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Exploring Consumers' Safety Anxiety about the Food Environment in South Korea

Suyoun Kim¹, Hye-Jong Yoo¹ and Jihyun Yoon^{2†}

¹Ph. D. Student, Department of Food and Nutrition, Seoul National University, Seoul 08826, Republic of Korea ²Professor, Department of Food and Nutrition, Seoul National University, Seoul 08826, Republic of Korea

ABSTRACT

The diversification of food sources has increased consumers' safety anxiety about the food environment in South Korea. This study aimed to investigate the level of consumers' safety anxiety about the food environment across six food source groups and factors related to the anxiety. Data were collected from 1,126 adults aged $20 \sim 59$ years using an online survey. Among the six food source groups consisting of 31 product items, the anxiety level about 'imported agricultural and fishery products' was highest (3.49 out of 5 points), followed by that of 'foods from commercial and institutional foodservice' (3.44). Gender, the age of the youngest child, and the level of health concern were related to consumers' safety anxiety about the food environment. Women (OR=1.72) were more likely to be anxious than men. Consumers whose youngest child was 12 years or younger (OR=1.66) were more likely to be anxious than those whose youngest child was over 12 years of age. Consumers with a high level of health concern (OR=1.50) were more likely to be anxious than those whose youngest that low level of health concern. In conclusion, the levels of consumers' safety anxiety differed according to the food source group and the consumers' characteristics. It is recommended that governments and food companies should develop differentiated communication strategies that consider such differences in order to decrease unnecessary consumers' safety anxiety about the food environment.

Key words: food safety, consumer anxiety, food environment, food source, health concern

INTRODUCTION

Recently, the rapid economic growth and rising income levels in South Korea have gradually changed food consumption patterns. Korean consumers have had more opportunities to eat out, which has been driven by recent demographic and socio-economic changes, including increases in female social activities, single-person households, and busy lifestyles (Korea Rural Economic Institute 2018). In addition, imported agricultural and fishery products and processed foods have been distributed in large quantities, along with an increase in international trade (Korea Institute for Health and Social Affairs 2011a). Nowadays, a wide variety of food is more accessible to consumers, as they purchase their food through online channels (Anckar B et al 2002). As food sources have diversified, consumers have become more anxious about their food environment. Consumers tend to be anxious about the severity of possible consequences, rather than the probability of their occurrence when exposed to a potential food hazard in the food environment (Yeung RM & Morris J 2001). A recent study reported that half of the adults in Korea were interested in food safety issues, and about 61% said they were willing to pay higher prices for safe foods (Korea Rural Economic Institute 2019).

Consumers' anxiety about the food environment is mostly related to food safety. Food safety embraces anything in the processing, preparation or handling of food to ensure that it is safe to eat (Griffith CJ 2006). A previous study on food safety defined consumers' safety anxiety as a social and psychological interpretation of food risk (Yeung RM & Morris J 2001). Another study on food safety defined such anxiety as the risk perception of consumers throughout the entire process from food production to consumption (Lee Y & Lee S 2014). It was also reported that safety anxiety is not momentary but a cumulative feeling of subjective concern that consumers experience (Sah J & Yeo J 2014). When consumers purchase or eat food, they can be anxious about the safety of food environment, because uncertain and uncontrollable food hazards in their food environment could harm their health (Lee SS 2016). This safety anxiety can increase, especially when consumers lack knowledge about the food (Kim E 2008).

Consumers' safety anxiety about the food environment has been directly affected by food-related issues. A study on food

Corresponding author : Jihyun Yoon, Tel: +82-2-880-6801, Fax: +82-2-884-0305, E-mail: hoonyoon@snu.ac.kr

safety reported that Korean consumers are anxious about harmful food items from overseas, such as fishery products contaminated with Japanese radioactive materials and US beef with mad cow disease (The Office for Government Policy Coordination 2017). The study also stated that recent domestic food-related incidents, such as contamination of egg with fipronil and mass food poisoning in school lunches, have further raised such anxiety. Such anxiety has spread quickly among consumers since social networking services (SNSs) have become a major means of communication through the rapid development of information and communications technology (Korea Institute for Health and Social Affairs 2015).

Earlier studies focused on consumers' anxiety about specific food hazards in the food environment (Yeung RM & Morris J 2001: Choe JS et al 2005: Jun SM 2014: Sah J & Yeo J 2014). According to the Food Sanitation Act of Korea (Korean Law Information Center 2020), food hazards are 'hazards present in food, food additives, appliances, containers or packages that are feared to harm the health of the human body'. A study on food safety risk stated that food hazards can be classified into sources of risk, namely, microbiological, chemical, or technological hazards (Yeung RM & Morris J 2001). A study on Korean adults reported that the level of consumers' safety anxiety about genetically-modified foods, food additives, and mad cow disease differs according to socio-demographic variables (Sah J & Yeo J 2014). In that study, high levels of anxiety about genetically-modified foods and food additives appeared in older, married, and housewife groups, whereas high levels of anxiety about mad cow disease appeared in those with liberal political tendencies. Another study on Korean adults reported that female or highly educated consumers were more likely to have higher levels of anxiety compared with males or those who were less educated (Jun SM 2014). Housewives generally tend to express greater concern about food hazards in their food environment. In particular, housewives with young children were shown to have high levels of anxiety (Choe JS et al 2005; Jun SM 2014).

