



## Factors affecting risk perception of culturally sensitive food

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### Abstract

The purpose of this study was to identify the relevant factors affecting risk perception towards culturally sensitive food such as gelatine and to analyze the relationships among all the factors using structural equation modelling. Risk perception towards culturally sensitive food was measured using self developed questionnaire with seven-point Likert scales. Many factors were found to influence the acceptability of gelatine usage in food. Perceived benefit is the most important predictor of the acceptability of risk related to gelatine and encouragement of the usage of gelatine in food. On the other hand, perceived risk has an inverse relationship with risk acceptance and encouragement. Familiarity, food concern, confidence in key actor, impact of science and technology and risk taking attitudes contributed either directly or indirectly to the acceptability of risk and encouragement of the usage of gelatine in food. Based on the study findings, appropriate strategy for consumers' education could be devised as well as the improvement of existing food policy and food safety regulation.

**Key words:** Structural equation modelling, risk perception, culturally sensitive food, gelatine.

### Introduction

Gelatine is a highly processed protein which is widely used in food, pharmaceutical, cosmetics and photographic applications. It has also attracted much attention from researchers in recent years as edible films and coating for food packaging. Gelatine is obtained by hydrolysis of collagen which is extracted from bones, hides and skins from animal slaughter house <sup>1</sup>. Bovine and porcine waste are the most frequent sources to obtain the good quality gelatine and fish bones and skins are another source of gelatine <sup>2</sup>. The most abundant sources of gelatine are pigskin (46%), bovine hide (29.4%), pork and cattle bones (23.1%) while other sources contribute another 1.5% <sup>3</sup>. In Europe, 80% of edible gelatine is produced from pigskin but halal gelatine is prepared from seaweed, fish bones or non-porcine source <sup>4</sup>. The most common forms of gelatine used in food industry are derived from bovine and porcine sources. The issue of replacing gelatine from animal sources has existed for many years due to objections raised by vegetarians, development of halal and kosher markets as well as the emergence of bovine spongiform encephalopathy towards the end of the 20<sup>th</sup> century <sup>1,5</sup>. Culture is the set of values, beliefs, rules and institutions held by a specific group of people. The main components of culture included aesthetics, values and attitudes, manners and customs, social structure, religion, personal communication, education, and physical and material environments. Cultural views influence the economic development as well as risk acceptability of any technology. Food is an important aspect of culture and religion that strongly affects foods and services acceptable to certain religion. For example the production of gelatine from pig sources is not acceptable to the Muslims and Jewish people, while gelatine from cattle is acceptable, if it is prepared according to religious requirements <sup>1</sup>.

The knowledge of risk perception towards culturally sensitive food can play a very important factor during the introduction of new food policy and regulation. Risk perception involves people's beliefs, attitudes, judgement and feelings as well as wider cultural and social dispositions adopting towards hazards and their benefits <sup>6</sup>. Many factors such as individual risk perception, public discussion and political trends are changing the internal and external dynamics in our society <sup>7</sup>. There were significant differences between expert and public perception of risk from a variety of hazards <sup>8-10</sup>. The experts have lamented that the public reactions to scientific risk assessment as ignorance and irrational but researcher have shown that the public understanding if risk is driven by factors not taken into account by the expert <sup>11</sup>. Lay person looks at risk more broadly than the expert whose expertise is narrow and therefore likely to miss something of important to broader community <sup>12</sup>.

The psychometric paradigm seems to be a promising approach for analyzing people's perception of different types of hazards. It has been frequently used to study lay people's perception of hazards <sup>13</sup>. This approach has been designed to address the question of why various hazards are perceived different. Previous research has successfully used the psychometric approach in the food domain <sup>14,15</sup>. Two of the most common dimensions in risk perception in the food area are dread or severity and familiarity or sometimes called unknown risks or knowledge of the risks <sup>14,15</sup>. Some psychometric researchers have examined the perceived risk and benefit dimensions <sup>16,17</sup>. People will tolerate some degree of risk, if the hazard has some benefits to the risk taker. However, if the hazards are perceived to be very severe, perceived benefit will not compensate for perceived risk or the risk will not be acceptable <sup>18</sup>.

