework results during interviewing during data collection. These solutions were prioritized using the Garrett ranking technique. The method was applied to rank the respondents' stated preferences based on various criteria. Following the methodology, the study asked participants to rank several strategies. The ranking findings were then translated into score values using the formula below:

$$\text{Percent position} = \frac{100(R_{ij} - 0.5)}{N_j}$$

Where R_{ij} = Rank is given for the i th variable by the j th respondent. N_j = Number of variables ranked by the j th respondent.

4 Results

4.1 Sample characterization and key constructs

The profile of the respondents offers valuable insights into the consumer for nutri-cereal-based foods in the surveyed region of Uttarakhand. The sample captured a diverse cross-section of the

TABLE 1 Analysis of measurement model.

Measurement constructs and their items	Outer loading
Environmental awareness (Mainardes et al.,2017 with slight modification) (Cronbach alpha = 0.831, composite reliability = 0.832 and AVE = 0.661)	
I believe nutri-cereal, being environmentally sustainable, will help in conserving natural resources	0.846
I feel good when I utilize nutri-cereal and its food products	0.774
I am very knowledgeable about environmental issues	0.811
Using nutri-cereal and its food products is one of the main means to mitigate climate change	0.823
Health consciousness (Petrescu et al.,2017 with minor modification) (Cronbach alpha = 0.753, composite reliability = 0.778 and AVE = 0.574)	
I feel that I sacrifice a lot for my health	0.787
I am ready to abandon a lot, to eat as healthy as possible	0.832
I believe that I consider health a lot in my life	0.748
I believe it is important to understand, well, how to eat healthy	0.653
Price perception (Chu,2018 with slight modification) (Cronbach alpha = 0.812, composite reliability = 0.824 and AVE = 0.649)	
Nutri cereals and their food-based products are not cheap/bit pricey	0.844
I believe nutri cereals and their food-based products are more suitable for high-revenue groups	0.789
I am sure that I am ready to pay a premium for nutri cereals and its food-based products	0.807
Nutri cereals and its food-based products are beyond my budget	0.780
Attitude (Zayed et al.,2022 with slight modification) (Cronbach alpha = 0.858, composite reliability = 0.873 and AVE = 0.585)	
I think that purchasing nutri-cereals and their food-based products is a good idea.	0.762
I think that purchasing nutri-cereals and their food-based products is interesting.	0.727
I think that purchasing nutri-cereals and their food-based products is important.	0.748
I think that purchasing nutri-cereals and their food-based products is beneficial.	0.718
I think that purchasing nutri-cereals and their food-based products is wise.	0.811
I think that purchasing nutri-cereals and their food-based products is favorable.	0.819
Marketing communication (Chu,2018 with slight modification) (Cronbach alpha = 0.735, composite reliability = 0.749 and AVE = 0.558)	
I can acquire nutri-cereals and their food-based products' information by advertisements (i.e., magazines, newspapers, TV channels, internet, etc.)	0.831
Word-of-mouth from friends, family members, referrals, or food blogs has affected my knowledge of nutri-cereals and their food-based products	0.692
I get information on nutri-cereals and their food-based products by email/mail/phone calls from my favored retailer	0.736
Sales workers in the retail shops are always available to make suggestions for me about nutri-cereals and their food-based products	0.722
Subjective norm (Chu, 2018 with slight modification) (Cronbach alpha = 0.814, composite reliability = 0.839 and AVE = 0.639)	
Family and close friends think it is a good idea for me to buy nutri-cereals and their food-based products	0.805
I listen to advertisements that could influence me to purchase nutri-cereals and their food-based products	0.858
Mass media reports have influenced me to test nutri-cereals and their food-based products	0.822
Important people in my life would expect me to buy nutri-cereals and their food-based products	0.706
Perceived behavior control (Wang et al.,2019, with slight modification) (Cronbach alpha = 0.716, composite reliability = 0.726 and AVE = 0.637)	
If I wanted to, I could buy nutri-cereals and their food-based products, instead of normal food	0.808
I think it is easy for me to buy nutri-cereals and their food-based products	0.749
It is mostly up to me whether or not to buy nutri-cereals and their food-based products	0.835
Purchasing intention (Zayed et al.,2022, with slight modification) (Cronbach alpha = 0.771, composite reliability = 0.772 and AVE = 0.522)	
I mean to purchase nutri-cereals and their food-based products in the near future	0.724
I plan to buy nutri-cereals and their food-based products in regular basics	0.703

