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Consumers' intention to participate in food safety risk communication: A model integrating protection motivation theory and the theory of reasoned action

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Abstract

Food safety risk communication aims to enhance stakeholders' understanding of the assessment and management of food safety hazards and allows people to make informed judgements about food production and consumption. To analyse consumers' intention to participate in food safety risk communication, this paper develops an integrated model that combines the protection motivation theory with the reasoned action theory. Structural equation modeling with the partial least squares technique is used to test the theoretical model. Data were collected from 676 valid online survey responses from randomly selected consumers in northeast China. The results indicated that attitude is a key factor mediating the relationships between perceived severity, response efficacy, self-efficacy, and consumers' intention to participate in food risk communication.

Keywords: Food risk communication, theory of reasoned action, protection motivation theory, consumers, participating intention

1. Introduction

Around the world, people are exposed to biological, chemical, and physical foodborne hazards. It was estimated that 600 million people fall ill every year after consuming contaminated food (WHO, 2015). Food safety risk is a function of the probability of an adverse effect resulting from a foodborne hazard and the severity of that effect (FAO&WHO, 2016). Food safety risk communication is thus necessary to safeguard physical health and overall quality of life; it is defined by the Codex Alimentarius (Codex, 1999) as the interactive exchange of information and opinions concerning hazards and risk-related factors among risk assessors, risk managers, consumers, and other interested parties. Food risk communication encompasses risk information

seeking, processing, and sharing. For consumers, effective food risk communication helps them manage or respond to food risks and make appropriate food consumption decisions; for food producers, it can increase consumers' confidence in the food industry; for governments, it can increase public trust in the food regulatory system.

Notwithstanding the benefits of food risk communication, there are many barriers to effective communication among stakeholders. These barriers include institutional and procedural obstacles such as a lack of technical and policy resources; individual differences such as perception, receptivity, and value; a lack of understanding of the scientific process and knowledge; a lack of trust in information sources, experts, and institutions; and societal factors such as language, culture, religion, dietary habits, illiteracy, and poverty (Christopher et al., 1998; WHO, 1999).

Consumers' intention to participate in food risk communication can also be hindered in other ways (Frewer, 2004; Wen & Lee, 2020; Wu, 2015). Frewer (2004) argues that people's responses to risks are determined by psychological factors, of which trust is particularly important in risk communication. Fear, the attitude towards information, the perceived effectiveness of information, and the severity of food-related health incidents also significantly influence the intention to engage in food risk communication (Wen & Lee, 2020). Numerous studies have examined the effects of food-related health incidents on risk perception (Cho et al., 2017; Kim et al., 2015), and its relationship with consumers' intentions and behaviour (Guo et al., 2020; Vainio et al., 2020; Wen & Kwon, 2017; Wu, 2015). Therefore, it is vital to study consumers' intention to participate in food safety risk communication. Despite the above discussion of the factors influencing the intention to participate in risk communication, there is no integrated theoretical framework to explain consumers' motivation to engage in communication. In particular, the roles of attitudes and subjective norms remain unclear.

To fill this gap, this study aims to improve our understanding of consumers' intention to participate in food risk communication and of how attitude affects this intention. This study develops a model that integrates the protection motivation theory (PMT) (Cox et al., 2004; De Steur et al., 2015; Rahnama & Somogyi, 2020; Rogers, 1975; Rogers, 1983) and the theory of reasoned action (TRA) (De Canio & Martinelli, 2021; Fishbein et al., 1980; Petrovici et al., 2004;) to analyse data collected in northeast China using a survey focused on respondents' intention to participate in food safety risk communication in response to food incidents. This integrated model allows us to

systematically explore the relationships between consumers' threat appraisal, coping appraisal, attitude, and subjective norms and the influence of these factors on the intention to participate in food safety risk communication.

2. Theoretical framework

To analyse human behaviour in the context of risk, research has utilised the PMT to explain the cognitive mediation process of behavioural change in terms of threat and coping appraisal. The TRA has also been widely used to explore consumers' purchasing behaviour (De Canio & Martinelli, 2021; Petrovici et al., 2004; Wang et al., 2021). Thus, both theories have been used to predict people's intention and, hence, behaviour.