Risk acceptance is another important dimension suggested by Rohrmann<sup>19</sup> while encouragement has been used in many attitude studies related to controversial foods such as genetically modified foods<sup>20,21</sup>. Borcharding *et al.*<sup>22</sup> developed a conceptual framework for the subjective evaluation of risky activities which hypothesized that impact of science and technology is amongst the relevant co-determinants of risk perception. The perceived risk and benefits have also been shown to be influenced by a number of more general attitudes such as technology scepticism, safety culture and risk taking attitude<sup>19,23</sup>, while Gaskell *et al.*<sup>24</sup> proposed another dimension confidence on key actors that could have induced exaggerated perceptions of risk.

To our knowledge, there has been no study on risk perception towards the use of gelatine in food. Sufficient and necessary information on risk perception towards culturally sensitive food such as gelatine is important to the policy makers and food producers in order to devise appropriate strategy for consumers' education, as well as improvement of food policy and food safety regulation. Therefore, the present study has been undertaken to identify the relevant factors affecting risk perception towards culturally sensitive food by using gelatine as an example, and to construct a structural equation model to analyze the relationship among all the factors.

### Materials and Methods

Data was collected by means of a survey carried out between June 2004 and February 2005. This is one of the first in-depth study on risk perception towards culturally sensitive food in Malaysia. The respondents were sampled from the general public in the Klang Valley region, stratified according to their occupations, as classified by the Malaysian Standard Classification of Occupations, 1998 (MASCO) with slight modifications. The group comprising skilled agricultural and fishery workers was not included as the population for this group was rather small in the Klang Valley region. The 'unemployed' group was included. The people in the Klang Valley region were chosen as the target population as this region lies in the centre of the country's economic and social development. The conventional multiple indicator survey research approach, as proposed by Kelley<sup>25</sup>, was developed so that measurement errors were reduced.

The questionnaires were handed over personally to the respondents by trained science graduate enumerators. Before completing the questionnaires, respondents were given an introduction to the basic concepts, and several possible benefits and risks associated with gelatine. The respondents were then asked to describe their perceptions concerning the use of gelatine in foods.

**Instrument:** The psychometric instrument for risk perception towards culturally sensitive food was developed based on past studies and literature reviews<sup>15, 19, 24</sup> and validated in an earlier study<sup>26</sup>. The instrument incorporated several dimensions or factors: familiarity<sup>15, 19</sup>, perceived benefits<sup>19, 24, 27</sup>, perceived risks<sup>19, 24</sup>, risk acceptance<sup>19</sup>, encouragement<sup>24</sup>, food concern, confidence in key actors, impact on science and technology and risk taking attitude.

Familiarity ( $\alpha = 0.791$ ) comprised of three items: easy to know, easy to judgement and effect known. Each item was measured on a 7-point scale, ranging from 1 (not easy at all for the first two items/strongly disagree for the remaining two items) to 7 (very

easy for the first two items/ strongly agree for the other items). A higher score indicates greater familiarity. Perceived benefit ( $\alpha = 0.916$ ) comprised of five items; benefit to society, enhance quality of food, enhance quality of life, enhance economy and benefits exceed risks. Each item was measured on a 7-point scale, ranging from 1 (not useful at all or item 1/strongly disagree for other items) to 7 (very useful for item 1/strongly agree for other items). A higher score indicates higher perceived benefit. The measurement of perceived risk ( $\alpha = 0.905$ ) was obtained by using six items; feelings to anxiety, harm to health, long-term effect, catastrophic potential, overall risk magnitude and need to be regulated. Each item was measured on a 7-point scale, ranging from 1 (not worried at all for the first four items/no harm at all for the last item) to 7 (very worried for the first four items/very harmful for the last item). A higher score indicates higher perceived risk. Encouragement ( $\alpha = 0.888$ ) was measured by four factor items; more intensive research and development, should be scaled up/commercialized, the government should provide more financial support and overall encouraged. Each item was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A higher score indicates higher encouragement. Risk acceptance ( $\alpha = 0.783$ ) was measured by three items: accept risk if it can boost economy, societal risk acceptance and risk minimal in comparison with other risk. Each item was measured on a 7-point scale, ranging from 1 (not willing at all for the first item/not acceptable for the second and strongly disagree for the last item) to 7 (very willing for the first item/very acceptable for the second item and strongly agree for the last item). A higher score indicates higher risk acceptance.

