Article

Vietnamese Consumers' Preferences for Functional Milk Powder Attributes: A Segmentation-Based Conjoint Study with Educated Consumers

Trong Phan, Phil Bremer and **Miranda Mirosa** *

Department of Food Science, University of Otago, Dunedin 9016, New Zealand;
trong.phan@postgrad.otago.ac.nz (T.P.); phil.bremer@otago.ac.nz (P.B.)
* Correspondence: miranda.mirosa@otago.ac.nz

check for updates

Abstract: This paper investigated Vietnamese consumers' preferences for functional milk powder products to determine if there were differences in market segments. A Qualtrics survey and a 1000minds choice-based conjoint survey were completed by 272 participants, predominantly 18-30-year-old males with high education levels and above average incomes. Firstly, general perceptions of the use of functional foods to maintain health were determined, with results revealing that participants believed in the benefits the foods claim to provide. Secondly, participants' tradeoffs for specific extrinsic functional milk powder attributes were determined by examining the relative importance they placed on a range of attributes. Participants prioritized a quality stamp attribute and preferred that this was obtained from an international certification body. Finally, a two-step cluster analysis and multinomial logistic regression was used to profile the participants and analyze relationships between socio-demographic data and the four resulting segments (i.e., Food Safety Concerned, Price Sensitive, Premium Product Focused, and Nutrition Focused). The largest of these segments was Food Safety Concerned (46.3%) with males significantly less likely than females to be in this segment. Given the limited literature on Vietnamese consumers' decision-making processes, this study is an important contribution to this topic, as well as providing information about market opportunities.

Keywords: food quality and safety labels; conjoint analysis; milk powder; functional food; consumer preference

1. Introduction

After almost four decades of war, Vietnam is undergoing radical change and development. Improved education and higher income levels have coincided with a shift in the Vietnamese market, from basic food products to heathier, more nutritious alternatives [1]. According to Euromonitor 2020, the health and wellness category saw a good performance in 2019, with this linked to several strong long-term trends. Within the overall health and wellness category, fortified/functional food is by far the most popular area [2]. Demand for high-value dairy products is high. According to the Vietnam Dairy Association, the revenue from the Vietnamese dairy sector reached USD 4.7 billion in 2018, with an average growth rate of 12.7% per year from 2010–2018 [3]. While the lower range of the market is the domain of a few key producers, the upstream market for nutritious products is highly fragmented, providing plenty of opportunities for foreign investors. In 2020, two thirds of the Vietnamese milk market was supplied by foreign companies. Likewise, the Vietnamese functional food market is largely dominated by foreign brands [3]. Given that demand is expected to rise sharply for high value dairy products, especially products that are novel and healthy, it is worthwhile for companies to obtain good consumer insights into this promising market.

Consumer research is well established in Western markets and much has been published on the factors that influence the purchasing decisions of Western consumers [4,5]. However, little is known about the decision-making processes occurring for Vietnamese consumers when deciding whether to purchase a product. Interestingly, several studies have explored how Vietnamese consumers rank various types of functional milk powder and their attitudes toward these products [6–8].

A limitation of much of the literature to date that deals with Vietnamese consumers' decision-making processes and purchasing behaviors is that consumers in this market are treated as homogenous when of course, in reality, consumers do not have similar preferences, nor do they prioritize attributes in the same way. The key theoretical contribution of this study is that it builds on previous work by going one step further, taking a market segmentation approach to profile the different groups of consumers in the functional milk powder market. It therefore explores Vietnamese consumers' perceptions to determine which group of consumers is more interested in high nutritional value and which prefers a premium product, for example. As such, the current study also works to aid future research on Vietnamese consumers and their perceptions about functional food products.

Specifically, the objectives of this study are fourfold: (1) to determine the general perceptions of the use of functional foods to maintain health; (2) to discover which attributes Vietnamese consumers prioritize when choosing a functional milk powder product; (3) to segment consumers based on how they prioritize attributes to identify different preferences for product attributes; and (4) to profile the participants and analyze relationships between socio-demographic data for each of the resulting segments.

This paper consists of four sections, with the first section organized into three subsections. Section 1.1 offers some background information to further outline the theory underpinning this study, which concerns how consumers make trade-offs between health and safety attributes and other product attributes when making purchasing decisions. Section 1.2 offers a general overview of conjoint analysis. Section 1.3 provides a more detailed discussion about the credence attributes and extrinsic cues influencing functional milk powder purchase decision making. The materials and methods are outlined in Section 2, the results are presented and discussed in Section 3, and the paper concludes in (Section 4) by summarizing the theoretical and practical contributions and implications of this study.

1.1. Overview of the Methodological Framework

To better understand how consumers negotiate trade-offs and their underlying decision-making processes, the current study uses a well-known technique called conjoint analysis. Although conjoint analysis is a psychological method, it is widely used by consumer food scientists to investigate consumers' preferences for a product's attributes and the trade-offs occurring owing to competing attributes. In this approach, the researcher presents the alternative attributes using either a full profile or a factorial design. Part-worth utilities indicate the level of importance of each attribute [9] and this information can be used to develop consumer choice simulators, which subsequently enable researchers to better predict consumer decisions based on how they prioritize different attribute levels [10].

1.2. Conjoint Analysis and Choice-Based Conjoint Analysis

Conjoint analysis is a generic term adopted by consumer scientists to describe ways of simulating consumers' preferences for food and beverage products. The theoretical foundations of conjoint analysis include Lancaster's Consumer Demand Theory [11], which suggests that consumers derive value or 'utility' from consuming a product's attributes, and Random Utility Theory [12], which models consumer choice amongst substituted product alternatives.

