

Knowledge, attitude and practice regarding food poisoning and its prevention in Malaysia: a systematic literature review

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Abstract

Foodborne diseases, including food poisoning, are becoming a concern as the increasing prevalence of food poisoning and incidents worldwide. This study reviewed previous knowledge, attitudes and practices (KAP) studies on food safety and the prevention of food poisoning in Malaysia. This study also reviewed the behavioural evidence, similarities and differences of the KAP food safety and food poisoning prevention studies in Malaysia and provided an overview of the relationship between KAP level and the socio-demographic profile of the respondents. Sixteen studies covered from 2015 to 2020 (March 2020) were selected. Research was identified through Scopus and Web of Science as main databases and manual searching in Science Direct, PubMed and Springer-Link as the electronic database with Google Scholar as search engines. The journal (research articles) within last five years from 2015 to March 2020, the published articles are easily accessible for researchers, open access with full text, the language was limited to English, and research studies that were done in Malaysia. Knowledge was the most influential factor in the prevention of food poisoning. Ten articles reviewed showed that there was a good level, two studies showed a moderate level, and three studies reported a poor level of knowledge among respondents. For the attitude part, eight studies showed a positive attitude towards food safety attitudes and the prevention of food poisoning with a high level of satisfaction. However, one study had reported that there was a negative attitude to the prevention of food poisoning among respondents. For the practical part, six studies had a good level, two studies showed that there was an average score of food safety towards practices and food poisoning prevention, and one study reported that there were unsatisfactory food safety practices. In the reviewed studies, there was a positive association between KAP's level of food poisoning prevention and its socio-demographic profile, including age, sex, ethnicity, education, income, work experience, and attending food safety and hygiene training. There is a need to improve knowledge, awareness and practice among the community on food safety due to the increase in foodborne disease cases in Malaysia.

1. Introduction

Foodborne diseases are defined as the toxic or infectious in nature that caused by bacteria, viruses, parasites, or chemical substances that enter the body through contaminated food or water, which can give an infection including severe diarrhoea and meningitis (WHO, 2019). There are five categories of foodborne diseases including cholera, typhoid fever, hepatitis A, dysentery, and food poisoning (i.e. associated with acute gastrointestinal symptoms like diarrhoea and vomiting)

(WHO, 2018). The common symptoms of foodborne diseases are nausea, vomiting, stomach cramps, and diarrhoea (CDC, 2019).

Approximately about two million of fatal cases occur worldwide in a year due to food poisoning particularly in developing countries (WHO, 2019). About 600 million people worldwide fall ill after eating contaminated food, and 420 000 fatal cases occur every year. The most common diseases due to digestion of contaminated food are diarrhoeal diseases, which cause 550 million people

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to fall ill and 230 000 fatal cases every year, especially in developing countries (WHO, 2019). The incidence rate and cases of food poisoning increased in Malaysia from 2000 to 2017 (Ministry of Health Malaysia, 2018). Growing cases involving the consumption of non-hygienic food are becoming more serious, not just among the public but also among school children, even though numerous attempts have been made by the authorities. Consumer safeguards in food handling are critical to eliminate or reduce the growth of emerging bacteria, avoiding cross-contamination that would prevent foodborne diseases from occurring (Moreb *et al.*, 2017).

Lack of knowledge, attitude and practice to prevent food poisoning can lead to foodborne outbreaks. Food mishandling and poor personal hygiene may allow pathogens to grow and multiply in sufficient numbers and cause human illness (Abdullah, 2015). Understanding the interaction between consumers on the prevailing knowledge, practices and beliefs of food safety can minimize the occurrence of foodborne illness (WHO, 2001). It is, therefore, necessary to educate consumers about the choice of food premises as well as the proper food safety and hygiene guidelines for food preparation at home.

This study reviewed previous knowledge, attitudes and practices (KAP) studies on food safety and the prevention of food poisoning in Malaysia. This study also reviewed the behavioural evidence, similarities and differences of the KAP food safety and food poisoning prevention studies in Malaysia and provided an overview of the relationship between KAP level and the socio-demographic profile of the respondents.

2. Materials and methods

2.1 Exploration resources

Literature was conducted in March 2020 using Scopus and Web of Science as main databases. Only research articles from 2015 to March 2020 were included. Research articles were chosen because research articles act as the primary sources that offer empirical data (Shaffril *et al.*, 2019). Nevertheless, it should be noted that no database comprehensive or perfect including Scopus and Web of Science (Shaffril *et al.*, 2019). Therefore, this study conducted a manual searching on several established sources including Science Direct, PubMed and Springer-Link as an electronic database with Google Scholar as search engines to obtain the articles regarding KAP towards food poisoning in Malaysia. The language was limited to English and open access with full text.

2.2 The systematic review process in selecting articles

2.2.1 Identification process

The first process in the systematic review was the identification of keywords, followed by the process of searching the similar and interrelated terms of study based on the previous studies, encyclopedia, dictionaries, and thesaurus. After all relevant and related terms managed to identify, the search strings on Scopus and Web of Science database were conducted in March 2020 (Table 1). Literature was completed using the term “knowledge”, “attitude”, and “practice”, and synonyms for the terms; knowledge = awareness, recognition; attitude = belief, practice = habit. There were five main keywords used to search appropriate studies includes “knowledge”, “attitude”, “practice”, “food poisoning”, and “Malaysia”. The interchangeable word used in this study was from food poisoning to food safety and food hygiene. The studies that addressed only “knowledge” or “attitude” or “practice” or combination of any two of these terms were included to account the number of articles related to the topic. In total, 165 articles were chosen in the first stage of the systematic literature review process.

2.2.2 Screening process

The main purpose of the screening process was to remove duplicate articles and articles that do not meet the inclusion criteria. A total of 110 articles remained in the first stage after the removal of duplicate articles. As previously stated, the inclusion criteria for this review included only journals for the last five years from 2015 to March 2020; published articles in English that are easily accessible to researchers; open access to full text; and was conducted in Malaysia. The exclusion criteria were the publication that is in the form of conference proceeding, chapter in a book, book, book series, meta-synthesis, meta-analysis, review and systematic review. As a result, a total of 40 articles remained on the basis of inclusion and exclusion criteria.

