Research Article
Consumer Uncertainty in Online Food Purchase Behavior: An Analysis of the Online Food Safety Problem

[1]Zhehui Xiao, [2]Dekui Li, [3]Chinling Chen and [1]Jinlong Zhang
[1]School of Management, Huazhong University of Science and Technology, Wuhan, 430074, China
[2]Department of Logistics, Wuhan Technology and Business University, Wuhan, 430065, China
[3]College of Management, Chaoyang University of Technology, Taiwan

Abstract: This study develop a theoretical framework describing the uncertainty-based decision making process when a consumer purchasing food online in China. Drawn on the information asymmetry theory and based on a survey of 710 randomly selected online food buyers in China, the results show that website seller uncertainty and food uncertainty are critical barriers in consumers' online food purchase decision making. Furthermore, the majority of the antecedents mitigate consumers' perceived uncertainty. These findings show that the food vendor and website managers can mitigate uncertainty by providing a secure and user-friendly food shopping environment in China.

Keywords: Consumer uncertainty, Food purchase decision, Food safety

INTRODUCTION

As online retailing has grown rapidly worldwide and become globally competitive over the past decade, online markets still face a barrier in physical experience products that cannot be easily described via the Internet interface, such as online food retailing. In contrast to the overall success of online retailing, the online food retailing market has witness some failure in the west (e.g. Gilt Taste, Webvan) and in the east (e.g. yoocai.com). In the report of the CNNIC (2014) in China, about 60% consumers reject to purchase food online based on high risk in the food purchase and lacking sufficient food quality information on the Internet.

The risk and uncertainty of food buying is an emerging issue in many countries. After facing serious food safety incidents, including mad cow disease in Korea, the foot-and-mouth epidemic in China and the Belgian dioxin scandal, consumers worldwide have increasingly concerned with the quality and safety of the food they eat. Consumers would like to acquire sufficient information in order to make informed shopping decisions about food in online purchase. However, although buyers in offline markets can physically evaluate the food quality by "kicking the tires" (Animesh *et al.*, 2010), buyers in online markets can only do so via the Internet interface, which cannot perfect convey product and seller's quality or future performance, especially for food, which is physical, experience and credence goods (Benlian and Hess, 2011). As a result, the literature has focused on two major sources of information asymmetry that food buyers face in the online markets: about the website seller and about the product (Chang and Chen, 2009), resulting two sources of buyers' information asymmetry: website seller uncertainty and food uncertainty.

There is a rich body of literatures on understanding and reducing website seller uncertainty with reputation (Chatterjee and Datta, 2008) and website quality (Chen and Huang, 2013) being the two most common IT solutions. However, there has been little work on food uncertainty. In contrast to physical channels where buyers can see, touch, smell and test the product, online markets create a physical separation between buyers and products. Food uncertainty is exacerbated by the technological limitations of the Internet to replicate the buyer's face to face interactions. In the traditional food purchase, consumers can evaluate food quality by smelling, tasting, or using the basic attributes of the foods, however on the Internet, the food source, description and performance information cannot be perfectly described online even the seller is honest and ethical, creating the need for IT-enabled solutions to help mitigate the product origin uncertainty, description uncertainty and performance uncertainty. To overcome these limitations of online food markets, we seek to (1) distinguish between website seller uncertainty and food uncertainty, (2) focus on mitigating product uncertainty by relying on IT-enabled solution and (3) test the mediating effects of product uncertainty between the seller uncertainty and purchase intention.

Corresponding Author: Dekui Li, Department of Logistics, Wuhan Technology and Business University, Wuhan, 430065, China

Furthermore, understanding the antecedents to the two types of uncertainty in online food shopping also constitutes an important research issues. Prior studies focusing on different IT tools which can reduce customers' perceived uncertainty and promote consumers' purchase intention. For example, Choe *et al*. (2009) argued that perceived effectiveness of food traceability mechanism is major determinant of mitigating consumers' perceived uncertainty in the food website (Choe *et al*., 2009; Teng *et al*., 2015) found that food safety assurance can reduce consumers' perceived uncertainty in food purchasing. Therefore, it is believed that understanding the antecedents to the two types of uncertainty in online food shopping context would provide meaningful insights into the trust formation process.

