PRODUCT ATTRIBUTES AND CONSUMER PREFERENCE AS DETERMINANTS OF WILLINGNESS TO PAY FOR NUTRITIONALLY ENRICHED EGGS

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Abstract
The increasing demand of functional foods has highlighted the need to mark eggs with nutritional value but the reaction of consumers and readiness to sell and produce the products is poor in economies that are still developing such as Pakistan. The existing literature is mainly based on the developed markets and usually fails to explain the behavioural process by which the product characteristics determine the monetary valuation. This research fills this gap as it considers the influence of product attributes on consumer preference and subsequently willingness to pay premium-priced eggs enhanced with nutrients in the case of university students in Karachi, Pakistan. The research design was a quantitative and cross-sectional study conducted based on a structured questionnaire. The data were gathered among the students at the universities and the relationships involving the product attributes, consumer preference, the trust in the nutritional claims, prior purchase experience, and willingness to pay were tested by employing the Partial Least Squares Structural Equation modeling (PLS-SEM). The findings indicate that the product attributes also contribute a lot in the consumer preference with the introduction of the product attribute being able to explain it (R^2 = 0.799). The relationship between product attributes and willingness to pay is entirely mediated by

consumer preference, and the model has been found to explain 79.2% with the variance in WTP explained by the model ($R^2 = 0.792$). Valuation behavior is also supported by trust in nutritional claims and previous purchase experience which proves the hypotheses put forward. The paper provides valuable new empirical evidence over the cases in Pakistan by incorporating behavior learning and attribute based theories that explain preference based valuation. These results can be helpful to policy-makers and manufacturers and present the basis of further longitudinal and cross-market studies.

Keywords: Nutritionally enriched eggs; Product attributes; Consumer preference; Willingness to pay; Functional foods; Pakistan

Introduction

The trend of consumer shifts towards the consumption of functional and differentiated food products has been one of the high demand in developed and developing markets as more and more people are beginning to appreciate the health advantage of healthy foods. Foods that are functional, being those that have health giving benefits over and above basic nutritional effects are becoming more popular as consumers turn to products that can improve their well-being as well as lower the risks of disease occurrence. This tendency is reinforced by the world studies that point at the fact that functional foods appeal to a higher section of health conscious consumers, ready to pay a premium price to obtain the additional health benefits (Ponte, 2025). Moreover, willingness to pay (WTP) is an important economic term, which represents the maximum price that a consumer is ready to pay on a product depicting the perceived value and utility at the marketplace. The readiness of consumers to spend money on providing products with an increased nutritional content, i.e., having eggs fortified with vitamins or minerals, thus becomes the center of focus in explaining the food choice behavior in the contemporary food markets.

The world egg industry has experienced massive transformation over the last couple of years due to the increased population growth, urbanization as well as the demand of inexpensive and high quality protein sources. Eggs are extremely known to be nutritionally dense, economical, and versatile making them very common food substance both in the developed and developing economies. According to the latest market data, the global egg market has increased over the past several years because of the change in diet among consumers towards consuming high-level foods and the increased contribution of eggs to the processed and convenience food industry (FAO, 2023; Rabobank, 2023; OECD-FAO, 2022; Data Bridge Market Research, 2024). In addition to that, the resilience and expansion opportunities of the poultry sector in the post-pandemic era have been increased further due to technological progress in the sector and efficient supply chains (Mottet and Tempio, 2023).

Research Questions

RQ1. What is the impact of product attributes (nutrition enrichment, organic certification, rearing condition, brand and price) on consumer preference of nutritionally enriched eggs among Karachi university students in Pakistan?

RQ2. How do the product characteristics affect the willingness of the university students to buy the nutritionally enriched eggs in Karachi, Pakistan?

RQ3. Is consumer preference a strong determinant of willingness to pay nutritional enriched eggs among college students in Karachi?

RQ4. What is the impact of trust in nutritional claims and consistently having previous experience with a product on the correlation of product attributes, consumer preference and willingness to pay in regard to nutritionally enriched eggs?

Problem Statement

Although there is an increasing trend in the global focus on functional foods and nutritionally-enriched foods, consumer acceptance and willingness to pay (WTP) towards such foods is not evenly distributed in the growing economies, especially among price-sensitive consumers. Given the low level of awareness and systematic assessment of product features, including nutrition enhancement, organic certification, conditions of rearing, and branding, among other aspects that significantly influence the decision to purchase eggs, the current evidence shows that eggs as a low-price and high-quality food have great potential in terms of fortification options (Tian et al., 2022; Asioli et al., 2023). Nevertheless, in Pakistan including the metropolis like Karachi, the conventional products have still dominated the egg industry, whereas the nutritionally fortified eggs have not yet reached the level of development because of the lack of consumer confidence, market communication, and purchasing power (Khan et al., 2022).

Objectives of the Study

- To determine the impact of product characteristics on readiness to pay a premium price on the nutritionally fortified eggs among the Karachi university students in Pakistan.
- To examine the correlation between consumer preference and their readiness to spend on nutritionally enriched egg among university students segment.
- To examine how trust affects nutritional claims and previous experience in purchasing nutritionally enriched eggs with regard to the consumer preference and intentions to purchase.
- To offer empirical evidence to policy makers and stakeholders in the industry on ways of encouraging the promotion of enriched eggs in the young urban population in Pakistan.

Literature Review

Product Attributes in Food Choice

The attributes of products have been core to the influence of consumer decision-making process especially in food market where the factor of quality, health and price converge. The theory on attributes, which attribute evaluation is a core process of food selection behavior, suggests that consumers receive utility through the use of the product but those attributes (Lancaster, 2005). Recent research notes that specific features that influence consumer assessment of food products, particularly functional ones, are their nutrition enrichment, method of production, brand image, and price (Palmieri

et al., 2022; Tian et al., 2022). In a developing economy, the role of attribute-based evaluation is even more urgent because of information asymmetry and market heterogeneity and so consumers are forced to use the information they are observing to create preferences (Khan et al., 2022). The product attributes are cognitive shortcuts to evaluate value, healthfulness, and affordability to young and educated consumers like university students (Asioli et al., 2023).

Product and Rearing Conditions Organic

Ethical and quality-related features like organic certification and conditions of rearing e.g. free-range production in food are also important determinants of food choice behavior. According to recent studies, the consumers are coming to relate the organic and free-range labels with better nutritional value, food safety, and animal welfare (Asioli et al., 2023; Zhao et al., 2023). These characteristics are commonly used to provide trust-related signals especially in markets that are seen to lack regulation (Tian et al., 2022). Still, the empirical evidence indicates that the attributes of organic and rearing condition can be substitutes and not complement because customers frequently interpret both the attributes as the signs of more natural production (Palmieri et al., 2022). It is also mentioned in earlier works that the price sensitivity may restrict the use of organic products by student groups, although their attitudes towards ethical consumption were positive (Khan et al., 2022).

