


Article

Analysis of Decisive Elements in the Purchase of Alternative Foods Using Bivariate Probit Model

Hwanseok Seo ^{1,*}  and Jaehyun Hwang ^{2,*}¹ Department of Industrial Economy Research, Jeonbuk Institute, Jeonju 55068, Korea² Department of Food Industrial Management, Dongguk University-Seoul, Seoul 04620, Korea

* Correspondence: im2b4u@gmail.com (H.S.); hwang0627@dgu.edu (J.H.)

Abstract: There has been growing attention among major developed countries to alternative food products using vegetable-derived ingredients to help animal welfare and environmental sustainability. The development of ICT technology and awareness of animal welfare, health, and environmental damage have led to a rise in alternative food products. This study explains consumer selection attributes for alternative foods in categories of intrinsic and extrinsic attributes, storage and usage, ethical consumption, awareness of the environment, and vegetarianism. It also intends to clarify the connection between purchase intentions and purchase preferences caused by selection attributes. The bivariate probit model (BPM) was used to quantitatively analyze consumers' selection attributes for alternative foods. Element analysis was conducted on twenty-three variables for alternative food selection attributes to derive five elements: quality and safety, environmental awareness, product specifications, ethical consumption, and storage and usage. Analysis indicated that of the five selection attributes, quality and safety and ethical consumption significantly affected vegetarian or semi-vegetarian purchase intentions and preferences. This study intends to identify the elements that affect consumer purchase intentions for alternative foods introduced from an expanding alternative food market, investigate directions for future food development, and provide useful information for consumption promotion strategies.

Keywords: bivariate probit model; alternative food; selection attributes; purchase intention; purchase preference



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1. Introduction

Food consumers seek better health, hence the increase in eco-friendly food consumption. This is why demand is moving toward a healthier lifestyle and the consumer base increasingly focuses on health. The food industry is grounded in consumer preference diversity, safety, and the culinary culture to create new value in the form of coexisting food, technology, and culture. The government has suggested a new paradigm for the food industry focusing on growth that encompasses citizens' health, food consumption, and sustainability through the Food Industry Invigoration Strategy [1]. The development of ICT technology and awareness of animal welfare, health, and environmental damage have led to a rise in alternative foods. Consumer interest is also leaning toward food safety, health, decrease of animal waste, and other environmental sustainability and bioethical issues. Population increase is expected to lead to higher consumption of meat as a source of protein. Alternative foods can decrease environmental damage and social costs for resource saving. "Alternative food" refers to food that replaces animal protein. They can be categorized into five types: insect protein, vegetable protein, seaweed protein, microorganism protein, and artificial meat [2]. The market has been rapidly formed around plant-based meat, while there are some studies on in vitro meat, but the growth of its market is relatively slowing, and the inset protein is grown around pet food. The level of current skills and the status of the market were examined to show that consumers recognize the plant-based

meat as a kind of alternative food, so this study investigated the selection attributes around the plant-based meat. The alternative food market is expected to increase along with the technological innovations in the food industry converging with ICT. The market size is expected to grow at an annual average of 9.5% from 2019 on (Krei, 2020). Convenience, customization, increase in demand for nutritive improvement, and increased awareness of animal welfare and ethics are driving forces in the alternative food market. This has been followed by an increase in corporate investment, thus increasing the alternative food market. Concerns about livestock diseases have been increased due to frequent occurrence of them such as avian influenza, BSE (Bovine spongiform encephalopathy), African swine fever, foot-and-mouth disease, etc. China, Denmark and other countries consider the legislation about charging a tax on meat. Socially, entire conditions such as a surge of interest in the environmental condition of livestock production as well as health and religion, the popularity of diet, the vegetarian declaration of global well-known influencers, and the trend of consumers reflect consumers' needs for alternative food. The development of skills about the alternative food and the extension of consumption has been promoted by the needs of European and American food companies and consumers. In Korea, the demands for the alternative food have been also increased around vegans, and young people give more attention to the social needs for the self-determination right of food and the future food. As such, this study is determined as a timely one, in that it quantitatively analyzes the intention to purchase the alternative food. This study structurally analyzed the selection attributes of alternative food, in line with previous research, and therefore attempted to elucidate the relationship between consumers' purchase intention and purchase preference. It also intends to clarify the connection between purchase intentions and purchase preferences caused by selection attributes. This study intends to investigate directions for government policies on alternative food and other future foods, directions for future food development, and to provide useful information for consumption promotion strategies.

