International Food Research Journal 28(6): 1204 - 1215 (December 2021)
Journal homepage: *http://www.ifrj.upm.edu.my*

Reliability and validity of knowledge, attitude, practice, and perception (KAP2) questionnaire on food poisoning and its prevention among consumers in Bangi and Kajang, Selangor, Malaysia

[1,4]Mamot, M., [1]Mohamed, N. A., [1]Mohd Rani, M. D., [2]Osman, M., [3]Mohd Zulkefli, N. A., [2]Sekawi, Z. and [2]*Awang Hamat, R.

[1]*Department of Primer Healthcare/Department of Medical Sciences, Faculty of Medicine and Health Sciences, Universiti Sains Islam Malaysia, Pandan Indah, 55100 Kuala Lumpur, Malaysia*
[2]*Department of Medical Microbiology and Parasitology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia*
[3]*Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia*
[4]*Institute of Medical Science Technology, Universiti Kuala Lumpur, A1-1, Jalan TKS 1, Kajang Sentral, 43000 Kajang, Selangor, Malaysia*

Article history

Received: 6 August 2020
Received in revised form: 2 November 2020
Accepted: 14 May 2021

Keywords

food poisoning questionnaire, validity, reliability, item analysis, difficulty index, discrimination index

Abstract

Most food poisoning outbreaks are caused by consumers' poor knowledge, attitude, perception, and behaviour in relation to food safety. A valid and reliable tool is thus needed to measure these factors among the consumers. A total of 79 respondents participated in this pilot survey using convenient sampling, and participants self-completed the questionnaire given. Item analysis was conducted to determine the difficulty and discrimination indices of 40 items involved in knowledge construction. Construct validity and reliability were performed on 33 items which measured attitudes, preventive practices, and perceptions. Item analysis showed that more than 80% of respondents answered 19 items correctly. The discrimination index revealed that 16 items scored below 0.20. The Average Variance Extraction for all latent constructs, namely attitude, practice, and perception met acceptable threshold values of 0.527, 0.517, and 0.535, respectively. The Fornell-Larcker criterion suggested that three latent constructs were acceptable for discriminant validity. The internal consistency and reliability for all scaled items in each construct were good, with Cronbach's alpha values of more than 0.7 (0.820, 0.809, and 0.799 for attitude, practice, and perception, respectively). In conclusion, the present work indicated that the knowledge, attitude, practice, and perception (KAP^2) questionnaire used could be a valid and reliable measure to evaluate consumer's knowledge, attitude, preventive practice, and perception on food poisoning.

Introduction

Food poisoning is a major cause of public concern, and it is estimated that there are 420,000 deaths worldwide every year (WHO, 2020). In May 2020, 99 cases of food poisoning with one death were reported in Malaysia due to the consumption of *puding buih* by consumers (MOH, 2020). Food poisoning is the most prevalent cause of gastrointestinal illnesses in Malaysia. It remains a significant morbidity among foodborne and waterborne diseases with 15,023 cases, and mortality rate of 0.02 was reported in 2018 (MOH, 2019). The risk of contracting food poisoning is much higher from food bought outside the home (Soon *et al.,* 2011; Zarina and Faisal, 2012; Wahida *et al.,* 2017). This is due to improper handling of raw food during food preparation, which can transmit foodborne pathogens from food handler to the food (EFSA, 2014).

Rapid urbanisation has led to changes in lifestyle, with eating out becoming a trend (Zarina and Faisal, 2012). The flourishing of food premises, especially 24-h food outlets, can expose consumers to cross-contamination and food served at incorrect temperature (Sharifa-Ezat *et al.,* 2013). In addition, consumers' selection of food premises when they prioritise lower prices over cleanliness may put them at risk of food poisoning (Abdul Mutalib *et al.,* 2015). Individuals' behaviour relating to the avoidance of food poisoning is linked to several psychosocial factors. For instance, Byrd-Bredbenner *et al.* (2008) and Mullan *et al.* (2015) outlined several significant

*Corresponding author.
Email: rukman@upm.edu.my

DOI: https://doi.org/10.47836/ifrj.28.6.12

predictors of behaviour related to avoiding unsafe food consumption, including self-efficacy, individuals' continuum of behavioural change, gender and ethnicity, and their safe food-handling habits. Based on this premise, WHO regards consumers as the final link in the food chain necessary to ensure the safety of food being consumed and to avoid food poisoning (Milton and Mullan, 2010). Therefore, a well-designed program to prevent food poisoning should take into consideration the consumers' psychosocial factors if the program is to be successful (Young *et al.,* 2015).

