RESEARCH ARTICLE

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Are Nutrition Labels Useful for the Purchase of a Familiar Food？ Evidence from Chinese Consumers' Purchase of Rice

Abstract Nutrition labeling has been accepted by Chinese consumers as an information source to learn about food quality and safety. This paper uses Chinese consumers' rice purchase as an example to study how consumers use food nutrition labels to make purchase decision of a familiar food product. The goal is to understand how consumers seek information from the labels to make purchase when extensive experience with the food has been developed. Survey data from 400 random respondents in Beijing were analyzed using an empirical framework and a Mont Carlo integral econometrics model. We find that more than 50% of the consumers in Beijing have heard of food nutrition labels in general, 36.50% carefully use label information even if they are familiar with the food, and nearly 70% consider mandatory food nutrition labels as beneficial. Those who are more knowledgeable about rice nutrition labels are more likely to use the labels when purchasing rice, no matter how familiar they are with the product. Frequent users of nutrition labels are more likely to consider food mandatory nutrition labels as beneficial. This study suggests that consumers

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still use the label information to reassure the quality and safety of food despite a history of consumption.

1 Introduction

The use of labeling information is believed to be much related to the purchase of new products (Mareau, Markman and Lehmann, 2001; Zhao, Hoeffier and Dahl, 2009). With the consumption of a familiar food product, do consumers still pay significant attention to information provided on the nutrition labels? Reading information on the label takes time, and for many consumers, understanding the label is challenging. Therefore, the cost of information search could be high but the perceived benefits could be low. Under this situation, do consumers ignore the nutrition labels and just use their experience to make purchase decisions, or do they still use the labels? If consumers do use labels, marketers could have a chance to influence purchase by designing the information provided in the labels. If not, the reasons may interest marketers to help them develop alternative marketing plans to motivate purchase.

In the case of Chinese consumers' purchase of rice, with the improvement of living standard and health awareness, more attention has focused on the issue of rice quality and safety. In general, food safety concerns have become more significant after frequent food safety scandals exposed in China, including the most recent melamine-milk scandal in 2008, which has caused serious kidney problems of about 294 000 children (Zhou, 2009). Therefore, Chinese consumers tend to pay more attention to the safety and nutritional contents of the food they purchase.

Adopted by many countries and areas, nutrition labels have been effectively used to measure food quality and protect consumers' health, and are perceived by the public as an important information signal which transfers nutritional composition, nutritional nature and nutritional efficacy of the food. According to the Codex Alimentarius Commission (CAC), there are two components in nutrition labels: nutrition facts and nutrition claims. In most countries and regions, the former should contain energy, protein, fat and carbohydrates. In some countries, the labels for unsaturated fatty acid, cholesterol, dietary fiber, sodium and other elements are also required. The latter presents the nutritional nature of the commodity, including the claim of nutrients content, content comparison, and the physiological function and health.

In the 1940s, the first nutritional label appeared in Great Britain, which

presented information about an excellent source of vitamin C. Afterwards, countries worldwide started to develop the standard of daily intake of nutrients and require nutrients content of food in the labels. The CAC has set up a series of guidance and principles for nutrition label and an increased number of countries have enacted related laws and regulations since 1985.

Nutrition labels first appeared in China in the early 1990s. Although the Chinese government required food labels for special nutrient GB13432, which focused on baby food, fortified food, and nutrient adjusted food, it only started to require other labeling since 1992. By then, adding nutrition labels or not is still voluntarily for most food products. There were many problems associated with food labeling including confusing expressions, inaccurate nutrition claims, and non-standardized labeling language, which have caused serious misunderstandings by consumers. China fell far behind developed countries in formalizing nutrition labels in the 1990s.

In recent years, nutrition labels have attracted growing attention among consumers. There are three main reasons behind this new trend. First, unhealthy diet has become a threat to public health. Second, the problem of low food quality has threatened the health of many consumers. Third, exported food was frequently returned or detained by the import countries because of unclear nutrition labels. Following international institutions of food nutrition labels, the Ministry of Public Health of China enacted a new food nutrition labeling management practice, effective from May 1st, 2008. This practice standardizes the content and format of nutrition labels, and requires all packed food to comply with the regulations. From then on, nutrition labels have become mandatory instead of voluntary in China.

