

Research Article

Research on Risk Perception and the Influence Factors Analysis of Freshwater Edible Fish

^{1,3}Ruixin Liu, ^{1,2}Linhai Wu, ¹Lijie Shan and ³Chunxian Han

¹School of Business, Jiangnan University, Wuxi 214122, China

²Synergetic Innovation Center of Food Safety and Nutrition, Wuxi 214122, China

³School of Tourism, Yangzhou University, Yangzhou 225127, China

Abstract: This paper studied 192 consumers' risk perception of freshwater fish and its influencing factors with Probit regression method based on the survey of Yangzhou city in Jiangsu province. Results showed that nearly 40% of consumers have a higher risk perception for the quality safety of freshwater fish and think that environmental hormone residues and antibiotic residues are main safety problems of freshwater fish. According to the influencing degree, the factors influencing consumer's risk perception of freshwater fish are food safety concern, food safety situation, consumers' gender, knowledge of freshwater fish, the concept of healthy diet, the purchase experience, kids under the age of 18, education and price of freshwater fish in sequence.

Keywords: Consumer, freshwater edible fish, influencing factors, risk perception

INTRODUCTION

At present, food safety risks are increasingly becoming one of the biggest social risks in China. Overall Well-off Research Center of China (2012) showed that 80.4% of respondents lack security on food and more than 50.6% of respondents think that the current situation of food safety is worse than ever. After the occurrence of so many aquatic product security incidents such as turbot, apple snail and shrimp with gum injection, the edible safety of freshwater fish has become a hot topic of the general public. Due to the credence product characteristic of food safety, lots of food hazards have time-lag effects and non-traceability and because of the severity of the consequences of food safety problems, consumers also will exaggerate the risks that they are faced with in many cases and their subjective perception of food safety problems always deviates from the actual level of food safety risks (Frewer and Miles, 2003). According to the cognitive theory of food safety risks, it is consumers' subjective perception of food safety risks rather than the risks themselves that determines consumers purchasing behaviors. When consumers are making decisions of purchasing food, compared with the maximization of food utility, they pay more attention to how to avoid the physical and economic losses caused by food safety problems (Scully, 2003). Therefore, consumers' subjective perception of food safety risks may be more important than food safety problems themselves.

Based on the basic means of field research, this study has constructed Probit model, used SPSS software to study consumers' risk perception of

freshwater fish and the factors of affecting the risk perception and clarified the mechanisms of consumers' risk analysis of freshwater fish. It may be helpful to guide consumers to establish scientific risk perception of food safety and provide decision basis for the government to release security information and make reasonable fishery development policies to further promote the benign development of the local fish farming.

MATERIALS AND METHODS

Survey design: The questionnaire was designed based on the research achievements of Zhang and Chen (2013) with some adjustments according to the actual situation. This research selects Yangzhou as a representative to investigate consumers' risk perception of freshwater fish. The main reasons of choosing Yangzhou are as follows: first, Yangzhou is located in the middle and lower reaches of Yangtze River and has Lixia River Aquaculture Areas which is the largest one in Northern Suzhou and one of the top ten wholesale market of freshwater products in Jiangsu; Second, the annual consumption of freshwater fish in Yangzhou is about 37,000,000 kg and its daily market volume is about 50,000 kg, especially in holidays, the consumption quantity can reach 100,000 kg; Third, freshwater fish is an important part of the daily diet consumption of Yangzhou residents. Therefore, that this study takes Yangzhou residents as investigation objects has good representativeness and rationality.

The questionnaire is in the form of five scales of Likert and is divided into four parts: the first part is mainly to measure consumers' consumption characteristics of freshwater fish; the second part is to measure consumers' situation of risk perception of freshwater fish; the third part is to measure the influence factors of consumers' risk perception of freshwater fish; the fourth part is consumers' statistic characteristics.

