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Risk perception towards food safety issues: GM foods versus non-GM foods

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Abstract

Food is a need for every living man on the earth. With the advance in various technologies, food production has dramatically increased in quantity but not necessarily in quality. The public has become more concerned about the risks from food hazards in recent years. So it is important to assess the level of awareness and food safety concerns amongst the public and to study how they perceived the risk aspects of several food safety issues. A survey was carried out on the general public (550 respondents) in the Klang Valley region**,** stratified according to their occupation classification by Malaysian Standard Classification of Occupations 1998. Risk perception was measured using self-developed questionnaires with seven point Likert scales. The Malaysian public was found to be highly attentive to food safety issues, but they only have moderate knowledge on food safety and divided on how to choose quality food. The level of awareness towards several food safety issues varies. Only food preservatives and pesticide residues were perceived as familiar. All six food safety issues were perceived as risky by the respondents and need high level of regulation. The level of perceived benefits and encouragement differed across food safety issues. GM palm oil and GM soybean were the only food safety issues perceived as beneficial and were moderately encouraged. The level of confidence towards Malaysian regulatory body related to food safety among the respondents who were aware about its existence was moderate. It can be concluded that the public perceived and assessed food risks as a complex and sensitive expressions of their value system as well as multi-dimensional. Results from this study provide some insights into the social acceptance of food-related technologies in developing countries that can be adopted by food scientists, food industries and government regulatory bodies in developing suitable risk communication strategies.

Key words: Risk perception, awareness, food safety.

Introduction

The public has become more concerned about the risks from food hazards in recent years [1-3]. Inherent food-related risks result from pathogenic microorganisms, naturally occurring toxicants, environmental contaminants, pesticide residues, antibiotics, hormones in animals and food additives while the Muslims have always been wary regarding the presence of 'non-halal' ingredients in food. Lately, there have been great concerns regarding genetically modified foods. Increased in concerns is likely to have been caused by several factors such as the numerous publicized and the decline of consumer trust in the regulation of food supply [4, 5]. Food scares about a particular food do not just adversely affect perception, sale and consumption of that food, they can widely affect the food supply and consequently the food industry [6].

When discussing food safety, one must understand the concept of risk. Risk or hazard has been defined as the probability that injury, danger or damage will result from the uses from the substances in the proposed quantity and manner. Danger, injury or damage can be encountered only if some risks or hazards exist[7]. Although the severity of the hazard posed by each of the above listed factors may not follow that order in the opinion of some, it does serve as a useful base discussion and elaboration. Hall [7] emphasized that safety is the practical certainty that injury will not result from the substance when it is used in the manner and quantity proposed. Substance in the context refers to food or food ingredients. According to Cliver [8], food safety is a matter that affects anyone who eats food. Whether or not a person consciously thinks about food safety before eating a meal, a host of other people has thought about the safety of that food, from farmers to shopkeepers to customers. The concept of safe food includes many diverse elements. Chemical, microbiological and physical hazards are the three types of hazards which contributed to the safety of food. They have long considered the most dangerous hazards to be those of microbiological origin, followed by those of naturally occurring toxins. However, pesticides and additives have been prominent subjects for the media, which may lead some people to focus on those hazards more than others.

Earlier research in risk perception has indicated that there were significant differences between expert and public perception of risks from a variety of hazards [9-11]. There is a wide gap between how scientists and risk experts think about, define and evaluate risks compared to the lay public. The experts have lamented that the public reactions to scientific risk assessments as ignorance and irrational but researchers have shown that the public understanding of risk is driven by factors not taken into account by the experts [12]. According to Sandman [13], the public generally pays too little attention to the hazardous nature of risks while experts usually completely ignore those factors which fuel consumer unrest or outrage. These are two very different starting

points and not surprisingly, experts and consumers often rank the relative importance of various risks very differently [13, 14]. Scientists, in general, define risks in the language and procedures of science itself. They consider the nature of the harm that may occur, the probability that it will occur, and the number of people who may be affected. Focus of risk analysis is on the assessment of health risks and limited effort has been done on assessment of the social-economic and ethical impact [15]. Most citizens, in contrast, seem less aware of the quantitative or probabilistic nature of a risk, and much more concerned with broader, qualitative attributes, such as whether the risk is voluntarily assumed, whether the risks and benefits are fairly distributed, whether the risk can be controlled by the individual, whether a risk is necessary and unavoidable or whether there are safer alternatives, whether the risk is familiar or exotic, whether the risk is natural or technological in origin, and so forth [13].

