DATE ANALYSIS OF CONSUMERS' PURCHASE INTENTION BASED ON THE SAFETY OF FOOD PLASTIC PACKAGING MATERIALS

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Abstract. With the rapid development of food technology and the packaging industry, frequent food contact packaging safety issues. This paper uses questionnaire survey method to obtain related data and uses methods such as multivariate ordered Logistic model to explore the relationship between food packaging material safety and customers’ purchasing intention. It is found that consumers are short of knowledge about food packaging. Education level, food packaging safety knowledge, and perceived risk have a negative impact on consumers’ purchasing intention plastic packaging materials and food. And there is a positive correlation between health status and consumers’ purchasing intention of buying food with plastic packaging materials. We should strengthen the promotion of plastic packaging materials and food, strengthen the risk control of plastic packaging materials and food, and improve the safety management of plastic packaging materials and food.

1. Introduction
More and more people pay attention to food packaging safety with the economy booming and the development of society in China. The exposure of food contamination accidents also become more frequent with the diversified food culture [1]. Food packaging plays a role in food-protecting, decoration, sales-pushing, and food brand promotion. Unfortunately, many food packaging problems have occurred in China, and unsafe food packaging seriously threatens consumers’ health. The proportion of fast and convenience food has relatively increased. However, their packaging quality is generally miserable. Food plastic packaging materials have become one of the threats to people’s health. Although consumers are more concerned about food safety, the dangers imposed by plastic packaging are often ignored. For example, foods with high calory may be packed in plastic bags, and the residues of those toxic materials may be left with the food [2]. And consumers' awareness of food packaging safety problems is not enough to protect them from this danger.

The existing domestic research on food safety and consumers’ purchasing intention demonstrates a multi-disciplinary integration but still stays far behind the western countries. Regarding the exploration of consumers’ sage food consumption, He Jing et(2015) took Nanjing consumers' trust and awareness of organic fruits and vegetables as the experimental starting point of the research and considered that food health and safety issues were already widely concerned by customers[3]. Regarding the customers’ purchasing intention in food safety consumption, Anupam Singh (2017) used the multiple regression method to empirically analyze the influence of consumers’ attitude on purchasing intention and behavior and found that attitude is a key intermediary variable that affects
purchasing behavior\textsuperscript{[4]}. Guo Ji (2013) built a consumer purchase model of genetically modified foods, which proved that perceived benefits, perceived risks, and risk reduction strategies directly improved the accuracy of the assumptions about consumers' purchasing intention\textsuperscript{[5]}. Based on the western six risk perception theory, Cui Yanhong (2016) discovered that consumers were more willing to buy fresh agricultural products, but it’s affected by their perceived risk\textsuperscript{[6]}.

This paper gave recommendations to consumers to scientifically select packaging materials based on the empirical analysis of the impact of the plastic packaging safety of food on consumers' purchasing intention. At the same time, this paper is also written with the intention of reducing related food safety accidents and improve the overall economic benefits of the food industry.

2. Data source and its reliability and validity

2.1. Data source

A questionnaire survey method is used to collect the data of consumers' cognition and perception of the safety of food plastic packaging. The questionnaire is designed with three parts:

The first part is designed to collect the basic information of the respondents, including their gender, age, monthly income, education level, health status, etc. The second part is designed to investigate consumers’ concerns about food safety and the knowledge of food packaging safety. The third part is designed to understand consumers’ perceived risks in the safety question of food packaging materials. The questionnaire survey was launched in xx, mainly targeting consumers in the supermarkets and shopping malls, and adopted an anonymous questionnaire survey. A total of 500 questionnaires were distributed, among which 482 questionnaires were returned, and 460 over 482 are valid, which the effective rate counts 92%.

2.2. The test of reliability and validity

This paper uses the Cronbach alpha coefficient to test the reliability of the questionnaire. The specific results are as shown in Table 1.

| Dimension                  | Number of items | Cronbach alpha coefficient |
|---------------------------|-----------------|----------------------------|
| Food safety awareness & Food packaging safety knowledge | 6               | 0.932                      |
| Perceived risks           | 8               | 0.867                      |

As shown in Table 1, the Cronbach $\alpha$ coefficients of the dimensions of Food safety awareness & Food packaging safety knowledge and the perceived risk are all above 0.8, and all passed the Cronbach $\alpha$ coefficient test.