2.2.3 Eligibility process

A total of 40 articles were prepared for the third process in systematic literature review known as the eligibility. In this stage, the abstract and main contents of all the articles were examined assiduously to achieve the objectives of the current study and to fulfil the inclusion criteria. A total of 24 articles were excluded after reviewing the abstracts and main contents. In total, 16 articles were selected to be reviewed.

2.3 Data extraction and analysis

PRISMA table or Preferred Reporting Items for a systematic review is a published standard to conduct a

Table 1. The search string

Main database	Keywords	Search string
Web of Science (WoS)	Knowledge, attitude, practice, food poisoning, Malaysia	(TS=((“knowledge*” OR “aware*” OR “recognition”) AND (“attitude*” OR “belief*”) AND (“practice*” OR “habit*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”))
	Knowledge, attitude, food poisoning, Malaysia	(TS=((“knowledge*” OR “aware*” OR “recognition”) AND (“attitude*” OR “belief*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”))
	Knowledge, practice, food poisoning, Malaysia	(TS=((“knowledge*” OR “aware*” OR “recognition”) AND (“practice*” OR “habit*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”))
	Attitude, practice, food poisoning, Malaysia	(TS=((“attitude*” OR “belief*”) AND (“practice*” OR “habit*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”))
	Knowledge, food poisoning, Malaysia	(TS=((“knowledge*” OR “aware*” OR “recognition”) (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”))
	Attitude, food poisoning, Malaysia	(TS=((“attitude*” OR “belief*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”))
	Practice, food poisoning, Malaysia	(TS=((“practice*” OR “habit*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”))
Scopus	Knowledge, attitude, practice, food poisoning, Malaysia	TITLE-ABS-KEY((“knowledge*” OR “aware*” OR “recognition”) AND (“attitude*” OR “belief*”) AND (“practice*” OR “habit*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”)
	Knowledge, attitude, food poisoning, Malaysia	TITLE-ABS-KEY((“knowledge*” OR “aware*” OR “recognition”) AND (“attitude*” OR “belief*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”)
	Knowledge, practice, food poisoning, Malaysia	TITLE-ABS-KEY((“knowledge*” OR “aware*” OR “recognition”) AND (“practice*” OR “habit*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”)
	Attitude, practice, food poisoning, Malaysia	TITLE-ABS-KEY((“attitude*” OR “belief*”) AND (“practice*” OR “habit*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”)
	Knowledge, food poisoning, Malaysia	TITLE-ABS-KEY((“knowledge*” OR “aware*” OR “recognition”) (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”)
	Attitude, food poisoning, Malaysia	TITLE-ABS-KEY((“attitude*” OR “belief*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”)
	Practice, food poisoning, Malaysia	TITLE-ABS-KEY((“practice*” OR “habit*”) AND (“food safety” OR “food poisoning” OR “food hygiene”) AND “Malaysia”)

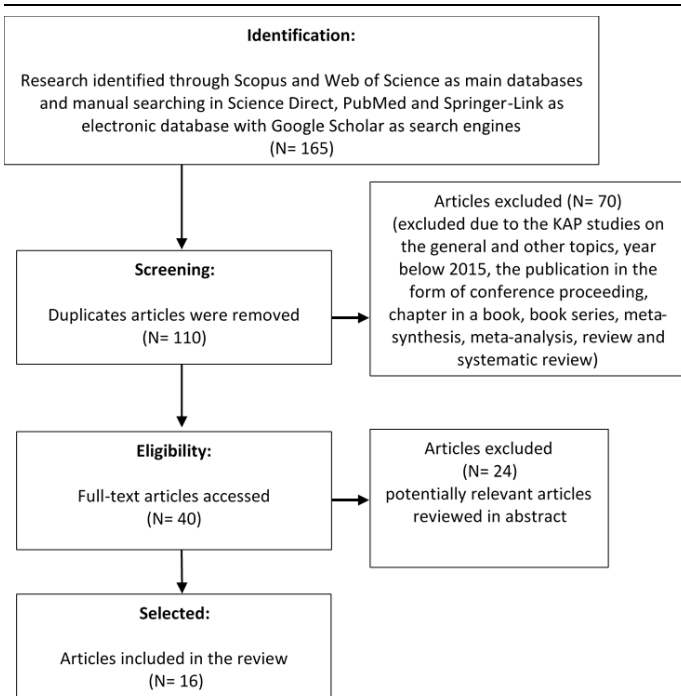


Figure 1. Study selection process

systematic literature review. A publication standard is required to guide the researchers to obtain the related and

necessary information that will enable them to examine and evaluate the thoroughness and quality of a review (Shaffril *et al.*, 2019). Sierra *et al.* (2015) had claimed that PRISMA can identify the inclusion and exclusion criteria for a particular study and is often used within medical studies. The PRISMA table was adopted and used in this study by reporting the main process in conducting a systematic literature review which includes identification, screening and eligibility process. A flow diagram for the study selection process is shown in Figure 1. Further consideration of Malaysia as a country, the articles included in the review led to 16 studies. The following data were extracted from the selected articles: KAP constructs (Knowledge, Attitude, Practice), authors, publication year, sample size, study area/district, and main outcomes as shown in Table 2.