Slovic and colleagues have developed the psychometric paradigm which involved measuring the psychological basis of risk perceptions [14]. Previous research has successfully used the psychometric approach in the food domain [2, 16]. The psychometric approach suggests that lay people perceive risks multi-dimensionally. In other words, people do not rate risks on a single scale in their daily life. Some of the variables assessed include dread, catastrophic potential, controllability, equity and risk to future generations [17, 18]. 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 [2, 16]. Other studies of the psychometric nature have also examined another important dimension: perceived benefit and risks [19, 20]. 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 [18]. Risk acceptance is another important dimension suggested by Rohrmann [21]. In studies involving genetically modified food two additional dimensions have been used [22, 23]. They are moral acceptance and encouragement. Moral acceptance appeared to act as a 'veto' in the Europeans attitude towards modern biotechnology products[24]. If a biotechnology application is regarded as useful but morally unacceptable, it will not be encouraged. People also judge risk according to their trust in information sources [25] and their perception of its controlling agents: if these controlling agents have a track record of secrecy, or they dominate supposedly independent regulatory bodies and the public policy process, then people magnify the perceived risks [26, 27]. The objective of this study was to assess the level of awareness and food safety concerns amongst the Malaysian public.

Materials and Methods

Data was collected by means of a survey carried out between June 2004 and February 2005. The respondents were the general public (550 respondents) in the Klang Valley region, stratified according to their occupation classification by Malaysian Standard Classification of Occupations 1998 (MASCO) with slight modifications. The group comprised of skilled agricultural and fishery workers was not included as the population for this group was rather small in the Klang Valley region. An additional group, the unemployed, was included.

Instrument: The psychometric instrument for risk perception towards food safety issues was developed based on past studies and literature reviews [2, 21, 24]. Risk perception was measured using questionnaires with seven-point Likert scales. In this study awareness is defined as what the public know about food safety issues acquired by study, investigation, observation or experience. As for awareness, the concept used by Gaskell *et al.* [22] was followed where the respondents were asked whether they had heard of seven food safety issues. The standardized alpha coefficient for awareness was acceptable (0.65). Attentiveness to food quality and safety consisted of five items: self-rated knowledge on food safety, concern about food quality and nutritional value of foods, ability to choose good quality food, interest on new stories about food safety and frequency of reading label on food wrappings before buying. The standardized alpha coefficient for attentiveness to food safety variable was very good (0.83).

The multi-dimensional instrument measuring risk perception towards food safety issues used in this study was self constructed based on earlier researches [28]. The instrument incorporated six dimensions of risk perception: familiarity [2, 21, 29] perceived benefits[21, 24, 30], perceived risks [21, 24], regulatory needs [31], risk acceptance [21] and encouragement [22]. Familiarity ($\alpha = 0.75$) comprised of the average mean of the following four items: how easy is it for you to know or identify the following food/medicine, how easy is it for you to judge whether it is good or bad to consume/use the following food/medicine, the effect of consuming the following food or using the following medicine are well known and consumers are able to avoid consuming the following food or using the following medicine if they want to. 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 scale ($\alpha = 0.81$) comprised of five items: to what extent does the following application useful to society, the following application will enhance quality of food/medicine for the Malaysian society, the following application will enhance quality of life of the Malaysian society, the following application will enhance the Malaysian economy and the benefits of the following applications exceed their risks. Each item was measured on a 7-point scale, ranging from 1(not useful at all or item 1/ strongly disagree for the other items) to 7 (very useful for item 1/ strongly agree for the other items). A higher score indicates higher perceived benefit.

