

## 식품표시에 대한 소비자 인식과 식품 구입: 식품위해 인식의 조절효과를 중심으로

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### Perception of Food Labeling and Purchase of Food: The Moderating Effect of Food Risk Perception

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#### Abstract

This study examined the influence of perceptions of food risk and food labeling on the purchase of labeled food items and the intention to pay higher prices for safe food. Data were obtained from the Korea Rural Economic Institute's Consumer Behavior Survey for Food 2020. The analysis focused on the responses of 6,355 consumers, all of whom were mainly responsible for food purchases. The analysis investigated the moderating effect of food risk perception on the relationship between food labeling perception and the purchase of labeled food. Regarding the purchase of labeled food, statistically significant effects were noted for gender, educational level, perception of food labeling, and perception of food risk; however, the interaction effect of perceptions of food labeling and food risk was not statistically significant. With regard to the intention to pay higher prices for safe food, except for age, statistically significant effects were observed for gender, educational level, food expenditure, perception of food labeling, and perception of food risk; moreover, the interaction effect of perceptions of food labeling and food risk was significant. The results indicate that consumers reporting low food labeling perception and low purchase of labeled food were most vulnerable regarding food safety; therefore, it is necessary to provide such consumers with food label provision methods and specified education programs.

#### Keywords

perception of food labeling, perception of food risk, purchase of labeled food, intention to pay high prices for safe food

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## Introduction

Food safety is defined as a set of methods for handling, preparing, and storing food to preserve food quality and prevent contamination and food-borne illnesses (Song & Yoo, 2008; Yoon & Kim, 2013). The pandemic has not only heightened global awareness around health and immunity but also emphasized the critical nature of hygiene management in preventing the spread of infectious diseases, thereby influencing consumer concerns about food safety (Kim, 2020). This increased emphasis on selecting safe food reflects a broader shift in societal attitudes toward health and safety in response to the pandemic (Galanakis,

2020).

Furthermore, the integration of Korea into the global food market has introduced unique challenges, including extended distribution chains and amplified consumer demands for higher food quality and safety standards. These challenges highlight the complexities of modern food safety paradigms where technological advancements in food production introduce new risks (Choi et al., 2019; Kim, 2022). These developments underscore the importance of effective operational policies and individual efforts to cope with food risks.

Consumer perceptions of safety, significantly shaped by their ability to recognize hazards and access diverse food-related information, play a crucial role in determining attitudes and behaviors toward food safety. This subjective nature of safety perception, influenced by individual risk assessment and information processing, reveals the complexity of consumer decision-making in the context of food safety (Jenkins et al., 2020; Slovic, 2010; You & Ju 2017). Moreover, the psychological dimensions of risk perception, where subjective interpretation often outweighs objective data, indicate a significant gap in understanding how Korean consumers internalize and respond to food labeling information (Fischhoff et al., 1978; Santeramo & Lamonaca, 2021; Yeung & Morris, 2001).

In this complex landscape, food labeling emerges as a pivotal tool for empowering consumers to make safe and informed choices, serving as a key mechanism for navigating the modern food market's complexities (Krieger et al., 2013). Proper labeling not only enhances consumer knowledge but also provides them with the means to actively safeguard against potential food risks (Lee, 2019). Despite its importance, there's a concerning gap in understanding and effectively using food labels among Korean consumers, pointing to a disconnect between policy efforts and practical consumer application (Choi & Kang, 2015; Jun, 2017; Kim & Kim, 2012; Lee, 2008).

The limited awareness and use of food labels, especially those indicating food risks such as additives, pesticides, and

GMOs, underscore the urgent need for more comprehensive research into how consumers perceive and utilize food labeling. Studies targeting Korean consumers have found a tendency to overlook food labels in making food choices, suggesting a lower awareness about the importance of labels in identifying food risks and often resulting in habitual food choices without considering the safety indicated by labels (Choi & Kang, 2015; Jun, 2017; Kim & Kim, 2012; Lee, 2008).

Addressing this gap, the current study aims to investigate the dynamic relationship between the Perception of Food Risk (PFR) and Perception of Food Labeling (PFL), focusing on enhancing consumer understanding and effective use of food labels to foster more informed decision-making in food purchases. This is crucial for empowering individual consumers and broader public health promotion, considering the implications of these decisions on dietary choices and health outcomes (Martini & Menozzi, 2021; Staub et al., 2022).

This approach aims to offer a rich and detailed understanding of consumer behavior in the realm of food safety. By examining how different aspects of food labeling, such as clarity, trustworthiness, and relevance, affect consumer decisions, this research seeks to provide valuable insights for policymakers and educators. These insights are intended to guide the development of strategies that not only inform but also empower Korean consumers in making safer food choices, thereby enhancing public health and well-being (Bearth & Siegrist, 2016; Grunert et al., 2014). To this end, the study poses the following research questions: (a) What is the perception of food labeling according to participants' demographic variables? (b) What is the perception of food risk according to demographic variables? (c) How does the perception of food risk moderate the relationship between the perception of food labeling and the purchase of labeled food? (d) How does the perception of food risk moderate the relationship between the perception of food labeling and the intention of paying a high price for safe food?

## Theoretical Background

### 2.1 Food Labeling

The food labeling system is used to satisfy consumers' safety-seeking needs by providing accurate food-related information to ensure consumers' health and safe eating habits (Lee, 2019). Food labeling can be used for systematic tracking and management of production and distribution information from the suppliers, with the advantage that consumers can choose foods safely and rationally based on hygiene- and safety-related information through food labeling.

The food labeling system in Korea is operated according to the classification standards and is divided into mandatory and voluntary labeling. In the case of mandatory labeling, the law stipulates labeling to protect consumers, while voluntary labeling is operated through a certification system to encourage production (Kim et al., 2018). Mandatory label information includes essential information on nutrition, consumer caution/warning, traceability, indication of sodium content, GMO and non-GMO content, irradiation, and freshness. In contrast, voluntary labeling includes information such as hazard analysis critical control point (HACCP), Good Agricultural Practices (GAP), certifications of being eco-friendly, health functional foods, children's preference food quality, low-carbon agricultural products, animal welfare, geographical indication, traditional food quality, alcohol quality, as well as Korean Industrial Standard (KS) certifications.

In addition, if food labels are divided by attributes according to the system's operational purpose, attributes such as quality standards, hygiene and safety, environmental ethics, and nutritional health are considered (Kim et al., 2018). The quality standard attributes include certifications like traditional food quality, alcohol quality, KS, agricultural standard, and geographical indication. The hygiene and safety attributes include HACCP, GAP, irradiated food labeling, and traceability management. The environmental ethics attributes include certifications in organic processing, organic products, organic livestock

products, pesticide-free agricultural products, antibiotic-free livestock products, low-carbon livestock production, and animal welfare. Finally, the nutritional health attributes include sodium content, healthful functional food, and children's preferred food quality certifications.

Most previous research on food labeling was limited to individual labeling systems, such as genetically modified food (Hwang & Nam, 2021; Nam & Lee, 2022), health supplements (Moss, 2006; Vincent, 2017), and nutrition labeling (Brecher et al., 2000; Wang et al., 1995). This study, however, is not limited to analyzing consumers' perceptions and characteristics of individual specific food labels but instead examines differences in consumers' perceptions of the overall food labeling system.

