Exploring consumers' attitude and adoption intention toward plant-based meat alternatives in South India: Key drivers and barriers

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ORIGINAL ARTICLE

Abstract

Consumers are increasingly adopting plant-based diets driven by concerns about health, animal welfare, and the environment. This study examines the factors influencing consumers' attitudes and adoption intention toward plant-based meat alternatives (PBMA) in Coimbatore city of South India, employing the Theory of Planned Behavior. Key variables include perceived meat importance, initial reactions (food curiosity and food neophobia), relative motivational factors (health, environmental, and animal welfare concerns), and food choice determinants. Data were collected from 285 respondents through a direct survey and analyzed using Partial Least Squares Structural Equation Modeling. The findings revealed that food neophobia and perceived meat importance negatively influence attitude toward PBMA, whereas animal welfare concern and food choice determinants, including sensory appeal and healthiness, positively influence consumers' attitude. Furthermore, attitudes toward PBMA and perceived behavioral control were found to have a significant positive effect on consumers' adoption intentions. Increasing awareness and educating consumers about the benefits of PBMA, along with implementing effective pricing strategies and developing more cost-effective, energy-efficient production techniques, could significantly expand the market while catering to the unique preferences of Indian consumers.

Keywords: adoption intention; barriers; consumers' attitude; drivers; plant-based meat alternatives

Introduction

With the rapid advancements in food technology, innovative scientific techniques are increasingly shifting conventional agricultural and processed food production worldwide (Chen, 2022). Plant-based meat, a food product primarily made with plant-based ingredients that resemble the taste, texture, and appearance of animal meat, is gaining popularity among consumers due to the transition toward healthy and sustainable diets. Although meat is a vital source of high-quality proteins and other nutrients in several countries, its excessive consumption has been associated with several health risks (Willett *et al*., 2019). Alternatively, plant-based diets have been related to improved cardiovascular health, minimizing the risk of type II diabetes and cancer when compared to a typical diet (Baden *et al*., 2019; Satija and Hu, 2018). Because livestock production is a primary cause for habitat destruction and greenhouse gas emission, minimizing the consumption of animal-based products would have a beneficial effect on biodiversity and the natural environment (Machovina *et al*., 2015). Plant-based meat can significantly contribute to environmental sustainability since its production utilizes 46% reduced amount of energy,

generates 90% less greenhouse gas, and requires 93% less land and considerably more than 99.9% less water than traditional meat production (i.e., beef) (Detzel *et al*., 2022). In addition to health and environmental issues, meat consumption creates moral conflicts between the enjoyment of eating and its implications for animal welfare, known as the meat paradox (Loughnan *et al*., 2010).

India is a country rich in cultural, linguistic, climatic, religious, and communal diversities, which led to a wide range of cuisines utilizing various ingredients and cooking techniques (Ananthanarayan *et al*., 2019). Indian cuisine is traditionally influenced by the regional and caste factors. Food serves as a key factor in defining cultural differences, with each community developing unique food-related behavior influenced by its local environment. Another important aspect is religion, which often plays a significant role in promoting sustainable food choices. Despite several studies on consumer behavior focusing primarily on the nutritional aspects of food choices, there remains a significant research gap in understanding the sociocultural factors that influence dietary decisions, particularly within the Indian context (Das and Priya, 2022).

South India, comprising the five major states of Tamil Nadu, Karnataka, Kerala, Andhra Pradesh, and Telangana, plays a significant role in India's agricultural economy, with nearly 48% of the population engaged in agriculture. The major crops grown include paddy, coconut, sorghum, millets, chilly, and pulses. South India is also a leading producer of spices, making its cuisines comparatively more popular and spicier than those of other Indian states (Parthasarathi *et.al*., 2022). Rice is the main staple of South India as it is grown abundantly in the region and is well-suited to its tropical climate, which aids in its digestion. South India is renowned for its cultural heritage, with food playing a significant role. Tradition and foods are deeply interconnected in South India, where the cuisine still reflects many aspects of ancient Dravidian civilization, which flourished about 4500 years ago (Parthasarathi *et al*., 2022).

Regarding dietary habits, while the majority of Indians follow a vegetarian diet, the coastal region, particularly South India, has a higher proportion of nonvegetarians (Ananthanarayan *et al*., 2019). Around 30% of South India's population are vegetarians, typically from some Hindu communities. Despite that a majority of South India's population is nonvegetarians, many individuals are increasingly reducing meat consumption and shifting toward plant-based diets. With the growing emphasis on sustainable consumption, even if regular meat consumers who account for majority of the world population minimize their meat intake and replace it with plant-based meat alternatives (PBMA) at least once in a week, the overall effect on health, animal welfare, and the natural environment would be valuable (Michel *et al*., 2021b).