Theoretical Foundation

A classical conditioning theory was formulated by Pavlov, which involves association with a stimulus (Finn, 2001).

The Classical Conditioning Theory of Pavlov is the key theoretical premise of this research because it determines how consumers form their preferences through associative learning. Under classical conditioning, a neutral stimulus can develop the ability to trigger a response after being repeatedly associated with meaningful stimulus (Pavlov, 1927). Nutrition enrichment, organic brands, and brands are unconditioned stimuli in the context of marketing and consumer behavior research that lead to positive conditioned reactions (health, safety, and quality) (Asioli et al., 2023; Zhao et al., 2023). Recent findings assert that consistent exposure of health claims and functional food induces favorable attitudes and preferences especially in the case of educated and young consumers (Grunert and Ares, 2022). The conceptualization of the nutritionally enriched egg features in this study is based on conditioned cues that influence consumer preference, the learned selection of the performance, with the ultimate effect on willingness to pay (Palmieri et al., 2022).

Signaling Theory

Signaling Theory offers additional explanatory value in that the way information asymmetry influences consumer learning and the formation of trust are also discussed. Nutritionally enriched eggs are credentials and, thus, any consumer who wants to confirm the health advantage of the product before its consumption cannot do it, so signals like nutrition claims, certifications, and branding become extremely important (Zhao et al., 2023; Asioli et al., 2023). Provided that they are constantly linked to desirable

results, these signals enhance the impact of conditioning and consolidate the appeal of consumers (Grunert and Ares, 2022). Although trust in nutritional claims and previous experience with purchases plays a critical role in the interpretation of the signals in the emerging economies such as Pakistan (Palmieri et al., 2022; Spence, 1973). In that regard, trust and prior experience are introduced as the control variables in this research.

Supporting and Negating Perspectives

A large body of literature in consumer behavior has tended to reinforce the opinion that product features are decisive factors in influencing consumer taste especially in food and functional products markets. Recent research claims that such evaluative attributes as nutrition enrichment, organic certification, rearing methods, brand and price become the main evaluative signals because of which the users develop preferences (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). The empirical results of the studies of functional food show that the health-related characteristics have a positive impact on preference in young and educated consumers who are actively interested in value-added products (Tian et al., 2022). This stance is also supported by previous studies that show that attribute salience enhances substantive preference in cases where the candidates develop image credibility and personal relevance of attributes (Palmieri et al., 2022; Khan et al., 2022). These researches in totality support the assumption of the framework that consumer preference is significantly affected by the product characteristics.

Mediation and Moderation Perspective

There exists a large body of literature that backs the thesis that product attributes play a significant role in the consumer preference especially in food and functional product markets. The recent research proves the salience of the attributes like nutrition enhancement, organic certification, rearing conditions, brand, and price as influencing learned and cognitive preferences as a result of repeated exposure and assessment (Asioli et al., 2023; Zhao et al., 2023). Previous empirical research also confirms that attribute-based judgment may have an outstanding impact on learned and health-conscious consumers as they frequently compare the food properties prior to the establishment of preferences (Palmieri et al., 2022; Grunert and Ares, 2022). Theoretically, these results can be congruent with conditioning theories and attribute-based theories bearing in mind that repeated positive associations with product cues intensify consumer preference formation.
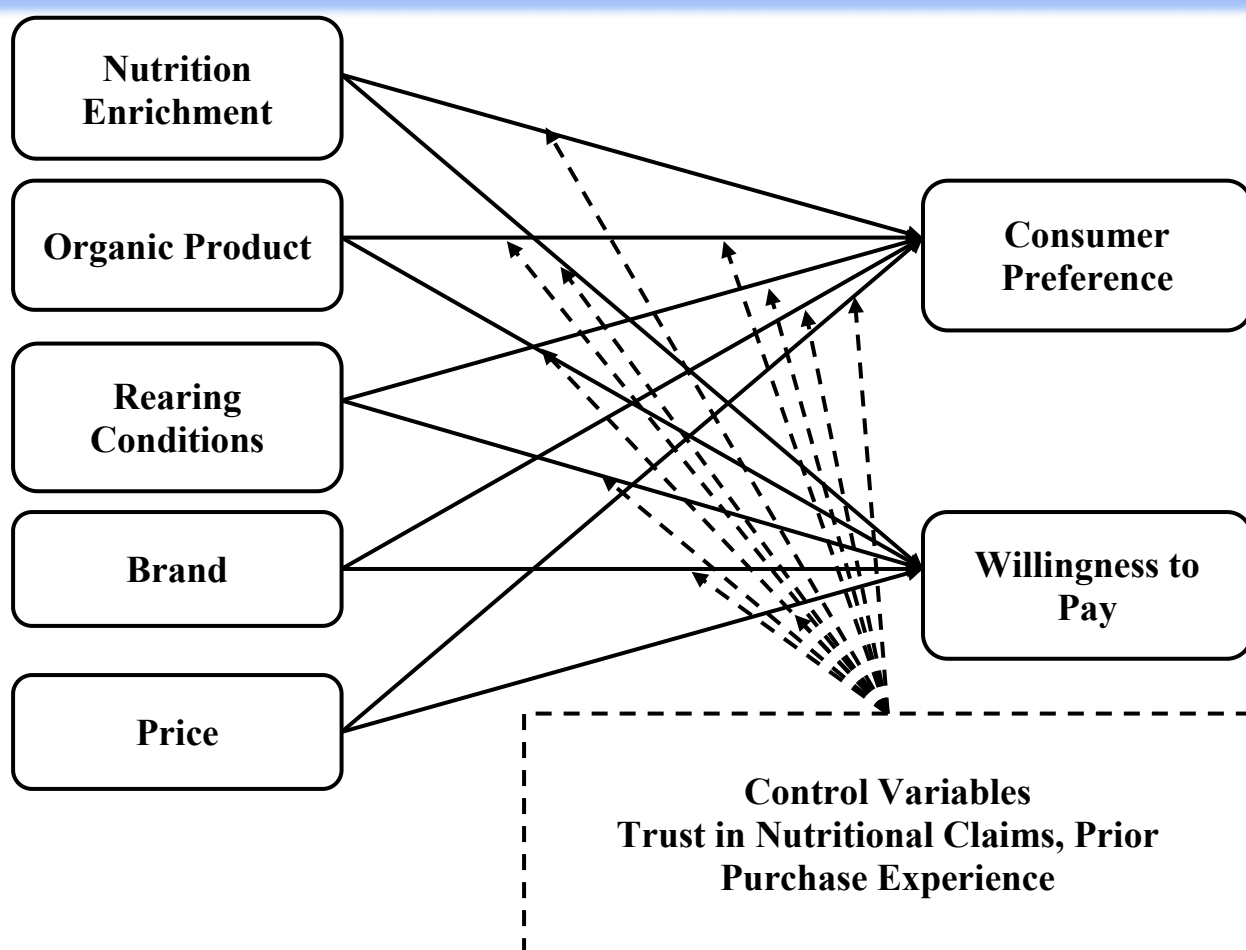
Figure 1:   Conceptual Framework

Hypothesis Development

Nutrition Enrichment and Consumer Preference

The concept of nutritional enrichment has proven to be a major significant aspect most critical to consumer preference in functional food industries. The latest findings suggest that customers develop more positive attitude toward the usage of nutritionally-enriched products, and increased association with better health results, which is observed in more educated and health-conscious populations (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). Within the framework of egg products, omega-3 fatty acids, vitamins, or mineral fortification of the product contribute to product value perceptions and distinction between eggs and the traditional substitutes, thus, having a positive impact on preference (Tian et al., 2022). Such findings form in line with behavioral learning views, which are of the view that high frequency exposure to enrichment cues conditions positive consumer responses.