Chinese scholars have conducted research on nutrition labeling, however, academic analysis using quantitative and qualitative methods to study consumers' perception, acceptance and perceived benefits of nutrition labels, and purchasing behaviors is very limited. Based on a survey collected from about 400 consumers in Beijing in February 2008, we studied Chinese consumers' perception of nutrition labels when they purchase rice, a main staple in the Chinese diet. We examined whether Chinese consumers use the nutrition labels to make purchase decisions and how they believe they could benefit from a mandatory rice nutrition label.

2 Literature Review

Consumers' purchase intention is well examined in the literature (Ippolito et al., 1990; Gila et al., 2000; Nayga, 2000; Sedjo and Swallow, 2002; Soregarol et al., 2003; Cranfield and Magnusson, 2003; Matsumoto et al., 2004; Wu and Fu 2007; Yang and Wang 2010). A number of studies have investigated the effect of

nutrition labels on consumption behaviors (Bush et al., 1999; Kim et al.. 2001; Piedra et al., 1996; Teisl et al., 2003). In particular, Gracia et al. (2007) suggested that the consumers who encountered health problems can better understand nutrition labels and thus can make better use of these labels. They also concluded that mandatory nutrition label is perceived as beneficial. Barreiro et al. (2008) highlighted the positive influence of nutrition labels and pointed out that consumers have obtained more nutrition and health information from the labels.

A great amount of research has been conducted to understand the credibility of labeling and its impact on consumer choices about genetically modified (GM) food (Siegrist, 2000; Roe and Teisl, 2007). For example, Roe and Teisl's study suggested that providing contact information of the certification agency is one way to enhance the credibility of a GM label.

Perceived benefits of nutrition labels are used to measure the effectiveness of labels. Wang et al. (1995) examined what consumers could gain from nutrition labels as a transferring channel of nutritional information. Nayga Jr. (1997) conducted a demographic analysis to analyze the influence of food nutrition on physical health and the importance of nutrition labels. Teisl et al. (2003) evaluated the welfare influence of the information extracted from the nutrition labels, which indicates that the value of information is high compared to the costs of disease prevention. Zeng et al. (2008) explored consumers' willingness to pay for labeled food and their perceived benefits of the safety of moon cake addictive.

In summary, the majority of the studies on nutrition certification and labels concentrate on consumers' perception, purchasing behavior and perceived benefits. Many studies have concluded that nutrition message contained in labels have significant impacts on consumer perceptions and thus greatly affect the successfulness of a product in the marketplace. The adoption of food labeling could potentially reshape the food industry as labels change consumer purchase intent. The effect of nutrition information on consumer responses to food has important public policy and market implications in China as well. This is especially important when promoting a more strict food labeling system in China. However, little has been done on this topic and this paper aims to fill in the research gap.

3   Conceptual Framework and Research Design

Consumers' utility of food is influenced not only by food quantity (Q), but also by food attributes (Z), determined by the information (K) obtained from the nutrition labels. Accordingly, consumers' utility function is presented as:

$$U = U(Q(Z(K))). \tag{1}$$

A combination of utility maximization function and consumers' budget constraint determines the demand function, which is affected by food price, income of consumers, information and other factors. This is typically defined as an indirect test of preference (Chang and Kinnucan, 1991). However, it fails to fully describe how consumers obtain and process the information contained in nutrition labels, and how nutrition labels in turn influence consumer purchasing decisions.

It is a successive procedure that consumers gain information from nutrition labels, integrate it with their own evaluations of food, and generate a new consumption concept. On the basis of the new concept, consumers form a new attitude towards the products and this attitude will influence their purchase intention and decisions. In this framework, the attitude of consumers is affected by their perceptions, as suggested by Swartz and Strand (1981).

$$\Pr efer = f_2(D, Aware). \tag{2}$$

Kinnucan and Venkateswaran (1990) presented an empirical model with eight equations based on the Enger model, in their effort to evaluate consumers' perception, concept, attitude and purchasing behavior. According to this method, they assumed that consumers' perceptions are determined by the characteristics of nutrition labels (D).

$$Aware = f_1(D). \tag{3}$$

Perception is formed based on information acquired (K). If consumers understand the nutrition labels, then the information may be significant in changing their buying decision. Therefore, it is presumed that consumers' characteristics and perception change individual buying decision. Perceived benefits of purchasing can affect consumers' utility function. If consumers feel that they can benefit from nutrition labels, they would recognize the welfare associated with purchasing. Hence, utility can be affected by consumers' purchasing behavior.

