

## Relationship of knowledge and attitude with food handling practices: A systematic review

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### ABSTRACT

Foodborne disease is still a public health problem in several countries. Food handler's knowledge, attitude, and practice (KAP) are factors that are risk factors for foodborne disease incidence. The research objective was to assess the level of knowledge, attitudes, and behavior of food handlers in maintaining food hygiene using a systematic review approach. The research method used is the preferred reporting items for systematic review and meta-analyses (PRISMA) protocol approach. The article search process was accessed on PLOS ONE, Pro-Quest, and Google Scholar. A descriptive analysis was carried out on each research variable. The results obtained eight papers (100% sociodemography, 100% knowledge, 62.5% attitude, and 87.5% behavior). The mean of significant articles on sociodemographic variables was 18.5%, experience 59.38%, attitudes 13.33%, and 23.81%. There are 37.5% of the articles showed significant relationship between knowledge and attitude with food handling practice.

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## 1. INTRODUCTION

An unclean and healthy practice is one of the causes of various diseases in society [1]. One of the impacts of unsanitary practice is the emergence of foodborne illness, causing death. Food that is unsafe and contains bacteria, viruses, parasites, or chemicals, can cause 200 diseases ranging from diarrhea to cancer [2].

The World Health Organization (WHO) estimates that about 600 million people worldwide have fallen ill from food in 2015. One in 10 people is affected, and 420 thousand out of 33 million lose their lives each month and each year [3]. WHO reports that there are about two million fatal cases of food poisoning occurring each year globally, especially in developing countries due to poor food safety and general hygiene in these countries. In 2014, Malaysia recorded 49.79 cases of food poisoning per 100,000 populations. More than 50% of the total food poisoning cases are associated with improper handling of food by food handlers. Outbreaks in academic institutions account for 43% of food poisoning incidents in Malaysia [4]. The Malaysian Ministry of Health has identified training ineffective food handlers, their deliberate use of unsalted water, and poor hygiene as significant risk factors for food poisoning. Food handlers play an essential role in ensuring food safety and preventing food poisoning [5], [6]. Infected food handlers can pass on gastrointestinal infectious disease agents through poor personal hygiene practices [7], [8].

In 2007-2016 the Brazilian Health Ministry reported 6848 incidents of foodborne disease outbreaks according to data from the National Notifiable Diseases Information System. Among the 610,465 people exposed to danger while 121,283 people fell ill, and 111 died [9]. There is little documentation for the incidence of foodborne disease in Ethiopia, but many foods are not guaranteed health in Ethiopia. In a study conducted by Adane *et al.* only about 53% of fares were safe for consumption in samples taken from roadside food colonizers. Another study showed that 2.5% of samples tested positive for *Escherichia coli* in food taken from meat sold by food colonizers [10]. Bangladesh National Hygiene Baseline Survey research as traders only know about 37% of cleanliness, potentially triggering foodborne disease [11]. In Saudi Arabia, the foodborne disease outbreak has infected catering food vendors, amounting to 1.26% of the 1000 catering food sellers [12].

Besides, many reports have shown that foodborne illness is still a public health problem in Indonesia; based on data from the POM (2010), during the 2001-2009 periods, 1,101 outbreak of food poisoning occurred. In 2015 data on outbreak, the types of food that caused outbreaks of food poisoning in 2015 were household cooking as 25 incidents (40.98%), snack food as many as 14 events (22.95%), food and food services as many as 13 incidences (21.31%), and processed food as many as nine events (14.75%) [13].

Lifestyle and human consumption practices have changed, the tendency to prepare meals at home has decreased, and food consumption outside the home has increased. Increased food consumption outside of homes, restaurants, and other eating establishments plays a role in increasing the risk of foodborne diseases [14]. Foods that are cooked on a large scale have a higher chance of being contaminated. Foodborne disease outbreaks due to contamination by food handlers are estimated to be 10 to 20%. Not paying attention to food hygiene allows pathogens to contact food, survive, increase in sufficient numbers, and impact consumers [3].

