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Assessment of knowledge, attitude and practice of food allergies among food handlers in the state of Penang, Malaysia

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ABSTRACT

Objectives: Food handler's knowledge, attitude and practice regarding food allergies are important to prevent debilitating and sometimes fatal reactions. This study aimed to assess their food allergy knowledge, attitude and practice, which could help to maintain the safety and hygiene of food consumed by the public.

Study design: Cross-sectional survey.

Methods: A cross-sectional survey involving 121 conveniently sampled (81.76% response rate) respondents among the food handlers in the state of Penang, Malaysia, was conducted using a validated self-administered questionnaire. Their knowledge, attitude and work practice were captured using a 37-item questionnaire that elicited their responses using a mixture of closed-ended and Likert scale techniques.

Results: The mean knowledge score for respondents was 50.23 (SD = 14.03), attitude score was 54.26 (SD = 11.67) and practice score was 45.90 (SD = 24.78). Only 1.79% of the respondents were considered to have excellent knowledge, 21.37% had a low risk practice and 4.27% had positive attitudes towards food allergies. Most of the respondents (70%) knew about food allergies and their seriousness. There was a statistically significant correlation between the attitude and practice of respondents ($r = 0.51$). The type of establishment was the only characteristic significantly associated ($P < 0.05$) with food handler allergy knowledge, attitude and practice.

Conclusions: More than half of food handlers in Penang have moderate levels of food allergy knowledge, practice and attitude. Only a small proportion of them have excellent food allergy knowledge, practice and attitude. Integration of food allergy training into compulsory food safety training programmes is needed to reduce food allergy risks and prevent fatal allergic reactions to food among their customers.

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Introduction

Food allergies are a common problem with a higher prevalence among children compared to adults.¹ Some of the foods thought to be responsible for causing the majority of food allergies are cow's milk, eggs, fish, shellfish, peanuts, tree nuts, wheat and soy.² A food allergy can be defined as an 'immunologically mediated adverse reaction to food, with immediate, late phase, and delayed hypersensitivity reactions all included'.³ Immediate allergic reactions are mediated by the immunoglobulin E (IgE) class of antibodies. Symptoms vary from mild reactions such as perioral urticaria to severe reactions such as anaphylaxis, the most serious form of allergic reaction that typically involves the cardio-vascular and respiratory systems and can be fatal.^{3,4} Mixed immunological mechanisms typically result in conditions such as eczema and eosinophilic esophagitis. In most cases, symptoms start to show within minutes or up to 2 h after eating food containing the allergen.⁵ Food allergies have no cure, and because it can cause severe and even fatal symptoms, avoiding the culprit foods is essential for those at risk. Unfortunately, many people, including food handlers are unaware that an allergic reaction to food could be life-threatening. Because reactions are rare, and usually resolve quickly, food allergies are not always well understood and awareness of them may be limited.⁶

The documented prevalence of food allergy has been believed to be low in Asian regions because there have been few cases of food allergy reported, despite the fact that Asians makes up a large portion of the world's population.⁷ However, recent research estimates that more than half (55.4%) of the 150 million people worldwide who have food allergies are Asian, consisting mainly of children and young adults.¹ In Malaysia, one in three Malaysians are currently suffering from some form of allergy. If the current trend continues, it is expected that half of the population will be allergic to something by 2020.⁶ There are additional social and practical risk factors that could leave people vulnerable to allergic reactions to food, including the trend of eating out and the use of common food allergens as key ingredients in most Malaysian food.⁸

With the significant increase in fatal cases of allergic reactions,⁹ the issue of food allergy has come to the attention of public health authorities,¹⁰ particularly regarding food allergy competence and practice among food handlers. A food handler is a person who is directly involved in preparing food, in contact with food or food contact surfaces and/or handles packaged or unpackaged food or appliances in any food premise.¹¹ Therefore, food handlers have a key role in the safety and hygiene of the food consumed by the public.