(Continued)

TABLE 1 (Continued)

Measurement constructs and their items	Outer loading
I intend to buy nutri-cereals and their food-based products for my long-term health benefits	0.729
I intend to buy nutri-cereals and their food products because they are more environmentally friendly	0.713
Buying nutri-cereals and their food-based products is the correct thing to do, even though they cost more	0.744
<i>Purchase behavior—items developed with experts (Cronbach alpha = 0.830, composite reliability = 0.835 and AVE = 0.596)</i>	
I buy nutri-cereal very often	0.725
The quantity of purchase is very high	0.784
I spend a portion of my monthly grocery budget on nutri-cereal-based foods	0.776
Nutri-cereal is a healthy alternative to rice or wheat	0.822
I have recommended nutri-cereal to others	0.750

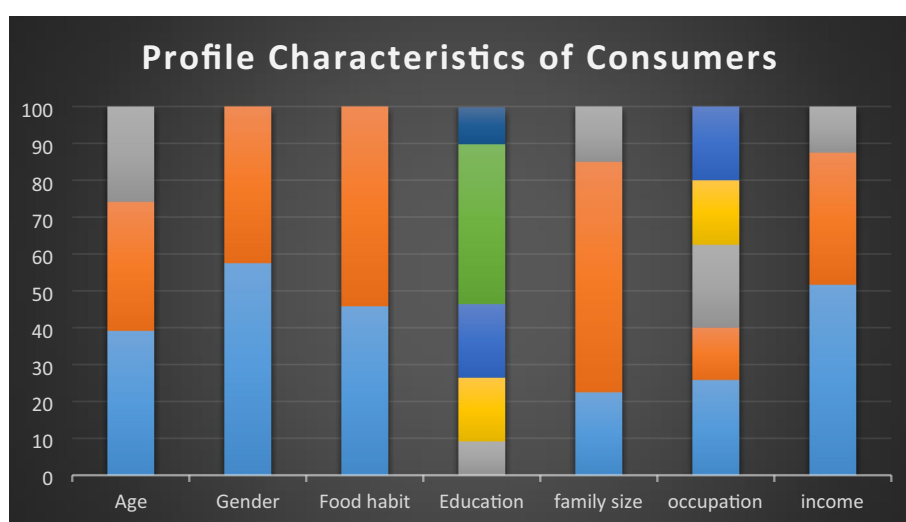


FIGURE 5 Profile characteristics of consumers.

population, with a strong representation of young (39.16%) and middle-aged adults (35%), who are often more receptive to new food trends and health-conscious messaging. The gender-wise distribution was relatively balanced (men constituted 57.5% and women 42.5%), and a significant proportion of respondents were educated (43.33% graduates), suggesting that respondents included in the study sample were capable of processing health and nutritional information. In the context of occupation, 25.83% worked in the government sector, 22.5% in business, 20% were homemakers, 17.5% were self-employed, and 14.16% worked in private jobs (Figure 5).

Crucially, the data reveal a consumer segment that is positively predisposed toward nutri-cereals but operates within economic constraints. This is evidenced by two key findings: first, the majority of respondents (53.33%) held a highly favorable attitude toward purchasing these products, and second, over half (51.67%) belonged to the low-income bracket. This juxtaposition of positive attitude and limited purchasing power underscores the critical role of price perception (neutral 40% and negative for 25%) in this market, which was found to be collectively for 65% of the sample. This suggests that while consumers are interested, the current value proposition may not fully align with their economic reality, potentially creating a barrier to

converting positive attitudes into actual purchase behavior (Mirza and Ali, 2017; Zheng et al., 2021).

Furthermore, the high levels of reported health consciousness (47.5% high) align with the strong positive attitudes, reinforcing the proposition that health benefits are a primary motivator (H5). This provides a solid foundation for market communication strategies. The fact that a majority (52.5%) reported high exposure to market communication indicates that promotional efforts are reaching the target audience. However, the translation of this exposure into uniformly high purchase intention (which was high for 45%) suggests that the content and persuasive quality of these communications may require refinement to more effectively bridge the gap between awareness, intention, and actual purchase.