Recently, consumers have become more interested in the health of themselves and their families. They have also become more concerned about their food environment, and their safety anxiety about that food environment has increased. According to Becker M *et al* (1977), health concern or health consciousness is a criterion for assessing readiness to undertake health-related actions. Consumers with a high level of health concern

tend to be worried about their health and are often consciously healthy (Plank RE & Gould SJ 1990; Newsom JT *et al* 2005). Therefore, consumers with a high level of health concern can be more anxious about the food environment than those with a low level of health concern.

A study on food safety reported that Korean consumers are not anxious as they used to be, but they show relatively high levels of anxiety about certain foods, such as imported foods and street foods sold near schools (The Office for Government Policy Coordination 2017). A study on housewives reported a high level of anxiety about processed foods and fast foods but a relatively low level of anxiety about agricultural products (Lee JY & Kim KD 2009). A study investigating the differences in consumers' safety anxiety about foods from five cooking places found that the level of anxiety about home-cooked foods was the lowest, while the level of anxiety about delivery and take-out foods was the highest (Jin H et al 2014). Although the level of consumers' safety anxiety varies depending on the food source, there has been a relative lack of research on analyzing differences in anxiety about various food sources in consideration of the overall food environment in Korea. It is necessary to recognize and manage food source groups associated with relatively high levels of safety anxiety in the overall food environment. In addition, it is important to understand what factors are related to safety anxiety about the food environment.

Therefore, this study aimed to investigate the level of consumers' safety anxiety about the food environment across six food source groups, and related factors in Korea. In particular, we examined the differences in consumers' safety anxiety levels according to six food source groups in the current food environment. In addition, we identified consumer characteristics related to safety anxiety about the food environment.

STUDY METHODS

1. Data Collection

An online survey was completed by individuals aged $20 \sim$ 59 years between July 24 and 30, 2018. A quota sampling method using gender and age according to their demographic ratios in Korea was employed. The data were collected from the consumer panel of Macromill-Embrain, a marketing research firm in Korea. All respondents gave their informed consent for inclusion before participating in this study, and

they were paid for their time. Respondents were also informed that they could quit the survey if they did not want to complete it. Before the main survey was conducted, a preliminary survey involving about 10% of the samples (108) was conducted between July 12 and 13, 2018. The questionnaire was finalized by reflecting on the findings from the preliminary survey. A total of 1,126 questionnaires were collected and used for the final analysis.

2. Measures

The questionnaire was developed to measure safety anxiety about aspects of the overall living environment, including food, clothing, financial services, and telecommunications services, as well as the characteristics of respondents. This study used responses to questions about consumers' safety anxiety about the food environment and respondents' characteristics. Studies analyzing safety anxiety about clothing environment and financial environment have recently been published by other researchers (Yu Y *et al* 2019; Park S *et al* 2020).

The measurement items were derived from previous studies and modified to reflect the current study's context. Specifically, the measurement item for safety anxiety was based on a previous study (Lee JY & Kim KD 2009). The levels of anxiety about the overall food environment and each food item were measured using a 5-point scale ranging from 1 (not very anxious) to 5 (very anxious).

In order to analyze the level of safety anxiety according to food source, the foods were classified into several food source groups. The lists of food source groups were primarily developed based on previous studies (Korea Consumer Agency 2014; The Office for Government Policy Coordination 2017) and Korea's food classification system (Ministry of Food and Drug Safety 2020a). The lists were then modified based on the results of the preliminary survey and several discussions among researchers. Finally, the foods were classified into the following six food source groups consisting of 31 items: imported agricultural and fishery products, agricultural and fishery products, processed foods and health functional foods, foods from commercial and institutional foodservice, foods from retailers, and others. Respondents who answered 'anxious' or 'very anxious' about each food item were asked to allocate 10 points to three areas of reasons for their anxiety: 'because they do not trust the ingredients', 'because they do not trust the producers', and 'because they do not trust the sellers'.

The respondents were also asked to indicate the important factors considered when purchasing foods, the self-rated health status, and the level of health concern. The self-rated health status measurement item was modified from Korea Institute for Health and Social Affairs (2011b). The status was measured using a 5-point scale ranging from 1 (very poor) to 5 (very good). The items assessing the level of health concern were modified from the items by Dutta-Bergman MJ (2004). The level was measured by three items using a 5-point Likert scale: 'It is important for me to live healthy', 'I usually make an effort for my family's health'. The Cronbach's a value, which indicates the internal consistency among the three items, was 0.743, confirming that the reliability of the measurement tools was reasonable.

3. Data Analysis

The characteristics of the respondents and the important factors considered in food purchases were calculated in terms of frequency and percentage. Based on the average levels of self-rated health status (3.18) and level of health concern (3.81), respondents were categorized as belonging to the poor health status group (2.83) or the good health status group (4.11) and to the low health concern group (3.28) or the high health concern group (4.30). The mean levels of anxiety about the overall food environment and each food item were calculated. χ^2 tests were conducted to determine significant differences among the important factors considered in food purchases according to the participants' socio-demographic characteristics and between low and high anxiety groups.

A logistic regression analysis was conducted to identify factors related to consumers' safety anxiety about the food environment. Based on the average level of safety anxiety about the overall food environment (3.57), the respondents were categorized into two groups: a low anxiety group (mean =2.86) and a high anxiety group (mean=4.12). The low anxiety and high anxiety group were coded as 0 and 1, respectively. Seven independent variables – gender, education, monthly household income, residential region, employment status, age of the youngest child, and level of health concern – were included in the logistic models based on previous studies (Davidson DJ & Freudenburg WR 1996; Choe JS *et al* 2005; Newsom JT *et al* 2005; Michaelidou N & Hassan LM 2008; Korea Consumer Agency 2009; Kim SU *et al* 2012; Jun SM 2014; Sah J & Yeo J 2014; Kim H *et al* 2015; The Office for Government Policy Coordination 2017). The variance inflation factors (VIFs) of the independent variables were less than two, indicating that there was no multicollinearity problem. All analyses were performed using SPSS ver. 23.0 (IBM SPSS Statistics 23, SPSS Inc., Armonk, NY, USA), and the level of significance was set at p<0.05.