Hygiene food sanitation is an effort to maintain or control food factors, people, places, and equipment, causing illness or health problems. In good food management, several sanitation hygiene factors must be considered to maintain adequate food quality, including washing hands before contact with food and washing food with clean water. These practices positively affect and can contribute to the occurrence of diarrhea disease [13]-[15]. Also, all food processing activities must be protected from direct contact with the body. Food handlers can make some efforts to avoid contamination of food by wearing clean clothes, using disposable gloves, and using food tongs when working [16]. Another step to maintain food quality remains good by storing foodstuffs in an appropriate place because contamination can occur during the food processing or through containers and food handlers that leave food at room temperature. Several studies have concluded that the risk factors for foodborne disease incidence occur when cleaning cutlery, incompatibility with storage time temperatures, and inadequate personal hygiene [17]-[20]. Efforts to maintain food quality to stay good can also be made through training and education for food handlers because it can be an effective means of increasing knowledge and practices of food safety in food handlers [21].

In an effort to increase knowledge and practice about food safety, different behavioral theories have been used, including the Health Belief Model, where an individual will perform preventive behavior depending on their desire to avoid disease (or if sick, recover) and the belief that certain health measures will prevent (improve) disease [1], [2], [22], [23] the KAP model, which assumes that the behavior or practices of individuals on their knowledge (K) and shows that providing information will directly lead to a change in attitude (A) and, consequently, a change in behavior or practice (P) [3], [24] and planned behavior theory (PBT) which focuses on individual intention to perform certain behavior and has been supported by many researchers for the prediction of determinants of food handler behavior [4]-[6], [25]-[27].

Several studies have proven the relationship between the level of knowledge, attitudes, and hygiene practice in food handlers, which impact food hygiene. According to Maywati, there is a significant relationship between knowledge and street food handlers [28]. Another researcher from Hiskia *et al.* stated a relationship between knowledge, attitudes, and Practice with the food snack players' hygiene around the snack market in Kotamobagu city [29]. Based on this, it is necessary to study the level of knowledge, attitudes, and practice of food handlers in maintaining food quality using a systematic review approach.

## 2. RESEARCH METHOD

The research method uses a systematic review approach based on the preferred reporting items for systematic review and meta analyzes (PRISMA) protocol [30], to identify relevant research articles and include sociodemographic, knowledge, attitude, and practice (KAP) variables of food handlers in maintaining food quality. The article search process was accessed on three electronic databases, namely PLOS ONE, Pro-Quest, and Google Scholar. The keywords used in the search for journal articles are food safety, food handler, KAP, and hygiene.

The feasibility study was conducted using inclusion and exclusion criteria. The inclusion criteria set are quantitative research, primary data, year of publication (September 11, 2015-September 11, 2020), in

English, have gone through the peer review stage, and are full-text articles. The exclusions of this review are qualitative research, literature other than items, and literature review. Data extraction was carried out through the Identification stage by searching for articles from the database, screening to determine the time range, eligibility, and included screening in deciding the title of the items to be selected based on the inclusion criteria.

The results of the literature search were then analyzed descriptively narrative. The descriptive analysis includes; (a) analysis based on sociodemographic factors, consisting of age, sex, education, experience, marital status, and monthly income, (b) analysis based on knowledge factors consisting of personal hygiene, prevention of cross-contamination and sanitation, food handling and health problems has an effect on food, (c) analysis based on attitude factors, which consists of views on knowledge of correct food handling, views on personal hygiene, opinions on the separation between raw food and cooked food, thoughts on a safe place for food storage, idea of the cleanliness of tools and views of work experience, (d) analysis based on practice factors, which consists of washing hands before contact with food, wearing clean masks and uniforms while working, washing food or tools with clean water, wearing gloves when contacting with ma right, store food ingredients in a suitable place, do not smoke or are not coughing and sneezing while preparing food and food handlers conducting training.

### 3. RESULTS AND DISCUSSION

#### 3.1. Articles search results with the PRISMA protocol method

Figure 1 show the selection results based on keywords and following the PRISMA protocol obtained 4,260 articles and eliminating duplication of articles. Furthermore, in the screening based on the year of publication (September 11, 2015 -September 11, 2020), there were 1.884 articles. Screening of English journals, full text, and having gone through the peer review stage obtained from PLOS ONE, ProQuest, and Google Scholar, received 278 articles. An eligibility study was conducted to eliminate items that did not match the problem variables and did not match the established inclusion criteria. In the last stage, eight articles match the inclusion criteria.