2.4 General study characteristic

A total of 16 studies on knowledge, attitude and practice regarding food poisoning in Malaysia covered from 2015 to March 2020 were selected. 16 reviewed articles included on knowledge, attitude and practice

Table 2. Studies based on KAP considered in the review and their characteristics

Study	References	Study area/ District	Respondent	Main Finding
1.	Mohd Firdaus Siau <i>et al.</i> (2015)	Food court at Putrajaya, Malaysia	274 food handlers	<p>Knowledge</p> <ul style="list-style-type: none"> The respondents had a high level of knowledge Two factors that influence the level of knowledge among the respondents; the age and attended food handler training. Level of knowledge increasing accordingly to the level of age group. The mean of knowledge among the respondents not attended food handler training lower than attended food handler training. <p>Attitude</p> <ul style="list-style-type: none"> The respondents showed a positive attitude in food safety handling and at a high level of satisfaction; except topic related to refrozen of defrosted food The educational level of food handlers significantly influence the attitudes of food handlers; the mean level of attitudes increased accordingly to the level of education. <p>Practice</p> <ul style="list-style-type: none"> Knowledge and attitude not turned into safe practices with a mean score of 79.5%. Five aspects of personal hygiene were not practised properly by a majority of respondents which related to rubbing their hands on hair, face etc; refreeze defrosted foods; touch food that does not wrap up with the bare hand; use the same towel to clean many places, and use apron as a towel to clean hand. Two factors significantly influencing food handlers' practices were the education level and nationality of food handlers. The mean level of practices was higher among the food handlers with education compared to food handlers without formal education and the average scores increased with educational level.
2.	Norhaslinda <i>et al.</i> (2016)	*not specific. Four different districts of Terengganu hospital, Terengganu Malaysia	54 food handlers	<p>Knowledge</p> <ul style="list-style-type: none"> Respondents have a good level of knowledge Knowledge significantly associated with gender; female respondents have a high score in knowledge aspects than male respondents. Knowledge had associated with age; knowledge increased as age increased. No significant difference between the level of knowledge concerning the attendance of the training course. <p>Attitude</p> <ul style="list-style-type: none"> Good level of attitude. Attitude significantly associated with gender; female respondents have a high score in attitude aspects than male respondents. Attitude significantly associated with age; showed the highest mean points of attitude as group age increase. There was a significant difference between the level of attitudes with working experiences; high working experience gives positive attitudes in a food operation. No significant difference between the level of attitude concerning the attendance of training courses. <p>Practice</p> <ul style="list-style-type: none"> Had a good level of practice among food handlers. Practice significantly associated with gender; female respondents have a high score in practice aspect than male respondents. The practice had an association with age; respondents with age 21 -30 years old showed the lowest average of practices. No significant difference between the level of practices with respect to the attendance of the training course

Table 2 (Cont.). Studies based on KAP considered in the review and their characteristics

Study	References	Study area/ District	Respondent	Main Finding
3.	Dora-Liyana et al. (2018)	*not specific. Seven boarding schools in the Northern Region of Malaysia	134 food handlers	<p>Knowledge</p> <ul style="list-style-type: none"> • The respondents have good knowledge of food safety and food hygiene, but most of the respondent lacks knowledge of equipment hygiene and did not know that dishtowels were not suitable to wipe wet equipment. • Female respondents scored significantly higher knowledge scores on personal hygiene and cross-contamination knowledge compared to male respondents. • Knowledge of equipment hygiene is positively correlated with personal hygiene and temperature control knowledge. • There is a positive correlation between knowledge of equipment with temperature control knowledge and personal hygiene. • There is a positive significant relationship with personal hygiene knowledge and food safety knowledge; indicated the increase of knowledge of respondents on food safety might increasing the respondent's attitude towards food safety. <p>Attitude</p> <ul style="list-style-type: none"> • Showed high mean score for food safety attitude among the respondents. • Female food handler's food safety attitudes were statistically higher than male; indicated attitude significantly associated with gender. • Food safety attitude had a positive significant relationship with overall food safety knowledge and personal hygiene knowledge; indicated that the food handler's attitude towards food safety increasing with increasing knowledge on food safety. <p>Practice</p> <ul style="list-style-type: none"> • Good food safety practices among the respondents. • Practice significantly associated with food handlers training course; food handlers that attended food handling courses have higher self-reported food safety and hygiene practices than those who not obtained any training. • Self-reported food safety and hygiene practice sources were not affected by educational level. • Self-reported food safety and hygiene practice have a positive significant relationship with overall food safety knowledge, equipment hygiene knowledge and food safety attitude.
4.	Woh et al. (2016)	Kuala Terengganu (80), Ipoh (184), Shah Alam (119) Malaysia	383 migrants food handlers	<p>Knowledge</p> <ul style="list-style-type: none"> • The respondents showed poor knowledge of food safety. • The knowledge among the respondents was poor on the symptoms of foodborne pathogens and foodborne illness and fair on food hygiene and cleanliness. • There was a significant difference in food safety knowledge among variables country origin and educational level. • Respondents with higher learning scored better on knowledge of food cleanliness and hygiene. Compared to those only having primary and secondary education. • Poor level of knowledge among the respondents was associated with respondents' nationality, poor attendance at food training programs and low educational levels among migrant food handlers. <p>Practice</p> <ul style="list-style-type: none"> • The average score for food handling practices among respondents. • There was a significant effect of nationality and attendance at food training with food handling practice; those who had attended food training had good handling practices than those who did not attend. • Nationality had moderate effect while attendance at food training programs had a small effect of food handling practice.

Table 2 (Cont.). Studies based on KAP considered in the review and their characteristics

Study	References	Study area/ District	Respondent	Main Finding
5.	Lee <i>et al.</i> (2017)	University located in Kuala Lumpur, Malaysia	85 food handlers	<p>Knowledge</p> <ul style="list-style-type: none"> • The respondents have a moderate level of knowledge of food safety. • The respondents score poorly in cross-contamination and sanitation, a high score in personal hygiene. • Education level, working experience, and safe food handling courses give an impact on food safety knowledge. <p>Attitude</p> <ul style="list-style-type: none"> • Overall good attitude showed among the respondents. • Educational level, working experience, and safe food handling course gave an impact on attitudes of food handlers. • Safe food handling course had a significant positive impact on the attitudes toward food safety. <p>Practice</p> <ul style="list-style-type: none"> • The average score for food handling practices among respondents. • There was a significant effect of nationality and attendance at food training with food handling practice; those who had attended food training had good handling practices than those who did not attend. • Nationality had moderate effect while attendance at food training programs had a small effect of food handling practice
6.	Abdullahi <i>et al.</i> (2016)	Kuala Terengganu, Dungun, Kemaman, Besut, Terengganu, Malaysia	165 abattoir workers	<p>Knowledge</p> <ul style="list-style-type: none"> • Majority of the respondents had a low level of knowledge on food safety. • Sex had a significant association with the level of knowledge and the workers; female respondents had a higher level of knowledge than male respondents. • Knowledge had a significant association with the level of practice towards compliance abattoir laws. • Based on personal interviews and observation made during data collection, the males appeared to be more knowledgeable than female respondents. • Level of education had related to the level of knowledge among the respondents as the low educational level was evident in the respondent's demographic characteristics that 2.5% of workers had attended tertiary institutions. • No association between knowledge and attitude among the workers. <p>Attitude</p> <ul style="list-style-type: none"> • Majority of respondents showed a positive attitude <p>Practice</p> <ul style="list-style-type: none"> • Majority of respondents had a good level of practice of compliance. • Sex had a significant association with the level of practice among the workers; the male had a better practice of compliance than female respondents. • 50% of the respondents had a good practice of sanitation and pest control. • Level of education had no association between marital status and level of practice towards compliance with abattoir laws among the workers. • Knowledge had a significant association with the level of practice towards compliance abattoir laws.