2. Theoretical Background

2.1. Selection Attributes

An attribute is a characteristic that a product has. A selection attribute affects the decision of a consumer when purchasing, and it affects the purchase intention and purchase activity [3–5]. A selection attribute is an important attribute that affects purchase. Active studies to understand and explain the purchase activities of consumers are ongoing [6,7]. The product consists of a variety of attributes, and these attributes provide decisive clues that influence perception and evaluation of the product. In general, consumers evaluate or decide to purchase products based on intrinsic and external attributes among these attributes [8]. According to Zeithaml [9], consumers generally perceive quality by intrinsic and extrinsic attributes. Intrinsic attributes mean functional and physical aspects as objective judgments about consumer quality. It disappears as it consumes and has properties that do not change unless the nature of the product changes [10].

Studies focused on alternative food selection attributes are just beginning. Most studies have centered on food product elements and food reliability and safety in relation to consumer preference. Due to the insufficient number of preceding studies on the selection of alternative foods, the study examined purchase attributes by focusing on new foods, convenience foods, home meal replacements, and genetically modified foods that were determined to be similar.

In a study by Park, M. S. et al. [11], new food products were categorized into characteristic, taste, texture, shape, color, odor, hygiene, health awareness, resource and environmental awareness, ethical consumption and interest in animal welfare, and others. Alternative foods were categorized into vegetable-derived meat, artificial meat, insect foods, and vegetable-derived eggs to be analyzed by both logit and probit methods. The analysis results showed that attributes that affected purchase intentions varied by product. Awareness of animal welfare was the main attribute. Geeroms et al. [12] divided the selection criteria of convenience food into the aspects of reliability (nutrition, ecofriendly,

etc.) and those of senses (prices, convenience of use, etc.), and they were found to be significantly varied, depending on individual characteristics. Boer et al. [13] suggested that the prices and nutritional contents of convenience food have significant effects on consumers' purchase behavior. Jiang et al. [14] divided the attributes of genetically modified food into functional and environmental ones. Choi et al. [15] suggested prices and products, health, safety, time, family, convenience and packaging environment as the value of food consumption. Yoo et al. [16] divided selection attributes for convenience foods purchased at online shopping malls into food quality, convenience, homepage configuration, promotion services, and shipment; Yang, S. J and Y. B., Cho [17] named the selection attributes for convenience foods as the five factors of food quality, packaging and brand, accessibility and convenience, preference, and price; and Oh, S. B. [18] offered quality, shopping, convenience, promotion services, informativeness, and the importance of trends as purchase attributes for convenience foods. With regard to purchase attributes in terms of organically processed foods, Chen, M. F. [19] offered expected health effectiveness, sensory characteristics such as taste and texture, as well as the inclusion of artificial additives, price acceptability, product familiarity, and ecofriendly production methods. In a study by Oh, W. K. and J. Y., Hong [20], categories were safety, convenience, taste and quality, economic efficiency, reliability, and others. The study proposed home meal replacement (HMR) significance and satisfaction using the IPA method. The results of the analysis showed that food hygiene was significant and that the freshness, quality, and safety of additives were prioritized in that order. A study by Choi, T. H. et al. [7] categorized selection attributes as taste and quality, convenience, price, and packaging as four subvariables to analyze satisfaction and intention to repurchase. All selection attributes showed a positive effect on purchase intention. Based on a precedent study by Park, H. J. et al. [21], convenience food evaluation criteria were re-categorized for forms of usage and the significance and execution of intrinsic and extrinsic attributes. In this study, intrinsic attributes are categorized as the characteristics of the product itself: a new launch of the product, freshness, price, nutrition, digestibility, safety, and hygiene. Extrinsic attributes are categorized as the hygiene of the packaging, transportation stability of the packaging, safety of the packaging material, color of packaging, expiry date, certifications, place of origin, manufacturer, convenience of opening and closing, and packaging appearance. The selection attributes proposed by prior studies showed that intrinsic attributes of the product, such as quality, taste, texture, and hygiene, as well as extrinsic attributes of price, packaging design, and brand, are significant. Environmental awareness, ethical consumption, and product usage instructions also showed an influence in selecting alternative foods. This study intended to re-categorize and analyze the selection attributes proposed by prior studies to be more appropriate for alternative food characteristics. There has been little research quantitatively analyzing the intention to purchase alternative food in Korea, and the results of this study are determined as important basic data for developing alternative food in the future.