$$Benefit = f_3(D, \Pr efer). \tag{4}$$

4   Data and Descriptive Statistics

Data used in the research were collected from a random survey of rice consumers in Beijing in February 2008. The questionnaire consists of three sections. The first section investigates consumers' individual, social and statistical characteristics, including gender, age, marital status, work nature, educational experience, current address, age distribution of families, average monthly expenditure on food, self-evaluated health status, the relationship between health and diet. The second section asks questions about the frequency of rice purchase,

and considerations of rice purchase (price, freshness, nutrition, flavor, quality and safety). The third section collects information about nutrition labels of rice, including purchasing channels, the reason for choosing a certain purchasing channel, the perception of nutrition labels, the usage of the information supplied by nutrition labels and whether it is beneficial.

In total, 480 questionnaires were collected from Chaoyang District, Haidian District, Chongwen District and Dongcheng District in Beijing, among which 400 questionnaires were valid. The invalid questionnaires were eliminated because of missing information on key questions such as gender, marital status and purchase intention.

Table 1 lists descriptive characteristics of consumers. The ratio of male to female surveyed was approximately 1 to 1. 93.5% of the respondents were below 49 years old. With regard to education experience, more than half of the consumers graduated from college and a quarter graduated from junior or senior middle school. 19 respondents had an education of graduate degree or above and 58 had a low education of elementary school or below, which accounted for 14.5% of the sample. 55% of the respondents worked at enterprises of different types, followed by respondents who worked for public institution, government, and freelance business, and 5% were migrant workers. A wide variety of occupations in the survey guaranteed representativeness of the sample. About two thirds of the respondents (275, 68.75%) lived in the central districts of Beijing, and the rest lived in suburbs. About half of respondents had a family size of 2 people (188, 47.00%), 40.75%, a family of 3 people, 6.75%, a family of 4 people, and 5.50% of the respondents were single. About 80% of respondents spent 142.85–214.14 or 214.28–285.57 USD in food consumption monthly. The ratios of respondents with monthly food expenditure of 71.42–142.71 (20), 285.71–357(35), 357.14–428.43 or above 428.57 (8) were relatively small (exchange rate: 1 USD = 7 yuan, approximately).

Table 1 Descriptive Statistics of Surveyed Consumers' Demographic Characteristics

Statistical Indicator	Category	No. of respondent	Proportion (%)
Gender	Male	196	49.00
	Female	204	51.00
Age	< 29	180	45.00
	30–49	194	48.50
	> 50	26	6.50
Educational experience	Primary school or below	58	14.50
	Junior and senior middle school	105	26.25
	College & undergraduate	218	54.50

(*To be continued*)

Statistical Indicator	Category	No. of respondent	Proportion (%)
	Graduate school or above	19	4.75
Work nature	Government	56	14.00
	Public institution	65	16.25
	Enterprise	220	55.00
	Self-supporting business	0	0.00
	Freelance	27	6.75
	Student	0	0.00
	Inoccupation	12	3.00
	Peasant worker	20	5.00
Current address	Inside the city	275	68.75
	Outside the city	125	31.25
Family size	1	22	5.50
	2	188	47.00
	3	163	40.75
	> 4	27	6.75
Average expenditure on food (USD/month)	< 71.42	0	0.00
	71.42–142.71	20	5.00
	142.85–214.14	136	34.00
	214.28–285.57	187	46.75
	285.71–357	35	8.75
	357.14–428.43	14	3.50
	> 428.57	8	2.00

Nearly half of the respondents claimed that their health status is normal (48.75%). Respondents in excellent health status (59) and good health status (93) accounted for 14.75% and 23.25%, respectively. Fifteen respondents evaluated their health status as bad or very bad, accounting for 13.25% of the sample. Seventy percent of the respondents felt high or very high time pressure, while only less than one third of the respondents felt low or very low time pressure. Regarding physical exercises, about 70% of the respondents took exercises occasionally (272), 24.50% often took exercises (98) and 7.50% never (30). Although most of the respondents had very limited time to take exercises because of high time pressure, the majority still insisted on spending time on exercises, suggesting that consumers' health awareness has been enhanced. Finally, more than 80% of the respondents (339) claimed that health has good or normal relation with diet and only 15.25% of the respondents thought these two are

irrelevant with each other. It was shown that most consumers were aware of food quality and safety issues and the connection to their own health and welfare.

