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Evaluation of basic knowledge on food safety and food handling practices amongst migrant food handlers in Peninsular Malaysia

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ABSTRACT

This study was aimed to measure the basic knowledge on food safety and food handling practices among migrant food handlers as these information is scarce in Malaysia. A cross-sectional study was conducted face-to-face amongst 383 migrant food handlers from three major cities in Peninsular Malaysia through questionnaire. Socio-demographic information of all respondents was collected. Questions on food safety knowledge (i.e. food cleanliness and hygiene, symptom of foodborne illnesses and foodborne pathogens) and food handling practices were assessed. The compiled data were analyzed by using the Statistical Packages for Social Science (SPSS) 16.0. Overall, migrant food handlers had poor level of knowledge on food safety with an average food handling practice. Significant effects were observed between respondents' food safety knowledge and socio-demography (country of origin and educational level) and two factors namely; respondents' nationality and attendance at food training programs showed significant associations with their food handling practices. Multiple logistic regression analyses revealed that attendance at food training programs was a significant and independent predictor of the respondent's food handling practice. The study's findings highlighted issues with regards to the extent of knowledge acquisition on food safety and hygiene by migrant food handlers. Therefore, this warrants improvements not only in the better delivery methods of training modules but also tight enforcement of attendance at the programs by the respective authorities.

1. Introduction

Foodborne diseases are responsible for the majority of mortality and morbidity worldwide with up to 30% of population in industrialized countries suffering from foodborne illness annually (WHO, 2014). The consumption of food and water contaminated with potential foodborne pathogens such as bacteria, viruses, parasites and toxins accounts for more than 250 different foodborne illnesses (Linscott, 2011; Scallan et al., 2011; Scallan, Hoekstra, Mahon, Jones, & Griffin, 2015; WHO, 2014). Each year, approximately 48 million or 1 in 6 individuals in the United States fall sick, 128,000 are hospitalized and 3000 die from foodborne related illness (CDC, 2014), thus proving the importance of food safety and hygiene practices in the prevention of such illnesses.

The food service industry in Malaysia become more attractive as a results of change in life style from home cooking to "dining out" especially among urban dwellers, and lead to the phenomenon 'mushrooming' of the local food industry (Yeo & Leu, 2014). This has created a high demand for manpower in the food service industry resulting in the increase of employment of migrant workers from 6.6% in 2000 to 11.9% in 2013 (MEF, 2014). Unfortunately, an upward trend of food poisoning cases was also recorded with more than half of the linked to insanitary food handling (MOH, 2007) despite better food hygiene awareness (Zulkifle, 2007). Mishandling of food and the lack of hygiene can facilitate the transmission of foodborne diseases from farm to fork i.e., from the stage of food production, processing to packaging and distribution of food to presentation for food consumption (Abera, Biadegelgen, & Bezabih, 2010; Rall et al., 2010), thus enabling pathogens to contaminate edible products after ingestion of the contaminated food and multiply sufficiently to cause serious illness. The incidence of food and water borne

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diseases in Malaysia (i.e. cholera, typhoid/paratyphoid fevers, viral hepatitis A, food poisoning and dysentery) was approximately 60.97 cases per 100,000 populations, with the majority denoted as food poisoning (56.25) and a mortality rate of 0.03 (MOH, 2013). Unhygienic food handling practices, the use of untreated water and poor environmental sanitation were some of the determinants identified (MOH, 2012; Siow & Norrakiah, 2011).

In order to improve the worker's basic understanding on food safety a food handling training program was introduced in Malaysia is governed under the 1983 Food Act and 1985 Food Regulation. The program was initiated in 1996 and controlled by the Food Quality Control Division (FQCD) of the Ministry of Health (MOH), Malaysia. It comprises of a 3-h lesson, aimed to educate food handlers on food safety, personal hygiene and cleanliness in the food premises (FQCD, 2012). While cleanliness of a premise is categorized into three bands; A the highest grade, B for moderate and C for low cleanliness. Despite this program in place, a total of 151,198 food handlers were trained in 2012 however, in the same year, 3447 (2.6%) of the 132,526 food premises inspected were shut down due to bad hygiene premises under Section 11, Food Act 1983 (FQCD, 2012).

Numerous studies have highlighted the need for food safety training and education for food handlers, due to lack of knowledge on microbiological food hazards, optimal food storage temperatures, risks of cross contamination and the importance of personal hygiene (Bas, Ersun, & Kivanc, 2006; Mudey et al., 2010; Nuchprayoon, Sanprasert, Kaewzaithim, & Saksirisampant, 2009). These assessments were based on the KAP approach, as knowledge (K) is believed to be the precursor that influences an individual's practice (P) and the information will lead to a change in attitude (A) and consequently a change in behaviour (Bas et al., 2006). Unfortunately, these findings failed to show that the knowledge gained was subsequently translated into practical application in the workplace. Although food hygiene training programs gave exposure and increased knowledge about food safety of the attendees, this did not always translate into positive changes in food handling behaviour (Angelillo, Viggiani, Greco, Rito, & Collaborative Group, 2001; Clayton, Griffith, Price, & Peters, 2002; Green et al., 2005). It is suggested the implementation of strategies by combining surveillance and monitoring, good manufacturing practices and good hygiene practices (GHP), the use of International Organization for Standardization (ISO) method 9001, hazard analysis critical control point (HACCP) and Total Quality Management (TQM) (Aruoma, 2006; Soon, Singh, & Baines, 2011), all which can contribute to significant impact on the prevention of foodborne outbreaks (Osimani, Aquilanti, Babini, Tavoletti, & Clementi, 2011). However, these measures in Malaysia are voluntary and facilitated under Food Act 1983 and Food Hygiene Regulations 2009 (Food Act 1983).