RESULTS

1. Characteristics of the Survey Respondents

The characteristics of respondents participating in the survey are shown in Table 1. The male to female ratio was similar, and there were a relatively higher proportion of respondents from the 40 \sim 50 year age group compared with the 20 \sim 30 year age group. Approximately 84% of the respondents were college students, graduates, or had a higher degree. About 32% of the respondents indicated a monthly household income ranging from 2.5~4.5 million won. More than 60% of respondents were living in large cities and engaged in managerial or professional occupations. About 60% were married. More than half of the respondents had children. About 20% of the respondents were parents whose youngest child was aged 12 years or younger. Less than 30% of the respondents rated their health status as good, while more than 70% rated their health status as poor. The numbers of respondents classified into groups with high and low levels of health concern were similar.

2. Important Factors Considered in Food Purchases according to Socio-Demographic Characteristics

Table 2 shows the results of examining the factors that consumers consider important when purchasing food. The most important factor was taste (26.1%), followed by quality (20.2%), safety (20.1%), nutrition (13.2%), and price (12.8%). Other responses were the country of origin (4.6%), trust in producers and sellers (2.8%), and others (0.3%). The important factors considered in food purchases differed according to gender, age, monthly household income, employment status, marital status, and the age of the youngest child. Both men and women considered taste (28.8% and 24.3% respectively) to be the most important factor, followed by quality (20.7%) for men and safety (21.4%) for women. When buying food, those in their 20s and 30s considered taste (38.9% and 29.2%)

Table 1. Characteristics of the survey respondents

Variables	n(%)
Gender	
Male	575(51.1)
Female	551(48.9)
Age (years)	
20 - 29	247(21.9)
30 - 39	260(23.1)
40 - 49	313(27.8)
50 - 59	306(27.2)
Education	
High school graduate or lower	178(15.8)
College student, graduate or higher	948(84.2)
Household income	
(Korean million won ¹⁾ /month)	
<2.5	191(17.0)
\geq 2.5 & <4.5	355(31.5)
≥4.5 & <6.5	333(29.6)
≥ 6.5	247(21.9)
Residential region	
Rural	425(37.7)
Urban	701(62.3)
Employment status	
Housewife	143(12.7)
Manager, professional, office worker	677(60.1)
Service and salesperson, production worker	164(14.6)
Others (student, inoccupation,	
part-time worker, etc.)	142(12.6)
Marital status	
Married	666(59.1)
Unmarried (single, divorced, bereaved, etc.)	460(40.9)
Age of the youngest child	
>12 years	374(33.2)
≤ 12 years	214(19.0)
No child	538(47.6)
Self-rated health status ²⁾	
Poor	818(72.6)
Good	308(27.4)
Level of health concern ³⁾	
Low	544(48.3)
High	582(51.7)
Total	1,126(100.0)

¹⁾ KRW 1 million=USD 882.07.

³⁾ Measured by 3 items (using a 5-point Likert scale: 1=strongly disagree, 2=disagree, 3=neither, 4=agree, 5=strongly agree). The respondents were divided into a low health concern group (mean=3.28) and a high health concern group (mean=4.30) based on the mean (3.81) level of health concern.

²⁾ Using a 5-point scale: 1=very poor, 2=poor, 3=neither, 4= good, 5=very good. The respondents were divided into a poor health status group (mean=2.83) and a good health status group (mean=4.11) based on the mean (3.18) self-rated health status.