Because those consumers at risk need to avoid culprit foods both as ingredients and from cross contamination with other foods, it is crucial to improve food handlers' allergen management competence when preparing and handling food. Fatal and 'near miss' reactions among those at risk may be partially attributed to uninformed work practices, which are perhaps linked to staff awareness and knowledge of food allergies. However, little is known about the level of food allergy knowledge of food handlers or their attitudes or work practices; few studies have been conducted to better understand

them, and no studies have been conducted in Asia.^{4,12} Hence, the goal of this survey was to evaluate the food allergy knowledge, attitude and practice of food handlers in the state of Penang, Malaysia.

Methods

Study design and population

This cross-sectional study was conducted between December 2012 and February 2013 among food handlers in the state of Penang, Malaysia, and included managers, waiters, cooks and other personnel from independent and chain restaurants. It was approved for its ethical conduct and design by the School of Pharmaceutical Sciences' Ethics Committee.

The tool used was based on a previously published self-administered questionnaire.^{13,14} Due to the lack of a population sampling frame, the respondents were selected using convenience sampling.

A sample of 114 food handlers was required at the analysis stage given a 5% margin of error, 80% confidence level and 50% response distribution for an unknown population size. To account for a possible 30% non-response, the number of samples targeted was 148. Adult food handlers (>18 years old) able to understand spoken English or the Malay language were eligible for the study.

Development of the questionnaire

The questionnaire comprised four sections. Section A consisted of 17 items to evaluate knowledge of food allergies. Areas assessed included the identification of food allergies (three items), the risks of allergic reactions to food (seven items) and the causes of food allergies (seven items). Section B (practice) was designed to assess what the food handlers have done or will do to address food allergies at their premises. An additional ten items addressing the attitudes of food handlers towards food allergy were included in Section C. Respondents were requested to choose from three options provided: 'True', 'False' or 'Unsure' in Section A. In addition, knowledge about common allergens, onset of allergic reactions and the risk of fried foods were explored with multiple choice options in Section A. There were also yes/no questions in Sections B and C. Other than yes/no questions, a five-point Likert scale ranging from 'Strongly Agree' to 'Strongly Disagree' was used to assess the attitude of the respondents.

The questionnaire was initially developed in English and was then translated into the Malay language by two independent translators well versed in both languages (tertiary language qualification) and with experience in the health service. Both versions were made available to the respondents, based on their language preference. Face and content validation of the questionnaire was performed by two experts in health service research. The questionnaire was piloted with five lay people, and modifications were made to the questionnaire based on these preliminary findings.

Table 1 – Demographic characteristics of the respondents.

Variables		
Age in years, mean (SD)		31.9 (11.8)
Maximum level of education, n (%)	Primary education	12 (10.3)
	Secondary education	73 (62.4)
	Tertiary education	32 (27.4)
Position, n (%)	Manager	28 (23.9)
	Kitchen crew	33 (28.2)
	Waiter/waitress	31 (26.5)
	Other	25 (21.4)
Experience with allergies, n (%)	Yes	54 (46.2)
	No	63 (53.8)
Type of establishment, n (%)	Independent	70 (59.8)
	Chain	47 (40.2)

Data collection

The food handlers were approached, face-to-face, by the researcher, and their verbal informed consent was confirmed prior to administration of the questionnaire. The participant was given the option to either self-administer the questionnaire or complete it as an interview (to accommodate people with different language comprehension, literacy skills and time schedules). In both instances, the questionnaire was administered individually according to the original structure, and the respondents were allowed to clarify their responses with the researcher.

Data analysis

Each correct answer in Section A was given a score of one (1) whilst wrong or unsure responses were given a zero (0) score. For questions requiring more than one answer, each correct answer was given a score of one divided by the total number of correct answers. For Section B, one mark was awarded for each practice that posed a low risk of an allergic reaction, and zero for each high-risk practice. The same method was used for the yes/no questions in Section C where each positive attitude was awarded one mark, with a zero mark for each negative attitude. For items measured using the Likert scale, four marks (4) were given for the most positive attitude while a zero mark was given for the most negative one.

The score for each section was converted to a percentage by dividing the total score by the maximum score obtainable.