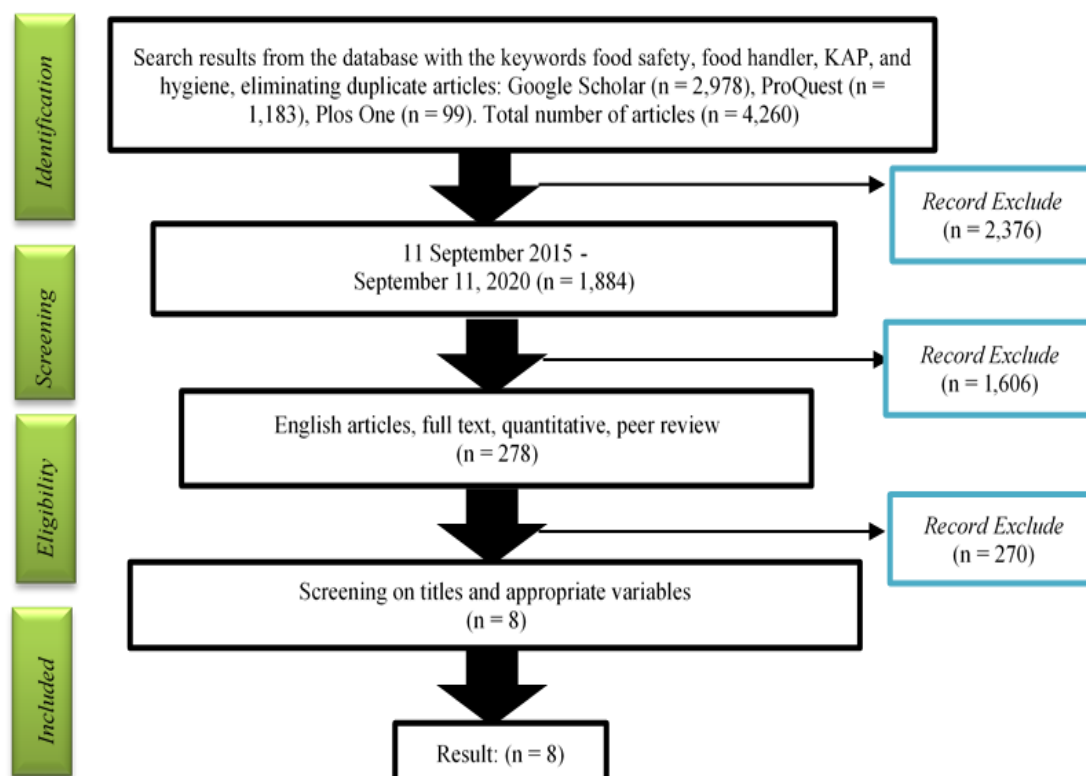


Figure 1. Literature search results based on the PRISMA protocol

Table 1 shows that articles discussing sociodemographic variables on knowledge, attitudes, and practice were found in five studies (62.5%). Meanwhile, articles discussing sociodemographic variables on experience and practice were examined in two items (25%), and articles discussing sociodemographic variables to knowledge were only discussed in one study (12.5%).

Table 1. The distribution of articles is based on variable

Variable	Frequency (article)	Percentage (%)
Sociodemography of knowledge, attitudes, and practice	5	62.5%
Sociodemography of knowledge and practice	2	25%
Sociodemography of knowledge	1	12.5%
Total	8	100%

The number of research samples used and the number of item categories on the aspects assessed by each factor are described in Table 2. The Table 2 illustrates the number of various research samples. The assessment aspect items on the elements used in this community participation research vary; only five use these four factors (codes 1, 3, 4, 7, 8), then sociodemographic factors, knowledge, and practice in two studies (code 2, 6), the last is sociodemographic and practice factors in one study (code 5).