2.1 Protection motivation theory

The PMT was first developed by Rogers (1975) to explain individuals' motivation to engage in self-protection in response to potential threats. It includes a broad range of factors that initiate cognitive processes and holds that individuals are incentivised to take protective measures through threat appraisal and coping appraisal.

Threat appraisal involves an individual's assessment of the threat level, including the perceived severity and vulnerability: the former represents the severity of the consequence of the threat, and the latter is the probability of the threat actually occurring. Coping appraisal consists of response efficacy, self-efficacy, and response barriers. Response efficacy has a significant impact on the intention to protect oneself (Rogers, 1983). Self-efficacy is a predictor of intention and behaviour; it signifies the perceived ability to perform the adaptive behaviour and partially mediates the effects of social influences on behaviour (Slater, 1989). Response barriers refer to the difficulties and obstacles encountered by an individual taking adaptive action, which include the expense of time, money, and effort.

Food risk communication is a form of protective action that allows consumers to respond to food risks or threats. Protective measures include avoiding the consumption of certain food items, seeking expert advice, and communicating with regulators or producers about food-related health problems. Food risk communication can also foster understanding of food risks through greater information exchange, public awareness of food safety, transparency, and cooperation among stakeholders in food production and consumption.

The PMT has been widely used to predict the intention and behaviours of consumers in face of food risks (Cox et al., 2004; De Steur et al., 2015; Rahnama &

Somogyi, 2020), such as the choice of whether to eat seafood, organic food, or genetically modified food. The findings of most studies suggest that people are motivated to perform a certain self-protective behaviour when they perceive its efficacy and have a sense of self-efficacy.

Notwithstanding the PMT's significance in predicting the motivation of individuals to follow protective measures, it omits how attitude can influence the motivation to take self-protective action. For example, studies have recognised the relationship between attitude and behavioural intention (Kim et al., 2020; Sultan et al., 2020). Thus, the PMT can be improved by including attitude as a predictor of motivation.

2.2. Theory of reasoned action

Based on the assumption that behavioural intention is determined by individual influence and normative influence, the theory of reasoned action (TRA) was developed to predict behavioral intention and hence behavior (Madden et al., 1992). While an individual influence refers to one's attitude, which refers to a type of belief about performing the behaviour, a normative influence is related to subjective norms, which refer to perceived social pressure to perform the behaviour (Petrovici et al., 2004). Empirically, the TRA has been widely used to explain the intention to engage in health behaviour (Fishbein et al., 1980), consumption behaviour, and food choice (Basha et al., 2019; Tandon et al., 2020).

The TRA has several limitations; for example, it provides little insight into how individuals make the crucial step from attitude to intention, and similarly, from subjective norms to intention (Slater, 1999). To strengthen the explanatory power of this theory, some external variables have been incorporated. One of the best-known extended versions is the theory of planned behaviour (TPB) (Ajzen, 1991), which includes perceived behavioural control as a new component.

In our research context, attitude denotes the positive or negative assessment of food risk communication. Subjective norms correspond to the perceived social pressure to perform the behaviour and the motivation to comply with this pressure (Pender & Pender, 1986), and are related to an individual's perception of whether others in their social circle would perform food risk communication (Hoa et al., 2014; Wu, 2020). Intention to participate in food safety risk communication describes consumers' motivation to communicate food issues with others to minimise the negative effects or

to acquire knowledge about food safety.

2.3 The integrated framework and hypotheses

In this study, an integrated PMT/TRA model is developed to explore consumers' intention to participate in food safety risk communication in response to food poisoning incidents. There are two main rationales for this study. First, participation in food risk communication is a self-protective behaviour, which makes the PMT a suitable theoretical framework for analysis. Second, as attitude is an important factor in influencing one's intention and behaviours, this makes the TRA appropriate for analysing consumers' intention to participate in food risk communication, as it is one of the most useful attitude-behaviour theories (Fishbein et al., 1980). Note that we have selected the TRA instead of the TPB because the component of perceived behavioural control in the TPB is similar to self-efficacy and response barriers in the PMT. However, it is meaningful to explore the differences between the PMT and TPB integrated model and the TRA model in future research. Figure 1 presents the integrated PMT/TRA model used in this study.