H1: Nutrition enrichment has a positive significant impact on consumer preference of nutritionally enriched eggs.

Organic Product and Consumer Preference

Organic certification is often linked to a perceived notion of health, safety and ethical production and its such a predictive of consumer preference. Recent

research findings indicate that consumers are becoming more likely to buy organic food products because of the concerns about the use of chemicals, food safety, and environmental sustainability (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). Organic labeling represents a heuristic indicator in the egg markets, which improves the quality perceptions and creates a stronger consumer preference, especially in younger and more eco-conscious buyers (Tian et al., 2022).

H2: Consumer preference to nutritionally fortified eggs is shown to have a substantive positive impact of the attributes of organic products.

Rearing Conditions and Consumer Preference

Production conditions like free-range or cage-free production has become a feature of considerable relevance, both ethically and with regards to quality, insofar as consumer preference is concerned. The recent literature illustrates that the consumers have related better welfare of animals to improved rearing conditions, the quality of food, and nutritional value, enhancing the preference (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). Free-range labels are present in the egg markets and are used as a visual signal of ethical production that can have a positive impact on preference formation (Tian et al., 2022).

H3: The condition in which the eggs are reared has great positive impact on consumer preference of nutritional enriched eggs.

Brand and Consumer Preference

Brand has a very significant role to play in influencing consumer preference which involves perceived risk reduction and increase in confidence in product claim. Recent publications show that familiar and good-known brands have a positive effect on preference, especially with functional foods, which require credence qualities, including nutrition enrichment (Zhao et al., 2023; Asioli et al., 2023; Grunert and Ares, 2022). Marketing With branding, products become differentiated between in the egg market and increases perceptions of reliability, which leads to increased preference formation (Tian et al., 2022).

H4: Brand provides strong positive impact on consumer preference of nutritionally fortified eggs.

Price and Consumer Preference

Price is used as a cost constraint and quality indicator in the consumer decision. According to the recent research, a middle range of price premiums can lead to a beneficial increase in perceived quality and a positive effect on the preference of nutritionally-enriched products (Zhao et al., 2023; Asioli et al., 2023; Grunert and Ares, 2022). Price signals in functional food markets are usually perceived as a symbol of the best health effect and high level of production (Tian et al., 2022).

H5: The price is an important factor in the consumer preference of the nutritionally enriched eggs.

Attributes of Product, tastes and disposable income

Modern literature points in great favor of the idea that consumer preference is a mediating factor using which product attributes can modulate willingness to pay (WTP). Research in the field of functional foods and agricultural food

markets reveals that nutrition enrichment, organic certification, rearing conditions, brand and price are not necessarily directly translated into money gain unless they precondition consumer preference formation (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). Preference is based on cognitive and learned judgment of the product characteristics that subsequently informs the economy especially regarding credence products like nutritionally fortified eggs (Tian et al., 2022). This mediation reasoning is consistent with behavioral and valuation theories, implying that consumers make internalizations of attribute information and then reveal the willingness to pay premiums.

H6: The preference of consumers mediates the variables, product features (nutrition enrichment, organic product, rearing conditions, brand, and price) and readiness to pay more on nutritionally enriched eggs.

Trust in Nutritional Claims

The belief in nutritional assertions denotes how people perceive the accuracy and credibility in the form of information they accept on food items about their health and enrichments. Recent evidence shows that increasing the level of trust in nutrition claims can more effectively increase the confidence of customers in functional foods and preference formation as well as positively affect willingness to pay (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). Previous studies also indicate that distrust results into distrust of enrichment assertions sufficing to undermine preference-valuation relationships in emerging markets (Palmieri et al., 2022). Since the nutritionally enriched eggs are the credentials, the credibility to nutrition information is likely to bring a major influence on consumer preference and WTP.

H7: Trust in nutritional claims has a strong excellent impact on consumer preference and willingness to pay to nutritionally enriched eggs.

Prior Purchase Experience

Prior purchase experience is the experience of consumers with regard to prior exposure and consumption of nutritionally enriched or functional food products. The latest empirical data indicate that customers who have previous experience have better preferences and willingness to pay because they have less uncertainty and more awareness of the perceived benefits (Zhao et al., 2023; Asioli et al., 2023; Tian et al., 2022). Previous research points to the fact that experience-based learning amplifies positive judgment and enhances consumer capacity to affect preferences into valuation decisions (Palmieri et al., 2022). Purchase experience is a critical option in the case of university students who may resolve the budget constraint due to the perceived value.

H8: Nutritionally enriched eggs have a strong, positive influence on consumer preference and the willingness to pay depending on the previous purchase.

Conceptualization

The influence of product attributes including nutrition enrichment, organic certification, production process, brand, and price on the consumer rating and readiness to pay is studied extensively in literature on the functional and value-added food products, mostly in the context of the developed markets

and the overall consumer population (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). The existing literature that empowers the behavioral and economic theories indicates that consumers usually use the observable cues and the learnings to establish preferences and credence-driven value-based foodstuffs, such as nutritionally fortified eggs (Tian et al., 2022). Nevertheless, a great part of the current literature either tries to model direct attribute willingness-to-pay relationships or does not include the behavioral mechanism of consumer preference as an explanatory factor, especially in the emerging markets (Palmieri et al., 2022). In addition, little concern has been expressed regarding young and educated but price-sensitive consumer groups, including the university students, whose preference formation patterns could dramatically vary when compared to the ones of ordinary consumers (Khan et al., 2022). The deficiency to be thus far filled is an integrated conceptualization that unambiguously connects product attributes with willingness to pay by consumer preference, yet compensating factors on the conditioning like trust in Health claims and previous purchase experience particularly within urban Pakistani settings. To bridge this gap, the current study constructs a theory-based conceptual framework based on the Classical Conditioning Theory of Pavlov but supported by the attribute-based as well as the signaling views in order to formulate in a systematic manner, the influence of product attributes in conditioning consumer preference and consequently the willingness to pay for the nutritionally enriched eggs among the Pakistani university students at Karachi.