Validity research is used to analyze whether the research scale is reasonable. A comprehensive analysis of the KMO value, common degree, variance interpretation rate value, factor loading coefficient value, and other indicators was conducted to verify whether the data of the scale is valid. The validity test results of consumers’ questionnaires on food safety awareness & Food packaging safety knowledge is as shown in Table 2.

| Test of KMO and Bartlett | KMO value | approximate chi-square | df | P   |
|--------------------------|-----------|------------------------|----|-----|
| Bartlett's sphere test   | 0.819     | 542.012                | 3  | 0.000|

As shown in Table 2, the validity test of consumers on the Food safety & Food packaging safety knowledge’s KMO value is 0.819, which is higher than 0.8, indicating that the scale data is valid.
3. Model building and variable design

3.1. Theoretical basis

It can be seen from the questionnaire survey that the perceived risk by customers of food packaging materials refers to the related safety and environmental issues. Consumers’ purchasing intention has a negative correlation with the perceived risk. The consumer decides to buy when the perceived risk is reduced to his acceptable level or disappears. Therefore, this article analyzes the impact of consumers' perceived risk of food packaging materials on their purchase intention.

Consumer behavior is an everyday activity with a particular decision-making process, and the possibility of the purchase decision can be observed through behavioral willingness. Individual statistical variables refer to a consumer’s individual factors such as age, gender, marital status, education level, monthly income, etc., which affect consumers' purchasing intention. For example, Kazuo Nakamoto (2014) believes that age is a significant factor that affects the decision to buy organic agricultural products [7]. Therefore, in the study of consumers' purchasing intention, it is necessary to study the factors such as age, gender, education level, monthly income, etc., so as to analyze how they influence consumers’ purchasing intention.

In addition, consumers' knowledge and familiarity with a product are also closely related to consumers' perception of risk when buying food. In terms of food-grade plastic packaging safety knowledge, the factors influencing the purchasing intention are: whether a customer has knowledge of food-grade packaging materials, whether he recognizes the appropriate labeling for food packaging, and whether he is aware of the food safety situation in China as indicators.

Based on the above analysis, this paper studies the impacts on consumers' purchasing intention of buying food by analyzing individual characteristics, food packaging safety knowledge, and the perceived risks of food packaging.

3.2. Model building

Consumers’ purchase expectations of foods with plastic packaging is an orderly and multi-categorical variable. According to the Likert scale, consumers’ purchase expectations can include 5 levels: very reluctant, unwilling, so so, willing, very willing. This paper chooses a multivariate ordered Logistic model to study consumers' purchasing intention of buying food with plastic packaging and analyzes its main influencing factors. The logistic model is chosen because its variables may not meet the requirements of normal distribution or homoscedasticity, and its functional form is:

\[ p(y = j|X) = \frac{1}{1 + e^{-(\alpha + \beta X)}} \]  

In this functional form, \( X_j \) represents the i-th index, and \( y \) represents the probability of a certain level of consumers' purchasing intention of buying food with plastic packaging. The build cumulative logistic model is:

\[ \text{Logit}(p_j) = \log \left( \frac{p(y \leq j)}{p(y \geq j + 1)} \right) = \alpha_j + \beta X \]  

In this logistic model, \( p_j = p(y=j), j=1, 2, 3, 4, 5, X \) represents an index that affects consumers' purchasing intention of buying food with plastic packaging, \( \beta \) is a set of regression coefficients corresponding to \( X \), which is the model intercept.

\[ p(y = j|X) = \frac{e^{-(\alpha_j + \beta X)}}{1 + e^{-(\alpha_j + \beta X)}} \]  

According to the previous theoretical framework and related assumptions, the empirical model of consumers' purchasing intention of buying food with plastic packaging established through Stata12.0 is:

\[ Y = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7) \]  

