

## Article

# Purchase Behavior According to the Development of Sustainable Pistachio (*Pistacia vera* L.) Rice Cake: For Korean Consumers

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**Abstract:** In recent years, the rice cake market has grown considerably in terms of research and development of products suitable for consumer needs and beneficial to health at the same time. Since the outbreak of COVID-19, the number of consumers consuming antioxidant-rich foods and immunity-boosting foods to improve health and promote healthy eating habits has increased. Pistachio rice cakes have been tested and found to be high in polyphenols, which have good antioxidant activity and strengthen the immune system. Therefore, research was conducted on pistachio rice cakes to develop safe, health functional, and sustainable food. In order to maximize the sales potential of pistachio rice cakes, a survey was conducted among Korean adults to investigate perception of pistachio, pistachio rice cake purchasing behavior, and popularization plans. Pearson's correlation analysis was performed to examine the correlation between pistachio perception, pistachio rice cake purchasing behavior, and pistachio rice cake popularization measures, and they were found to have a close relationship. In addition, as a result of multiple regression analysis, perception and purchasing behavior of pistachio rice cake products were found to have a significant positive (+) effect on rice cake technology development, development of brand specializing in rice cakes, and cultivation of traditional rice cake experts. This study suggests that continuous research and development of food safety and sustainability of rice cakes are required, and it is expected to be utilized as basic data to form a research basis that can be a strategy for increasing sales in the rice cake industry.

**Keywords:** food safety; sustainability; purchase behavior; perception; popularization plan; pistachio (*Pistacia vera* L.); rice cake



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## 1. Introduction

As the food industry trends continue to shift toward wellbeing and lifestyle of health and sustainability (LOHAS) around the world including Korea, traditional food, slow food, and local food are in the spotlight. With consumers adopting a more health-oriented mindset, more and more consumers are choosing healthy food and improving their eating habits [1]. Likewise, food safety and quality are of paramount importance and consequently a hot topic of discussion. Globally, food safety concerns are a high priority, and incidents frequently make headlines in all countries [2]. Safe food means food that is suitable for human consumption without any detrimental effect on health [3]. As concerns about the content and safety of food supply increase, consumers are also taking a closer look [4]. Many countries have invested heavily in risk management systems to regulate food safety in line with the standards and procedures established by food safety authorities. For the concerns raised by consumers regarding the content and safety of food, major systems are in place including good agricultural practices (GAP), good manufacturing practices (GMP), and hazard analysis critical control point (HACCP) facilities; analytical methods and technology development to ensure food safety are also thriving [4,5]. In particular,

because consumers want safer and higher-quality food, safety and quality inspections on food are conducted thoroughly. Food production processes are so important that they continue to challenge multi-factor food inspection techniques to avoid the occurrence of factors such as strict regulatory agency rules and increasing outbreaks of foodborne illness [6]. As a traditional Korean food, Tteok has also acquired HACCP certification, and more and more places are producing rice cake products. Globally, interest in Korean food is increasing due to the Hallyu craze such as K-Drama, K-pop, K-beauty, and K-food. Garaetteok is one of the K-foods being exported overseas. As such, Korean rice cake products are competitive enough to be on a par with other countries' foods, so the rice cake industry is expected to continue to go from strength to strength.

According to the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO), a healthy and sustainable diet limits saturated fats, trans-fats, sugar and salt, and the consumption of vegetables, fruits, and whole grains is recommended. These diets are nutritious, safe, and healthy. To contribute to healthy living, food and nutrition security and ecosystems must be protected and respected for present and future generations. Food should be socially and culturally acceptable without damaging the environment and economically accessible to all. Agricultural workers and food producers should be provided with adequate income and livelihoods [7–10]. Among Korean traditional foods, rice cake has all these elements and high cultural value, so it is gradually attracting attention from modern consumers [1]. In order to change the current perception of rice cakes, they were developed to be high-quality and enjoyed as meal substitute or dessert; hence the high growth rate in the rice cake industry [11]. Moreover, with the growth of the Korean economy, busy modern people prefer convenience food, and changes have occurred in the rice cake industry. Unlike before, the perception that rice cakes are healthy has spread, and many people prefer them because they are packaged individually and in small quantities for easy consumption. As rice cakes are gradually diversified and developed into nutritious products, rice cake consumption is expected to continue to increase and achieve remarkable growth considering all these factors.

According to statistical data, there were 1101 bread manufacturers in Korea in 2017, but the number of rice cake makers increased to 13,405. This may reflect the growth rate of rice consumption, showing that the rice cake market is increasing [12]. Moreover, the rice cake industry in Korea can be said to have grown further as the coffee culture has become popular. Korean dessert cafes which have started to increase in the past few years played a big role in changing consumer awareness of traditional rice cakes by making rice-based desserts and fusion rice cakes [11]. However, previous research has been limited to studies on antioxidant experiments such as adding physiologically active substances to rice cakes, and studies on the awareness, preference, and consumption of rice cakes [13,14]. Moreover, it is difficult to find research related to purchase after the development of rice cake products. Most rice cakes use rice as the main ingredient; according to a study by Josse et al. [15], Kendall et al. [16], and Kendall et al. [17], pistachios are nutritious, and when consumed with rice and bread made of carbohydrates they help reduce blood sugar spikes. Kendall et al. [16] found that a combination of parboiled rice and pistachios attenuated relative glycemic responses (RGRs). The particular rice used in Han et al. [18] and parboiled rice have similar type of shape. Therefore, rice cakes made of rice and pistachio ingredients will improve blood sugar health in humans.