Variables	Total	Taste	Quality	Safety	Nutrition	Price	Others ¹⁾	$p^{2)}$
variables				n(%)				
Gender								
Male	575(100)	160(27.8)	119(20.7)	108(18.8)	68(11.8)	87(15.1)	33(5.7)	0.011
Female	551(100)	134(24.3)	108(19.6)	118(21.4)	81(14.7)	57(10.3)	53(9.6)	0.011
Age (years)								
20~29	247(100)	96(38.9)	37(15.0)	29(11.7)	34(13.8)	35(14.2)	16(6.5)	
30~39	260(100)	76(29.2)	55(21.2)	42(16.2)	38(14.6)	30(11.5)	19(7.3)	-0.001
40~49	313(100)	62(19.8)	68(21.7)	71(22.7)	42(13.4)	40(12.8)	30(9.6)	< 0.001
50~59	306(100)	60(19.6)	67(21.9)	84(27.5)	35(11.4)	39(12.7)	21(6.9)	
Education								
High school graduate or lower	178(100)	38(21.3)	32(18.0)	45(25.3)	25(14.0)	26(14.6)	12(6.7)	
College student, graduate or higher	948(100)	256(27.0)	195(20.6)	181(19.1)	124(13.1)	118(12.4)	74(7.8)	0.300
Household income (Korea	n million won ²	³⁾ /month)						
<2.5	191(100)	62(32.5)	26(13.6)	28(14.7)	29(15.2)	37(19.4)	9(4.7)	
≥2.5 & <4.5	355(100)	90(25.4)	83(23.4)	59(16.6)	46(13.0)	50(14.1)	27(7.6)	
≥4.5 & <6.5	333(100)	73(21.9)	65(19.5)	83(24.9)	38(11.4)	43(12.9)	31(9.3)	< 0.001
≥6.5	247(100)	69(27.9)	53(21.5)	56(22.7)	36(14.6)	14(5.7)	19(7.7)	
Residential region								
Rural	425(100)	102(24.0)	91(21.4)	86(20.2)	58(13.6)	59(13.9)	29(6.8)	
Urban	701(100)	192(27.4)	136(19.4)	140(20.0)	91(13.0)	85(12.1)	57(8.1)	0.696
Employment status								
Housewife	143(100)	19(13.3)	36(25.2)	42(29.4)	19(13.3)	15(10.5)	12(8.4)	
Manager, professional, office worker	677(100)	190(28.1)	143(21.1)	131(19.4)	90(13.3)	73(10.8)	50(7.4)	
Service & salesperson, production worker	164(100)	40(24.4)	27(16.5)	37(22.6)	18(11.0)	31(18.9)	11(6.7)	< 0.001
Others (student, inoccupation, part-time worker, etc.)	142(100)	45(31.7)	21(14.8)	16(11.3)	22(15.5)	25(17.6)	13(9.2)	
Marital status								
Married	666(100)	131(19.7)	141(21.2)	170(25.5)	82(12.3)	79(11.9)	63(9.5)	
Unmarried (single, divorced, bereaved, etc.)	460(100)	163(35.4)	86(18.7)	56(12.2)	67(14.6)	65(14.1)	23(5.0)	<0.001
Age of the youngest child	1							
>12 years	374(100)	70(18.7)	84(22.5)	106(28.3)	38(10.2)	45(12.0)	31(8.3)	
≤ 12 years	214(100)	46(21.5)	41(19.2)	45(21.0)	34(15.9)	26(12.1)	22(10.3)	< 0.001
No child	538(100)	178(33.1)	102(19.0)	75(13.9)	77(14.3)	73(13.6)	33(6.1)	
Total	1,126(100)	294(26.1)	227(20.2)	226(20.1)	149(13.2)	144(12.8)	86(7.6)	

Table 2. Important factors considered in food purchases according to socio-demographic characteristics

¹⁾ Others include country of origin, the trust of producers, the trust of sellers, etc.

²⁾ By x² test.
³⁾ KRW 1 million=USD 882.07.

respectively) to be the most important factor, while those in their 40s and 50s identified safety as the most important (22.7% and 27.5%, respectively). As the age of consumers increased, the number of consumers who valued safety in their food purchases tended to increase. Further, there were specific consumer groups who considered safety to be the most important factor when buying foods. Safety was most important for those who were in their 40s and 50s, those who had graduated only from high school or did not finish high school, those with a monthly household income of 4.5 to 6.5 million won, those who were full-time housewives, those who were married, and those whose youngest child was over 12 years of age.

3. Level of Consumers' Safety Anxiety according to the Food Source Group and the Reasons for the Anxiety

The results of examining the level of consumers' safety anxiety according to the food source group are shown in Table 3. Among the six food source groups consisting of 31 items, the anxiety level about imported agricultural and fishery products was the highest (3.49), followed by foods from commercial and institutional foodservice (3.44), processed and health functional foods (3.17), foods from retailers (3.15), agricultural and fishery products (3.07), and others (2.76).

Among imported agricultural and fishery products, the level of anxiety about imported fishery products was the highest (3.68). The levels of anxiety about imported meat and imported fruits were 3.48 and 3.31, respectively. The reasons for the anxiety about imported products differed between items. In the case of imported fishery products and meat, 'distrust of ingredients' had the highest score among the reasons for anxiety. On the other hand, in the case of imported fruits, 'distrust of sellers'' had the highest score among the reasons for anxiety.

The item associated with the highest level of anxiety in the group of foods from commercial and institutional foodservice was street foods (3.78), which was the highest among the 31 items, followed by delivery foods (3.59), fast foods (3.46), foods served at childcare centers (3.41), highway rest stop foods (3.40), snack bar foods (3.37), school meals (3.30), and restaurant foods (3.22). Among the reasons for anxiety about foods from commercial and institutional foodservice, 'distrust of ingredients' had the highest score.

Among processed and health functional foods, the item associated with the highest level of anxiety was diet foods (3.39), followed by health functional foods (3.14), home meal replacements (3.13), refrigerated processed foods (3.13), and frozen processed foods (3.09). Among the reasons for the anxiety about processed and health functional foods, 'distrust of ingredients' had the highest score.

The level of anxiety differed according to the food retailer. Consumers were the most anxious about online shopping mall foods (3.29), followed by TV home shopping foods (3.23), convenience store foods (3.17), neighborhood supermarket foods (3.16), and large discount mart foods (2.90). Among the reasons for the anxiety about foods from retailers other than large discount chains, 'distrust of ingredients' had the highest score.

Among agricultural and fishery products, the item associated with the highest level of anxiety was fishery products (3.55), followed by eggs (3.28), chicken (3.12), beef (3.11), pork (3.06), vegetables (2.94), milk and dairy products (2.93), fruits (2.90), and cereals (2.76). Among the reasons for anxiety about agricultural and fishery products, 'distrust of ingredients' had the highest score. Lastly, the average level of anxiety for environmentally friendly foods was 2.76, which was the lowest among all items. For anxiety about environmentally friendly foods, 'distrust of ingredients' also showed the highest score.

