A Study on Causal Relationship between Food Handler's Awareness and Safe Food Handling Practices in Malaysia

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Abstract
This study analyzes the food handler's awareness towards safe practices in food handling. 322 food handlers from Sungai Petani, Kedah, Malaysia have been given structured questionnaire. Two different dimensions to identify awareness towards safe practice in food handling are knowledge and general perception on safe food handling. Construct of knowledge divided into five different dimensions which are knowledge on minimizing risk of contaminated ingredients, temperature control, personal hygiene, minimizing risk of cross contamination and sanitation. Food handler's knowledge about safe food handling explored to be in slightly good level. While food handler's perception identified to be in good level. Food handlers are discovered to practice safe practices in food handling. Significant relationship exists between knowledge and perception of food handlers towards safe practices in food handling.

Keywords: awareness, knowledge, perception

1.0 Introduction

Foodborne disease outbreaks define by Olsen et al (2000) is the occurence of two or more cases of a comparable or similar illness consequential from ingestion of the same food. Foodborne disease outbreak is one of the crucial diseases that need to be taken extremely because it poses significant impact towards human population. World Health Organization (WHO) (2015) agrees that foodborne disease cause of 3% rate of mortality in 2014. In the United States alone, the incidents rates of foodborne disease are more than 25,000 cases per 100, 000 populations (Teisl & Roe, 2010).

In Malaysia, foodborne disease is not infrequent, but the real problem is it relates to the real number of the case being revealed. This is common event when the cases are considered not serious by the diseased person. In some cases, late treatment caused death as reported by Safina et al. (2013) and Embun (2013) when a serious outbreak happens in Malaysia on 2013. The outbreak caused three people death and 59 others hospitalized. The outbreak is caused by eating the chicken dish that had been contaminated with *Salmonella* bacteria.

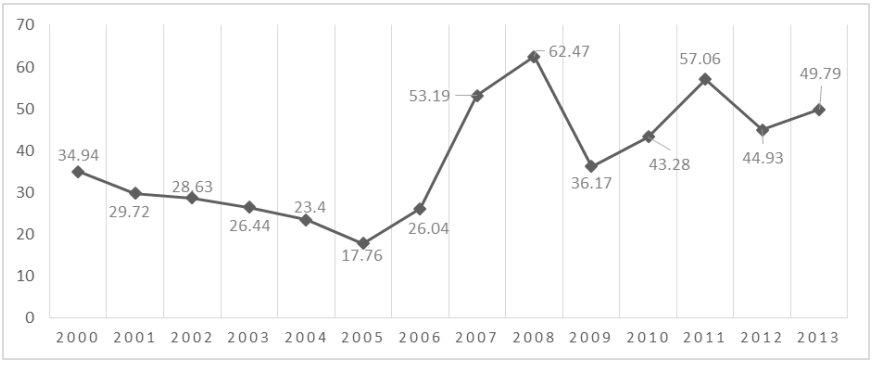

Figure 1: Incidents rate of Foodborne Disease in Malaysia from 2000 2013 per 100,000 Populations (A'aishah, 2015)

Figure 1 summarize incidents rate of foodborne disease in Malaysia per 100,000 of populations. The figure demonstrates that from 2000 to 2005, the incidents rate of foodborne disease is declining from 34.94 cases on 2000 to the lowest 17.76 cases on 2005. However, the incidents rate of foodborne disease is increasing rapidly from year of 2005 to 2008. From 17.76 cases on 2005, the incidents rate of foodborne disease increase gradually until it reaches the highest number of cases throughout 13 years which is 62.47 cases on 2008. The next five years, rate of foodborne disease outbreak is fluctuating from 36.17 cases on 2009, 43.28 cases on 2010, 57.06 cases on 2011, 44.93 cases on 2012 and 49.79 cases on 2013. Based on the figure above, it can be concluded that rate of foodborne disease outbreak cases are unpredictable and preventive measures are important to minimize risk of foodborne disease.

Safe food handling practices at foodservice establishment are crucial part to prevent foodborne disease outbreak. Through continuous training, most of the food handlers nowadays have the basic skills and knowledge to prepare food safely. In addition, in response to daily exposure to the unlimited information via social media such as Facebook, Instagram, Twitter, etc., perceptions towards safe food handling might change positively. However, as a normal human being, errors resulting from unawareness of safe practice during food handling have been associated in most outbreaks of food poisoning (Greig, Todd, Bartleson, & Michaels, 2007). Greg et al (2007) also specifies that unawareness of unsafe practices during food handling by the food handlers has been associated in 97% of food borne disease cases.