Consuming pistachios with a meal reduces BMI (body mass index) and has no significant effect on body weight and waist circumference, so consumers are becoming increasingly more interested [19]. Pistachios have glucose and insulin-lowering effects and they have proven to be a useful nutritional strategy for people with prediabetic conditions [20]. Pistachios can be said to be a promising addition when developing foods with high nutritional value.

Pistachio has low fat content and glycemic index and contains lots of polyunsaturated fatty acids, monounsaturated fatty acids, and protein. In addition, it is rich in minerals (K, Mg, Ca, Zn, Se, Cu, Mn) with an appropriate amount of vitamin (vitamin A, vitamin B, vitamin C, vitamin E) and essential amino acids, so FAO and WHO recommend the intake of pistachios [21–24]. It is also rich in water-soluble and fat-soluble antioxidants such as phenolic compounds (anthocyanins, flavan-3-ols, proanthocyanidins, flavonols, isoflavons, flavanones, stilbenes, and phenolic acids). In particular, it is rich in lutein,  $\beta$ -carotene, and  $\gamma$ -tocopherol that has been shown to have beneficial effects on inflammation and oxidative state and to help improve cardiovascular health. Moreover, circulating levels of IL-6, CRP, TNF and adiponectin have been reported to improve in both healthy males and patients with metabolic syndrome [25–29]. In particular, pistachio is rich in arginine, a type of amino acid that plays an important role in health by healing wounds, regulating blood pressure, and strengthening the immune system [30]. As a result of developing rice cakes with pistachios added and conducting antioxidant tests polyphenol content was found to be high [18]. Polyphenols are immunity-boosting components, and functional food components containing polyphenols help prevent pathogenic viral infections and improve immune system capabilities [31]. Moreover, even in the eradication of viral diseases including COVID-19 which was declared by the WHO as a global pandemic consumption of various functional foods using physiologically active compounds can improve immunity and serve as an alternative [32,33].

Everyone should be able to eat with peace of mind in terms of food safety. Furthermore, we must continue to research sustainable food for the health of the earth. As such, Korean rice cake products are in the spotlight because they are plant-based, which is thought to be safe and healthy.

Pistachio rice cake is a safe, sustainable food and beneficial to health as a health functional food. The purpose of this study is to examine the perception of pistachios and study the purchasing behavior and popularization plan. This study is expected to have a positive ripple effect and contribute to the further development of the rice cake industry.

### *1.1. Perception and Purchase Behavior*

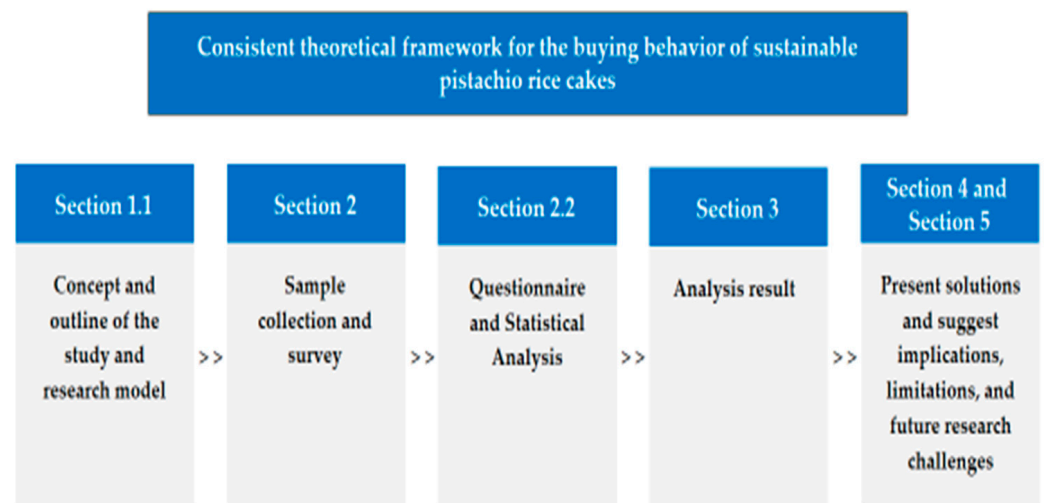
Recognizing and judging things is called perception, which refers to the process and action of becoming aware of something. Humans expand their knowledge through their perception activities and become influenced by the direction of new decision making [34]. Specifically, perceptions of food depend on attitudes and emotions, including the environment. Food preference can be said to be an intentionally selective act that determines which food to choose and consume, and experience with food is important from an early age. Therefore, ingestion and food preference are very important as they shape healthy eating behavior [35]. In general, it has been shown that the older one gets, the more one considers freshness, fat content, and nutrients when looking at food [36–38]. This is because one makes choices and judgments considering one's health as one goes through childhood, adolescence, and adulthood.