In addition to consumers' psychosocial factors in relation to avoiding food poisoning, their knowledge, attitude, and practice (KAP) are also known to play an important role in shaping their behaviour (Odeyemi *et al.,* 2019; Sharif and Al-Maliki, 2010). Some KAP surveys have been conducted in Malaysia, but they are mainly among food handlers (Abdullah Sani and Siow, 2014; Abdul Mutalib *et al.,* 2015; Lee *et al.,* 2017). We have found three studies that assessed food poisoning knowledge among consumers in Malaysia. Ruby *et al.* (2019) ascertained consumers' food safety knowledge within the household environment, while Odeyemi *et al.* (2019) conducted an online KAP survey on food safety among 188 Malaysian consumers. Joshi *et al.* (2015) highlighted that an appropriate response scale was crucial in assessing the components of attitude, practice, and perception. However, this was not reflected in Odeyemi *et al.* (2019), of which the study used 'frequently; sometimes; never' responses to assess attitude and 'correct; wrong; do not know' responses to assess practice. Lim *et al.* (2016) conducted a self-reported survey among consumers in Bum Bum Island, Semporna, Sabah, Malaysia on household food safety knowledge, attitude, and behaviour. To the best of our knowledge, no studies have investigated the preventive behaviour relating to the buying of outside food and consumers' perception on food poisoning prevention. To address this gap, we constructed a KAP[2] questionnaire on food poisoning and its prevention, and conducted a pilot study among consumers with the following objectives: (i) to identify the difficulty index of items in knowledge construct, (ii) to determine the validity of latent constructs (attitude, preventive practice, and perception), and (iii) to measure the reliability of the scaled items in the latent constructs (attitude, preventive practice, and perception).

Materials and methods

Participants and setting

We recruited consumers around Bangi and Kajang districts using a convenient sampling. These two districts were chosen due to the high number of food premises as compared to nearby areas. A total of 1,194 ready-made food premises were registered in 2009, and the number of applications for the new ones kept increasing each year (Mohd Azlan and Noraziah, 2011; MPKj, 2015). In addition, its strategic location that is compounded by higher learning institutions and industries contributes to the increased number of food premises around these areas (MPKj, 2015). Therefore, Bangi and Kajang are well-known as gastronomic centres with vast food selection, from eastern and western Malaysia, as well as Chinese and Arabic cuisines (Noor Alyani *et al.,* 2016). Respondents recruited were Malaysians who bought outside food at least one to three times per month (Chin and Nasir, 2009). Other eligibility criteria were (i) age 18 and above, and (ii) understand Malay or English language. Respondents were approached in offices and shopping centres during break hours (12:30 to 2:00 pm). The data collection was conducted over a period of one month (June to July 2019).

Sample size

Both Kajang and Bangi are inhabited by nearly half a million population (MPKj, 2015). According to Memon *et al.* (2017), 30 or more respondents were sufficient for a pilot study with the objective to validate a research instrument.

Research instrument

We constructed a questionnaire that comprised questions relating to sociodemographic factors, knowledge, attitude, practice, and perception on food poisoning and its prevention, which were based on previous studies (Haapala and Probart, 2004; Ng *et al.,* 2009; Nik Rosmawati *et al.,* 2015; Hanson *et al.,* 2015; Lim *et al.,* 2016; Low *et al.,* 2016; Zahiruddin *et al.,* 2018; Gupta *et al.,* 2018). The original questionnaire was written in English and translated to Malay using Brislin's back translation method, by two external translators who were experts in linguistics and the subject matter (WHO, 2019).