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In this model, $Y$ represents consumers’ purchasing intention of buying food with plastic packaging, where $Y=1$ means very reluctant, $Y=2$ means less willing, $Y=3$ means so so, $Y=4$ means more willing, $Y=5$ expresses total willingness;

$$\text{Logit}(p_j) = \ln \left[ \frac{p(y \leq j)}{p(y > j + 1)} \right] = \alpha_j + \beta X \quad (5)$$

### 3.3. Variable design and description

Based on the above analysis, the paper selects the following questions as the 3 dependent variables of this study: "Are you willing to buy food with plastic packaging?", "Are you willing to recommend food with plastic packaging to others?", and "Do you feel secure with the food with plastic packaging?"

The Cronbach alpha coefficient of the purchase intention questionnaire is 0.875, which has high reliability as the result of the test. Through comprehensive analysis of KMO value, common degree, variance explanation rate value, factor loading coefficient value, and other indicators, KMO value is higher than 0.8, and the P-value of Bartlett's sphere test is 0.000<0.05, indicating a good correlation between purchase intention variables.

To conclude, combining the above analysis and research hypotheses, the factors that affect consumers' purchasing intention of buying food with plastic packaging can be grouped into three categories:

| Table 3 Variable design of purchase intention and its influencing factors |
|---------------------------------------------------------------|
| **Individual characteristics**                               |
| Gender | Age | Education level | Monthly income | Health status |
|--------|-----|----------------|----------------|---------------|
| male=1, | under 20=1, | primary school and below=1, | 2000 RMB and less=1, | very healthy=5, |
| female=0 | 20-30=2, | middle school=2, | 2000-5000 RMB=2, | healthy=4, |
| | 30-40=3, | high school (secondary school)=3, | 5000-8000 RMB=3, | ordinary=3, |
| | 40-50=4, | college and undergraduate=4, | 8000-10000 RMB=4, | unhealthy=2, |
| | over 50=5 | postgraduate and above=5 | 10000 RMB and more=5 | very unhealthy=1 |

| Knowledge on Food packaging of safety                          |
|---------------------------------------------------------------|
| Food safety awareness | Food packaging knowledge | Food packaging materials awareness |
| very safe=5, | know very well=5, | know very well=5, |
| safe=4, | know=4, | know=4, |
| ordinary=3, | general understanding=3, | general understanding=3, |
| Unsafe=2, | don’t know=2, | don’t know=2, |
| very unsafe=1 | don’t know at all=1 | don’t know at all=1 |

| Risk perception | |
|--------------------------------|
| completely agree=5, | agree=4, |
| so so=3, | disagree=2, |
| disagree=2, | completely disagree=1 |

| Consumers' risk perception of food packaging                  |
|---------------------------------------------------------------|

| Purchasing intention | |
|----------------------|----------------------------------|
| Willing to buy food with plastic packaging | completely agree=5, agree=4, generally=3, disagree=2, completely disagree=1 |
| Willing to recommend food with plastic packaging to others | |
| feel secure with the food with plastic packaging | completely disagree=1 |

### 4. Description and regression analysis

#### 4.1. Descriptive analysis

Regarding the knowledge of food packaging, 9.1% of respondents chose the option ‘know very well’, 18.9% of respondents chose the option ‘know’, 26.3% of respondents chose the option ‘general
understanding, and the survey result shows that about 45% of customers don’t know much about food packaging. The knowledge about plastic packaging materials is even more lacking.

Which aspects of the packaging attract customers generally when they buy food? According to the survey results, 75.43% of respondents preferred ‘shelf life’ and ‘production date’, 36.96% of respondents preferred ‘packaging appearance’, 23.04% of respondents paid more attention to the ‘practicability’ of packaging, and only 24.35% of them gave importance to food packaging materials.

Regarding whether the public likes to learn more about food packaging safety, 73.17% of respondents think it is necessary, 14.63% of respondents think it is very urgent, only 10.98% of respondents think it doesn’t matter, and 1.22% of consumers don’t think at all it’s necessary.