Consumers go through the purchase intention stage which evaluates good or bad and develop purchasing behavior that serves as the final indicator of consumer behavior and refers to the concept [39,40]. As purchase intention is recognized as a key factor that can be predicted by consumers' actual purchasing behavior, many studies and analyses are being conducted in various fields including food [41]. Purchase intention directly affects consumer purchasing behavior [42] and refers to the possibility of leading to actual purchasing behavior due to personal beliefs and attitudes prior to purchase [43]. Purchase intention is explained as a determinant of not only the consumer's intention to purchase a product but also purchasing behavior. Various factors such as personal value, lifestyle, food consumption value, brand image, attitude, service quality, product selection attributes, and satisfaction were found to have an influence on purchase intention [44–47]. Consumers make the final purchase decision after deciding based on product information and product knowledge and consequently develop purchasing behavior [48]. Therefore, Korean food

companies are developing sustainable foods that do not negatively impact the ecosystem but can coexist with nature, and consider the health of the people and the earth. A representative dish among them is tteokbokki, a dish made with rice cakes.

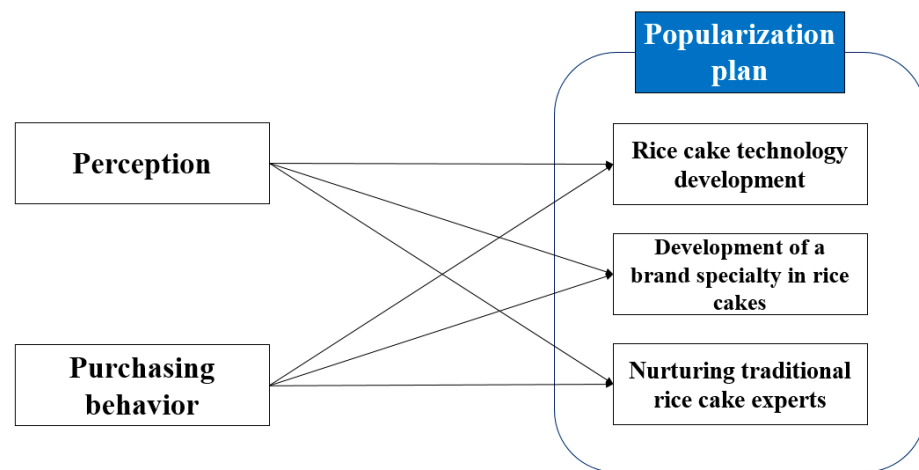
Research has shown that health-conscious consumers are increasingly consuming gluten-free products [49]. Tteok, a traditional Korean food made from rice, is considered a gluten-free product, so it is deemed to have commercial value worldwide as food with lots of potential [50]. Due to the ongoing COVID-19 pandemic, health is considered a central factor in food development and research. As food safety, sustainable food, immunity enhancement, antioxidant functional food, and eco-friendly food are revitalized, more diverse studies are required. Therefore, in keeping with current trends, research on purchasing behavior based on food development, food safety, and sustainable food can be said to be more necessary and valuable.

Figure 1 presents a consistent theoretical framework for the purchasing behavior of sustainable pistachio rice cakes. Components related to this will be discussed in the next section. In Section 1.1, we developed a research model, providing an overview and concept of perception, purchasing behavior, and popularization plan. In the Section 2 materials and methods, sample collection and survey were conducted to analyze this study. In Section 2.2, frequency analysis, reliability analysis, Pearson's correlation analysis, and multiple regression analysis were analyzed using the SPSS 25.0 statistical program to conduct the statistical analysis of questionnaire. The Section 3 results present analysis results on sustainable pistachio rice cake perception, purchase behavior, and popularization plan. The Section 4 discussion presents problem situations and ways to solve them. The Section 5 conclusions discusses the meaning of this study, then presents the implications, and future research challenges of the study.



**Figure 1.** Consistent theoretical framework for the buying behavior of sustainable pistachio rice cakes.

Figure 2 shows a research model to analyze whether awareness and purchasing behavior affect the development of rice cake technology, development of rice cake specialty brands, and training of traditional rice cake experts, which are sub-factors of the popularization plan.



**Figure 2.** Research model.

## 2. Materials and Methods

### 2.1. Participants and Survey Period

The data for this study were obtained online from October 4 to 7, 2021, and the preliminary survey was conducted on 3 October 2021 to confirm that there was no problem with this scale. Sampling was performed through a survey conducted among Korean adult males and females as a convenient sampling method. Participation in the study was voluntary and anonymous and no compensation was provided. A total of 600 questionnaires were collected, out of which 576 data were analyzed. At least 24 items that gave the same answer to multiple scales, had common results in factor analysis, and had low validity with factor load of less than 0.4 were deleted.