Table 2 (Cont.). Studies based on KAP considered in the review and their characteristics

Study	References	Study area/ District	Respondent	Main Finding
7.	Ismail et al. (2016)	Shah Alam, Selangor Malaysia	400 mobile food handlers	<p>Knowledge</p> <ul style="list-style-type: none"> • The respondents knew about personal hygiene. • Food safety knowledge was significantly correlated with personal hygiene. <p>Practice</p> <ul style="list-style-type: none"> • The respondents strongly agree food need to be kept in the fridge for 20hrs before cooking and cook food need to be cover while preparing and selling the food. • Personal hygiene was a moderate contribution to food hygiene practices. • Cross-contamination was less contributed to food hygiene practices among the respondents
8.	Syahira et al. (2019)	Hulu Langat district, Selangor	610 form four students	<p>Knowledge</p> <ul style="list-style-type: none"> • Level of food safety knowledge is insufficient for the majority of the students. • Good food safety knowledge higher among Malays; those with previous experience on food poisoning, those with parents who are food handlers, and in the Pure Science stream. • Level of food safety knowledge is significantly associated with ethnicity, academic stream, whether their parents are food handler and previous experience of food poisoning. • The respondents had a low level of knowledge regarding foodborne pathogens particularly <i>Salmonella</i>. • The difference in knowledge between difference ethnic; Malays had good food safety knowledge than the other ethnic. • There was a significant association between the academic stream and the level of food safety knowledge. • There was no significant difference in knowledge between genders. • There was a significant association between the level of food safety knowledge and whether the respondent's parents' work involving food handling.

Table 2 (Cont.). Studies based on KAP considered in the review and their characteristics

Study	References	Study area/ District	Respondent	Main Finding
9.	Aimi <i>et al.</i> (2018)	*not specific A public university in Malaysia	106 respondents; 53 dietetic students (DS), 53 food handlers (FH)	<p>Knowledge</p> <ul style="list-style-type: none"> The respondents had good knowledge of food poisoning. No significant difference was observed in the level of knowledge toward food poisoning across difference genders, age, education and income levels among food handlers. There was a significant difference in knowledge of food poisoning between genders. DS had higher knowledge regarding food poisoning compared to FH. DS showed a significantly higher mean total percentage score in knowledge and attitude compared to FH. Significant different found for comparison of knowledge between male and female DS with male DS have a high score as compared to female DS. <p>Attitude</p> <ul style="list-style-type: none"> The respondents had a poor attitude towards food poisoning. No significant difference was observed in attitude toward food poisoning across difference genders, age, education and income levels among food handlers. FH and DS had a poor attitude towards food poisoning. <p>Practice</p> <ul style="list-style-type: none"> The respondents had a poor practice of food poisoning. No significant difference was observed in practice towards food poisoning across difference gender, age, education and income levels among food handlers. There was a significant association in practice towards food poisoning with age among DS; total scores of practice towards food poisoning was lower with older age of DS. There was no significant relationship between gender and practice towards food poisoning among food handlers. A significant association between knowledge and attitude and between knowledge and practice was observed among food handlers. No significant association was observed between attitude and practice among food handlers towards food poisoning. Neither was a significant association between knowledge and attitude, knowledge and practice, and between attitude and practice among dietetic students.
10.	Ali, Jie, Prajapati <i>et al.</i> (2018)	Kedah state, Malaysia	869 public university students	<p>Knowledge</p> <ul style="list-style-type: none"> Majority of the respondents showed good knowledge of food safety and hygiene. Total knowledge score found to be moderate. A deeper level of knowledge towards food safety and hygiene was poor among the respondents. Factors behind poor extensive knowledge among respondents were due to the poor level of awareness among the public, as less attention was paid to their eating and preparing methods. <p>Attitude</p> <ul style="list-style-type: none"> Majority of the respondents showed a good attitude towards food safety and hygiene. But, low percentage regarding reasons for not washing hands.

Table 2 (Cont.). Studies based on KAP considered in the review and their characteristics

Study	References	Study area/ District	Respondent	Main Finding
11.	Ruby <i>et al.</i> , (2019a)	Sibu, Malaysia	623 adult consumers	<p>Practice</p> <ul style="list-style-type: none"> • Overall, food safety practices were unsatisfactory. • Male has a good level of food safety practices than female respondents. • Educational level affects the self-reported food safety practices; tertiary graduated scored good in food safety practices, compared to primary graduated and secondary school. • The respondents that had prepared food at home every day has a better score than that prepared food only 3 to 6 days at home.
12.	Asmawi <i>et al.</i> (2018)	Petaling Jaya, Malaysia	108 food handlers in food courts	<p>Knowledge</p> <ul style="list-style-type: none"> • Poor level of knowledge among food handlers (58.3%) • They do attend the training, but lack of understanding of the knowledge that taught during training • Training can improve the knowledge and belief on food safety and give a positive impact on food handling practices. <p>Attitude</p> <ul style="list-style-type: none"> • Overall, there was a high level of satisfaction on the attitude of food handlers toward the food hygiene and safety. • Most of them strongly agreed that they should wash their hands before wearing gloves (77.8%). However, there is slightly decreased in percentage (69.4%) that agreed they should wash their hands after wearing gloves. • There was no significant association between educational level with the attitudes of food handlers. <p>Practice</p> <ul style="list-style-type: none"> • The level of practices among food handlers was good. • Three aspects: glove use, contamination prevention, and hand washing • The aspect of glove used showed the lowest score. • The aspect of handwashing showed the highest score as they always practice right-hand washing procedure, always wash hand after handling waste, always wash hand after break session, always wash hand after doing unhygienic practice, and always wash hands after returning from the toilet. <p>Correlation</p> <ul style="list-style-type: none"> • A positive correlation between mean knowledge score and attitude score, between attitude and practice score, and between knowledge and practice score. • The strongest correlation was between the mean attitude score and mean practice score. • Respondents with low knowledge score also had high practice score.