Table 2. Researcher data, research location, number of samples, and number of questions in the questionnaire on the assessment of sociodemographic research variables and KAP food handlers

No (code article)	Research	Research sites	Number of samples	Sociodemographic (item)	Questionnaire items on variables		
					Knowledge (item)	Attitude (item)	Practice (item)
1	D. Suryani <i>et al.</i> 2019 [31]	Yogyakarta, Indonesia	109	5	11	22	11
2	N. A. Alqurashi <i>et al.</i> 2019 [32]	Al Madinah, Saudi Arabia	163	5	7	NA	8
3	L. I. Auad <i>et al.</i> 2019 [33]	Asa Norte and Sao Paulo, Brazil	40	9	10	10	10
4	A. L. Doraliyana <i>et al.</i> 2018 [34]	Selangor and Kuala Lumpur, Malaysia	134	7	21	10	6
5	J. Azanaw <i>et al.</i> 2019 [35]	Gondar, Ethiopia	98	6	8	NA	NA
6	M. K. Alam <i>et al.</i> 2020 [36]	Mymensingh and Gazipur, Bangladesh	116	4	14	NA	14
7	F. Ncube <i>et al.</i> 2020 [37]	Bindura, Zimbabwe	101	6	20	15	20
8	H. K. Lee <i>et al.</i> 2017 [7]	Kuala Lumpur, Malaysia	111	7	60	14	12

NA: nonavailable

Table 2 illustrates the distribution of samples and the factors used in the research of participating food handlers. These articles link a variety of different factors, as in Azanaw *et al.* linking the sociodemographic aspects with knowledge in the form of basic knowledge about personal hygiene to prevent the transmission of pathogens from food handlers to customers [35]. The study conducted by Alqurashi *et al.* and Alam *et al.* who linked aspects of sociodemography with knowledge and practice to ensure food handlers have the skills and knowledge for food safety [32], [36].

Sociodemographic elements associated with the three KAP factors on Suryani *et al.* [31]. Auad *et al.* [33], Doraliyana *et al.* Cube *et al.* and Lee *et al.* evaluate understanding, attitude and the practice of food handlers regarding the impact on food hygiene to produce good quality food [7], [31], [33], [34], [37]. Research with the four factors (sociodemography and KAP) will be beneficial to provide better insights for the development of good food handling.

### 3.2. Sociodemographic factors

Table 3 shows some of the sociodemographic aspects examined on community participation. Many aspects can be included in this factor, but only four aspects were studied the most in almost all studies: age, gender, education, experience, marital status, and monthly income. All variables are then categorized based on p-value if <0.05 means significant, and p>0.05 is not significant. After that, the sociodemographic variables were described one by one, namely starting from age, which did not affect the quality of the food

handlers in each article; it was found that  $p_{age} > 0.05$  was five articles with a percentage of 62.5%, which indicated insignificantly. For  $p_{gender}$  more than 0.05, there are four articles with a percentage of 55%, which indicates insignificance, and there is 1 article with a percentage of 12.5%, significant value  $p < 0.05$ . In the educational aspect, there is one article that shows the  $p$ -value is 0.05. For  $p_{experience}$  and  $p_{marital}$  status, there are two articles with a percentage of 25%,  $p$ -value  $< 0.05$ , which indicates a significant result.

Table 3. The distribution of articles is meant to determine the relationship between influencing sociodemographic variables on food handlers on food quality

Factor	Category	Research result		
		Code Article	Frequency	% Articles
Age	Significant	-	0	0%
	No sign.	(1,2,3,4,7)	5	62.5%
	NA	(5,6,8)	3	37.5%
	Total		8	100%
Gender	Significant	(4)	1	12.5%
	No sign.	(1,3,5,7)	4	50%
	NA	(2,6,8)	3	37.5%
	Total		8	100%
Education	Significant	(7)	1	12.5%
	No sign.	(1,4,8)	3	37.5%
	NA	(2,3,5,6)	4	50%
	Total		8	100%
Experience	Significant	(2,8)	2	25%
	No sign.	(1,3,4,5,7)	5	62.5%
	NA	(6)	1	12.5%
	Total		8	100%
Marital status	Significant	(3,5)	2	25%
	No sign.	-	0	0%
	NA	(1,2,4,6,7,8)	5	62.5%
	Total		8	100%
Income per month	Significant	(3)	1	12.5%
	No sign.	(5)	1	12.5%
	NA	(1,2,4,6,7,8)	6	75%
	Total		8	100%
The study means significant				18.5%