Food poisoning knowledge was assessed in relation to different components, including aetiologic agents of food poisoning, high-risk foods, signs and symptoms, complications, detection of spoiled food, and food poisoning prevention practices (Nik Rosmawati *et al.,* 2015; Lim *et al.,* 2016). The questions allowed responses in the form of "Yes," "No," or "Unsure." A mark of "1" was given to a correct answer, and a mark of "0" for an incorrect or

an "Unsure" response. Respondents' attitude was assessed with respect to food poisoning prevention, treatment, and risk-related behaviours using a five-point Likert scale ("strongly disagree" to "strongly agree"), adapted from Zahiruddin *et al.* (2018). Consumer's preventive practice items were modified from previous studies (Low *et al.,* 2016; Odeyemi *et al.,* 2019). Responses were rated as a frequency of "never," "sometimes," or "always".

Risk perception was ascertained using Health Belief Model constructs. Only four constructs were included as suggested in previous studies, namely perceived barriers, benefits, severity, and susceptibility (Schafer *et al.,* 1993; Milton and Mullan, 2010; Hanson *et al.,* 2015). Items were adapted and modified from several studies by Ng *et al.* (2009), Haapala and Probart (2004), Hanson et al. (2015), and Gupta *et al.* (2018). All items were ascertained using a five-point Likert scale, from "strongly disagree" to "strongly agree".

Instrument content and face validity

In addition, to ensure the constructs' validity, each construct in the questionnaire was validated by experts in the fields of epidemiology, community health, and food safety. The questionnaire was scrutinised based on whether (i) the questionnaire represents the theoretical framework used, (ii) items are adequately fit for the construct they are intended to assess, or (iii) items sufficiently cover the main study objectives. Feedback was recorded on a five-point rating checklist.

The questionnaire was pre-tested on 20 respondents to ensure wording consistency. Some words were rephrased into lay terms (*e.g.,* "pesticide residue", "cross-contamination"), and one item was added to the practice construct ("I smell the food before buying it"). The revised items were pre-tested again on the same respondents to ensure their understanding on the revised wording. Respondents involved in the pre-test were not included in the pilot test.

Study administration

Potential participants were approached, and the researchers introduced themselves. They were briefed about the purpose of the pilot study, and those who agreed to participate gave written consent prior to completing the questionnaire. The questionnaire was self-completed but was assisted by researchers or enumerators (if necessary) to clarify items and to ensure all items in the questionnaire were completely answered. Figure 1 shows the flow chart of the pilot study.

Statistical analysis

The data were analysed using SPSS version 21.0 for Windows (SPSS, Chicago) and SmartPLS version 3.2. Descriptive analyses were used to summarise the sociodemographic profiles, and data presented as means (SD) for numerical and normally distributed data, or frequency and percentage (%) for categorical data.

We employed item analysis to assess the difficulty of the knowledge sections by determining

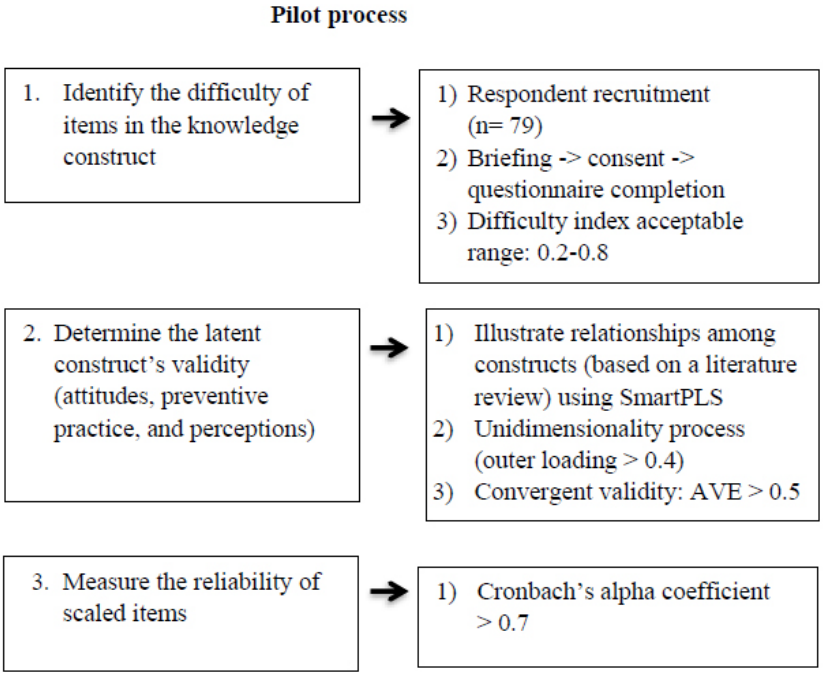

Figure 1. Flow chart of the pilot study.