Plant-based meat alternatives are gaining traction in India with notable examples including mock chicken, mock mutton, keema, nuggets, kebabs, sausages, strips, and ready-to-cook curries. Despite the growing presence of these products, awareness remains relatively low in many parts of India, particularly in rural and semi-urban areas. However, South Indian cities such as Bangalore, Chennai, and Hyderabad are seeing increased consumer interest driven by marketing efforts, health-conscious trends, and availability of PBMA in selected restaurants, supermarkets, and online platforms. In terms of pricing, PBMAs are generally more expensive than conventional meat due to higher production and processing costs. For example, plant-based chicken is priced at around Indian Rupees (INR) 1000/kg, considerably expensive than conventional chicken, which ranges from INR 250–300/kg.

Recently, there has been growing scholarly interest in the adoption of plant-based diets, including PBMA. However, most studies have been conducted in Western and European contexts, with a lack of research focus on how consumers in South India perceive PBMA. Furthermore, there is a significant gap in understanding the factors influencing consumers' acceptance of PBMA in South India, despite meat playing a vital role in local food culture.

Previous studies have identified various factors influencing the consumer acceptance of PBMA. Environmental concern (Bryant *et al*., 2019; Tosun *et al*., 2021), healthiness influence (De Koning *et al*., 2020), perceived sensory attributes (Chen, 2022; Pandey *et al*., 2021), and animal welfare (Ploll and Stern, 2020) have been identified as motivators for PBMA adoption. However, some studies have found food neophobia (Bakr *et al*., 2023) and perceived meat importance (De Koning *et al*., 2020) as significant barriers to adopting plant-based diets.

As a rapidly growing Tier-II city and key industrial hub in South India, Coimbatore, often referred to as the "Manchester of South India," was chosen as the study area. The city has diversified into various sectors, including IT, textiles, and automobiles, catering to the heterogeneous demographics with varying levels of exposure to innovative products like PBMA. The city's cultural and dietary diversity, with the presence of both vegetarian and nonvegetarian populations, makes it a suitable location to study the consumer acceptance of PBMA. With this background, the present study examines the factors influencing consumers' attitudes and adoption intention of PBMA in Coimbatore city of South India. The findings of the study will contribute to and enhance the understanding of the consumer behavior regarding PBMA for mainstream adoption in India.

Theoretical Underpinning

According to Berndsen and Van der Pligt (2004), attitudinal ambivalence plays a major role in determining both current and anticipated meat consumption behavior. Meat consumption is associated with conflicting emotions as described by the meat paradox. On one hand, meat is valued for its taste and health benefits, providing high-quality protein and essential nutrients (Kenyon and Barker, 1998). On the other hand, health risks, societal influence (Santos and Booth, 1996), environmental issues, and concerns about cruelty in the meat industry are significant negative factors that can influence the meat consumption decision. Consumers experiencing high ambivalence are more receptive to suggestions due to their unstable state (Hodson *et al*., 2001). Povey *et al*. (2001) indicated that contradictory emotions toward a particular diet—whether consuming meat, avoiding it, or adhering to a vegetarian or vegan lifestyle—can weaken the association between one's attitude and the intention to follow that diet. In the context of alternative meat, research indicates that consumers hold both favorable and unfavorable attitudes, which can shift their behavior based on the type of information they encounter (Crano and Prislin, 2008)

The primary concern about the adoption of alternative meat lies in the perceived individual and social impacts (Hwang *et al*., 2020). Several studies have examined the drivers and barriers to reducing meat consumption and shifting toward vegan and vegetarian diets (Safdar *et al*., 2022; Simons *et al*., 2021). Previous studies have identified the positive aspects of plant-based diets, which can drive consumers' adoption, including environmental (Bakr *et al*., 2023; Carlsson *et al*., 2022; Chen, 2022; Sabaté and Soret, 2014), health (De Koning *et al*., 2020; Estell *et al*., 2021), and animal welfare concerns (Ploll and Stern, 2020). However, some research has explored barriers to the adoption of PBMA, considering its negative aspects. Meat attachment was found to be a major barrier to adopting PBMA due to consumers' reluctance regarding both nutritional and sensory aspects (Bakr *et al*., 2023; Circus and Robison, 2019; De Koning *et al*., 2020). Furthermore, the unfamiliarity of alternative meat can lead to food neophobia while simultaneously inducing curiosity among consumers due to its innovative nature. Considering these aspects, prior studies identified food curiosity (Hwang *et al*., 2020) and food neophobia (Wang and Scrimgeour, 2021) as key factors influencing PBMA buying intentions.

The Theory of Planned Behavior (TPB) has been extensively used for understanding individual green buying behavior (Kumar, 2021), particularly consumer's dietary choices (Yazdanpanah and Forouzani, 2015). In the context of sustainable foods, the TPB describes the adoption of plant-based diets as well as vegan products (Bakr *et al*., 2023). However, Bagozzi (1992) indicated that while factors such as attitudes, normative beliefs, and perceived behavioral control explain the occurrence of individual behavior, there are still explicit variables that explain how intentions are developed to influence specific actions. Therefore, this study adopted the TPB framework by incorporating related variables including perceived meat importance, initial reaction (food curiosity and food neophobia), relevant motivational factors (healthiness influence, environmental concerns, animal welfare concern), and food choice determinants. The following section provides a literature review and introduces the research model.