Sign: Significant  
NA: nonavailable

Table 3 describes the sociodemographic factors. In terms of age, it does not provide significant results or as much as 0%. On gender significant at 12.5% in articles with code (4) in article Azanaw *et al.* explained that most food handlers are women 88%. It is significant in the education aspect that 12.5% of code (7) is in another article [35]. Alqurashi *et al.* explained that as many as 48.5% of the handlers knew the importance of cleanliness when preparing food serving, such as washing hands, wearing gloves before preparing food, cleaning knives, cutting boards, and various other equipment [32]. This research is in line with Kurniawan *et al.* which shows a significant relationship between the level of education and food handlers' actions in handling food [38]. According to Ramadani *et al.* the basic sanitation principle needs to be done to protect consumers from harmful microorganisms and infectious diseases. Some of these aspects significantly affect the quality of the food [39]. In the experience, 25% of the code is significant (code 2, 8).

The article by Suryani *et al.* said that experience did not affect food quality and safety [31]. In the article, Alam *et al.* explained that 85% of respondents did not attend training on food safety and meat hygiene; although most slaughterhouses and meat handling center workers (90%) expressed willingness to attend food safety or meat hygiene training [36]. In Azanaw *et al.* training can improve food handlers' overall performance in safe food handling practices [35]. In this study, food handlers who received safety training had a higher chance of good food safety practice because trained food handlers gained good awareness through training; this morning was supported by other similar studies-an essential training program to increase knowledge about food handlers. On the aspect of marital status, it is a significant 25% with code (3, 5). In the article Azanaw *et al.* declaring marital status is another factor related to food safety practices and according to Auad *et al.* the survey results showed a significant difference in attitude scores regarding marriage ( $p=0.029$ ), monthly income ( $p=0.018$ ), and food safety training ( $p=0.033$ ) [33], [35]. There are no studies in the literature that link marital status or monthly income with higher attitudes. On the aspect of significant monthly income, 12.5% with code (3). In the article Alam *et al.* worker practice is related to various socio-economic factors such as educational background, status, and enthusiasm of workers (related to their income and social status) [36].

### 3.3. Attitude and practice knowledge factor

Food handlers KAP question patterns are usually divided into several question points, namely personal hygiene, prevention of cross-contamination and sanitation, food handling, and health problems that affect food. The following are some of the article assessment results based on the food handler KAP questionnaire's main points in tabular form.

The data from Table 4 shows the distribution of aspects of the food handlers' knowledge factor. In this test analysis, what is shown is the most significant value of all existing elements; it is said to be substantial if the p-value <0.05. The studied factors and had the highest considerable amount were personal hygiene and food handling in 75% of the articles. Personal hygiene and food handling are the most significant aspects, followed by contamination prevention and sanitation of goods. The average number of significant research articles on this factor was 59.38% of the items. Significant results were obtained in all studies that discussed this aspect. Research that does not address this aspect is categorized as non-available (NA).

Table 4. The knowledge factor of food handlers on food quality

Factor	Category	Research result		
		Code	Freq.	% Articles
Personal hygiene	Significant	(2,4,5,6,7,8)	6	75%
	No sign.	(3)	1	12.5%
	NA	(1)	1	12.5%
	Total	(1)	8	100%
Cross-contamination prevention and sanitation	Significant	(2,4,5,6,7)	5	62.5%
	No sign.	(3,8)	2	25%
	NA	(1)	1	12.5%
	Total	(1)	8	100%
Food handling	Significant	(2,4,5,6,7,8)	6	75%
	No sign.	(3)	1	12.5%
	NA	(1)	1	12.5%
	Total	(1)	8	100%
Health problems that affect food	Significant	(5,8)	2	25%
	No sign.	(1)	1	12.5%
	NA	(2,3,4,6,7)	5	62.5%
	Total	(2,3,4,6,7)	8	100%
The study means significant				59.38%