The conjoint method is widely used in consumer food science fields with applications in product innovation and development, market segmentation, and purchase decision simulation [13]. With its extensive history and wide application, conjoint analysis has progressively developed to form three distinct methods, these being traditional, adaptive, and choice-based [9]. Choice-based conjoint analysis focuses on choices instead of ratings or rankings of product concepts like the traditional and

adaptive methods do. Consumers are shown a set of products on the screen and asked to choose which product they would purchase [14]. The current study uses the choice-based method to determine how important the extrinsic attributes are for Vietnamese participants when making purchasing decisions about functional milk powder.

1.3. Credence Attributes and Extrinsic Cues

Credence attributes (such as animal welfare assurance, environmental stewardship, organic production, or country of origin) and extrinsic cues (such as brand name, price, nutritional label, precautionary label) influence purchase decisions. In the context of milk purchases, it has been reported that important determinants include price, accessibility, being free from allergens [15], health claims such as nutrient and other function claims [16], packaging and brand image [17]. Such attribute/cue selection and prioritization processes are heterogeneous among different market segments and such decisions making processes are culturally embedded [18].

The most common way for the producer to relay extrinsic product attribute information to consumers is through product labelling. Labels can provide extrinsic cues to infer product quality, which in turn, set consumer expectations and influence attitudes and behaviors related to food purchase satisfaction and future purchase decisions [19]. Owing to the nature of the product packaging process, the extrinsic attributes of functional milk powder products are tied exclusively to labelling and product packaging. Not only does the information on product labels connect and attest to the information in advertisements, but product labels also help to attract consumers by providing them with the information they feel is necessary and essential to them [20,21].

A study by Pham [22] reported that Vietnamese consumers' purchase decisions are greatly influenced by factors such as brand, country of origin, nutrition, and the safety of the product. Another study published in 2015 reported that Vietnamese consumers ranked food safety and health as the two most important categories, followed by price [23]. A third study also reported that health played an important role in determining how Vietnamese consumers respond to new products [24]. Other studies have also suggested that Vietnamese consumers are willing to pay more for quality, nutritional products [1,7,22,25,26]. A specific (fresh) milk study reported that that there were five key determinants affecting student decision making: product quality, fair price, product promotion and customer services, product convenience, and the reference group's attitude to the brand [27].

The high value that Vietnamese consumers place on food safety and nutrition stems from a general distrust of the domestic food safety system [28]. The Vietnamese market has been confronted with a range of food safety issues including a high prevalence of food-borne illnesses (mainly from microbial pathogens, followed by toxin and chemical contamination) as well as high levels of toxic residues with food additives, pesticides, and antibiotics exceeding the maximum residue limits [29]. This lack of trust in the food system means that Vietnamese consumers are cautious about new products, including functional food products and product claims [7,8]. In response, a certified quality, safety control and country of origin stamp was designed, based on market research [22,30] and other reports in the literature highlighting the need for certification on labels [20]. A subsequent study of Vietnamese trust in food safety indicators and cues has shown that consumers trust signals provided by food suppliers more than by the government [21].

Regarding nutrition, the attribute "fat content" was chosen as an attribute to evaluate how important non-fat products are in comparison to other factors. Many markets are undergoing a reduced fat product trend and the fat content is becoming more important in many countries [31]. Thus, the current study measures how Vietnamese consumers make trade-offs between the fat content attribute and other attributes.

Therefore, credence and extrinsic health and safety attributes, such as quality control stamps, nutritional content, and fat content, were chosen to evaluate how consumers trade off between these and other important qualities, such as price and country of origin.

2. Materials and Methods

2.1. Research Location and Participant Requirements

Data was collected from an online survey. The selection criteria were Vietnamese citizens currently living in Vietnam, over 18 years of age who had either used functional milk powder products or had an interest in using such products in the future. To gain a range of participants broadly representative of online users in Vietnam, recruitment was via social media websites.

2.2. Design of the Survey

The survey consisted of two sections. The first section included a demographic and opinion questionnaire, with questions surrounding the attitudes and beliefs of Vietnamese consumers towards functional food and milk powder products. The questions required participants to express their level of agreement using the commonly used five-point Likert scale [32,33]. Participants were asked for their opinion on popular statements and beliefs using questions obtained from previous studies [6,24]. The survey also asked where participants purchased or would purchase functional milk powder, the likelihood of purchase, and the frequency of use in comparison to other products. In the second section of the survey, participants completed a choice-based conjoint survey, to evaluate how important Vietnamese consumers rate credence and extrinsic health and safety attributes when purchasing functional milk powder products compared to other attributes.

The five attributes and eleven levels (Table 1) used in the current study were selected based on the findings from previous studies [7,18,22,23]. The survey took approximately 10–15 min to complete. It was originally written in Vietnamese and then translated to English. To address language concerns, a pilot study was used to gather participant feedback for improvements.

Table 1. Attributes and levels of functional milk powder (ranked lowest to highest) used in the conjoint survey design.

Attribute	Level
Quality and safety control stamp	No stamp Vietnamese quality stamp International quality stamp
Nutritional content value	Low Medium High
Country of origin	Domestic product Asian origin, excluding Korea and Japan Western origin, including Japan and Korea
Price	High Medium Low
Fat content	Fat Non-fat

The conjoint survey used 1000minds, an internet-based software implementing Potentially All Pairwise Rankings of all Possible Alternatives (PAPRIKA) to collect data [34]. Participants were shown a pair of hypothetical powdered milk products, each of which had two attributes at different levels (Figure 1) and asked "Which of these hypothetical powdered milk products do you prefer (with all else being equal)?" The number of questions required to complete the survey varied, based on the participant's choices, as with each selection, the 1000minds software recognized all other hypothetical products that could be ranked pairwise via transitivity and eliminated them from the survey. For example, if a participant prioritizes product A over product B and then he/she prioritizes B

over C, then—by transitivity—A is prioritized over C and the question ranking the last pair of products is eliminated [34]. This procedure ensures participants are asked the minimum number of trade-off questions possible.