At present, to the best of our knowledge, there have not been any attempt to determine the food safety knowledge status of migrant food handlers in Malaysia. Many previous studies on food safety knowledge in Malaysia have all focused on specific groups such as youth and local food handlers (Low, Jani, Abdul Halim, Alias & Moy, 2016; Norazmir, Noor Hasyimah, Siti Shafurah, Siti Sabariah, Ajau & Norazian sha, 2012; Abdullah Sani & Siow, 2014; Tan, Abu Bakar, Abdul Karim, Lee & Mahyudin, 2013; Mazni, See, & Mohamed Adil, 2013; Abdul Aziz & Mohd Dahan, 2013; Ghazali, Othman, Mohamad Nashuki, & Roslan, 2012; Siow & Norrakiah, 2011; Mohd Zain & Naing, 2002; Toh & Birchenough, 2000). Therefore, it is highly relevant to gauge the extent of food safety knowledge particularly migrant food handlers due to the increased labour demand in the food service sector, and the impact on the general health status of the public. This study aimed to explore the socio-demographic profile of migrant food handlers and evaluate the basic knowledge on food safety and food handling practices through questionnaire with a series of pertinent questions.

2. Materials and methods

2.1. Study design

A cross-sectional survey through questionnaires and direct observation was adopted for the study and implemented from October 2014 until May 2015 among migrant food handlers from 55 food establishments across three different states in Peninsular Malaysia namely; Selangor, Ipoh and Kuala Terengganu.

2.2. Study instrument

Data were collected using a structured, paper-based questionnaire written in bilingual language (Malay and English), along with a cover letter explaining the purpose of the study and the voluntary nature of participation. Codes were assigned to each participant to maintain anonymity. All questionnaires were followed by face to face interview with the aid of pictorial show cards corresponding to the questionnaire to ensure the accuracy of the responses. Migrant food handlers in direct or indirect contact with food preparation and handling time, regardless of their employment status were included.

The questionnaire was designed by adapting and modifying questions based on previous studies (Norazmir et al., 2012) and the Malaysian Ministry of Health (MOH) guidelines in food safety and hygiene. The questionnaire was validated on 16 food handlers and it was then revised and the final questionnaire contained only 45 items (Tables 1–6) which were divided into three sections: (i) socio-demographic, (ii) food safety knowledge and (iii) food handling practices. Respondents were asked to choose from among three options-true, false or do not know for questions on food safety knowledge and three options-yes, no or do not know for questions on food handling practices. A right answer was considered as 'correct knowledge' and wrong answer as 'no knowledge'. Scores were totalled and converted into percentages. The score below 50% of food safety knowledge and food handling practices questionnaire is accepted as poor knowledge (Bas et al., 2006; Siow & Norrakiah, 2011).

2.3. Ethical consideration

Ethical approval (MECID no: 20143-40) for this study was obtained from the University of Malaya Medical Ethics Committee. Both informed and written consents were sought from all participants. The assurance of confidentiality and anonymity was maintained throughout the study.

2.4. Data analysis

Fig. 1 illustrates the conceptual framework for analysis. Data were processed and analyzed using the Statistical Package for Social Sciences software, version 16.0. Demographic data of all respondents were presented as frequency values and percentages. Mean scores for food safety knowledge and food handling practices were calculated and charts were drawn for visual interpretation. A multivariate analysis of variance (MANOVA) was used to examine the effects of the demographic variables (i.e. age, gender, geographical origin, educational level, marital status and attendance at food training) on each of the three components of food safety knowledge (i.e. food cleanliness and hygiene, symptoms of foodborne diseases and foodborne pathogens). Cross tabulation and relationships among multiple variables were carried out

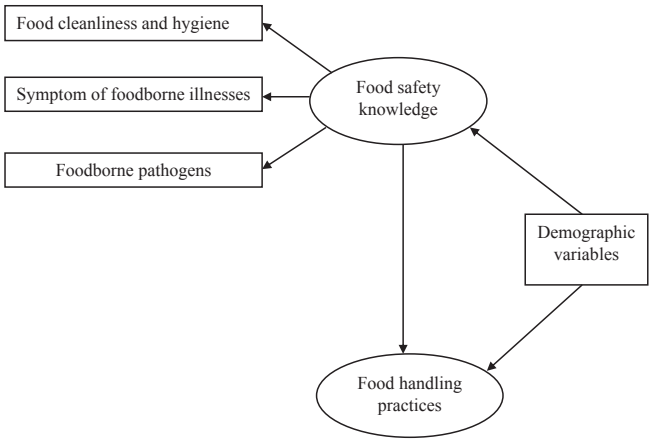

Fig. 1. Conceptual framework of the analysis.

through Chi-square to identify associations between food handling practices and demographic variables. Food handling practice scores were coded into three categorical variables: poor (<50%), moderate (50–80%) and good (>80%). Effect size was calculated using Cramer's V value for tables larger than 2 by 2, and the outcomes were described using Cohen (1988) criteria of 0.1 for a small effect, 0.3 for a moderate effect and 0.5 for a large effect. Finally, a multinomial logistic regression analysis was performed to examine whether or not, and to what extent, demographic variables and level of food safety knowledge independently predicted the respondents' practice during food handling (1 = poor (<50%); 2 = moderate (50–80%); and 3 = good (>80%)). The model contained seven categorical independent variables (country, gender, age, marital status, educational level, attendance at food training and level of food safety knowledge). The reference category was poor level of food handling practices (1 = poor). In all cases the cut-off for a significant effect was set at $p < 0.05$.