2.2. Purchase Intention and Purchase Preference

Purchase intention is defined as the consumer's personal conviction for repeated purchase based on past experience of a certain product [7]. Purchase intention is the result of being satisfied over a purchase and refers to the subjective condition that leads one's beliefs and attitude to behavior. Furthermore, as the will to do a given behavior, it refers to how much effort one puts forth in carrying out a certain behavior [22,23]. Fishbein [23] said that attitude toward behavior is the strength of belief as an evaluation of previous product use. In terms of consumer behavior, when the attitude of the consumer corresponds with the selection attributes of a product, purchase intention occurs. Blackwell, R. D. et al. [24] claim purchase intention to mean the future behavior of the consumer as well as the potential for the attitude of a belief to carry out behavior, seeing how the purchase intention of the consumer is much related to direct behavior in the decision-making model [25]. Generally, between attitude and behavior, a higher degree of favorable attitude toward certain products leads to a higher possibility of making a purchase [26]. Engel [27] said,

with regard to attitude, that because attitude is the subjective possibility of belief becoming behavior, it is highly likely to be converted into the behavior of purchasing an actual product. Baggett [28] argued that attitude forms while reflecting the identity, values, and beliefs of the individual within a complicated mutual relationship between cognitive elements acquired through experience and that, specifically, attitude forms in the process of satisfying needs. In the process of trying to fulfill a need, the individual forms a favorable attitude towards objects that satisfy their needs. Peter and Olson [29] defined it as the recognition-based evaluation. The attitude is defined as the degree to which an individual likes or dislikes a certain behavior. This study set a variable, the purchase preference, as an attitude toward a product.

This study set consumer attitude, noted as one of the selection attributes for alternative foods, as the explanatory variable that affects future purchase intention or preference for alternative foods.

3. Hypothetical Model

This study used the bivariate probit model (BPM) [30] to show both the endogenous types between purchase intention and purchase preference in selection attributes for alternative foods. If the consumer i , in deciding to select an alternative food at the point of purchase, makes an unobservable decision y_1^*, y_2^* , a mutual relation between the two decisions is permitted [31].

$$y_{1i}^* = \beta_1' x_{1i} + u_{1i} y_{1i} = 1 \text{ if } y_{1i}^* > 0, y_{1i} = \text{otherwise} \quad (1)$$

$$y_{2i}^* = \beta_2' x_{2i} + u_{2i} y_{2i} = 1 \text{ if } y_{2i}^* > 0, y_{2i} = \text{otherwise} \quad (2)$$

In other words, Equation (1) is composed of a measurable part (y_1, y_2) and immeasurable part (y_1^*, y_2^*), and these refer to the choice where the consumer i chose purchase intention and purchase preference. If the error terms u_1, u_2 hypothesize a bivariate normal distribution, x_i is the purchase intention and purchase preference selection explanation variable vector, and β_1', β_2' are the odds ratio estimate vectors. If the two error terms are independent, the value of ρ becomes $\rho = 0$. In this case, the two error terms do not follow the bivariate normal distribution. In this case, a single probit model can be used. Usually, two models that are mutually related show a consistent covariance, unlike an independent model, such as Equation (3).

$$\text{Cov}(u_{1i}, u_{2i}) = \rho \quad (3)$$

Equation (4) shows the joint probability density function in the case of bivariate normal distribution.