[Insert Figure 1 here]

With respect to attitude, Rogers (1983), the original author of the PMT, has also recognised the influence of outcome severity (perceived severity), probability of occurrence (perceived vulnerability), and coping response efficacy on attitude and behavioural intentions (Rogers, 1983). Protection motivation, and hence attitude change, are considered to be a multiplicative function of the cognitive process (Rogers, 1975). In other words, attitude change is a function of the protection motivation aroused by cognitive appraisal processes. In general, the more fear aroused, the more positive the attitude towards protective action (Rogers, 1975); similarly, the perceived seriousness of a threat will facilitate attitude change (Dabbs & Leventhal, 1966; Leventhal et al., 1965). Accordingly, we propose hypothesis 1 (H1) as follows:

H1. Perceived severity positively influences consumers' attitude towards food risk communication.

Vulnerability is related to the possibility of threat occurrence and affects attitude change (Leventhal & Watts, 1966). When an individual perceives a higher possibility of food risk occurrence, he has a more positive attitude towards food risk communication. Hence, we propose hypothesis 2 (H2) as follows:

H2. Perceived vulnerability positively influences consumers' attitude towards

food risk communication.

In addition, the effectiveness of a coping response induces a change in attitude towards protective action (Maddux & Rogers 1983). Coping appraisal is a summation of the appraisals of response efficacy, self-efficacy, and the barriers to adopting a preventive response. If an individual encounters food risks, his attitude towards food risk communication is influenced by response efficacy, self-efficacy, and response barriers. Thus, we propose hypotheses 3, 4, and 5 (H3–H5) as follows:

H3. Response efficacy positively influences consumers' attitude towards food safety risk communication.

H4. Self-efficacy positively influences consumers' attitude towards food safety risk communication.

H5. Response barriers negatively influence consumers' attitude towards food safety risk communication.

In addition, the attitude–intention link and subjective norm–intention relationship depends on cognitive processes and coping responses (Bagozzi, 1992). For example, Kim (2009)'s work on technology acceptance suggests that attitude towards system use plays a significant mediating role in the relationship between salient beliefs (perceived usefulness, perceived ease of use) and behavioral intention (Kim et al., 2009). Furthermore, there are also other determinants that influence one's behaviour, including perceived barriers and attitudes (Jewson et al., 2008). However, the nature of risk communication is a kind of activity with information exchange. Using that analogy, consumers' attitudes mediate the cognitive process on food risk and risk communication intention. Thus, we propose hypotheses 6 to 10 (H6–H10) as follows:

H6. Attitude towards food safety risk communication mediates the effect of perceived severity on consumers' intention to participate in food safety risk communication.

H7. Attitude towards food safety risk communication mediates the effect of perceived vulnerability on consumers' intention to participate in food safety risk communication.

H8. Attitude towards food safety risk communication mediates the effect of response efficacy on consumers' intention to participate in food safety risk communication.

H9. Attitude towards food safety risk communication mediates the effect of self-efficacy on consumers' intention to participate in food safety risk communication.

H10. Attitude towards food safety risk communication mediates the effect of response barriers on consumers' intention to participate in food safety risk communication.

Food risk communication is a multi-directional activity. In general, the government and food industry play dominant roles in risk communication. However, it is necessary to explore consumers' intention to participate in risk communication through their attitudes and subjective norms. We referenced the existing theoretical literature by Petrovici et al. (2004), which regards the relationship between attitude, subjective norms, and intention. Intentions are thought to be the result of both an individual influence and a normative influence (Hale et al., 2002). Therefore, we propose hypotheses 11 and 12 (H11–H12) as follows:

H11. Attitude towards food safety risk communication positively influences consumers' intention to participate in food safety risk communication.

H12. Subjective norms about food risk communication positively influence consumers' intention to participate in food safety risk communication.

3. Methodology

3.1. Variables and measurement

In the integrated PMT/TRA framework used in this study, there are eight latent variables: six independent variables (perceived severity, perceived vulnerability, response efficacy, self-efficacy, response barriers, and subjective norms), one dependent variable (intention to participate in food risk communication), and one intermediate variable (consumers' attitude towards food risk communication).

Building on previous studies, the constructs were measured using 35 items. Any item with a factor loading below the recommended cut-off of 0.7 was removed from the statistical model (Vinzi et al., 2010). Accordingly, the first indicator of perceived vulnerability and response efficacy and the third indicator of self-efficacy were removed. As a result, 32 measurement items remain.