HYPOTHESES DEVELOPMENT AND RESEARCH MODEL

In this section, the hypotheses that pertain to the new research model are developed. Based on the above discussion, Fig. 1 provides a pictorial depiction of this research framework. The hypotheses 1 and hypotheses 2 specify the expected relationship between IT solution and website seller uncertainty. Hypotheses 3 and 4 specify the expected relationships between food-related safety institution and food uncertainty. We next assume website seller uncertainty positively affect food uncertainty in hypotheses 5. Finally, the rest of hypotheses specify the expected relationships between the uncertainty and online food purchase intention.

Due to limited availability of information, consumers may have difficulty in making purchase decisions (Dimoka *et al*., 2012), resulting in failures to carry out market transactions. Website informativeness defined as the degree to which a website offers information buyers perceived as useful. After facing serious food safety incidents, consumer begin to care about the website food-related information before making online food purchasing decision. Website informativeness captures food-related information conveyed by signals that is credible to the consumers in terms of obtaining useful website seller information. Therefore, the greater the quality and quantity of useful website information buyers can obtain and thereby the lower of their degree of perceived uncertainty in the website. so we hypothesize as follows:

Hypothesis 1: Website informativeness mitigates a buyer's perceived food website seller uncertainty.

Website quality is defined as the degree to which a website offers information and service buyers perceived as useful (Du and Zhu, 2013). To enhance consumer's trust in online food purchase, online marketplace send signals that reveal their true characteristics, products and selling practices and information policies. If the information conveyed by these signals is deemed useful, these signals enhance the buyer's perception of online food website quality (Fornell and Larcker, 1981). Therefore, website quality captures the information conveyed by signals that is trustworthy to potential buyers. Applying these views to online food shopping contexts, it is believed that website quality can mitigate consumer's perceived uncertainty in website seller, because food website with high quality can send signals that aim to reduce online food consumer's perceived risk. Accordingly, the following hypothesis is proposed.
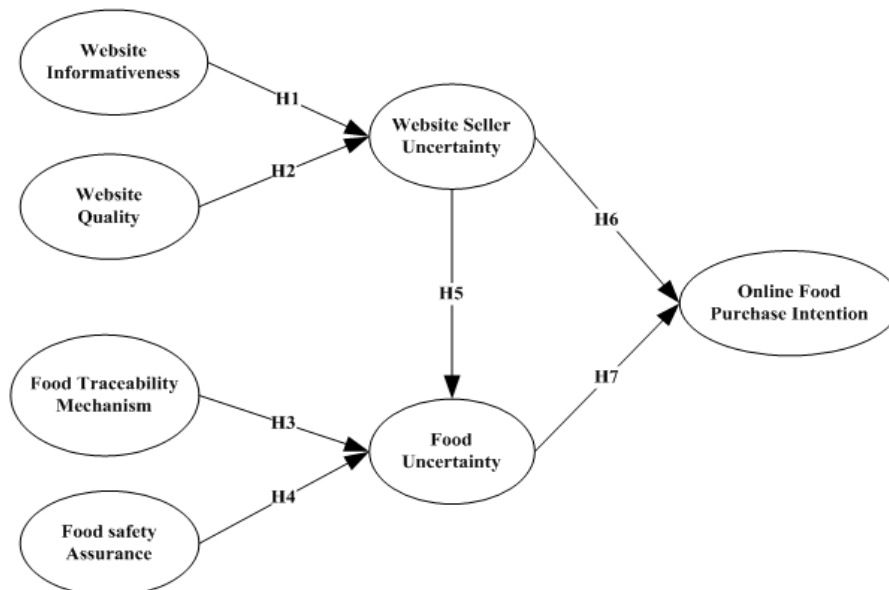

Fig. 1: Research model

Hypothesis 2: The online food website quality is negatively related to his/her perceived uncertainty in the website seller.

The food traceability mechanism in the website can provide detailed information on food production, processing, transfer and distribution, such as the birthplace of food, date of sale and other food-related information (Hsu and Chen, 2014). Though food traceability mechanism itself cannot preclude the possibility of food safety crises, it can help online food buyers to discover the crux of a food safety problem promptly and mitigate the perceived uncertainty in the online food purchase. Because of high risk of food purchase, many people rely on the food traceability mechanism to mitigate their uncertainty in the online food purchase. Thus, it is hypothesized that:

Hypothesis 3: A consumer's perceived effectiveness of food traceability mechanism mitigates a buyer's food uncertainty.