An arbitrary scoring system was used to assess the level of knowledge, attitude and practice based on the responses provided. The total knowledge, attitude and practice scores were interpreted based on an interquartile, whereby the first quartile (≤ 25) would be interpreted as 'Poor knowledge/Negative Attitude/High Risk Practice', the second and third quartiles ($>25 - <75$) would be interpreted as 'Moderate Knowledge/Moderate Attitude/Moderate Risk Practice' and the last quartile (≥ 75) as 'Excellent Knowledge/Positive Attitude/Low Risk Practice'.

As there was only one respondent with no formal education, his score was grouped into the primary school education category.

All data were analyzed using the SPSS Statistics for Windows, Version 17.0 (Chicago, US: SPSS Inc). Independent t-tests and ANOVA tests (confidence interval 95%) were used to compare the mean scores between the groups of respondents and their establishment characteristics.

Results

A total of 148 food handlers were approached, but only 121 consented to participate in the study (response rate = 81.76%). Of the 121 questionnaires collected, 4 were not fully completed and thus were excluded from the analysis. More than half (59.8%) of the respondents were from an independent establishment. All respondents were involved in food service businesses; only 46.2% of them had experience with food allergy or knew someone with a food allergy while 53.8% of them had no experience (Table 1). The majority of the respondents (71.8%) had received a formal education up to the secondary level.

The mean knowledge score for respondents was 50.23 (SD = 14.03), the attitude score was 54.26 (SD = 11.67) and the practice score was 45.90 (SD = 24.78) (Table 2). The mean attitude (mean = 58.81, SD = 11.67) and practice (mean = 51.92, SD = 25.10) scores of respondents from chain restaurants were significantly higher ($P < 0.05$) compared with the attitude (mean = 51.20, SD = 10.69) and practice (mean = 41.86, SD = 2.91) scores of respondents from independent restaurants. There were only minor variations between the mean scores of knowledge, attitude and practice for other demographic characteristics of the respondents. There was a moderate positive correlation between attitude and practice ($r = 0.51$, $P < 0.001$).

Only 1.71% of the respondents were considered to have excellent knowledge, 21.37% had low risk practice and 4.27% had a positive attitude to reducing food allergy risks. Most of the respondents (94%) had moderate knowledge levels, risk practices (63.25%) and attitudes (94.87%). Detailed responses by the respondents for each statement are summarized in Tables 3–5.

The knowledge questions revealed some common misunderstandings (Table 3). Almost 41.0% of the respondents believed that cross-contact was when raw foods touched cooked foods and 60.7% of them were unsure of the difference between lactose intolerance and milk allergy. A large number of respondents managed to identify peanuts, shellfish and eggs as three of the most common allergens, but not fish and wheat, which were identified by only 55.6% and 28.2% of the respondents, respectively.

The food handling practices (Table 4) of 21.4% of the respondents posed high risks for people with food allergies. Some of the respondents (9.4%) reported that there had been at least one recent food allergy case at their premises. Only 26.5% of respondents claimed that their customers were alerted about the presence of allergenic ingredients in their menu items by highlighting the allergenic ingredients or inserting cautionary notes in the menu. Over 60% of the respondents were not used to asking their customers if they had a food allergy (68.4%), had no plan to produce a suitable dish

for a person with a food allergy (67.5%) and had no provision for food allergy training (65.0%).

Overall, 80.3% of the respondents indicated that they would be able to accommodate people with food allergies, for example being able to specially prepare food that is safe for customers with food allergies on request. In contrast, there were a considerably higher proportion of respondents (53.8%) who never thought of any method to prevent allergic reactions to food among their customers.