Sign: *Significant*

NA: *nonavailable*

According to Siswati, knowledge is everything that is known that is obtained from sensory contact with a particular object. Experience results from seeing, hearing, feeling, and thinking based on humans and of behaving and acting [40]. So it can be said that knowledge about maintaining food quality should be a very influential factor for food handlers to maintain food quality. The results of research Azanaw *et al.*, Ncube, *et al.*, and Alam *et al.* showed that the level of knowledge of food handlers related to the practice of maintaining good food quality [35]-[37]. Researches by Lee *et al.*, Alqurashi *et al.*, Doraliana *et al.* revealed that personal hygiene is the most influential factor in food handlers regarding food quality [7], [32], [34]. Miranti and Adi research also support this and Assidiqi *et al.* showed a relationship between knowledge and food-handling hygiene [41], [42]. Research Lee *et al.* demonstrated that food handlers have a good understanding of personal hygiene but not cross-contamination and sanitation because, in Malaysia, food handler training focuses more on personal hygiene than prevention cross-contamination pathogens [7]. Research Auad *et al.* stated no significant relationship between knowledge, attitudes, and practice towards food handlers [33]. The research is in line with Indriany, Rahmayani, and Amalia *et al.* they showed that there is no relationship between knowledge and practices of food hygiene and sanitation [43]-[45]. Those studies showed that the knowledge factor holds the highest percentage, namely 59.38%, compared to the attitude and practice factors.

Based on the data from Table 5 shows the distribution of the food handlers' attitude factor. It seems that most of the aspects give the same value. In this test analysis, what is shown is the most significant value of all existing elements; it is said to be substantial if the p-value <0.05. The aspect that has been researched and has the highest considerable significance is a proper food handling, which holds the highest percentage, namely 40%; this shows that this aspect is the most significant aspect of other factors. On the part of a view of maintaining personal hygiene, 20%, a picture of a safe place for food storage 20%, and a view of work experience 20%. The idea of the separation between raw food and cooked food 0% and 0% view of appliance cleanliness. The average research article with significant value on the attitude factor based on the assessed aspects is 16.66% of the items.

Table 5. Attitude factors in food handlers on food quality

Factor	Category	Research result		
		Code	Frequency	Articles (%)
View of knowledge about proper food handling	Significant	(4,7)	2	40%
	No sign.	-	0	0%
	NA	(1,3,8)	3	60%
	Total		5	100%
View on maintaining personal hygiene	Significant	(4)	1	20%
	No sign.	-	0	0%
	NA	(1,3,7,8)	4	80%
	Total		5	100%
A view of the separation between raw and cooked foods	Significant	-	0	0%
	No sign.	(4)	1	20%
	NA	(1,3,7,8)	4	80%
	Total		5	100%
View of a safe place for food storage	Significant	(4)	1	20%
	No sign.	-	0	0%
	NA	(1,3,7,8)	4	80%
	Total		5	100%
View on tool cleanliness	Significant	-	0	0%
	No sign.	(4)	1	20%
	NA	(1,3,7,8)	4	80%
	Total		5	100%
View of work experience	Significant	(8)	1	20%
	No sign.	(7)	1	20%
	NA	(1,3,4)	3	60%
	Total		5	100%
The study means significant				16.66%

Sign: *Significant*NA: *nonavailable*

Table 5 shows that five articles discuss aspects for attitude factors in the participation of food handlers on the quality of food produced, the most significant results were obtained in one part, namely the view of knowledge about correct food handling, amounting to two articles (40%) with different items. Knowledge about proper food handling is contained in. Doraliana *et al.* which shows the importance of food handlers with good food safety experience and food safety knowledge. Food safety knowledge is mostly acquired through food safety training [34]. By attending certified training, participants will find out the benefits of temperature and time control, personal hygiene, safe food handling, and the causes of the spread of foodborne diseases. Other food safety knowledge sources are printed educational materials and new media, where food safety information can be found at the fingertips [34].

About 95.5% of respondents rated that maintaining personal hygiene while working was good. Keeping nails short, covering hair with a hair cap and washing hands effectively are essential habits to prevent cross-contamination. About 94.7% of food handlers agree on the importance of food hygiene training to reduce contamination risk. Sani and Siow found that trained food handlers' attitude score was higher than those who had never attended food safety training [46]. However, it has been reported that, although food hygiene training can increase knowledge of food safety, it is not the main factor affecting food handling practice and changing practices [47]. Approximately 89.6% agree that cleaning hands effectively can prevent disease transmission through food. 91.9% of food handlers agree that it is necessary to wash hands before putting on gloves. As many as 97.0% of respondents stated positively; they must wear gloves when touching food to reduce contamination [48].