two important indicators, namely, the difficulty and discrimination indices. This could assist the researchers to identify items that work well and those that should be deleted or improved (Karelia *et al.,* 2013). The difficulty index of an item was determined from the proportion of respondents that selected the correct answer out of the total number of respondents (Hotiu, 2006; Nik Rosmawati *et al.,* 2015). Several cut-off values were reported for the difficulty index. According to Karelia *et al.* (2013), an item is considered difficult, acceptable, or easy if the difficulty index value is less than 30%, 30 - 70%, or more than 70%, respectively. Nevertheless, our pilot study used a difficulty index target ranging between 20 and 80% (Ahmad Fuad, 2010).

The discrimination index identifies how well an instrument differentiates between high and low scorers (Hotiu, 2006). Each item in the knowledge construct is required to be calculated for its discrimination index (Nik Rosmawati *et al.,* 2015). In calculating the discrimination index, a correct response to an item was awarded a mark of "1," while responses that were incorrect or given as "unsure" were given a mark of "0." All responses were summed up for total scores to calculate the discrimination index. The respondents were ranked based on these total scores, from the highest to the lowest. The top 27% was classified as the upper group (U), and the bottom 27% was regarded as the lower group (L). The discrimination index for items for knowledge construct is defined by the proportion of the respondents in the upper group who answered it correctly minus the proportion of respondents in the lower group who answered it correctly, divided by 27% of the total number of respondents who attempted the question (Ahmad Fuad, 2010). The interpretation of the discrimination index value can vary. Karelia *et al.* (2013) proposed that items with a discrimination index of more than 0.35 be considered excellent, between 0.25 and 0.35 be considered good, between 0.20 and 0.24 be considered acceptable, and below 0.20 be considered poor. Conversely, Ahmad Fuad (2010) stated that a discrimination index with a negative value up to 0.19 should be regarded as poor, and that the question should be revised. When selecting an item, both discrimination and difficulty indices should be considered. Ahmad Fuad (2010) suggested that those items with a good discrimination index (> 0.19) and moderate difficulty index (0.2 - 0.8) were acceptable, and can be retained in a questionnaire. However, deleted items can be re-included, if the item is considered very important and related to the undertaken studies (Nik Rosmawati *et al.,* 2015).

To assess the constructs' validity for latent items in attitude, perception, and preventive practice, convergent and discriminant validity were employed using SmartPLS 3.2 software. SmartPLS 3.2 software allows relationships between latent constructs to be analysed without requiring a large sample size (Hair and Hult, 2014). Convergent validity is defined as a measure or an item that correlates positively with alternative measures of the same construct (Hair and Hult, 2014). To determine convergent validity, we had to consider outer loadings of the items and Average Variance Extraction (AVE). High outer loadings of a construct indicate that the associated indicators have much in common and can be captured by the construct (Hair and Hult, 2014). Generally, indicators with an outer loading between 0.4 and 0.7 should be considered for removal, only when deleting the item leads to an increase in composite reliability (Hair and Hult, 2014). Items with an outer loading of less than 0.4 should always be considered for deletion (Hair and Hult, 2014). Deletion of items should be carried out for one item at a time, with the item with the lowest loading deleted first. The process should continue until unidimensionality is achieved (Awang *et al.,* 2010; Wan Mohamad Asyraf, 2013). Unidimensionality in convergent validity refers to a set of items in a construct that measures only one thing in common (Awang *et al.,* 2010). On average, an AVE value of 0.5 or more indicates that the construct explains more than half of the variance of its item. Hence, an AVE value > 0.5 was used for the threshold value. On the other hand, discriminant validity is the extent to which a construct is truly distinct from other constructs. Hair and Hult (2014) suggested two indicators for discriminant validity, namely, cross loadings of the indicator, and the Fornell-Larcker criterion. Wan Mohamad Asyraf (2013) explained that the discriminant value is obtained from the square root of the AVE value. This value defines how much variance in the items which can explain the variance in the construct (Wan Mohamad Asyraf, 2010). The internal consistency of each item was measured using Cronbach's alpha, and items with an alpha-coefficient ≥ 0.7 were considered to be acceptable (Nik Rosmawati *et al.,* 2015).