Table 2 Descriptive Statistics of Consumers' Health Attitude

Statistical indicator	Category	No. of respondent	Proportion (%)
Self-evaluated health status	Excellent	59	14.75
	Good	93	23.25
	Normal	195	48.75
	Bad	38	9.50
	Very bad	15	3.75
Time pressure	Very high	112	28.00
	High	170	42.50
	Low	22	5.50
	Very low	96	24.00
Physical exercises	Often	98	24.50
	Sometimes	272	68.00
	Never	30	7.50
The relationship between health and diet	Strong	100	25.00
	Normal	239	59.75
	Irrelevant	61	15.25

Table 3 presents the influential factors of consumers' rice purchase. About 70% of the respondents (283) purchased rice once or twice per week, 26.25% once or twice per month (105) and only 3% 3 or 4 times a week. This shows that most Beijing consumers do not purchase a large amount of food at one time but choose to purchase frequently instead, because of their considerations of expatriation, storage, and convenient access to supermarket. Among factors affecting purchase, price is the primary factor (260, 65%), followed by nutrition (36, 9%), freshness (48, 12%), quality and safety (32, 8%), brand (10, 2.50%) and other factors including convenience of processing, flavor preference, pack, clarity, appearance and fineness, and production place (14, 3.50%). Most respondents considered recommendations from relatives and friends when making purchases (108, 27.00%). The appearance of rice (220, 55%) is also a deterministic factor. Other factors do not play a significant role.

Regarding the impact of information on rice purchase, about half of respondents considered quantity (40%) as the most important factor. Over two thirds of the respondents have paid extensive or strong attention to price, indicating that price plays an important role in rice purchase. Quality and safety

Table 3   Influencing Factors on Purchase of Rice

Statistical indicator	Category	No. of observations	Proportion (%)
Family's frequency of rice purchase	3 or 4 times per week	12	3.00
	1 or 2 times per week	283	70.75
	1 or 2 times per month	105	26.25
Considerations of rice purchase	Price	260	65.00
	Nutrition	36	9.00
	Freshness	48	12.00
	Quality and safety	32	8.00
	Brand	10	2.50
	Others	14	3.50
Reasons for rice selection	Recommendations from relatives and friends	108	27.00
	Impressions after having a look at the products	220	55.00
	Recommendations from sellers	12	3.00
	Others' purchase	14	3.50
	Advertisement promotions	6	1.50
	Trust in manufacturers	40	10.00

Table 4   Concern about Information in Rice Purchase

Concern	Quantity (%)	Price (%)	Quality and safety (%)	Guarantee period (%)	Nutritional composition (%)	Information of labels (%)
Extensive	13.50	25.25	48.25	24.50	33.25	2.75
Strong	24.50	43.00	24.25	46.75	36.75	4.25
Normal	46.75	16.75	20.25	19.50	23.50	14.50
Weak	8.25	12.00	6.25	3.75	4.25	48.25
Very weak	7.00	3.00	1.00	5.50	2.25	30.25

Table 5   Consumers' Information Demand for Nutrition Labels of Rice

Statistical indicator	Category	No. of respondent	Proportion (%)
Channel of purchasing rice	Supermarket	300	75.00
	Wet market	52	13.00
	Fixed retail store	44	11.00
	Others	4	1.00

(*Continued*)

Statistical indicator	Category	No. of respondent	Proportion (%)
Whether have heard about food nutrition labeling management practice	Yes	34	8.50
	No	366	91.50
Understand nutrition labels	Excellent	56	14.00
	Good	90	22.50
	Normal	62	15.50
	Bad	120	30.00
	No	72	18.00
Number of messages in nutrition labels accepted by consumers	3	160	40.00
	4	72	18.00
	5	84	21.00
	6	48	12.00
	> 7	36	9.00
Whether looking through the information in nutrition labels when selecting food	Often	146	36.50
	Sometimes	182	45.50
	Never	72	18.00
Whether it is beneficial to implement mandatory nutrition labels	Yes	277	69.25
	No	123	30.75

are also key influential factors on purchasing decisions (70%). About 71% of the respondents were extensively or strongly concerned about the expatriation date and nutrition of rice. Furthermore, respondents were not greatly concerned about information from labels and nearly 80% of the respondents stated that they do not consider information from labels when making purchases. The main reason is that the label of rice products usually contains more than sufficient information, making it difficult to understand. To sum up, our respondents paid most of their attention to price, quality and safety, expiration date and nutritional composition of rice when making purchase decisions.