$$\phi_2(u_1, u_2) = \frac{1}{2\pi\sigma_{u1}\sigma_{u2}\sqrt{1-\rho^2}} \exp\left[-\frac{1}{2}\left(\frac{u_1^2 + u_2^2 - 2\rho u_1 u_2}{1-\rho^2}\right)\right] \quad (4)$$

$$\Phi_2(u_1, u_2, \rho) = \int_{u_1} \int_{u_2} \phi(u_1, u_2, \rho) du_1 du_2 \quad (5)$$

If two error terms follow bivariate normal distribution, the cumulative density function Φ_2 is assumed as the normal cumulative density function, and the maximum likelihood estimation is hypothesized through the probit model. The maximized likelihood function is as follows.

$$\ln L = \sum_{i=1}^n \ln \Phi_2 = (u_{i1}, u_{i2}, \rho_{i*}) \quad (6)$$

4. Research Method

4.1. Data Collection

This study analyzed the purchase intention and purchase preference of consumers caused by selection attributes of alternative foods. The subjects of the survey were consumers from fourteen cities and counties. The survey was conducted for eight days,

beginning on 29 June and ending on 6 July 2020. The sampling was done by convenience sampling method of a nonprobable sampling method. Three hundred survey sheets were distributed; of these, three hundred (100.0%) valid sheets were used for analysis.

In Jeollabuk-do, the province surveyed, the food industry and the agriculture and life industry are specialized, so it made a business plan for customized special food, including alternative food. Jeollabuk-do has activated the food plan around its local food, and therefore, it is likely to be developed into the future food consumption city. Hence, this study collected data of 14 cities and counties in Jeollabuk-do. For the sample collection, the quota sampling was conducted in proportion to the number of local populations to properly reflect the characteristics of the whole population. The area of investigation was divided into urban and rural areas, with the investigation carried out at grocery stores—the place where food spending mainly takes place—and data collected by thoroughly trained investigators through face-to-face contact with respondents. Investigators explained the concept and characteristics of alternative foods using example cards as well as the definition for alternative foods in the survey in order to help interviewees understand (Table 1).

Table 1. Survey Time Period and Subjects.

Category	Details
Survey Time Period	29 June 2020–6 July 2020
Survey Subjects	Consumers over the age of 20
Survey Site	Fourteen cities and counties in Jeollabuk-do, Korea
Sampling Method	Convenience Sampling Method
Survey Subjects	Visited and collected in the survey location (professional surveyors employed)

4.2. Data Analysis

In the analysis process of this study, technical statistical analysis was done, including frequency and percentage, to identify the demographics of survey respondents and general status. Second, investigative elemental analysis was conducted to verify the measured variable concept validity and alternative food selection attributes were categorized accordingly. Cronbach's α coefficient was also reviewed to measure the reliability of the survey. Furthermore, a bivariate probit analysis was conducted to analyze the selection attributes of alternative foods.

4.3. Explanation and Measurement Tools for Variables

The measured variables used to infer the suggested research model are as follows.

First, the dependent variables were measured as dummy variables for “yes” and “no” answers to the question asking “whether one will increase the consumption of alternative foods.” Purchase preference was measured as dummy variables for “yes” and “no” answers to the question asking “whether one prefers to purchase alternative foods”.

Second, the selection attributes for alternative foods were classified into intrinsic and extrinsic attributes and observed for consideration when selecting alternative foods. Intrinsic attributes were set as nutrition, hygiene, place of origin, safety, taste, and quality. Studies by Park, M. S., et al. [11]; Oh, W. K and J. Y., Hong [20]; Choi, T. H. et al. [7]; and other studies were referred to for this. Extrinsic attributes were set as price, packaging design, brand, and product diversity. Multiple categories were measured on a scale of one to five, using the questions proposed by Park, H. J. et al. [21] and Choi, T. H. et al. [7].

Third, the storage and usage of alternative foods were operationally defined from the knowledge used for consumer characteristic analysis in Seo, H. S. and J. H. Hwang [32,33]. The usage purpose, handling, and purchasing knowledge after purchasing alternative foods were measured on a scale of one to five.

Fourth, ethical consumption and environmental awareness were classified into subcategories for the purpose of the study based on the ethical consumption variables used in Park.

M. S. et al. [11]. The vegetarian variables were classified into vegetarian or semi-vegetarian, and nonvegetarian bivariate dummy variables (Table 2).