Table 4. Result of descriptive analysis

| Variable                        | maximum | minimum | Average  | Standard deviation |
|---------------------------------|---------|---------|----------|--------------------|
| Gender                          | 1       | 0       | 0.082    | 0.090              |
| Age                             | 5       | 1       | 1.482    | 1.179              |
| Education level                 | 5       | 1       | 3.587    | 1.128              |
| Monthly income                  | 5       | 1       | 2.945    | 1.104              |
| Health status                   | 5       | 1       | 2.812    | 0.492              |
| Food packaging security knowledge | 5   | 2       | 2.451    | 0.948              |
| Risk perception                 | 5       | 1       | 3.012    | 0.862              |
| Purchasing intention            | 5       | 1       | 3.452    | 0.759              |

As shown in Table 4, the respondents who have participated in the survey have a significant gap in individual characteristics, especially in terms of education level, monthly income, and health status. The average value of food packaging security knowledge is 2.451, which shows that consumers' food packaging safety knowledge is still low. The average value of risk perception is 3.012, which means some customers are aware of the risk. The average value of purchasing intention is 3.452.

To sum up, although consumers do not blindly give up food with plastic packaging materials currently, they are still aware of the risk. The value of food with plastic packaging is not yet well determined. Consumers are mainly unwilling to recommend food with plastic packaging to others. The purchasing intention of buying food with plastic packaging is not high. The factors of gender, age, education level, monthly income, and health status influence consumers' purchasing intention of buying food with plastic packaging, and consumers with different individual characteristics demonstrate different purchase intentions.

4.2. Regression analysis

As shown in Table 4-3, the regression analysis results of the factors influencing consumers' purchasing intention of buying food with plastic packaging are statistically analyzed and processed with modele Stata12.0.

A multivariate ordinal logistic regression model is established according to Table 4-3 as follows:

\[ \text{Logit}(p_j) = \alpha_j + \beta X \]  

\[ \beta X = 0.026X_1 - 0.950X_2 + 0.037X_3 + 0.766X_4 + 0.637X_5 + 0.704X_6 - 0.62X_7 \]  

A significance test was conducted based on the multivariate and ordered logistic regression analysis of the factors affecting consumers' purchasing intention of buying food with plastic packaging. The conclusions are as follows:
a) It exists a difference among the individual characteristics indicators, influencing consumers’ purchasing intention of buying food with plastic packaging, which the education level has passed the test with the percentage of 10%, and its regression coefficient is -0.766. Therefore, the higher the education level, the less purchasing intention of buying food with plastic packaging, which shows a significant negative correlation. It exists a positive correlation between health status and consumers’ purchasing intention of buying food with plastic packaging, with a regression coefficient of 0.637. Consumers with poor physical health pay more and more attention to adverse factors in their diet and consider food packaging safety, and of course, are less willing to buy plastic packaging. On the contrary, the better the health condition, the less attention is given to good packaging. There is no correlation between the factors of gender, age, monthly income and consumers’ purchasing intention.

b) There is a significant negative correlation between food packaging safety knowledge and consumers’ purchasing intention, with a regression coefficient of -0.704. The higher the level of consumers’ food packaging safety knowledge, the less willing to buy food with plastic packaging because the consumers with good knowledge of food packaging safety are more aware and concerned about the problem and, of course, more cautious when buying. Risk perception has a significant negative impact on consumers’ purchasing intention, with a regression coefficient of -0.62. The higher risk perception customers have, they are more willing to choose foods free of pollution and adverse effects due to their food safety or environmental awareness

| Variable                  | Regression coefficients | Estimated standard error | Z       | P       | Confidence interval |
|---------------------------|-------------------------|--------------------------|---------|---------|--------------------|
| Gender (X1)               | 0.026                   | 0.324                    | 0.08    | 0.937   | -0.616 - 0.66      |
| Age (X2)                  | 0.95                    | 0.574                    | 1.66    | 0.198   | -0.165 - 2.046     |
| Monthly income (X3)       | -0.037                  | 0.161                    | 0.23    | 0.819   | -0.341 - 0.351     |
| Education level (X4)      | -0.766**                | 0.626                    | 0.03    | 0.031   | -0.316 - 1.993     |
| Health status (X5)        | 0.637***                | 0.267                    | 1.67    | 0.601   | -0.518 - 2.063     |
| Food packaging security knowledge (X6) | -0.704***              | 0.246                    | 2.64    | 0.004   | -0.312 - 1.116     |
| Risk perception (X7)      | -0.62***                | 0.351                    | 0.09    | 0.264   | -0.364 - 0.935     |