Discussion

The findings show that most of the food handlers only had moderate food allergy awareness or competence. Most were aware of the term ‘food allergy’ and three of most common food allergens (peanuts, shellfish and eggs). One possible reason for this awareness is that shellfish and eggs are the main causes of food allergy in Asian countries.^{15,16} However, many staff were not well informed about food allergy risks particularly from cross-contamination. Cross-contamination from other food proteins is one of the main reasons deep-fried and wok-cooked dishes could be dangerous to people with food allergies. Understanding this mechanism is important to reduce food allergy risks in the workplace. In addition, most of the food handlers also misunderstood the meaning of food allergy and erroneously equated it with the less fatal lactose intolerance. Lactose intolerance and milk allergy are actually two different things. Milk allergy is an abnormal response to milk that is triggered by a specific reaction in the immune system and expressed by certain symptoms that may occasionally become life-threatening, whereas lactose intolerance is caused by the absence of the enzyme lactase in the body and is not mediated by the immune system.¹⁷ Such misunderstandings and lack of both awareness and allergen management competence could explain why many food handlers, despite treating food allergy seriously, did not have the skills or knowledge to prevent reactions.

One possible reason for the lack of skills or knowledge could be that food handlers are untrained in appropriate food preparation and service methods that are safe for customers with food allergy. Although food business operators and owners are required by law to attend training in food handling,¹¹ the training provided does not usually include information on the assessment, management or control of food allergy risks, and only some owners include this in employee training. In addition to knowledge, it is important for the food business owner to create a workplace that encourages effective allergen competence and an understanding of the needs of customers with food allergies. Our study showed that food handlers in the chain restaurants were more prepared to meet the needs of customers with food allergies compared with those in the independent restaurants. This finding is similar to food businesses studied in New Mexico, where respondents from independent restaurants tended to obtain lower scores than multi-unit company-owned or franchise restaurants.¹⁸ This could be due to the higher standard of in-house training, practice and culture usually found in chain restaurants.

Over 90% of the respondents reported that there had been no cases of food allergy in their business in the last few months. While this may indicate that allergen controls are in place, leading to a low risk of allergic reactions to food, there is still a possibility that unreported allergic reactions may occur beyond the immediate business, for example triggered by their take-out food or involving a late phase reaction where symptoms take longer to become severe. However, there is a high percentage of food handlers (73.5%) who do not highlight the allergenic ingredients or insert a warning note in their menu. This is most probably due to a lack of awareness of food allergens and regulations that make the declaration of allergenic ingredients in food establishments compulsory in Malaysia.

The authors found that the percentage of the respondents who are not used to asking their customers if they are allergic to any food is actually quite high (68.4%). Instead, they expect their customers with food allergies to enquire about the

Table 2 – The mean scores for knowledge, attitude and practice by respondent characteristics.

Factors	Knowledge, mean (SD)	P-value	Attitude, mean (SD)	P-value	Practice, mean (SD)	P-value
Overall	50.23 (14.03)		54.26 (11.67)		45.90 (24.78)	
Maximum education level						
Primary	47.67 (17.45)	0.567	47.647 (10.58)	0.065	39.09 (13.00)	0.373
Secondary	49.76 (13.43)		54.19 (12.13)		47.53 (26.13)	
Tertiary	52.25 (14.21)		56.88 (10.20)		45.63 (24.36)	
Position						
Manager	53.13 (11.62)	0.265	52.86 (9.45)	0.673	43.21 (24.50)	0.882
Kitchen crew	50.42 (14.65)		53.09 (12.78)		45.76 (23.98)	
Waiter/Waitress	51.09 (15.07)		55.36 (12.82)		46.13 (23.48)	
Other	45.65 (14.02)		56.00 (11.20)		48.80 (28.62)	
Type of establishment						
Independent	50.89 (14.40)	0.533	51.20 (10.69)	<0.001*	41.86 (23.91)	0.031*
Chain	49.23 (13.60)		58.81 (11.67)		51.92 (25.08)	
Experience in food allergy						
Yes	50.86 (11.22)	0.654	53.14 (11.07)	0.267	44.92 (24.16)	0.647
No	49.69 (16.12)		55.56 (12.30)		47.04 (25.67)	

*P < 0.05.

Table 3 – The percentage of correct answers given by the respondents for each statement.