The food safety assurance is defined that the presence of an Internet food quality information provided by a third-party certifying such as consumer union, or food safety administration department (Hwang and Lee, 2012). Recently, a wide variety of safety assurances have been introduced to help reduce consumer risk in online food shopping context. The purpose of food safety assurance is to help promote consumers' perceived trust in online food buying (Lee and Yun, 2015). An example of food safety assurance is ISO 22000, a non-profit comprehensive assurance program which control the food safety along the food chain. The display of a food safety assurance such as ISO 22000 indicates to consumers that the online vendor will make a sincere effort to uphold its transactional obligations, which should mitigate the buyers' perceived food uncertainty. Based on the above arguments, we propose that:

Hypothesis 4: The presence of a food safety assurance is negatively related to a buyer's food uncertainty.

Because the food quality information is mostly described by the food website seller, food website seller uncertainty is expected to affect food uncertainty (Liang and Lim, 2011). First, uncertainty website sellers who suffer from buyers' fear of adverse selection may be willing hide or misrepresent true food quality information, thus exacerbating food uncertainty. Second, uncertainty website sellers who suffer from buyers' fear of moral hazard may be willing take advantage of consumers online and such consumers will be more likely to exacerbate the buyers' food uncertainty. Taken together, sellers that are deems by buyers to be uncertainty would be likely to make it more difficult for buyers to reduce. We thus hypothesize.

Hypothesis 5: The food website seller uncertainty is positively related to a buyer's food uncertainty.

According to Chen and Huang (2013), a negative effects of uncertainty in an online website on a buyer's intention to purchase from that merchant can be hypothesized under three preconditions. First, making a purchase can be considered to be a form of perceived risk. Second, making a purchase can be considered to constitute a form of relationship. Third, purchase intention is a strong proxy of making an actual purchasing. In general, customer's perceived uncertainty can increase perceived risk and reduce the intention of purchase (Loebnitz and Grunert, 2015). In online food shopping environment, the target of uncertainty can be categorized into two types: website seller uncertainty (Markopoulos and Clemons, 2013) and food uncertainty (Ozpolat *et al.*, 2013). As a result, it is reasonable to state the two type of uncertainty will affect consumers' intention to purchase.

Hypothesis 6: A buyer's perceived uncertainty in the website seller is negative related to a buyer's intention to purchase food online.

Hypothesis 7: A buyer's perceived uncertainty in the food is positively related to a buyer's intention to purchase food online.

Following the hypotheses, Fig. 1 describes the proposed model of this study.

MATERIALS AND METHODS

To test the theoretical framework, we chose members of an online food site in China, "Taobao fresh"(www.chitaobao.com) as our research subjects. The reason for choosing this site is that it is one of the most well-known online food marketplace in China. To date, the site's number of food sellers has grown to 2500,000 and site's food sales volume has exceeded US$5 billion. By the time the survey was completed, 710 valid questionnaires had been collected for data analysis.

In order to ensure the validity and reliability of the scales, measurement items were adapted from prior literature. All the items were measured using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Perceived effectiveness of food traceability mechanism was measured with four items from Chen and Huang (2013), website quality was assessed with four items from Liang and Lim (2011), website informativeness was adapted from Choe *et al.* (2009). Food website seller uncertainty and food uncertainty were adapted from Dimoka *et al.* (2012).

Partial Least Squares (PLS) analysis, a component-based Structural Equation Modeling (SEM) technique, was applied to test the measurement model and research

Table 1: A summary of demographic characteristics of subjects

Variables		Participants	Perception (%)
Gender	Male	224	31.5
	Female	486	68.5
Married Status	Married	340	47.9
	Single	379	52.1
Education	High School	224	31.5
	Bachelor	310	43.7
	Master	155	21.8
	PhD	21	3.0
Age	<30	280	39.4
	30-40	302	42.5
	>41	128	18.0
Monthly Income (RMB)	<4000	420	59.1
	4001-8000	251	35.4
	>8000	39	5.5