### 2.2. Questionnaire and Statistical Analysis

The questionnaire used in this study was developed from questionnaires used in previous studies [51–60]. Items included pistachio perception, pistachio rice cake purchasing behavior, pistachio rice cake popularization plan, and demographic characteristics. A 5-point Likert scale was used for pistachio perception, purchasing behavior, and popularization measures. Among the collected data, the final 576 questionnaires were analyzed using the SPSS 25.0 statistical program. The following were performed to derive the main statistics used in the analysis: frequency analysis, to examine the frequency and percentage of study subjects' characteristics; reliability analysis, to calculate Cronbach's  $\alpha$  value by examining the internal consistency among items related to pistachio perception, purchasing behavior of pistachio rice cake products, and measures to popularize pistachio rice cake products; Pearson's correlation analysis, to examine the correlation between perception of pistachio, purchasing behavior of pistachio rice cake products, and popularization plan of pistachio rice cake products; lastly, multiple regression analysis, to investigate the effect of pistachio perception and purchasing behavior of pistachio rice cake products on each sub-factor of the popularization plan of pistachio rice cake products. This study was verified at significance level  $p < 0.05$ ,  $p < 0.01$ ,  $p < 0.001$ .

## 3. Results

Table 1 presents the results of a frequency analysis performed to examine the characteristics of the study subjects. In terms of gender, 352 participants (61.1%) were male, a number much greater than the 224 (38.9%) females; for marital status, singles accounted for the highest portion at 345 (59.9%), followed by 207 (35.9%) married and 24 (4.2%) divorced or widowed.

**Table 1.** General characteristics of study subjects.

Division	Item	N (%)
Gender	Man	352 (61.1)
	Female	224 (38.9)
Marital Status	Single	345 (59.9)
	Married	207 (35.9)
	Divorce, widowed, etc.	24 (4.2)
Age	20's	188 (32.6)
	30's	199 (34.5)
	40's	60 (10.4)
	50's	84 (14.6)
	60's	45 (7.9)
Education	Less than high school	134 (23.3)
	Graduated from junior college	97 (16.8)
	University graduate	256 (44.4)
	Graduate school or higher	89 (15.5)
Job	Housewife	37 (6.4)
	Student	64 (11.1)
	Profession	145 (25.2)
	Technical job	48 (8.3)
	Public official	25 (4.3)
	Service industry	80 (13.9)
	Self-employment	66 (11.5)
	Unemployment	18 (3.1)
	Etc.	93 (16.1)
Average monthly income	Less than 1 million won	75 (13.0)
	More than 1 million won—less than 2 million won	45 (7.8)
	More than 2 million won—less than 3 million won	164 (28.5)
	More than 3 million won—less than 4 million won	136 (23.6)
	More than 4 million won—less than 5 million won	49 (8.5)
	Over 500 million won	107 (18.6)
	Total	576 (100.0)

The age group with the highest representation was those in their 30s (199, 34.5%), followed by those in their 20s (188, 32.6%), those in their 50s (84, 14.6%), those in their 40s (60, 10.4%), and those aged 60 or older (45, 7.8%).

Regarding the educational background, 256 participants (44.4%) graduated from a university, followed by 134 (23.3%) who graduated from high school or lower, 97 (16.8%) who graduated from junior college, and 89 (15.5%) who were enrolled in graduate school or higher. Professional occupation was the most common among participants (145, 25.2%), followed by others (93, 16.1%), service industry (80, 13.9%), self-employed (66, 11.5%), and students (64, 11.1%), technical workers (48, 8.3%), housewives (37, 6.4%), civil servants (25, 4.3%), and unemployed (18, 3.1%).

In terms of average monthly income, 164 participants (28.5%) with monthly income of 2~3 million won constituted the highest portion, followed by 136 (23.6%) with 3~4 million won and 107 (18.6%) with more than 5 million won. Those with monthly income of less than 1 million won numbered 75 (13.0%), with 49 (8.5%) earning between 4 million won to less than 5 million won and 45 (7.8%) earning between 1 million won to less than 2 million won.

As a basic analysis, the mean, standard deviation, skewness, and kurtosis of pistachio perception, pistachio rice cake product purchasing behavior, and pistachio rice cake product popularization plan are as follows (Table 2):

**Table 2.** Descriptive statistics of related variables.

Factor Name	M	SD	Skewness	Kurtosis
Perception	3.68	0.63	−0.31	2.15
Purchase behavior	3.38	0.78	−0.25	0.54
Popularization plan	3.99	0.63	−0.95	2.61
	4.02	0.66	−0.86	2.02
	3.97	0.72	−0.73	1.50
All	3.99	0.62	−0.88	2.66

The overall average was 3.99 (SD = 0.62) points, and the pistachio perception level was 3.68 (SD = 0.63) points. When looking at the purchasing behavior of pistachio rice cakes, the average score was 3.38 (SD = 0.78); the development of rice cake technology a sub-factor of the plan to popularize pistachio rice cake products scored an average of 3.99 (SD = 0.63) points. Referring to the development of a rice cake specialty brand, which is a sub-factor of the popularization plan of pistachio rice cake products, the average score was 4.02 (SD = 0.66), and the training of traditional rice cake experts scored 3.97 (SD = 0.72) points.

Finch and West (1997) suggested that the measured variables satisfy the normal distribution assumption when the absolute values of skewness and kurtosis do not exceed 2 and 7, respectively. However, SPSS assumes normal distribution as the kurtosis is closer to zero. Therefore, in this study, if both skewness and kurtosis did not exceed an absolute value of 2, the normal distribution assumption was considered satisfied.