Table 2. Measurement Subjects for Selection Attribute Measurement.

Composition Concepts	Names of Variables	Measured Subjects
Dependent Variables	Purchase Intention	① Alternative food consumption will increase (=1) ② Alternative food consumption will not increase (=0)
	Purchase Preferences (Attitudes toward alternative foods)	① Alternative food purchase is preferred (=1) ② Alternative food purchase is not preferred (=0)
Intrinsic Attributes	<ol style="list-style-type: none"> 1. Nutrition: nutrition facts on product 2. Hygiene: clean product production and distribution management 3. Place of origin: clear representation of product's place of origin 4. Certification: proven safety and reliability 5. Safety: fresh ingredients, no additives 6. Taste: the savory flavor when the product is consumed 7. Quality: product quality, percentage of domestic ingredients used, easy digestion 	Factor score (5-point Likert scale)
Extrinsic Attributes	<ol style="list-style-type: none"> 1. Price: adequate product price 2. Packaging: neat packaging design 3. Brand: brand popularity 4. Variety: a wide range of choices 	Factor score (5-point Likert scale)
Storage and Usage	<ol style="list-style-type: none"> 1. Cooking convenience: handling is easy 2. Access to purchase: easy to purchase 3. Storage convenience: storage is easy and convenient 4. Food handling convenience: food is easy to handle 	Factor score (5-point Likert scale)
Ethical Purchase	<ol style="list-style-type: none"> 1. Waste such as plastic and excessive packaging are considered when purchasing food. 2. Ecofriendly vegetable foods are preferred. 3. Vegan, ecofriendly, or other certifications are considered. 4. The consumer has relatively high environmental awareness. 	Factor score (5-point Likert scale)
Awareness of the Environment	<ol style="list-style-type: none"> 1. It is important to maintain ecological diversity. 2. We must maintain an environment we can pass down to future generations. 3. We must respond to future climate change. 4. It is important to cut down on energy consumption. 	Factor score (5-point Likert scale)
Vegetarianism	Vegetarian, semi-vegetarian, nonvegetarian	1 = Vegetarian or semi-vegetarian 0 = nonvegetarian

5. Empirical Analysis Results

5.1. Characteristics of the Sample

The average age of survey respondents was 45.81. Among them, respondents in their 20s and 40s were the largest sample at 22.0%. People in their 50s and 60s followed with 21.7% and 18.0%, respectively. Women made up 61.9% and men were 38.1%. In terms of marriage, 67.4% were married and 32.6% were not. Those who answered that they have

children were 66.8%. College graduates (including those with associate degrees) comprised the highest percentage with 42.9%, while high school graduates were 33.7%, and middle school graduates or below were 18.8%. The survey was conducted centered on Jeollabuk-do. The number of answers by city ranged in the order of Gunsan 12.7%, Jeonju 12.0%, Iksan 11.0%, Wanju 10.7%, and Buan 10.3%. Occupations showed that agricultural and fishery was highest at 21.5%. Sales and services were 17.8%, and professional and technical occupations were 14.8%. In the case of vegetarianism, semi-vegetarian was the majority at 64.9%. Nonvegetarian was 29.5%, and vegetarian was 5.6%. By monthly income, the highest number of people had incomes below 2,000,000 won at 29.1%, 2,000,000–2,990,000 won were 20.7%, and 5,000,000–5,990,000 won were 17.6% (Table 3).

Table 3. Distribution of Survey Respondent Characteristics.