The social environment also appears conducive to adoption, as indicated by the high level of subjective norms (47.5% high). This implies that consumers perceive significant social pressure or approval from their referent groups to consume nutri-cereals, supporting the relevance of H2. Similarly, the high degree of perceived behavioral control (48.33% high) suggests that consumers feel they have the necessary knowledge and access to purchase these products, a positive sign for the feasibility of H3.

In conclusion, the characterized sample represents a promising yet nuanced market. Consumers are health-aware, socially influenced, and positively inclined, but are also price-sensitive. A successful market penetration strategy will, therefore, require a synergistic approach that addresses economic barriers through smart pricing while simultaneously amplifying health benefits and social proof through targeted communication.

As regards the theoretical and practical implications of these findings, the consumer profile substantiates the value of extending the Theory of Planned Behavior (TPB), as the high salience of health consciousness and price perception confirms that these context-specific constructs are critical for a nuanced understanding of consumer intentions beyond core socio-psychological factors. Practically, the findings suggest that for nutri-cereals to penetrate the market effectively, strategies must synergistically leverage consumers' intrinsic health motivation through benefit-oriented communication, while simultaneously addressing economic sensitivities via strategic pricing and value-propositioning, all amplified by leveraging the potent influence of social norms.

4.2 Assessment of model

To assess the proposed framework, the analysis was carried out in two stages using SmartPLS. In the first stage, the reliability and validity of the measurement model were evaluated to ensure the robustness of the constructs. In the second stage, hypothesis testing was performed through a bootstrapping procedure using the PLS-SEM technique.

4.2.1 The measurement model

The [Table 1](#) depicts the measurement model and indicates that the outer loading lies between 0.653 and 0.858. Only one indicator from health consciousness and one indicator from market communication stated a value below 0.07; the rest exceeded the threshold value of 0.07 for outer loading. This stated that the indicator variable shows strong correlation within the constructs.

After assessing outer loading, the next stage was to assess Cronbach's alpha and rho value to measure internal consistency under the measurement model assessment. [Table 1](#) details that the Cronbach's alpha value lies between 0.716 to 0.859, which is higher than 0.70, a recommended value. Similarly, the rho value of each construct lies between 0.726 and 0.873. This states that the data are fit for structural modeling assessment, hence proving strong reliability. The value for AVE of each construct stated in the table lies between 0.522 and 0.664, which is almost higher than the recommended value of 0.5. Therefore, it indicates that the multiple indicators measure the same construct, and the model represents the theoretical framework.

[Table 2](#) reveals that the diagonal value that is in bold is the square root of AVE, whereas for the rest, correlation among the constructs is more significant and greater for all the variables. Thus, it indicates a clear distinction, confirming the discriminant validity between the constructs.

[Table 3](#) depicts that the HTMT values that are close to 1 indicate a lack of discriminant validity. Through table it was observed that the value of the HTMT is less than 0.90 (threshold value) thus, it can be concluded that there is a lack of discriminant validity. Thus, it can be concluded that while the HTMT assessment confirms acceptable discriminant validity across most construct pairs, the findings point to potential overlaps among environmental awareness, health

consciousness, and market communication. This insight offers valuable direction for future studies seeking to build more robust and conceptually distinct models in the domain of consumer attitudes and behaviors. Careful construct design and measurement refinement will enhance the validity and interpretability of such models.

4.2.2 The structural model estimation

4.2.2.1 Multi-collinearity assessment of inner model

After validating the measurement model, the research hypotheses were tested using the bootstrapping procedure within the PLS-SEM framework. The analysis was conducted following the three-step testing process detailed in the methodology section.

[Table 4](#) presents all the possible paths and their corresponding variance inflation factor (VIF) values, which serve as a measure of multi-collinearity. The results clearly indicate that all VIF values are below five, confirming the absence of significant variance inflation. This suggests minimal correlation among the indicators and distinct relationships with their respective latent constructs, ensuring that the regression coefficients remain unbiased.

4.2.2.2 Result of hypothesis testing

The results revealed in [Figure 6](#) and [Table 5](#) that attitude had a significant influence on consumers' purchase intention ($\beta = 0.161$, t value = 3.058, p value 0.008). Thus, H1 is accepted. The hypothesis H4 in [Table 5](#) stated that $\beta = 0.140$ with the t value = 1.653 and p value was 0.098, which was higher than 0.05. The findings clearly stated that there is an insignificant relationship between environmental awareness and purchasing intention, therefore, indicating that the path was rejected and the hypothesis proposed was also rejected. The result might be explained by the fact that the majority of the consumers were not concerned about environmental awareness.