After calculating skewness and kurtosis, the results indicate that skewness ranges from −0.95 to −0.25 and kurtosis ranges from 0.54 to 2.66. These values do not exceed the absolute value of 2 in any of the variables, suggesting that the assumption of univariate normality is satisfied. Based on these results, it is appropriate to use the maximum likelihood method to verify the significance of the research model as it assumes normal distribution in all variables.

Table 3 shows the results of Pearson's correlation analysis, which was conducted to examine the correlation between pistachio perception, purchasing behavior of pistachio rice cakes, and popularization plan of the pistachio rice cake product. Looking at the variables that are correlated with the training of traditional rice cake experts, purchasing behavior of pistachio rice cake products, and perception of pistachio rice cake products which are sub-factors of the popularization plan of pistachio rice cake products pistachio perception ( $r = 0.487, p < 0.01$ ), pistachio rice cake product purchasing behavior ( $r = 0.552, p < 0.01$ ), development of rice cake technology ( $r = 0.684, p < 0.01$ ) as a sub-factor of the popularization plan of pistachio rice cake products, and development of a rice cake specialty brand ( $r = 0.818, p < 0.01$ ), also a sub-factor of the pistachio rice cake product popularization plan, had significant positive (+) correlation with the training of traditional rice cake experts as a sub-factor of the pistachio rice cake product popularization plan.

**Table 3.** Correlation between related variables.

Division	1	2	3	4	5
1. Perception	1				
2. Purchase behavior	0.582 **	1			
3. Rice cake technology development	0.536 **	0.556 **	1		
4. Development of a brand specialty in rice cake	0.533 **	0.597 **	0.812 **	1	
5. Nurturing traditional rice cake experts	0.487 **	0.552 **	0.684 **	0.818 **	1

\*\*  $p < 0.01$ .

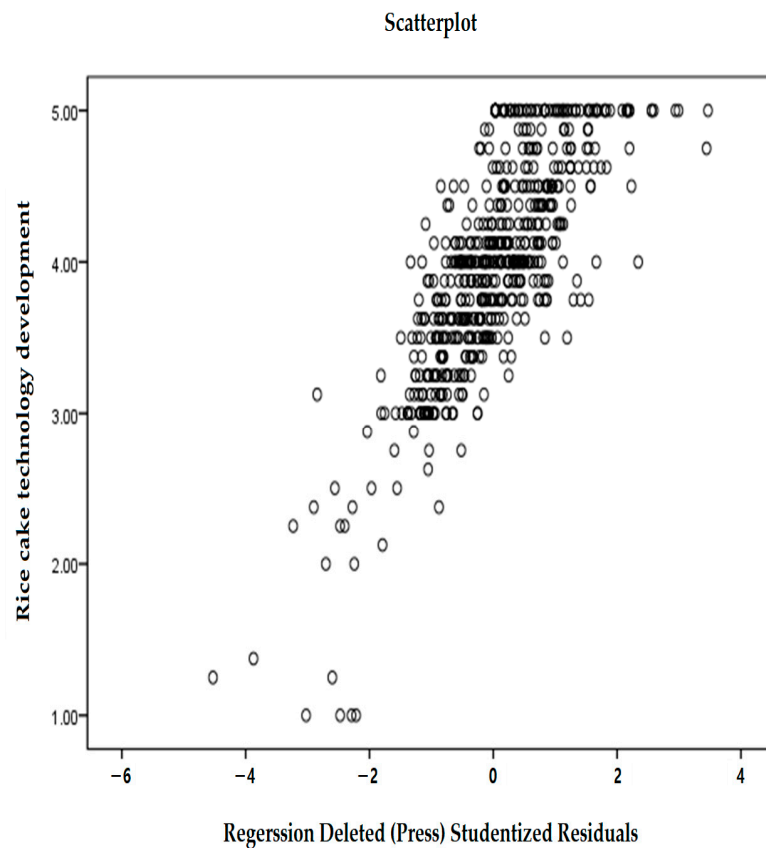
Therefore, pistachio perception, purchasing behavior of the pistachio rice cake product, and plan to popularize the pistachio rice cake product were found to have a close relationship.

Table 4 shows the results of multiple regression analysis conducted to examine the effects of pistachio perception and pistachio rice cake purchasing behavior on the development of rice cake technology. Figure 3 is the validation result for the Studentized Residuals analysis. The explanatory power of the model was about 37.5% ( $R = 0.375$ ), and the model was found to be suitable ( $F = 173.555$ ,  $p < 0.001$ ). In addition, the VIF was 1.512, which was below the reference value of 10, indicating that there was no multicollinearity between the independent variables. Pistachio perception ( $t = 7.949$ ,  $p < 0.001$ ) and purchasing behavior of pistachio rice cake products ( $t = 9.081$ ,  $p < 0.001$ ) were found to have a significant positive (+) effect on the development of rice cake technology.

**Table 4.** Effects of Pistachio Perception and Pistachio Rice cake Product Purchasing Behavior on Rice cake Technology Development.