General classes of attitude included food concern, confidence in key actors, impact of science and technology and risk taking attitude. Food concern ( $\alpha = 0.806$ ) was measured by four items: concern about quality and nutritive value of foods, know how to choose good quality gelatine, interest on new stories about food safety and read the label on food wrappings before buying. Each item was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A higher score indicates higher food concern. Confidence on key actors ( $\alpha = 0.827$ ) was assessed by asking the respondents three items on the extent to which scientists, biotechnology related industries and government departments involved in food and biotechnology regulation are perceived to have done a good job for society<sup>20</sup>. Each item was measured on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). A higher score indicates higher confidence in key actors. Risk taking attitude ( $\alpha = 0.858$ ) was assessed by asking the respondents five items on nothing ventured, nothing gained motto, to gain more daring decisions must be made, try for luck even when chances are limited, success lead to taking higher risk and express opinion even if most people have opposite views. Each item was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A higher score indicates higher risk taking attitude. Impact of science and technology ( $\alpha = 0.815$ ) was measured by three statements describing the impact of science and technology on human and nature. Each item was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A higher score indicates higher trust on science and technology.

**Statistical analysis:** Correlation analyses were carried out at a bivariate level followed by structural equation modelling (SEM)

analyses to test the overall relationships among the constructs. Structural equation model (SEM) is a statistical modelling technique that can handle a large number of endogenous and exogenous variables<sup>28</sup>. A single step SEM analysis as recommended by Hair *et al.*<sup>29</sup> was carried out to estimate the measurement and structural model using AMOS version 5.0 software with maximum likelihood function.

### Results and Discussion

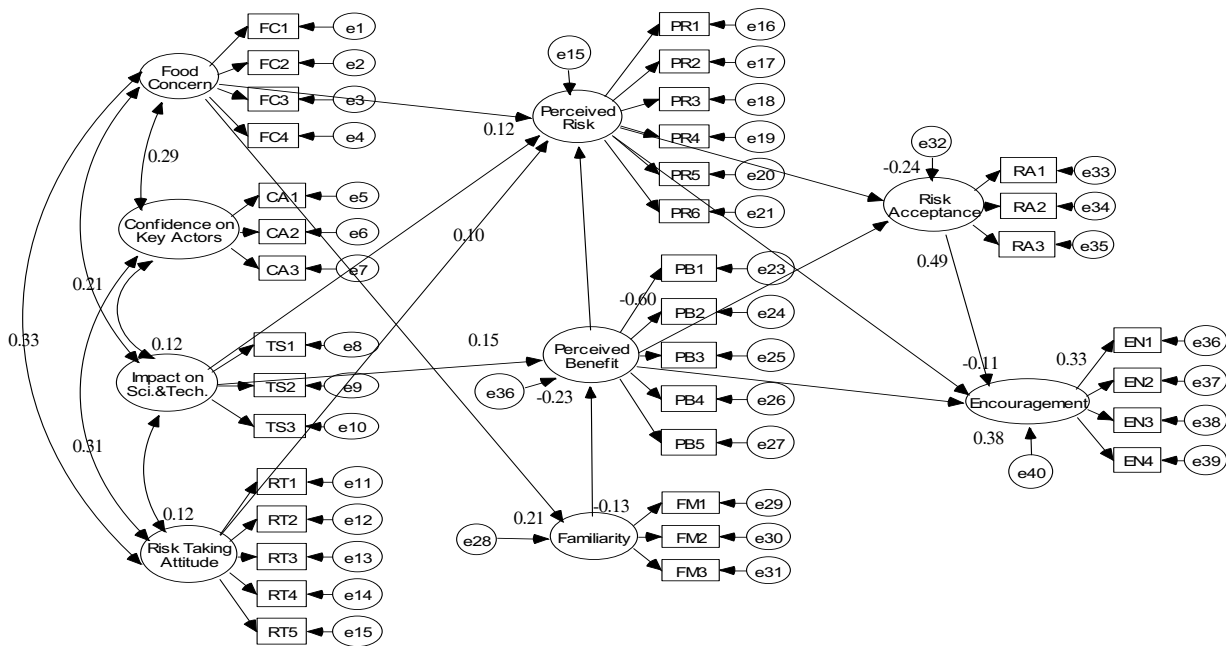
**Structural equation model:** Structural equation model (SEM) was developed on the basis of previous research findings as well as correlations among the variable. The SEM was designed according to the assumed influenced the variable as proposed by Pardo *et al.*<sup>30</sup>. A single step SEM analysis as recommended by Hair *et al.*<sup>29</sup> was carried out to estimate measurement and structural model using AMOS version 5.0 software with maximum likelihood function. According to the proposed model, 46 hypotheses were formulated for the relationship among the variables. Thirty six hypothesized paths retained in the final model which were statistically significant at the 0.05 probability level or lower. Ten of 46 hypotheses were