Research Framework and Hypothesis

Healthiness influence

Health consciousness reflects an individual's focus on maintaining their health by engaging in healthy habits such as consuming nutritious diets (Barauskaite *et al*., 2018). It encourages consumers to seek preventive health measures and increases their attitude toward healthy food purchases (Mai and Hoffmann, 2012). Plant-based foods are typically perceived as a healthy choice (Fehér *et al*., 2020; Rondoni *et al*., 2021), with health concerns being a major driver for adopting plant-based diets (Bryngelsson *et al*., 2022) and reducing meat consumption (Lentz *et al*., 2018). Based on this investigation, the hypothesis is formulated as follows.

Healthiness influence will positively influence attitude toward PBMA

Environmental concern

Green consciousness refers to consumers' concern for environmental issues and their willingness to take action to address them (Dunlap, 2010). Environmentally conscious consumers are more persuaded to make eco-friendly purchase decisions. Adopting a plant-based diet can improve resource use efficiency and minimize environmental impacts (Candy *et al*., 2019; Fehér *et al*., 2020), providing benefits such as mitigating global warming and pollution (Kökény, 2009; Leitzmann, 2014) while addressing the negative environmental effects of meat production (Vanhonacker *et al*., 2013). Several studies (Chen, 2022; Miguel *et al*., 2020; Tosun *et al*., 2021) have identified environmental concern as a significant predictor for adopting a plant-based diet. Accordingly, the following hypothesis has been proposed.

Environmental concern will positively influence attitude toward PBMA

Animal welfare concerns

Animal welfare refers to the overall quality of life of animals, including their health, emotions, and living condition (Wolf and Tonsor, 2017), reflecting respect for their well-being. Concern for animal welfare and the moral implications of killing animals often drive the shift toward vegetarianism or veganism (Petti *et al*., 2017). Consumers who support antispeciesism hold the beliefs that all species should receive equal moral consideration, opposing the use of animals for human consumption (Espinosa and Treich, 2021). Individuals who prioritize animal welfare tend to consume less meat, suggesting that animal welfare could be a significant factor affecting an individual's dietary choice (Clonan *et al*., 2015; De Backer and Hudders, 2015). Animal welfare is the primary motive for adopting a vegan lifestyle (Miguel *et al*., 2020), influencing the attitude toward plant-based diets. Considering these aspects, the following hypothesis has been formulated.

Animal welfare concerns will positively influence attitude toward PBMA

Food choice determinants

Individual's food choices are a complex behavior influenced by both sensory attributes of the food, such as its taste, smell, and texture, along with nonfood attributes such as societal factors, rational information, and geographic conditions (Chen, 2007). Steptoe *et al*. (1995) identified nine key motives for food consumption, including "Health, sensory appeal, mood, convenience, natural content, familiarity, weight control, and ethical considerations." Sensory characteristics of foods are often found to be the most significant factor influencing individual consumption decisions (Bryła, 2016; Chekima *et al*., 2017; Ditlevsen *et al*., 2019). The lack of artificial ingredients and residues (Nandi *et al*., 2017; Sondhi, 2014), along with factors like price (de Oliveira Padilha *et al*., 2022) and emotions (Chen, 2007), also play a significant role in determining consumers' food choice. In the context of plant-based diet including PBMA, prior research observed the effect of health and environmental concerns on the consumer behavior, revealing that ethical considerations have an influential positive impact on adoption of PBMA (Bakr *et al*., 2023; Cornovan, 2022; Wang and Scrimgeour, 2021). Some studies explored the impact of sensory attributes on the consumption of plant-based foods, showing that it plays an important role in determining consumers' purchase decisions (Michel *et al.*, 2021a; Niimi *et al*., 2022). Based on these previous studies, food choice determinants such as health, sensory appeal, naturalness, cruelty-free and sustainability dimensions adopted from (Bakr *et al*., 2023; Steptoe *et al*., 1995) will be examined in this study, suggesting the following hypotheses.

Health as a food choice determinant will positively influence attitude toward PBMA

Sensory appeal as a food choice determinant will positively influence attitude toward PBMA

Naturalness as a food choice determinant will positively influence attitude toward PBMA

Sustainability as a food choice determinant will positively influence attitude toward PBMA

Cruelty free as a food choice determinant will positively influence attitude toward PBMA

Perceived meat importance

Meat has been an important part of human diets across various cultures, valued for its high-quality protein, and easily absorbed iron and vitamins. Meat consumption is driven by factors such as its affordability, enjoyment, traditional habits, and the perceived challenges in preparing vegetarian meals (Clonan *et al*., 2016; Verbeke *et al*., 2010). Furthermore, meat intake is often associated with masculinity, strength, power, and affluence (Sares-Jäske *et al*., 2022). The primary reason for not reducing meat intake is the belief that it is essential for a healthy diet. Evidence shows that the perceived importance of meat in terms of nutritional and sensory aspects plays a major role in adopting plant-based diets (De Koning *et al*., 2020; Schouteten *et al*., 2016). The hypothesis is formulated as follows.