About 90.3% agree that it is essential to check the fridge or freezer periodically to make sure it is working correctly. Sani and Siow stated that 56.9% of respondents agreed that not monitoring refrigerators and freezer temperatures could harm health [46]. Food safety attitudes have a significant positive relationship with overall food safety knowledge and personal hygiene knowledge. The philosophy of food handlers towards food safety increases with increasing joyful experience and security [34]. Based on other studies, views on proper food handling are also found in the research of Ncube *et al.* [37] that is, obtained a significant positive correlation observed between food safety knowledge and attitudes. A good understanding of food processing will have a positive effect on food safety attitudes. Positive correlations regarding food handler knowledge, attitudes, and food safety practices are also reported in the literature Abdul-Mutalib *et al.*, Sani and Siow, Al-Shabib *et al.* [4], [46], [49]. In Brazil, de Souza, de Azevedo, and Seabra also reported a positive correlation between food safety knowledge and self-reported food-handling practices [37]. Overall, the attitude factor's average value was 16.66% lower than the average percentage of knowledge and practice.

Table 6 shows that the distribution of aspects of the food handler practice factors. In this test analysis, what is shown is the most significant value of all existing elements; it is said to be substantial if the

p-value <0.05. The widely researched aspect and has the highest considerable importance is the food handlers, who have conducted 71.42% of the articles. The food handler doing the training is the most significant aspect among the other elements. Other notable parts, respectively, are washing hands before contact with food, washing food or utensils with clean water, wearing gloves when in contact with food, and storing foodstuffs in an appropriate place, wearing sterile masks and uniforms when working, and not smoking or coughing and sneezing while preparing food. The average research article was significant on this factor of 30.61% of the items. Significant results were obtained in all studies that discussed this aspect. Research that does not address this aspect is categorized as non-available (NA). Research that does not have a p-value is also categorized as non-available (NA).

Table 6. Practice factors in food handlers on food quality

Factor	Category	Research result		
		Code	Frequency	% Articles
Wash hands before contact with food	Significant	(6,7)	2	28.57%
	No sign.	(1,2,3,4)	4	57.14%
	NA	(8)	1	14.29%
	Total	(8)	7	100%
	NA	(6)	1	14.29%
Wear a clean mask and uniform while working	Total	(1,2,4)	3	42.86%
		(3,7,8)	3	42.86%
		(7)	7	100%
		(6,7)	2	28.57%
Washing food items or utensils with clean water	No sign.	-	0	0%
	NA	(1,2,3,4,8)	5	71.43%
	Total	(1,2,3,4,8)	7	100%
	Significant	(6,8)	2	28.57%
Wear gloves when in contact with food	No sign.	-	0	0%
	NA	(1,3,4,7,8)	5	71.43%
	Total	(1,3,4,7,8)	7	100%
	Significant	(6,7)	2	28.57%
Store food ingredients in a suitable place	No sign.	(3,4)	2	28.57%
	NA	(1,2,8)	3	42.86%
	Total	(1,2,8)	7	100%
	Significant	(7)	1	14.29%
Not smoking or coughing and sneezing while preparing food	No sign.	(1)	1	14.29%
	NA	(2,3,4,6,8)	5	71.43%
	Total	(2,3,4,6,8)	7	100%
	Significant	(2,3,4,5,6)	5	71.42%
Food handlers doing the training	No sign	(1)	1	14.29%
	NA	(7)	1	14.29%
	Total			100%
The study means significant				30.61%

Sign: *Significant*

NA: *nonavailable*

Table 6 discusses practical factors in maintaining food quality for food handlers or food managers; the usual practice is maintaining food quality. According to Notoatmodjo, health practice is a person's (organism) response to illness and disease stimuli, the health service system, food, and the environment. Health practice includes health prevention practice, which is a response to prevent infection [48]. Food handlers who did the previous training gave significant results in 5 of the seven articles, according to research by Al Shabib *et al.* training and education can increase knowledge and practices of food safety among food handlers to prevent foodborne diseases [49]. This finding is supported by the research of Azanaw *et al.* [35]. Food handlers who receive training will better understand safe food handling practices because they may receive professional advice during the training. Exercise can improve the overall performance of the food handler in safe food handling practices, according to research Alqurashi *et al.* indicating that 68.1% of all staff have received food safety training and 63.8% of respondents understand HACCP as a system for ensuring safe food by identifying and controlling specific hazards, indicating an emphasis on food safety training in hospitals in Madinah. It is said that exercise universally reduces food-based diseases caused by food handlers in food companies. The study also emphasizes that food safety training can effectively increase food safety knowledge [32].