eliminated due to statistical insignificance at the 0.05 probability level. According to Hair *et al.*<sup>31</sup> and Arbuckle and Wothke<sup>32</sup>, a well fitting model should have GFI, AGFI, IFI and CFI greater than 0.90 and RMSEA value less than 0.05. The measurement model for risk perception towards socially unaccepted gelatine in this study was found to have a good fit with CMIN/DF = 1.748, GFI = 0.912, AGFI = 0.898, CFI = 0.962 and RMSEA = 0.036 with 90% confidence level in the range of 0.32- 0.40.

**Construct reliability and validity:** The reliabilities such as internal consistency (Cronbach's alpha), item reliability and construct reliability were measured. The results of three types of reliabilities are presented in Table 1. The Cronbach's alpha coefficients of all the construct were considered good (above 0.70). The corrected total correlations for all items was very good (correlation coefficients greater than 0.5). The construct reliability is represented by the composite reliabilities and the variance extracted. From Table 1 it can be seen that the composite reliabilities for all the constructs were above 0.7 and the variance extracted (AVE) were all above 0.50 indicating good construct reliability<sup>29</sup>. The convergent validity

**Table 1.** Measurement scales, reliability and validity.

Factors and Items	Corrected item total correlation	$\alpha$	Standardized factor loading	Composite reliability	Average Variance Extracted (AVE)
<b>Familiarity</b>					
Easy to know,	0.577	0.791	0.650	0.794	0.565
Easy to judgement	0.687		0.844		
Effect known	0.634		0.750		
<b>Perceived Benefit</b>					
Benefit to society	0.812	0.916	0.862	0.914	0.681
Enhance quality of food	0.820		0.879		
Enhance quality of life	0.806		0.875		
Enhance economy	0.763		0.773		
Benefit exceed risks	0.722		0.728		
<b>Perceived Risk</b>					
Feelings to anxiety	0.778	0.905	0.859	0.902	0.608
Harm to health	0.839		0.905		
Long term effect	0.719		0.716		
Catastrophic potential	0.729		0.738		
Overall risk magnitude	0.758		0.796		
Need to be regulated	0.613		0.636		
<b>Risk Acceptance</b>					
Accept if it can boost economy	0.666	0.783	0.813	0.836	0.545
societal risk acceptance	0.589		0.625		
Risk minimal in comparison with other risks	0.610		0.765		
<b>Encouragement</b>					
More intensive research and development	0.673	0.888	0.715	0.892	0.675
Should be scaled up/commercialised	0.797		0.877		
The government should provide more financial support	0.817		0.861		
Overall encouragement	0.745		0.825		
<b>Food Concern</b>					
Concern about quality and nutritional value of foods	0.678	0.807	0.757	0.810	0.518
Know how to choose good quality gelatine	0.566		0.638		
Interest on new stories about gelatine	0.658		0.773		
Read the label of food wrappings before buying	0.604		0.705		
<b>Confidence on Key Actors</b>					
Scientists do a good job for society	0.723	0.827	0.857	0.831	0.624
Industries do a good job for society	0.614		0.670		
Government does a good job for society	0.717		0.830		
<b>Risk Taking Attitudes</b>					
Nothing ventured, nothing gained motto	0.627	0.858	0.622	0.851	0.536
To gain more, more daring decisions must be made	0.729		0.737		
Try for luck even when chances are limited	0.669		0.742		
Success lead to taking higher risk	0.752		0.856		
Express opinion even if most people have opposite views	0.595		0.686		
<b>Trust on Science and Technology</b>					
Impact of Science and technology	0.669	0.815	0.774	0.816	0.597
Impact on humanity	0.689		0.813		
Impact of nature	0.646		0.729		



**Figure 1.** Structural equation model of risk perception towards gelatine showing interrelationships amongst relevant variables. Standardized estimates are presented.

was assessed by the factor loadings and composite reliability<sup>29</sup>. The standardized loadings of all factors were greater than 0.7 and the composite reliabilities for all factors were also above 0.7 indicating good convergent validity (Table 1).