Figure 1. Translated example of a pairwise ranking question (a screenshot from 1000minds software). The actual was presented to participants in Vietnamese.

All participants agreed to complete the surveys voluntarily. Before commencing the surveys, participants were asked to read an information sheet, accessible via an URL (Qualtrics), which described how the survey would present participants with pairs of hypothetical concepts. The sheet was embedded in the first demographic survey, however; participants had to go through screening questions and repeat this first step when entering the second survey. Ethical approval for this study was granted by the University of (blinded for review), Human Ethics Committee (reference number: 17/04B).

2.3. Statistical Analysis

The 1000minds software was used to calculate each consumer's part-worth utility, using mathematical methods based on linear programming. Further technical details are provided in Hansen and Ombler's paper [34]. In addition, the two-step cluster analysis, developed by [35], was used to identify potential segments of consumers, based on the attributes' levels in the conjoint analysis. As the name indicates, the two-step clustering algorithm is based on a two-step approach. In the first step, the algorithm scanning the dataset and storing the dense regions of data records, determines whether the current record can merge with any records previously constructed. In the second step, each dense region is treated as an individual point and a hierarchical clustering algorithm is applied, to cluster the dense regions. To determine the number of clusters automatically, the method used two stages. In the first one, the Akaike's Information Criterion (AIC, which estimates the quality of each model relative to each of the other models) and the Bayes Information Criterion (BIC, similar to AIC but with a larger penalty for the number of parameters), are calculated automatically for each different cluster solution to identify the optimal number of clusters via log-likelihood distance. These indicators are subsequently used to find an initial estimation for the number of clusters. Both of these model selection criterion methods, which the discerning reader can learn more about and compare

in more detail in the text 'Multimodal inference: understanding AIC and BIC in Model Selection' [36], chose four as the optimal number of clusters.

The final stage of statistical analysis used multinomial logistic regression (a commonly used model which allows for multiple comparisons across all outcomes) to test for significant differences between the different segments of consumers determined from the two-step cluster analysis (dependent variables) and the participants' demographic data (independent variables). The bivariate correlation test and the chi-squared test were used to validate the compatibility of the dataset and to test the qualification of the variables for both the two-step cluster analysis and multinomial logistic regression [37]. Both methods were carried out using Statistical Package for the Social Sciences (SPSS) software.

3. Results and Discussion

A total of 434 respondents took part in the survey. Overall, 328 respondents qualified for and completed the first survey (the demographic and functional food perception survey) and 272 participants qualified for both surveys (the first survey described above, and the additional choice based conjoint survey).

85% of the respondents were male participants, 77.74% were single and over 83% of the participants held a bachelor's degree or above. In total, 52.44% of the participants were from Ha Noi and Ho Chi Minh city and over 60% of the participants in the conjoint survey received a higher than average income for Vietnamese citizens. Altogether, 91% of the participants were between 18 to 30 years old. This high response rate from younger participants is probably due to the online demographic in Vietnam, where young adults are more likely to participate in general discussion forums. As the data collected for this study was predominantly from young males with high education levels and above average incomes, the study results have been derived from a subset of the population that does not represent all age and gender groups in Vietnam. However, understanding the preferences of these young adults is important since Vietnam has a young population, with the median age being only 31.9 years old [38]. With such a young population, it stands to reason that Vietnam's future income and purchasing power will fall within this age group.

3.1. Consumer Behavior and Attitudes Toward Functional Milk Powder and Functional Food

In the Qualtrics survey, the participants were asked to indicate levels of agreement to statements or questions using a Likert scale: 1 = highly disagree; 2 = disagree; 3 = uncertain or neutral; 4 = agree; and 5 = highly agree.

Most participants agreed that "using functional food is a good way to maintain health" (mean (avg): = 3.39 out of five, standard deviation (SD) = 0.851). However, they only slightly agreed with the statements: "I only buy functional food when I am sick and feel like I need them" (avg = 2.941, SD = 1.0080, "Functional food is usually expensive and not worth buying" while slightly leaned toward functional food was expensive (avg = 2.716, SD = 0.862) and "I cannot feel the difference between functional and normal food" (avg = 2.843, SD = 0.888).

On average, participants disagreed with the statement: "Functional food can be used to replace medicine" (avg = 2.015, SD = 0.791), while believing "in the benefit of functional food" (avg = 3.637, SD = 0.668) and "in the benefit of functional milk powder" (avg = 3.86, SD = 0.669).

When asked to rank the likelihood of purchasing based on function (with one being most important and five being the least important), participants ranked "to support body development" (avg = 2.288, SD = 1.29) first, followed by osteoporosis prevention (avg: 2.746, SD = 1.258), improving body function (avg = 2.827, SD = 1.345), digestive support ranked (2.882, SD = 1.374) and to provide nutritional supplementation for diabetic patients. Consumer rankings deviated greatly, indicating that participants had markedly different opinions about which product they would choose to buy.

The final question in the Qualtrics survey was about the location of purchase, with most participants purchasing functional milk powder products from the supermarket (58%), from grocery stores (30%) or online (8%).

3.2. Part-Worth Utility

The estimated utility values of the five attributes was calculated (Table 2) from the average weight of each level, as determined by the choices of the participants and scaled, so that the part-worth utilities added up to 100. The values in the single attribute score show the relative weight between the lower levels and the higher levels. The quality and safety control stamp was the most important attribute and the largest weight difference within attribute group belongs to the country of origin.

Table 2. Estimated part-worth utilities for all participants and four clusters based on their preferred milk powder attributes.