2.0 Problem statement

Bryan (1988) one the pioneers' scholar on the safety practices suggested that there are eight unsafe practices in the food handling. The eight of the unsafe practices are; 1. Failure to properly cool food, 2. Failure to comprehensively heat or cook food, 3. Infected employees who practice poor personal hygiene at home and at the workplace, 4. Foods prepared a day or days before they are served, 5. Raw and contaminated ingredients incorporated into foods that receive no further cooking, 6. Foods allowed remaining at bacteria-incubation temperatures, 7. Failure to reheat cooked foods to temperatures that kill bacteria, 8. Cross-contamination of cooked foods with raw foods, or by employees who mishandle foods, or through improperly cleaned equipment. CDC (2014) then narrowed down the eight unsafe practices into five different elements namely; 1. Contaminated ingredients, 2. Temperature control, 3. Personal hygiene, 4. Cross contamination and 5. Sanitation.

This is the key contributing factors of foodborne disease in the world (WHO, 2015; CDC, 2015). For example, in 2007 the outbreak related to *Shigella* and imported baby corn triggered European food community, and the outbreak lingered mysterious (Muller et al., 2009). In addition, there is a case related to *Yersinia pseudotuberculosis* and lettuces (Nuorti et al., 2004), *and* raspberries (Hjertqvist et al., 2006), to cite but a few.

In the Malaysian context, Ministry of Health Malaysia (MOH) (2015) revealed that the unsafe practices which associated with the growth of deadly microorganism have caused 50% cases of foodborne diseases. Most of the

cases on the unsafe practices in food handling are cause by the negligence among food handlers.

Result from above justifications, this research aims to study causal relationship between food handler's awareness and safe food handling practices in Malaysia. Food handler's awareness will have covered two different variables which are knowledge and perception towards safe practices in food handling. The study population will be food handlers at Sungai Petani District, Kedah. Major reason of selection the respondents at Sungai Petani is because main outbreak that reported three deaths due to contaminated chicken with salmonella bacteria happens there in 2013.

3.0 Literature review and hypotheses development

3.1 An overview of foodservice industry and foodborne disease outbreak in Malaysia

Food plays significant part in Malaysia culture. As a result, foodservice industry in Malaysia grows significantly in recent years. As shown in Table 1, Euromonitor (2014) suggested that Malaysia's foodservice industry is calculated to have value less than USD 10 billion between 2008 to 2011. But between 2008 and 2012, the industry showed an increasing of compound annual growth rate (CAGR) of 4.6%. It is expected until 2017 the industry will continue to show positive growth with compound annual growth (CAGR) of 5.3%. Designated site restaurant is leading which total historic market value of USD 15,890 million. 100% home delivery service/takeaway is the lowest which is USD 251000. However, in terms of CAGR percentage, 100% home delivery service/takeaway recorded tremendous increasing rate of 19.9 % from 2008 to 2012 and designated site is recorded the lowest growth rate of 3.3% from 2008 to 2012.

Table 1: Historic Market Value and Growth of Malaysian Foodservice by Subsector, US$ millions

	2008	2009	2010	2011	2012	Total Market Value 2008-2012	CAGR %2008-2012
Designated Site Restaurant	3,013.5	3,016.1	3,135.1	3,297.0	3,428.3	15,890	3.3
Cafes/Bar	2,427.2	2,427.5	2,593.0	2,719.8	2,869.8	13,037.3	4.3
Street Stalls/Kiosk	1,724.1	1,750.8	1,837.2	1,929.4	2,015.	9,256.5	4.0
Fast Food	995.7	1,063.9	1,186.5	1,309.3	1,415.4	5,970.8	9.2
Self-Service Cafeterias	166.5	173.1	180.3	188.8	195.3	904	4.1
100 % Home Delivery/takeaway	31.8	42.8	52.1	58.7	65.6	251	19.9
Pizza Consumer Foodservice	174.4	190.5	207.4	220.6	230.9	1,023.8	7.3
TOTAL MARKET VALUE	8,533.2	8,664.7	9,191.6	9,723.6	10,220.3		

Among above mentioned sectors, Ministry of Health Malaysia (MOH) (2015) suggested that Small and Medium Size Enterprise (SMEs) such as

designated site restaurant, street stalls/kiosk, and self-service cafeteria posed significant risk of food contamination due to poor practices in food handling. Poor or unsafe practice in food handling then lead to foodborne disease outbreak.