Ethical approval

The ethical approval to conduct this pilot study was obtained from the Research Ethics Committee of the Islamic Science University of Malaysia (approval no.: USIM/JKEP/2019-61).

Results

Respondent characteristics

A total of 79 respondents were successfully recruited to this pilot study. Table 1 shows the sociodemographic characteristics of the respondents. The mean age of the respondents was 30.63 ± 9.07 years. More than half of the respondents were female, and the majority of respondents were of Malay ethnicity. Just over half (53.2%) of the respondents were single, while 43% were married. More than half of the respondents received tertiary education. There were 40.5% of respondents working in the private sector, while 35.4% were unemployed (housewives or students).

Knowledge on food poisoning

Respondents were assessed for their knowledge on food poisoning, which involved six components: aetiologic agents, high-risk foods, signs and symptoms, complications, detection of spoiled food, and prevention practices. Table 2 shows the difficulty index and discrimination index for each item in the knowledge construct. Out of 40 items tested, 19 were answered correctly by more than 80% of respondents, thus reflecting that these questions were easy and correctly constructed for the respondents. Other items achieved more than 0.20 difficulty index which was considered acceptable.

The discrimination index revealed that 13 items were below the cut-off discrimination value (0.19). Therefore, the wording of four items were revised for better clarity which included 'respiratory failure', 'liver failure', 'dried food' and 'canned food that is not dented or not opened'. The remaining nine items were retained due to their importance in food poisoning prevention according to the experts.

Construct validity for food poisoning preventive practices, attitude, and perception

The number of preliminary items in preventive practices, attitude, and perception constructs were 13, 15, and 15 respectively. The unidimensionality process suggested that few items were deleted due to their minimal contribution to a construct (outer loading < 0.4). In this case, seven items from preventive practice, nine items from attitude, and eight items from perception were deleted. Subsequently, convergent analysis was performed on the selected items, and an AVE value of > 0.5 was considered acceptable. Convergent analysis enables researcher to identify items that positively correlates with other items in the same construct. Table 3 shows the AVE values for attitude,

Table 1. Consumers' sociodemographic profile (n = 79).

Attribute		**Mean (S.D)**	
Age		30.63 (9.07)	
		n	**(%)**
Sex	Male	34	43
	Female	45	57
Ethnicity	Malay	71	89.9
	Chinese	1	1.3
	Indian	3	3.8
	Others	4	5.1
Marital status	Single	42	53.2
	Married	34	43
	Separated/widowed	3	3.8
Education level	Informal	3	3.8
	Secondary	15	19
	Cert/STPM/Foundation	16	20.3
	Tertiary	45	57
Job sector	Self-employed	6	7.6
	Government	13	16.5
	Private	32	40.5
	Unemployed	28	35.4

Descriptive tests were used for the analysis. Data are presented as n (%).

preventive practices, and perception which were 0.527, 0.517, and 0.535, respectively.

The Fornell-Larcker criterion described that related items were able to explain more than 0.7 variance for each specific construct (Table 4). Fornell-Larcker criterion was used in order to confirm discriminant validity. Table 4 shows that the diagonal value in bold is higher than its row and column, and as such, confirmed the discriminant validity (Wan Mohamad Asyraf, 2013).

Table 2. Item analysis for food poisoning knowledge among consumers.