Category		N	%	Category	N	%		
Sex	Male	114	38.1	20s	66	22.0		
	Female	185	61.9	30s	34	11.3		
Marital Status	Married	188	67.4	Age (45.81)	40s	66	22.0	
	Single	91	32.6		50s	65	21.7	
With Children	Yes	169	66.8		60s	54	18.0	
	No	84	33.2		70s	11	3.7	
Educational Background	Middle School Graduate or Below	53	18.8		80s	4	1.3	
	High School Graduate	95	33.7	Student	35	11.7		
	College Graduate	121	42.9	Professional or Technical	44	14.8		
	Master’s Degree or Above	13	4.6	Office Work	17	5.7		
Region	Jeonju	36	12.0	Occupation	Public/Education	11	3.7	
	Gunsan	38	12.7		Agriculture or Fishery	64	21.5	
	Iksan	33	11.0		Housewife	23	7.7	
	Jeongeup	25	8.3		Sales or Services	53	17.8	
	Namwon	1	0.3		Self-employed/Freelance	35	11.7	
	Gimje	29	9.7		Other	16	5.4	
	Wanju	32	10.7		Monthly Income (won)	Below 2,000,000	76	29.1
	Imsil	24	8.0			2,000,000–2,990,000	54	20.7
	Sunchang	24	8.0			3,000,000–3,990,000	38	14.6
	Gochang	27	9.0			4,000,000–4,990,000	27	10.3
Buan	31	10.3	5,000,000–5,990,000	46		17.6		
			6,000,000–6,990,000	14		5.4		
			7,000,000–7,990,000	4		1.5		
			8,000,000 or above	2	0.8			
Type	Vegetarian	16	5.6	Subtotal	300	100.0		
	Semi-vegetarian	187	64.9					
	Nonvegetarian	85	29.5					
Subtotal		300	100.0					

5.2. Investigative Attribute Analysis and Reliability Verification

The fifteen variables that are selection attributes for alternative foods were summarized into several attributes. Investigative attribute analysis and reliability analysis were conducted to verify the validity and reliability of measurement tools. Attributes were extracted using varimax, a perpendicular rotation method through principal component analysis.

The eigenvalue standard was 1.0 or above. The factor loading was 0.5 or above. The results of the analysis showed that the total variance explanation power was 68.284%. It was above the 60% rate, which is normally accepted in social sciences, and the conformity of KMO to distinguish attribute analysis conformity was 0.878. Bartlett’s test of sphericity showed 3809.015, below the significance level of 0.05, and thus it is statistically significant. Attribute analysis was conducted on a total of 25 criteria. As a result of the analysis, five

attributes were extracted: quality and safety (intrinsic attribute), environmental awareness, product attributes (extrinsic attribute), ethical consumption, and storage and usage. Reliability analysis showed that all five attributes had a Cronbach's α value of 0.8 or above, showing sufficient reliability (Table 4).

Table 4. Investigative Cause Analysis and Reliability Analysis.

Variable	Factor Loading	Eigenvalue	% of Variance	α	Mean
Factor 1: Quality and safety (intrinsic attributes)		7.886	34.285	0.874	4.19
1. Certification: proven safety and reliability	0.807				
2. Hygiene: clean product production and distribution management	0.779				
3. Nutrition: nutrition facts on product	0.733				
4. Place of origin: clear representation of the product's place of origin	0.654				
5. Quality: product quality, percentage of domestic ingredients used, easy digestion	0.630				
6. Taste: the gustatory sense when the product is consumed	0.614				
7. Safety: fresh ingredients, no additives	0.583				
Factor 2: Environmental awareness		2.586	11.234	0.897	4.41
1. It is important to cut down on energy consumption.	0.820				
2. We must respond to future climate change.	0.819				
3. It is important to maintain ecological diversity.	0.813				
4. We must maintain an environment we can pass down to future generations.	0.792				
5. Disregarding pollution in farming lands or cities can cause higher loss in the future.	0.765				
Factor 3: Product attributes (extrinsic attributes)		2.344	10.191	0.811	3.81
1. Packaging: neat packaging design	0.873				
2. Brand: brand popularity	0.860				
3. Variety: a wide range of choices	0.762				
4. Price: adequate product price	0.578				
Factor 4: Ethical consumption		1.879	8.171	0.834	3.58
1. Ecofriendly vegetable foods are preferred.	0.842				
2. The consumer has relatively high environmental awareness.	0.841				
3. Vegan, ecofriendly, or other certifications are considered.	0.801				
4. Waste such as plastic and excessive packaging are considered when purchasing food.	0.755				
Factor 5: Storage and usage		1.010	4.393	0.830	4.11
1. Food handling convenience: food is easy to handle	0.801				
2. Storage convenience: storage is easy and convenient	0.759				
3. Cooking convenience: easy preparation	0.737				
Cumulative % = 68.284%, KMO = 0.878					
Bartlett's test of sphericity $\chi^2 = 3809.015$ (d.f = 253, $p = 0.000$ ***)					

Note: *** $p < 0.01$.