The perceived meat importance (nutritional value and sensory appeal) will negatively influence attitude toward PBMA

Initial reaction

The preliminary reaction to a novel food is a critical determinant of its success in gaining consumer acceptance. Food neophobia and neophilia (food curiosity) are the psychological traits of an individual that can lead to either avoidance or acceptance of a particular product (Lähteenmäki and Arvola, 2001). Because the plant-based meat market is still emerging, assessing the effect of consumers' initial reaction on behavioral intention is of great importance. According to Hwang *et al*. (2020), food neophilia and food neophobia as the initial reaction

are considered significant factors for predicting the consumption of PBMA. As a result, we use food curiosity and neophobia as key factors for evaluating consumers' attitudes toward PBMA.

Food Curiosity will positively influence attitude toward PBMA

Food neophobia will negatively influence attitude toward the PBMA

Theory of Planned Behavior

The Theory of Planned Behavior (Ajzen, 1991) suggests that the behavioral intention of an individual is influenced by three factors, namely attitudes, subjective norms, and perceived behavioral control. When an individual holds a favorable attitude toward a particular behavior, along with experiencing higher social support and a stronger sense of control over performing the behavior, they are more persuaded to have higher adoption intention. Jang *et al*., (2015) indicated that attitudes, normative beliefs, and behavioral control favorably influence the consumers' intention to visit an eco-friendly restaurant. Regarding plant-based diets, the effect of subjective norms on the adoption of plant-based diets resulted in mixed results. Some studies show a significant relationship between subjective norms and behavioral intention (Bakr *et al*., 2023; Chen, 2022), while Pandey *et al*. (2021) observed that social influence does not affect consumers' intention to consume a plant-based diet.

Perceived behavioral control refers to an individual's perception of the difficulty in performing a specific behavior influenced by factors that can either support or hinder it (Fishbein and Ajzen, 2010). Price, familiarity, cooking competency (Niimi *et al*., 2022), and availability are the major barriers to the adoption of plant-based diets (Contini *et al*., 2020). Prior research observed the significant positive relationship between perceived behavioral control and consumers' adoption intention of meat alternatives (Bakr *et al*., 2023; Chang and Chen, 2022; Shen and Chen, 2020). Based on this investigation, the following hypotheses have been formulated.

Attitude toward PBMA will positively influence consumers' intention to adopt PBMA

Subjective norms will positively influence consumers' intention to adopt PBMA

Perceived behavioral control will positively influence consumers' intention to adopt the PBMA

Research framework

The theoretical model proposed by Bakr *et al*. (2023), based on Ajzen's Theory of Planned Behavior, was adapted and modified to include relevant variables such as perceived importance of meat, initial reactions to the food choice, naturalness as a food choice motive, and related motivational factors. These modifications were incorporated into the research model for understanding consumers' adoption intention regarding PBMA. By combining Bakr's framework with these modifications, the significant factors influencing an individual's behavior in adopting PBMA are evaluated using empirical research methods. The related research hypotheses are visually represented in Figure 1.

Methodology

Sample and data collection

An overall sample of 285 responses was collected through a direct survey using a structured questionnaire in Coimbatore city of South India. The data were collected during the period of three months from March 2024 to May 2024. Given the exploratory nature of the study and the relatively new concept of PBMA in the Indian market, purposive sampling was employed to specifically target individuals who have tasted PBMA, as their direct experience is essential for understanding the factors influencing their adoption. With limited market penetration and consumer awareness in the study area, the population of individuals who have tasted PBMA remains small, which further narrows the sample pool. Table 1 depicts the demographic characteristics of surveyed respondents.

Questionnaire and scaling

The questionnaire comprised a different set of statements consistent with previous research (Bakr *et al*., 2023). Before conducting the survey, informed consent was obtained from the respondents, and all agreed to take part in it. The respondents answered the questionnaire by themselves, and the survey took approximately 10 min per participant. Before conducting the survey, basic information regarding PBMA was shared. All the items were answered on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The questionnaire consisted of three parts. Part one dealt with demographic characteristics and dietary patterns of respondents. Part two consisted of the perception of respondents toward PBMA, and Part 3 consisted of items describing PBMA purchase intention based on previous