Number of Participants: 272 (Ranking for Each Level is from Left to Right)	Mean Weight for Each Attribute Level Highest Levels of Each Category Sum to 100%	Cluster			
		Premium Products Segment N = 50 (18.4%)	Food Safety Segment N = 126 (46.3%)	Nutrition Focused Segment N = 32 (11.8%)	Price Sensitive Segment N = 64 (23.5%)
Country of Origin: Domestic Product	0%	0%	0%	0%	0%
Country of Origin: Asian Origin, Except for Japan And Korea	7.9%	13.12%[1st]	6.77%	7.73%	6.01%
Country of Origin: Western Origin (Japan And Korea Included)	18.9%	33.12%[1st]	16.83%	14.34%	14.05%
Quality and Safety Control Stamp: No Stamp	0%	0%	0%	0%	0%
Quality and Safety Control Stamp: Vietnamese Quality Stamp	20.4%	13.16%	25.67%[1st]	17.05%	17.92%
Quality and Safety Control Stamp: International Quality Stamp	33.0%	26.65%	39.24%[1st]	28.56%	28.25%
Nutritional Content Value: Low	0%	0%	0%	0%	0%
Nutritional Content Value: Medium	13.5%	11.23%	11.92%	24.16%[1st]	12.77%
Nutritional Content Value: High	26.1%	23.13%	24.46%	41.02%[1st]	23.98%
Fat Content: Fat	0%	0%	0%	0%	0%
Fat Content: Non-Fat	10.0%	9.20%	10.75%[1st]	7.61%	10.46%
Price: High	0%	0%	0%	0%	0%
Price: Medium	7.0%	4.19%	4.59%	5.29%	14.85%[1st]
Price: Low	12.0%	7.90%	8.72%	8.46%	23.27%[1st]

1st indicates which cluster ranked that attribute as most important.

This indicates participants favor Western, Japanese, and Korean products over products from other countries. The smallest difference within group belongs to the quality and safety control stamp attribute. The average weight given to the Vietnamese quality stamp attribute level is higher than all other attribute levels, except the high nutritional value attribute. These results indicate a great deal of concern about product safety and quality. Even though food safety and quality ranks second, its attribute levels outweigh almost all the attribute levels from the other categories.

This result, i.e., that participants were shown to be prioritizing food safety and quality certification, aligns with studies on Chinese participants, which also revealed a high demand for certification and safety labels [39,40]. The study results also showed that Vietnamese consumers were found to prefer international standard quality certification over domestic certification. Similarly, Chinese consumers favored US or EU certification [40].

Nutrition was the second most important attribute, a result that resembles Liu and Niyongira's [20] research on Chinese consumers and furthers the notion that Vietnamese consumers are highly aware of the nutritional status of milk powder.

Country of origin was the third most important attribute a result that suggests Vietnamese consumers view foreign brands as superior, in terms of quality and safety, and thus seek them out over local alternatives [24].

There was not a significant difference in weighting between fat content and price. This result aligns with the results from previous studies which have indicated that price is not as important as other attributes and that consumers are willing to pay more when it comes to high-value products [7,22,23,26].

3.3. The Segmentation of Vietnamese Consumers

The two-step cluster analysis identified four consumer segments: Food Safety Concerned; Price Sensitive; Premium Product Focused; and Nutrition Focused. Each segment has distinct characteristics which helped to identify the different consumer groups and their subsequent preferences for product attributes.

3.3.1. The Premium Product Focused Segment

The Premium Product segment (18.4%) were less interested in food safety per se as well as nutritional value, and more likely to prioritize foreign products. Of course, these consumers may prioritize foreign products based on their perception that they are safer than domestic products therefore, safety cannot be ruled out as also being an important consideration for this segment. They ranked country of origin as the most important attribute, at both levels in the country of origin category and perceived price as being the least important attribute. The Premium group of consumers are willing to trade off other attributes for country of origin alone. The Premium Product segment also had the largest gap between two attribute levels within the country of origin category, further demonstrating this group's preference for products of Western origin.

Marketing communications targeting products to this segment should highlight their foreign (particularly Western) origin. This can be done, for example, by selling products with a Western standardized (i.e., not adapted for the Vietnamese market) package design that so that the product looks obviously foreign. Quality trademark schemes used by governments, such as New Zealand's FernMark License Programme, which helps promote and protect New Zealand's products and services on a global scale, provide a guarantee of the country's origin and hence the quality of the product to consumers.

3.3.2. The Food Safety Concerned Segment

The Food Safety segment was the largest of the four segments (46.3%). This segment gave the highest weight to two of the quality and safety control stamp levels, the highest weight to the quality and safety control attribute and gave a slightly higher country of origin weight, compared to the Nutrition-Focused and Price-Sensitive segment. The Food Safety segment was also the only segment to rate both levels of the same attribute as the first and second most important attribute levels, indicating that participants in this segment highly prioritize certification on the label. While control stamps are the most obvious ways to assure quality and safety to consumers, there are other cues that can be used to convey that the product is safe that manufactures could consider using. Smart packaging including both intelligent and active technologies, for example, can assure consumers that the product is in its original packaging and has not been tampered with, that the product has not been temperature abused

along the cold chain, and that the product is not spoiled/off at the time of purchase and consumption. Promoting safety-related features such as these would help companies to target this segment.

3.3.3. The Nutrition-Focused Segment

The third segment was the Nutrition-Focused segment (11.8%), which was the smallest of the four segments, even though nutritional content was the second most important attribute This result indicates that although participants in other segments thought that nutritional content was an important attribute, they rarely prioritized it. Participants in this segment rank nutrition highly, weighting both levels of the nutrition attribute as most important in their respective levels, when compared to other segments.