The questionnaire is used to make the preliminary research by selecting 20 residents in Yangzhou at first. After fully asking for the opinions and suggestions of the respondents, five experts from Food College of Yangzhou University have assessed the questionnaires and combined with the situation of the preliminary research, I have adjusted and modified the content of the questionnaire and tested the reliability and validity of the questionnaire and the Cronbach's alpha value of the questionnaires is 0.815, which shows that the overall consistency of the questionnaire is good.

Data acquisition: From April 19th to 20th, 2014, I issued 200 copies of the questionnaires in Yangzhou city to formally conduct the investigation. I randomly issued the questionnaires to the citizens over the age of 18 in the aquaculture area of Yangzhou RT-MART, the entrance of farmer's market of the new town and Lixia River exclusive shop of aquatic products. In order to ensure that the respondents could understand the questionnaires furthest, I adopted the way that the researcher interviewed with the respondents face to face and the respondents filled in the questionnaires directly. After the investigation, excluding the questionnaires with incomplete answers and obvious mistakes, I took back 192 effective questionnaires in total.

Sample characteristics: The respondents' characteristics of this survey can be divided into personal and family characteristics. In personal characteristics, there are 53 males and 139 females that account for 28.0 and 72.0%, respectively; in the respondents, most of them are between 30 and 59 years old that accounts for 70.3% of the respondents; 6 of the respondents are 19 years old and younger, 24 of them are between 20 and 29 years old, 97 of them are between 30 and 39 years old, 38 of them are between 40 and 59 years old and 27 of them are 69 years old and older, which respectively account for 3.1, 12.5, 50.5, 19.8 and 14.1%, respectively of the respondents; the overall education level of the respondents is low, in which the respondents with junior high school and high school education account for 56.3% and there are 153 married respondents that account for 79.7%. In family characteristics, the respondents with children under the age of 18 account for 65.5%, the respondents with resident population of 4 and above account for 41.7%, the respondents with the monthly family income of

below 5,000 Yuan, between 5,000 and 10,000 Yuan, between 10,000 and 20,000 Yuan and above 20,000 Yuan account for 30.8, 40.9, 18.8 and only 2.6%, respectively.

Consumers' risk perception of freshwater fish:

Safety cognition of freshwater fish: When I investigated consumers' opinions on "whether the current freshwater fish products sold on the market are safe", 7.3 and 18.2% of the respondents respectively expressed "very safe" and "safe", 25.0 and 7.8% of the respondents respectively expressed "not very safe" and "not safe at all" and 78 respondents expressed "general" who accounted for 41.7% of the respondents.

When I investigated the influence of freshwater fish safety on consumers' physical and psychological health, 34.9% of the respondents thought that the safety problems of freshwater fish had a great influence or relatively large influence on their health, 27.1% of the respondents showed that there's no large influence or no influence on their health and 38.0% of the respondents believed that the safety problems of freshwater fish had a general influence on their health.

Risk perception of freshwater fish safety: The entire process of freshwater fish from farms to dining tables needs to experience many links including cultivation, transportation, storage, sales, processing, etc. and there are various factors in all links and between links that may lead to the safety problems of freshwater fish. In the process of cultivation, due to water pollution or unreasonable farming methods, freshwater fish may have safety problems such as parasites, excessive heavy metals, antibiotic residues and hormone residues; in the links of transportation and sales, due to inappropriate storage or illegal use of additives to improve the perception of the fish, freshwater fish is easy to have the problems such as microbiological contamination and malachite green residues; improper cooking and processing methods may cause some poisoning problems of freshwater fish similar to fugu; even in the process of eating, there may be safety problems such as being stabbed by fishbones and allergies (Jiang, 2008).

When I investigated consumers "which links may result in the safety problems of freshwater fish", up to 75.5% of the respondents thought that it's the cultivation link and then 66.1 and 58.9% of the respondents believed that it's the sales link and the transportation link, respectively and 11.4 and 5.9% of the respondents considered that it's the cooking and processing link and the eating link, respectively.