Dependent Variable	Independent Variable	Non-Standardized Coefficient		Standardization Coefficient	t	VIF	R <sup>2</sup>	F
		B	S.E.	$\beta$				
Rice cake technology development	(A constant)	1.793	0.126		14.272 ***			
	Perception	0.323	0.041	0.322	7.949 ***	1.512	0.375	173.555 ***
	Purchase behavior	0.298	0.033	0.368	9.081 ***	1.512		

\*\*\*  $p < 0.001$ . Durbin-Watson: 1.861.



**Figure 3.** Regression standardized residuals. The verification results for the regression studentized residuals are shown in Figure 3. The scatter plot shows that the  $y$ -axis increases as the  $x$ -axis increases. As a result of analyzing the data, it was confirmed that Korean consumers' perception and purchasing behavior of pistachio rice cake had a significant effect on the development of rice cake technology.



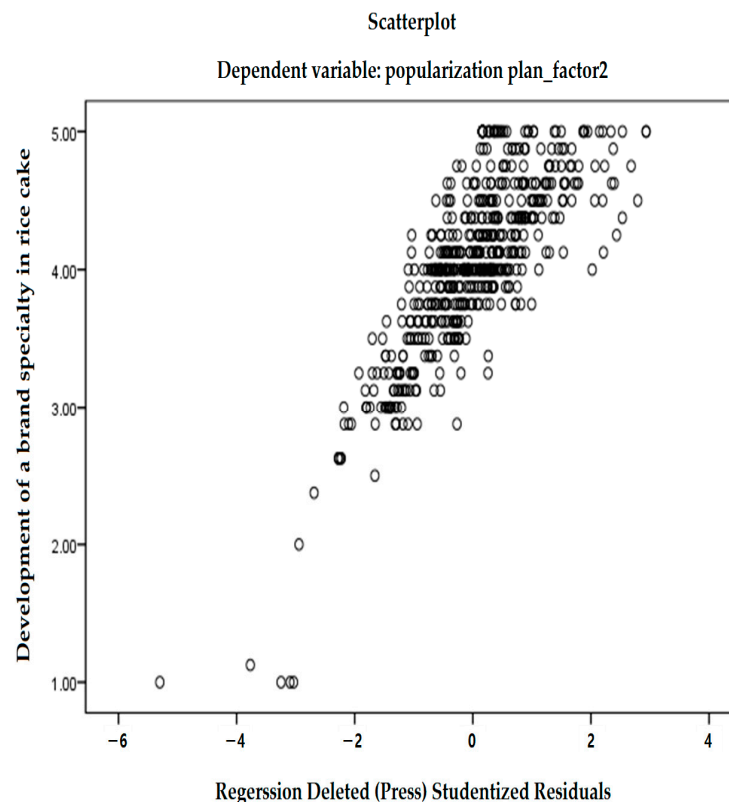
Notably, the study found that the influence of pistachio rice cake product purchasing behavior ( $\beta = 0.368$ ) > was greater than that of pistachio perception ( $\beta = 0.322$ ).

Table 5 presents the findings of a multiple regression analysis conducted to explore the impact of pistachio perception and purchasing behavior of pistachio rice cake products on the development of a specialty rice cake brand. Figure 4 is the validation result for the Studentized Residuals analysis. The explanatory power of the model was approximately 40.7% ( $R = 0.407$ ), which was deemed appropriate ( $F = 197.997, p < 0.001$ ). In addition, the VIF was 1.512, which was below the reference value of 10; thus indicating no multicollinearity between the independent variables.

**Table 5.** Effect of Pistachio Perception and Pistachio Rice Cake Product Purchasing Behavior on Development of Rice Cake Specialty Brand.

Dependent Variable	Independent Variable	Non-Standardized Coefficient		Standardization Coefficient	t	VIF	R <sup>2</sup>	F
		B	S.E.	$\beta$				
Development of a brand specialty in rice cake	(A constant)	1.677	0.129		12.999 ***			
	Perception	0.296	0.042	0.280	7.101 ***	1.512	0.407	197.997 ***
	Purchase behavior	0.370	0.034	0.434	10.988 ***	1.512		

\*\*\*  $p < 0.001$ . Durbin-Watson: 1.974.



**Figure 4.** Regression standardized residuals. The verification results for the regression studentized residuals are shown in Figure 4. The scatter plot shows that the  $y$ -axis increases as the  $x$ -axis increases. As a result of analyzing the data, it was confirmed that Korean consumers' perception and purchasing behavior of pistachio rice cake had a significant effect on the development of a brand specialty in rice cake.

The results revealed that both pistachio perception ( $t = 7.101, p < 0.001$ ) and pistachio rice cake purchasing behavior ( $t = 10.988, p < 0.001$ ) had a significant positive (+) effect on the development of a specialty rice cake brand.