3. Results

3.1. Demographic profiles

Three hundred and eighty three respondents from three urban cities in Peninsular Malaysia (Kuala Terengganu (80), Shah Alam (119) and Ipoh (184) participated in the study (Table 1). Majority were Indian nationals (41.8%) and 96.1% of the respondents possessed a legal passport with a valid working permit. Most were Muslims (48.3%) and 95% of whom were males within the age group of 25–34 years (48.6%) with secondary school education (56.1%) and slightly more than half (50.9%) were married.

3.2. Occupational and life style habits

Food handlers with direct or indirect contact with food were included (Table 2), where the majority were represented by cooks (41.0%) and waiters (31.9%). More than half (68.9%) of respondents possessed a valid typhoid vaccination certificate to indicate they had undergone the three year compulsory vaccination, while a third (31.1%) were without evidence of having been so vaccinated. Only 47.3% of respondents had attended the standardized food training program by the Ministry of Health, Malaysia. Most (67.9%) of the respondents were new employees with less than 5 years of experience in the food industry. Up to 32% were regular smokers and only a minority (12.2%) were alcohol consumers. Most worked on a shift basis (88.8%) with a minimum of 12 working hours per day. The majority of respondents were supplied with an apron (89.3%), clean shirt (76.5%) and hair cover (71.0%). Other personal protective equipment such as gloves (66.8%) and protective shoes (78.9%) were not supplied.

Table 1
Socio-demographic of migrant food handlers studied (n = 383).

Parameter	Characteristic	Frequency (%)
Working documents	Passport only	11 (2.9)
	Passport and working permit	368 (96.1)
	Working permit only	1 (0.3)
	Illegal	2 (0.5)
	Refugee	1 (0.3)
Country	India	160 (41.8)
	Nepal	95 (24.8)
	Indonesia	49 (12.8)
	Bangladesh	33 (8.6)
	Myanmar	23 (6.0)
	Pakistan	14 (3.7)
	Sri Lanka	4 (1.0)
	Thailand	3 (0.8)
	Vietnam	2 (0.5)
Age group	<25	117 (30.5)
	25–34	186 (48.6)
	35–44	62 (16.2)
	45–54	17 (4.4)
	>55	1 (0.3)
Gender	Male	364 (95.0)
	Female	19 (5.0)
Religion	Islam	185 (48.3)
	Hindu	151 (39.4)
	Buddhist	34 (8.9)
	Christian	12 (3.1)
	No religion	1 (0.3)
Marital status	Married	195 (50.9)
	Single	185 (48.3)
	Divorced	1 (0.3)
	Widowed	2 (0.5)
Educational level	Primary school	110 (28.7)
	Secondary school	215 (56.1)
	University/college	40 (10.4)
	No formal education	18 (4.7)

3.3. Knowledge on food cleanliness and hygiene

The majority (94.3%) of respondents showed basic knowledge about the importance of hand washing after coughing or sneezing, whereas most of respondents (67.6%) disagreed that it was sufficient to clean hands by using running water only to eliminate hand bacteria prior to touching food (Table 3). Most respondents answered correctly that hair exposure (91.4%) and bare hand contact with food was unacceptable (95.3%). Approximately 85% of respondents understood the importance of separating raw and pre-cooked food to avoid food contamination and 80% knew that necessity to store separately raw chicken, fish and meat in containers in the fridge/freezer. With regard to food safety, 85% of respondents regularly checked the expiry date of food packets to avoid food poisoning. More than half agreed that the best method to avoid food poisoning from fruits and vegetables was washing them under running water, while 32.9% thought that this method was not always necessary. The majority (71%) knew that the cleaning of kitchen sink drains should be undertaken on a daily basis to maintain cleanliness and hygiene. While, only 3.4% were aware that *Salmonella* bacteria can results in food poisoning.

3.4. Knowledge on foodborne illness symptoms

Less than 30% of the respondents were aware that symptoms such as stomach pain, diarrhea, vomit and fever are common

Table 2
Occupational information and life style habits.