When I made in-depth investigation on consumers' perception of safety risks of freshwater fish and the harm to human body, as high as 73.4 and 70.3% of the respondents believed that the freshwater fish sold in the market had environmental hormone residues and antibiotic residues, respectively; 68.8, 62.0 and 51.6%,

respectively of the respondents respectively thought that microbiological contamination, pesticide residues and illegal addition in the process of transportation and sales were existed in freshwater fish; besides, 35.9 and 29.2% of the respondents believed that there were parasite infections and excessive heavy metals in freshwater fish, respectively. There are 58.9, 54.7, 45.3, 33.3 and 17.2%, respectively of the respondents who respectively thought that the freshwater fish with safety hazards would make the eaters suffer the risks of digestive tract or liver diseases, precocious puberty or infertility, teratogenesis and carcinogenesis, parasite infections and heavy metal poisoning.

Causes of safety problems of freshwater fish: The survey results show that the consumers think that the main reasons of the safety problems of freshwater fish are that: one-sided pursuit of profits by breeding or sales enterprises (73.4%), government supervision not in place (67.7%), asymmetrical consumer information (61.5%), enterprises' weak awareness of social responsibility (56.8%), imperfect national safety standards (38.0%), too low punishment strength of violations by the government (42.7%), no quality traceability system established in fishery (18.2%) and other (4.9%). It's not difficult to find that the respondents consider that one-sided pursuit of profits by breeding or sales enterprises, government supervision not in place and asymmetrical consumer information are the top three reasons of the safety problems of freshwater fish.

RESULTS AND DISCUSSION

Influence factors of consumers' risk perception of freshwater fish:

Theoretical analysis: Based on the previous research achievements of consumers' risk perception of food safety, this study classifies the major factors that will affect consumers' risk perception of freshwater fish mainly in the following aspects:

- Consumer characteristics that mainly include the consumers' gender, age, education, monthly family income, whether there are children under the age of 18 in the family and other characteristic factors. A large number of empirical studies have shown that consumers' these personal or family characteristic factors will affect their perception and acceptance of food safety risks, but these factors have the difference of significance and direction on the effects.
- Product characteristics that mainly include the freshwater fish's price, place of production, whether there's a safety certification mark and other factors. For consumers, freshwater fish has the characteristic of the search attribute of product and when they buy freshwater fish, the ultimate

goal of searching and determining the characteristics of freshwater fish is to ensure secure purchase and reduce security risks. Tonsor *et al.* (2009) also showed that after the BSE crisis, the beef's price, place of production and whether there's a safety certification have had significant effects on American consumers' safety risk perception of beef (Tonsor *et al.*, 2009).

- Consumption behaviors of freshwater fish that mainly include purchasing experience and understanding of the knowledge of freshwater fish. As the daily products with an extremely high repurchase rate, consumers can obtain the relevant knowledge of product quality safety in the repeat purchase. With the accumulation of the purchasing experience and the grasp of the knowledge of quality safety of freshwater fish, consumers also will have a corresponding reduction of the level of risk perception.
- Situation involvement that mainly includes the factors such as consumers' concept of healthy diet, the concern extent of the safety of freshwater fish and the situation of food safety. Compared with other kinds of meat, freshwater fish is healthier and more nutritious; as consumers have a stronger concept of healthy diet and a higher concern extent of the safety of freshwater fish and at the same time, the security incidents of aquatic products emerge in endlessly and consumers perceive a worse situation of food safety, consumers will have higher levels of risk perception of freshwater fish.

Model construction: Consumers' risk perception of freshwater fish is the result of comprehensive consideration of various factors. In order to analyze the influence factors of consumers' risk perception of freshwater fish and further clarify the direction of the effects and the degree of the influence, I have constructed the Probit model for the influence factors of consumers' risk perception of freshwater fish and analyzed the samples of 192 consumers. The specific form of the model is:

$$y^* = \alpha + \beta X + \mu \quad (1)$$

and $y = 1$, when $y^* > 0$, it represents that consumers think that freshwater fish products are safe; $y = 0$, when $y^* \leq 0$, it represents that consumers think that freshwater fish products are not safe.