### 2.2 Perceptions of Food Labeling (PFL)

Food labeling is an essential source of information in food selection and purchasing behavior and serves as a criterion for consumer purchasing choices. It effectively addresses and solves the consumer information asymmetry in the food selection market (Choi & Kang, 2015). Therefore, the Korean government has implemented policies to manage, promote, and educate consumers about food-related labeling and certification systems. Nevertheless, if consumers do not confirm or understand food labeling information, or if there is no change in purchasing behavior by food label recognition, it is difficult to evaluate the impact of the food labeling policy. Generally, consumers do not use food labeling properly (Miller & Cassady, 2015). Jackey et al. (2017) showed that although most consumers were familiar with food labels, fewer than half were able to interpret food labels accurately. According to the 2017 Food Behavior Survey by the Korea Rural Economic Research Institute, 51.4% of Korean adults asserted the importance of food labeling information in choosing food; however, only 18.3% answered that they use it.

In today's evolving consumer environment, where preferences and concerns about food safety are ever-changing, PFL is increasingly being recognized as an advanced level of understanding and a fundamental initial

stage of knowledge. This stage encompasses awareness and familiarity with labeling information, which is essential in shaping consumer attitudes and behaviors toward food choices. At this initial stage, PFL includes recognizing labels and gaining a general understanding of their meanings, such as the implications of organic certification or non-GMO labels (Visschers & Siegrist, 2015). This early recognition and understanding lay the groundwork for more informed consumer decisions, with consumers often relying on their initial perceptions of labels to make quick judgments (Miller & Cassady, 2015).

The impact of sociodemographic factors on consumer interactions with food labeling information is crucial, with education level, age, and gender as significant determinants. The role of education is evident, as higher education levels are associated with an enhanced understanding and utilization of food labels, suggesting that educational attainment is a critical factor in promoting label literacy (Drichoutis et al., 2006). This underscores the potential of education to equip consumers with the skills to interpret food labels effectively, thereby enabling more informed food choices.

Age differences also play a role, with younger and older consumers displaying varying preferences and understandings, reflecting generational shifts in food-related concerns and awareness (Shamim et al., 2022; Van der Merwe et al., 2013). Younger individuals are less likely to check food labels (Ryu, 2016). Gender differences further influence the examination of food labels, with studies showing that women are more likely to scrutinize food labels than men (Ryu, 2016). This gender disparity suggests a deeper concern among women regarding nutritional information and food safety, potentially driving more health-conscious or informed food selection behaviors (Lee, 2019). Understanding these demographic nuances is essential for developing effective food labeling policies and education programs that address the diverse needs and behaviors of the consumer base, thereby fostering a more informed and health-conscious society.

Recent studies have further emphasized the importance of PFL in bridging the gap between essential label

perception and more informed, information-based decision-making. Even a fundamental level of label awareness can significantly impact consumer purchasing behavior, underscoring the vital role of PFL in enabling informed consumer choices (Jacobs et al., 2011; Lundeberg et al., 2018). It has been observed that consumers' knowledge of food label information is closely linked with their level of informedness about nutrition, thereby affecting their purchasing decisions (Shamim et al., 2022).

### 2.3 Perception of Food Risk (PFR)

Perception of Food Risk (PFR) revolves around the subjective interpretation of potential dangers in food consumption. Risk, as characterized by Slovic (1993), pertains to the probability or uncertainty of facing an undesirable event. This notion emphasizes that personal subjectivity shapes risk perception more than objective data. The amalgamation of personal judgment and various cognitive and situational factors, as discussed by authors like Siegrist (2000) and Sjoberg (2001), further complicates this individualized perception. Consequently, this complexity necessitates that government entities, serving as risk managers, are attuned to the diverse consumer concerns regarding food risks.

Food risks can be classified into various categories depending on the criteria used. Kramers and Ravenswaay (1989) broadly divide food risks into chemical and biological hazards. The chemical hazards are subdivided into natural toxins and chemical additives (such as agrochemicals, food additives, altered GMOs, etc.) and environmental contaminants (including heavy metals, antibiotics, hormones, pesticide residues, etc.). On the other hand, biological hazards are split into bacteria (food poisoning bacteria, various germs, etc.) and zoonotic diseases (such as Bovine Spongiform Encephalopathy – BSE, etc.). The food risks mentioned vary over time; while some factors like food additives, pesticide residues, and GMOs are consistently discussed, others such as BSE, radioactive contamination, avian influenza, and foot-and-mouth disease are highlighted only during specific periods when they become

relevant social issues.

This study considers food risk factors to include foreign substances, pesticide residues, the use of antibiotics in livestock and fish, inherent toxicity, food additives, heavy metals and endocrine disruptors, food poisoning bacteria, diseases in livestock, genetically modified organisms (GMOs), irradiated food, packaging hazards, and allergens. This classification allows for a comprehensive understanding of the various risks associated with food consumption, facilitating a more targeted approach to managing and mitigating these hazards.

Studies exploring the factors influencing PFR have indicated that objective knowledge about food can significantly reduce consumers' psychological perception of risk (Klerck & Sweeney, 2007). This understanding implies a vital role for consumer education in alleviating undue anxiety about food risks. Research has shown that consumers' responses to food risks, such as fear or rejection, are often rooted in a lack of familiarity or perceived severity of these risks (Fife-Schaw & Rowe, 1996; Tucker et al., 2006). Additionally, the influence of specific factors like harmful ingredients or genetic modification on consumer decisions has been noted as overshadowing the impact of demographic variables (Gifford & Bernard, 2007).

However, the role of demographic factors in shaping PFR is undeniable. Research indicates that individuals with higher income or education levels generally exhibit lower anxiety about food risks (Hogan & Berning, 2012). In contrast, studies have found that women, particularly older ones or those with higher education, tend to have higher levels of anxiety regarding food hazards (Jun, 2014). This increased concern is linked to a heightened responsibility for family health. Specifically, research focusing on women raising children has highlighted their significant anxiety levels about food risks, underscoring their proactive approach to food risk management for their family's health (Davidson & Freudenburg, 1996).

These findings call for the need for customized communication strategies in food safety. These strategies should be designed to address various demographic groups'

concerns and information needs. For instance, educational interventions could be pivotal in mitigating anxiety among higher-income or more educated groups, while targeted information could specifically address the concerns of women, especially those raising children.

The moderating effects of PFR on the relationship between PFL and food purchasing decisions are highly significant. Research has shown that when individuals perceive high levels of food risk, they are more inclined to scrutinize food labels, leading to more informed and cautious food choices (Siegrist, 2000; Slovic, 1993). For instance, studies such as Kang et al. (2021) have observed a change in consumer concerns about food additives, reflecting how evolving PFR, influenced by increased awareness and education, can change in how consumers interact with food labels and, ultimately, their purchasing decisions. Furthermore, the research underscores the critical role of information, mainly as conveyed through food labeling, in molding the PFR and subsequently affecting consumer behavior (Miles & Frewer, 2003). This emphasizes the importance of food labels in providing consumers with the necessary information to make informed decisions regarding food safety, thereby highlighting the integral link between adequate labeling, consumer risk perception, and behavioral responses. These findings suggest that PFR is a critical moderator in the relationship between PFL and food purchases. This indicates that strategies focused on enhancing food label clarity and consumer education can effectively influence food purchasing decisions toward safer choices.

## 2.4 Safe Food Purchase

The exploration of consumer behavior in food purchasing within this study is methodically segmented into two core aspects: the decision-making process behind buying of labeled food (BLF) and the intention to paying a high price for safe food (IHPS). This bifurcated approach provides a detailed insight into the complex interplay between food labeling and consumer purchase decisions, emphasizing the role of both informational and psychological factors in

shaping these behaviors.