Variables	Categories	Frequency (%)
Working responsibilities (n = 383)	Cook	157 (41.0)
	Bartender	55 (14.4)
	Cashier	14 (3.7)
	Waiter	122 (31.9)
	Cleaner	22 (5.7)
	Manager/supervisor	13 (3.4)
KKM food training (n = 383)	Yes	181 (47.3)
	No	164 (42.8)
	Unknown	38 (9.9)
If yes, when was the last food training attended (n = 181)	<1 year ago	6 (3.3)
	1-3 years ago	141 (77.9)
	>3 years ago	34 (18.8)
Anti-typhoid injection (n = 383)	Yes	264 (68.9)
	No	64 (16.7)
	Unknown	55 (14.4)
If yes, when was the last typhoid vaccination (n = 264)	<1 year ago	14 (3.6)
	1–3 years ago	242 (91.6)
	>3 years ago	13 (4.9)
Length of employment (year) (n = 383)	<1	20 (5.2)
	1–5	260 (67.9)
	6–10	84 (21.9)
	>10	19 (5.0)
Personal protective equipment (n = 383)		
(i) Glove	Yes	127 (33.2)
	No	256 (66.8)
(ii) Apron	Yes	342 (89.3)
	No	41 (10.7)
(iii)Clean shirt	Yes	293 (76.5)
	No	90 (23.5)
(iv) Shoes	Yes	81 (21.1)
	No	302 (78.9)
(v) Cap/hair cover	Yes	272 (71.0)
	No	111 (29.0)
Nature of working time (n = 383)	Day only	36 (9.4)
	Night only	7 (1.8)
	Shift	340 (88.8)
Alcohol consumer (n = 383)	Yes	47 (12.2)
	Yes, but now stopped	8 (2.1)
	Never	331 (85.8)
Cigarettes user (n = 383)	Yes	121 (31.6)
	Yes, but now stopped	8 (2.1)
	Never	254 (66.3)
Illegal drug user (n = 383)	Yes	0 (0)
	Yes, but now stopped	0 (0)
	Never	383 (100.0)

symptoms of foodborne illness (Table 4).

3.5. Knowledge about foodborne pathogens

The respondents were found to be least knowledgeable on this aspect with only a small group of the respondents knowing about *Salmonella* (3.7%), *Bacillus cereus* (1.0%), *Escherichia coli* (1.0%), *Vibrio* (0.5%) and *Staphylococcus aureus* (0.3%) while not one among those surveyed was aware of *Campylobacter* (Table 5).

3.6. Food handling practices

Up to 50% of respondents wore uniforms during food preparation (Table 6). The majority (86.4%) practiced hand washing with soap and warm running water prior to food preparation. Fewer than 10% went for health checks every six months and approximately 60% had undergone typhoid vaccination. Most respondents (90%) took regular showers and kept their fingernails short. While less than 50% covered hand wounds with band aid, the majority

Table 3
Responses to "knowledge on food cleanliness and hygiene".

Attributes (n = 383)	True (%)	False (%)	Don't know (%)
Should always wash hands after coughing or sneezing	**94.3**[a]	0.5	5.2
Is it enough just by washing your hands under running water to remove bacteria before touching food?	30.5	**67.6**[a]	1.8
Exposing hair to food can cause foodborne disease	**91.4**[a]	0.3	8.4
Avoid bare hand contact with ready to eat food	**95.3**[a]	3.4	1.3
Contamination occurs when the raw and ready to eat food are put together in one place	**86.4**[a]	8.1	5.5
Do not place chicken, fish and raw meat at the same place (fridge/freezer)	**83.8**[a]	10.7	5.5
To determine the safety of food, you should taste/smell/check the expiry date before you eat	**85.6**[a]	2.3	12.0
The best way to avoid food poisoning from fruits and vegetables is to wash them under running water	**63.2**[a]	32.9	3.9
The kitchen sink drain should be cleaned every week	28.0	**71.0**[a]	1.0
Salmonella bacteria can cause food poisoning	**3.4**[a]	0.0	96.6

[a] Responses in bold color are correct knowledge.

Table 4
Responses to "knowledge on foodborne illness symptoms".

Attributes (n = 383)	Had heard/experienced foodborne illness symptoms		
	Yes (%)	No (%)	Don't know (%)
Stomach pain is a symptom of foodborne illness	**26.9**[a]	72.4	0.8
Diarrhea is a symptom of foodborne illness	**23.8**[a]	75.2	1.0
Vomit is a symptom of foodborne illness	**12.5**[a]	86.9	0.5
Fever is a symptom of foodborne illness	**9.1**[a]	90.3	0.5

[a] Responses in bold color are correct knowledge.

Table 5
Responses to "knowledge on foodborne pathogens".

Foodborne pathogens	Had heard of foodborne pathogen (%)
Salmonella	3.7
Staphylococcus aureus	0.3
Bacillus cereus	1.0
Escherichia coli	1.0
Campylobacter	0.0
Vibrio	0.5

(97.4%) agreed that there should be no smoking during food preparation. More than 85% used kitchen utensils to handle food and did not overlap food dishes while serving food. Fewer than half of the food servers used gloves during food preparation.

3.7. Mean score for food safety knowledge and practices

Overall the mean score for 20 food safety knowledge questions tested was 31.1% (SD = 11.8), indicating generally poor knowledge on food safety (Fig. 2). The mean score of food safety on food cleanliness and hygiene (M = 74.2%, SD = 14.9) was higher compared to knowledge on symptoms of foodborne illness (M = 18.1%, SD = 30.3) and knowledge on foodborne pathogens (M = 1.1%, SD = 5.8). Meanwhile, most respondents exhibited an average score for food handling practices, with a mean of 69.8% (SD = 15.7).