Table 2 recapitulates episode of foodborne disease outbreak and number of cases of foodborne illness in Malaysia from 2012 and 2013 (A'aisah and Norrani (2015). Total case reported in 2012 and 2013 is 14202 cases with Selangor leading with 2150 cases, Sabah with 2044 cases, and Perak with 1746 cases. In terms of foodborne disease outbreak, Sarawak recorded highest number of outbreak which is 69 in 2012 and 82 in 2013 followed by Selangor which recorded 63 outbreaks in 2012 and 80 outbreaks in 2013 and Perak which recorded 57 outbreaks on 2012 and 52 outbreaks on 2013. In 2012, only one cases of foodborne disease cause mortality at Johor but in 2013 food poisoning was revealed to cause 12 mortality of Malaysian. Sabah reported seven mortalities in 2013, followed by Kedah which reported three mortality and Sarawak with one mortality case.

Table 2: Episode of foodborne disease outbreak and number of cases of foodborne illness in Malaysia from 2012 and 2013

State/Disease	Episode of Foodborne Outbreak (2012)	Total Case	Number of Death	Episode of Foodborne Outbreak (2013)	Total Case	Number of Death
Perlis	7	245	0	8	182	0
Kedah	19	1018	0	18	1115	3
P. Pinang	11	360	0	15	556	0
Perak	57	1397	0	52	1746	0
Selangor	63	2078	0	80	2150	0
Kuala Lumpur	7	231	0	21	446	0
N. Sembilan	16	674	0	18	450	0
Melaka	28	915	0	24	705	0
Johor	61	1486	1	42	1447	0
Pahang	28	662	0	22	501	0
Kelantan	20	611	0	27	1137	0
Terengganu	26	855	0	28	582	0
Sarawak	69	1252	0	82	1141	1
Sabah	42	1397	0	58	2044	7
Labuan	0	1	0	0	0	0
Total	454	13182	1	495	14202	12

To quote a few case of foodborne disease outbreak in Malaysia, there are one of the case occurred in Kuala Nerang, Kedah on 2014. According to Food Safety News (2014) the case demonstrate that more than 150 students at a boarding school were hospitalized resulting from foodborne illness. Unsafe practices when handling of food, such as violation in temperature control identified as contributing factors towards increasing number of foodborne disease outbreak cases (MOH, 2015; Adam and Moss, 2008).

3.2 Knowledge and perception of safe food handling as contributing factor of awareness

Numbers of study related to food safety issues, such as safe practices in food handling adapted Knowledge, Attitude and Practice Model (KAP Model) (Nasser et al., 2015; Tan et al., 2013 and Poh & Birchenough, 2008). According to Vandamme (2009) as a KAP survey is directed to study human behavior related to a certain phenomenon, it identifies what people know (Knowledge), how they feel (Attitude) and what they do (Practice). However, Oxford Dictionary (2015) defined awareness as "knowledge or perception of a situation or fact". As a result, to relatively study regards on awareness, knowledge and perception is two important aspects. Supporting the statement, when Badrie et al. (2006) study the awareness and perception regarding food safety hazards, model of perception and knowledge also being applied. Thus, the hypotheses as below were developed:

H1 There is a significant relationship between knowledge and safe food handling practices.

H2 There is a significant relationship between perception and safe food handling practices.

3.3 Knowledge on safe food handling

CDC (2014) list down safe practices in food handling into five different dimensions which are 1. Minimizing risk of contaminated ingredients, 2. Temperature control, 3. Personal hygiene, 4. Minimizing risk of cross contamination and 5. Sanitation.

a. Minimizing Risk of Contaminated Ingredients

   Food can be contaminated via microbiological, chemical and physical source (Sharmila, 2011). However, according to the CDC (2015) most of the cases related to the outbreak of foodborne disease associated with microbiological hazards followed by chemical hazards. Case related to physical hazards is rarely exposed. Causal factor by microbiological, chemical and physical hazards contribute to foodborne disease cannot be totally diminish. As a result, prevention of to minimize risk of contaminated ingredients is vital. For example, Lynch et al. (2008) explained, key points to obey in Hazard Analysis and Critical Control Point systems (HACCP) is prevention of contamination of fresh produce. Jacqueline (2013) also highlight to minimize risk of contaminated ingredients, prevention of chemical and physical hazards is crucial. Jacqueline (2013) state that, it is important to separate chemicals and food supplies in the different storage room. In addition, the chemicals should be clearly labeled to avoid misunderstanding. It is important for food handlers to wear gloves to cover any finger cots or bandages, not wearing jewelry, and avoiding nail polish and artificial nails when handling food to prevent contamination cause by physical hazards (Mensah et al., 2003).