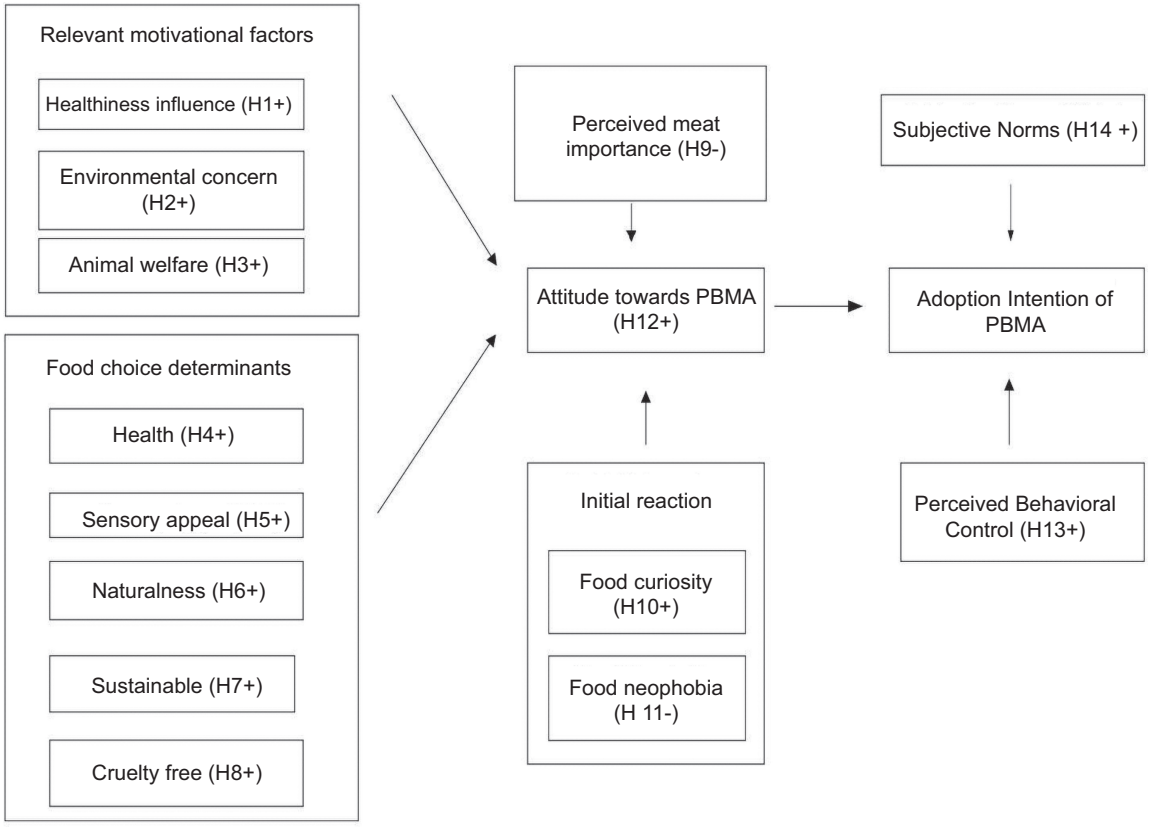

Figure 1. Conceptual framework of factors influencing consumers' adoption intention of PBMA.

Table 1. Demographic characteristics of surveyed respondents.

Particulars	Classification	Frequency (N = 285)	Percentage
Age	Between 18 and 24 years	55.00	19.29
	Between 25 and 34 years	81.00	29.47
	Between 35 and 44 years	64.00	22.45
	Between 45 and 55 years	52.00	18.24
	More than 55 years	33.00	11.57
Gender	Male	138.00	48.42
	Female	147.00	51.57
Dietary pattern	Vegetarian/Vegan	183.00	64.21
	Nonvegetarian	102.00	35.78

studies. The following scales were used in the questionnaire to assess the distinct variables. The relevant motivational factors, such as healthiness influence, were selected from the "impact of the healthiness of food choices" scale (Roininen *et al*., 1999), and environmental concern was adapted from the research studies (Roberts, 1996; Verbeke *et al*., 2010). In addition, the animal welfare construct was based on de Graaf *et al*. (2016). Food choice determinants measuring health, sustainability, sensory appeal, naturalness, and cruelty-free were adopted from Steptoe *et al*. (1995). The food curiosity scale was based on Ueda (2017), and the food neophobia scale was adapted from Pliner and Hobden (1992). Perceived meat importance, consisting of three statements, was based on De Koning *et al*. (2020). The TPB components, including attitude and subjective norms scales, were adopted from Chen (2007), whereas perceived behavioral control and adoption intention scales were based on Bakr *et al*. (2023).

Data analysis

The partial least squares structural equation modeling was performed using Smart PLS 4 statistical package and

IBM SPSS Statistics 25.0. The analytical tools, including descriptive statistics (frequency and percentage), measurement model analysis (Reliability and Validity), structural model assessment (Path relationship), and overall fitness of the models, were employed to evaluate the proposed hypothesis.

Results

Measurement model assessment

Item reliability

To validate the internal consistency of each item, Cronbach's alpha and composite reliability were calculated. As shown in Table 2, all constructs had Cronbach's alpha value and composite reliability value higher than the required minimum of 0.70 (Hair *et al*., 2014), ensuring that the items effectively measured their respective latent variables.