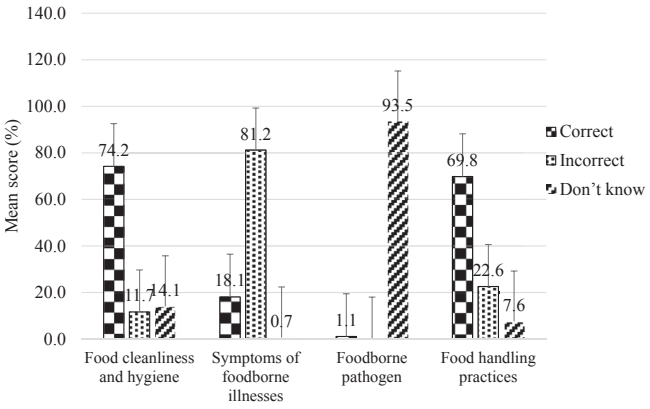

Fig. 2. Mean score of food safety knowledge and food handling practice.

3.8. The effect of demographic variables on food safety knowledge

Analysis by MANOVA revealed a significant difference in food

Table 6
Response to "food handling practice".

Attributes (n = 383)	Yes (%)	No (%)	Don't know (%)
I wear uniform during food preparation	**49.9**[a]	49.6	0.5
I wash my hands using soap and warm running water before preparing the food	**86.4**[a]	12.3	1.3
I go for medical health check every six months	**9.1**[a]	80.4	10.4
I have undergone anti-typhoid injection	**68.4**[a]	16.9	14.7
I bath regularly	**96.6**[a]	3.2	0.3
I keep long and colored fingernail	5.2	**94.3**[a]	0.5
I cover my wound on hands with bandages during food preparation	**47.3**[a]	12.8	39.9
I smoke in food preparation area	1.8	**97.4**[a]	0.8
I use chopstick to take food	**86.7**[a]	8.1	5.2
I overlap food dishes while serving food	9.7	**88.2**[a]	2.1
I wear glove during food preparation	**44.4**[a]	47.8	7.8

[a] Responses in bold color are correct knowledge.

Table 7
Effect of demographic variables on food safety knowledge.

Independent variables (demographic variables)	Levels	Mean	Pillai's trace	df	F	p	Effect size
Country	India	27.40	0.16	24	1.63	0.03*	0.05
	Indonesia	38.58					
	Bangladesh	30.64					
	Nepal	30.49					
	Myanmar	26.09					
	Thailand	25.55					
	Sri Lanka	15.55					
	Pakistan	25.02					
	Vietnam	10.00					
Gender	Male	27.81	0.01	3	1.09	0.35	0.01
	Female	36.44					
Age	<25	31.41	0.04	12	0.85	0.59	0.02
	25–34	29.69					
	35–44	31.67					
	45–54	20.33					
	>55	23.33					
Marital status	Single	28.84	0.05	9	1.40	0.18	0.02
	Married	28.57					
	Widowed	42.50					
	Divorced	35.00					
Educational level	Primary school	28.67	0.08	9	2.05	0.03*	0.03
	Secondary school	29.33					
	University	34.58					
	No school	23.07					
Food training	Yes	31.22	0.02	6	0.77	0.59	0.01
	No	26.64					
	Unknown	31.05					

Cohen (1988) defined the effect sizes (eta squared) as follows: 0.01 – small effect; 0.09 – moderate effect; 0.25 – large effect.
*Significant at $p < 0.05$.

Table 8
Mean difference between demographic variables on food safety knowledge aspects.

Independent variables	Dependent variables	Group I	Group J	Mean difference (I-J)	p
Turkey's HSD multiple comparisons					
Country	Symptom of foodborne illnesses	Indonesia	India	29.45	0.001*
			Nepal	22.91	0.001*
			Myanmar	28.28	0.006*
			Pakistan	34.18	0.005*
	Foodborne pathogen	Indonesia	India	3.32	0.021*
	Food cleanliness and hygiene	Myanmar	India	−10.10	0.032*
			Nepal	−10.05	0.050*
		Vietnam	India	−45.31	0.001*
			Indonesia	−46.12	0.001*
			Bangladesh	−44.55	0.001*
			Nepal	−45.26	0.001*
			Myanmar	−35.22	0.018*
			Thailand	−46.67	0.008*
			Pakistan	−40.00	0.005*
Educational level	Foodborne pathogen	University	Primary school	3.60	0.007*
	Food cleanliness and hygiene	Primary school	High school	−4.26	0.044*
			University	−10.07	0.001*
		No school	High school	−13.22	0.001*
			University	−19.03	0.001*

Insignificant multiple comparisons results are excluded from the table.
*Significant at $p < 0.05$.