Item no	Item	Difficulty index	Discrimination index	Action
Food poisoning aetiology				
1a	Bacterium	0.97	0.10	Included
1b	Virus	0.53	0.67	Included
1c	Parasite	0.57	0.62	Included
1d	Pesticide residue	0.62	0.67	Included
High-risk food				
2a	Poultry	0.85	0.38	Included
2b	Meat	0.81	0.38	Included
2c	Bread	0.48	0.66	Included
2d	Dried food	0.52	-0.24	Revised wording
2e	Dairy product	0.43	0.86	Included
2f	Seafood	0.75	0.76	Included
2g	Rice	0.52	0.62	Included
2h	Canned food that is not dented or not opened	0.52	-0.05	Revised wording
2i	Vegetable	0.39	0.71	Included
2j	Fruit	0.33	0.62	Included
Food poisoning sign and symptom				
3a	Diarrhoea	0.99	0.05	Included
3b	Vomiting	0.95	0.19	Included
3c	Abdominal pain	0.96	0.14	Included
3d	Dryness of lips	0.46	0.57	Included
3e	Lethargy	0.82	0.48	Included
3f	Yellow eyes (jaundice)	0.24	0.62	Included
3g	Fever	0.53	0.57	Included
3h	Bloody stool	0.44	0.76	Included
3i	Muscle pain	0.33	0.71	Included
Food poisoning complication				
4a	Death	0.73	0.52	Included
4b	Kidney failure	0.41	0.52	Included
4c	Liver failure	0.33	-0.14	Revised wording
4d	Dehydration	0.84	0.38	Included
4e	Respiratory failure	0.30	0.00	Revised wording
Spoiled food detection				
5a	Physical change of food	0.96	0.14	Included
5b	Foul smell of food	0.97	0.10	Included
5c	Taste change of food	0.97	0.10	Included
Food poisoning prevention				
6a	Ensure food is thoroughly cooked	0.94	0.24	Included
6b	Use same cloth to wipe countertop and plate	0.89	0.19	Included
6c	Use same chopping board to cut different raw foods	0.84	0.33	Included
6d	Wash eggs before cooking	0.91	0.24	Included
6e	Wash hands with soap each time after using toilet	0.94	0.24	Included

6f	Wash hand using liquid soap	0.84	0.24	Included
6g	Eat cooked food that is kept at room temperature for 12–24 h	0.77	0.19	Included
6h	Keep raw food separated from cooked food	0.92	0.14	Included
6i	Avoid pest (rodents, cockroaches, and flies) harbourage in food premises	0.97	0.05	Included
6j	Practice good personal hygiene	0.96	0.14	Included

Difficulty index was accepted at ≥ 0.20, while discrimination index was accepted at > 0.19.

Table 3. Factor loading, AVE value, and Cronbach's alpha for each item.

Item	Statement	Construct	Outer loading[a]	AVE value[b]	Cronbach's alpha[c]
Att3	I will choose food premises at which the food handlers wear glove while handling food	Attitude	0.611	0.527	0.820
Att5	I will not buy food from food handlers whose nails are not trimmed		0.610		
Att8	I will ensure the premises' hygiene grade when choosing a food premises		0.857		
Att9	I will not purchase cooked food that is left at room temperature for a long period		0.739		
Att10	I will ensure the food premises that I visited is clean		0.793		
Att15	I need to see the doctor if I exhibit food poisoning symptoms		0.712		
Prac2	I will use liquid soap over bar soap when washing my hands	Preventive practice	0.761	0.517	0.809
Prac4	I reject food premises that harbours pests		0.882		
Prac5	I reject food premises at which the food handlers smoke during food handling		0.700		
Prac6	I choose clean food premises		0.680		
Prac11	I will not choose food premises at which the food handlers do not wear glove while handling food		0.615		
Prac13	I will smell the food in order to ensure the food is not spoiled		0.644		
Percept 9	My risk of getting food poisoning is very small because my food is prepared by hygienic food handler	Perceived susceptibility	0.4000	0.535	[d]
Percept 10	Food poisoning can be life-threatening	Perceived severity	0.833		0.840
Percept 11	I think unsafe food can make people really sick		0.890		
Percept 12	I believe proper food handling reduces risk of food poisoning	Perceived benefit	0.867		0.758
Percept 13	I believe that clean food premise can attract more consumers		0.889		
Percept 14	I think that safe-to-consume food is usually sold at reasonable price		0.616		
Percept 15	I believe that safe-to-consume food is easy to obtain		0.425		

[a]Outer factor loading was accepted at ≥ 0.4; [b]Average Variance Extraction (AVE) was accepted at > 0.5; [c]Cronbach's alpha was accepted at > 0.7; and [d]Cronbach's alpha could not be performed due to it being a single item.