The Nutrition-Focused segment believed that quality and safety control stamps were important attributes, with fat content being the least important attribute. In the other three segments fat content was more important than price. This result differs from previous research, which have reported that consumers perceive low fat as a sign of healthy product [22,41]. Given their emphasis on high value nutrition, companies that can offer health claims about the functionality of their product, especially if these claims are scientifically proven, are likely to find favor with this segment.

3.3.4. The Price-Sensitive Segment

The final segment was the price-sensitive segment (23.5%). Here, despite having a similar weight in the part-worth utility, fat content and price had very different positions in participant segmentation.

This shows that despite having a low weight in the overall part-worth utility, a significant portion of Vietnamese participants consider price as the second most important of the five attributes. However, they are willing to trade-off some of the attributes of lower price products, as they have the highest average weight for both price levels. This trade-off reveals valuable information the part-worth utility misses, in the previous section. In terms of average weight level, the price attribute is close to that of the fat content attribute. There is a high number of participants who care about price significantly more than other groups of participants. Thus, reducing the price will attract price-oriented Vietnamese consumers as previously reported [42]. In the price-sensitive segment, the participants' trade-off all other attributes to have a lower-priced product. This is despite them still considering safety to be the most important attribute. Note that while lowering the price will attract this group, it is possible that consumers within the other segments associated a higher price with a higher quality. Therefore, there is a risk in this strategy. If feasible, price promotions (such as discount vouchers) to target just this segment might be better than just discounting the product in-store for all. Online sales might be one way to do this.

In all four segments, an international quality and the safety control stamp was essential for all participants. All participants preferred a product certified at international standard. Furthermore, the Vietnamese quality and safety control level weighted the lowest in the premium product segment, in comparison with other segments. The weight suggests that a significant portion of consumers favor foreign products and find little value in Vietnamese standard certification.

3.4. Exploring the Influence of Demographic Background

To examine how socio-demographic characteristics influence participant clusters, a multinomial logistic regression analysis was carried out. All the demographic factors were tested in the chi-square analysis to find interrelated factors and to identify the independent variables. The independent variables were used as factors for the multinomial logistic regression analysis. Two pairs of variables were found to be interrelated, namely income—education level, and income—province and city (Tables 3 and 4). Thus, two models were created to avoid conflict between the dependent variables. The results from the analysis indicate that a consumer's demographic background is unlikely to influence the segments they belong to, from the two-step cluster analysis.

Table 3. Multinomial logistic regression with four variables: gender, education, province and city, and marital status.

Two-Step Cluster Number		B	Sig.	Exp(B)
	Intercept	−1.016	0.555	
	Male	−0.805	0.205	0.447
	Female	0 [b]		
	High school	14.404	0.973	1,801,185.890
	Tertiary—bachelor or equivalent degree	0.285	0.717	1.330
Price-Sensitive segment	Postgraduate and master's degree	−0.423		0.655
	Post-master (doctorate or equivalent)	0 [b]		
	Ho Chi Minh city	0.535	0.250	1.708
	Hanoi capital	0.391	0.432	1.478
	Other provinces	0 [b]		
	Married	1.476	0.346	4.376
	Unmarried	1.376	0.367	3.958
	I do not want to tell	0 [b]		
	Intercept	17.512	0.998	
	Male	−1.107	0.055	0.330
	Female	0 [b]		
	High school	−3.141	1.000	0.043
	Tertiary—bachelor or equivalent degree	−17.279	0.998	3.131×10^{-8}
	Postgraduate and master's degree	−18.094	0.998	1.386×10^{-8}
Food Safety segment	Post-master (doctorate or equivalent)	0 [b]		
	Ho Chi Minh city	0.314	0.456	1.369
	Hanoi capital	0.486	0.271	1.626
	Other provinces	0 [b]		
	Married	1.196	0.390	3.306
	Unmarried	1.449	0.284	4.258
	I do not want to tell	0 [b]		
	Intercept	3.995	1.000	
	Male	0.438	0.644	1.550
	Female	0 [b]		
	High school	−6.002	0.999	0.002
	Tertiary—bachelor or equivalent degree	−19.576	0.998	3.150×10^{-9}
	Postgraduate and master's degree	−33.639	0.996	2.458×10^{-15}
Nutrition-Focused segment	Post-master (doctorate or equivalent)	0 [b]		
	Ho Chi Minh city	0.098	0.860	1.103
	Hanoi capital	0.068	0.913	1.070
	Other provinces	0 [b]		
	Married	13.498	0.992	728,228.420
	Unmarried	14.858	0.991	2,835,838.066
	I do not want to tell	0 [b]		

The reference category for the above table is the Premium product segment. [b] This parameter is set to 0 because it is redundant.

Table 4. Multinomial logistic regression with three variables: age, gender and education.