safety knowledge among the two demographic variables country origin (Pillai's trace = 0.16, $F_{24,693} = 1.63$, $p = 0.03$) and educational level (Pillai's trace = 0.08, $F_{9,693} = 2.05$, $p = 0.03$) (Table 7). In relation to nationality (Table 8), the mean differences between Indonesians (M = 41.3%, SD = 39.7) and other nationalities were positive and these indicated that the Indonesians were more knowledgeable about symptoms of foodborne illnesses compared to Indians (M = 11.8%, SD = 24.9), Nepalese (M = 18.4%, SD = 28.8), Myanmar (M = 13.0%, SD = 21.1) and Pakistani (M = 7.1%, SD = 26.7). Similarly Indonesians (M = 3.7%, SD = 8.5) scored better on knowledge of foodborne pathogens compared to the Indian (M = 0.4%, SD = 3.6). The negative mean difference values on knowledge of food cleanliness and hygiene for respondents from Vietnam (M = 20.0%, SD = 10.2) were significantly lower compared to subjects from India (M = 68.3%, SD = 13.6), Indonesia (M = 71.8%, SD = 13.6), Bangladesh (M = 74.8%, SD = 10.0), Nepal (M = 73.1%, SD = 15.3), Myanmar (M = 66.5%, SD = 16.9), Thailand (M = 73.3%, SD = 5.7), Sri Lanka (M = 65.0%, SD = 7.2) and Pakistan (M = 62.8%, SD = 18.9).

In relation to educational level (Table 8), respondents with tertiary education scored better on knowledge of foodborne pathogen (M = 3.7%, SD = 11.5) compared to those with only primary

Table 9
Association of demographic variables on food handling practices.

Demographic variables	n (%)	Level of food handling practices			Chi-square test			
		Poor n (%)	Moderate n (%)	Good n (%)	X^2	df	p	Effect size
Country								
India	160 (41.8)	20 (62.5)	115 (51.6)	25 (19.5)	85.71	16	0.001*	0.34
Indonesia	49 (12.8)	4 (12.5)	26 (11.7)	19 (14.8)				
Bangladesh	33 (8.6)	0 (0.0)	12 (5.4)	21 (16.4)				
Nepal	95 (24.8)	7 (21.9)	32 (14.3)	56 (43.8)				
Myanmar	23 (6.0)	0 (0.0)	19 (8.5)	4 (3.1)				
Thailand	3 (0.8)	0 (0.0)	2 (0.9)	1 (0.8)				
Sri Lanka	4 (1.0)	0 (0.0)	4 (1.8)	0 (0.0)				
Pakistan	14 (3.7)	0 (0.0)	12 (5.4)	2 (1.6)				
Vietnam	2 (0.5)	1 (3.1)	1 (0.4)	0 (0.0)				
Gender								
Male	364 (95.0)	30 (93.8)	215 (96.4)	119 (93.0)	2.17	2	0.338	0.08
Female	19 (5.0)	2 (6.2)	8 (3.6)	9 (7.0)				
Age								
<25	117 (30.5)	10 (31.2)	62 (27.8)	45 (35.2)	8.33	8	0.401	0.10
25–34	186 (48.6)	14 (43.8)	113 (50.7)	59 (46.1)				
35–44	62 (16.2)	4 (12.5)	38 (17.0)	20 (15.6)				
45–54	17 (4.4)	4 (12.5)	9 (4.0)	4 (3.1)				
>55	1 (0.3)	0 (0.0)	1 (0.4)	0 (0.0)				
Marital status								
Single	185 (48.3)	16 (50.0)	109 (48.9)	60 (46.9)	6.44	6	0.375	0.09
Married	195 (50.9)	15 (46.9)	113 (50.7)	67 (52.3)				
Widowed	2 (0.5)	1 (3.1)	0 (0.0)	1 (0.8)				
Divorced	1 (0.3)	0 (0.0)	1 (0.4)	0 (0.0)				
Educational level								
Primary school	110 (28.7)	12 (37.5)	69 (30.9)	29 (22.7)	5.29	6	0.506	0.08
Secondary school	215 (56.1)	16 (50.0)	118 (52.9)	81 (63.3)				
University	40 (10.4)	3 (9.4)	24 (10.8)	13 (10.2)				
No school	18 (4.7)	1 (3.1)	12 (5.4)	5 (3.9)				
Food training								
Yes	181 (47.3)	8 (25.0)	97 (43.5)	76 (59.4)	26.78	4	0.001*	0.26
No	164 (42.8)	16 (50.0)	98 (43.9)	50 (39.1)				
Unknown	38 (9.9)	8 (25.0)	28 (12.6)	2 (1.6)				
Total	383 (100.0)	32 (8.4)	223 (58.2)	128 (33.4)				

*Significant at $p < 0.05$.
Effect size was calculated by Cramer's V value. Cohen (1988) defined the effect sizes (eta squared) as follows: 0.1 – small effect; 0.3 – moderate effect; 0.5 – large effect.

education (M = 0.1%, SD = 1.6). Similarly, respondents with higher learning scored better on knowledge on food cleanliness and hygiene (M = 77.7%, SD = 10.4) compared to those only having primary (M = 65.9%, SD = 16.2) and secondary education (M = 71.5%, SD = 13.7).

3.9. Association of demographic variables on food handling practices

The Chi-square test (Table 9) indicated a significant effect of only two demographic variables (nationality ($\chi^2_{16} = 87.5$, $p = 0.001$) and attendance at food training ($\chi^2_2 = 14.5$, $p = 0.001$)) with food handling practice. Using Cohen (1988) benchmark effect size for Cramer's V value 0.1 for a small effect; 0.3 for a moderate effect and 0.5 for a large effect, results showed that nationality had a moderate effect (0.34) while attendance at food training programs had a small effect (0.19) on food handling practice.