4. Characteristics of the Low Anxiety Group and the High Anxiety Group

Table 4 presents the characteristics of the low anxiety group and the high anxiety group included in the logistic regression analysis. There were significant differences between the low and high anxiety groups regarding gender, employment status, marital status, age of the youngest child, self-rated health status, and level of health concern. More than half of the female respondents were included in the high anxiety group. There were more married consumers in the high anxiety group (61.7%) compared with the low anxiety group (55.8%). The group of consumers with a high level of anxiety showed a higher level of health concern compared to the group with a low level of anxiety (56.4% vs. 45.5%, respectively). There were no significant differences between the two groups regarding age, education, household income, and residential region.

5. Factors Related to Consumers' Safety Anxiety about the Food Environment

The results of the logistic regression analysis are shown in

г 1			Reasons for anxiety ²⁾ (Mean±S.D.)			
groups	Items	(Mean±S.D.)	Distrust of ingredients	Distrust of producers	Distrust of sellers	
Imported agri	cultural and fishery products	3.49±0.15 ³⁾	3.71±0.38 ³⁾	3.11±0.17 ³⁾	3.17±0.22 ³⁾	
	Imported fishery products	3.68±0.82	4.19±2.34	2.87±1.54	2.93±1.78	
	Imported meat	3.48±0.81	3.69±2.11	3.19±1.48	3.12±1.65	
	Imported fruit	3.31±0.77	3.26±1.98	3.28±1.53	3.46±1.79	
Foods from c	commercial and institutional foodservice	3.44±0.16 ³⁾	3.90±0.19 ³⁾	$3.46 \pm 0.08^{3)}$	2.65±0.17 ³⁾	
	Street foods	3.78±0.79	4.18±1.86	3.37±1.47	2.45±1.62	
	Delivery foods	3.59±0.78	4.09±1.72	3.52±1.36	2.39±1.49	
	Fast foods	3.46±0.78	4.14±1.85	3.39±1.39	2.47±1.42	
	Foods served at childcare centers	3.41±0.78	3.78±1.90	3.45±1.51	2.77±1.55	
	Highway rest stop foods	3.40±0.78	3.72±1.67	3.50±1.34	2.78±1.43	
	Snack bar foods	3.37±0.74	3.77±1.70	3.56±1.32	2.67±1.58	
	School meals	3.30±0.81	3.77±1.78	3.33±1.41	2.90±1.56	
	Restaurant foods	3.22±0.69	3.72±1.49	3.54±1.22	2.74±1.53	
Processed and	health functional foods	3.17±0.11 ³⁾	4.07±0.36 ³⁾	3.38±0.21 ³⁾	2.55±0.17 ³⁾	
	Diet foods	3.39±0.79	4.60±2.10	3.06±1.39	2.34±1.52	
	Health functional foods	3.14±0.77	4.41 ± 1.87	3.24±1.36	2.35±1.35	
	Home meal replacement (retort pouch, refrigerated food, etc.)	3.13±0.72	3.73±1.70	3.62±1.49	2.65±1.48	
	Refrigerated processed foods	3.13±0.70	3.77±1.62	3.52±1.31	2.71±1.45	
	Frozen processed foods	3.09±0.75	3.83±1.66	3.48±1.38	2.69±1.43	
Foods from r	etailers	3.15±0.14 ³⁾	3.58±0.22 ³⁾	3.48±0.10 ³⁾	2.94±0.27 ³⁾	
	Online shopping mall foods	3.29±0.75	3.68 ± 1.81	3.46±1.33	2.86±1.54	
	TV home shopping foods	3.23±0.74	3.56±1.73	3.42±1.32	3.02±1.63	
	Convenience store foods	3.17±0.75	3.96±1.80	3.58±1.36	2.46±1.41	
	Neighborhood supermarket foods	3.16±0.70	3.39±1.85	3.34±1.50	3.27±1.95	
	Large discount store foods	2.90±0.72	3.33±1.51	3.59±1.25	3.08±1.42	
Agricultural a	and fishery products	$3.07 \pm 0.22^{3)}$	3.34 ± 0.32^{3}	$3.67 \pm 0.28^{3)}$	$2.99 \pm 0.16^{3)}$	
	Fishery products	3.55±0.85	3.93±1.32	3.10±1.68	2.97±1.77	
	Egg	3.28±0.83	3.05 ± 2.08	4.12±1.91	2.83±1.64	
	Chicken	3.12±0.79	3.24 ± 1.88	3.71±1.57	3.05 ± 1.58	
	Beef	3.11±0.78	3.51±1.99	3.55±1.66	2.94±1.61	
	Pork	3.06±0.77	3.34 ± 1.97	3.58 ± 1.58	3.08±1.65	
	Vegetable	2.94 ± 0.78	3.21±1.93	3.90±1.68	2.89±1.51	
	Milk or dairy products	2.93±0.77	3.28±1.93	3.53±1.47	3.19±1.77	
	Fruit	2.90±0.78	2.80±1.72	3.93±1.69	3.27±1.74	
	Cereals	2.76±0.74	3.69±2.06	3.58±1.51	2.73±1.50	
Others	Environmentally friendly foods	2.76±0.81	4.03±1.97	3.39±1.54	2.58±1.56	

Table 3. Level of consumers' safety anxiety according to food source group and the reasons for the anxiety

¹⁾ Using a 5-point scale: 1=not very anxious, 2=not anxious, 3=neither, 4=anxious, 5=very anxious.

²⁾ Respondents were asked to allocate 10 points into three areas of reasons for their anxiety.