Table 2 (Cont.). Studies based on KAP considered in the review and their characteristics

Study	References	Study area/ District	Respondent	Main Finding
13.	Ruby <i>et al.</i> (2019b)	Sibu Sarawak, Malaysia	103 adult consumers	<p>Knowledge</p> <ul style="list-style-type: none"> • Overall, food safety knowledge among adult consumers considered as good. • The majority had a high score of food safety knowledge which accounted on the consumers who agreed that it is important to put some hand washing effects after going to the toilet, after handling poultry or raw meats, as well as prior to meal preparation. • There was a significant difference in the scores of knowledge between female and male which showed female received a higher score than male. • There was no significant difference between unemployed and employed consumers regarding food safety knowledge. • There were significant differences in food safety knowledge based on the frequency of food preparation at home, the number of children in a family, educational level and age. • Those aged 20 and 29 and aged 30-39 received a good score of knowledge than those aged above 50. • 99.0% of tertiary graduates achieved a good score of food safety knowledge than primary and secondary school level. • The consumers that have three children received a good knowledge compared to those has one child. • Those who prepared food every day at home received a good score of food safety knowledge than consumers that prepared food at home 3 days per week.
14.	Mahmood <i>et al.</i> (2018)	Penang, Malaysia	203 foreign students	<p>Knowledge</p> <ul style="list-style-type: none"> • The respondents demonstrate better knowledge of food poisoning • Male respondents have a higher score in food poisoning and food handling knowledge than female. • Majority of the respondents agreed on the responsibility of the consumers for food safety after purchase food items. • The high number of respondents had better preparation surfaces in the kitchen and better understanding about the cleanliness of utensils. • Male (93.28%) had a higher score than female (89.2%) students on confirming the suitability of food consumption depends on the taste, appearance, and smell. <p>Practice</p> <ul style="list-style-type: none"> • The respondents demonstrate better practice on food poisoning prevention. • 76.35% of students never used food with damaged packaging which indicates the majority of students are positively concerned about food handling practices. • More than 50 % of students established that food preparation with injuries and buries, and unwashed chopping board/knife are not good practices in food handling. • Female students showed good understandings on the major symptoms of food poisoning, such as fatigue, diarrhoea, and abdominal cramps.

Table 2 (Cont.). Studies based on KAP considered in the review and their characteristics

Study	References	Study area/ District	Respondent	Main Finding
15.	Saipullizan <i>et al.</i> (2018)	Kuala Pilah, Negeri Sembilan, Malaysia	134 food handlers	<p>Knowledge</p> <ul style="list-style-type: none"> The median score of knowledge among respondents categorized as sufficient with 80% on knowledge towards the hygiene of food utensils. 72.4% of respondents selected the correct answer that cross-contamination is the main causal factor for foodborne diseases. 64.2% of respondents choosing wooden chopping boards than plastic even though cracked wooden chopping boards encourage the growth of bacteria. 76.9% knew that the use of dirty clothes can increase the risk of food contamination. <p>Attitude</p> <ul style="list-style-type: none"> The median score of attitude among respondents categorized as sufficient with 89% towards the hygiene of food utensils. Most of the respondents responsible to clean food utensils as part of their routine work and agreed on the importance of having good knowledge of the hygiene of food utensils. <p>Practice</p> <ul style="list-style-type: none"> Showed positive practices due to attending food handling training and practices. 45.5% of the respondents always make sure food utensils are washed before preparing food, cleaned before starting their daily tasks, and properly cleaned.
16.	Mustaffa <i>et al.</i> (2017)	All cafeterias in a selected university located in Peninsular Malaysia	30 cafeteria's food handlers	<p>Knowledge</p> <ul style="list-style-type: none"> The respondents have a satisfactory level of knowledge score Low level of knowledge on the risk of contamination during the storage process Low level of knowledge on bacteria-causing food poisoning <p>Attitude</p> <ul style="list-style-type: none"> The respondents have a positive attitude with the scored of a satisfactory level The respondents are willing to attend any training that can increase their level of knowledge, attitude, and practice. The respondents agree that they are responsible to practice food safety handling All respondents agree that foodborne diseases can be prevented by implementing good personal hygiene. <p>Practice</p> <ul style="list-style-type: none"> Overall, the respondents have satisfactory level of practice towards food safety and hygiene Most of the respondents did not use a thermometer to determine the suitable temperature of the meat to cook. Most of the respondents do clean their workstation before and after work as well as cover cooked foods.

(KAP) (n= 10 articles); knowledge and practice (n=3 articles); knowledge (n=2 articles); and practice (n=1 article). Nine articles focusing on food handlers, one article on abattoir workers, three articles on students, one article was focusing on evaluating the level of KAP among both students and food handlers, and two articles were focusing on consumers. One study was done in Kuala Pilah, Negeri Sembilan (Saipullizan *et al.*, 2018); one study in Penang (Mahmood *et al.*, 2018); one study in Putrajaya (Mohd Firdaus Siau *et al.*, 2015); three studies in Terengganu (Abdullahi *et al.*, 2016; Norhaslinda *et al.*, 2016; Woh *et al.*, 2016); one study in Ipoh (Woh *et al.*, 2016); two studies in Shah Alam (Ismail *et al.*, 2016; Woh *et al.*, 2016); one study in Kuala Lumpur (Lee *et al.*, 2017); one study in Selangor (Syahira *et al.*, 2019); one study in Kedah (Ali, Jie, Prajapati *et al.*, 2018); two studies in Sarawak (Ruby *et al.*, 2019a; Ruby *et al.*, 2019b); and lastly one study was conducted in Petaling Jaya (Asmawi *et al.*, 2018).