For health consciousness to purchase intention, the finding revealed that the path coefficient was 0.200 and had a T statistic value of 2.882 with a p value of 0.004, which is less than 0.05. Thus, this relationship was found to be significant. From the data, it could be inferred that health consciousness was the strongest influential factor on the purchasing intention of consumers among the other eight constructs. Irrespective of all the ages and genders, the consumer was consuming these millet-based food products because of their high nutritional and health functional properties. The hypothesis between market communication and purchase intention is explained through the path estimated β at 0.162, t value = 2.047, and p value is 0.041, which is lower than 0.05, stating that there is a direct and significant relationship between market communication and purchase intention, resulting in acceptance of the hypothesis. The results also showed that the market communication have second highest significant effect on their purchase intention ($\beta = 0.183$; t value = 2.885, p value = 0.004).

It was revealed that the price perception associated with millet-based food products was found to be in a positive and significant relationship with the purchasing intention regarding nutri-cereal-based food products (path coefficient = 0.145 with t value 2.457 and p value 0.014). [Table 5](#) depicts the path coefficient of 0.142 and p value of 0.040 for a particular path. Therefore, the hypothesis was found to be accepted as the p value is less than 0.05, and the

TABLE 2 Results of discriminant validity assessment using Fornell-Lacker criterion.

Constructs	Att	E A	HC	MC	PB	PCB	PI	PP	Sub
Att	0.765								
E A	0.611	0.815							
H C	0.623	0.711	0.858						
MC	0.564	0.73	0.687	0.787					
P B	0.677	0.62	0.698	0.654	0.772				
PCB	0.539	0.664	0.561	0.564	0.499	0.798			
PI	0.693	0.81	0.796	0.762	0.674	0.733	0.723		
PP	0.464	0.692	0.633	0.643	0.642	0.556	0.728	0.805	
Sub	0.452	0.628	0.631	0.509	0.445	0.602	0.702	0.553	0.8

Bold indicates construct square rooted AVE.

TABLE 3 Result of discriminant validity assessment using HTMT ratio.

Constructs	Att	E A	HC	MC	PB	PCB	PI	PP	Sub
Att									
E A	0.708								
HC	0.757	0.879							
MC	0.698	0.725	0.889						
P B	0.798	0.739	0.876	0.828					
PCB	0.668	0.859	0.748	0.767	0.641				
PI	0.833	0.778	0.765	0.812	0.831	0.898			
PP	0.545	0.838	0.787	0.814	0.775	0.716	0.893		
Sub	0.500	0.740	0.781	0.623	0.525	0.753	0.861	0.662	

Att, attitude of consumers; EA, Environmental awareness; HC, Health consciousness; MC, Market communication; PB, Perceived behavior; PCB, Perceived Control Behavior; PI, Purchase Intention; PP, Price perception; Sub, subjective Norm.

relationship was found to be significant between subjective norm and purchasing intentions. The path drawn from the structural model estimation revealed that purchasing intention has a significantly stronger influence on purchase behavior. The value of $\beta = 0.674$ and a p -value of 0.000 indicates that there is a strong influence of purchasing intention on purchasing decision. Table 5 provides the summary of hypothesis.

4.2.2.3 Coefficient of determination

The coefficient of determination of purchasing intention was 0.847. This explains that the independent variable included in the model has substantial explanatory power in predicting consumers' purchasing intention. Whereas in the case of purchasing behavior, the model explained approximately 45.5% of the variance in purchasing behavior. This suggests that the independent variable included in the model has a moderate level of explanatory power for predicting the purchasing behavior of consumers.

4.2.2.4 Purchasing intention as a mediator

The indirect coefficient for the path attitude → purchase intention → purchase behavior, health consciousness → purchase intention → purchase behavior, market communication → purchase intention → purchase behavior, perceived control behavior → purchase intention → purchase behavior, price perception → purchase intention →

TABLE 4 Multi-Collinearity value using VIF.