³⁾ Composite values for food source groups are averages and standard deviations of comprising items.

	Total	Low anxiety group ¹⁾	High anxiety group ¹⁾	2)
Variables –		n(%)	<u> </u>	p^{2}
Gender				
Male	575(51.1)	288(59.3)	287(44.8)	.0.001
Female	551(48.9)	198(40.7)	353(55.2)	< 0.001
Age (years)				
20~29	247(21.9)	112(23.0)	135(21.1)	
30~39	260(23.1)	103(21.2)	157(24.5)	0.070
40~49	313(27.8)	123(25.3)	190(29.7)	0.069
50~59	306(27.2)	148(30.5)	158(24.7)	
Education				
High school graduate or lower	178(15.8)	74(15.2)	104(16.3)	0 (1 1
College student, graduate or higher	948(84.2)	412(84.8)	536(83.8)	0.641
Household Income (Korean million won ³⁾ /month)				
<2.5	191(17.0)	95(19.5)	96(15.0)	
\geq 2.5 & <4.5	355(31.5)	154(31.7)	201(31.4)	0.1.47
\geq 4.5 & <6.5	333(29.6)	131(27.0)	202(31.6)	0.147
≥ 6.5	247(21.9)	106(21.8)	141(22.0)	
Residential region				
Rural	425(37.7)	187(38.5)	238(37.2)	0.670
Urban	701(62.3)	299(61.5)	402(62.8)	0.658
Employment status				
Housewife	143(12.7)	45(9.3)	98(15.3)	
Manager, professional, office worker	677(60.1)	293(60.3)	384(60.0)	0.010
Service and salesperson, production worker	164(14.6)	80(16.5)	84(13.1)	0.010
Others (student, inoccupation, part-time worker, etc.)	142(12.6)	68(14.0)	74(11.6)	
Marital status				
Married	666(59.1)	271(55.8)	395(61.7)	0.044
Unmarried (single, divorced, bereaved, etc.)	460(40.9)	215(44.2)	245(38.3)	0.044
Age of the youngest child				
>12 years	374(33.2)	170(35.0)	204(31.9)	
\leq 12 years	214(19.0)	76(15.6)	138(21.6)	0.042
No child	538(47.8)	240(49.4)	298(46.6)	
Self-rated health status ⁴⁾				
Poor	818(72.6)	372(76.5)	446(69.7)	0.011
Good	308(27.4)	114(23.5)	194(30.3)	0.011
Level of health concern ⁵⁾				
Low	544(48.3)	265(54.5)	279(43.6)	-0.001
High	582(51.7)	221(45.5)	361(56.4)	< 0.001
Total	1,126(100)	486(100.0)	640(100.0)	

Table 4. Characteristics of the low anxiety group and the high anxiety group

¹⁾ Using a 5-point scale: 1=not very anxious, 2=not anxious, 3=neither, 4=anxious, 5=very anxious. The respondents were divided into a low anxiety group (mean=2.86) and a high anxiety group (mean=4.12) based on the mean score (3.57) of the level of anxiety about the food environment.

²⁾ By χ^2 test.

³⁾ KRW 1 million=USD 882.07.

⁴⁾ Using a 5-point scale: 1=very poor, 2=poor, 3=neither, 4=good, 5=very good.

⁵⁾ Measured by 3 items (using a 5-point Likert scale: 1=strongly disagree, 2=disagree, 3=neither, 4=agree, 5=strongly agree).

Table 5. The model χ^2 value of the logistic regression model was 49.361, which is significant (*p*<0.001). The value of model fit (Hosmer and Lemeshow's Goodness-of-Fit Index) was 7.899 (*p*=0.443). Therefore, the estimated model was

statistically appropriate. The results indicate that gender, the age of the youngest child, and the level of health concern were related to consumers' safety anxiety about the food environment. In particular, women (OR=1.71) were more likely to

Table 5. F	actors r	elated to	consumers'	safety	anxiety	about	the	food	environment
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Variables	OR	95% CI	$p^{1)}$
Gender			
Male (Ref.)			
Female	1.717	(1.315~2.242)	< 0.001
Education			
High school graduate or lower (Ref.)			
College student, graduate or higher	0.976	(0.685~1.391)	0.894
Household income (Korean million won ²⁾ / month)			
<2.5 (Ref.)			
≥2.5 & <4.5	1.259	(0.864~1.834)	0.230
\geq 4.5 & <6.5	1.405	(0.943~2.093)	0.095
≥6.5	1.217	(0.804~1.844)	0.353
Residential region			
Rural (Ref.)			
Urban	1.054	(0.820~1.354)	0.682
Employment status			
Housewife (Ref.)			
Manager, professional, office worker	0.757	(0.487~1.178)	0.217
Service and salesperson, production worker	0.704	(0.420~1.178)	0.181
Others (student, inoccupation, part-time worker, etc.)	0.701	(0.397~1.237)	0.220
Age of the youngest child			
>12 years (Ref.)			
≤ 12 years	1.658	(1.153~2.384)	0.006
No child	1.305	(0.961~1.772)	0.088
Level of health concern ³⁾			
Low (Ref.)			
High	1.498	(1.170~1.918)	0.001
⁴⁾ Model χ^2 (p)		49.361(<0.001)	
⁵⁾ Hosmer and Lemeshow test χ^2 (p)		7.899(0.443)	

Ref: reference, OR: odds ratio, 95% CI: 95% confidence interval.