Concerning where to purchase rice, three quarters of the respondents bought rice at supermarkets, wet markets was the second popular place (13%) and followed by fixed retail stores (11%). These findings suggest that Chinese consumers trust supermarket most and consider supermarkets as convenient for food purchases. When respondents were asked about whether they have heard of Food Nutrition Labeling Management Practice, over 90% said no. When asked about how familiar they are with the nutrition labels, 146 respondents (36.50%)

said they have excellent and good understandings about nutrition labels, and 192 respondents (48%) had little understanding. A great majority of them (91%) could not accept more than 6 messages in the nutrition labels. About two thirds of respondents (254, 63.50%) read the nutrition labels only occasionally or never, indicating that the consumers' usage of nutrition labels is still limited. Most respondents (277, 69.25%) reported that the information of mandatory nutrition labels is useful.

5 Econometric Model and Results

5.1 Econometric Model

It is very difficult to determine whether consumers consider the mandatory nutrition labels as useful, although we are certain that experience plays a role. Meanwhile, consumers who use nutrition labels tend to feel benefited from the labels. These two tendencies are caused by the fact that the information of nutrition labels reduces consumers' uncertainty about food quality. We assume that the usage frequency of nutrition labels is positively and significantly related to the perceived benefits of consumption. Consumers' perception of nutrition labels and their usage of the labels will explain whether they consider the mandatory nutrition labels useful. In addition, different personal and social characteristics may also influence purchase behaviors

Based on Gracia et al. (2006), this paper estimates three equations which constitute a multiple limit dependent variable model, and each equation is constructed to explain consumers' perceived benefits from mandatory nutrition labels, their usage of and their perception of nutrition labels.

Consumers' perceived benefits from mandatory nutrition labels are defined by the following equation:

$$B_i^* = \lambda LU_i^* + \beta X_i + u_i, \tag{5}$$

where LU_i^* represents whether consumers will use nutrition labels when purchasing food, X_i represents all the exogenous variables. u_i is the error term which follows a normal distribution of $N(0, \sigma_u^2)$. B_i^* is the unobservable utility variable which indicates whether consumers perceive benefits associated with the mandatory nutrition labels. The value of B_i^* is presented as:

$$\begin{cases} B_i = 1, \text{if } B_i > 0, \\ B_i = 0, \text{if } B_i \leqslant 0. \end{cases} \tag{6}$$

The equation of consumers' usage of nutrition labels is:

$$LU_i^* = \delta K_i^* + \alpha Z_i + e_i, \tag{7}$$

where K_i^* indicates consumers' perception of nutrition labels. Z_i denotes all the exogenous variables. e_i is the error term which follows a normal distribution of $N(0，s_e^2)$. LU_i^* represents the unobservable utility which indicates whether consumers will use or consult the nutrition labels when purchasing food. The value of LU_i^* is presented as:

$$\begin{cases} LU_i^* = 1, \text{ if } LU_i^* > 0, \\ LU_i^* = 0, \text{ if } LU_i^* \leqslant 0. \end{cases} \tag{8}$$

In the end, the equation of consumers' perception level is defined as:

$$K = \varpi Y + \xi. \tag{9}$$

In Equation (9), Y_i represents all the exogenous variables. ξ_i is the error term which follows a normal distribution of $N(0，\sigma_\xi^2)$. K_i^* is the unobservable utility as well as a ordinal variable. It represents consumers' perception level of nutrition labels and it could be expressed as follows:

$$\begin{cases} K_i = 1, \text{ if } K_i \leqslant \mu_1(=0), \\ K_i = 2, \text{ if } \mu_1 < K_i \leqslant \mu_2, \\ K_i = 3, \text{ if } \mu_2 < K_i \leqslant \mu_3, \\ \dots \\ K_i = J, \text{ if } \mu_{j-1} \leqslant K_i, \end{cases} \tag{10}$$

where μ_i is an unknown initial parameter for estimating ϖ. The first initial parameter equals to 0 ($\mu_1 = 0$).