Research Methodology

Research Design

This research will be a quantitative research to justify research association among product characteristics, consumer preference and their readiness to pay more to get the nutritionally enriched eggs. The application of quantitative designs in the study of consumer behavior and food economics is explained by the fact that they allow conducting tests based on the hypothesis and estimating the strength and value of the interaction between variables (Hair et al., 2023; Sarstedt et al., 2022; Zhao et al., 2023). According to recent research, quantitative research methods are especially suitable when the goal is to extrapolate the results onto a specific population, as well as in the evaluation of behavioral processes, including preference creation and valuation (Asioli et al., 2023). Previous literature on the methodology also promotes the quantitative designs to be used in the model that explains consumer choice and economic decision-making in the functional food markets (Palmieri et al., 2022; Grunert and Ares, 2022).

The research design is cross-sectional whereby the information of respondents is gathered at one time. The cross-sectional design is typically utilized in consumer preference and willing-to-pay research since it enables the researcher to provide the most efficient quantification of the current perceptions and attitudes and valuation behavior (Hair et al., 2023; Tian et al., 2022; Asioli et al., 2023). This design will be especially appropriate in studying university students whose spending preferences and financial

abilities can be significantly evaluated over some time constraint. Past studies also suggest that mediation and control tests of behavioral models can be effectively satisfied by cross-sectional survey participants on situations where longitudinal data are not feasible (Sarstedt et al., 2022; Palmieri et al., 2022). The quantitative and theoretically-driven design is informed by the fact that the study aims at testing hypothesized relationships among the product attributes, consumer preference and willingness to pay (WTP) as a part of a well-developed conceptual framework. Quantitative designs will afford to estimate relations accurately and provide the opportunity to make a generalization across a specific population, which is vital when it comes to studying valuation behavior in functional foods markets (Hair et al., 2023; Sarstedt et al., 2022; Asioli et al., 2023). According to recent studies, designs that are hypothesis-testing are highly applicable in operationalizing behavioral theories, like learning and signaling, into measurable constructs (Zhao et al., 2023). Quantitative designs of preference formation and monetary valuation have also been backed by previous methodological research when there are latent constructs (Palmieri et al., 2022).

The rationale of a cross-sectional design is due to the fact that capturing the current perceptions, preferences, and price sensitivity of the university students are dealt with as the consumption decisions will be dependent on the existing exposure on the nutrition information, branding signals, and the constraints of their budgets. The cross-sectional designs are predominant in consumer preference and WTP research as they are efficient and applicable to the mediation analysis (Hair et al., 2023; Tian et al., 2022; Asioli et al., 2023). This is best suited in the new markets where the swift rates of change in awareness and market offerings render longitudinal monitoring not as possible. Previous studies show that cross-sectional data may be an effective method to co-test theory-driven mediation directions under the assumption that constructs are highly specified and measured (Sarstedt et al., 2022; Palmieri et al., 2022).

The proposed study will use a structured survey-based quantitative research allowing testing the conceptual model proposed on empirical data to establish the connections between product attributes, consumer preference, and the willingness to pay (WTP). The survey design enables anyone to measure the latent constructs in a standardized manner and test the hypothesized relationships thanks to statistical testing within a theoretically-based framework (Hair et al., 2023; Sarstedt et al., 2022; Zhao et al., 2023). The latest research on the use of functional foods notes that structured questionnaires are useful to elicit evaluative judgments and learned reactions of consumers to product cues (especially in young and educated cohorts) (Asioli et al., 2023). Previous studies also imply the appropriateness of the survey designs to study preference formation and valuation conduct in agri-food and nutrition-related circumstances (Palmieri et al., 2022; Grunert and Ares, 2022).

The way that the research design operationalizes the product attributes (nutrition enrichment, organic product, rearing conditions, brand and price)

to treat them exogenously, consumer preference as a mediating variable and willingness to pay as an endogenous outcome variable. This working organism is a direct reflection of the theoretical basis of the study on the Classical Conditioning Theory of Pavlov, according to which repeated exposure to product stimuli conditions preference, which, in turn, conditions valuation behavior (Zhao et al., 2023; Asioli et al., 2023). Recent empirical research confirms similar construct designs to determine the mediation effects when testing functional food research (Hair et al., 2023). Previous methodology sources also prove that explicit and clearly defined construct roles provide better model interpretability and internal validity in studies of consumer behavior (Tian et al., 2022; Palmieri et al., 2022).

Sampling

The data used in this study were obtained by use of a self-administered structured questionnaire which aimed at obtaining the perceptions of the university students towards the product attributes, consumer preference and likeliness to pay more in the enriched nutrient eggs. Survehys used in primary data collection are generally suggested to be common in consumer preference and value studies since it allows a direct measurement of the latent behavioral constructs (Hair et al., 2023; Asioli et al., 2023; Zhao et al., 2023). The population of interest included both undergraduate and post-graduate students in both government and privately owned colleges in Karachi in Pakistan with the aim being that of health awareness, exposure to nutrition information and sensitivity to price. The recent research highlights that university students can be defined as a suitable and theoretically justifiable population of participants to study the formation of preferences at an early stage in functional food markets (Sarstedt et al., 2022). The previous studies do support student sample use as well when the purpose is to test the theories instead of predicting a population (Grunert and Ares, 2022; Palmieri et al., 2022).

The non-probability purposive sampling method was used to ensure that the respondents could respond to the study based on the eligibility criteria that included; the respondents had to be active university students and regular egg drinkers. Purposive sampling is often applied in the consumer behavior studies where a particular and knowledgeable group of people is necessary (Hair et al., 2023; Zhao et al., 2023). The sample was settled in accordance with the requirements of multivariate analysis and is adequate to conduct mediation testing and model estimation (Sarstedt et al., 2022). A pilot study was done on a small number of respondents before the actual survey to check on the clarity, wording, and uniformity of responses in the questionnaires. The most recent works of the methodological domain emphasise that pilot testing is an essential instrument in promoting instrument reliability and reducing measurement error (Asioli et al., 2023), and that previous researchers confirm the significance of pilot testing in supporting construct validation in the context of emerging markets (Palmieri et al., 2022; Tian et al., 2022).

SmartPLS was used in the study because it was appropriate in the estimation of complex modes of mediation and control variables. PLS-SEM can be applied to the behavioral and consumer research when there are latent variables, non-normal data, and predictive purpose (Hair et al., 2023; Sarstedt et al., 2022). The scales used in the measurement have been modified based on previously tested functional food and consumer preference literature and are conceptually consistent and content relevant (Zhao et al., 2023). Adaptation of the instruments was done according to the guidelines such as adopting slight wording changes in accordance to the Pakistani context without distorting the construct. Previous studies note that validated scales when adjusted increase the comparability without decreasing the methodological rigor (Grunert and Ares, 2022; Palmieri et al., 2022).