The inclination to opt for labeled food is significantly influenced by the information on these labels, ranging from nutritional content to provenance details. Labels are critical signals of quality, safety, and other desirable attributes, steering consumers toward certain products (Urala & Lähteenmäki, 2007). The success of these labels in transmitting valuable information hinges on their clarity and reliability, which directly affects consumer choice, highlighting the necessity for transparent and accurate food labeling (Caswell & Mojduszka, 1996).

On the other hand, IHPS for the assurance of food safety zeroes in on a distinct facet of consumer behavior that revolves around the quest for safety. This willingness is not only guided by the presence of safety labels but also by individual perceptions of risk associated with food consumption (Verbeke, 2005). The premium placed on safety, often molded by personal experiences and beliefs regarding food risks, prompts consumers to invest more in products perceived as be safer or that adhere to higher safety standards (Lobb et al., 2007).

Consumers actively seek out products with extended shelf lives, organic credentials, reputable brands, locally sourced ingredients, and non-GMO certifications as a strategy to mitigate the risks posed by hazardous foods (Jun, 2017). The perception of food-related risks has been positively linked to the inclination towards selecting safer food options (Song & Yoo, 2008), with consumer anxiety about food risks also favoring the purchase of eco-friendly products (Jun, 2014). Additionally, evidence suggests that consumers attentive to nutritional labels tend to make healthier food choices, as seen in preferences for products and menus with better nutritional profiles (Drichoutis et al., 2005; Krieger et al., 2013). This is further supported by findings that individuals who consult nutritional labels show a significantly higher intake of fruits and vegetables and a lower intake of fats (Satia et al., 2005), alongside more healthful consumption patterns in terms of calories, fats, cholesterol, sodium, dietary fibers, and sugars (Ollberding et al., 2011).

However, there is a contrasting narrative in some studies that suggests a reluctance among consumers to engage with nutrition and food safety labels, with no notable behavioral change post-consultation. Instances include adolescents who, despite their skepticism towards the safety of food additives, disregard nutritional education in favor of impulsive and simplistic buying patterns (Song & Choi, 2013). Similarly, the provision of calorie information in fast-food outlets was reported to have no significant effect on altering food selections across various demographics, including teenagers, adults, and the economically disadvantaged, possibly due to the perception that nutritional labeling demands a behavior change (Grunet & Wills, 2007).

This nuanced exploration maintains the original content's integrity while ensuring a logical and cohesive flow, thereby effectively mapping the intricate relationship between food labeling and consumer purchasing behaviors.

## Materials and Methods

### 3.1 Data

This study utilized the 2020 Consumer Behavior Survey for Food (CBSF) data from the Korea Rural Economic Institute. The data was collected via face-to-face interviews from June 10 to August 21, 2020. The CBSF included diverse questions encompassing aspects such as food purchasing habits, preferences for specific food types, attitudes toward food labeling and safety, and factors influencing food choices. A stratified sampling method was employed to ensure the survey's representativeness. This approach involved dividing the broader consumer population into subgroups based on age, gender, geographical location, and income level. The CBSF employed a stratified sampling method targeting consumers aged between 19 and 75 years residing across 16 metropolitan cities. This study focused on analyzing responses from 6,355 consumers who primarily handled food purchasing decisions. The overall demographic profiles of these participants are shown in Table 1.



**Table 1.** Demographic Characteristics of Participants

Characteristics		Frequency (%)
Gender	Male	2820 (44.4)
	Female	3535 (55.6)
Age	19 - 29	805 (12.7)
	30 - 39	760 (12.0)
	40 - 49	1417 (22.3)
	50 - 59	1711 (26.9)
	60 - 69	1273 (20.0)
	70 - 74	389 (6.1)
Education	Uneducated	42 (0.7)
	Middle-school graduate	848 (13.3)
	High-school graduate	2836 (44.6)
	College graduate	2581 (40.6)
	Graduate	48 (0.8)
Monthly household food expenditure <sup>1</sup>	<40	1180 (18.6)
	41-60	1543 (24.3)
	61-80	1715 (27.0)
	81-100	826 (13.0)
	101≤	1091 (17.2)
Perception of Food Risk	Low	3258 (54.1)
	High	2763 (45.9)
Perception of Food Labeling	Low	3000 (47.2)
	High	3355 (52.8)
		<i>M (SD, Range)</i>
Buying of labeled food		2.50 (.66, 1-4)
Intention to pay high prices for safe food		3.60 (.58, 1-5)

Note: <sup>1</sup>South Korean 10,000 won.

### 3.2 Measures

The perception of food labeling (PFL) was rated as “2” if well known, “1” if heard of, and “0” if not known. The scores for 10 food labeling items (e.g., traditional food certification, KS for processed food, HACCP, country of origin, certified organic, geographic indication, traceability, GAP, GMO, and animal welfare certification) were summed, resulting in a scale ranging from 0 to 20 points.

The perception of food risk (PFR) is defined as a consumer’s subjective judgment about the likelihood of hazardous situations occurring in food consumption (Jun, 2017). It was measured using a 5-point Likert scale,

ranging from “not concerned at all” to “very concerned,” across 12 food safety-related items. These items include foreign substances, pesticide residues, antibiotic use in livestock and fish, inherent toxicity, food additives, heavy metals and endocrine disruptors, food poisoning bacteria, diseases in livestock, genetically modified organisms (GMOs), irradiated food, packaging hazards, and allergens. The Cronbach’s  $\alpha$  for this scale was 0.922. This study employed a median split method to categorize participants based on their PFR and PFL. Specifically, the median values were established at 44.0 for PFR and 12.0 for PFL. Accordingly, participants were divided into two distinct groups for each perception category. For PFR, individuals with scores above the median were classified into the high PFR group, indicating a higher awareness and concern for food-related risks, while those with scores below the median were placed into the low PFR group, suggesting a lower perception of food risk. Similarly, for PFL, participants with scores above the median were categorized into the high PFL group, reflecting a significant value placed on food labeling information in their purchasing decisions. In contrast, those with scores below the median fell into the low PFL group, indicating a lesser reliance on or importance attributed to food labeling. This classification method facilitated a clear differentiation among participants, allowing for targeted analyses of how varying levels of food risk and labeling perceptions influence consumer behavior and safety considerations in food purchasing.

The buying of labeled food (BLF) was rated as “1” for never purchasing products, “2” for purchasing once or twice, “3” for occasional purchases, and “4” for frequent purchases. This rating was applied for the purchase experience of the 10 items measured in PFL. The intention to pay a high price for safe food (IHPS) was measured using a 5-point Likert scale ranging from “not at all” to “very positive.”

### 3.3 Analysis

SPSS ver. 21.0 (IBM) was used to analyze the data. A chi-squared test was employed to assess whether respondents’ characteristics were related to PFL and PFR.

A general linear model (GLM) was used to examine the main and interactional effects of PFL and PFR on BLF and IHPS. A multiple linear regression, an extension of simple linear regression to multiple independent variables, is a particular case of the general linear models, bound to a single dependent variable. The standard formula for multiple linear regression is given as:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_p X_{ip} + \epsilon_i$$

for each observation  $i = 1, \dots, n$ .

In the formula above, we consider  $n$  observations of single dependent variable and  $p$  independent variables. Thus,  $Y_i$  symbolizes the  $i^{\text{th}}$  observation of the dependent variable, while  $X_{ij}$  represents the  $i^{\text{th}}$  observation of the  $j^{\text{th}}$  independent variable, with  $j$  ranging from 1 to  $p$ . The  $\beta_j$  values are parameters that require estimation, and  $\epsilon_i$  denotes the  $i^{\text{th}}$  independent error term, assumed to be normally distributed.