b. Temperature Control

   Unsafe practice that contributes to error in temperature control can lead to contamination of food and lead to outbreak of foodborne disease. WHO (2011) describes that exposing food for a longer period of time at

room temperature can cause bacteria (such as *Staphylococcus aureus*, *Salmonella Enteritidis*, *Escherichia coli* O157:H7, and *Campylobacter*) multiply to a hazardous level and then can lead to foodborne disease. MOH (2015) describes bacteria can multiply fast/rapidly in the range of temperature between 4 degrees Celsius and 60 degrees Celsius. In this range of temperature, bacteria can double in numbers as little as 20 minutes. The range of this temperature, as mention before called "Danger Zone" or in complete form "Food Temperature Danger Zone" (MOH, 2014).

c. Personal Hygiene

According to Tan et al. (2013) personal hygiene among food handlers covers the aspect related to hand hygiene (e.g. proper handwashing, not wearing jewelry when handling food, not touching food with bare hand) clean attire (e.g. clean and complete uniform), personal health (e.g. typhoid injection), and personal habit or behavior (e.g. no smoking when handling food, not touching nose or face when handling food). Food handlers with poor personal hygiene can be medium in spreading the food-borne diseases directly, or cause by cross-contamination.

d. Minimizing Risk of Cross Contamination

Food Standard Agency (FSA) (2015) describe cross contamination as one of the most contributing factors of foodborne disease. Cross contamination occurs when harmful microorganisms that can cause foodborne disease are spread to the food from other food, surfaces, hands or equipment. According to WHO (2015), 25% of foodborne outbreaks are diligently related to cross-contamination. It involves in lacking hygiene practices, contaminated equipment, and contamination via food handlers, processing, or inadequate storage. Example of unsafe practice related to cross contamination is handling of raw meat in close range of raw vegetables. It causes outbreaks of *E. coli* O157:H7 in 1993 in the Pacific Northwest (Jackson et al., 2000).

e. Sanitation

To safely provide food to consumers, food handlers need systematic sanitation facilities, sanitation management, knowledge of personal hygiene, and sanitary practices (Jeon et al., 2015). Jeon et al. (2015) also state that even when complete sanitation equipment and facilities are in the foodservice environment, unsafe practice in food handling still occur due to inadequate supervision and management There are several studies indicates that violation in application of sanitation among food handler can to lead foodborne disease. For example, a study related to hotel's food handlers shown that their level of sanitation practice to be high, with percentage of over 80 percent (Kim, 2004). Kim (2004) then describe there were a lot of immoral habits and difficulties with negligence among management and excessive workloads; that lead the food handlers to neglect their responsibility towards sanitation when handling food.

3.4 Perception on safe food handling

Perception with regards to safe food handling is normally relatively positive among food handlers but positive perception actually did not reflect the actual food handling process. Research by Badrie et al. (2006) indicates that most of the food handlers (83.2%) in their study felt that safe food handling is very important issue when handling food but more than 50 % of their respondents could not recall when last their kitchen drains were sanitized. In addition to above study, another study by Aygen (2012) also indicates that although that more than 75 % of the respondents in the study believed that they had adequate knowledge of preparing safe food and high degree of attention was given to safe and hygienic food preparation conditions during food preparation, findings of the study were not that encouraging because it was found that in the sense that knowledge of safe food handling among the respondents was found not to be at good or satisfactory level. In addition to above statement, Clayton et al. (2002) also describes that majority of the food handlers state that they do not always put into practices food safety knowledge they know they should applying. As a result from above mentioned study, it was discovered that the transfer of knowledge or awareness to actual practice is unpredictable. This proposes that food handlers might be put food safety practices less frequently than the self-reported in many study. In addition**,** demographic factors also one of the contributing factors reflect food handler's perception on safe food handling. For example, research done throughout 394 responding food handlers show a positive perception towards safe food handling, significantly higher in older and more educated women, was reported by the great majority, who agreed that improper storage of food represents a health hazard (95.7%), that washing hands before handling unwrapped raw or cooked food reduces the risk of food poisoning (93.2%), and that the awareness of the temperature of the refrigerator is crucial in reducing risk of food poisoning (90.1%) (Angelillo et al., 2001).