¹⁾ By logistic regression analysis. Dependent variable: 1 if high anxiety group, 0 if low anxiety group.df

²⁾ KRW 1 million = USD 882.07.

³⁾ Measured by 3 items (using a 5-point Likert scale: 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree). ⁴⁾ df=12.

⁵⁾ df=8.

be anxious about the food environment than men. Consumers whose youngest child was 12 years or younger (OR=1.66) were more likely to be anxious than those whose youngest child was over 12 years of age. Further, consumers with a higher level of health concern (OR=1.50) were more likely to be anxious about the food environment than those with a low level of health concern.

DISCUSSION

In this study, the most important factor considered in food purchases was taste, followed by quality and safety. The result was inconsistent with a previous study having reported not taste but safety as the most important factor (Kim HA & Jung HY 2018). This inconsistency seems to be due to the different demographic composition of the survey respondents between these two studies; the proportion of respondents in their 20s in our study was much higher than that in the previous one (38.9% vs. 10.3%). The respondents in their 20s in the present study predominantly considered taste as the most important factor.

Meanwhile, in the present study safety was the most important factor among certain consumer groups: consumers who were in their 40s and 50s, those with a high school level education or lower, those with a monthly household income of $4.5 \sim 6.5$ million won, those who were full-time housewives, those who were married, or those whose youngest child was over 12 years of age. There has been no study that investigated the most important factors considered in food purchases according to other socio-demographic characteristics except for gender. Nevertheless, another study examining consumers' perception of food safety reported that the primarily important factors when purchasing meat or fishery products were the place of origin and expiration dates, which were closely related to safety in the food environment (Kim H & Kim M 2011). Thus, more studies are needed to explore important factors considered in food purchases according to socio-demographic characteristics and food groups all together.

Among the six food source groups, the group associated with the highest level of anxiety was imported agricultural and fishery products, followed by foods from commercial and institutional foodservice, processed and health functional foods, foods from retailers, agricultural and fishery products, and environmentally friendly foods. A previous study on safety anxiety also reported that the level of anxiety about imported agricultural and fishery products was the highest (Jun SM 2014).

In this study, the level of anxiety about imported fishery products was highest for imported agricultural and fishery products. These results support a previous consumer safety sentiment index study that reported that the food items associated with the highest level of consumer anxiety are imported fishery products (Korea Consumer Agency 2014). According to a study on risk perception toward Japanese fishery products, consumers concerned about the safety of imported fishery products showed a high level of anxiety about the foods and were reluctant to purchase them (Joo J & You MS 2016).

In the present study, the reasons for consumers' anxiety about imported agricultural and fishery products differed among food items. Consumers were anxious about imported fishery products and meats mainly because they did not trust the ingredients, while they were anxious about imported fruits mainly because they did not trust the sellers. This is probably because consumers were likely to be concerned about the pesticides used for preservation and long-term transportation for imported fruits such as oranges and grapes (Yoon Y & Kim K 2013). Previous studies on food hazards (Choe JS et al 2005; Lee JY & Kim KD 2009; Kim H & Kim M 2011) found that consumers showed a high level of anxiety about pesticide residues among various food hazards. One study conducted on housewives reported that the highest level of anxiety among food hazards was toward residual pesticides, followed by food additives and environmental hormones (Choe JS et al 2005). However, about 96% of the residual pesticides in fruits and vegetables can be removed by peeling off the skin, and more than 80% can be removed by cleaning (Ministry of Food and Drug Safety 2015). Consumers showed a high level of anxiety about residual pesticides because they lacked information and knowledge about residual pesticides (Yoon Y & Kim K 2015). Therefore, it is necessary to provide accurate information to consumers to reduce such unnecessary anxiety.

Among the foods from commercial and institutional foodservice, the item associated with the highest level of anxiety was street foods, followed by delivery foods and fast foods. The level of anxiety about fast food was similar to that about imported agricultural and fishery products. These results are similar to those from the consumer safety sentiment index study (Korea Consumer Agency 2014). In the present study, the main reason for anxiety about foods from commercial and institutional foodservice was distrust of the ingredients. This finding differed slightly from a study on consumers' knowledge of food hazards (The Office for Government Policy Coordination 2016). In that study, consumers were found to be anxious about foods from commercial foodservice because of fear that the foods might have been cooked under unsanitary conditions, while they were anxious about school meals because they did not trust the food suppliers or food managers.

Among the processed and health functional foods, the item associated with the highest level of anxiety was diet foods, followed by health functional foods, home meal replacements, refrigerated processed foods, and frozen processed foods. This finding was similar to the results of the consumer safety sentiment index study (Korea Consumer Agency 2009), which reported that diet foods and health functional foods were associated with the highest levels of consumer anxiety. The main reason for anxiety about processed and health functional foods was distrust of the ingredients. Diet foods are not defined by law as foods, rather "diet foods" is used as a generic term for weight control formulas (Ministry of Food and Drug Safety 2020b). As the demand for diet foods has increased recently, the level of consumers' safety anxiety about diet foods has also increased. According to the Functional Health Foods Act (Korean Law Information Center 2019), health functional foods are 'foods made from ingredients that are useful to the human body'. As consumers' health concerns have increased recently, the demand for health functional foods has increased, and the level of anxiety about health functional foods has also increased.

Agricultural and fishery products were associated with the second-highest level of consumer anxiety among the six food source groups. One study on the safety sentiment index reported that only domestic agricultural products were recognized as safe foods for consumers (Korea Consumer Agency 2014). Consumers were anxious about the agricultural and fishery products mainly because of distrust of the producers, while consumers were anxious about other food source groups mainly because of distrust of the ingredients.