Perceived severity was measured by three items regarding the perceived seriousness of food risks (Chen, 2020; Mousavi et al., 2020). Perceived vulnerability was measured by three items regarding the perceived probability of food risk (Ling et al., 2019; Mousavi et al., 2020). Response efficacy was measured by five items assessing the respondents' views on the efficacy of food risk communication (Ling et al., 2019; Wu, 2020). Self-efficacy was measured by five items evaluating the respondents' perceived capacity to engage in food risk communication (Mousavi et al.,

2020). Response barriers were measured by four items measuring costs and other difficulties in food risk communication (Ling et al., 2019; Neuwirth et al., 2000). Attitude was measured by four items concerning the respondents' perspective on food risk communication (Bulgurcu et al., 2010; Tejaswini & Reghav, 2009; Wu, 2020). Four items were used to measure subjective norms related to different sources of social pressure (Hoa et al., 2014; Wang et al., 2019; Wu, 2020). Intention, which refers to the degree of intention to participate in food risk communication, was measured by four items (Husni et al., 2020; Mousavi et al., 2020). All items were measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

3.2. Data collection and sample

The *suan tang zi* food incident in northeast China served as the background for our survey, as it drew public attention to the safety issue of homemade fermented food (Daily Mail Online, 2020). *Suan tang zi* is a kind of soup with noodles made from fermented corn flour. In 2020, food poisoning from consuming *suan tang zi* caused nine deaths in Jidong county, Jixi city, Heilongjiang province. *Suan tang zi* is a local delicacy in northeast China, where the high latitude and long winters allow local people to make homemade fermented or pickled foods for the winter.

The survey was conducted in northeastern China from March to April 2021 via a professional online platform, Sojump. Sojump is widely used by academic institutions, industries, and individuals in China for data collection. We imported the questionnaire into the platform and generated a URL where respondents could submit their responses. Data were obtained from Heilongjiang, Liaoning, and Jilin provinces in northeastern China, based on restrictions to IP addresses. Respondents who completed the questionnaire obtained RMB 6 (about USD 0.93) as a reward through the platform. A total of 676 valid responses were obtained, with all respondents having previously consumed *suan tang zi*.

The questionnaire included seven parts. The first part introduced the survey and defined food safety risk communication. The second part asked about threat appraisal, including perceived severity and perceived vulnerability, and the third asked about coping appraisal, including response efficacy, self-efficacy, and response barriers. The fourth and fifth parts concerned the respondents' attitudes towards food safety risk communication and subjective norms, respectively. The sixth part asked about the respondent's intention to participate in food safety risk communication. Finally, the last

part collected personal information, including gender, age, marital status, education, annual personal income, and location.

The data were analysed statistically using SPSS (IBM Net., United States) and SmartPLS (SmartPLS GmbH, Germany), and the hypotheses were tested using the partial least squares method based on structural equation modelling (PLS-SEM) to simultaneously evaluate the measurement model and structural model. Table 1 summarises the measurement items of all constructs.

[Insert Table 1 here]

4. Results

4.1 Statistics analysis

The descriptive statistics reveal that 217 men and 459 women responded to the survey. Most respondents were between 18 and 49 years old. There were more married respondents (59%) than single. Most respondents (59.2%) had received a higher education, and most respondents' annual personal income was less than USD10,787. Residents in Jilin and Heilongjiang provinces accounted for 88.6% of the respondents, representing the region where *suan tang zi* is a specialty. Table 2 summarises the demographic information of the sample.

[Insert Table 2 here]

4.2 Measurement model

Data analysis was performed using the PLS approach, which can simultaneously estimate both the measurement model and the SEM (Chin, 1998). PLS is less dependent on sample size than other approaches and does not need normally distributed data (Hair et al., 2012). PLS can also be applied to complex structural equation models with many constructs. Overall, PLS-SEM fits the scope and objective of the study. All scales of constructs were developed from the relevant literature to suit our research context.

To check the adequacy of the measurement model, we assessed its reliability, convergent validity, and discriminant validity. Cronbach's alpha and composite reliability (CR) were used to evaluate the reliability of each construct. Composite reliability was used to estimate the internal consistency of the latent variables (Wang et al., 2019). Values above 0.7 indicate that the reliability of the measurement model is acceptable (Nunnally & Bernstein, 1994). The results in Table 3 of this study show that the values of Cronbach's alpha and CR were both above 0.8, indicating satisfactory reliability of the measurement model (Cronbach, 1951; Nunally & Bernstein, 1994).