Statement	Correct answer, n (%)
Section A: true-false questions concerning the knowledge of food allergies	
A food allergy is an abnormal response of the immune system to an ordinarily harmless food or ingredient in a food.	86 (73.5)
A food allergy is not common but can be serious.	90 (76.9)
A food allergy is an exaggerated immune response triggered by eggs, peanuts, milk, or some other specific food.	88 (75.2)
Children are able to outgrow their food allergies, but adults do not.	13 (11.1)
People with allergies come from families in which allergies are common.	55 (47.0)
A food allergy can initially be experienced as an itching in the mouth and difficulty swallowing and breathing.	74 (63.2)
A food allergy reaction can cause death.	60 (51.3)
Food allergens are usually proteins.	22 (18.8)
Lactose intolerance and milk allergy are one and the same condition	17 (14.5)
Individuals who have peanut or tree nut allergy are sometimes advised to avoid both peanuts and tree nuts from their diets.	89 (76.5)
Hidden food allergens are one of the most common causes of food allergy occurrences	75 (64.1)
Cross-contact is when raw foods, such as uncooked meat and poultry, touch cooked foods	19 (16.2)
Persons of a known food allergy who begin experiencing symptoms while or often eating a food should initiate treatment immediately, and go to a nearby emergency room if symptoms progress.	99 (84.6)
Individuals with food allergies can safely consume the foods that cause the allergies if only a small amount is consumed.	58 (49.6)
Section B: multiple choice questions regarding the knowledge of food allergies	
Food-allergic reactions occur within what time period after ingestion?	33 (28.2)
(a) within seconds	
(b) from 2 min to 12 h	
(c) from within minutes to 2 h*	
(d) within 2 days	
Fried foods can be dangerous for those with food allergies because(a) high fat content makes allergic reactions worse	31 (26.5)
(b) frying changes the chemical structure of foods	
(c) cross-contact with other food proteins can occur*	
Section C: the capability of respondents to select the eight most common allergens	
Please choose the eight most common allergens.	YES, n (%)
(a) Peanuts*	109 (93.2)
(b) Milk*	95 (81.2)
(c) Tomato	14 (12.0)
(d) Soy*	85 (72.6)
(e) Fruits	17 (14.5)
(f) Fish*	65 (55.6)
(g) Shellfish*	108 (92.3)
(h) Gluten	63 (53.8)
(i) Monosodium glutamate (MSG)	72 (61.5)
(j) Sesame seed	55 (47.0)

Table 3 – (continued)

Statement	Correct answer, n (%)
(k) Egg*	103 (88.0)
(l) Wheat*	33 (28.2)
(m) Tree nuts*	97 (81.9)
*Correct answer.	

ingredients in their food before ordering. This increases the risk that allergic reactions to food will occur in their establishments, especially from hidden allergens. A study in New York reported that 50% of the allergic reactions to food that occurred in food establishments were caused by hidden food allergens in sauces, dressings, egg rolls and more.¹⁹ The current law in Malaysia only applies to food allergen labelling in manufactured food, and there is no law regulating the practices of food handlers. In Massachusetts, US, information about food allergies must be posted in the work area and a warning note for patrons must be printed on menus and other printed menu materials.²⁰ The European Union has also recently required food handlers to inform consumers about common allergens in the food that they serve.²¹ To address the risk of hidden allergens, some countries in Europe, including the UK, have extended this rule further by requiring food handlers who provide food information face-to-face to display a notice inviting diners to ask.²²

Educational intervention must be introduced to increase the knowledge level of food handlers in terms of allergen management competence and awareness of food allergy issues. Educational materials can be developed and provided by local authorities for food handlers. The materials should be interactive and easy to understand as the majority of the food handlers do not receive high levels of education. Government and non-government organizations can also design useful guidelines or toolkits for food handlers as an aid for them to perform good food handling practices that minimize the risk of allergic reactions to food. One relevant example is the toolkit designed by the Food Allergy and Anaphylaxis Network and UK Food Safety Agency.^{23,24} The content of compulsory food safety training for food handlers could be enhanced to equip food handlers with essential information on food allergies, similar to the one provided by the University of Minnesota or the UK Food Standards Agency to food handlers that aims to remedy poor knowledge and misinformation.^{25,26} At present, food allergen management training courses are only provided to food manufacturers in Malaysia. These could be extended to food handlers serving ready-to-eat and catered foods. Participants from several studies who work in the food service industry have expressed their interest in receiving training on food allergies.^{4,27,28} However, the training must be comprehensive and concise. Emphasis should be given to the identification of common allergen ingredients in menus and from cross-contamination as they are the most common causes of unexpected allergic reactions to food and can occur easily if meticulous care is not taken.