Corresponding paths	VIF
Attitude → purchase intention	1.901
Environmental awareness → purchase intention	4.451
health consciousness → purchase intention	2.853
market communication → purchase intention	2.606
perceived control behavior → purchase intention	2.114
price perception → purchase intention	2.238
purchase intention → purchase behavior	1.000
subjective norm → purchase intention	2.059

purchase behavior, subjective norm → purchase intention → purchase behavior was 0.109, 0.135, 0.109, 0.123, 0.098, 0.096, respectively, with a p value less than 0.05. Thus, providing supporting evidence for a hypothesis suggesting that “purchasing intention may act as a mediator in the relationship between other constructs and purchasing behavior,” except for the path environmental awareness → purchase intention → purchase behavior, the indirect coefficient ($\beta = 0.094$) yielded a non-significant p -value of 0.104, unable to surpass the required threshold. This underscores the non-significance of

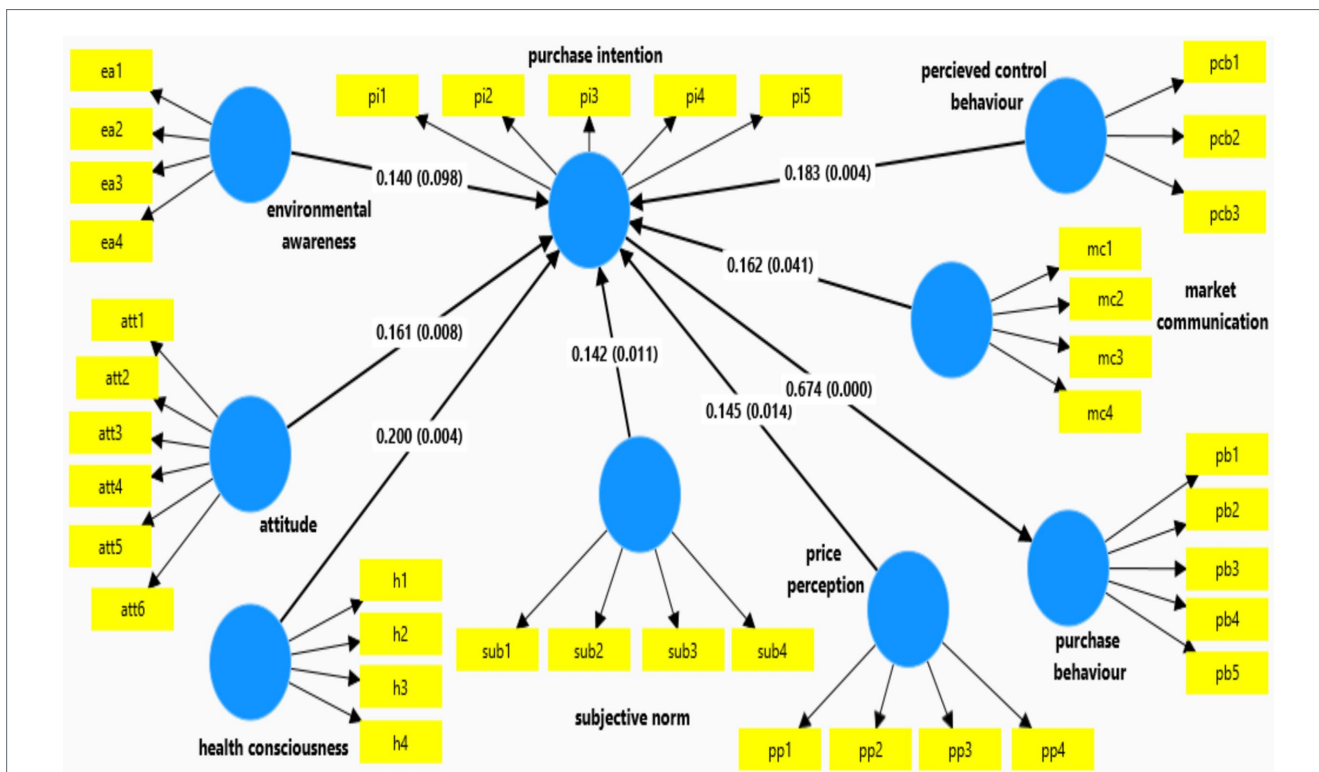


FIGURE 6 Structural model of PLS-SEM showing path coefficients and *p*-value of the inner model.

TABLE 5 Summary of hypothesis testing.