3.10. The effect of demographic variables and level of food safety knowledge on food handling practices

The final model showed good fit to the data (Pearson $\chi^2_{268} = 196.8$, $p = 1.00$) and was significantly different from a model with no fitted explanatory factors (null model, $\chi^2_{42} = 137.9$, $p < 0.001$) (Table 10). Only two variables made a unique statistically significant contribution to the model (country origin ($\chi^2_{16} = 99.6$, $p < 0.001$) and attendance to food training program ($\chi^2_2 = 19.2$, $p < 0.001$) (Table 11). However, the stronger predictor between the two variables was attendance at food training with odd ratio 2.9 (2 = moderate) and 6.5 (3 = good), respectively. This indicated that those who had attended a food training program were three times more likely to have moderate food handling practices and six times more likely to have good food handling practices than those who did not attend.

4. Discussion

The present study provides an insight to the basic knowledge on food safety and food handling practices among foreign food workers in Malaysia. In general, results showed an overall knowledge mean score of 31.1% and 69.8% indicating poor knowledge on food safety and an average score for food handling practices, respectively. More specifically, the respondent's knowledge on 'food cleanliness and hygiene' was fair but poor on 'symptoms of foodborne illness' and 'foodborne pathogens'. However, the overall results in this study showed better knowledge acquisition compared to a study among secondary school children (Norazmir et al., 2012) which scored low on food safety knowledge (mean = 12.1%) and food safety practices (31.1%). The differences could be explained by the different study group cohort (secondary school students vs food handlers) and protocol method (face-to-face interview versus self-administrated questionnaire).

The present study also showed respondents faired better on questions regarding to food cleanliness and hygiene with a score of 74.2% particularly those with higher education (secondary school and university qualification) demonstrated better knowledge. This

Table 10
Multinomial logistic regression analysis for the effects of demographic variables and level of food safety knowledge on food handling practices.

	Likelihood ratio tests		
	Chi-square	df	*p*
Final model (Pearson)	196.8	268	1.000
Null model	137.9	42	0.001
Demographic variables			
Country	99.6	16	0.001*
Gender	1.1	2	0.555
Age	8.3	8	0.399
Marital status	6.6	6	0.352
Educational level	8.6	6	0.196
Food training	19.2	2	0.001*
Food safety knowledge	1.6	2	0.434

*Significant at $p < 0.05$.

finding concurred with the study by Toh and Birchenough (2000) accrediting food handlers with upper secondary education and a higher degree with better knowledge on personal hygiene compared to handlers without formal schooling, indicating that education is the key link to knowledge. It was also possible that respondents could have attained knowledge on food safety through opportunities of skill enhancements from continual learning at their workplace or from former schooling education prior to employment in the country. While others with no knowledge and practical skills may have acquired theoretical and practical training privately from superiors in their work place. In most cases, those with better understanding of Malay or English language and/or had longer employment or length of residence in Malaysia tend to acquire knowledge better. However, it remains uncertain whether their superiors imparted the proper information to other employees in view as only 47.3% attended to formal training programs.

The respondents had the least knowledge on questions regarding to foodborne pathogens with knowledge score of 1.1%, despite a visual instrument presenting a list of six pathogens was provided. Similarly, numerous studies also reported low level of knowledge amongst food handlers on dangers of microbiological hazards of food contamination, as observed in Portugal (Santos, Nogueira, Patarata, & Mayan, 2008), Western Romania (Jianu & Chis, 2012), Nigeria (Onyeneho & Hedberg, 2013) and Malaysia (Abdullah Sani & Siow, 2014). Majority of the respondents were unable to recognize foodborne pathogens and only 3.7% with higher education understood on the hazards of *Salmonella* (see Table 5). The lack of knowledge concerning microbiological hazards and the risk of bacterial contamination often leads to inappropriate food handling practice, thus increasing the risk of food poisoning (Toh & Birchenough, 2000).

Furthermore, a large proportion of the respondents had limited knowledge on *Staphylococcus aureus* (0.3%) (see Table 5), the world third most causative agent in foodborne disease (Normanno et al., 2005). Abdullah Sani and Siow (2014) reported that majority (70%) respondents did not recognized *Staphylococcus aureus* and its importance to foodborne diseases and if an unknown carrier could transmit the toxin-producing bacteria on food, infecting others after food consumption. Another study also stated that infected food handlers are the key factor of food contamination after isolation of methicillin resistant *S. aureus* (MRSA) from several food producing animals (Boer et al., 2009).

The migrant food handlers were found less knowledgeable (percentage score = 18.1) on symptoms of foodborne illnesses. However, this result was not in agreement with many worldwide studies as reported among night market vendors in Taiwan identified diarrhea (98.3%) and stomach pains (80%) as the most common food-borne illness symptoms (Sun, Wang, & Huang, 2012), while 76.7% respondents in western Romania recognized vomiting, fever, diarrhea, and stomach pain as food borne symptoms (Jianu and Chis, 2012). In addition, 80% of food handlers recognized the association of diarrhea with gastrointestinal illness (Omemu & Aderoju, 2008; Walker, Pritchard, & Forsythe, 2003). It is advisable that those infected be excluded from food preparation as these pathogens are potential vehicle for transmission through oral-fecal route and putting consumers at risk of food poisoning.