Note: *, **, *** represent the significance level of 10%, 5%, and 1%, respectively.

5. Conclusion and recommendation

5.1. Conclusion
This paper takes the impact of food packaging safety on consumers’ purchasing intention as the research topic. The first purpose of the research is to understand consumers' perceptions of food packaging safety; the second purpose is to analyze the correlation between food plastic packaging safety and consumers' purchasing intention.

This paper adopts the documentary method, questionnaire survey method, and comprehensive multivariate ordered Logistic model to carry out the research. The specific conclusions are as follows:

a) Consumers' risk perception analysis on food packaging safety. Consumers care about food safety and worry about the safety of food packaging materials, but they don’t have much knowledge about that, especially concerning food plastic packaging materials. Some consumers are aware of the safety risks of food plastic packaging materials, but most have insufficient knowledge of the risks of food packaging materials.

b) The impact of food packaging safety on consumers' purchasing intention. The factors of education level, food packaging safety knowledge, and risk perception are negatively related to consumers' purchasing intention of buying food with plastic packaging. A positive correlation exists between health status and consumers' purchasing intention of buying food with plastic
packaging. However, the factors of gender, age, and monthly income do not influence consumers' purchasing intention of buying.

5.2. Recommendation

5.2.1. Widely promote and strengthen food packaging safety knowledge
Carry out publicity and education activities to help the public understand the importance of food packaging safety. Establish public opinion among the public to help the public familiarize themselves with the relevant knowledge of food packaging materials. On the one hand, it can contribute to Chinese society's understanding of food packaging safety and increase people's confidence in governmental control; On the other hand, food package warnings can be communicated to consumers as soon as possible and benefit from food packaging risk assessment and prevention mechanisms. Consumers should also continuously improve their self-protection awareness by learning relevant knowledge and actively participate in food packaging safety supervision. Food-producing companies must take their social responsibility and strictly build up self-supervisor and reporting systems. The media must give objective, fair, and timely reports on the related subjects to fully play a public opinion supervision role.

5.2.2. Strengthen the risk control of food packaging materials
Introduce risk assessment and prevention mechanisms to detect harmful substances in food packaging materials as early as possible and understand the risk. Consumers must be warned if the packaging materials have increased consumption risks so that they can control their consumption risks within an acceptable range. Establish a food packaging risk detection network covering all provinces, cities, and the whole of China to benefit from modern technology for food packaging safety control. The network can be extended for information collection to the production, circulation, and consumption of food packaging materials and carry out pollution source investigation and tracking. Activate a system of inspection on high-risk food packaging materials and additives to minimize systemic risks.

5.2.3. Improve the safety management of food with plastic packaging
According to laws, regulations, and national standards, manufacturers should indicate the plastic packaging materials' composition and its national standards. Establish a multi-level legal system to regulate packaging materials' production and circulation, and provide a benign environment for the development of the food packaging industry. The government should also incorporate risk assessment systems, defective product recall mechanisms, and traceability systems into laws and regulations. In addition, the related governmental departments should strengthen law enforcement, focusing on the food plastic packaging products that consumers often come into contact with, and strengthening laws and regulations for areas where companies producing food packaging materials are concentrated. Small businesses with unlicensed production and no quality assurance capabilities and those enterprises that produce fake and inferior products should be closed down to eliminate toxic and harmful food plastic packaging. Prohibit the production and sales of unqualified food packaging raw materials and recycled waste materials to ensure food packaging safety from the root.

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