Hypothesis	Corresponding paths	β	T statistics	<i>p</i> values	Result
H1	Attitude → purchase intention	0.161	3.058	0.008	Accepted
H4	Environmental awareness → purchase intention	0.140	1.653	0.098	Rejected
H5	Health consciousness → purchase intention	0.200	2.882	0.004	Accepted
H7	Market communication → purchase intention	0.162	2.047	0.041	Accepted
H3	Perceived behavior control → purchase intention	0.183	2.885	0.004	Accepted
H6	Price perception → purchase intention	0.145	2.457	0.014	Accepted
H8	Purchase intention → purchase behavior	0.674	12.802	0.000	Accepted
H2	Subjective norm → purchase intention	0.142	2.548	0.011	Accepted

hypothesis (H11) that posits “environmental awareness may act as a mediator in the relationship between environmental awareness and purchasing behavior” (Table 6).

4.2.3 Prioritization of consumer-oriented strategies

The consumption-oriented strategies for the promotion of nutri-cereal in Uttarakhand are essential to drive demand, for improving

health, increasing dietary diversity, and ensuring access to nutritious, affordable food. There were a total of six strategies identified from the discussion with respondents (Table 7).

This prioritization exercise reinforces the earlier insights that tangible, consumption-linked strategies, such as product innovation and institutional provisioning, are more immediately effective in driving nutri-cereal consumption than awareness campaigns alone. Therefore, the findings strongly advocate for consumer-driven and context-specific policy planning.

TABLE 6 Mediating effect of intention between other constructs and purchasing behavior.

Corresponding path	β	T value	p	Result
Attitude → purchase intention → purchase behavior	0.109	2.521	0.012	Accepted
Environmental awareness → purchase intention → purchase behavior	0.094	1.624	0.104	Rejected
Health consciousness → purchase intention → purchase behavior	0.135	2.762	0.006	Accepted
Market communication → purchase intention → purchase behavior	0.109	1.989	0.047	Accepted
Perceived control behavior → purchase intention → purchase behavior	0.123	2.858	0.004	Accepted
Price perception → purchase intention → purchase behavior	0.098	2.374	0.018	Accepted
Subjective norm → purchase intention → purchase behavior	0.096	2.597	0.009	Accepted

TABLE 7 Consumer-oriented strategies.

Sl. No.	Strategies	Garrett mean score
1	Product diversification	58.87
2	Culinary innovation and traditional revival	54.60
3	Institutional integration for habit formation	53.64
4	Government supported festive promotion and expert endorsement	50.41
5	Enhance affordability and market reach	48.03
6	Awareness and educational campaign	45.36

Thus, we can conclude that a strategic combination of product diversification (GMS = 58.87) followed by culinary adaptation and traditional revival (GMS = 54.60), institutional integration for habit formation (GMS = 53.64), government supported by accessibility measures, and promotional efforts (GMS = 50.41), is likely to generate the most sustainable impact. This prioritization should guide policymakers, development agencies, and private sector actors in aligning their interventions with consumer preferences and regional dietary contexts.

5 Discussion

The findings of this study confirm the validity of the extended Theory of Planned Behavior (TPB) in explaining consumer purchase behavior toward nutri-cereal-based foods. The model effectively captures the interplay between psychological, social, and contextual factors shaping food purchase choice in an emerging market setting. There were five major insights that emerged from the results that need to be discussed. First, the strong and statistically significant effect of health consciousness, followed by attitude, suggests that nutri-cereal consumption is primarily driven by perceived personal health benefits and favorableness due to its unique attributes rather than altruistic motives. Consistent with the Theory of Planned Behavior, health-related beliefs and favorable attitudes shape purchase intention, that translate into purchase behavior as consumers increasingly view nutri-cereals as functional foods suited to modern lifestyle needs. This health-first cognitive framing explains the revival of traditional nutri-cereals through a contemporary nutrition lens. The findings corroborate prior studies, such as Pant et al. (2024), Escobar-Farfán et al. (2025), Kaur et al. (2025); show the dominance of health motives over environmental concerns in food choice.