Next, the average variance extracted (AVE) was used to assess convergent validity (Fornell & Larcker, 1981), with a value above 0.5 being considered acceptable. The AVEs of all constructs in the study ranged from 0.746 to 0.892, indicating adequate convergent validity of the measurement model.

Overall, the results suggest that the latent variables had good convergent validity and reliability. Hence, the data are suitable for further analysis.

[Insert Table 3 here]

To test for the discriminant validity of the measurement model, the cross-loadings, Fornell–Larcker criterion, and Heterotrait–Monotrait Ratio (HTMT) were also analysed. The following criteria were applied: (i) if the loading of each indicator is higher for its designated construct than for any of the other constructs, and each of the construct’s loads are highest with its own items, it can be inferred that the model’s constructs differ sufficiently from one another (Chin, 1998). (ii) AVE values should be greater than the off-diagonal in the measurement model for discriminant validity to be deemed satisfactory (Fornell & Larcker, 1981). (iii) HTMT should not exceed 0.85 (Henseler et al., 2015). In Table 4, the related item factor-loadings in bold and on the diagonal are higher than other cross-loadings. Table 5 indicates that the square roots of the AVE values are higher than the square of the constructs’ correlation values. Table 6 shows that all HTMT values are lower than 0.85. The results suggest that the criteria have all been satisfied, indicating adequate discriminant validity of the measurement model.

[Insert Table 4-6 here]

4.3 Common method bias

Common method bias (CMB) is a common measurement problem (Podsakoff et al., 2003); to avoid it, we used two methods. First, Harman’s single factor test was used; the result of the principal component factor analysis indicated that no factor accounted for a majority of the total covariance (Podsakoff et al., 2003). Second, we applied a full collinearity assessment approach (Kock & Lynn, 2012; Kock, 2015). The variance of the model’s inflation factor (VIF) values was lower than the recommended cut-off value of 3.3 (Hair et al., 2010). Therefore, CMB is not a major issue in our study.

4.4 Structural equation model

Two separate SEM analyses were performed: PMT and PMT plus TRA. First, based on the single PMT theoretical model, we explore the relationship between intention to

participate in food safety risk communication, threat, and coping appraisal without considering consumers' attitudes. Next, we conduct SEM analysis for the integrated theoretical model of PMT and TRA to assess its predictive power for consumers' intention to participate in food safety risk communication. To test the structural model's validity, the coefficients of determination, path coefficient, and effect size are considered.

[Insert Figure 2 and Table 7 here]

As summarised in Figure 2, if attitude is not included in the theoretical model, PLS analysis of PMT explains 55% of the variance in consumers' intention to participate in food safety risk communication. The results of the single PMT model are shown in Table 7, showing show that perceived severity and response barriers have no significant direct effects on consumers' intention to participate in food risk communication ($t = 1.313, p > 0.05$; $t = 1.293, p > 0.05$). In addition, self-efficacy is more crucial for determining the intention to participate in food risk communication than other factors ($t = 7.230, p < 0.01$). Perceived vulnerability and response efficacy had a significant effect on the intention to participate in food risk communication ($t = 3.458, p < 0.01$; $t = 2.213, p < 0.01$). According to the analysis above, consumers are not likely to participate in food risk communication if they encounter food risk.

[Insert Figure 3 here]

With respect to the integrated PMT/TRA theoretical model, PLS analysis explains 67.4% of the variance in consumers' intention to participate in food risk communication and 56.4% of the variance in attitude (see Figure 3). In other words, the integrated theoretical model we proposed had greater predictive power for consumers' intention to participate in food risk communication.

In the integrated PMT/TRA analytical model, the Q^2 value is a measurement of predictive relevance based on the blindfolding technique, which is a modified version of the jackknife approach (Geisser, 1974; Shmueli et al., 2016). In Table 8, the Q^2 value is higher than 0, indicating that the model has predictive relevance. In summary, the structural model validity is satisfied; the goodness-of-fit statistics for this measurement model are acceptable.