Two-Step Cluster Number		B	Sig.	Exp(B)
	Intercept	−5.483	0.999	
	18–30	−11.597	0.984	9.192×10^{-6}
	31–40	−12.465	0.982	3.860×10^{-6}
	41–50	−0.059	1.000	0.943
	51–60	−31.752	0.997	1.623×10^{-14}
	61 and above	0 [c]		
Price-Sensitive segment	Gender			
	Male	−1.086	0.210	0.338
	Female	0 [c]		
	Education level			
	High school	20.012	0.997	491,098,567.190
	Tertiary—bachelor or equivalent degree	18.733	0.997	136,637,674.386
	Postgraduate and master's degree	30.495	0.995	17,536,988,771,870.232
	Post-master (doctorate or equivalent)	0 [c]		
	Intercept	11.696	0.984	
	18–30	−11.499	0.984	1.014×10^{-5}
	31–40	−11.355	0.984	1.171×10^{-5}
	41–50	0.061	1.000	1.062
	51–60	−31.530	0.996	2.025×10^{-14}
	61 and above	0 [c]		
Food Safety segment	Gender			
	Male	−1.431	0.080	0.239
	Female	0 [c]		
	Education level			
	High school	3.634	0.031	37.856
	Tertiary—bachelor or equivalent degree	2.366	0.078	10.658
	Postgraduate and master's degree	13.935	0.960	1126595.311
	Post-master (doctorate or equivalent)	0 [c]		
	Intercept	−17.982	0.982	
	18–30	0.237	1.000	1.268
	31–40	−0.378	1.000	0.685
	41–50	0.412	1.000	1.509
	51–60	−8.117		0.000
	61 and above	0 [c]		
Premium Product segment	Gender			
	Male	−0.419	0.659	0.658
	Female	0 [c]		
	Education level			
	High school	7.962	0.981	2870.152
	Tertiary—bachelor or equivalent degree	18.642	0.947	124,771,460.242
	Postgraduate and master's degree	31.074		31,295,458,219,895.800
	Post-master (doctorate or equivalent)	0 [c]		

The reference category for the above table is the Nutrition-Focused segment. [c] This parameter is set to 0 because it is redundant.

Using the Nutrition-Focused segment as the reference, the impact of the variables of age, gender, and education level was tested (Table 4). Education level was shown to affect participants in the Food Safety segment. In the second table, gender and education affected the likelihood of the participants belonging to the Food Safety segment. In this test, the likelihood of males to fall into the Food Safety segment reduces significantly (when compared to females) with a significant level of the data also being reduced ($p < 0.1$).

The results from the multinomial logistic regression show that males are less likely to fall into the Food Safety segment at a confident level of 90%. The probability for male participants to belong to the Food Safety segment is only 33% compared to female participants ($p < 0.1$). All other variables are insignificant, which means the demographic information from education levels and marital status does not affect the participants' cluster memberships.

4. Conclusions and Future Implications

Using a behavioral survey combined with a choice-based conjoint analysis, this research determined attitudes towards functional foods and measured the relative importance of health and safety attributes that influence the milk powder purchasing decisions of young, well-educated Vietnamese consumers. This study makes several important scientific contributions this study makes to the literature.

Firstly, Vietnamese consumers' general perceptions of the use of functional foods to maintain health have been determined, with results revealing that participants believe in the benefits that functional foods generally, and functional milk powder specifically, claim to provide. With few key studies exploring either the Vietnamese functional food market or the dairy food market, there was a gap in knowledge about Vietnamese consumers and their functional food and dairy product preferences. The present research findings which explore Vietnamese consumers' preferences and behaviors towards functional milk powder enhances understanding in this field.

Secondly, this study has discovered which attributes Vietnamese consumers prioritize when choosing a functional milk powder product. The results showed that participants prioritized a quality certification stamp above all other key attributes. Previous studies similarly suggest consumers seek such specific information on the label to help make purchase decisions [19]. The present research findings extend on previous food safety and quality control attribute research by showing that preferences are for that stamps that are from an international certification body. Knowing how vital food quality and safety certification is highlights the need for further insight on how Vietnamese consumers interpret food safety cues and attributes, both on labels and in advertisements. Since Vietnamese consumers establish trust through personal beliefs [24], it would be advantageous to understand the drivers behind their purchasing behavior, based on accessible information like labels and advertisements. Future research could examine consumer awareness and seek to discover what types of quality and safety cues are more likely to attract attention.

Thirdly, the study extended on several previous studies that have explored how Vietnamese consumers rank various types of functional milk powder and their attitudes [6–8] by taking a market segmentation approach to identify different preferences for product attributes by grouping consumers based on how they prioritize attributes. Based on attribute selection consumers could be segmented into groups described as being either focused on either food safety, nutrition, premium product, or price. The largest of these segments was Food Safety Concerned (46.3%).

Finally, the study profiled participants and analyzed the relationships between socio-demographic data and each of the four identified segments using a two-step cluster analysis and multinomial logistic regression. The results showed, for example, that males were less likely than females to fall into the Food Safety Concerned segment. This new approach makes an important addition to the literature by providing a more nuanced understanding of the complexities of consumer decision making and one that is more likely to better represent reality than previous approaches which have taken a homogenous market approach.

Several practical marketing recommendations can be drawn from each of the four segments identified.

The results from the conjoint study showed consumers prioritizing the certified stamp for food safety and nutritional value attributes, over other attributes. The consumers favored international products with certification for functional milk powder, which reflects previous studies [7,24]. As such, this study's key recommendations are to inform consumers about certification types, quality standards, and product origins. As consumers indicated that there was a preference for international standard quality certification systems over domestic equivalents, a public policy suggestion is that the Vietnamese Government need to engender trust and awareness in their own national government certifications standards in order for these to be seen as credible assurances of quality for local fare. Non-governmental third-party certification is another option but due to the immaturity of private certification in Vietnam, a focus on certifications schemes issued by non-governmental third parties could be beneficial to consumers. Above all, to satisfy the expectations of these Vietnamese consumers, companies need to manufacture safe and nutritious products and then convey this safety information to consumers to reassure them.

Except for gender, significant relationships between socio-demographic information and segmentation was not detected. Regarding gender, male participants were less likely to belong to the food safety segment than females. This finding matches previous studies that also suggest females worry more about food safety than males [43,44].

While not being significant, possibly owing to the low sample number, there appeared to be a trend that lower education levels being more likely to belong to the food safety segment. If validated by further studies this result would be in line with a US study, which found that participants with lower education levels tended to fall within the food safety category, through a lack of trust and knowledge [45]. Other socio-demographic factors did not influence functional food choices. This might result may have occurred, owing to the narrow highly homogenous group of young adults sampled.