5.3. Inference Results

First, the BPM with purchase intention and purchase preference as dependent variables was assessed for validity. Dependent variables were set as purchase intention (int_pur) and purchase preference (pur_pre). Independent variables were set as quality and safety

(emp_prd), environmental awareness (environ), product attribute (pro_att), ethical consumption (ethics), storage and usage (sto_use), and vegetarian or semi-vegetarian (vegan) for analysis. A likelihood ratio test (LR) was conducted to verify whether the value was identified. Verification statistics showed a value of 196.021, forfeiting the null hypothesis at $p < 0.05$. Therefore, the bivariate probit model (BPM) with dependent variables of purchase intention and purchase preference was confirmed as the appropriate model. In particular, a value of 0.9820 was derived from enabling confirmation that purchase intention and purchase preference had a mutually positive influence through the error term. Therefore, it was decided that the bivariate probit model was a statistically more efficient model compared to the univariate probit model in inferring purchase intention and purchase preference. Parameter estimate results showed that there was little difference in the attributes that influence purchase intention and purchase preference. Quality and safety, ethical consumption, and vegetarian or semi-vegetarian were significant attributes. In reviewing each attribute that influences purchase intention, the following attributes were each significant at the specified rate: quality and safety $p < 0.05$, ethical consumption $p < 0.01$, and vegetarian or semi-vegetarian $p < 0.01$. In reviewing each attribute that influences purchase preference, the following attributes were each significant at the specified rate: hygiene and quality $p < 0.05$, ethical consumption $p < 0.01$, and vegetarian or semi-vegetarian $p < 0.01$ (Table 5).

Table 5. Alternative food selection attribute analysis using BPM.

Division		BPM Estimated Results (γ)			
		Purchase Intention (y_1)		Preference for Purchase (y_2)	
		Coef.	S.E.	Coef.	S.E.
x_1	qual_saf	0.453 **	0.228	0.567 **	0.231
x_2	environ	−0.017	0.165	−0.071	0.167
x_3	pro_att	−0.097	0.159	−0.042	0.151
x_4	ethics	0.424 ***	0.127	0.366 ***	0.128
x_5	sto_use	−0.095	0.176	−0.039	0.178
x_6	vegan	0.940 ***	0.176	0.984 ***	0.178
	_cons	−2.933 ***	0.842	−3.624 ***	0.865

Number of obs = 279
Wald test of rho (ρ) = 0.9820 ***
Wald = 196.021 *** ($p = 0.0000$)
Log pseudo likelihood = −223.96903
Wald = 58.04 *** ($p = 0.0000$)

Note: *** $p < 0.01$, ** $p < 0.05$.

The odds ratio estimate provides significance and direction in the variables but is irrelevant to the actual amount of influence that each variable has on the dependent variable. Therefore, the marginal effect was measured to confirm the scale of the explanatory variable. The marginal effect refers to the probability change in purchase intention and purchase preference in accordance with a single unit of change in the explanatory variable. Marginal effects were analyzed in the case where purchase intention and purchase preference were simultaneously selected. The results of the marginal effect analysis showed that the attributes that lead to satisfaction of both purchase intention and purchase preference of alternative foods were quality and safety, ethical consumption, and vegetarian and semi-vegetarian. The results indicated that if other variables are consistent, a single unit of increase in the attitude of prioritizing quality and safety leads to an 18.3% increase in the likelihood to choose both purchase intention and purchase preference. For a single unit of increase in significance toward ethical consumption, a 12.6% likelihood was observed in choosing both purchase intention and purchase preference. If the consumer was vegetarian or semi-vegetarian, the likelihood of choosing both purchase intention and purchase preference for alternative food increased by 32.7% in comparison to nonvegetarians (Table 6).

Table 6. Marginal Effects of the BPM.