In formula (1), μ is a disturbing term that subjects to the standard normal distribution, so the binary discrete choice model of influencing the level of consumers' risk perception of freshwater fish can be expressed as:

$$prob(y = 1|X=x) = prob(y^* > 0|x) = prob\{\mu > -(\alpha + \beta X)\} | x\} = 1 - \phi[-(\alpha + \beta X)] = \phi(\alpha + \beta X) \quad (2)$$

Table 1: Explanatory variable settings and assignments

Variable name	Measurement index	Symbol	Explanatory variable settings and assignments
Characteristics of consumers	Gender	x ₁	Male = 0 Female = 1
	Age	x ₂	≤19 years old = 1 20 to 29 years old = 2 30 to 39 years old = 3 40 to 59 years old = 4 ≥60 years old = 5
	Education background	x ₃	Primary school = 1 Junior high school = 2 High school = 3 Bachelor/junior college = 4 Master and above = 5
	Average monthly family income	x ₄	<5000 = 1 5000 to 9999 = 2 10000 to 14999 = 3 15000 to 19999 = 4 ≥20000 = 5
	Children under the age of 18	x ₅	No = 1 Yes = 2
Product characteristics	Price	x ₆	Very low = 1 Low = 2 General = 3 High = 4 Very high = 5
	Quality safety certification	x ₇	No = 1 Yes = 2
Consumption behaviors	Purchasing experience	x ₈	No = 1 Little = 2 General = 3 Rich = 4 Very rich = 5
	Knowledge of freshwater fish	x ₉	Don't understand = 1 Understand little = 2 General = 3 Understand a little = 4 Understand = 5
Situation involvement	Concept of health diet	x ₁₀	Very low = 1 Low = 2 General = 3 Strong = 4 Very strong = 5
	Concern extent of safety	x ₁₁	Very low = 1 Low = 2 General = 3 High = 4 Very high = 5
	Situation of food safety	x ₁₂	Very bad = 1 Bad = 2 General = 3 Good = 4 Very good = 5

In formula (2), ϕ is the standard normal cumulative distribution function, y^* is the unobserved latent variable, y is the actually observed dependent variable that indicates consumers' risk perception of freshwater fish, 0 is "unsafe" and 1 is "safe"; X is the actually observed independent variable that mainly includes factors such as the gender, age, education degree, average monthly family income of consumers and whether there are children under the age of 18; factors of product characteristics such as the freshwater fish's price, place of production and whether there's a safety certification; factors of consumption behaviors such as consumers' purchasing experience and the

understanding of the knowledge of freshwater fish; factors of situation involvement such as consumers' concept of healthy diet, concern extent of the safety of freshwater fish and the situation of food safety.

Variable declaration: All variables and the corresponding assignment are as shown in Table 1.

Model estimation and result analysis: This study uses EViews 6.0 software, includes all the involved variables into the model, adopts the maximum likelihood estimation method for estimation and uses White test to correct heteroscedasticity. The estimation

results are as shown in Table 2. Model 1 is the estimation results for the first time and model 2 is the
 Table 2: Estimation results of Probit model for the influence factors of consumers' risk perception of freshwater fish

Variable	Model 1		Model 2	
	Estimated parameter	Z statistical value	Estimated parameter	Z statistical value
X ₁	0.528***	0.873	0.547***	0.915
X ₂	-0.019	-0.165	-	-
X ₃	-0.136**	-0.334	-0.133**	-0.411
X ₄	0.161	3.844	-	-
X ₅	0.116***	0.589	0.149***	0.522
X ₆	0.072*	0.639	0.074*	0.712
X ₇	-0.087	2.461	-	-
X ₈	-0.153**	-2.153	-0.155**	-2.165
X ₉	-0.315**	-3.669	-0.362**	-3.679
X ₁₀	0.251**	0.274	0.254**	0.283
X ₁₁	1.267***	2.371	1.286***	2.376
X ₁₂	-0.890***	-1.443	-0.792***	-1.512
Constant	-0.177	-0.264	-0.182	-0.264
R ²	0.393		0.411	
Log-likelihood value	-127.690		-127.706	
Maximum likelihood ratio	32.145***		32.252***	
Number of samples	192		192	

*, ** and ***: Parameters are significant at the level of 10, 5 and 1%, respectively

estimation results for the second time after getting rid of the explanatory variables with little correlation with the explained variables and those with multicollinearity.