Most participants did perceive functional food as being a good way to maintain health, but most were uncertain about their price and effectiveness. However, participants were more certain about the effectiveness of milk powder products than other types of functional food. This result aligns with the finding from Siegrist et al. (2008) who reported that consumers demonstrated different levels of acceptance for functional foods based on the carriers.

Participants were also asked to determine which function they most desired from a functional milk powder product, with the most popular being to support body growth, followed by osteoporosis prevention with diabetic milk powder being rated last. These results differ from the finding of Pham et al. who reported that diabetic and bone health powdered milk to be the most popular milk powder product [26]. The contrasting results are most likely due to differences in the sample pools. Older participants have more interest in and more need for bone health products, compared to younger participants [26].

From this study, researchers and companies can identify which product attributes they need to focus on, explore, or improve, in line with Vietnamese consumers' preferences. Understanding consumers' preferences towards functional milk powder is crucial to the success of milk powder products, or any other health products, on the Vietnamese market.

References

1.　De Koning, J.I.; Ta, T.H.; Crul, M.R.; Wever, R.; Brezet, J.C. GetGreen Vietnam: Towards more sustainable behaviour among the urban middle class. *J. Clean. Prod.* **2016**, *134*, 178–190. [CrossRef]

2.　EUROMONITOR. Euromonitor Research. 2020. Available online: https://www.euromonitor.com/health-and-wellness-in-vietnam/report (accessed on 1 April 2020).

3.　Vietnam Dairy Association. Dairy Majors Investing Heavily as Vietnam Ramps up Milk Production. 2020. Available online: https://www.dairyreporter.com/Article/2020/01/08/Dairy-majors-investing-as-Vietnam-ramps-up-milk-production (accessed on 7 April 2020).

4.　Palma, M.A.; Ribera, L.A.; Knutson, R.D. The era of the functional consumer. *J. Food Prod. Mark.* **2016**, *22*, 555–570. [CrossRef]

5.　Hartmann, L.H.; Nitzko, S.; Spiller, A. Segmentation of German consumers based on perceived dimensions of luxury food. *J. Food Prod. Mark.* **2016**, *23*, 733–768. [CrossRef]

6.　Tu, P.V.; Vu, H.M.; Ha, T.D. Study on the representation of functional food in Vietnam. *Vietnam J. Sci. Technol.* **2014**, *52*, 67–73.

7.　Mergenthaler, M.; Weinberger, K.; Qaim, M. Consumer valuation of food quality and food safety attributes in Vietnam. In *Review of Agricultural Economics*; Oxford University Press and Association of Agricultural and Applied Economics: Oxford, UK, 2009; Volume 31, pp. 266–283.

8.　Nguyen, H.V.; Tran, H.T.; Unger, F.; Dang, S.X.; Grace, D. Food safety in Vietnam: Where we are at and what we can learn from international experiences. *Infect. Dis. Poverty* **2017**, *6*, 39. [CrossRef]

9.　Orme, B.K. *Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research*; Research Publishers: Madison, WI, USA, 2006.

10.　Green, P.E.; Krieger, A.M.; Wind, Y. Thirty years of conjoint analysis: Reflections and prospects. In *Marketing Research and Modeling: Progress and Prospects, International Series in Quantitative Marketing*; Green, P.E., Wind, Y., Eds.; Springer: Boston, MA, USA, 2001; Volume 14, pp. 117–139.

11.　Lancaster, K.J. A new approach to Consumer Theory. *J. Political Econ.* **1996**, *74*, 132–157.

12.　Ben-Akiva, M.E.; Lerman, S.R. *Discrete Choice Analysis: Theory and Application to Travel Demand*; MIT Press: Cambridge, MA, USA, 1985; Volume 9.

13.　Ares, G.; Deliza, R. Studying the influence of package shape and colour on consumer expectations of milk desserts using word association and conjoint analysis. *Food Qual. Prefer.* **2010**, *21*, 930–937. [CrossRef]

14.　Orme, B.K. *Which Conjoint Method Should I Use?* Sawtooth Software, Inc.: Washington, DC, USA, 2009; Available online: https://www.sawtoothsoftware.com/download/techpap/whichmth.pdf (accessed on 1 April 2020).

15.　Lanfranchi, M.; Zirilli, A.; Passantino, A.; Alibrandi, A.; Giannetto, C. Assessment of milk consumer preferences: Identifying the choice factors through the use of a discrete logistic model. *Br. Food J.* **2017**, *119*, 2753–2764. [CrossRef]

16.　Tan, K.Y.; van der Beek, E.M.; Kuznesof, S.A.; Seal, C.J. Perception and understanding of health claims on milk powder for children: A focus group study among mothers in Indonesia, Singapore and Thailand. *Appetite* **2016**, *105*, 747–757. [CrossRef]

17.　Gulseven, O. Estimating factors for the demand of organic milk in Turkey. *Br. Food J.* **2018**, *120*, 2005–2016. [CrossRef]

18.　Lee, P.Y.; Lusk, K.; Mirosa, M.; Oey, I. An attribute prioritization-based segmentation of the Chinese consumer market for fruit juice. *Food Qual. Prefer.* **2015**, *46*, 1–8. [CrossRef]

19.　Grunert, K.G. Current issues in the understanding of consumer food choice. *Trends Food Sci. Technol.* **2002**, *13*, 275–285. [CrossRef]

20.　Liu, A.; Niyongira, R. Chinese consumers food purchasing behaviours and awareness of food safety. *Food Control* **2017**, *79*, 185–191. [CrossRef]

21.　Le, A.T.; Nguyen, M.T.; Vu, H.T.T.; Thi, T.T.N. Consumers' trust in food safety indicators and cues: The case of Vietnam. *Food Control* **2020**, *112*, 107162. [CrossRef]

22.　Pham, H.T. Factors influencing on purchasing formula milk for babies: An empirical research in Hanoi. *Int. J. Bus. Adm.* **2015**, *6*, 37–43.