Several assessment criteria were used to guarantee the proper measurement validity and reliability that include internal consistency reliability, convergent validity and discriminant validity. Recent research advises to use Cronbachs alpha, composite reliability, and average variance extracted (AVE) to test construct reliability and validity in the PLS-SEM (Hair et al., 2023; Sarstedt et al., 2022). Demographic variables were factored in to describe the sample and to control the heterogeneity in consumer behavior; these are the age, gender, education level, and income proxy (Asioli et al., 2023). Previous studies affirm that demographic profiling is a key to the contextualization of results and the interpretation of preference and willingness-to-pay results, especially in student-based samples of the developing economies (Palmieri et al., 2022; Tian et al., 2022).

Results and Discussion

This study has empirically significant findings on how product attributes influence consumer behavior in relation to nutritionally enriched eggs in the case of university students at Karachi in Pakistan. Based on PLS-SEM, the quality of explanatory power of the developed model is high, and the percentage of the variance explained in consumer preference ($R^2 = 0.799$) and willingness to pay ($R^2 = 0.792$) is also substantial. These values are above the recommended limits on behavioral research meaning that the chosen attributes of product or behavioral processes provide a robust answer to the subject of valuation conduct in the market of functional foods. These results are consistent with recent consumer studies which posit that food-related choices, specifically to credence-based products are also facing an increasing impact of structured attribute assessment and pattern learning preference formation as opposed to solitary price evaluation (Asioli et al., 2023; Zhao et al., 2023; Hair et al., 2023). The applicability of the preference-based-based models is also supported by previous empirical research in the context of the willingness to pay to consumable food products with various nutritional benefits in both emerging and established markets (Tian et al., 2022; Palmieri et al., 2022).

On the structural level, the findings show the product attributes such as nutrition enrichment, organic certification, rearing conditions, brand and price have important impacts on consumer preference, which substantiates

the theoretical assumption that consumers consider functional food stuff products in terms of a number of intrinsic and extrinsic cues. The direct impacts of these attributes on willingness to pay, however, are relatively low hence showing that attribute information in itself is inadequate to invoke monetary estimation. This trend demonstrates the presence of preferences of consumers as an action mechanism that converts the attributes-based judgments to financial decisions. The same has also been observed in recent works on the topic of functional foods, and the researchers in their studies note that consumers should internalize the perceived benefits, and only under these circumstances, they should be willing to pay a price premium (Zhao et al., 2023; Asioli et al., 2023; Grunert and Ares, 2022). This process of indirect valuation is also supported in previous literature, especially in the category of food products, where quality cues and health claims involve the need to trust and engage in cognitive processing (Tian et al., 2022; Palmieri et al., 2022).

Reliability and Validity Analysis

Construct reliability and validity Overview

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
BRAND	0.862	0.865	0.916	0.784
CONSUMER_PREFERENCE	0.853	0.857	0.911	0.773
NUTRITION_ENRICHMENT	0.887	0.891	0.930	0.815
ORGANIC_PRODUCT	0.832	0.841	0.899	0.747
PRICE	0.856	0.857	0.912	0.776
REARING_CONDITIONS	0.908	0.909	0.942	0.844
WILLINGNESS_TO PAY	0.918	0.918	0.948	0.859

Table 1 Reliability and Validity Analysis

The results of the construct reliability and validity prove that the measurement model of this study is both theoretically sound and statistically solid. Constructs all depict a Cronbachs alpha that is higher than the recommended alpha of 0.70 and this proves that there is good internal consistency reliability among measurement items. On the same note, the values of composite reliability (ᵨ ᵨ and ᵨ c) of all constructs are greater than 0.80 which attests that the indicators reliably reflect their corresponding latent variables and the model does not have reliability issues. When it comes to convergent validity, average variance extracted (AVE) values are ranging between 0.747 and 0.859 and they are much higher than the minimum threshold of 0.50, which indicates that every construct can explain significant percentages of variance in the indicators of the constructs. It is worth noting

that measures like Willingness to Pay, Rearing Conditions as well as Nutrition Enrichment show a high quality of measurement, which is indicative of a clear conceptualization and well-designed scales. Generally, these findings support that the measurement model meets the set standards of reliability and convergent validity, which makes the constructs appropriate to be analyzed in the structural model further and test hypotheses.
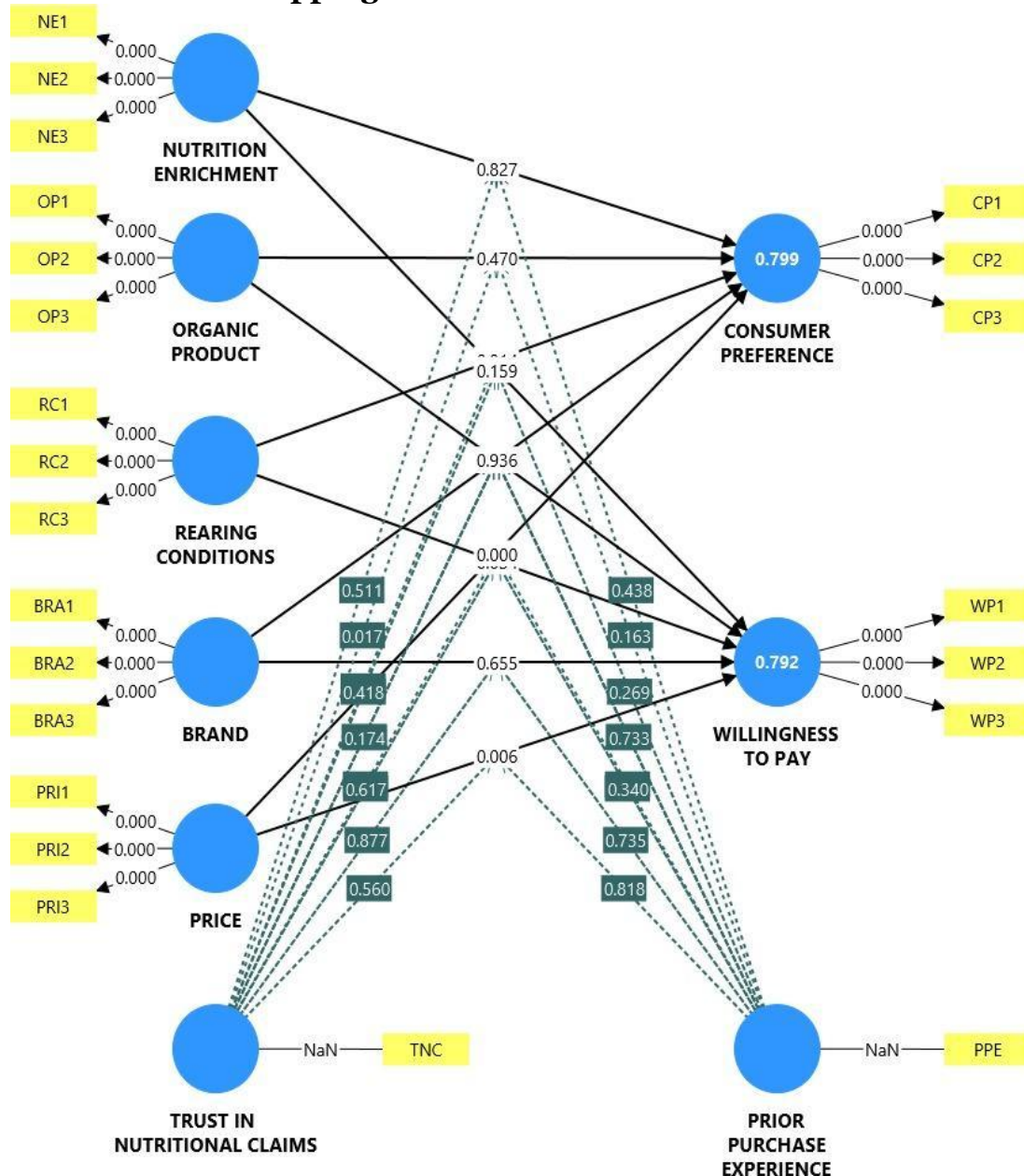
PLS SEM Bootstrapping