The measure for perceived risk ($\alpha = 0.80$) was obtained by using five items: how worried are you about consuming the following food or using the following medicine? How worried are you about potential risks of the following food/medicine to your health? any harmful effects from consuming/using the following food/medicine will only manifest itself after long-term duration, any danger from the following food/medicine could cause a major catastrophe to the Malaysian society and considering all possible harms and adverse effects that might occur from the following food/medicine, how harmful are they? Each item was measured on a 7-point scale, ranging from 1 (not worried at all for the first four items/ no harm at al. 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.

The measure for risk acceptance ($\alpha = 0.77$) comprised of three

items: we must be willing to accept some risk from the following food or medicine if it can boost the Malaysian economy, after considering the advantages and disadvantages of the following things, to what extent the Malaysian society should accept any possible risks associated with them? in comparison with other dangers in our everyday life, the risks from consuming/using the following food/medicine are minimal. 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. Regulatory needs (α = 0.77) comprised of two items: the need to be regulated and the need to be labeled. Each item was measured on a 7-point scale, ranging from 1 (not necessary at all) to 7 (very necessary). A higher score indicates higher need for regulation.

Encouragement (α = 0.86) was measured by four items: more intensive research should be encouraged to develop the following technology, the following applications should be scaled up/ commercialized, government should provide more financial support to researchers and industries in developing the following technology and how far should the following applications be 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.

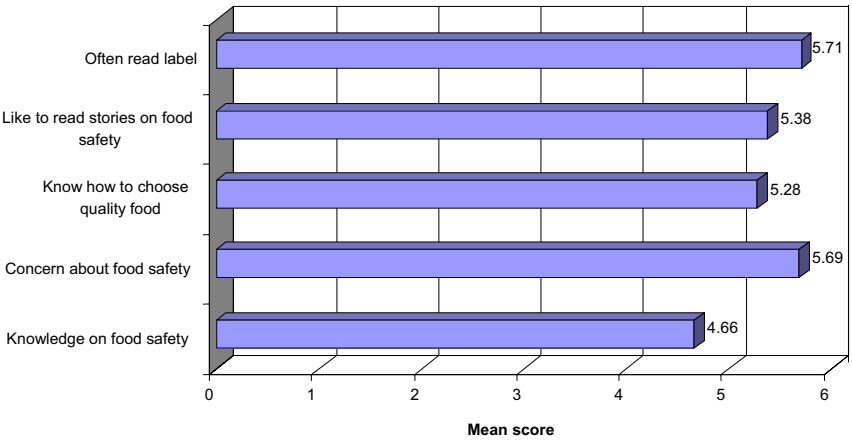

Figure 1. Attentiveness to food quality and safety.

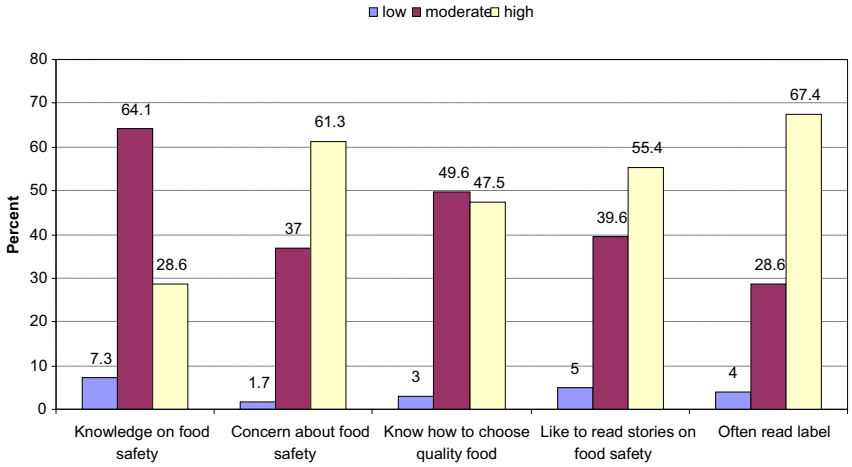

Figure 2. Percentage of respondents who are attentive to food quality and safety.