3. Results and discussion

The different targeted population and socio-demographic profile of respondents were the major elements that may influence the results in KAP studies (Ajibola *et al.*, 2018). The results were focused on the differences and similarities of the level of knowledge, attitude and practice towards food poisoning and its prevention among respondents; the relationship between the level of KAP and socio-demographic profile which give a variety results in KAP studies; as well as the relationship between knowledge, attitude and practice.

3.1 Knowledge towards food poisoning

Food safety knowledge was the most influential factors in predicting food hygiene practices (Ismail *et al.*, 2016). Overall, ten articles reviewed showed that there was a good level, two studies showed a moderate level, and three studies reported a poor level of knowledge among respondents.

Four reviewed articles on KAP level among students had reported that there were three studies showed a good level of knowledge among students on food poisoning prevention (Aimi *et al.*, 2018; Ali, William, Prajapati *et al.*, 2018; Mahmood *et al.*, 2018). However, the results were contrasted with a study conducted by Syahira *et al.* (2019) in Selangor among form four students which had reported that level of food safety knowledge was insufficient for the majority of the students. Meanwhile, one review article among consumers reported by Ruby *et al.* (2019b) which conduct a study in Sibu Sarawak, Malaysia had reported that the level of food safety knowledge among respondents was considered as good. On the basis of these results, the different outcomes of

the level of knowledge among respondents due to the different population were agreed.

Differences in the level of knowledge between respondents can differ due to their socio-demographic characteristics, including age, gender, work experience, educational level, ethnicity, as well as their attendance at any food handler training. Two studies have shown that there is an important correlation between the level of knowledge and age group (Mohd Firdaus Siau *et al.*, 2015; Norhaslinda *et al.*, 2016). Such results are consistent with a study conducted by Mohd Firdaus Siau *et al.* (2015) among food handlers in Putrajaya which found that the level of knowledge increased accordingly to the age group level. However, the findings contrasted with the research by Aimi *et al.* (2018) between food handlers and dietary students at a public university in Malaysia, which indicated that there was no significant correlation between the level of knowledge and age.

Next, undergoing food safety and hygiene training is also one of the reasons that lead to the disparity in knowledge. Three studies have shown that food safety and hygiene training has been related to the level of knowledge among respondents (Mohd Firdaus Siau *et al.*, 2015; Woh *et al.*, 2016; Lee *et al.*, 2017). The findings were confirmed by an earlier study conducted by Halim *et al.* (2014) among food handlers at public university in Malaysia, which indicated that there was a positive correlation between the level of knowledge and attending food handlers training. Mohd Firdaus Siau *et al.* (2015) stated the level of knowledge among food handlers who attended food handler training was better than those who did not attend the food handler training. This finding can be explained by the fact that during food safety and hygiene training, participants were exposed to disease aetiology related to foodborne pathogens, personal hygiene, proper and appropriate food handling as well as cause and effect of not strictly following the food safety guidelines particularly among food handlers, as most of the food poisoning cases occurred at the restaurant.

As set out in the Food Hygiene Regulations 2009 and the Food Act 1983, enacted by the Food Safety and Quality Division (FSQD), commercial food handlers are exposed to the attend food safety courses (Food Safety and Quality Division Ministry of Health Malaysia, 2016; Ruby *et al.*, 2019a) and to be monitored by the authorities. However, the result contrasted with a study conducted by Norhaslinda *et al.* (2016) on the assessment of KAP Good Manufacturing Practices (GMP) among food handlers at Terengganu's Hospital, which reported that there was no substantial difference between the level of knowledge and attendance at the

training course. A reviewed Abdullahi *et al.* (2016) on evaluating the level of knowledge, attitude and practices among abattoir workers had shown that there was no attending training that could lead to differences in the level of knowledge.

Four reviewed studies showed there was a significant association between the level of knowledge and gender (Abdullahi *et al.*, 2016; Norhaslinda *et al.*, 2016; Aimi *et al.*, 2018; Dora-Liyana *et al.*, 2018). Three studies had reported that the female respondents have a higher level of knowledge towards food safety than male respondents (Norhaslinda *et al.*, 2016; Aimi *et al.*, 2018; Dora-Liyana *et al.*, 2018). However, the results contrast with a study by Abdullahi *et al.* (2016) that had reported that male had a high level of knowledge based on personal interview and observation during data collection among the abattoir workers.

One reviewed study showed the level of knowledge had an association with working experience (Lee *et al.*, 2017). Lee *et al.* (2017) had reported that those who had more working experience in the food industry had better overall food safety knowledge. They might have been taught and experienced in food safety and hygiene due to some training has been given by their company. Four studies reported that educational level had associated significant association towards the level of knowledge (Abdullahi *et al.*, 2016; Woh *et al.*, 2016; Lee *et al.*, 2017; Syahira *et al.*, 2019). Woh *et al.* (2016) had reported that the respondents with higher learning level of education scored better on knowledge compared to those only having primary and secondary education. These results were contrasted with a study conducted by Aimi *et al.* (2018) which revealed that there was no significant difference observed in the level of knowledge towards food poisoning across difference gender, age, education level and income levels among food handlers. These results were similar with a study conducted by Rosnani *et al.* (2014) which had reported that there were no significant differences on knowledge when compared to ethnicity for Malaysians, nationality, monthly income, age groups, education status, working experiences and attended training before being engaged as food workers.

3.2 Attitude towards food poisoning

For the attitude part, eight studies showed a positive attitude towards food safety and the prevention of food poisoning with a high level of satisfaction. However, one study had reported that there was a negative attitude to the prevention of food poisoning among respondents.