4.0 Research methodology

4.1 Survey

Figure 2 - 7 shows the demographics of the 322 food handlers by sex, age, ethnicity, education level, and years of experience in foodservice industry and types of foodservice business of respondents. These respondents were answered structured questionnaire. In regards to the sampling, sample in this study fall under non-probability sample which are sample that do not have any probability of becoming sample. The sample was selected randomly from those who are currently available during data collection. It was more convenient and effective way of getting sample due to time and location constraint. In addition, use of non-probability sampling was practicable in the social science field as it was likely to get the sample more effectively.

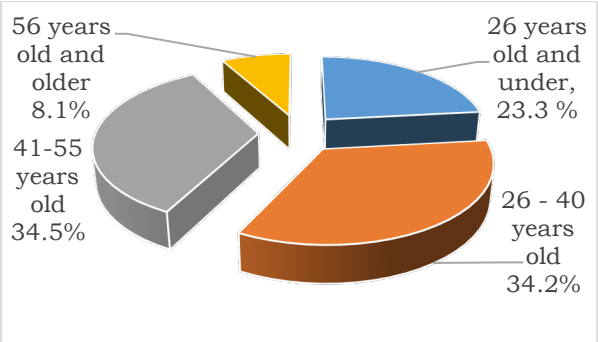

Figure 2: Respondent's age

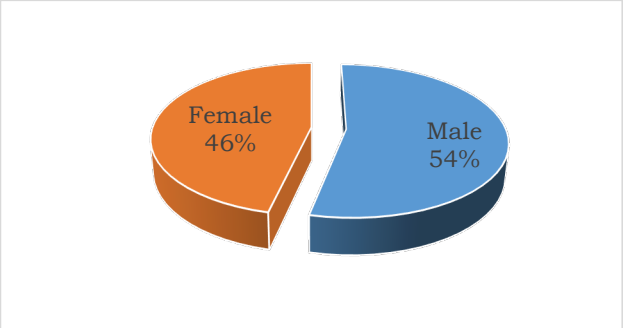

Figure 3: Respondent's gender

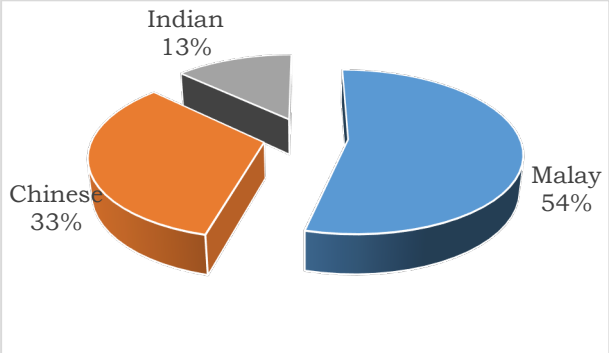

Figure 4: Respondent's race

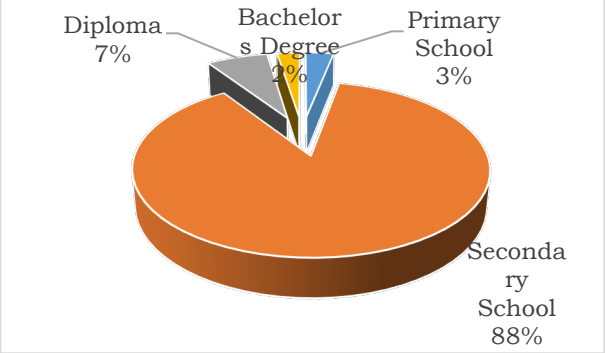

Figure 5: Respondent's education

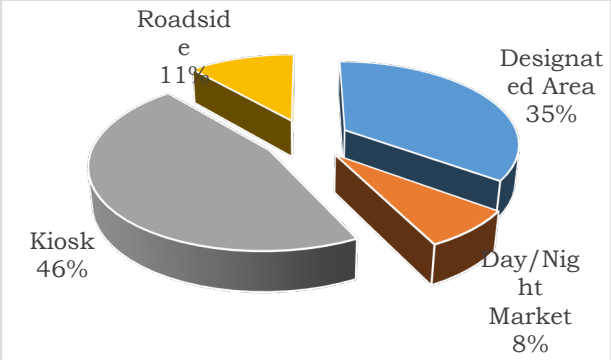

Figure 6: Respondent's Food Premises Location

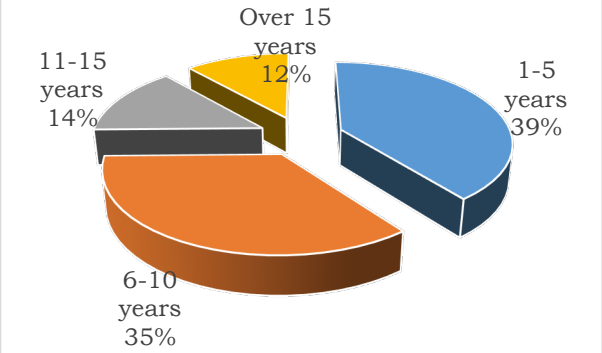

Figure 7: Respondent's Years of Experience in Foodservice Industry

4.2 Questionnaires

The questionnaires survey was in 5 point Likert scale format as shown in Table 3. The questionnaire was design to obtain information on demographics (age, sex, ethnicity, education level, years of experience in foodservice industry and types of foodservice business) of respondents. Areas of inquiry include knowledge on safe food handling, perception on safe food handling and safe food handling practices. The questionnaire was pilot tested on 30 comparable food handlers. Adjustments are made if necessary.

Table 3: 5 Point Likert Scale Format

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

4.3 Statistical analysis

Statistical Analyses Statistical Packages for Social Science (SPSS) was used to analyze the collected data. The analytical method which are reliability, descriptive statistic, correlation and multiple regression analysis was used to analyze all the gathered data.

5.0 Analysis and result

5.1 Food handler's knowledge and perception of safe food handling

Descriptive analysis in regards to above statement proved that food handler's awareness in relation to knowledge and perception is in good level, especially when focusing on the perception towards safe food handling. Table 4 summarize level of food handler's knowledge on safe food handling. Based on result obtain illustrated in Table 4, most of the respondent has slightly good knowledge on safe food handling because Means (M) was ranging from 3.82 – 4.02. Majority of the food handlers agree that when raw food items such as chicken, fish or meat are delivered, the quality of the items must