Second, the non-significant relationship between environmental awareness and nutri-cereal purchase intention reveals a clear value action gap, where expressed environmental concern does not translate into actual behavior. This suggests that in contexts like India, immediate health and economic motives are more salient than abstract environmental concerns in shaping food purchase decisions. Thus, the broader environmental awareness is often overshadowed by the personal gains of consumers. It also raises the possibility that our measurement of environmental consciousness may not have been sufficiently specific to nutri-cereals, potentially limiting its predictive power. The result challenges assumptions about the primacy of sustainability in food choice and aligns with broader discussions in the literature that health and utilitarian factors frequently overpower ecological motives in purchase behavior, contrasting with studies such as Cavite (2025) and Li and Shan (2025). Consequently, positioning nutri-cereals solely as environmentally sustainable foods is unlikely to stimulate widespread uptake; instead, communication strategies should foreground personal relevance by linking environmental benefits to tangible outcomes such as improved livelihoods and community nutrition.

Third, the significant influence of price perception and market communication underscores the centrality of marketing mix variables in shaping purchase intention. While consumers exhibit overall price sensitivity, a segment of buyers is willing to pay a premium when nutri-cereals are perceived as offering value for money, particularly due to attributes such as organic production, high nutritional density, tangible health benefits, and associations with traditional and culturally familiar diets, aligning with the findings of Krishnasamy et al. (2024) and Ongudi et al. (2017). At the same time, clear, credible, and consistent communication about product value, nutritional content, versatility, and cost efficiency, through word of mouth, point of sale, social media marketing, and recommendation, reduces purchasing uncertainty and justifies purchase decisions, as also mentioned by Waghay et al. (2024). The results further highlight similar findings by Panda et al. (2024), Sagayanathan and Sudhagar (2025), Lv (2025)

regarding the importance of subjective norms and perceived behavioral control (PBC) in predicting purchase behavior. Social influence—through family, peers, or digital communities—emerges as a meaningful enabler for sustaining consumer interest and repeat purchase.

Fourth, the model's strong explanatory power ($R^2 = 84.7\%$) and the significant linkage between intention and behavior affirm the robustness of the proposed framework. This high level of predictive accuracy reinforces the pivotal role of purchase intention as a mediating construct that translates psychosocial antecedents into actual behavior (Leong and Paim, 2015). The results not only validate the theoretical soundness of the extended TPB framework but also strengthen its applicability to functional food categories in developing market contexts.

Finally, the strategy level analysis highlights four complementary pathways for strengthening consumer purchase and demand for nutri-cereals. The highest-ranked strategy *product diversification* reflects consumers' demand for convenient, ready-to-eat, and value-added millet formats compatible with modern lifestyles that reduce preparation effort and enhance perceived behavioral control, thereby translating positive health attitudes into actual purchases. *Culinary adaptation and revival of traditional recipes* further support millet promotion by embedding millets within familiar, culturally rooted food practices, improving taste acceptability, and sustaining habitual intake. This approach bridges cultural familiarity with modern dietary preferences. *Institutional integration for habit formation* through school meals, hospitals, armed forces, and public food programs can emerge as a powerful mechanism to normalize millet consumption, complementing market-based interventions and reducing behavioral barriers through regular exposure. Additionally, government-supported festive promotions and expert endorsements enhance social legitimacy by associating millets with positive cultural meanings and credible health authority support. Government agencies can support this by organizing millet-themed food festivals, including millet dishes in official events, and partnering with chefs, nutritionists, doctors, and public health experts to endorse their benefits through media campaigns. Such visible and trusted endorsements help build confidence, influence social norms, and encourage households to adopt millets as part of their regular diets.

In contrast, affordability, market reach, and general awareness campaigns received comparatively lower prioritization, but this does not imply irrelevance but reflects that consumers already possess a basic level of knowledge about millet benefits and availability. Although millets are sometimes perceived as slightly expensive, this has not discouraged all consumers; instead, a segment is attracted to purchasing them due to their perceived health value, nutritional quality, and traditional appeal. This suggests that the key constraint lies not in awareness or basic access, but in converting existing knowledge into habitual consumption through experiential, social, and institutional reinforcement.

6 Implications

The findings carry important implications for marketing strategists, policymakers, and nutrition advocates, aiming to promote

nutri-cereal purchase and consumption. Theoretically, the dominance of health consciousness reinforces behavioral models of purchasing food by highlighting self-oriented health motives as stronger drivers than abstract sustainability concerns. It should prioritize benefit-based positioning through credible health claims, front-of-pack labeling, and nutrition-focused campaigns. Integrating nutri-cereals into public health programs and collaborating with healthcare professionals and NGOs can further enhance consumer trust and sustained adoption.