Table 2: Descriptive statistic and reliability

Construct	Indicator	Composite reliability	AVE	Standard loading	Cronbach's α
Purchase	PI1	0.886	0.771	0.921	0.721
Intention	PI2			0.873	
	PI3			0.728	
Website seller uncertainty	WU1	0.907	0.766	0.885	0.723
	WU2			0.832	
	WU3			0.823	
Food	FU1	0.815	0.595	0.814	0.726
Uncertainty	FU2			0.822	
	FU3			0.851	
Food traceability	FT1	0.892	0.675	0.838	0.744
Mechanism	FT2			0.851	
	FT3			0.772	
	FT4			0.822	
Website quality	WQ1	0.835	0.662	0.728	0.872
	WQ2			0.885	
	WQ3			0.777	
	WQ4			0.716	
Website informativeness	WI1	0.872	0.581	0.814	0.723
	WI2			0.822	
	WI3			0.851	
	WI4			0.772	
	WI5			0.822	
Food safety assurance	FSA1	0.889	0.668	0.862	0.759
	FSA2			0.885	
	FSA3			0.777	

hypotheses. PLS is more amenable for analyzing complex relationships and model under development our study than covariance-based SEM techniques such as LISREL. Moreover, PLS does not assume a multivariate normal distribution and interval scales, which works well for controlling binary variables such gender. We used Smart-PLS 2.0 with bootstrapping. The sample included 224 men and 486 women and the mean age is 37.2 with a range from 20-55 years. About 69.5% of subjects showed some college and above as their highest education completed.As shown in Table 1.

Before the path effects of the structural framework can be examined, reliability and validity test should first be conducted. To assess the internal consistency of each construct, Composite Reliability (CR) and Cronbach's α were calculated. Fornell and Larcker (1981) suggested that the commonly acceptable threshold level for these tests is 0.7 (Pavlou *et al*., 2007). As shown in Table 2, all the values of CR and Cronbach's α exceed 0.7.

Further, we test the discriminate validity and convergent validity. To test convergent validity, we exam the Average Variance Extracted (AVE). Table 2 illustrates that for each construct, the AVE values was greater than the cut-off value of 0.5 (Teng *et al*., 2015). To test discriminate validity, we compared the squared root of AVE for each construct with its cross-correlation with other constructs. As shown in Table 3, all the diagonal values exceed the inter-construct correlation, thus satisfying the criteria to establish discriminate validity (Yeh *et al*., 2012; Zhu *et al*., 2014).

The proposed tested through the PLS structural model. To test the significance for all paths, the bootstrap procedure with replacement using 2000 was implemented. Path estimates and t-statistics were calculated for hypothesis testing. The results are presented in Table 3.

In Fig. 2, we see all the hypotheses were supported. Food website informativeness significantly and

Table 3: Discriminate validity and square root of AVE

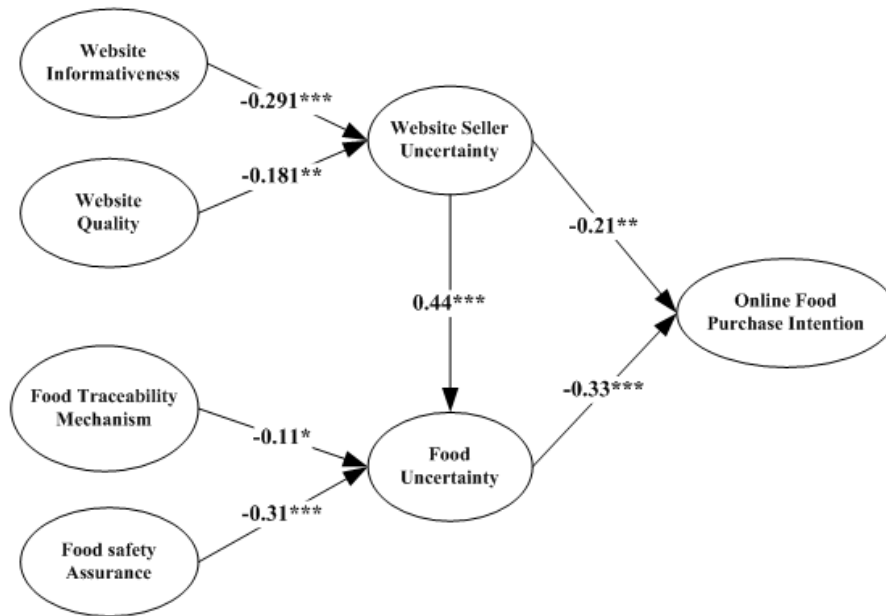| Construct	PI	WU	FU	PEFTM	WQ	WI	FSA
PI	0.843						
WU	-0.323	0.821					
FU	-0.339	0.543	0.771				
PEFTM	0.251	-0.222	-0.323	0.821			
WQ	0.372	-0.403	-0.274	0.187	0.814		
WI	0.271	-0.452	-0.465	0.118	0.333	0.762	
FSA	0.118	-0.258	-0.285	0.114	0.198	0.232	0.817