Equation (5), (7) and (9) are estimated simultaneously. Based on the independent variables and dependent variables in these three equations, the endogenous (dependent) variables in one equation are the exogenous (independent) variables in another equation. As a result, these three equations are combined to form a multiple limit dependent variable model. In this model, u_i, e_i, and ξ_i, the error terms in three equations, follow a multiple normal distribution with a mean of 0 and a variance or covariance of matrix Ω. To better carry out the spatial numerical integral, it is effective to first check whether the error terms in the three equations are correlated when evaluating the multiple limit dependent variable model. If the error terms are correlated with each other, the model will be invalid. This paper will use Monte Carlo integral on the basis of the calculation procedure proposed by Hajivassiliou and McFadden (1998).

The theoretical model of the relationships between endogenous (dependent) variables and exogenous (independent) variables in Equation (5), (7) and (9) is

presented in Fig. 1 below.
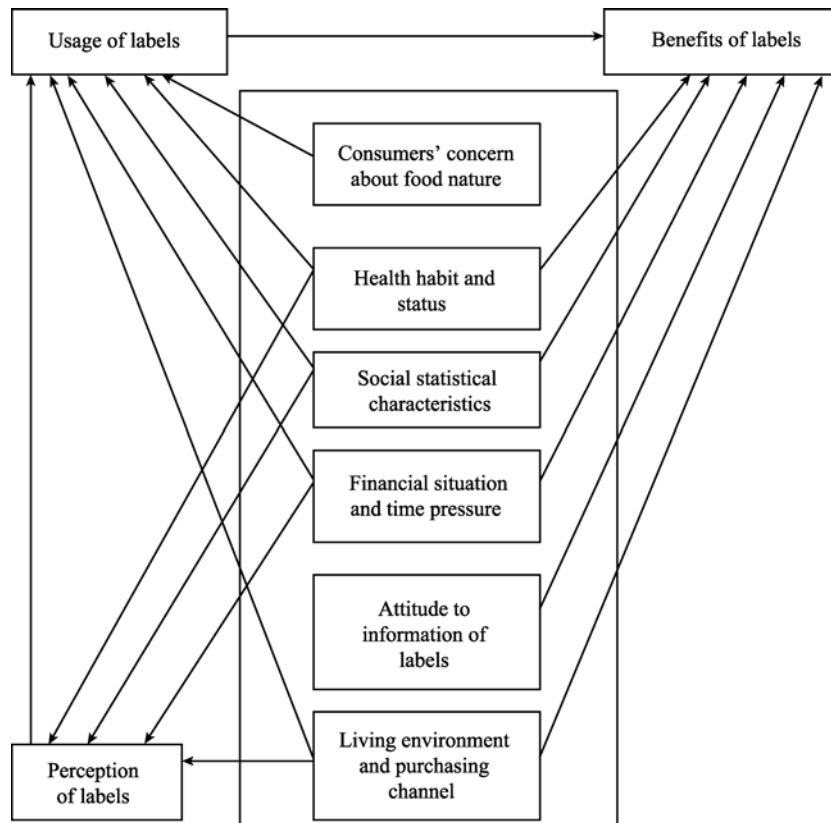
Fig. 1   Empirical Model

The endogenous variables in this paper are discrete variables. Consumers'
perceived benefits from the mandatory nutrition labels form a dummy variable
(0, 1) with 1 if consumers perceive benefits from the labels and 0 otherwise.
Consumers' usage of nutrition labels is also dummy variable with 1 if consumers
use the information presented in the labels or 0 otherwise. Finally, as an ordinal
variable, consumers' perceived importance of nutrition labels is divided into five
levels, with 1 the lowest and 5 the highest.

Gender, age, education are selected as independent variables. Due to the fact
that female consumers will be more careful than male consumers in making
purchase decisions, we expect that female consumers make more use of the
labels. We also expect that consumers with higher education are expected to have
a better understanding of the labels and make more use of them.

To measure consumers' financial situation and time pressure when purchasing

food, average household monthly food expenditure and household size are used. Health status of consumers is expected to influence their perception and usage of nutrition labels. If consumers find their health problems are related with their diet, they will be likely to search for relevant nutritional knowledge. Therefore, health habit and health status are expected to positively affect consumers' perception and usage of nutrition labels. In addition, the model also includes consumers' frequency of physical exercises as an explanatory variable. Those who have a better health status are expected to have a higher usage of nutrition labels.

Consumers' usage of nutrition labels will be affected by their concerns about different kinds of information during purchase. Several variables are selected, such as price, quantitative information, expiration date, nutritional composition of rice, quality and safety. It is expected that the higher the consumers are concerned about price and quantitative information, the lower the probability the consumers use the nutrition labels. In contrast, if consumers pay more attention to expiration date, nutritional composition and information of quality and safety, they will tend to make more use of nutrition labels.