From the estimation results of the models, both model 1 and 2 have passed the significance test of likelihood ratio, so the regression equation is valid. At the same time, for cross-section data, R² respectively reaches 0.393 and 0.411, which are also acceptable. Generally speaking, the models and the test results are statistically significant. In further comparison between model 1 and 2, all explanatory variables in model 2 have passed the screening of the association with the explained variables and they are significant at different levels and the degree of fitting is also better than model 1. Therefore, based on the results of model 2, we can find that:

- In the statistical characteristics of consumers, gender, education background and whether there're children under the age of 18 have significant impacts on consumers' risk perception of freshwater fish, while the influence of consumers' age and average monthly family income on the risk perception is not significant. Among them, gender has a large influence on the risk perception of freshwater fish and has a significant influence at the level of 1%, which may be related to that women bear more responsibility than men in the aspects of purchasing freshwater fish and taking care of family life and diet so that women have higher perception of safety risks of freshwater fish. The families with children under the age of 18 pay more attention to the safety and nutrition of diet, therefore, their risk perception of freshwater fish is significantly higher than that of the families without children. Education background affects consumers' risk perception of freshwater fish

adversely at the level of 5%, which shows that the higher the education level of consumers is, the lower the level of risk perception of freshwater fish is. This may be because that well-educated people learn more knowledge of freshwater fish and the measures of avoiding the risks so that they have a lower risk perception of freshwater fish.

- In product characteristics, the price of freshwater fish affects consumers' risk perception positively at the level of 10%. For the products with higher prices, in order to avoid the double loss of money and security, consumers will be more cautious when purchasing the products and their risk perception will be higher. Whether the product has a quality safety certification doesn't have significant influence on consumers' risk perception, which is inconsistent with numerous existing research results, which may be related to a large number of negative reports of the current media on a variety of product quality certifications that cause consumers to show skepticism to various quality safety certifications.
- In consumption behaviors, both the purchasing experience and the knowledge of freshwater fish affect consumers' risk perception adversely at the level of 5%, which shows that the richer the consumers' purchasing experience of freshwater fish is and the more the understanding of the knowledge of freshwater fish is, the lower the level of risk perception of freshwater fish will be. The reason is possibly that rich purchasing experience enables consumers believe that they can make accurate judgments on quality safety by themselves. The more the understanding of the knowledge of freshwater fish is, the more reasonable the consumers' risk perception will be, at the same time, the consumers will be more likely to know various measures to avoid risks and the

level of their risk perception of freshwater fish will be lowered correspondingly.

- In situation involvement, consumers' concept of healthy diet, concern extent of food safety and the situation of food safety have affected consumers' risk perception of freshwater fish in varying degrees and different directions. Among them, the concern extent of food safety is the factor with the largest influence in all the explanatory variables and the influence coefficient reaches 1.267. The estimation results of the models indicate that the more consumers concern food safety and the stronger their concept of healthy diet is, the higher their level of risk perception of freshwater fish will be. At the same time, the situation of food safety influences consumers' risk perception of freshwater fish adversely and the better the overall situation of food safety is, the more relieved the consumers will feel about food safety and the lower the level of risk perception will be.

CONCLUSION

Main conclusions: Through the questionnaires of 192 Yangzhou residents, this research studied consumers' safety risk perception of freshwater fish and its influence factors. The main conclusions are as follows:

- (32.8%) of consumers believe that freshwater fish on the market is not safe and they have a high risk perception of the quality safety of freshwater fish and 34.9% of consumers think that the safety problems of freshwater fish have great impact on the physical and psychological health of their families.
- As high as 75.5% of consumers consider that the safety problems of freshwater fish occur mainly in the cultivation link and the sales link and the transportation link are the second. The vast majority of consumers believe that there are environmental hormone residues and antibiotic residues at first in the freshwater fish sold in the current market has and then there are microbiological contamination, pesticide residues and illegal addition in the process of transportation or sales. The hazards caused by the freshwater fish with security hazards to human body will lead mainly to risks of the eaters such as digestive tract or liver diseases, precocious puberty or infertility and teratogenesis and carcinogenesis.
- Consumers think that the top three reasons of the safety problems of freshwater fish are one-sided pursuit of profits by breeding or sales enterprises, government supervision not in place and asymmetrical consumer information.