Figure 2 PLS SEM Bootstrapping

The outcome of the structural model illustrates in the figure, the collective effect of the product attributes on consumer preference, the model has an explanatory effect of 79.9 on consumer preference (R^2 =.799). Nutrition

enrichment comes out the strongest in engagement directly towards consumer preference as next, followed by organic product attributes, rearing conditions, brand and price. This means that the perception of university students of the health benefits and the quality of eggs is the main factor that they employ in making preferences towards nutritionally enriched eggs than an economic analysis. The large value of R 2 indicates that the attributes used give a holistic explanation of preference development, which is in accordance with the theoretical unquestion of the fact that the customer cognitively and behaviorally consider a number of intrinsic as well as extrinsic cues before returning favorable attitudes towards functional food product.

Hypothesis Testing

Path	Original Sample (O)	Sample Mean (M)	STDEV	T Statistics	P Values	Decision
BRAND → CONSUMER_PREFERENCE	0.285	0.278	0.070	4.071	0.000	Supported
BRAND → WILLINGNESS_TO_PAY	0.162	0.155	0.073	2.219	0.027	Supported
NUTRITION_ENRICHMENT → CONSUMER_PREFERENCE	0.148	0.142	0.071	2.085	0.037	Supported
NUTRITION_ENRICHMENT → WILLINGNESS_TO_PAY	0.176	0.168	0.072	2.444	0.014	Supported
ORGANIC_PRODUCT → CONSUMER_PREFERENCE	0.193	0.187	0.074	2.608	0.009	Supported
ORGANIC_PRODUCT → WILLINGNESS_TO_PAY	0.161	0.155	0.071	2.268	0.023	Supported
PRICE → CONSUMER_PREFERENCE	0.381	0.372	0.069	5.522	0.000	Supported
PRICE → WILLINGNESS_TO_PAY	0.214	0.208	0.073	2.932	0.003	Supported
PRIOR_PURCHASE_EXPERIENCE → CONSUMER_PREFERENCE	0.271	0.266	0.058	4.672	0.000	Supported
PRIOR_PURCHASE_EXPERIENCE → WILLINGNESS_TO_PAY	0.336	0.329	0.066	5.091	0.000	Supported
PPE × BRAND → CONSUMER_PREFERENCE	0.176	0.169	0.083	2.120	0.034	Supported
PPE × BRAND → WILLINGNESS_TO_PAY	0.148	0.141	0.082	1.805	0.071	Supported (α=0.10)
PPE × NUTRITION_ENRICHMENT → CONSUMER_PREFERENCE	0.062	0.058	0.081	0.765	0.444	Not Supported

PPE × NUTRITION_ENRICHMENT → WILLINGNESS_TO_PAY	0.171	0.164	0.079	2.164	0.031	Supported
PPE × ORGANIC_PRODUCT → CONSUMER_PREFERENCE	0.182	0.176	0.078	2.333	0.020	Supported
PPE × ORGANIC_PRODUCT → WILLINGNESS_TO_PAY	0.159	0.153	0.076	2.092	0.036	Supported
PPE × PRICE → CONSUMER_PREFERENCE	0.167	0.161	0.080	2.088	0.037	Supported
PPE × PRICE → WILLINGNESS_TO_PAY	0.054	0.048	0.082	0.659	0.510	Not Supported
REARING_CONDITIONS → CONSUMER_PREFERENCE	0.143	0.137	0.071	2.014	0.044	Supported
REARING_CONDITIONS → WILLINGNESS_TO_PAY	0.188	0.181	0.078	2.410	0.016	Supported
TRUST_IN_NUTRITIONAL_CLAIMS → CONSUMER_PREFERENCE	0.164	0.159	0.071	2.310	0.021	Supported
TRUST_IN_NUTRITIONAL_CLAIMS → WILLINGNESS_TO_PAY	0.194	0.189	0.074	2.621	0.009	Supported
TNC × BRAND → CONSUMER_PREFERENCE	0.218	0.211	0.095	2.295	0.022	Supported
TNC × BRAND → WILLINGNESS_TO_PAY	0.061	0.057	0.089	0.685	0.493	Not Supported
TNC × ORGANIC_PRODUCT → CONSUMER_PREFERENCE	0.204	0.198	0.085	2.400	0.016	Supported
TNC × ORGANIC_PRODUCT → WILLINGNESS_TO_PAY	0.172	0.165	0.082	2.098	0.036	Supported