Within the broader context of general linear regression, for each of the  $m > 1$  dependent variables, a similar equation is employed, all sharing the same explanatory variables. These are concurrently estimated:

$$Y_{ij} = \beta_{0j} + \beta_{1j} X_{i1} + \beta_{2j} X_{i2} + \dots + \beta_{pj} X_{ip} + \epsilon_{ij}$$

for all observations indexed as  $i = 1, \dots, n$  and for all dependent variables indexed as  $j = 1, \dots, m$ .

The GLM is a foundational statistical tool that underpins a wide range of analyses commonly used in applied and social sciences (Nelder & Wedderburn, 1972). It is the basis for various statistical procedures such as the t-test, Analysis of Variance (ANOVA), Analysis of Covariance (ANCOVA), and regression analysis. Moreover, the GLM allows the inclusion of one or more control variables in the model, enabling the control of their influence while estimating the pure effects of the main independent variables. This type of

**Table 2.** Perceptions of Food Risk and Food Labeling by Demographics Characteristics

Characteristics		Perception of Food Labeling		$\chi^2$	Perception of Food Risk		$\chi^2$
		Low	High		Low	High	
Gender	Male	1473 (52.2)	1347 (47.8)	51.408***	1492 (55.7)	1188 (44.3)	4.740*
	Female	1527 (43.2)	2008 (56.8)		1766 (52.9)	1575 (47.1)	
Age	19-29	430 (53.4)	375 (46.6)	186.033***	387 (50.9)	374 (49.1)	13.130*
	30-39	290 (38.2)	470 (61.8)		376 (52.0)	347 (48.0)	
	40-49	563 (39.7)	854 (60.3)		780 (57.4)	579 (42.6)	
	50-59	736 (43.0)	975 (57.0)		869 (53.5)	755 (46.5)	
	60-69	722 (56.7)	551 (43.3)		635 (53.4)	555 (46.6)	
	70-74	259 (66.6)	130 (33.4)		211 (58.0)	153 (42.0)	
Education	Uneducated	30 (71.4)	12 (28.6)	126.928***	18 (51.4)	17 (48.6)	13.402**
	Middle school	526 (62.0)	322 (38.0)		431 (53.9)	369 (46.1)	
	High school	1363 (48.1)	1473 (51.9)		1397 (51.8)	1301 (48.2)	
	College	1056 (40.9)	1525 (59.1)		1385 (56.7)	1059 (43.3)	
	Graduate	25 (52.1)	223 (47.9)		27 (61.34)	17 (38.6)	
Food expenditure <sup>1</sup>	<40	671 (56.9)	509 (43.1)	62.924***	577 (50.8)	559 (49.2)	35.062***
	41-60	708 (45.9)	835 (54.1)		879 (58.4)	625 (41.6)	
	61-80	789 (46.0)	926 (54.0)		810 (50.1)	806 (49.9)	
	81-100	333 (40.3)	493 (59.7)		408 (53.1)	360 (46.9)	
	101≤	499 (45.7)	592 (54.3)		584 (58.6)	416 (41.4)	

Note. <sup>1</sup>South Korean 10,000 won.  
\* $p < .05$ , \*\* $p < .005$ , \*\*\* $p < .001$



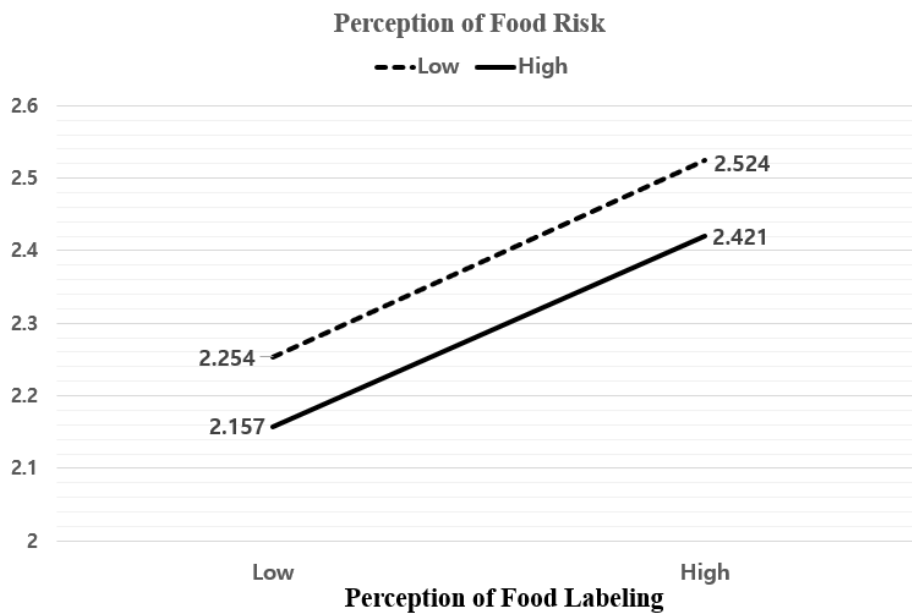
analysis can also take the form of ANCOVA, an extension of ANOVA. However, the use of GLM provides a more general and flexible approach, allowing for handling more extensive and complex data structures (Huitema, 2011). This flexibility makes it particularly suitable for factorial designs where

both main and interaction effects must be verified, as in social science research. Consequently, this study conducted an ANOVA-based GLM analysis to examine the impact of PFL and PFR on BLF and IHPS.

**Table 3.** GLM Results for the Buying of Labeled Food

Characteristics		Estimated mean (SE)	SS	df	F	p	$\eta_p^2$
Gender	Male	2.287 (.030)	6.738	1	15.856	.000	.006
	Female	2.390 (.027)					
Age	<39	2.327 (.035)	.073	2	.172	.842	.000
	40-59	2.342 (.032)					
	60<	2.348 (.032)					
High school and higher	No	2.272 (.046)	2.956	2	6.955	.008	.003
	Yes	2.406 (.020)					
Food expenditure <sup>1</sup>	<40	2.310 (.037)	1.061	2	2.496	.083	.002
	41-80	2.325 (.029)					
	80<	2.381 (.032)					
Perception of Food Labeling (A)	Low	2.205 (.036)	25.131	1	59.134	.000	.022
	High	2.289 (.033)					
Perception of Food Risk (B)	Low	2.389 (.036)	3.559	1	8.373	.004	.003
	High	2.289 (.033)					
AxB			.003	1	.007	.932	.000

Note. <sup>1</sup>South Korean 10,000 won.  
<sup>•</sup>*p*<.05, <sup>••</sup>*p*<.005, <sup>•••</sup>*p*<.001



**Figure 1.** The effects of perception of food labeling and food risk on buying of labeled food.

## Results

### 4.1 PFL and PFR according to Demographics

Table 2 shows the PFL and PFR according to participants' demographics. Regarding PFL, gender, age, education, and food expenditure were all statistically significant. The low group for men and the high group for women showed a high frequency. With an increase in age, the frequency in the low group increased, while that in the high group decreased. The results of education were inconsistent, but as food expenditure increased, the frequency of the low group decreased, whereas, the frequency of the high group increased.