have checked first (M= 4.02, SD = 0.965). However, the result illustrated that most of the respondents have less knowledge related temperature control/abuse during food preparation. For example, most of the respondents slightly agree when displaying food, temperature of the equipment (salamander or bain-marie) must be at least 63 degrees Celsius (M = 3.82, SD = 1.121). Moreover, most of the respondents also slightly agree when they thermically processing food, measuring internal food temperature is important to ensure harmful bacteria are destroyed (M=3.83, SD=1.088).

Table 4: Level of Food Handler's Knowledge on Safe Food Handling

Items	Means	SD
If fresh vegetables want to be stored in the refrigerator together with fresh meat, fresh vegetables must be stored on the highest rack in the refrigerator.	3.93	1.019
Lowest allowed temperature for maintaining thermically processed food warm is 63 degree Celsius.	3.90	0.976
When the food smells bad, it may be contaminated with bacteria causing foodborne disease.	3.92	1.054
Bacteria causing foodborne disease can be transfer from raw chicken to fresh vegetables.	3.99	1.065
When displaying food, temperature of the equipment (salamander or bain-marie) must be at least 63 degree celsius.	3.82	1.121
In refrigerator microorganisms that are on/in a foodstuffs grow very slowly.	3.93	0.953

When raw food items such as chicken, fish or meat are delivered, the quality of the items must checked first	4.02	0.965
When thermically processing food, measuring internal food temperature is important so that we know when harmful bacteria are destroyed.	3.83	1.088
When having a diarrhea, you can't handle food.	3.91	1.011
When handling food, person can't wear jewelry.	3.91	1.064
When handling food, you can't to touch your nose, face and hair.	3.95	1.074
You must use hot water and disinfectant cleaners to mop/clean the kitchen floor.	3.90	1.109
Cutting boards for chicken and vegetables must be separated.	3.88	1.098
When your colleagues in the kitchen having vomiting, he can't handle food.	3.97	1.047
After using the toilet, washing my hand is priority before handling food.	3.94	1.037

Table 5 illustrated food handler's perception on safe food handling. Looking at the table, most of the respondent has good perception on safe food handling because Means (M) was ranging from 4.09 – 4.38. To mention certain example, majority of food handlers agree that they have important responsibility to follow all safe food handling principles. (M= 4.38, SD = 0.585). Besides, most of the respondents believed that when storing chicken in the refrigerator for over one night (12 hour) and the refrigerator damaged the chicken is not safe to be prepared and cooked (M = 4.09, SD = 0.597. In addition, they also believed that if canned food exceeds only one day of its expiry date it is not safe to eat (M = 4.15, SD = 0.547.