Table 4. Discriminant validity for each latent construct.

Construct	Attitude	Preventive practice	Perception
Attitude	**0.726**		
Preventive practice	0.332	**0.719**	
Perception	0.108	0.409	**0.731**

Discussion

We recruited the respondents based on selection criteria which included being Malaysian, aged 18 years and above, and buying outside food at least one to three times per month. Previous findings on the frequency of eating out among Malaysians in Pahang revealed that at least 41.3% of respondents reported having an outside meal one time to three times per month, with the remaining 46% buying outside food more than once a week (Chin and Nasir, 2009). Most respondents in our pilot study who bought outside food were single and had received tertiary education. This was similar to Farzana *et al.* (2011) who reported that majority of their respondents who consumed outside food were unmarried. In addition, previous studies among respondents who bought outside food were more prevalent among 25 - 30 age group and those who are working (Anwar and Nagarathanam, 2013; Noor Alyani *et al.,* 2016). Anwar and Nagarathanam (2013) highlighted several factors which affected individual's choice of buying outside food, namely income, age, and type of food premises. In addition, few studies revealed that the intention of consumers buying outside food is not influenced by hygienic or environmental risks (Yoon and Chung, 2017), but more towards sensory perceptions and restaurant environment (Li *et al.,* 2019). With this respect, consumers should be regarded as the final gatekeeper to ensure the safety of the food consumed. This is because 50% of food poisoning reported among consumers who bought outside food is from food malpractice (Soon *et al.,* 2011; EFSA, 2014).

Prior to the pilot study, we constructed a questionnaire on knowledge, attitude, preventive practices, and perception on food poisoning and its prevention based on previous research (Haapala and Probart, 2004; Ng *et al.,* 2009; Nik Rosmawati *et al.,* 2015; Hanson *et al.,* 2015; Lim *et al.,* 2016; Low *et al.,* 2016; Zahiruddin *et al.,* 2018; Gupta *et al.,* 2018). This questionnaire was constructed to measure consumers' knowledge on food poisoning and their practices, attitude, and perception towards food poisoning prevention. The content validity of the questionnaire was reviewed and commented on by experts in the field, and their recommendations for improvement were taken into consideration. The draft questionnaire was pre-tested among 20 respondents in Kajang to ensure wording consistencies and comprehension. Two words were rephrased from the pre-testing phase: "pesticide residue" and "cross-contamination."

In line with Veiros *et al.* (2009), we conducted a pilot study in order to evaluate the research instrument to verify its ease of application and the adequacy of the terms, and to facilitate comprehension of the items. The item difficulty index in the knowledge construct had good quality items, with 19 items considered very easy (difficulty index > 0.8). Our findings were quite similar to those of Nik Rosmawati *et al.* (2015), in which 12 items in their food knowledge section were considered easy.

However, the discrimination index showed that 13 items failed to distinguish between respondents who had high scores with that of low scores for specific item. In computing discrimination index, each respondent's scores were ranked by segregation of 27% top scorers (upper group) and 27% bottom scorers (lower group) (Ahmad Fuad, 2010; Bichi, 2015). Next, the difference between the proportion of correct responses from upper group and lower group for the specific item was calculated. According to Bichi (2015), positive discrimination index indicates that high proportion of upper group answers the item correctly, whilst negative index indicates larger proportion from lower group answers the item correctly. Our result showed three items with negative discrimination index. These were items 2d, 2h, and 4c on 'dried foods', 'canned food that is not dented or not opened' and 'liver failure'. Considering both discrimination (> 0.19) and difficulty (0.2 - 0.8) indices, we revised the wording of these items including 'respiratory failure' (item 4e), and re-introduced them in the questionnaire. Based on the discussion among experts, we decided to include the other nine remaining items after considering their importance and relatedness to food poisoning, such as aetiologic agents, signs and symptoms and its preventive measures (Nik Rosmawati *et al.,* 2015). For example, items 3a and 3c on 'diarrhoea' and 'abdominal pain', respectively, are very crucial for respondents to correctly identify the signs and symptoms of food poisoning. Soon

et al. (2011) argued that there were substantial under-reported food poisoning cases due to misinterpreting diarrhoea as a transient convenience rather than a symptom of food poisoning. This subsequently led to poor treatment seeking at the hospital or clinic (Wahida *et al.,* 2017). With this respect, acquiring a good knowledge on food poisoning signs and symptoms will empower the consumer to be more involved in their self-health care and to seek prompt medical attention for appropriate treatment.