23. De Koning, J.I.; Crul, M.R.; Wever, R.; Brezet, J.C. Sustainable consumption in Vietnam: An explorative study among the urban middle class. *Int. J. Consum. Stud.* **2015**, *39*, 608–618. [CrossRef]

24. Bui, T.D. Consumer acceptance of functional foods in Ho Chi Minh City. *Eurasian J. Bus. Econ.* **2015**, *8*, 19–34. [CrossRef]

25. Luu, T.T.; Nguyen, P.T.; Luu, N.B.; Luu, M.H. Powdered milk consumers' buying behavior. *Int. J. Bus. Manag.* **2013**, *8*, 29–36.

26. Pham, T.V.; Moritaka, M.; Fukuda, S. Factors affecting consumers' willingness to pay for functional foods in Vietnam. *J. Fac. Agr. Kyushu Univ.* **2011**, *56*, 425–429.

27. Ngo, H.Q.; Nguyen, T.Q.; Long, N.T.; Van Tran, T.; Hoang, T.M. Factors Affecting Brand and Student Decision Buying Fresh Milk: A Case Study in Ho Chi Minh City, Vietnam. *J. Asian Financ. Econ. Bus.* **2019**, *6*, 247–258. [CrossRef]

28. Wertheim-Heck, S.C.; Spaargaren, G.; Vellema, S. Food safety in everyday life: Shopping for vegetables in a rural city in Vietnam. *J. Rural Stud.* **2014**, *35*, 37–48. [CrossRef]

29. Ha, T.M.; Shakur, S.; Do, K.H.P. Consumer concern about food safety in Hanoi, Vietnam. *Food Control* **2019**, *98*, 238–244. [CrossRef]

30. Pew Research Center. *Global Attitudes and Trends Topline Results*; Pew Research Center: Washington, DC, USA, 2014; Available online: http://www.pewglobal.org/files/2014/07/2014-07-14-Balance-of-Power-Topline.pdf (accessed on 1 April 2020).

31. Li, X.E.; Lopetcharat, K.; Drake, M. Extrinsic attributes that influence parents' purchase of chocolate milk for their children. *J. Food Sci.* **2014**, *79*, S1407–S1415. [CrossRef] [PubMed]

32. Siegrist, M.; Shi, J.; Giusto, A.; Hartmann, C. Worlds apart: Consumer acceptance of functional foods and beverages in Germany and China. *Appetite* **2015**, 87–93. [CrossRef] [PubMed]

33. Siegrist, M.; Stampfli, N.; Kastenholz, H. Consumers' willingness to buy functional foods. The influence of carrier, benefit and trust. *Appetite* **2008**, 526–529. [CrossRef] [PubMed]

34. Hansen, P.; Ombler, F. New method for scoring additive multi-attribute value models using pairwise rankings of alternatives. *J. Multi-Criteria Decis. Anal.* **2008**, *15*, 87–107. [CrossRef]

35. Chiu, T.; Fang, D.; Chen, J.; Wang, Y.; Jeris, C. A robust and scalable clustering algorithm for mixed-type attributes in large database environment. In Proceedings of the Seventh ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, San Francisco, CA, USA, 26 August 2001; ACM: New York, NY, USA, 2001; pp. 263–268.

36. Burnham, K.P.; Anderson, D.R. Multimodel inference: Understanding AIC and BIC in Model Selection. *Sociol. Methods Res.* **2004**, *33*, 261–304. [CrossRef]

37. Sarstedt, M.; Mooi, E. A concise guide to market research. In *The Process, Data, and 12*; Springer: Berlin/Heidelberg, Germany, 2014.

38. Central Intelligent Agency. *The World Fact Book—East South East Asia: Vietnam*; Central Intelligent Agency: Langley, VA, USA, 2020; Available online: https://www.cia.gov/library/publications/the-world-factbook/geos/vm.html (accessed on 1 June 2020).

39. Ortega, D.L.; Wang, H.H.; Olynk, N.J.; Wu, L.; Bai, J. Chinese consumers' demand for food safety attributes: A push for government and industry regulations. *Am. J. Agric. Econ.* **2012**, *94*, 489–495. [CrossRef]

40. Ortega, D.L.; Wang, H.H.; Wu, L.; Olynk, N.J. Modeling heterogeneity in consumer preferences for select food safety attributes in China. *Food Policy* **2011**, *36*, 318–324. [CrossRef]

41. Robb, C.A.; Reynolds, L.M.; Abdel-Ghany, M. Consumer preference among fluid milk: Low-fat vs high-fat milk consumption in the United States. *Int. J. Consum. Stud.* **2006**, *31*, 90–94. [CrossRef]

42. Speece, M.; Nguyen, P.D. Countering negative country of origin with low prices: A conjoint study in Vietnam. *J. Prod. Brand Manag.* **2005**, *14*, 39–48. [CrossRef]

43. Bieberstein, A. Empirical evidence for gender and risk perception. In *An Investigation of Women's and Men's Perceptions and Meanings Associated with Food Risks*; Springer Science & Bussiness Media: Berlin/Heidelberg, Germany, 2013; pp. 70–71.

44. Zhang, C.; Fan, J. A study of the perception of health risks among college students in China. *Int. J. Environ. Res. Public Health* **2013**, *10*, 2133–2149. [CrossRef]

45. Kennedy, J. Segmentation of US consumers based on food safety attitudes. *Br. Food J.* **2008**, *110*, 691–705. [CrossRef]