Results

Attentiveness to food quality and safety: The overall self-rated knowledge on food safety is classified as moderate [mean score 4.66 out of total mean score of 7.0 (Fig. 1). Majority of the respondents (64.1%) claimed to have moderate knowledge on food safety, another 28.6% confessed to know a lot while only 7.3% had low knowledge (Fig. 2). It is interesting to note that the highest percentage of respondents in the Klang Valley region were very attentive to food quality and food safety issues. From Fig. 2, it can be seen that 61.3% were highly concerned about food safety, 55.4% strongly agree that they like to read stories on food safety and 67.4% claimed to frequently read label on food wrappings before buying food. However, when asked whether they know how to choose quality food, the respondents were mostly divided into having high (47.5%) and moderate know how (49.6%).

Awareness on food safety: The respondents were asked whether they have heard about seven food safety issues before the survey. The issues asked were vegetables or fruits that contain pesticide residues, food preservatives were added to most processed food, food poisoning can occur after consuming Salmonella contaminated food, food containing gelatin from 'non-halal' animal sources, 'golden rice' which is high in Vitamin A content, genetically modified soybeans (resistant to herbicide) are already available in the Malaysian market and genetically modified crop resistant to diseases.

As can be seen from Fig. 3, the highest level of awareness is towards food preservatives (92.4%), followed closely by pesticide residue (86.3%) and thirdly by non-halal gelatin (58.1%). Less than half of the respondents seemed to have heard about Salmonella (42.4%) and the three genetically modified (GM) foods/ crops. Among the GM foods/crops, the respondents were more aware of disease resistant crops (41%) compared to golden rice (28.7%); and GM soybean (21.3%).

Familiarity: From Fig. 4, it can be seen that only two food safety issues, food preservatives and pesticide residues were perceived as familiar by the Malaysian public in the Klang Valley region (mean score above the mid-point value of 4.0). The remaining food safety issues were ranked as not familiar (mean score below the mid-point value of 4.0). Among the six issues, food preservatives were deemed as the most familiar to the respondents (mean score 4.6) followed by pesticide residues (mean score 4.28), non-halal gelatin (mean score 3.85), GM palm oil (mean score 3.63) and GM soybean (mean score 3.66) while the least familiar was Salmonella (mean score 3.47).

Perceived benefit: The mean scores for perceived benefit are shown in Fig. 5. Two technologies related to genetic engineering (GM palm oil and GM soybean) were perceived as moderately beneficial (with mean score above the mid-point value of 4.0). The remaining three technology applications (pesticide usage in agriculture, food preservatives, and GM palm oil while the use of

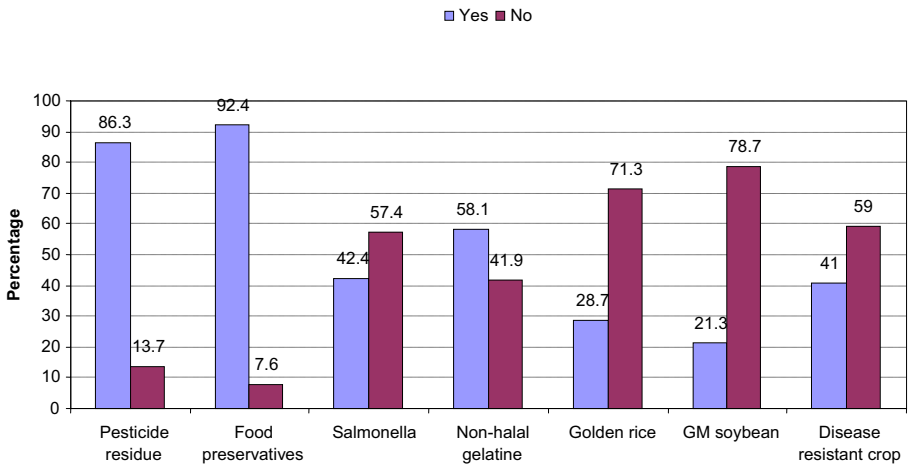

Figure 3. Awareness on food safety issues.