5.2　Results

Based on the simulative estimation method proposed by Hajivassiliou and McFadden (1998), the independent variables listed in Table 6 are used to evaluate the multiple limit dependent variable model of Equation (5), (7) and (9). By applying the procedure of maximum likelihood estimate, all the parameter results are presented in Table 7.

Table 6　Variable Definitions

Variable	Value range	Meanings of the value
Social statistical characteristics		
Gender	0–1	Female = 1, Male = 0
Age	1–3	< 30 = 1, 31–50 = 2, > 50 = 3
Educational experience	1–4	Primary school and below = 1, Junior and senior middle school = 2, College and undergraduate school = 3，Graduate school and above = 4
Financial situation and time pressure		
Average monthly Expenditure on food (family)	1–3	< 1 000 = 1, 1 000–1 999 = 2, > 2 000 = 3
Family size	Continuous variables	
Health habit and health status		
Physical exercises	0–1	Participate =1, Do not participate = 0

(*To be continued*)

Variable	Value range	Meanings of the value
Health status	1–5	Very bad = 1, Bad = 2, Normal = 3, Good = 4, Excellent = 5
The relation between health problem and diet	0–1	Relevant = 1, Irrelevant = 0
Concern about kinds of information		
Price	1–5	Weakest (1)–Strongest (5)
Quantitative information	1–5	Weakest (1)–Strongest (5)
Guarantee period	1–5	Weakest (1)–Strongest (5)
Nutritional composition	1–5	Weakest (1)–Strongest (5)
Information of quality and safety	1–5	Weakest (1)–Strongest (5)
Attitude to nutrition labels		
Number of messages in nutrition labels accepted by consumers	Continuous variables	
Living environment and purchase channel		
Living environment	0–1	Inside the city = 1, Outside the city = 0
Purchasing channel	0–1	Supermarket = 1, Others = 0
Dependent variables		
Perception level	1–5	Very bad = 1, Bad = 2, Normal = 3, Good = 4, Excellent = 5
Usage of labels	0–1	Use = 1, Do not use = 0
Whether perceiving benefits from the labels	0–1	Gain = 1, Do not gain = 0

Table 7   Regression Results of Model Parameters

Independent variables	Perception level		Usage of labels		Perceived benefits	
	Coefficient	z-value	Coefficient	z-value	Coefficient	z-value
Gender	−0.24	−1.51	−0.12	−0.55	4.81	4.22***
Age	0.10	0.71	−0.25	−1.66*	−0.35	−0.97
Educational experience	2.94	14.67***	1.15	5.33***	4.53	4.63***
Current address	0.29	2.16**	0.03	0.24	—	—
Purchase channel	—	—	—	—	−0.12	−0.34
Average monthly expenditure on food (family)	0.51	4.20***	−0.16	−1.23	−0.37	−1.13

Independent variables	Perception level		Usage of labels		Perceived benefits	
	Coefficient	z-value	Coefficient	z-value	Coefficient	z-value
Family size	−0.12	−1.11	−0.44	−4.00***	−0.74	−2.74***
Health status	0.20	1.97**	−0.19	−1.88*	−0.79	−3.30***
Physical exercises	−0.08	−0.29	0.03	0.11	0.43	2.68***
Health awareness	0.02	−0.11	0.51	2.27**	0.46	1.10
Concern about food quantity	—	—	−0.24	−2.80***	—	—
Concern about food price	—	—	−0.13	−1.97**	—	—
Concern about food quality and safety	—	—	−0.07	−0.96	—	—
Concern about guarantee period	—	—	0.23	2.82***	—	—
Concern about nutritional composition	—	—	0.13	1.75*	—	—
Number of messages in labels	—	—	—	—	−0.33	−2.55**
Perception level	—	—	0.94	6.82***	—	—
Usage of labels	—	—	—	—	0.84	2.86***
Sample size	400					
Maximum likelihood value	−587					
μ_2	2.93	11.56	—	—	—	—
μ_3	3.89	14.81	—	—	—	—
μ_4	5.13	18.18	—	—	—	—
Correlation of perception level, usage of labels and perceived benefits						
Perception level	—	—	−0.65	−5.21	0.02	0.15
Usage of labels	—	—	—	—	0.58	3.15

Note: *, **, and *** represent significant at 10%, 5%, and 1% levels, respectively.