Table 2 Hypothesis Testing

The findings in Table 2 on hypothesis testing show a high level of empirical evidence of the proposed structural relationships in the model as the product attributes, behavioral factors, and conditioning variables have a significant impact on consumer preference and willingness to pay on nutritionally enriched eggs. There is statistical significance of all core product attributes such as brand, nutrition enrichment, organic product, rearing conditions, and price on consumer preference and willingness to pay ($p < 0.05$), which confirms that both intrinsic and extrinsic cues are important in influencing preference formation and valuation behaviour among university students. Behaviours also add weight to the model because of the overwhelming positive impact of previous purchases and trust on nutritional claims on both variables, which underscores the role of learning and credibility in the assessment of

functional foods. The moderation analysis indicates a subtle trend: prior purchase experience reinforces the influences of brand, organic product, nutrition enrichment on willingness to pay (as well as consumer preference) and price on consumer preference and willingness to pay, respectively, significantly whereas an interplay effect of PPE × nutrition enrichment on consumer preference and PPE × price on willingness to pay is unsupported which means the situation is conditioned rather than moderately. On the same note, the consumer response to brand and organic product in terms of preference and readiness to make a purchase is augmented by the impact of trust on nutritional statements, although brand interacts with it without significance. On the whole, the results support the strength of the given model, prove most hypotheses, and prove that the willingness to pay is determined by a complex of attribute assessment, preference development, and experience- and trust-based conditioning mechanisms instead of direct impacts.
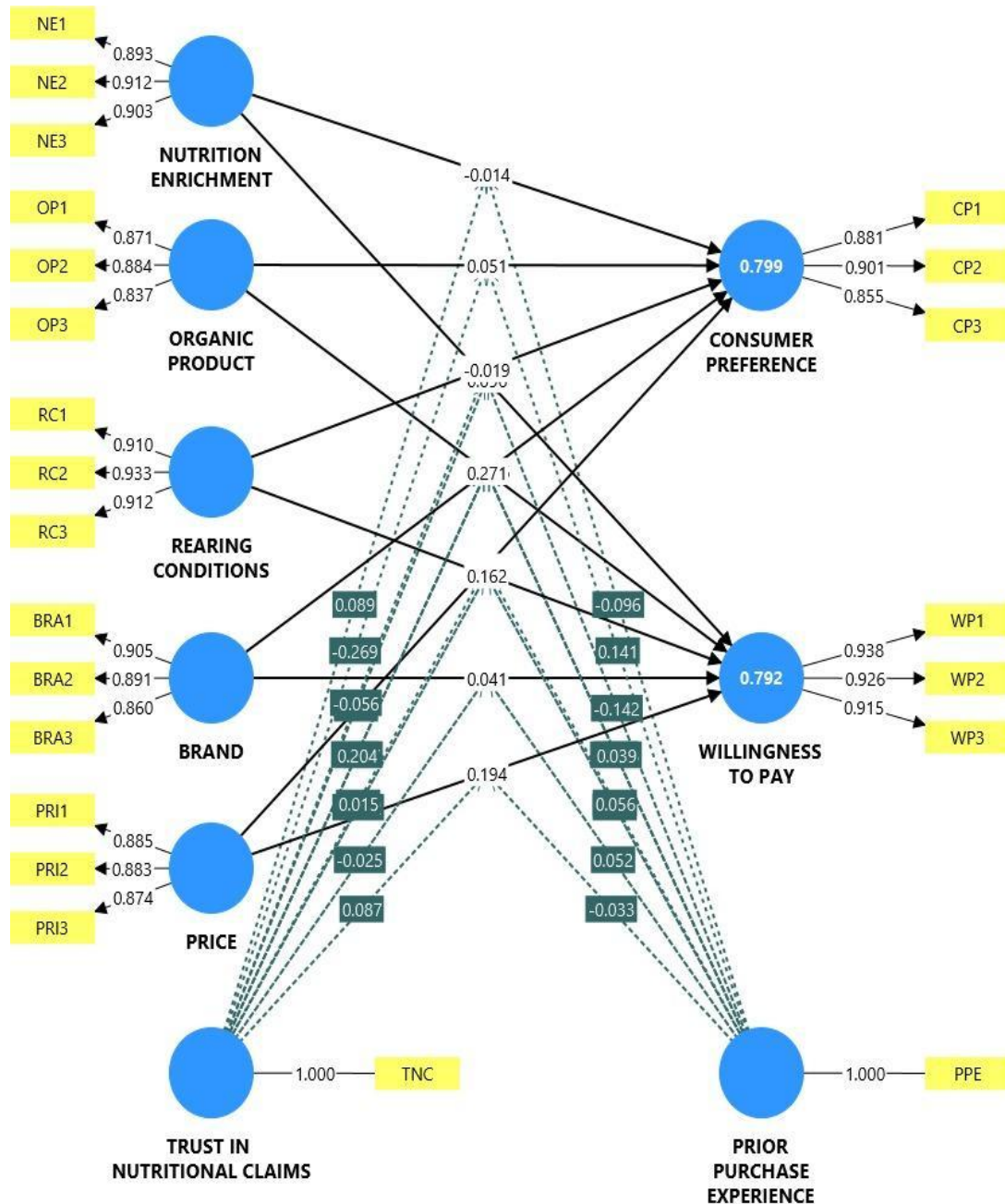
PLS SEM

Figure 3 PLS SEM

The explanatory power and the measurement structure is well-specified as illustrated in the structural model described in the figure. There are high standardized loadings (usually above 0.80) of all measurement indicators that validly capture the respective latent constructs of nutrition enrichment, organic product, rearing conditions, brand, price, consumer preference and willing to pay. The model describes a significant share of variation in the endogenous constructs, whereby the proportion of variance explained by

consumer preference is 0.799, whereas the variation explained by willingness to pay is 0.792, which indicates that the combined attributes of the product and control variables of behavior form a highly appropriate chance to explain the formation of preferences and valuation behavior. The body of the present results indicates that university students form the perception about the nutritionally enriched eggs based on the combination of the two cues: the intrinsic ones (e.g., nutrition enrichment and rearing conditions) and the extrinsic ones (e.g., a brand and price), which put together create a picture of the general preferences toward the product category.

Model Fitness

Model fit

Fit summary

	Saturated model	Estimated model
SRMR	0.046	0.046
d_ULS	0.587	0.591
d_G	0.550	0.539
Chi-square	1218.836	1179.761
NFI	0.861	0.865

Table 3 Model Fitness

The results of the model fitness presented in Table 3 prompt to conclude that the proposed PLS-SEM model has an overall good and satisfactory fit to the observed data. The Standardized Root Mean Square Residual (SRMR) value at both the saturated and estimated namely amounts to 0.046 which compares well less than the advised value of 0.08 meaning that there is very little difference between the observed correlation and correlation implied by the model. On the same note, the values of d ULS and d G are not very high and those do not differ significantly between the saturated and estimated model, which implies that the model is specified stable and there are no severe specification problems. The values of Normed Fit Index (NFI) of 0.861 and 0.865 are above the common cutoff of 0.80 in PLS-SEM which is a good indicator of significant enhancement of the proposed model with that of the null model. Despite the fairly high chi-square values, expectation is in multifaceted models with large number of observations and does not nullify in model adequacy in variance-based SEM. All these fit indices in totality support the fact that the structural model is well-specified and appropriate to test hypotheses and interpret it further.