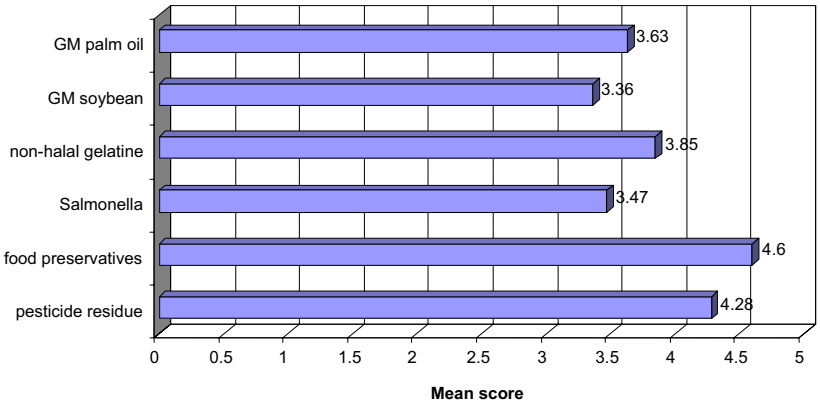

Figure 4. Familiarity of several food safety issues.

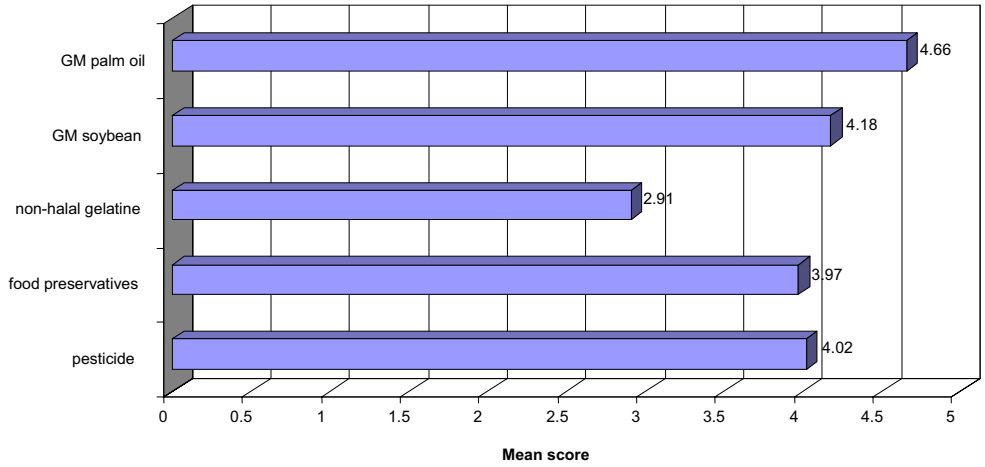

Figure 5. Perceived benefit.

non-halal gelatin in food) were rated as not beneficial (mean score below the mid-point value of 4.0). The questions related to perceived benefit did not cover Salmonella. Among the five food technology applications, GM palm oil was ranked as having the most benefit (mean score 4.66) followed by GM soybean (mean score 4.18), pesticide usage in agriculture (mean score 4.02), food preservatives (mean score 3.97) and lastly the use of non-halal gelatin in food (mean score 2.91).

Perceived risks: All six food safety issues were perceived as risky (mean score above the mid-point value of 4.0) (Fig. 6). Comparing the six food safety issues, pesticide residues were ranked as the highest risk (mean score 5.78) closely followed by Salmonella (mean score 5.73). The perceived risk of food preservatives was rated as third highest (mean score 5.48) followed by non-halal gelatin (mean score 5.45), GM soybean (mean score 4.77) and lastly GM palm oil (mean score 4.4).

Risk acceptance: The mean scores for risk acceptance are shown in Fig. 7. It can be seen that the risks associated with five of the food safety issues (pesticide residues, food preservatives, non-halal gelatin, Salmonella and GM soybean) were not acceptable to