Regarding PFR, factors including gender, age, education, and food expenditure were all statistically significant. Both men and women showed high frequency in the low group, and the results of education were inconsistent. In contrast, as age and food expenditure increased, the frequency in the low group increased, while that in the high group decreased.

### 4.2 Results of the GLM for BLF

Table 3 and Figure 1 show the result of the GLM for BLF. The main effects of gender, education, PFL, and PFR were statistically significant. Significant main effects were observed for gender, educational attainment (high school graduation or higher), PFL, and PFR. However, the moderating effect of PFR did not show statistical significance. Notably, PFL exerted the most substantial relative influence when considering factors such as gender, age, and education. For PFR, the average score was lower in the group with a high PFR (2,289) compared to the group with a low PFR (2,389).

### 4.3 Result of the GLM for IHPS

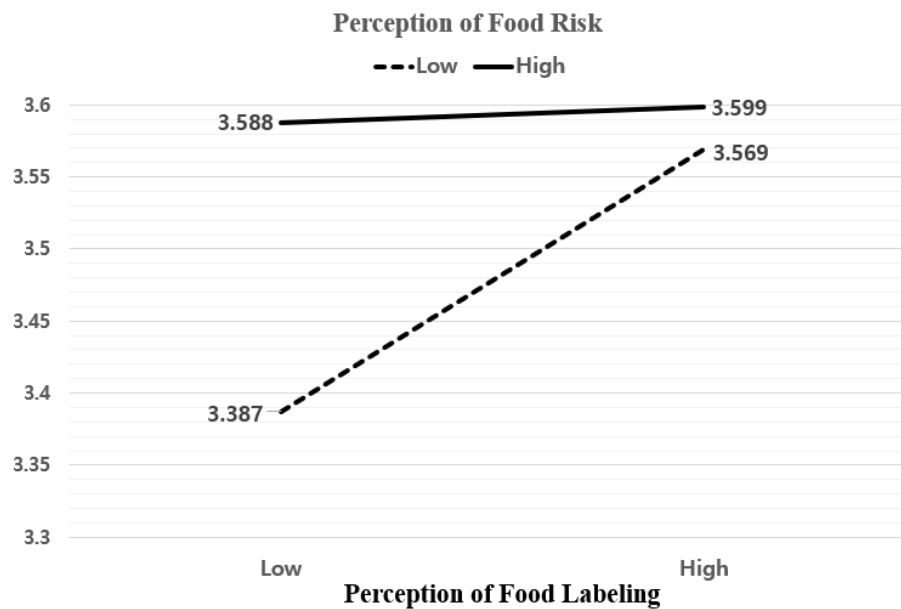
Table 4 and Figure 2 show the results of the GLM for IHPS. Except for age, the main effects of gender, education, food expenditure, PFL, and PFR were all statistically significant. The main effects ( $F=40.943, p=.000$ ) and interaction effect ( $F=60.943, p=.000$ ) of PFL and PFR were all statistically significant.

Specifically, in the group with low PFR, a notable

**Table 4.** Result of GLM for Intention to Pay a High Prices for Safe Food

Characteristics		Estimated mean (SE)	SS	df	F	p	$\eta_p^2$
Gender	Male	3.513 (.015)	3.064	1	9.390	.002	.002
	Female	3.559 (.013)					
Age	<39	3.517 (.019) <sup>a</sup>	.444	2	1.361	.257	.000
	40-59	3.537 (.016) <sup>b</sup>					
	60<	3.554 (.015) <sup>b</sup>					
High school and higher	No	3.449 (.022)	15.245	1	46.728	.000	.008
	Yes	3.622 (.010)					
Food expenditure <sup>1</sup>	<40	3.476 (.018) <sup>a</sup>	5.338	2	16.361	.000	.005
	41-80	3.529 (.014) <sup>b</sup>					
	80<	3.603 (.017) <sup>c</sup>					
Perception of Food Labelling(A)	Low	3.487 (.014)	13.358	1	40.943	.000	.007
	High	3.584 (.014)					
Perception of Food Risk (B)	Low	3.478 (.013)	19.897	1	60.943	.000	.010
	High	3.594 (.014)					
AxB			10.748	1	32.944	.000	.005

Note. <sup>1</sup>South Korean 10,000 won.  
<sup>a</sup> $p < .05$ , <sup>b</sup> $p < .005$ , <sup>c</sup> $p < .001$



**Figure 2.** The effects of perception of food labeling and food risk on buying of the intention to pay a high price for safe for food.

difference in scores was observed between the low and high PFL groups (low PFL=3,387, high PFL=3,569). In contrast, within the high PFR group, the difference between the low and high PFL groups was minimal (low PFL=3,588, high PFL=3,599), indicating that the moderating effect of PFR was prominent in the low PFL group but not in the high PFL group.

## Discussion

This study examined whether the influence of PFL on BLF and IHPS varies with PFR, using data from 6,355 adult consumers in Korea.

First, no consistent differences were found in PFR according to gender, age, education, and food expenditure, and overall, the frequency of low PFR was higher than that of high PFR in all groups. However, PFL differed according to gender, age, education, and food expenditure. Male participants showed a higher frequency of low PFL, while females exhibited a higher frequency of high PFL. Regarding age, compared to age groups, participants aged 70–74 had a higher frequency of low PFL. The results of

education were inconsistent; the group with higher food expenditure exhibited a higher frequency of high PFL.

Hogan and Berning (2012) argued that high-income or highly educated groups had lower levels of anxiety regarding food risks and perceived that they could control such risks. In contrast, women, older people, or highly educated people were found to have higher levels of anxiety about food risks compared with others (Jun, 2014). In particular, women raising children had a very high level of anxiety about food hazards, and showed a tendency to actively respond to them (Davidson & Freudenburg, 1996). Interestingly, our findings reveal a noteworthy disparity between the prevalence of low PFR and the established trends in the literature. The higher frequency of low PFR across all demographic groups in our study challenges the prevailing notion of heightened anxiety regarding food hazards among specific subpopulations.

One potential explanation for this divergence is the unique contextual factors that may have influenced our participants' perceptions of food risk. It is plausible that changes in food safety regulations, increased public awareness campaigns, or shifts in media coverage have collectively contributed to a sense of improved control over food risks among the general population (King et al.,

2017; Zanin et al., 2017). Consequently, individuals across various demographics may now perceive lower levels of food risk, leading to the observed prevalence of low PFR in our study. Moreover, the absence of consistent differences in PFR based on gender, age, education, and food expenditure suggests that contemporary society's emphasis on food safety and the availability of information may have successfully transcended these traditional demographic boundaries (Fung et al., 2018). As a result, individuals of diverse backgrounds may have access to similar resources and knowledge, which, in turn, could contribute to the convergence of low PFR levels.

Second, regarding BLF, the main effects of gender, high school graduation or higher, PFL, and PFR were statistically significant, but the interaction effect between PFL and PFR was not significant. Therefore, PFL showed the largest relative influence with regard to gender, age, and education.

In the case of PFR, the score of the low PFR group was 2.389, while that of the high PFR group was 2.289. In general, perceived risk affects consumer safety behavior (Abbot et al., 2009); however, the relationship between food-related risk perception and safe food behavior has revealed inconsistent results. Among Korean consumers, the effect of perceived risk on the purchase of safety-labeled food was positively significant in all groups (Jun, 2017). However, a study of Malaysian consumers revealed that the relationship between risk perception for diseases and the practice of food label usage was not significant (Evelyn et al., 2020). This study found that the group with a low PFR purchased more safety-labeled food.