Table 5: Level of Food Handler's Perception on Safe Food Handling

Items	**Means**	**SD**
I have to make sure that prepared food is safe for customers	4.29	0.542
My important responsibility is following all safe food handling principles.	4.38	0.585
My handling with foodstuffs does affect food safety.	4.30	0.607
It is important that I constantly educate myself about safe food handling	4.27	0.600
I think that foodborne disease is more dangerous for vulnerable group of people (e.g. children, older people, and pregnant women).	4.25	0.634
If condition prohibits me from following safe food handling principles, I'm obliged to notify my supervisor or my superior	4.37	0.615
I believe that other employees, dealing with food, respect good hygiene practice principles	4.27	0.620
All conditions that enable me to do my job according to safe food handling principles are ensured.	4.29	0.662

I think raw food items are likely containing more bacteria compare to cook food.	4.27	0.593
I think if canned food exceed only one day of its expiry date it is not safe to eat	4.15	0.547
I believe that it is not safe to put cooked food on a plate that held raw meat poultry or seafood.	4.31	0.630
I think that typhoid injection is must for food handlers in Malaysia and it is not causing me trouble.	4.39	0.603
I think cooking improperly thawed chicken can cause food borne disease.	4.29	0.645
I'm storing chicken in the refrigerator. For over one night (12 hour) the refrigerator damaged. I think the chicken is not safe to be prepared and cooked.	4.09	0.737
I believe that consumer who is buying and eating food at my premises is free from getting foodborne disease	4.20	0.597

5.2 Level of safe practices in food handling among the food handlers

All questions related to safe practices in food handling are negative questions based on negative practice in food handling. As a result, if respondent's answer 1 or 2, it means that they are not doing the negative practices. In contrast, if the respondent's answer 4 or 5 it means they are doing negative practices in food handling.

Table 6 represents the safe practices in food handling among the food handlers. Looking at the table, most of the respondents practice good practices of safe food handling because Means (M) was ranging from 2.1 – 2.54. For example, majority of food handlers disagree that they are using cold water and regular cleaners to mop the kitchen floor (M= 2.54, SD = 1236). Besides, the respondents also disagree that they kept raw food and cooked food in same containers (M = 2.01, SD = 1243). In addition, they also disagree that last time they took typhoid injection was more than three years ago (M = 2.27, SD = 1268).

Table 6: Level of Safe Food Handling Practices among Food Handlers

Items	Means	SD
I'm kept raw food and cooked food in same containers	2.01	1.243
I'm put cooked food at room temperature	2.37	1.281
I'm put tray containing frozen food on the ground to be defrosted as it make my work easier and faster	2.03	1.271
I'm put raw food items such as chicken and meat in the same rack in the refrigerator with fresh vegetables before cooking process	2.17	1.245
After using the toilet, I will not wasting time and go straight to continue my work in the kitchen	2.32	1.182
I'm using insect repellent to spray cockroach as when on duty in a kitchen	2.28	1.274
If I'm having diarrhea and vomiting I can handle food	2.17	1.312

I'm touching cooked food with bare hand as its make it easier and faster for me to complete my work.	2.23	1.272
If I want to use canned food, I will use it without any doubt because I'm confident canned food is always safe to eat	2.34	1.248
I'm using same cutting board for raw chicken and cucumber for salad.	2.17	1.390
I'm checking refrigerator temperature once a month.	2.38	1.362
I'm using cold water and regular cleaners to mop the kitchen floor.	2.54	1.236
After receiving raw food items such as fish, chicken and meat, I immediately prepared it to be cook.	2.37	1.264
The knife used for cutting raw meat I later thoroughly wash and once a week I will disinfect it. (e.g: wash with hot water)	2.37	1.254
I'm not checking temperature of display cooked food regularly at the buffet line	2.34	1.331
Last time I took typhoid injection was more than three years ago.	2.27	1.268
I'm using same towel for wiping table and wiping washed cutleries	2.09	1.272
In our premise, we are not using bain-marie or salamander when serving cooked food at buffet line.	2.23	1.383
I'm using regular cleaners on the surface of food preparation table/area.	2.43	1.284
I'm wearing ring when handling food	2.04	1.367

5.3 The relationship between knowledge and perception of food handlers and safe practices in food handling

A multiple regression which includes all the variables which are Knowledge of Safe Food Handling, Perception on Safe Food Handling and Safe Practices in Food Handling is conducted to test the framework model used in this study.