Construct validity

To evaluate construct validity, both convergent and discriminant validity were measured. Factor loadings, average variance extracted (AVE) and composite reliability were analyzed to confirm the convergent validity of constructs. As depicted in Table 2, the standardized loadings for all individual items were above the recommended threshold of 0.6 (Guadagnoli and Velicer, 1988) and their cross loadings. Moreover, the AVE for each variable was equal to or above the value of 0.50 (Fornell and Larcker, 1981). Taken together, the findings presented in Table 2 confirm the convergent validity of the constructs.

Discriminant validity

The discriminant validity of the variables was examined using both the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio methods. According to Fornell and Larcker (1981), the square root of the AVE of a particular variable must be greater than its correlations with other variables to ensure discriminant validity. The AVE values for all variables exceed the correlation coefficients among them, indicating the distinct validity of the latent variables in this study. In addition, the results reported in Table 3 indicate that the HTMT ratio of all latent constructs was below the suggested criterion of 0.85 (Kline *et al*., 2012), further supporting discriminant validity.

Structural model assessment

The structural model was assessed to evaluate the factors influencing consumers' attitude and adoption intention of PBMA, following the procedure outlined by Hair *et al*. (2021). The initial step involved collinearity assessment by examining the inner variance inflation factor values with all construct score values below five. The second step evaluated the significance of the proposed relationship based on path coefficients with a T value higher than 1.96 at a 0.05 significance level. Out of 14 hypothesized relationships in the model, 8 were statistically significant ($P < 0.05$). In the next step, the goodness of fit (R^2 values) was evaluated to ensure the model's explanatory power. The R^2 values ranged from 0.744 (Attitude) to 0.770 (PBMA Adoption intention), and significantly lies within the acceptable limit.

The hypothesis testing results (Table 4) showed that "Animal welfare concern" (H3) has a significant positive impact on attitude toward PBMA with a path coefficient of 0.170 and a P-value of 0.001. Similarly, food choice determinants such as health (H4), sensory appeal (H5), and sustainability (H7) positively influenced the attitude toward PBMA. As hypothesized, the attitude toward PBMA was negatively influenced by factors such as perceived meat importance and food neophobia, hence validating H9 and H11. All relationships within the TPB were significant, except for subjective norms, which, although positively related to adoption intention, did not reach statistical significance, thereby confirming H12 and H13. In contrast, factors such as healthiness influence (H1), environmental concern (H2), and food choice determinants including naturalness (H6) and cruelty free (H8) do not significantly influence consumers' attitude, leading to the rejection of these hypotheses.

Discussion

Factors influencing consumers' attitudes toward PBMA

Consumers' adoption of PBMA is a complex process influenced by various attitudinal and cognitive perceptions. The present study found that food neophobia had the strongest negative impact on consumers' attitudes toward PBMA. These results suggest that the resistance to trying new foods poses a major barrier to the adoption of PBMA. This may be attributed to the unfamiliarity with alternative meat, which can lead to distrust among consumers. Furthermore, when evaluating the moral and legal acceptability of innovative food products, individuals are more inclined to focus on negative aspects, which impede the acceptance of such foods (Hwang *et al*., 2020). Similarly, perceived meat importance in terms of nutritional and sensory aspects had a significant negative impact on consumers' attitudes toward PBMA as indicated by De Koning *et al*. (2020). It could be inferred that consumers might perceive traditional meat as a healthier dietary choice due to its nutritional composition and sensory qualities, which impose resistance to adopting PBMA, as they might feel that alternatives cannot fully

Table 2. Factor loadings, reliability, and convergent validity.

Latent constructs	Items	Factor loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Healthiness influence	HI1	0.698	0.700	0.712	0.627
	HI2	0.839			
	H13	0.831			
Environmental concern	EC1	0.948	0.839	0.848	0.746
	EC2	0.976			
	EC3	0.621			
Animal welfare concern	AW1	0.933	0.820	0.833	0.846
	AW2	0.907			
Health	H1	0.777	0.926	0.931	0.823
	H2	0.956			
	H3	0.946			
	H4	0.937			
Sensory appeal	SA1	0.927	0.940	0.953	0.847
	SA2	0.930			
	SA3	0.925			
	SA4	0.899			
Naturalness	N1	0.932	0.850	0.850	0.870
	N2	0.933			
Sustainable	S1	0.991	0.979	0.987	0.979
	S2	0.988			
Cruelty free	CF1	0.938	0.730	0.856	0.778
	CF2	0.822			
Perceived meat importance	MI1	0.987	0.975	0.978	0.952
	MI2	0.978			
	MI3	0.962			
Food curiosity	FC1	0.941	0.959	0.964	0.924
	FC2	0.975			
	FC3	0.967			
Food Neophobia	FN1	0.875	0.911	0.932	0.849
	FN2	0.925			
	FN3	0.962			
Attitude	A1	0.989	0.988	0.988	0.976
	A2	0.983			
	A3	0.992			
Adoption intention	AI1	0.975	0.984	0.984	0.969
	AI2	0.991			
	AI3	0.986			
Perceived behavioral control	BC1	0.872	0.906	0.927	0.842
	BC2	0.945			
	BC3	0.934			
Subjective norms	SN1	0.902	0.853	0.968	0.867
	SN2	0.960			

Table 3. Discriminant validity: Heterotrait–Monotrait ratio (HTMT).