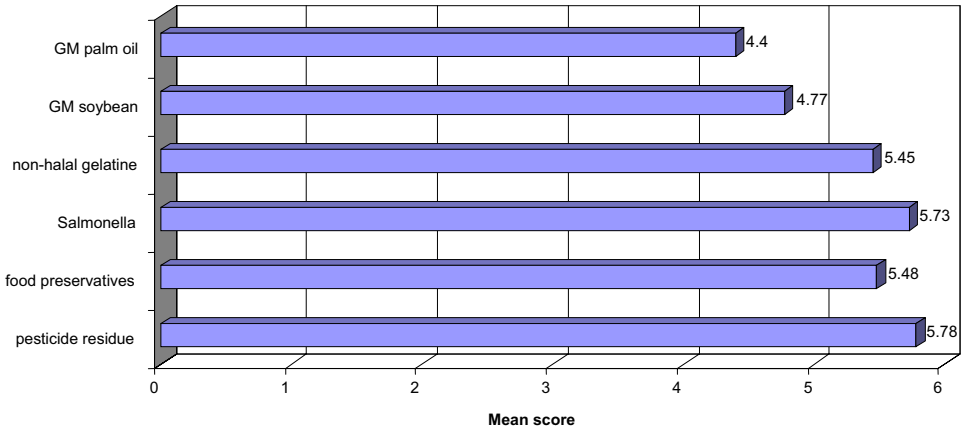

Figure 6. Perceived risk of several food safety issues.

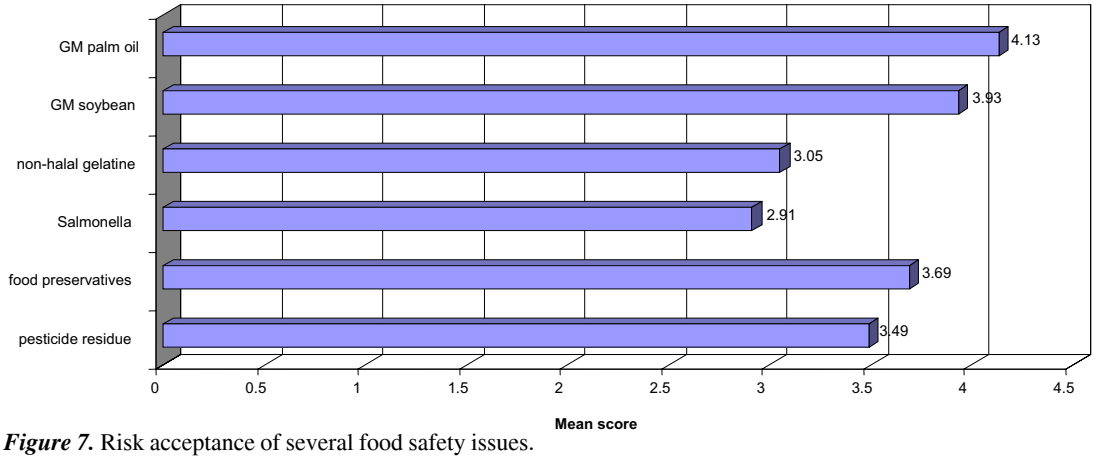

Figure 7. Risk acceptance of several food safety issues.

the Malaysian public in the Klang Valley region. Only the risk related GM palm oil was ranked as slightly acceptable (mean-score 4.13, slightly above the mid-point value of 4.0).

Regulatory needs: Regulatory needs refer to the need for regulation and labeling for the technology. All food safety issues were considered as needing high level of regulation by the Malaysian public in the Klang Valley region (mean score above 5.0, Fig. 9). The highest regulatory needs was for pesticide residue (mean score 6.32) followed by both food preservatives and non-halal gelatin (mean score 6.19), Salmonella (mean score 6.05), GM soybean (mean score 5.7) and GM palm oil (mean score 5.47). From Fig. 8, it can be seen that majority of the respondents rated all food safety issues as needing high level of regulation.

Encouragement: In this study, encouragement referred to whether more rigorous development of each application should be carried out, whether the application should be commercialized and should be given monetary support by the government and overall encouragement of each technology except Salmonella. The use of three technologies in food production (pesticide, food preservatives and non-halal gelatin) were not encouraged by the Malaysian stakeholders in the Klang Valley region. (mean score below the mid-point value of 4.0, Fig. 9). Only two food technologies, GM palm oil and GM soybean were moderately encouraged (mean score above the mid-point value of 4.0). The highest encouragement was for GM palm oil (mean score 4.87) followed by GM soybean (mean score 4.31), usage of pesticide in agriculture (mean score 3.77), food preservatives (mean score 3.74) and the least non-halal gelatin (mean score 3.0).