However, the influence of PFL was found to be relatively high, and the high PFL group had a higher BLF score than the low PFL group. This result is consistent with previous studies. Food knowledge may be necessary to encourage better, safer consumer behavior (Nani, 2016). Prior food knowledge can increase food label use by increasing motivation to seek more information about safe food. A UK-based study found that prior knowledge of food labels influenced their use (Buyuktuncer et al., 2018); additionally, consumers' higher knowledge levels led them to use food

labels when purchasing food actively (Grunert et al., 2010). The results of the current study also showed that the group with a high PFL purchased more safety-labeled food than the group with a low PFL. Consumers with a high PFL for safety labeling seem to cope with food risk anxiety by using their existing knowledge. Therefore, the importance of increasing the level of consumer perception can be stressed in providing sufficient information regarding food hazards and safety labeling for safer consumption.

Third, regarding the results of the IHPS, the main effects of gender, education, food expenditure, PFL, and PFR were statistically significant. Unlike BLF, the interaction between PFL and PFR was also statistically significant. In the low PFR group, there was a significant difference in the scores of the low and high PFL groups (low PFL=3.387, high PFL=3.569), whereas, in the high PFR group, there was only a small difference between the two (low PFL=3.588, high PFL=3.599). Thus, the moderating effect of PFR was found in the low PFL group but not in the high PFL group. This suggests that consumers who lack awareness of safety labeling tend to have lower awareness of food risks, resulting in reduced confidence in purchasing safe food.

Conversely, consumers well-versed in safety labeling seem unaffected by PFR (Yu et al., 2018). When individuals with limited perception of safety labeling do not experience anxiety related to food risks, their intention to purchase safety-labeled food decreases, potentially rendering them more susceptible to risks. Consequently, there is a pressing need for food labeling to convey information easily, especially for consumers with limited familiarity with safety labeling. Furthermore, consumers with minimal knowledge of safety labeling may perceive lower risks, primarily because they remain unaware of food hazards. Hence, it is imperative to provide comprehensive and adequate information regarding food hazards and risk levels (Lee, 2016).

Effective food labeling and risk perception are pivotal factors influencing consumer choices and food safety. This study investigated how consumer perceptions of food

labeling and risk impact their choices regarding safe food consumption. Unlike previous studies that primarily focused on processed foods, nutritional labeling, or specific food-related risks, our research encompassed a broader spectrum of food risks. Furthermore, in contrast to earlier studies, which predominantly emphasized social and demographic characteristics, this study delved into the intricate relationship between food labeling, consumer perception, and behavior, specifically examining the influence of safety labels and risk perception.

Our findings underscore the vulnerability of a specific group characterized by low PFL and PFR, highlighting the need for tailored strategies and education programs to enhance food safety awareness. Notably, older individuals and those with lower educational backgrounds are more likely to belong to the low PFL and PFR groups, demanding special attention.

First, to enhance PFL among older individuals or those with lower educational backgrounds, it is essential to present food labels in more accessible formats. Empirical research by Yang and Yang (2009) has empirically demonstrated the superiority of graphical and pictorial information over textual information when conveying details about hazardous food consumption. Therefore, exploring effective methods for promoting PFL among consumers is imperative.

Second, considering that older individuals or those with limited education may find it challenging not only to comprehend food labels written in English but also to decipher professional food terminology (e.g., HACCP, GAP, animal welfare certification), a tailored consumer education program is warranted. This program should be designed to increase the utilization of labels, specifically targeting older individuals or individuals with lower education levels.

Finally, generating consumer interest in food labels is crucial to bolster overall food label awareness. Mass media channels have proven to be highly effective in achieving this objective. In conclusion, for consumers to effectively

acquire information, the display form of food labeling should be more understandable, and various consumer education programs should be provided to cater to consumers' characteristics.

The limitations of this study are as follows.

First, The analysis involved secondary data, which led to a subjective assessment of safety labeling perception, potentially introducing overestimation or underestimation of PFL. As a result, future research should incorporate objective measures to gauge safety labeling perception more accurately.

Second, a critical limitation of this study is its reliance on data from the 2020 CBSF. The decision to utilize this dataset was primarily driven by the fact that 2020 marked a significant period of change and turmoil due to the onset of the COVID-19 pandemic in South Korea. The data from 2020 was chosen to capture the consumer food selection patterns at a time when the PFR was arguably at its peak, aiming to provide insights into consumer behaviors and attitudes in the face of emerging global health challenges. However, it is important to recognize that since 2020, the pandemic has led to considerable shifts in consumer behaviors and patterns. As such, the findings from this study may not fully encapsulate the ongoing adaptations and trends in consumer food purchasing behavior that have evolved as the pandemic has progressed. Acknowledging this, future research must endeavor to include the most recent data available to accurately reflect the latest changes in consumer behavior. Incorporating updated datasets will enable researchers to assess how consumer preferences and purchasing patterns have been shaped by the long-term impacts of the pandemic.

## Declaration of Conflicting Interests

The author declares no conflict of interest with respect to the authorship or publication of this article.