Latent constructs	A	AI	AW	BC	CF	EC	FC	FN	H	HI	MI	N	S	SA	SN
Attitude (A)															
Adoption intention (AI)	0.832														
Animal welfare concern (AW)	0.686	0.592													
Perceived behavioral control (BC)	0.794	0.798	0.591												
Cruelty free (CF)	0.261	0.329	0.106	0.334											
Environmental concern (EC)	0.359	0.270	0.753	0.257	0.244										
Food curiosity (FC)	0.589	0.426	0.503	0.405	0.358	0.381									
Food neophobia (FN)	0.704	0.489	0.446	0.598	0.247	0.284	0.292								
Health (H)	0.553	0.640	0.656	0.563	0.450	0.528	0.300	0.264							
Healthiness influence (HI)	0.296	0.314	0.579	0.362	0.167	0.347	0.081	0.156	0.343						
Perceived meat importance (MI)	0.261	0.149	0.316	0.152	0.052	0.199	0.074	0.111	0.249	0.064					
Naturalness (N)	0.298	0.404	0.226	0.582	0.377	0.142	0.067	0.045	0.367	0.169	0.262				
Sustainable (S)	0.251	0.208	0.267	0.119	0.483	0.347	0.139	0.076	0.590	0.063	0.063	0.093			
Sensory appeal (SA)	0.504	0.621	0.286	0.561	0.262	0.221	0.108	0.294	0.211	0.197	0.085	0.501	0.040		
Subjective norms (SN)	0.062	0.076	0.042	0.062	0.037	0.033	0.073	0.132	0.025	0.047	0.104	0.042	0.026	0.083	

replicate the health benefits associated with traditional meat.

This study shows the impact of animal welfare concern as an altruistic motive on the consumers' acceptance of PBMA. The study findings indicated that the animal welfare concern had a significant positive impact on the attitude toward PBMA, showing that an individual's personal belief significantly influences a consumer's attitude. This finding is similar to a study related to attitude toward vegan products (Miguel *et al*., 2020). Given the growing emphasis on concern for the ethical treatment of animals, consumers who prioritize animal welfare are likely to reduce or avoid products related to exploitation or animal cruelty and often seek alternatives. Despite the findings, the study revealed that "cruelty-free" as a food choice determinant had a negative but nonsignificant relationship with consumers' attitudes. This may be attributed to the possibility that meat avoiders or reducers experience confusion due to the product's similarity to traditional meat. Such resemblance might lead to a negative perception of PBMA, as observed by Wobker *et al*. (2015). As expected, other motives such as healthiness influence and environmental concern had a positive relationship with consumers' attitude, but were not significant. On the other hand, health and sustainability as food choice determinants were found to have a significant positive association with the attitude toward PBMA. It could be inferred that consumers increasingly recognize the benefits of plant-based diets in promoting personal health and reducing environmental impact, which positively influences their attitudes. These results are consistent with previous research on the acceptance of eco-friendly products, including PBMA (Miguel *et al*., 2020; Profeta *et al*., 2021). As hypothesized, sensory appeal was found to have a significant positive impact on consumers' attitude toward PBMA. When PBMA closely resembles the taste and texture of traditional meat and are competitively priced, they are more likely to successfully replace meat. The greater the sensory appeal, the more favorable the consumers' attitude toward PBMA. The results were in line with the findings of Lee and Yun (2015).

Theory of Planned Behavior and adoption intention of PBMA

The findings of the study strongly highlight the relevance of the Theory of Planned Behavior in determining the consumers' intention to adopt PBMA. The study found that attitude toward PBMA has a significant impact on consumers' intention to adopt PBMA (β = 0.661). Similarly, perceived behavioral control addressing the barriers impeding PBMA adoption (availability, price, and cooking ability) was found to have a significant

Table 4. Direct path relationship.

Hypothesis	Hypothesized path relationship	Path coefficient	T statistics	P	Hypotheses test
H1	Healthiness influence → Attitude	0.019	0.524	0.600	Rejected
H2	Environmental concern → Attitude	0.033	0.839	0.402	Rejected
H3	Animal welfare concern → Attitude	0.170	3.293	0.001	Confirmed
H4	Health → Attitude	0.112	2.499	0.012	Confirmed
H5	Sensory appeal → Attitude	0.248	5.723	0.000	Confirmed
H6	Naturalness → Attitude	0.043	1.076	0.282	Rejected
H7	Sustainable → Attitude	0.132	3.427	0.001	Confirmed
H8	Cruelty free → Attitude	–0.032	0.822	0.411	Rejected
H9	Perceived meat importance → Attitude	–0.205	6.637	0.000	Confirmed
H10	Food curiosity → Attitude	–0.046	0.858	0.391	Rejected
H11	Food neophobia → Attitude	–0.556	10.391	0.000	Confirmed
H12	Attitude → Adoption intention	0.661	11.620	0.000	Confirmed
H13	Perceived behavioral control → Adoption intention	0.262	4.608	0.000	Confirmed
H14	Subjective norms → Adoption intention	0.014	0.498	0.618	Rejected

positive effect on consumers' PBMA adoption intention ($\beta = 0.262$), reflecting the consumers' ability to overcome the barriers such as high price and limited availability. These findings match with the results of previous studies (Bakr *et al*., 2023; Wang and Scrimgeour, 2021). However, the effect of subjective norms on consumer behavioral intention was positive but not significant.