Overall, the reviewed articles revealed that there were seven studies showed a positive attitude with a high level of satisfaction among food handlers (Mohd Firdaus

Siau *et al.*, 2015; Norhaslinda *et al.*, 2016; Lee *et al.*, 2017; Mustaffa *et al.*, 2017; Dora-Liyana *et al.*, 2018; Asmawi *et al.*, 2018; Saipullizan *et al.*, 2018) and among abattoir workers (Abdullahi *et al.*, 2016). The results were contrasted with a study conducted by Aimi *et al.* (2018) among food handlers in a public university in Malaysia which showed there were poor attitude towards food poisoning prevention among respondents. On the other hand, a reviewed study conducted among public university students in Kedah state, Malaysia by Ali, William, Prajapati *et al.* (2018) had reported that there was a positive attitude among students.

One reviewed study had reported that there was an association between level of attitude and age among respondents with the age group of 21-30 years old showed the lowest average mean points of attitude (Norhaslinda *et al.*, 2016). One reviewed study revealed that attendance food handler training had associated with the level of attitude among food handlers (Lee *et al.*, 2017). The finding was confirmed by a study conducted between food handlers at residential colleges and canteens on food safety KAP by Nee and Sani (2011) and stated that respondents who attended courses had a better attitude to food handling than those who did not attend the course on food handling. The findings were similar to those of a study conducted by Rosnani *et al.* (2014) to assess food safety knowledge, attitudes and practices among restaurant staff in Putrajaya, and this study confirms that there were substantial gaps between trained and untrained employees. Thus, attending a food handler training may have an effect on the attitudes of food handlers (Lee *et al.*, 2017). However, the results were contrasted with a study conducted in Terengganu among food handlers by Norhaslinda *et al.* (2016) which had reported that there was no significant difference between the level of attitude to attendance of training courses.

The association between the level of attitude with gender, working experience, and educational level had been reported in earlier studies. Two reviewed studies showed there was an association between level of attitude among respondents with the gender. Female respondents have higher grades in attitude aspects than male respondents (Norhaslinda *et al.*, 2016; Dora-Liyana *et al.*, 2018). Two reviewed studies had reported that there was an association between level of attitude with the working experience which those who had more working experience had a better score of attitude on food safety than those had short duration of working experiences (Norhaslinda *et al.*, 2016; Lee *et al.*, 2017). Three studies reported the educational level was associated with the level of attitude among respondents (Rosnani *et al.*, 2014; Woh *et al.*, 2016; Lee *et al.*, 2017).

Abdul-Mutalib *et al.* (2012) also had reported that there was a correlation between education level and attitude. Lee *et al.* (2017) had reported that the higher the education level, the better the impact on attitudes of the food handler. However, the results were contrasted with a study conducted by Aimi *et al.* (2018) which had reported that there was no significant difference was observed in attitude toward food poisoning across difference genders, age, education and income levels among food handlers.

3.3 Practice towards food poisoning

Overall, for the practical part, six studies had a good level, two studies showed that there was an average score of food safety practices and food poisoning prevention, and one study reported that there were unsatisfactory food safety practices.

The reviewed studies showed that there were six studies had a good level of practice on food safety and food poisoning prevention among food handlers (Norhaslinda *et al.*, 2016; Dora-Liyana *et al.*, 2018; Asmawi *et al.*, 2018; Saipullizan *et al.*, 2018) and abattoir workers (Abdullahi *et al.*, 2016). However, the results were contrasted with a study conducted among migrant food handlers in Kuala Terengganu, Ipoh, and Shah Alam Malaysia by Woh *et al.* (2016) and a study conducted among food handlers in a university located in Kuala Lumpur Malaysia by Lee *et al.* (2017) reported that there was an average score for food handling practices among respondents. A study on self-reported food safety practices among adult consumers conducted by Ruby *et al.* (2019a) in Sibu Sarawak had revealed that the food safety practices among respondents were unsatisfactory. This might indicate that the future study needs to be more concern and focus on consumers as they are more exposed to the food poisoning by buying food outside and Mahmood *et al.* (2018) had revealed that the food from restaurants is the main cause of food poisoning to occur as improper and not strictly followed the food safety practices. However, Ruby *et al.* (2019a) had stated that the majority of food poisoning cases occur was due to improper food handling and preparation at home. Therefore, it is also important to educate the consumers on choosing the food premises and proper guideline on food safety, as they also prepared food at home.

The reviewed studies reported that there were associated with the level of practice among respondents with sociodemographic characteristics such as age, attendance food handler training, gender, educational level, nationality, and vaccination. Three studies reported that there was an association between level of practice among respondents with the age group (Rahman *et al.*,

2012; Norhaslinda *et al.*, 2016; Aimi *et al.*, 2018). Norhaslinda *et al.* (2016) had reported that practice had an association with age; respondents with age 21-30 years old showed the lowest average of practices. These results were proved by Ali, William, Prajapati *et al.* (2018) which stated that a number of studies found that poor food handling practices were among the respondents with ages of 18-29 with education above high school level 1.

Four studies reported that attendance of food handler training had associated with the level of practice among respondents (Rahman *et al.*, 2012; Halim *et al.*, 2014; Woh *et al.*, 2016; Dora-Liyana *et al.*, 2018); those who had attended the food handler training had better practice in food safety and hygiene than those who had not attended. However, a reviewed study by Abdullahi *et al.* (2016) which to evaluate the level of knowledge, attitude and practices among abattoir workers had no report on the attending training might cause differences in the level of knowledge. It is compulsory for the abattoir workers that handling with fresh food to registered with the ministry as required in the Abattoirs (Privatization) Act 1993 (Commissioner of Law Revision Malaysia, 2006) and they are required to ensure that their surrounding areas and premises in the pollution-free and hygienic conditions (Ruby *et al.*, 2019b). Therefore, more efforts are needed to improve the level of practices among food handlers and abattoir workers as cross-contamination might occur if they did not strictly follow the food safety guidelines and caused food poisoning.