## References

- Abbot, J. M., Byrd-Bredbenner, C., Schaffner, D., Bruhn, C. M. & Blalock, L. (2009). Comparison of food safety cognitions and self-reported food-handling behaviors with observed food safety behaviors of young adults. *European Journal of Clinical Nutrition*, 63(4), 572–579. <https://doi.org/10.1038/sj.ejcn.1602961>
- Bearth, A., & Siegrist, M. (2016). Are risk or benefit perceptions more important for public acceptance of innovative food technologies: A meta-analysis. *Trends in Food Science & Technology*, 49, 14–23. <https://doi.org/10.1016/j.tifs.2016.01.003>
- Brecher, S. J., Bender, M. M., Wilkening, V. L., McCabe, N. M. & Anderson, E. M. (2000). Status of nutrition labelling, health claims and nutrient content claims for processed foods: 1997 food label and package survey. *Journal of the American Dietetic Association*, 100(9), 1057–1062. [https://doi.org/10.1016/S0002-8223\(00\)00308-4](https://doi.org/10.1016/S0002-8223(00)00308-4)
- Buyuktuncer, Z., Ayaz, A., Dedebyraktar, D., Inan-Eroglu, E., Ellahi, B., & Besler, H. T. (2018). Promoting a healthy diet in young adults: The role of nutrition labelling. *Nutrients*, 10(10), 1335. <https://doi.org/10.3390/nu10101335>
- Caswell, J. A., & Mojduzka, E. M. (1996). Using informational labeling to influence the market for quality in food products. *American Journal of Agricultural Economics*, 78(5), 1248–1253. <https://doi.org/10.2307/1243501>
- Choi, J. M., Lee, S. I., Rackerby, B., Moppert, I., McGorin, R., Ha, S. D., et al. (2019). Potential contamination sources on fresh produce associated with food safety. *Journal of Food Hygiene and Safety*, 34(1), 1–12. <https://doi.org/10.13103/JFHS.2019.34.1.1>
- Choi, K. Y., & Kang, K. O. (2015) Survey on the purchasing status and perceptions of housewife with young children on food-nutrition labeling of organic food. *Food Service Industry Journal*, 11(3), 29–38. <https://doi.org/10.22509/kfsa.2015.11.3.003>
- Davidson, D. J., & Freudenburg, W. R. (1996). Gender and environmental risk concerns: A review and analysis of available research. *Environment and behavior*, 28(3), 302–339. <https://doi.org/10.1177/0013916596283003>
- Drichoutis, A. C., Lazaridis, P., & Nayga Jr, R. M. (2006). Consumers' use of nutritional labels: A review of research studies and issues. *Academy of marketing science review*, 2006(9), 1–22.
- Evelyn, H., Aziz, A. F., & Sariman, S. (2020). Associations of knowledge, attitude and practices of food label on Cardiovascular diseases (CVD) risk amongst university students in Selangor, Malaysia. *Journal of Nutrition Science and Vitaminology*, 66, S275–S282. <https://doi.org/10.3177/jnsv.66.S275>
- Fife-Schaw, C., & Rowe, G. (1996) Public perceptions of everyday food hazards: A psychometric study. *Risk Analysis*, 16(4), 487–500. <https://doi.org/10.1111/j.1539-6924.1996.tb01095.x>
- Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits. *Policy sciences*, 9, 127–152.
- Fung, F., Wang, H. S., & Menon, S. (2018). Food safety in the 21st century. *Biomedical journal*, 41(2), 88–95. <https://doi.org/10.1016/j.bj.2018.03.003>
- Galanakis, C. M. (2020). The food systems in the era of the Coronavirus (COVID-19) pandemic crisis. *Foods*, 9(4), 523. <https://doi.org/10.3390/foods9040523>
- Gifford, K., & Bernard, J. C. (2007). Influencing consumer purchase likelihood of organic food. *International Journal of Consumer Studies*, 30(2), 155–163. <https://doi.org/10.1111/j.1470-6431.2005.00472.x>
- Grunert, K. G., Fernandez-Celemin, L., Wills, J. M., Bonsmann, S. S. & Nureeva, L. (2010). Use and understanding of nutrition information on food labels in six European countries. *Journal of Public Health*, 18(3), 291–277. <https://doi.org/10.1007/s10389-009-0307-0>
- Grunert, K. G., Hieke, S., & Wills, J. (2014). Sustainability labels on food products: Consumer motivation, understanding and use. *Food policy*, 44, 177–189. <https://doi.org/10.1016/j.foodpol.2013.12.001>
- Grunert, K. G., & Wills, J. M. (2007). A review of European research on consumer response to nutrition information on food labels. *Journal of public health*, 15, 385–399. <https://doi.org/10.1007/s10389-007-0101-9>
- Hogan, J. J., & Berning, J. (2012, August). *Estimating the relationship between education and food purchases among food insecure household*. Agricultural and Applied Economics Association Conference 2012 Annual Meeting August 12–14, 2012, Seattle, Washington.
- Huitema, B. (2011). *The analysis of covariance and alternatives: Statistical methods for experiments, quasi-experiments, and single-case studies*. New Jersey: John Wiley & Sons.
- Hwang, H. S. & Nam, S. J. (2021). The influence of consumers' knowledge on their responses to genetically modified foods. *GM Crops & Food*, 12(1), 146–157. <https://doi.org/10.1080/21645698.2020.1840911>
- Jackey, B. A., Cotugna, N. & Orsega-Smith, E. (2017). Food label knowledge, usage and attitudes of older adults. *Journal of Nutrition in Gerontology and Geriatrics*, 36(1), 31–47. <https://doi.org/10.1080/21551197.2017.1280868>
- Jacobs, S. A., de Beer, H., & Larney, M. (2011). Adult consumers' understanding and use of information on food labels: A study among consumers living in the Potchefstroom and Klerksdorp regions, South Africa. *Public Health Nutrition*, 14(3), 510–522. <https://doi.org/10.1017/S1368980010002430>
- Jenkins, S. C., Harris, A. J., & Osman, M. (2020). Influence of psychological factors in food risk assessment - A review. *Trends in Food Science & Technology*, 103, 282–292. <https://doi.org/10.1016/j.tifs.2020.07.010>
- Jun, S. M. (2014). Effect of consumer anxiety about food hazards on the purchase of environment-friendly products and satisfaction of



- food consumption: The moderating effect of gender and income. *Journal of Consumer Policy and Studies*, 45(2), 77-96. <http://doi.org/10.15723/jcps.45.2.201408.77>
- Jun, S. M. (2017). The influence of consumer anxiety about food hazards on food label use and safe food purchase: Focusing on the difference test by knowledge level of safety labeling. *Journal of Consumption Culture*, 20(1), 87-108. <http://doi.org/10.17053/jcc.2017.20.1.004>
- Kang, H. J., Kim, S. N., & Kim, J. W. (2021). Trends in Korean parents' perceptions on food additives during the period 2014-2018. *Nutrition Research and Practice*, 15(3), 346-354. <http://doi.org/10.4162/nrp.2021.15.3.346>
- Kim, K. J. (2022). Food safety perception, perceived risk, and willingness to pay for safe foods of Korean and Chinese consumers. *Journal of Consumer Studies*, 33(3), 19-39. <http://doi.org/10.35736/JCS.33.3.2>
- Kim, O. H. (2020). The effects of health beliefs and prevention behavior intentions on eating out during the COVID-19 pandemic: Applying a health belief model. *International Journal of Tourism and Hospitality Research*, 34(12), 169-185. <http://doi.org/10.21298/IJTHR.2020.12.34.12.169>
- Kim, S. H., Lee, G. I., Hong, Y. A., & Huh, S. Y. (2018). *National Agri-food Labelling and Improvement of Consumers' Utilization*. Naju: Korea Rural Economic Institute.
- Kim, Y. S. & Kim, B. R. (2012). Intake of snacks, and perceptions and use of food and nutrition labels by middle school students in Chuncheon area. *Journal of the Korean Society of Food Science and Nutrition*, 41(9), 1265-1273.
- King, T., Cole, M., Farber, J. M., Eisenbrand, G., Zabar, D., Fox, E. M., et al. (2017). Food safety for food security: Relationship between global megatrends and developments in food safety. *Trends in Food Science & Technology*, 68, 160-175. <https://doi.org/10.1016/j.tifs.2017.08.014>
- Klerck, D., & Sweeney, J. C. (2007). The effect of knowledge types on consumer-perceived risk and adoption of genetically modified foods. *Psychology & Marketing*, 24(2), 171-193. <https://doi.org/10.1002/mar.20157>
- Kramer, C. S., & Van Ravenswaay, E. O. (1989). Proposition 65 and the economics of food safety. *American Journal of Agricultural Economics*, 71(5), 1293-1299. <https://doi.org/10.2307/1243124>
- Krieger, J. W., Chan, N. L., Saelens, B. E., Ta, M. L., Solet, D., & Fleming, D. W. (2013). Menu labeling regulations and calories purchased at chain restaurants. *American Journal of Preventive Medicine*, 44(6), 595-604. <https://doi.org/10.1016/j.amepre.2013.01.031>
- Lee, K. H. (2008). Study on the empirical analysis and the implications for the effective food risk Communication. *Journal of Consumer Policy Studies*, 34, 105-134. <https://doi.org/10.15723/jcps.34.200810.105>
- Lee, S. S. (2016). Food hazard awareness and food apprehension towards food safety management system evaluation: Focus on moderating effect of food safety information awareness. *Human Ecology Research*, 54(1), 69-81.
- Lee, Y. A. (2019). Determinants of consumers' awareness, satisfaction, and trust of food labelling. *Consumer Policy and Education Review*, 15(4), 97-122. <http://doi.org/10.15790/cope.2019.15.4.097>
- Lobb, A. E., Mazzocchi, M., & Traill, W. B. (2007). Modelling risk perception and trust in food safety information within the theory of planned behaviour. *Food Quality and Preference*, 18(2), 384-395. <https://doi.org/10.1016/j.foodqual.2006.04.004>
- Lundeberg, P. J., Graham, D. J., & Mohr, G. S. (2018). Comparison of two front-of-package nutrition labeling schemes, and their explanation, on consumers' perception of product healthfulness and food choice. *Appetite*, 125, 548-556. <https://doi.org/10.1016/j.appet.2018.02.027>
- Martini, D., & Menozzi, D. (2021). Food labeling: Analysis, understanding, and perception. *Nutrients*, 13(1), 268. <https://doi.org/10.3390/nu13010268>
- Miles, S., & Frewer, L. J. (2003). Comparative risk perception and foods: The impact of optimistic bias on risk communication and health promotion. *Food Info Online Features*.
- Miller, L. M., & Cassady, D. L. (2015). The effects of nutrition knowledge on food label use. A review of the literature. *Appetite*, 92, 207-216. <https://doi.org/10.1016/j.appet.2015.05.029>
- Moss, J. (2006). Labeling of trans fatty acid content in food, regulations and limits-The FDA view. *Atherosclerosis Supplements*, 7(2), 57-59. <https://doi.org/10.1016/j.atherosclerosissup.2006.04.012>
- Nam, S. J., & Lee, B. K. (2022). The moderating effect of information channel on the relationship between type of information search and knowledge of genetically modified organisms. *GM Crops & Food*, 13(1), 26-37. <https://doi.org/10.1080/21645698.2021.2015272>
- Nani, M. O. (2016). *Relationship between nutrition knowledge and food intake of college students* (Unpublished doctoral dissertation). Kent State University, Ohio, U.S.
- Nelder, J. A., & Wedderburn, R. W. (1972). Generalized linear models. *Journal of the Royal Statistical Society Series A: Statistics in Society*, 135(3), 370-384. <https://doi.org/10.2307/2344614>
- Ollberding, N. J., Wolf, R. L., & Contento, I. (2011). Food label use and its relation to dietary intake among US adults. *Journal of the American Dietetic Association*, 111(5), S47-S51. <https://doi.org/10.1016/j.jada.2011.03.009>
- Ryu, M. H. (2014). A study on adolescent consumers' label checking behavior and repurchase intention of processed food. *Crisisonomy*, 10(11), 345-368.
- Santeramo, F. G., & Lamonaca, E. (2021). Objective risk and subjective risk: The role of information in food supply chains. *Food Research International*, 139, 109962. <https://doi.org/10.1016/j.foodres.2020.109962>