Sources of information: The respondents were asked which of the ten possible sources where they regularly obtained their information about food safety issues. Majority of respondents (84.5%) chose newspapers as their main source of information on food safety, followed by television and radio (72.2%), magazines and books (59.3%), family and friends 52.8%), pamphlets (44%), internet (38%), doctors (37%), scientists (12.3%), conferences (11.5%) and others (0.3%).

Awareness and confidence on food regulatory body: The respondents were asked whether they have heard about the Malaysian regulatory body on food safety.Of the respondents 60.5% claimed they have heard about the Malaysian regulatory body on food safety while the remaining 39.3% stated otherwise. The respondents who claimed they never heard about the Malaysian regulatory body on food safety were then asked three possible reasons why. Majority of those who were ignorant (80.4%), stated that the reason was because activities of food regulatory body rarely appeared in newspapers, television and radio. Only 12.9% claimed the reason was due to their being not interested in food safety issues while the remaining 6.7% mentioned other reasons.

The respondents who were aware about the food regulatory body in Malaysia were then asked to what extent that the food regulatory body has done a good job in ensuring food safety for

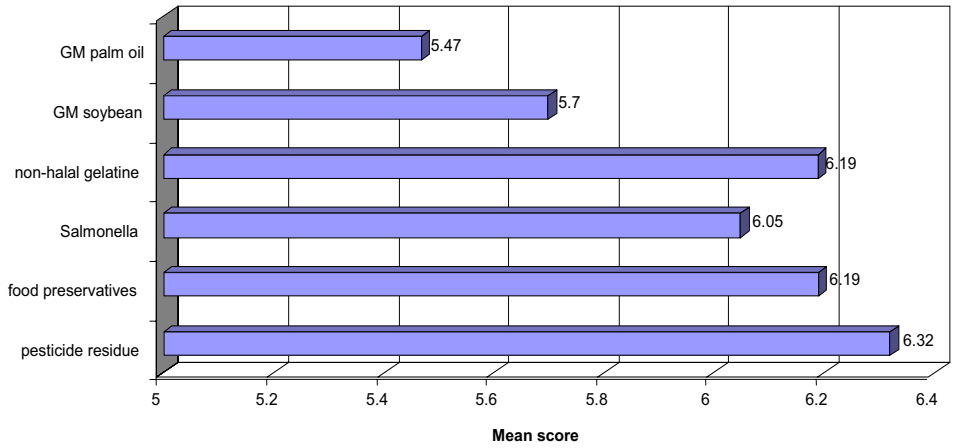

Figure 8. Regulatory needs.

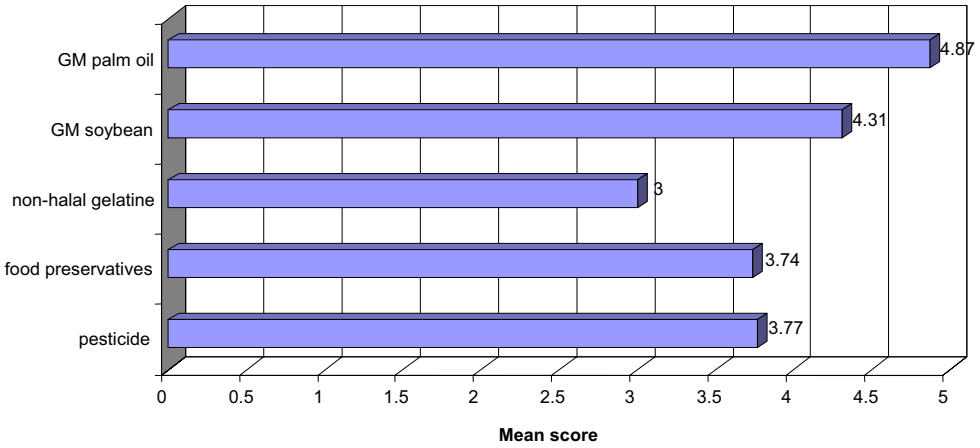

Figure 9. Encouragement.

the Malaysian public. Majority of the respondents who have heard about the food regulatory body (72.9%) have moderate confidence on the body while another 22.3% have high confidence and the remaining 4.8% claimed to have low confidence. The overall mean score for confidence on the Malaysian food regulatory body was also moderate (4.61).