[Insert Table 8 here]

Next, we tested our hypotheses with bootstrapping, a resampling method in which 5,000 resamples are used to obtain the t -values (Henseler et al., 2009; Vinzi et al., 2010). As shown in Figure 3, perceived severity ($p < 0.01, t = 3.298, b = 0.108$),

perceived vulnerability ($p < 0.01$, $t = 1.994$, $b = 0.079$), response efficacy ($p < 0.01$, $t = 2.844$, $b = 0.206$), and self-efficacy ($p < 0.001$, $t = 6.327$, $b = 0.466$) had significant positive effects on consumers' attitude towards food safety risk communication. However, the response barrier had a negative but nonsignificant effect on attitude ($p > 0.05$, $t = 0.521$, $b = -0.016$). Consumers' attitude towards food safety risk communication and subjective norms ($p < 0.001$, $t = 7.642$, $b = 0.406$) had significant positive effects on consumers' intention to participate in risk communication, respectively. In other words, H1, H2, H3, H4, H11, H12 were supported, as summarised in Table 9.

[Insert Table 9 here]

To assess the mediating effect of attitude on the relationships of the independent variables on intention to participate in food risk communication, the sampling distribution was bootstrapped for the indirect effect (Preacher and Hayes, 2004; 2008). The indirect effects and associated 95% bias-corrected confidence intervals after 5,000 bootstrap replications are summarised in Table 10. If the confidence intervals do not include zero, the indirect effect is considered significant and mediation is established (Srivastava et al., 2016). The confidence intervals of H10 has included zero in Table 10, which indicates that the indirect effect is not significant.

[Insert Table 10 here]

The results indicate that attitude acts as a mediating variable between perceived severity and intention to participate in food safety risk communication; similarly, attitude mediates the effects of response efficacy and self-efficacy on intention. The indirect effect between perceived severity and intention is 0.05, whereas the t -value is 3.115, above the benchmark of 1.96. The indirect effects between other independent variables, such as perceived vulnerability, response efficacy, self-efficacy, and response barriers, and the dependent variable of intention to participate in food risk communication are shown in Table 10. Overall, H6, H7, H8, and H9 are supported while H10 is rejected. The results suggest that attitude plays a mediating role in the relationships of perceived severity, response efficacy, and self-efficacy with consumers' intention to participate in food safety risk communication.

In contrast to previous studies, response barriers were considered in our study. Furthermore, unlike previous research, which has focused on privacy-preserving behaviour or food consumption behaviour (Cox et al., 2004; Wu, 2020), this study focuses on food risk communication. Scholars have found that threat appraisal and

coping appraisal have significant direct impacts on intention but have neglected the effect of attitude on food risk communication (Chen, 2016; Neuwirth et al., 2000; Scarpa & Thiene, 2011). Our results support those of previous studies by demonstrating that threat appraisal and coping appraisal without response barriers have a significant impact on consumers' attitude towards risk communication (Mousavi et al., 2020; Wu, 2020). In addition, our results also support prior studies (Chen et al., 2014; Petrovici et al., 2004;) that attitude and subjective norms have positive effects on one's intention. However, there are inconsistencies in the mediating effect of attitude in the relationship between response barriers and intention to communicate food risk (Wang, 2019). Our results do not support the mediating function of attitude between response barriers and intention to communicate food risk.

5. Discussion

This study combines the PMT and TRA to explore consumers' intention to participate in food risk communication in the context of the *suan tang zi* incident. It makes several theoretical contributions to the literature.

First, this study adds to the PMT literature and enhances its explanatory power by incorporating the factors of attitude and subjective norms from the TRA. Although the PMT-only theoretical model explained consumers' intention to participate in food safety risk communication with a 55% variance level, the addition of attitude and subjective norms to the integrated PMT/TRA theoretical model increased the variance level to 67.4%. In other words, the inclusion of attitude and subjective norms contributes to the literature on PMT and TRA. Indeed, the PMT was first proposed by Rogers (1975) to understand how fear appeals create attitude changes (Maddux & Rogers, 1983). Nevertheless, the relationships between coping appraisal, threat appraisal, attitude, and intention have rarely been explored in studies of protection motivation. This study has filled this theoretical gap by constructing an extended model to explore consumers' intention to participate in risk communication. The results show that similar to subjective norms (H12), attitude has a significant influence on behavioural intention (H11). Specifically, attitude determines consumers' intention to participate in risk communication more than subjective norms (path coefficients: 0.468 > 0.406).