Fig. 2: Estimates of the research framework; p-value<0.05*, p-value<0.01**, p-value<0.001***

negatively affects food website uncertainty, with a path coefficient of -0.291 (p<0.001), supporting H1. Moreover, the path from an individual's perceived food website quality to his/her perceived website vendor uncertainty (β = -0.181, p<0.01) is statistically significant in the expected direction, showing that H2 is supported in this case. In addition, the path from consumer's perceived effectiveness of food traceability mechanism (β = -0.11, p<0.05) and food safety assurance (β = -0.31, p<0.001) to his/her perceived food uncertainty are statistically significant. As expected, the directions of the paths bear positive signs, thus supporting H3 and H4.

In terms of consumers' perceived uncertainty, H5 is supported: food website seller uncertainty significant and positively affects food uncertainty, the path coefficient is 0.44 (p<0.001).

Turning now to the outcomes of the two types of uncertainty, the results shown in Fig. 2 indicate that the path from an individual's perceived food website seller uncertainty(β = -0.21, p<0.01) to his/her purchase intention is statistically significant. As expected, the directions of paths bear negative signs, supporting H6. Also, consumers' perceived food uncertainty significant and negatively affects food uncertainty, the path coefficient is -0.33(p<0.001), supporting H7.

RESULTS AND DISCUSSION

While consumers' perceived uncertainty is a major problem for online food market in the food safety research area. The purpose of our study is to provide a better picture of factors influencing behavioral decisions in online food shopping. Based on the model of "antecedents-uncertainty-outcomes", we proposed and empirically tested a model of behavioral intention in a food-buying website and, by doing so, understanding the important of the two types of uncertainty and the IT solution to mitigate consumers' perceived uncertainty in online food purchase environment. Overall, the results provide robust support for the fitness of the proposed model and a number of findings are worth discussing.

First, this study formally confirm the significant negative impact of perceived food website seller uncertainty and food uncertainty on purchase intention, validating the paper's proposition that the existence of uncertainty perceptions is a major impediment on online food exchange perceptions. This study's findings suggest that the food website managers should recognize that buyer's fear of seller opportunism and perceived information asymmetry should be their primary focus when selling high risk food online.

Second, the economics literature essentially ignored food uncertainty and focused on seller uncertainty by assuming food uncertainty to arise from the high risk product online. This study extends this literature by theorizing product uncertainty as distinct from food website seller uncertainty because of the seller's inability to describe the food quality information online and the seller's unawareness of the true food quality information. Furthermore, this implies that information asymmetry in the online food markets is not from dishonest sellers misrepresenting food quality information, but also that the seller online inability and unawareness to describe true food quality information. The structural model shows that seller uncertainty positively influence food uncertainty, indicating that online food sellers should aware of the food defects and help buyers predicts how the food perform in the future.

Third, Both website informativenss and website quality exert a negative effect on consumers' perceived food website seller uncertainty. Additionally, website informativenss has a more stronger direct influence on consumers' perceived food website seller than website quality. One plausible explanation for this might be that consumers pay more attention to food safety than website quality. As long as the e-marketplace is able to satisfy their particular needs in these online mechanisms, website quality is not a major concern for them when buying food online.

At last, Regarding the antecedents to the food uncertainty, our results indelicate that both food traceability mechanism and food safety assurance are major enabling factors for trust in the vendor. The mitigates of food uncertainty show how IT-enabled solutions, such as food safety assurance and food traceability mechanism, primarily enhance the seller's ability to describe food quality information online. To our surprise, the food safety assurance has a more stronger direct influence on food uncertainty than food traceability mechanism. This result adds to the food safety literature by addressing the call for identifying the relationship between food safety certificate and consumers' perceived uncertainty.