Discussion

It is enlightening to note that majority of the Malaysian public in the Klang Valley region were highly concerned about food quality and food safety issues. This should be seen as a positive input to risk communications. However, they only claimed to have moderate knowledge on food safety and divided on how to choose quality food. Only two food safety issues (pesticides and food preservatives) were perceived as moderately familiar with the remaining four food safety issues ranked as not familiar by the respondents. These findings called for more effort by relevant bodies to disseminate more information on the food safety issues to the public.

When come to the risk aspects, the Malaysian public was not very compromising. They acknowledge that all food safety issues surveyed as risky and the risks associated with majority of them were not acceptable even though they might have advantages and can help to boost the Malaysian economy. According to Verbeke *et al.* [11], consumers tend to worry most about risks caused by external factors over which they have little or no control. Four food safety issues, pesticide residues, Salmonella, food preservatives and non-halal gelatin were perceived as having high risks by the Malaysian public in the Klang Valley. Verbeke *et al.* [11] quoted that emerging food-processing technologies or food-borne illnesses caused by chemical contamination are perceived as having high risks. Saba and Messina [32] indicated the lowest positive ratings on perception of risks associated with pesticides. The Europeans also worry most about food adulteration, in particular from pesticides (2.9 out of total mean score of 4.0) followed by additives (2.8), genetic modification (2.8) and bacteria (2.8) [33].

In this study, if the food safety issues involved sensitive issues such as non-halal gelatin the risk was also perceived as high. The issue of gelatin from non-halal sources is a sensitive and important issue to the respondents who are of Muslim majority. The risk related to GM palm oil was slightly acceptable to them compared to the others most likely due to GM palm oil (modified to reduce the saturated fat content) was seen as having direct benefits to them. GM palm oil was also the most encouraged in this study. When a product was deemed as having direct benefits to the consumers, the product will be seen as less risky, the risk will be more acceptable and it will be more encouraged. This balancing relationship between perceived benefit, risk and encouragement has been described by Amin *et al.* [34].

The respondents also felt that all food safety issues need to be highly regulated and labeled. The public expression of the

necessity for food labeling should be heeded by the food regulatory body and industries. Although the main function of labels is to provide information, labeling may also function as an indication of product safety [30]. Although some consumers may use the labeling to avoid biotechnology products, others may perceive the explicit labeling as a sign of the manufacturers' confidence in a product's safety. Wansink and Kim [30] highlighted the importance of providing consumers a sense of control over their choices. The level of confidence towards Malaysian regulatory body related to food safety among the respondents who were aware about its existence was moderate. So it is recommended that the related government regulatory body in Malaysia to be more visible and responsible in governing food safety issues such devising more effective risk communication programmes to increase the public confidence.

Conclusions

From the results of this study, it can be concluded that the Malaysian public in the Klang Valley region were rational and sophisticated. They were able to recognize both the benefits and risks associated with food safety issues surveyed. It is interesting to note that if the technologies were seen as beneficial even though there were some risks associated with them, the risks were more acceptable and they did not totally reject the technology. However, if the food safety issues involved sensitive issues such as non-halal gelatin whereby the benefit was deemed low, the risk high, the acceptance of risk was also low, translating into it being the least encouraged. The issue of gelatin from non-halal sources is a sensitive and important issue to the respondents who are of Muslim majority. This issue should be taken seriously by the food manufacturers and the regulatory bodies.

Results of this study have confirmed that the public perceived and assessed risk differently from the scientists. Lay people assess food risks as a complex and sensitive expressions of their value system as well as multi-dimensional. This must be understood by food industries and government regulatory bodies in order to devise suitable communication strategies and to assess the acceptance of food-related technologies in Malaysia.

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