Two reviewed studies had reported that the level of practice among respondents had significantly associated with gender (Abdullahi *et al.*, 2016; Norhaslinda *et al.*, 2016). Earlier studies by Nee and Sani (2011); Norhaslinda *et al.* (2016); and Rosnani *et al.* (2014) had reported that female respondents have high grades in practice aspects than male respondents. This is because the female is more likely to be involved in food handling and preparing activities as well as providing food for households since they are traditionally responsible for (Aquad *et al.*, 2019). Contrast with the study by Abdullahi *et al.* (2016) which evaluated the abattoir workers in Terengganu as reported that male respondents had a better practice of compliance than female respondents, in handling fresh meat.

Two studies showed that the level of practice had significantly associated with the educational level (Rosnani *et al.*, 2014; Mohd Firdaus Siau *et al.*, 2015). Mohd Firdaus Siau *et al.* (2015) had reported that the mean level of practices was higher among food handlers with education compared to food handlers without formal education. However, Aimi *et al.* (2018) had

evaluated food handlers and dietetic students in a public university in Malaysia, had reported that there was no significant difference was observed in practice towards food poisoning across difference genders, age, education and income levels among food handlers, but there was a significant association in practice toward food poisoning with age among dietetic students.

Halim *et al.* (2014) had used correlation to examine the association between sociodemographic variables and KAP regarding hygiene status of food premises among food handlers at the cafeterias of a public university in Malaysia. The result showed that there was a significant difference between the relationship of hygiene status of food premises and food handlers with their working experiences, KAP score with training attended and vaccination received; no significant association between KAP score and overall hygiene status of food handler and food premises. This indicated those who had highest working experience had the highest percentage of good hygiene status compared to those had less working experience, and those who had undergone training and vaccination had a higher percentage of good overall KAP score.

3.4 Relationship between knowledge, attitude and practice towards food poisoning prevention

There was a positive relationship between knowledge and attitude; attitude and practice which might indicate that the level of knowledge affects the score of attitude and the level of attitude will affect the level of practices on food safety and food poisoning prevention (Mohd Firdaus Siau *et al.*, 2015; Norhaslinda *et al.*, 2016). The result contrasted with a study conducted by Abdullahi *et al.* (2016) which had reported that there was a statistically significant association between knowledge and level of practice toward compliance with abattoir laws, but no association between knowledge and attitude among the workers; and also no association between attitude and practice of compliance with the abattoir laws among workers.

Ali, William, Prajapati *et al.* (2018) had examined the correlation between total knowledge, total attitude and total perception against KAP scores among public university students in Kedah. The result showed that there were significant strong positive correlations between total knowledge, total attitude and total perception. The results were supported by a previous study conducted by Rosnani *et al.* (2014) among food handlers in Putrajaya which showed that there was a strong relationship between knowledge, attitude, and practice about food safety. The results indicated that as knowledge increase, attitude and practice will improve accordingly.

Food safety knowledge was significantly correlated with personal hygiene (Ismail *et al.*, 2016). The result was similar with a study conducted by Dora-Liyana *et al.* (2018) in seven boarding schools in the northern region in Malaysia which reported that there was a positive significant relationship between food safety knowledge and personal hygiene knowledge and indicates that the increase of knowledge on food safety might increase the attitude towards food safety among respondents. However, the result contrasted with a study conducted by Ali, William, Prajapati *et al.* (2018) which had reported that the students have a good level of knowledge, however, there was a negative attitude on personal hygiene had revealed. A study conducted by Mohd Firdaus Siau *et al.* (2015) had revealed that the high level of knowledge and positive attitude on food safety and food poisoning prevention not necessarily turned into safe practices. Nevertheless, it still can conclude that the people with high food safety and food poisoning knowledge are more likely to have a positive attitude and practices towards safe food preparation and food poisoning prevention (Ruby *et al.*, 2019b). All of the reviewed articles concluded that it is critical for consumers and food handlers to be well informed about proper food handling practices in order to prevent cross-contamination and food poisoning.

On the other hand, there was a study conducted by Aimi *et al.* (2018) among food handlers in a public university in Malaysia had revealed that the respondents that had a good level of knowledge obtained low scores of attitude and practices regarding food safety and food poisoning prevention. The results may indicate that a high degree of awareness is sufficient to ensure that people comply with the guidelines on food safety and the prevention of food poisoning due to some of the obstacles as addresses in the Health Belief Model (HBM). According to the Health Belief Model (HBM), individuals will adopt preventive health behaviours when they know and believe that they are at risk of disease (perceived susceptibility) which may result in a disease that is harmful to their health (perceived severity). There is a shift in conduct that can help avoid or minimize the risk and seriousness of the disease (perceived benefits). There are, however, social, mental or physical barriers to the success of these behaviours (perceived barriers). Perceived vulnerability and severity can energize individuals to take action to change their behaviour to perform preventive behaviour (Bolte, 2013). There are still many people who have not understand the value of food safety knowledge, attitude and practices in the prevention of cross-contamination and food poisoning (Norazmir *et al.*, 2012). This may, therefore, mean that Malaysia still needs to step up its efforts to prevent food poisoning among the population, in particular

consumers, due to limited consumer-oriented study.

4. Conclusion

Clear evidence has shown that a high degree of knowledge does not guarantee a positive attitude and practice towards the prevention of food poisoning due to certain obstacles, including social, mental or physical obstacles to the success of such behaviour. It is therefore important to enhance knowledge, attitudes and practices of food poisoning and its prevention in the population. The studies reviewed have shown that socio-demographic characteristics affect the degree of knowledge, attitude and practice of food safety and the preventive of food poisoning. These findings can guide health education programs to pay more attention to increasing the level of KAP among communities in order to reduce cases of food poisoning specifically in Malaysia. Preventive measures to increase the level of KAP must be considered in order to minimize cases of foodborne diseases. Approach to educating people in the field of foodborne prevention can be rendered in the future by considering the target population and their socio-demographic profile. This reviewed literature will contribute to the literature of the future KAP study on food poisoning prevention and will serve as an eye-opener for future studies to increase knowledge, attitude and practice among consumer.

Conflict of interest

No conflict of interest among all the authors.

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