Finally, policy interventions could embed nutri-cereals into national nutrition programs and lifestyle-disease prevention schemes, thereby integrating sustainability messaging with compelling health and economic incentives. Policies aimed at improving supply-chain efficiency, farmer-market linkages, supporting public-private partnerships for retail promotions, in-store millet sections, and price-linked loyalty incentives can improve trial and repeat purchase. Collectively, these measures can reposition nutri-cereals from niche health foods to mainstream dietary staples while aligning health, economic, and sustainability objectives.

7 Conclusion

This study proposed and empirically tested a comprehensive framework to understand consumer purchase behavior toward nutri-cereal-based foods. Besides, the study also attempted to delineate the determinants of purchase intention and subsequent behavior regarding nutri-cereal-based foods in India. The findings confirm the utility of an extended Theory of Planned Behavior framework, revealing that purchase intention is a potent mediator, significantly translating psychosocial antecedents into actual consumption. Notably, health consciousness, price perception, market communication, and subjective norms emerged as the primary drivers of intention, while the non-significant effect of environmental awareness underscores the primacy of personal health and economic value over broader ecological concerns in this specific food choice context.

Derived from robust consumer insights, the study proposes a strategic roadmap to catalyze market growth. Key recommendations include: (1) product innovation and culinary integration, focusing on diversification and adaptation to modern dietary habits; (2) enhanced, targeted awareness campaigns that effectively communicate health benefits; (3) strategic price-value optimization and potential government-supported promotional initiatives to improve affordability and trial; and (4) expert and social media endorsement to leverage social influence. For policymakers and agri-entrepreneurs, prioritizing these strategies is paramount to enhancing product visibility, accessibility, and ultimately, consumer adoption.

Thus, we can conclude that this research provides a validated theoretical framework that explicates the cognitive and behavioral mechanisms underlying nutri-cereal consumption, offering significant contributions to the literature on sustainable food choices in emerging economies. Future research should explore the longitudinal evolution of these behavioral dynamics and investigate the amplifying role of digital marketing and sustainable branding. Furthermore, expanding this inquiry to incorporate the perspectives of producers and other value-chain actors would be

instrumental in fostering a resilient, sustainable, and inclusive nutri-cereal ecosystem.

Taken together, these findings provide an integrated understanding of how nutri-cereal consumers evaluate, internalize, and act upon purchases related to nutri-cereal-based foods. They demonstrate that while consumers are increasingly aware of broader sustainability issues, their food choices remain largely anchored in individual health priorities, perceived value, and social reinforcement. This insight has important implications for both marketing strategy and policy design, calling for approaches that balance personal relevance with collective benefits.

7.1 Future research implications

The study suggests several directions for future research. Comparative analyses between the basic Theory of Planned Behavior and extended TPB models can help assess the added explanatory power. Adopting more complex conceptual models that incorporate direct, indirect, and moderating pathways would allow a deeper understanding of the mechanisms shaping purchase behavior. As the present study is limited to a single state, future research should adopt a pan-India approach to capture regional diversity in consumption patterns and cultural influences. Given the non-significant findings, environmental awareness warrants focused investigation using food- and millet-specific measures to better understand its behavioral relevance. Further studies should also examine heterogeneity across consumer segments, regions, and income groups to explain differences in willingness to pay and the process of habit formation.

7.2 Limitation of the study

This study has several limitations that should be acknowledged. The use of non-probability convenience sampling from nutri-cereal retail outlets and data collection from a single state limits the generalizability of the findings, particularly to non-consumers and other regional contexts. The cross-sectional design restricts causal inference. Additionally, some constructs, such as environmental consciousness, were measured at a general level and may not fully capture millet-specific influences. Despite these limitations, the approach is appropriate for understanding purchase intention and behavior among existing nutri-cereal consumers.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the [patients/ participants OR patients/participants legal guardian/ next of kin] was not required to participate in this study in

accordance with the national legislation and the institutional requirements.

Author contributions

SB: Formal analysis, Methodology, Writing – review & editing, Writing – original draft, Data curation, Software, Conceptualization, Investigation. MA: Validation, Writing – review & editing, Supervision, Conceptualization. NAR: Writing – review & editing, Data curation, Resources, Visualisation, Software.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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