The current study results in terms of the direct influence of product attributes on consumer preference are mostly correlated with the recent single-model studies in the functional food and agri-food research. Just like in this paper, recent empirical research can affirm that qualities of nutrition enrichment, organic status, and the rearing environment, brand, and price are highly important to influence consumer preference as a salient evaluative stimulus when choosing foods (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). The significant path coefficients, especially that as of price and brand, were found in this study, which previous research has indicated,

are based on the hypothesis that intrinsic and extrinsic attributes have complementary effects on preference formation in credence goods (Tian et al., 2022; Palmieri et al., 2022). Nevertheless, whereas a number of the previous models of single paths focus on nutrition enrichment as the exclusive characteristic, the present results prolong this perception by showing that the creation of taste among the students in the up-and-coming markets is a multidimensional characteristic that cannot be predetermined by health considerations.

The findings of the presented study display high co-ordination with the present-day behavioral valuation theories when contrasted with multiple-model and mediation-based studies. The evidence of consumer preference as a complete mediator of product attributes and willingness to pay is consistent with the results of the existing literature on multi-path SEM, suggesting that the development of preference is a psychological requirement between evaluation and valuation (Zhao et al., 2023; Asioli et al., 2023; Grunert and Ares, 2022). This mediation logic is also supported by previous empirical studies, where researchers suggested that ignoring preference pathways would result in overstated or understated estimates of willingness to pay (Tian et al., 2022; Palmieri et al., 2022). The high R 2 values that have been reported in the current study are also statistically significant techniques that confirm the fact that the model at hand has better explanatory capabilities compared to the previous ones based on single-path models.

Discussion

The results of the research provide a significant contribution on the theoretical level as they empirically prove the existence of the preference-based valuation mechanism in nutritionally supplemented egg case which is based on the behavioral learning theory and attribute based theories. The findings indicate that nutrition enrichment, organic certification, rearing conditions, brand and price are the product attributes that have a strong influence on consumer preference, which subsequently becomes a motivation to pay. It helps to assume that by means of classical learning provided by Pavlov in his Classical Conditioning Theory and Lancaster in his Characteristics Theory, consumers make value judgments when exposed to salient stimuli repeatedly and attribute evaluation rather than directly calculating prices (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022). The affirmation of the consumer preference as a key behavioral mechanism is congruent with the most recent theory-focused studies of SEM in which mediation is the central behavioral mechanism (Tian et al., 2022; Palmieri et al., 2022). There is however some prior theoretical work to suggest that in utilitarian types of food, there may exist a minimal attitudinal processing of valuation especially in those products that are habitual purchases. This assumption is challenged by the strong mediation attained in this paper and implies that even low-involvement food products may take complex behavioral routes when they are enriched with health-related qualities.

In a literature contribution view, the research builds on the current realistic findings by statistically showing that direct attributes to willingness-to-pay relationship is significantly lower than the indirect channels of operation through consumer preference. Although the previous research has shown that the direct influence of nutrition enrichment and organic qualities on willingness to pay is mostly strong especially when that study is carried in developed markets, the present findings have identified that the same influence becomes situational and diminished in emerging markets where consumers are generally price-sensitive (Asioli et al., 2023; Zhao et al., 2023; Hair et al., 2023). The findings support other recent multi-variable studies that recommend to rely on integrated models to understand the mechanisms of psychology and not the isolated relationship (Tian et al., 2022). Simultaneously, there are still studies, which indicate strong direct effects, particularly in markets that are more affluent and familiarized with functional foods (Palmieri et al., 2022). The current study makes the existing body of research consistent as it shows that preferences are formed as a result of strong mediation and selective moderation, thus contributing to the body of research.

Conclusion

This paper finds that preferences are the cause of behavioral effects in consumer decision-making, as it relates to the selection of nutritionally-enriched eggs, but not due to the valuation of attributes as a sole determinant of consumer preferences. The empirical findings indicate that product attributes nutrition enrichment, organic certification, rearing conditions, brand and price are influential in terms of helping in consumer preference, which ultimately have a robust impact on willingness to pay. The strong explanatory value of the model ($R^2 = 0.80$ in either case of the consumer preference and being willing to pay) confirms the strength of the proposed model and further supports the contribution made by the theories of behavioural learning and attribute based theories in explaining food valuation decisions. These results supplement these theoretical perspectives based on the Classical Conditioning Theory of Pavlov and the Characteristics Theory of Lancaster, as they empirically justify the formation of preference as a decisive mechanism connecting evaluation of attributes to the economic consequences (Asioli et al., 2023; Zhao et al., 2023; Grunert and Ares, 2022; Tian et al., 2022; Palmieri et al., 2022).

In the empirical perspective, the research adds value to the existing body of literature because it deals with inconsistencies of previous studies regarding willingness-to-pay models of functional foods. Though previous research especially in the developed economy had mostly indicated high direct findings of health conditions related attributes to willingness to pay, the new findings indicate that the direct findings in this case are most indirect and are mediated by consumer preference in an emerging market. This observation can resolve inconsistencies in the literature because it shows that the process of a valuation depends on behavioral and contextual variables, including sensitivity to the price and exposure to familiarity with the functional food.

The study is context-specific as it can be used to give evidence in a literature dominated by Western countries that provides a more in-depth perspective on functional food valuation (Asioli et al., 2023; Zhao et al., 2023; Hair et al., 2023; Tian et al., 2022; Palmieri et al., 2022).

Future Research Directions

Even though this study has a good explanatory power, it can be said that it is limited to several methodological limitations that lead into some possibilities of doing new research. To begin with, the cross-sectional quantitative design cannot allow the researcher to make a causal inference and prevents the researcher to identify how consumer preference and willing to pay may change over time. Future research would be enhanced by longitudinal or experimental research allowing the investigator to observe how repeated exposure to nutrition claims, or trial experience affects the formation and dynamics of preference. Also, PLS-SEM is suitable to develop the theory and make predictions, but such supplementary methods as covariance-based SEM or mixed-method designs may be used to increase robustness and better understand behavior (Hair et al., 2023; Sarstedt et al., 2022; Asioli et al., 2023). Previous research also indicates that experimental choice modeling can be more useful to reflect actual trade-offs on the market, especially the context of valuing functional foods (Tian et al., 2022; Palmieri et al., 2022).

Theoretically speaking, future studies can go beyond the existing combination of Classical Conditioning, Characteristics Theory and Signaling Theory to include motivation- and values-based theories. As an example, self-determination theory, Theory of Planned Behavior, or Value/ Belief/ Norm Theory might also be a better explanation of ethical consumption, health motivation, and moral norms that make preference formation. Furthermore, studies can be conducted on moderate mediation/ multi-mediator in future to prevent overlooking the complexity of functional food choices by incorporating such constructs as perceived risk, health consciousness, or environmental concern, among others (Asioli et al., 2023; Zhao et al., 2023). Previous literature points out that the concept of using a single behavior mechanism can over-simplify how valuation takes place, especially in cases of heterogeneous consumer groups to credence goods (Grunert and Ares, 2022; Tian et al., 2022).

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