In this study, gender was associated with consumers' safety anxiety about the food environment. Specifically, women were more likely to be anxious about the food environment than men. This supports previous findings (Korea Consumer Agency 2009; Kim SU et al 2012; Jun SM 2014; Korea Consumer Agency 2014) in which women showed a higher level of anxiety than men. Women generally act as nurturers or care providers at home and still view family health and safety as their primary responsibility (Davidson DJ & Freudenburg WR 1996; Kim SU et al 2012). Therefore, their levels of anxiety about the food environment are likely to be higher than those of men. A study on housewives reported that women with young children, such as infants and elementary school students, had a level of anxiety that was about twice as high as that in women without young children (Choe JS et al 2005). This was probably because they were concerned about the health of their young children, who are likely to be vulnerable to changes in the food environment and to have low immunity to food hazards.

Another factor found related to consumers' safety anxiety was the age of the respondent's youngest child. In this study, consumers whose youngest child was 12 years or younger were more likely to be anxious than those whose youngest child was over 12 years of age. This result supports previous studies reporting that consumers with young children showed a high level of anxiety about food safety in the food environment (Davidson DJ & Freudenburg WR 1996; Sah J & Yeo J 2014). Further, one of the possible explanations for the age of the youngest child being associated with consumers' safety anxiety in this study is the parents' age. In this study, compared with other age groups, consumers in their 30s and 40s showed a relatively higher level of anxiety. This finding is similar to the results of a study on food safety conducted by The Office for Government Policy Coordination (2017). This is probably because the middle-aged consumers in their 30s or 40s were more likely to be parents with young children than other age groups.

The present study also identified a relationship between the level of health concern and consumers' safety anxiety about the food environment. The results showed that consumers with a high level of health concern were likely to be more anxious about the food environment than those with a low level of health concern. One study on American adults reported that consumers with a high level of health concern were more likely to try to improve their health and quality of life (Newsom JT *et al* 2005). Recently, Korean consumers have become

more concerned about their health than before. Consumers with a higher level of health concern tend to value food safety when choosing their food and are more concerned about risk factors (Kim H *et al* 2015). Therefore, consumers tend to be more sensitive to food hazards and are more anxious about the food environment. Studies on the relationship between health concern and environmentally friendly behavior reported that consumers with a high level of health concern try to relieve their anxiety by consuming safe and environmentally-friendly agricultural products (Magnusson MK *et al* 2008; Lee S *et al* 2011).

Meanwhile, studies have reported that the level of anxiety differs according to characteristics of consumers other than gender, age of the youngest child, and level of health concern (Choe JS et al 2005: Korea Consumer Agency 2009). The Korea Consumer Agency stated that married consumers are more anxious about their food environment than single consumers (Korea Consumer Agency 2009). One study on housewives showed that as the education level was higher, the level of anxiety was higher (Choe JS et al 2005). Additionally, a study on specific food hazards reported that older or married consumers or housewives showed high levels of anxiety about genetically modified foods and food additives (Sah J & Yeo J 2014). In order to decrease the level of consumers' safety anxiety, it is necessary to identify the characteristics of consumer groups that show different levels of anxiety and prioritize those with high levels of anxiety.

There were some limitations in this study. This study used a single-item scale to measure the level of consumers' safety anxiety about the food environment. Consumers' anxiety about the food environment, which is continuously changing and uncertain, is subjective and is easily affected by psychological and social factors (Kim H et al 2015). Therefore, it would be more effective to use a multiple-item scale rather than a single-item scale to measure the level of anxiety about the food environment. Another limitation is related to the characteristics of the survey respondents. Several studies have reported that high-educated consumers show a higher level of anxiety than low-educated consumers (Choe JS et al 2005; Kim SU et al 2012; Jun SM 2014). In this study, however, about 84% of respondents were college students, graduates, or had a higher degree. Such characteristics of respondents would have been reflected in the results.

In this study, we did not consider consumers' purchase ex-

periences when analyzing the level of consumers' safety anxiety. It may be important to manage consumers' safety anxiety about food items that are frequently purchased rather than items that are purchased less frequently. Therefore, it is suggested that future studies should consider consumers' purchase experiences for each food item when investigating the level of safety anxiety. For example, food items could be classified into four groups: a group with a high purchase frequency and a high level of anxiety, a group with high purchase frequency and a low level of anxiety, a group with a low purchase frequency and a high level of anxiety, and a group with a low purchase frequency and a low level of anxiety. By considering such differences among four groups, it would be possible to develop a differentiated and more feasible communication plan aimed at decreasing consumers' safety anxiety.

CONCLUSION

In conclusion, the level of consumers' safety anxiety about Korea's food environment was found to differ according to the food source group. Consumers showed a high level of anxiety about imported or externally made foods because of a lack of trust in the ingredients. In particular, consumers' safety anxiety increased when they lacked knowledge about the food they were consuming. Therefore, it is necessary to provide accurate information about food source groups with a high level of safety anxiety in order to decrease consumers' anxiety. In addition, gender, the age of the youngest child, and the level of health concern were related to anxiety about the food environment. Thus, a different approach is needed to prepare educational and promotional activities that reflect the characteristics of consumer groups with high levels of safety anxiety, such as women, parents with young children, and consumers with a high level of health concern. Based on the results of the current study, it is recommended that the government and food companies should develop differentiated communication strategies that consider such differences to reduce unnecessary safety anxiety about the food environment among consumers.

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