The results of the regression reported in a Table 7 indicated Knowledge of Safe Food Handling and Perception on Safe Food Handling explained 28.7% of the variation in Safe Practices in Food Handling. Thus, it can conclude that at least one of independent variables has significantly related to Safe Practices in Food Handling (R^2=0.287, F (2,319) = 64.218, P-value=0.000 < 0.05). In this model, the most influence factors are Knowledge of Safe Food Handling (β = 0.479, p-value = 0.000 < 0.05) followed by Perception on Safe Food Handling (Perception) (β = 0.115, p-value = 0.026 < 0.05). Since the both of independent variable p-value is less than 0.05, it can conclude that there is a significant relationship exist between knowledge and safe food handling practices. In addition, the result also clearly illustrated that there is significant relationship exist between perception and safe food handling practices.

Table 7: Results of Linear Regression of Independent and Dependent Variables

Safe Practices in Food Handling		Value
	R^2	0.287
	F(2, 319)	64.218
Knowledge	Standardized Coefficient	0.479
	P-value	0.000*
Perception	Standardized Coefficient	0.115
	P-value	0.026*

*p-value < 0.05

6.0 Discussion

Descriptive analysis proved that food handler's awareness in relation to knowledge and perception is in good level. From the descriptive analysis, respondents showed that they have slightly good knowledge on safe food handling measured by five different elements which are knowledge on minimizing risk of contaminated ingredients, temperature control, personal hygiene, minimizing risk of cross contamination, and sanitation. This result indicates similar comparative result with earlier study by Tan et al. (2012), Ansari-Lari et al. (2010) and Abdul-Mutallib et al. (2012). However, the study also reveals that most of the respondents demonstrates they have fewer knowledge regards on temperature control/abuse during food preparation. As a result, it can be concluded that temperature is one of the important factors that can cause foodborne disease outbreak. Supporting the statement, Embun (2013) and Safina et al. (2013) describes the causes of foodborne disease outbreak that happen at Sungai Petani, Kedah in 2013 is due to error in temperature control (improperly cooked foods which are stored at room temperature for almost a day and contaminated with salmonella bacteria). In addition, Adam & Moss (2008) stated that "temperature control is one of the key tools in controlling microbial growth in foods and, where inadequately performed, is a major cause of the proliferation or permanence of microbial hazards and, thus, subsequent food borne disease". In relation to good perceptions towards safe food handling, result of this study provide similar comparative result with earlier study which looked into risk perception of food safety by food-handlers by Aygen (2012).

Furthermore, descriptive analysis which illustrated food handler's safe practices in food handling demonstrated that most of the respondents practice good practices of safe food handling. This result indicates similar comparative result with earlier study which looked into knowledge, attitudes and practices of food handlers on food safety in food service operations by Sani & Siow (2013) and knowledge, attitude and practices regarding food hygiene and sanitation of food handlers by Ansari-Lari et al. (2010) and Abdul-Mutallib et al. (2012).

Multiple regression analysis to analyzed relationship between knowledge of safe food handling and safe food handling practices among food handlers demonstrates that significant relationship exists between the variables. The result indicates similar comparative result with earlier study by Toh & Birchenough (2000) which focused on food safety knowledge and

attitudes on culture and environment impact on hawker. The result also supports earlier study by Mojca Jevsnik et al. (2008) which focused on food safety knowledge and practices among food handlers. Multiple regression analysis also demonstrates the relationship exist between perception of food handlers and safe practice in food handling. But based on the result obtain from this study, it determines that knowledge is a much more significance influence towards safe practices in food handling compare to perception. Significance relationship that exist between perception of food handlers and safe practices in food handling provide similar result comparative to previous study by Badrie et al. (2006) which focused on awareness and perception to food safety hazards and study by Carbass et al. (2013) which focused on investigation on the awareness associated with foodborne diseases.

7.0 Conclusion and recommendations

The research succeeded to discover that food handler's awareness which measured by knowledge and perception have significant relationship with safe practice in food handling. Food handler's knowledge and perception in terms of safe food handling is in good level. Furthermore, based on the result obtain through this study, food handlers demonstrate that they do practice safe practices when handling food.

The study that has been dedicated during the research practice benefit to further understanding the awareness of food handlers to safe practices in food handling. In the other hand, food handler's also needed to put into practice their knowledge about safe food handling. Next, government can also demonstrate their action by organizing a better ruling system and gazette a new law in regards to reducing foodborne disease outbreaks. Furthermore, the study also reveals that there is a trace of foodborne disease outbreak cases in Sungai Petani, Kedah after major incidents of foodborne disease outbreak on 2013. Related to above statement, government body should take further action by educating and creating awareness to food handlers to provide safe food to consumers. In short, increasing knowledge of food handlers is a key factor to prevent foodborne disease outbreak.

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