- Satia, J. A., Galanko, J. A., & Neuhouser, M. L. (2005). Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African Americans in North Carolina. *Journal of the American Dietetic Association, 105*(3), 392-402. <https://doi.org/10.1016/j.jada.2004.12.006>
- Shamim, K., Ahmad, S., & Alam, M. A. (2022). Consumer understanding of food date labels: preventing food wastage. *British Food Journal, 124*(10), 3116-3132. <https://doi.org/10.1108/BFJ-06-2021-0672>
- Siegrist, M. (2000). The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk analysis, 20*(2), 195-204. <https://doi.org/10.1111/0272-4332.202020>
- Sjoberg, L. (2001). Limits of knowledge and limited importance of trust. *Risk Analysis, 21*(1), 189-198. <https://doi.org/10.1111/0272-4332.211101>
- Slovic, P. (1993) Perceived risk, trust, and democracy. *Risk Analysis, 13*(6), 675-682. <https://doi.org/10.1111/j.1539-6924.1993.tb01329.x>
- Slovic, P. (2010). The psychology of risk. *Saúde e Sociedade, 19*(4), 731-747.
- Song, E. G., & Yoo, H. J. (2008). The covariance structural analysis of perceived risk on food safety consciousness and food safety pursuit between Seoul & Shanghai consumers: Focused on food consumption. *Journal of Consumer Studies, 19*(3), 215-244.
- Song, H. J., & Choi, S. Y. (2013). A study on intake and purchasing behavior of processed food among adolescents. *Culinary Science & Hospitality Research, 19*(1), 230-243. <http://doi.org/10.20878/cshr.2013.19.1.017>
- Staub, C., Fuchs, C., & Siegrist, M. (2022). Risk perception and acceptance of health warning labels on wine. *Food Quality and Preference, 96*, 104435. <https://doi.org/10.1016/j.foodqual.2021.104435>
- Tucker, M., Whaley, S. R., & Sharp, J. S. (2006). Consumer perceptions of food-related risks. *International Journal of Food Science & Technology, 41*(2), 135-146. <https://doi.org/10.1111/j.1365-2621.2005.01010.x>
- Urala, N., & Lähteenmäki, L. (2007). Consumers' changing attitudes towards functional foods. *Food Quality and Preference, 18*(1), 1-12. <https://doi.org/10.1016/j.foodqual.2005.06.007>
- Van der Merwe, D., Bosman, M., Ellis, S., De Beer, H., & Mielmann, A. (2013). Consumers' knowledge of food label information: An exploratory investigation in Potchefstroom, South Africa. *Public health nutrition, 16*(3), 403-408. <https://doi.org/10.1017/S136898001200287X>
- Verbeke, W. (2005). Consumer acceptance of functional foods: Socio-demographic, cognitive and attitudinal determinants. *Food Quality and Preference, 16*(1), 45-57. <https://doi.org/10.1016/j.foodqual.2004.01.001>
- Vincent, J. B. (2017). New evidence against chromium as an essential trace element. *The Journal of nutrition, 147*(12), 2212-2219. <https://doi.org/10.3945/jn.117.255901>
- Visschers, V. H., & Siegrist, M. (2015). Does better for the environment mean less tasty? Offering more climate-friendly meals is good for the environment and customer satisfaction. *Appetite, 95*, 475-483. <https://doi.org/10.1016/j.appet.2015.08.013>
- Wang, G., Fletcher S. M., & Carley, D. H. (1995). Consumer utilization of food labelling as a source of nutrition information. *Journal of Consumer Affairs, 29*(2), 368-380. <https://doi.org/10.1111/j.1745-6606.1995.tb00052.x>
- Yang, S. B., & Yang, S. R. (2009). Economic values of voluntary food labelling. *Journal of Channel and Retailing, 14*, 79-93.
- Yeung, R. M., & Morris, J. (2001). Food safety risk: Consumer perception and purchase behaviour. *British food journal, 103*(3), 170-187. <https://doi.org/10.1108/00070700110386728>
- Yoon, Y. Y., & Kim, K. A. (2013). A qualitative study on consumers' perceptions of food safety risk factors. *Journal of Korean Home Management Association, 31*(4), 15-31.
- You, M., & Ju, Y. (2017). A comprehensive examination of the determinants for food risk perception: Focusing on psychometric factors, perceivers' characteristics, and media use. *Health communication, 32*(1), 82-91. <https://doi.org/10.1080/10410236.2015.1110003>
- Yu, Y., Tong, Y., Tang, W., Yuan, Y., & Chen, Y. (2018). Identifying spatiotemporal interactions between urbanization and eco-environment in the urban agglomeration in the middle reaches of the Yangtze River, China. *Sustainability, 10*(1), 290. <https://doi.org/10.3390/su10010290>
- Zanin, L. M., da Cunha, D. T., de Rosso, V. V., Capriles, V. D., & Stedefeldt, E. (2017). Knowledge, attitudes and practices of food handlers in food safety: An integrative review. *Food research international, 100*(1), 53-62. <https://doi.org/10.1016/j.foodres.2017.07.042>