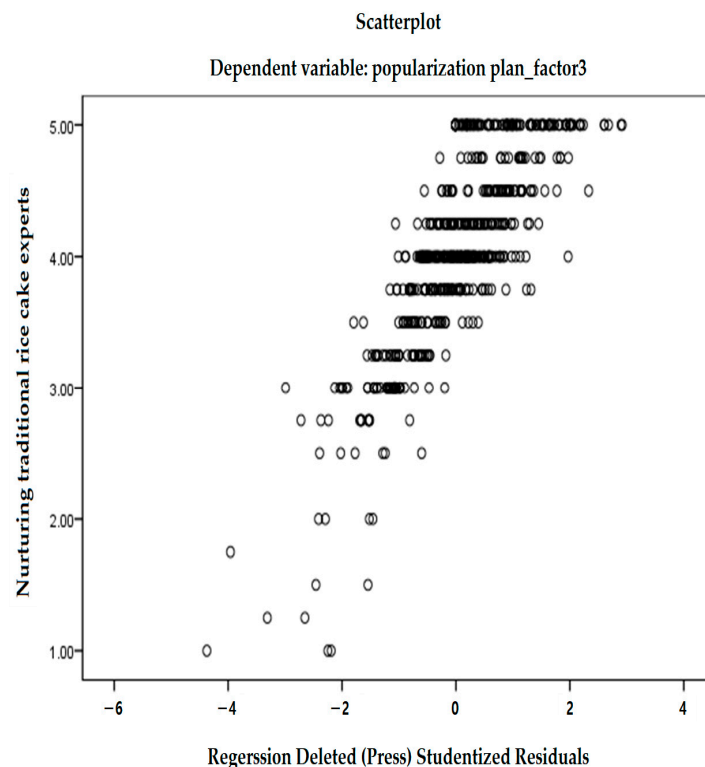
Furthermore, among these factors, the purchasing behavior of pistachio rice cake products ( $\beta = 0.434$ ) was found to have greater influence on the development of a specialty rice cake brand compared to pistachio perception ( $\beta = 0.280$ ).

Table 6 presents the results of a multiple regression analysis conducted to investigate the impact of pistachio perception and purchasing behavior of pistachio rice cake products on the training of traditional rice cake experts. Figure 5 is the validation result for the Studentized Residuals analysis.

**Table 6.** Effects of Pistachio Perception and Pistachio Rice cake Product Purchasing Behavior on Rice cake Technology Development.

Dependent Variable	Independent Variable	Non-Standardized Coefficient		Standardization Coefficient	t	VIF	R <sup>2</sup>	F
		B	S.E.	$\beta$				
Nurturing traditional rice cake experts	A constant	1.636	0.147		11.113 ***			
	Perception	0.289	0.048	0.252	6.060 ***	1.512	0.344	151.819 ***
	Purchase behavior	0.375	0.038	0.405	9.762 ***	1.512		

\*\*\*  $p < 0.001$ . Durbin-Watson: 2.001.



**Figure 5.** Regression standardized residuals. The verification results for the regression studentized residuals are shown in Figure 5. The scatter plot shows that the  $y$ -axis increases as the  $x$ -axis increases. As a result of analyzing the data, it was confirmed that Korean consumers’ perception and purchasing behavior of pistachio rice cake had a significant effect on the nurturing of traditional rice cake experts. It should be noted in this study is that pistachio rice cakes, which can be said to be safe and sustainable food, are important and necessary.

The model's explanatory power was about 34.4% ( $R = 0.344$ ), so the model was determined to be adequate ( $F = 151.819$ ,  $p < 0.001$ ). Moreover, the VIF was 1.512, which was below the standard value of 10, indicating that there was no multicollinearity between the independent variables.

The results suggest that Pistachio perception ( $t = 6.060$ ,  $p < 0.001$ ) and purchasing behavior of pistachio rice cake products ( $t = 9.762$ ,  $p < 0.001$ ) have a significant positive (+) effect on the nurturing of traditional rice cake experts.

Of the two variables, the purchasing behavior of pistachio rice cake products ( $\beta = 0.405$ ) was found to wield greater influence than pistachio perception ( $\beta = 0.252$ ) in fostering traditional rice cake experts.

The purpose of this study was to test hypotheses. Pistachio perception was found to have a significant effect on purchase behavior.

In addition, it was found to have a significant effect on rice cake technology development, development of a brand specialty in rice cake, and nurturing traditional rice cake experts, which are sub-factors of pistachio rice cake's purchasing behavior and popularization plan. Although the analysis technique and direction of this research are different, residual analysis was conducted to find out how the two independent variables affect the dependent variable. Therefore, the scatterplot shown in the figure shows that the  $y$ -axis increases as the  $x$ -axis increases.

#### 4. Discussions

As consumers' interest in immunity enhancement, antioxidant function, eco-friendly food, and sustainable food increased due to COVID-19, there was a need to solve health, environmental, and social problems. Accordingly, in all fields, we are focusing on research as a task to be considered and solved with emphasis on safety and sustainability for the present and future. In addition, as more and more consumers adopt a health-oriented mindset, products that meet consumer needs and which are beneficial to health must be provided. Therefore, this study aims to present an effective direction for the rice cake industry by developing pistachio rice cakes and seeking purchasing behavior.

Research and development are continuing with emphasis on food safety and sustainability for the entire process from how ingredients are grown and how food is made to consumption. It is being developed by using natural fungicide and organic farming method when growing wheat, and quality is improved as safe and sustainable food by adding high-protein insects, legumes, and fiber to breads, bread, pasta, bakery products, snacks, and juices [61–64].