The correlation tests of error terms in the three equations are conducted. It indicates that Equation (5) and (7) are significant at 5% significance level, Equation (7) and (9) at 5% significance level and Equation (5) and (9) at 10% significance level. Hence, three error terms are not correlated with each other which suggests a satisfactory goodness-of-fit of our model.

In the equation of perception level of nutrition labels, current address and health status appear to be significant at 5% significance level while education experience and family average monthly food expenditure are significant at 1%

significance level. All significant variables have positive effects on perception level. As expected, both educational experience and health status have a positive and significant influence on consumers' perception level of nutrition labels. Consumers with better education will consider nutrition labels as more important, and consumers with better health status pay more attention to diet quality and safety than consumers who are not in good health situation. Consumers living inside the city will have higher perception level than those living in the suburbs. Family average monthly food expenditure is positively related to the perception level of nutrition labels and those consumers with better incomes will concern more about nutrition labels for information of food quality, so that they could be able to choose high-quality food.

From the equation of nutrition labels' usage, we found that the perception level of nutrition labels has a significant and positive effect on the usage of the labels. Age has a negative influence on consumers' usage of the labels which suggests the probability of using the labels is lower if the consumers are older. Consistent with the relationship of education experience and consumers' perception of nutrition labels, consumers' usage of the labels is significantly and positively affected by education experience. As a representation of time pressure, family size appears to be statistically significant and negatively affect the usage of label. It implies that consumers with larger family size are less likely to use nutritional labels. Health status was found to be negatively related to the usage of nutrition label (significant at 10%), partly because consumers tend to care more about diet quality and safety when they are experiencing health problems. Consumers' concern about food quantity, price, expiration and nutritional composition all significantly affect labeling usage.

Gender, educational experience, family size, health status, physical exercises and number of messages in nutrition labels are significant in changing the usage of labels.

In sum, consumers making more use of nutrition labels tend to feel beneficial from mandatory nutrition labels and the higher the consumers' education level is, the more their perceive benefits, partly because people with higher education accept new things more easily, thus pay more attention to nutritional labels. Also consumers who exercise more will perceive more benefits from the labels. Family size reflects the time pressure of consumers' families. The heavier the time pressure (the larger the family size is), the less likely consumers use nutrition labels, and the lower the probability that consumers perceive benefits from the labels. Consumers in good health conditions tend to perceive fewer benefits from the labels than that of the consumers in poorer health conditions. In addition, we also found that nutrition labels could convey appropriate and useful information to consumers only if the number of messages contained in the labels is moderate.

6 Conclusion

This paper empirically analyzes Beijing consumers' rice consumption behavior to understand whether Chinese consumers benefit from the mandatory nutrition labels when purchasing rice, the most important staple food in China. Our findings show that Chinese consumers do not use the labels often. However, this infrequent use of labels is not caused by unwillingness to use the label, rather, because the label itself is difficult to use. Chinese consumers have realized the importance of nutrition labels but they have difficulties in accurately understanding the labels. This may be caused by the lack of governmental promotion or consumers' own educational level. No matter which reason is behind, it prevents consumers from precisely receiving information and lowering their ability to use the labels. Our sample indicates that consumers believe that they could benefit from nutrition labels and the policy behind the reinforcement of the labels, i.e., the enactment of *Food Nutritional Labeling Management Practice*. It indicates that although consumers' understanding of nutrition labels is still limited, they have kept high expectations for the reinforcement of the labels, given the expected benefits they could receive.

Key factors behind consumers' perception of nutrition labels include education, access to supermarket, monthly expenditure on food, and health status. These factors all have significant effects on consumers' perception. The variables like perception level of nutrition labels, age, educational experience, family size, health awareness, concern about food quantity, concern about food price, concern about guarantee period and nutritional composition of food are confirmed to have a significant influence on the usage of nutrition labels. Among these variables, positive influencing factors are perception level of nutrition labels, education experience, health awareness, concern about guarantee period and concern about nutritional composition, and negative influencing factors are age, family size, concern about food quantity and price.

Finally, consumers' perceived benefits from nutrition labels are affected by their usage of nutrition labels, gender, education experience, family size, health status, physical exercises and the number of messages in labels. Usage of the labels, gender, education experience and physical exercises positively influence consumers' perceived benefits while other three variables negatively affect consumers' perceived benefits.

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