Table 4 – Itemized response to practices and attitudes related to food allergies of food handlers.

#	Statement	Yes, n (%)	No, n (%)
1	Was there any case of food allergy at your premise in the last few months?	11 (9.4)	106 (90.6)
2	Do you have any plan to produce only non-allergenic food?	38 (32.5)	79 (67.5)
3	Is there any training for staff about food allergies?	41 (35.0)	76 (65.0)
4	In your menu, did you highlight the allergenic ingredients or insert a cautionary note to warn the presence of specific allergens on the menu, such as 'contains peanuts'?	31 (26.5)	86 (73.5)
5	Are you used to asking your customers if they have food allergies?	37 (31.6)	80 (68.4)
6	Are you used to checking the label of food products to find out whether they contain any ingredient that may cause a food allergy?	64 (54.7)	53 (45.3)
7	Will you talk to the guest in person to address food allergy needs and to suggest non-risky choices?	51 (43.6)	66 (56.4)
8	Did you verify with the chef whether or not a food can be made without the allergenic ingredients?	57 (48.7)	60 (51.3)
9	Once the meal is ready, will you double check to make sure no allergens had been inadvertently added?	60 (51.3)	57 (48.7)
10	After the meal is served, do you verify directly with the food allergic guest whether or not expectations have been met?	52 (44.4)	65 (55.6)
11	Do you treat food allergy seriously?	90 (76.9)	27 (23.1)
12	Are you concerned about the food allergy among your customers?	94 (80.3)	23 (19.7)
13	Have you ever thought of any method to prevent food allergic reaction among your customers?	54 (46.2)	63 (53.8)
14	Do you think that you have the responsibility to inform your customers of the presence of food allergens in their food?	75 (64.1)	42 (35.9)
15	Would you specially prepare food that is safe for customers with food allergies when it is requested?	97 (82.9)	20 (17.1)

#1: 'no' indicates low risk practice; # 2–10: 'yes' indicates low risk practice; #11–15: 'yes' indicates positive attitude.

Table 5 – Perception of food handlers towards their responsibility in practicing prevention of allergic reactions to food.

	Statement	Strongly Disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly agree, n (%)
1	Food handlers should provide special tables where customers with food allergies can eat safely	16 (13.7)	30 (25.6)	38 (32.5)	29 (24.8)	4 (3.4)
2	The authors would expect the customers with food allergies to question me on the ingredients in my foods before ordering.	0 (0.0)	2 (1.7)	17 (14.5)	53 (45.3)	45 (38.5)
3	They do not think that it is their responsibility if people with food allergies have allergy reactions at my premise.	9 (7.7)	29 (24.8)	45 (38.5)	29 (24.8)	5 (4.3)
4	These play an important role in ensuring the health and safety of people with food allergies.	1 (0.9)	7 (6.0)	32 (27.4)	66 (56.4)	11 (9.4)
5	The authors have the responsibility of updating myself on the information regarding food allergies.	1 (0.9)	3 (2.6)	37 (31.6)	61 (52.1)	15 (12.8)

In conclusion, it was found that most food handlers have only moderate levels of food allergy knowledge, practice and awareness. However, only a small proportion of them have excellent food allergy knowledge, practice and attitudes. Many food handlers misunderstand key information about food allergy prevention, including cross contamination. The outcome of this study will aid in understanding the current food allergy knowledge, attitude and practice of the respondents in Malaysia and contribute to the development of appropriate educational tools and strategies (by targeting the main misunderstandings) to improve them. This is important because until this occurs, customers with food allergies will not be able to dine out safely. Customers with food allergies will continue to be put at risk by the restaurant staff's poor

understanding of food allergen risks, poor knowledge of appropriate controls, inappropriate practices and lack of awareness.

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Ethical approval

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Competing interests

None declared.

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