Second, this study also improves our knowledge of food risk communication; it represents the first attempt to consider social pressure and attitude in the cognitive

processes of risk communication. Studies have focused on specific strategies for effective food risk communication (Chammem et al., 2018; Cho et al., 2017; Frewer, 2004), and the impacts of knowledge, risk perception, and trust on the decision to enforce food safety measures (Eiser et al., 2002; Frewer, 2000; Gong et al., 2016; Wang et al., 2021). However, the relationship between cognitive processes and the attitude towards food risk communication has received limited attention. The integrated theoretical framework in this study offers a new perspective on consumers' intention to participate in food safety risk communication.

Our findings suggest that attitudes mediate the relationship between the cognitive processes of handling food risk and intentions to participate in risk communication (H6, H7, H8, H9). Specifically, perceived severity, perceived vulnerability, response efficacy, and self-efficacy have significantly positive effects on consumers' attitude towards food safety risk communication (H1–H4). Self-efficacy has the most significant effect on attitude; response barriers, however, have a nonsignificant negative effect (H5). This finding implies that consumers are not restricted by the difficulties involved in food risk communication if they perceive such communication as effective. Our finding is different from the relationship between perceived behavioral control and intention in the TPB (theory of planned behaviour) model. In the PMT and TRA integrated models, we found an indirect relationship between self-efficacy and intention.

Attitude and subjective norms have significantly positive effects on consumers' intention to participate in food safety risk communication; in addition, attitude plays a mediating role between external threats and consumers' intention to participate. If attitude is not included in the theoretical model, perceived severity does not have a significant effect on consumers' intention to participate in food risk communication.

Third, response efficacy and self-efficacy in coping appraisal are significant factors altering consumers' attitude towards food risk communication. Comparatively, self-efficacy is more determinative of consumers' attitude towards food risk communication than response efficacy (path coefficients: $0.466 > 0.206$). In addition, coping appraisal is more determinative of consumers' attitude towards food risk communication than threat appraisal. These results imply that the effectiveness of communication in reducing food risks is more decisive in determining consumers' attitudes.

In summary, building on the integrated PMT/TRA theoretical model, this study

has explored the influences of threat appraisal, coping appraisal, attitude, and subjective norms on consumers' intention to participate in food risk communication. The results support most of the hypotheses, and thus the integrated model has excellent explanatory power for consumers' intention to participate in food safety risk communication in the context of food incidents.

6. Conclusion: Practical implications

In China, food risk communication is not yet a common practice or norm. Although research has explored the effectiveness of various food risk communication strategies, it has largely neglected stakeholders' intention to participate in the communication mechanism. By focusing on consumers' intention to participate in food risk communication, this study has several practical implications.

First, given the significant role of subjective norms in promoting consumers' intention to participate in food safety risk communication, it is necessary to cultivate a participatory culture or consensus among stakeholders to engage in food risk communication. Because consumers with different demographic characteristics are subject to different social pressures, it is necessary to design diversified communication tools and platforms targeting consumers of different ages, education levels, genders, and ages.

Second, given the crucial role of attitude in determining consumers' intention to participate in the communication mechanism, it is important to develop strategies to alter consumers' attitude to increase their intention to participate in it. This study has provided valuable evidence that attitude changes are largely determined by fear appeals and the efficacy of the protective behaviour. Therefore, to engage consumers in the communication mechanism, different stakeholders could emphasise the potential threats, severity, and vulnerability of food hazards to induce consumers' fears, and at the same time highlight the effectiveness of food risk communication in reducing the negative impacts of food risks on humans. For example, the government can cooperate with other stakeholders to demonstrate how effective food risk communications can improve risk recognition and avoidance, and at the same time allow producers to communicate directly with consumers for instant response.

Third, in view of the significant impacts of self-efficacy on attitude change and hence consumers' intention to participate in food risk communication, the government should take a more active role in such communications. For example, consumers may

lack the knowledge of how to engage in risk communication and hence have the misunderstanding that only experts or professionals are capable of participating in the mechanism. To cultivate consumers' belief and confidence in their self-efficacy of participating in risk communication, the government and food industries can cooperate with the communication sector to promote the accessibility, readiness, and convenience of various communication channels including face-to-face conversations, emails, written letters, blogs, and online chats and messaging platforms.

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