**Relationship among the constructs:** The structural equation model of risk perception towards gelatine is presented in Fig. 1. Perceived benefit was the most important direct predictor of risk acceptance ( $\beta = 0.49$ ) and encouragement ( $\beta = 0.38$ ). It was also negatively associated with perceived risk ( $\beta = -0.60$ ) (Fig.1). When the use of gelatine in food is perceived as beneficial by the respondents, the risk associated with it is more acceptable to them and they are more encouraging towards the use of gelatine in food. The findings in this study are supported by some earlier study on public perception towards controversial foods. Gaskell *et al.*<sup>20</sup> reported that perceived usefulness of GM food increased its support. Amin *et al.*<sup>33</sup> stated that perceived benefit has been found to be inversely related to perceived risk. They found that if the application is beneficial to consumers, the risk will be perceived as lower. Earlier researchers have also suggested an inverse relationship between risk and benefit<sup>6, 20</sup>. Perceived risk has negative association with risk acceptance ( $\beta = -0.24$ ) and encouragement ( $\beta = -0.11$ ). When the risks associated with gelatine is high, it would not be acceptable to them and the use of gelatine in food is not encouraged. Perceived risk has been identified as a significant variable of encouragement for GM foods<sup>34</sup>. In this study, risk acceptance was found to have a positive association with encouragement ( $\beta = 0.33$ ). When the risk related to gelatine is more acceptable to the respondents, then its usage in food is more encouraged.

Familiarity has negative association with perceived benefit ( $\beta = -0.13$ ) (Fig.1). The result indicates that when the respondents were more familiar with culturally sensitive food such as gelatine, they tended to perceive the use of it in food as less beneficial. This finding showed that the Malaysian respondents were indeed sensitive on the use of gelatine in their food. Food concern was found to positive association with familiarity ( $\beta = 0.21$ ) and perceived

risk ( $\beta = 0.12$ ). This result revealed that when the respondents were more concerned about food safety, they tended to be more familiar with gelatine and tend to view the risk associated with gelatine as high. Frewer *et al.*<sup>35</sup> stated that risk perceptions are socially constructed and cannot be viewed without taking into consideration their social context. Impact (negative) of science and technology has positive association with perceived risk ( $\beta = 0.10$ ) but negatively associated with perceived benefit ( $\beta = -0.23$ ). The respondents who perceive science and technology as more negative tend to perceive the usage of gelatine in food as more risky and of less beneficial. Borcherding *et al.*<sup>22</sup> reported that impact of technology amongst the relevant co-determinants of risk perception variables. According to Rohrmann<sup>36</sup>, attitude towards science and technology or impact of technology was found to influence risk magnitude and benefit of technological hazards.

Risk taking attitudes has positive association with perceived risk ( $\beta = 0.15$ ). The people who has high risk taking attitude tend to perceive more risk on the usage of gelatine in food. The factors, food concern, confidence in key actors, impact of science and technology and risk taking attitudes are positively correlated. People who were more concerned about food safety issues tended to perceive a higher negative impact of science and technology but had more confidence in key actors as well as possessing high risk taking attitudes.

## Conclusions

Risk perception towards culturally sensitive food such as gelatine involved the interplay between many inter-related factors. Perceived benefit is the most important direct predictor for the acceptability of risk related to gelatine as well as encouragement of the usage of gelatine in food. On the other hand, perceived risk has an inverse relationship with risk acceptance and encouragement. Other factors such as familiarity, food concern, confidence in key actor, impact on science and technology and risk taking attitudes do contribute either directly or indirectly to the acceptability of risk and encouragement of the culturally unaccepted gelatine. The factors could be used to

devise appropriate strategy for consumers' education, as well as improvement of food policy and food safety regulation.

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