As a result of the investigation by Yoon et al. [65], people were found to buy traditional rice cakes for health (improvement of constitution, diet). In addition, in the study of Kim et al. [66], it was shown that rice cakes were eaten as a health food. In particular, they cited the need for continuously developing traditional rice cakes using good immunity-enhancing foods, customized functional foods, and modern functional ingredients [66]. As the importance of health and sustainability is emerging every year, an increasing amount of research is being conducted to promote solutions that reduce environmental impact while promoting human health. The results of the previous study indicated that there was a high demand to develop rice cakes by adding functional ingredients, specifically those that promote health, such as Seolgitteok [67]. These results show the necessity and importance of developing Korean traditional food, rice cake. Therefore, some Korean food companies are selling rice cake products as health functional foods and sustainable foods beneficial to the global environment.

Rice cake is mainly made of rice flour, although glutinous rice flour, potato flour, starch, and other grain flour may also be used. In addition, salt, sugar, pulses, vegetables, fruits, nuts, alcoholic beverages, dairy products, etc., are added, kneaded, and cooked [68]. Tteok, a traditional Korean food, is a valuable food that has been handed down to date and is beneficial in terms of nutrition and health. Using no food additives but developed using only vegetable ingredients, pistachio rice cake can be said to be safe, sustainable, and func-

tional food. Rice cakes with a long history are currently being researched and developed according to consumer tastes and trends and are featured in many news and articles.

Garaetteok, Jeolpyeon, and Baekseolgi are filled with red beans, sweet potatoes, cheese, vegetable spread, jam, etc., and are popular among all ages [69]. In order to inherit the heritage of rice cakes, it is necessary to maintain the traditional parts while focusing on nutrition, health, and eco-friendliness and continue to develop them. Antioxidant tests have revealed high amounts of polyphenols [18]. Therefore, pistachio rice cake is a sustainable food that contributes to the healthy life of present and future generations and minimizes environmental pollution, and is expected to influence consumers' purchasing behavior.

Despite the growth of the rice cake industry in Korea, there are few studies on this field. Therefore, we developed pistachio rice cake, which can be considered safe and sustainable food, and analyzed consumer purchasing behavior and popularization plans. Perception and pistachio rice cake buying behavior were confirmed to have a significant influence on the popularization plan and were closely related to each other.

These results are consistent with the research findings that higher satisfaction with rice cakes and hangwa affects purchase [56], the research results of Hwang [70] that there is a significant difference in purchasing motivation depending on the perception of rice cakes, and the research results that popularization is influenced by the motivation to buy rice cakes [58,71]. A positive attitude toward Yak-sun food, Korea's representative cuisine, is strongly associated with a greater tendency to purchase it among Korean consumers [72]. In addition, previous studies with similar data analysis results supporting the hypothesis of this study showed that environmental awareness was positively related to organic food purchase intention [73]. What differentiates this study from other studies is the development of pistachio rice cake as a safe and sustainable food and the investigation on purchasing behavior and popularization plans. Given the increasing need for research on rice cakes, there are studies on the purchasing behavior and popularization of rice cakes, but they have not been confirmed. Therefore, the positive results of the purchasing behavior of pistachio seolgi rice cake indicate the importance of safe and sustainable pistachio rice cakes and the need to popularize them.

The subjects of this study do not represent all Korean consumers. In other words, it is one of the main limitations because this study was conducted with a small number of data as a convenient sampling method among non-probability sampling methods. In addition, it is necessary to conduct sustainable rice cake development research to reduce impact on food safety and environment, and additional research on purchasing behavior is needed to explore more diverse methods. Moreover, workers in the rice cake market, various researchers, and officials in the field of rice cakes should dedicate themselves more to researching sustainable rice cakes.

## 5. Conclusions

The structure of this study presented a consistent theoretical framework to guide the purchasing behavior of sustainable pistachio rice cakes. It is thought that it will be possible to meet the social demand for sustainable pistachio rice cake through the introduction of related concepts and data. Therefore, our data results are believed to play a decisive role in the current context of growing consumer interest in health, sustainability, and traditional food. Pearson's correlation analysis was conducted to examine the correlation between pistachio perception, pistachio rice cake purchasing behavior, and pistachio rice cake popularization measures, and they were found to have a close relationship. In addition, as a result of multiple regression analysis, perception and purchasing behavior of pistachio rice cake products were found to have a significant positive (+) effect on rice cake technology development, development of a brand specializing in rice cakes, and cultivation of traditional rice cake experts. The research proved that rice cake, a traditional Korean food, is a valuable food with food safety and potential as a sustainable food. The research results can be said to have a positive impact on the future and the global environment and are helpful in promoting the value and culture of the rice cake industry and business.

In addition, consumption rate is expected to increase due to the nutrition and efficacy of pistachios, an important ingredient of pistachio rice cakes. As interest in Korean culture and food has increased worldwide due to the Korean Wave, research on purchasing behavior and popularization of rice cake among Korean traditional foods is necessary and essential. The study is considered appropriate in addressing the food problem an unspoken concern of the rice cake industry by showing and discussing food safety, sustainability issues, purchasing behavior, and popularization plans.

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