Hygiene practice is another important component to consider in the reduction of foodborne illnesses. Our study has revealed that most respondents showed moderate levels of awareness of hygienic practices in food handling (mean = 69.8%, SD = 15.7). Siow and Norrakiah (2011) also showed that the majority of food handlers (n = 65) exhibited average food handling practice in hand washing (68.0%), personnel hygiene (66.5%), raw materials management (66.2%), food safety control (59.3%) and usage of gloves (52.3%). However it is not surprising that food workers do not adhere to the proper food handling protocol (Kosa, Cates, Hall, Brophy, & Fraser, 2014; Borda et al., 2014). Fortunately certain basic practices were applied by most participants (86.4%) such as hand washing with soap prior to food preparation, as described in other previous studies (Soares, Almeida, Cerqueira, Carvalho, & Nunes, 2012). The majority also agreed that bathing was necessary to remove visible dirt or unpleasant body odors, as was also shown by Omemu and Aderoju (2008).

The statistical findings linked the poor levels of food safety knowledge with several relevant factors that included respondents' nationality, poor attendance at food training programs and low educational levels among migrant food handlers. Therefore, it is no surprise that one third of the respondents have low level of food safety knowledge as most came from different geographical background and spoken languages therefore miscommunication was predominant due to low comprehension of the most spoken language in this country which is Malay and English (Salleh, Mohd Nordin & Abdul Rashid, 2012). Despite the use of pictorial show cards corresponding to the questionnaire to aid the accuracy of the responses, high numbers of respondents were still unable to answer correctly (81.2%) or responded 'do not know' (93.5%) to the questions on symptoms of foodborne illness and foodborne

Table 11
Effect of predictor on food handling practices.

Food handling practices:						
	B	S.E.	Wald	df	*p*	Exp(B)
Block1: MODERATE						
Country	0.19	0.13	2.13	1	0.144	1.21
Gender	−1.00	0.86	1.34	1	0.246	0.36
Age	0.07	0.31	0.05	1	0.813	1.07
Marital status	0.02	0.48	0.01	1	0.960	1.02
Educational level	0.15	0.27	0.30	1	0.583	1.16
Food training	−0.68	0.28	6.10	1	0.013*	0.51
Food safety knowledge	0.71	0.79	0.81	1	0.367	2.03
Constant	2.58	1.60	2.58	1	0.108	NA
Block 2: GOOD						
Country	0.37	0.13	7.33	1	0.007*	1.45
Gender	−0.45	0.87	0.26	1	0.606	0.63
Age	−0.05	0.33	0.03	1	0.863	0.94
Marital status	0.20	0.51	0.15	1	0.692	1.22
Educational level	0.18	0.28	0.38	1	0.533	1.19
Food training	−1.45	0.31	20.95	1	0.001*	0.23
Food safety knowledge	0.84	0.82	1.04	1	0.306	2.31
Constant	1.88	1.67	1.26	1	0.261	NA

*Significant at $p < 0.05$.
Predictors: country, gender, age, marital status, educational level, food training and food safety knowledge.
Predicted variable: food handling practices (1 = POOR, 2 = MODERATE, 3 = GOOD).
Reference category: food handling practices (1 = POOR).

pathogens, respectively.

The regression model suggests that attendance to food training program was a predictor for good food handling practices (see Table 11) however, results contradicted to a study by Mohd Zain and Naing (2002) who reported no significant differences in food handling practices between trained and untrained food handlers. Fig. 2 shows that despite having poor knowledge on food safety issue (symptom of foodborne illnesses and foodborne pathogens), most workers answered correctly questions on food cleanliness and hygiene (74%) and food handling practices (69%) confirming that high level knowledge is not necessary for good practice conduct. However, the knowledge during training programs was not fully assimilated due to lack of comprehension due to the language barriers and low education levels of the attendees, and this was reflected by a low mean score of only 31.1%.

5. Conclusion and recommendations

This is the first study in Malaysia targeted among migrant workers in food service industry in respect to their knowledge on food safety and hygiene practices in food establishments. In general, migrant food handlers had poor knowledge on food safety (M = 31.1%, SD = 11.8) with average knowledge on food handling practices (M = 69.8%, SD = 15.7). Three key factors were identified linked to the poor knowledge acquisition included poor participation in food training programs, low educational level and language barriers. This findings calls for better improvements in food training programs with a view to improve knowledge acquisition to develop good practice. Several recommendations may include compulsory basic Malay or English language classes prior to attendance at food training programs to ensure better understanding of the content of food training modules with emphasis on symptoms of foodborne illnesses and foodborne pathogens. Moreover, regular health inspections of food handlers and closure of food premises that fail to comply should be enforced by the regulatory bodies if the health and safety guidelines are not fully adhered.

However, general interpretation of the overall results should be viewed cautiously due to several limitations. First, the study sample is only a fraction of the whole study community as we covered only three major cities in Peninsular Malaysia and therefore may not reflect the true composition of migrants distribution in Malaysia. It is recommended that future studies should include a larger randomized sample size across the country to permit a better statistical power and generalizability. Secondly inaccuracies could have arised during the questionaire screening (question and answer options) due to low comprehension and language barrier despite questions were repeated several times with assistant of a translator.

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