- Consumers' risk perception of freshwater fish is mainly affected by consumers' gender, education background and whether there are children under the age of 18, at the same time, freshwater fish's price, consumers' purchasing experience, understanding of the knowledge of freshwater fish, concept of healthy diet, concern extent of food safety and the situation of food safety all have produced significant influence on consumers' risk perception of freshwater fish. Consumers' risk perception of freshwater fish has nothing to do with the age, average monthly family income and whether the product has a quality safety certification.
- The factors of affecting the level of consumers' risk perception of freshwater fish are different on the degree of influence and the direction of action. The three factors including the concern extent of food safety, the situation of food safety and gender have the largest degree of influence on consumers' risk perception of freshwater fish and the influence coefficients are respectively 1.286, -0.792 and 0.547. The degree of influence of other factors is successively the understanding of the knowledge of freshwater fish (-0.362), the concept of health diet (0.254), purchasing experience (-0.155), whether there are children under the age of 18 (0.149), education background of consumers (-0.133) and freshwater fish's price (0.074).

POLICY RECOMMENDATIONS

- The relevant departments of the government need to establish drug use norms in freshwater fish aquaculture, increase the supervision of the breeding process, strengthen the construction of freshwater fish quality safety system and severely investigate and renovate breeding or sales enterprises' illegal behaviors of misusing various additives to improve the overall quality safety level of freshwater fish and reduce consumers' risk perception of quality safety of freshwater fish.
- Breeding enterprises of freshwater fish should disclose breeding and testing indexes and other information to consumers as much as possible in time to reduce consumers' high risk perception caused by negative information. Meanwhile, aquaculture enterprises need to strengthen and standardize breeding management, completely eradicate the drugs outside of the national standards, improve breeding techniques and establish a traceability system in the breeding process of freshwater fish as much as possible to make liability accidents traceable and reduce the

liability risks of enterprises' quality safety incidents to some extent.

- The government needs to strengthen the universal education of food safety to improve consumers' knowledge of food safety and gradually guide consumers to establish a scientific concept of risk perception of food safety.

ACKNOWLEDGMENT

The authors are grateful for the financial support of the social science project of Jiangsu Education Department of China No. 2013SJD630063, Yangzhou university humanity and social science project No. xjj2014-67, Key Projects of National Social Science Foundation of China No. 14ZDA069, the National Natural Science Foundation of China No. 71273117, Central University Basic Research Funds No. JUSRP51325A and JUSRP51416B, the project of the Six Top Talents in Jiangsu Province No. 2012-JY-002 and the project of college Innovation Team of Jiangsu Province social science No. 2013-011.

REFERENCES

- Frewer, L.J. and S. Miles, 2003. Temporal stability of the psychological determinants of trust: Implications for communication about food risks. *Health Risk Soc.*, 5(3): 259-271.
- Jiang, Y.S., 2008. *Cooking Health and Safety Science*. China Light Industry Press, Beijing, pp: 78-81.
- Overall Well-off Research Center of China, 2012. Food safety report of China in 2011-2012. *Well-Off*, 1: 47-52.
- Scully, J., 2003. Genetic engineering and perceived levels of risk. *Brit. Food J.*, 105(1/2): 69-77.
- Tonsor, G.T., T.C. Schroeder and J.M.E. Pennings, 2009. Factors impacting food safety risk perceptions. *J. Agr. Econ.*, 60(3): 625-644.
- Zhang, Z. and J. Chen, 2013. Research on residents' freshwater fish consumption habits indoor with the view of regional perspective. *Chinese Fish. Econ.*, 31(5): 50-58.