	Division	dy/dx	Marginal Effect (y=Pr{y ₁ =1, y ₂ =2})		
			S.E.	z	P> z
x ₁	qual_saf	0.183	0.072	2.53 **	0.012
x ₂	environ	−0.020	0.054	−0.37	0.708
x ₃	pro_att	−0.018	0.049	−0.36	0.720
x ₄	ethics	0.126	0.040	3.16 ***	0.002
x ₅	sto_use	−0.017	0.058	−0.29	0.772
x ₆	vegan	0.327	0.049	6.73 ***	0.000

Note: *** $p < 0.01$, ** $p < 0.05$.

6. Conclusions

This study attempted to infer selection attributes from consumers in fourteen cities and counties in Jeollabuk-do. The bivariate probit model (BPM) was used to quantitatively analyze consumers' selection attributes for alternative foods. Elemental analysis was conducted on twenty-three variables for alternative food selection attributes to derive five elements: quality and safety, environmental awareness, product attributes, ethical consumption, and storage and usage. Analysis showed that of the five selection attributes, quality and safety and ethical consumption significantly affected vegetarian or semi-vegetarian purchase intentions and preferences.

Some implications can be derived in accordance with these analysis results. First, consumers who perceive alternative food quality as high tend to purchase alternative foods. This also positively influences purchase preference. In the case of vegetable-derived meat, the technology to make meat out of vegetable ingredients exists, but most products have a texture that is far from animal meat. In particular, the sensual quality of meat analogue, including tastes and textual characteristics, was lower than that of meat, so skills for enhancing the quality seem to be necessary in order to overcome this problem. Moreover, because consumers of alternative foods have high expectations of quality and safety, food processing and product distribution standards must be systematized to improve the safety and functionality of food. The names and classification system of in vitro meat have been controversial so far; some problems remain to be solved, including GMO and stability. In Korea, the standards of the certification system for the quality of safety of alternative product, so the consumption of it would be able to be increased if the standardization is accomplished. Second, environmental awareness showed an insignificant effect on alternative foods. This means that the environment does not have a direct influence on the decision to consume alternative foods. Previous research, however, demonstrated that persons who pursued the lifestyle of veganism have a tendency to have more interest in health, environmental protection and ethical consumption, which may have an indirect effect on the selection of alternative food. Awareness of the environment and resources is increasing in line with increased consumer interest in food safety, health, and bioethics. By publicizing the environmental pollution, animal welfare, etc., it is necessary to help consumers deeply recognize the ecofriendly image of alternative food. Third, to improve a variety of alternative foods, the field must expand into pet foods, vegan foods, and home meal replacements (HMR). It is also necessary to develop alternative food materials using local resources to help consumers perceive alternative foods as local specialties and to set a purpose in product development for environmental production. Fourth, consumption categories should be specified in line with the increased popularity of veganism and ethical consumption. Products must be developed to reinforce the value of consumption. Safe and healthy foods must be launched in the market so that the consumption of safe alternative foods can lead to the betterment of health and family wellness. Fifth, a recommendation manual should be distributed so that balanced meals with alternative foods are feasible. Information on the food's nutrition and servings should be provided for the consumer to check. Cooking instructions should also be provided, acknowledging digestive abilities and improving masticatory functions. Lastly, a differentiated marketing strategy is needed

for demographic characteristics. For vegetarian or semi-vegetarian consumers, a positive influence was observed for alternative food purchase intentions and preferences. The Korean vegan population is assumed to be more than 1,500,000 people (www.vege.or.kr, 2019, accessed on 28 October 2020) and is expected to increase. Vegetarianism can be divided into vegan, lacto, ovo, lacto ovo, polo, pesco, and flexitarian. Products must be developed in line with such types of vegetarianism and consumer preferences and tastes.

This study is significant in that it derived selection attributes through categorization. Further studies are required focusing on consumers and local characteristics. This study was focused on a certain city in which the food industry is specialized, due to limits in the cost of survey and the research period, and a follow-up study reflecting consumers' characteristics by the types of vegetarians, and local ones. Alternative foods continue to grow in popularity with consumer interest in food safety and wellness, as well as environmental sustainability. This study proposed an understanding of selection attributes that affect consumer purchase intentions for alternative foods according to alternative market expansion and suggested a direction for production system improvement, distribution efficiency, and sales promotion in response to the changing food market.

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