In addition, items 5a to 5c in 'spoiled food detection' are important for the respondents to assess the nature of food spoilage by smelling, observing, and tasting. Similarly, for items 6h to 6j in 'food poisoning prevention', these items were considered important for the respondents to distinguish the occurrence of cross-contamination during food handling, the harbourage of pests in food premises that can lead to food contamination, as well as good personal hygiene in preventing the occurrence of food poisoning (Young *et al.,* 2015).

We also assessed the construct validity. Construct validity is defined as the appropriateness of items in a construct that represent the related measure in the undertaken study (Hair and Hult, 2014; Nik Rosmawati *et al.,* 2015). Although some previous studies suggested factor analysis as an appropriate approach for assessing construct validity, our pilot study employed convergent and discriminant validity, using SmartPLS 3.2 software. This software is a powerful tool when used with a small sample size and compared with other approaches to SEM analysis (Memon *et al.,* 2017). Our sample size (n = 79) was considered sufficient to perform SmartPLS to give a statistical power of 80% (Hair and Hult, 2014).

The latent items in the questionnaire were further examined for unidimensionality. Unidimensionality refers to the existence of a single construct underlying a set of measures or items (Hair and Hult, 2014). Findings from the unidimensionality test suggested that some items from each latent construct of attitude, preventive practices, and perception should be deleted due to their lower contribution to the specific construct (outer loading < 0.4). The AVE of the final items showed acceptability at AVE > 0.5, in line with the findings of Wan Mohamad Asyraf (2013). The AVE value obtained suggested that the construct explained more than half of the variance of its item. The discriminant validity performed using the Fornell-Larcker criterion proposed that all items in the specified construct were unrelated. Hence, we could conclude that the items in the construct following unidimensionality were valid.

Findings from the present work suggested that knowledge, attitude, practice, and perceptions (KAP^2) on food poisoning and its prevention questionnaire was valid and reliable. The reliability analysis demonstrated that all items in the three latent constructs obtained high internal consistency for each construct, with Cronbach's alpha coefficient being more than 0.7. Our findings are consistent with those of Nik Rosmawati *et al.*'s (2015), with all items in a food safety practice questionnaire achieving satisfactory criteria for internal consistency, and that a Cronbach's alpha of 0.5 or more is an acceptable criterion for internal consistency in reliability analysis (Bautista *et al.,* 2013).

There were several limitations faced by the present work that need to be addressed. Our pilot study was confined to urban consumers and did not reflect other populations in suburban or rural areas. Therefore, validation studies should also be conducted in these areas to further assess the validity and reliability of the questionnaire. Moreover, the language used in the questionnaire (English and Malay) may limit representativeness among other ethnic groups who did not understand either language. The questionnaire should be translated into other languages, *e.g.,* Mandarin, validated, and piloted for use among other ethnic groups. We also propose to conduct test-retest reliability studies to determine the questionnaire's measurement resemblance and stability over time.

Conclusion

The KAP^2 on food poisoning and its prevention questionnaire met the fundamental psychometric criteria of validity and reliability assessment. Therefore, this instrument can be considered a good tool for evaluating consumer knowledge, attitudes, practices, and perceptions on food poisoning and its prevention. Furthermore, this questionnaire encompasses important aspects necessary in ensuring that food to be consumed is safe. It can also be used to ascertain changes associated with intervention management aimed at improving consumer knowledge and preventive practices on food poisoning.

Acknowledgement

The authors would like to thank all respondents and enumerators who were involved in the present work. The present work was financially supported by the Ministry of Higher Education through the Malaysia Research University Network

(MRUN) grant scheme (grant no.: UPM/800-4/11/MRUN/2018/5539240).

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