CONCLUSION

As with all studies, this study has several limitations that create opportunities for future research. First, we only collect the data from a special food-buying website which already enjoys a reputation as an established site. Future research can replicate this study across a wider variety of food-buying websites to verify the generalizability of our findings. Second, as an exploratory study, this study explored the antecedents behind consumers' perceived uncertainty and purchase intention, however, the model does not consider other aspects of these antecedents such as service quality, website security and privacy protection. Future research are encouraged to consider how these alternative antecedents affect consumers' trust in the website and

trust in the vendor. Finally, the respondents might have been influenced from both their prior purchase experience and also from their exposure to the familiar task in the particular food website. Future research could experiment with different levels of purchase experience and socio-demographic characteristics of consumers to examine their potential impact on the proposed model.

REFERENCES

Animesh, A., V. Ramachandran and S. Viswanathan, 2010. Quality uncertainty and the performance of online sponsored search markets: An empirical investigation. Inform. Syst. Res., 21(1): 190-201.

Benlian, A. and T. Hess, 2011. The signaling role of IT features in influencing trust and participation in online communities. Int. J. Elec. Comm., 15(4): 7-56.

Chang, H.H. and S.W. Chen, 2009. Consumer perception of interface quality, security and loyalty in electronic commerce. Inform. Manag., 46(7): 411-417.

Chatterjee, S. and P. Datta, 2008. Examining inefficiencies and consumer uncertainty in e-commerce. Commun. Assoc. Inform. Syst., 22(1): 29.

Chen, M.F. and C.H. Huang, 2013. The impacts of the food traceability system and consumer involvement on consumers' purchase intentions toward fast foods. Food Cont., 33(2): 313-319.

Choe, Y. C., J. Park, M. Chung and J. Moon, 2009. Effect of the food traceability system for building trust: Price premium and buying behavior. Inform. Syst. Front., 11(2): 167-179.

Dimoka, A., Y. Hong and P.A. Pavlou, 2012. On product uncertainty in online markets: Theory and evidence. Mis Quart., 36(2): 395-426.

Du, B. and F.M. Zhu, 2013. Safety assessment and countermeasures of genetically modified food. Adv. J. Food Sci. Technol., 5(3): 318.

Fornell, C. and D.F. Larcker, 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res., 18(1): 39-50.

Hsu, C.L. and M.C. Chen, 2014. Explaining consumer attitudes and purchase intentions toward organic food: Contributions from regulatory fit and consumer characteristics. Food Qual. Prefer., 35: 6-13.

Hwang, Y. and K.C. Lee, 2012. Investigating the moderating role of uncertainty avoidance cultural values on multidimensional online trust. Inform. Manag., 49(3): 171-176

Lee, H.J. and Z.S. Yun, 2015. Consumers' perceptions of organic food attributes and cognitive and affective attitudes as determinants of their purchase intentions toward organic food. Food Qual. Prefer., 39: 259-267.

Liang, A.R.D. and W.M. Lim, 2011. Exploring the online buying behavior of specialty food shoppers. Int. J. Hosp. Manag., 30(4): 855-865.

Loebnitz, N. and K.G. Grunert, 2015. The effect of food shape abnormality on purchase intentions in China. Food Qual. Prefer., 40: 24-30.

Markopoulos, P.M. and E.K. Clemons, 2013. Reducing buyers' uncertainty about taste-related product attributes. J. Manag. Inform. Syst., 30(2): 269-299.

Ozpolat, K., G.D. Gao, W. Jank and S. Viswanathan, 2013. The value of third-party assurance seals in online retailing: An empirical investigation. Inform. Syst. Res., 24(4): 1100-1111.

Pavlou, P.A., H.G. Liang and Y.J. Xue, 2007. Understanding and mitigating uncertainty in online exchange relationships: A principal-agent perspective. Mis Quart., 31(1): 105-136.

Teng, C.C., Y.M. Wang and C. Griffith, 2015. Decisional factors driving organic food consumption: Generation of consumer purchase intentions. British Food J., 117(3): 1066- 1081.

Yeh, J.C., K.L. Hsiao and W.N. Yang, 2012. A study of purchasing behavior in Taiwan's online auction websites effects of uncertainty and gender differences. Int. Res., 22(1): 98-115.

Zhu, X., Q. Zhang and L. Zhang, 2014. Consumers' demand and online promotion of the food retailing through the e-commerce websites in China. Adv. J. Food Sci. Technol., 6(1): 102-111.