Conclusion

Plant-based meat alternatives are gaining popularity among consumers as a potential substitute for animal meat that can aid the shift toward sustainable and healthy diets. With the growing vegan and vegetarian populations in India and the increasing availability of PBMA in the market, it is essential to study how consumers perceive these products and the factors influencing their adoption. The study indicates that the consumers' adoption of PBMA is a complex process influenced by various drivers and inhibitors. Addressing one such barrier, food neophobia, which negatively affects consumers' attitudes, is more crucial. To familiarize PBMA and reduce reluctance for trying new food among consumers, it is essential to present these products in retail stores in a way that makes them easy to find and compare them with traditional meat. Enhancing visibility of PBMA in retail stores is essential for attracting wider audience. It is also suggested to offer PBMA products in restaurants and food retail outlets to encourage consumers trying them, which can increase the likelihood of future adoption. Social media advertisements and celebrity endorsement can boost public awareness and drive demand for PBMA for promoting sustainable transitions. Another important barrier is perceived meat importance. It is essential to ensure the nutritional and sensory attributes of PBMA similar or comparable to those of traditional meat particularly for gaining acceptability among nonvegetarians. To overcome the perception that animal meat is nutritionally superior, it is essential to educate consumers through nutritional comparison and endorsements from health experts. Therefore, marketers should focus on positioning PBMA as a viable substitute to traditional meat by emphasizing its nutritional values, sensory appeal, and cooking techniques to persuade regular meat eaters for adopting PBMA. A targeted marketing approach can be used to deal with various consumer motivations such as animal welfare, health, or environmental concern. Since perceived behavioral control has significant effect on consumers' purchase intentions, it is suggested to enhance the accessibility, affordability, and food literacy of PBMA through broader distribution channels and pricing strategies for overcoming the perceived barriers to the acceptance of PBMA.

Future of PBMA Market in India

India, with its large vegetarian and flexitarian population, holds a significant potential for the growth of PBMA markets. The sector can be expanded by tailoring PBMA products to meet diverse regional and cultural preference boosting adoption across the country. Investing in research and development to enhance both nutritional and sensory qualities of PBMA along with eco-friendly packaging can attract wider audience. Many consumers experience food neophobia, particularly toward new technologies and unfamiliar food products, which may

hinder adoption. Therefore, increasing awareness and educating consumers on sustainable benefits of PBMAs through targeted campaigns in addition to expanding retail presence are essential for achieving wider consumer acceptance. However, the higher cost of PBMA compared to conventional meat could limit their adoption among price-sensitive consumers. Pricing is a crucial factor that must be addressed to make PBMA more attractive and to increase market share. This challenge can be mitigated by focusing on cost reduction through economies of scale and offering a variety of products. As PBMA become a popular sustainable choice, addressing pricing concerns and developing more cost-effective, energy-efficient production techniques could further expand the market while catering to the unique preferences of Indian consumers.

Limitations and Future Directions

Conducting a cross-sectional study can present a potential drawback, specifically when examining attitude toward foods. Individuals may experience better sensory appeal and become more familiar with certain foods over time leading to a favorable attitude. Hence, it is recommended to conduct longitudinal study for follow-up research. To improve the research framework, future studies could make use of larger sample size and simple random techniques in addition to examining the effect of other variables such as personal factors (age, education, gender, etc.,), food safety, and price-related concerns. Furthermore, the study sample included a significant portion of respondents aged below 25 years who may have distinct characteristics such as lower level of income, limited cooking skills, and varying levels of awareness of PBMA, which may influence attitude and adoption intention, thereby affecting the generalizability of the findings across all age categories. In the context of sustainable food consumption, social desirability bias might influence the outcomes of research relying on self-reported data which should be addressed in future research. To improve the practical usefulness, future research should investigate the perception and attitude of consumers of different lifestyle and diverse cultural backgrounds. To increase the scope of the study, comparing the findings with western countries where PBMA adoption is advanced can provide valuable insights into cultural and socioeconomic differences, influencing consumer attitudes, thereby helping to identify regional drivers and common strategies for promoting PBMA globally.

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Authors' Contributions

Conceptualization, methodology, data collection, and original draft writing were carried out by W.J. Data analysis and supervision were conducted by K.M. Writing, reviewing, and editing were performed by S.M.L.

Conflicts of Interest

The authors declare no conflicts of interest.

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