Washing hands before contact with food and washing food items or tools cleanly gave the same significant results in two out of seven articles (28.57%). This is in line with the research of Purwandari *et al.* that the relationship between hand washing practice and the incidence of infectious diseases shows a significant relationship [15]. Washing hands is often considered a trivial thing in society, even though washing hands can improve the community's health status. While wearing a mask and clean uniform while



working, one in seven articles (14.29%). When in contact with food [50], wearing gloves gave significant results in two out of seven articles (28.57%), in the study Alqurashi *et al.* the majority of staff (81%) wear gloves when handling food during preparation [32]. There was a slight difference between respondents who reported that they felt uncomfortable wearing gloves during food preparation, and those who never used gloves (3.7% and 3.1%) storing food ingredients appropriately when preparing meals gave the same significant results one in seven articles (14.29%). The application of food storage is needed to improve the quality of the food itself, based on the research of Gultom *et al.* that the storage of foodstuffs on food quality from the results of the correlation test and determination of 63.2% shows a strong relationship between the effect of food storage on food quality with a value of 0.795 [51].

### 3.4. Relationship of knowledge and attitude with food handlers practice

Table 7 shows that the relationship between knowledge and practice and the relationship between attitude and practice. When associated with the practice, knowledge and attitude variables obtained a significant relationship in two articles, namely and Lee *et al.* and Doraliyana *et al.* which shows that there is a substantial relationship with p-value <0.05 [7], [34]. In comparison, the relationship between knowledge and practice obtained a significant relationship in one article, namely. Cube *et al.* show a meaningful relationship with a p-value of 0.001 [37]. The relationship between attitude and practice has a significant relationship in one article that shows a substantial relationship with a p-value of 0.031 [31].

Table 7. The relationship between knowledge and attitude with food handler practice maintains food quality

Variable	Article code	p
Knowledge and attitude with practice	4	0.005 and 0.015
	8	<0.05 and <0.05
Knowledge with practice	7	0.001
Attitude with practice	1	0.031

Table 7 describe that six articles discuss the relationship between knowledge and attitudes with practice, knowledge with practice, and the relationship between attitudes and practice in food handlers in maintaining food quality. Sani and Siow research concluded a positive correlation between food handlers' knowledge and practices in maintaining food quality [46], [52], [53]. A study by Suryani *et al.*, Doraliyana *et al.*, as well as Lee *et al.* concluded that there is a relationship between the attitudes and practices of food handlers in maintaining food quality and the ways of food handlers in maintaining food hygiene will increase with increasing knowledge of food safety and positive attitudes about food safety [7], [31], [34]. Research conducted by Al-Shabib *et al.* and Amalia *et al.* showed a significant positive correlation between the attitudes and practices of food handlers in maintaining food quality [44], [49].

This finding raises many health concerns because gaining knowledge is essential, but using this knowledge into good practice is even more critical [7]. Likewise, the results confirmed that the sample of restaurant employees' simple food safety practices was mirrored by bacteria's presence in the food samples. The dominant factors for safe food are information and knowledge, and personnel competence [53].

Many obstacles and factors (environmental, social, cultural, belief systems, and so on) can influence whether food handlers effectively implement food safety practices at their workplace [1]-[3], [24], [27], [54], including the lack of adequate food safety training, pressure time, competition for job duties, lack of uncomfortable location of equipment/resources, lack of managerial support, lack of motivation/incentives, lack of reminders, or lack of clarity in food safety messages [24], [27], [54]-[57].

In the context of training, our findings suggest the importance of training to acquire positive food safety knowledge, attitudes, and practices, offer regular training, use various techniques and strategies, use theoretical and practical methods, and provide training for all employees whether they are newcomers, experienced and even ordinary or temporary. This finding was further supported by Cunha *et al.* [57]. They argue that practical training must include a variety of techniques to improve food power skills. Sufen *et al.* reported that training should be tailored to suit managers and subordinates [58]. Professional personnel competence, implementation of food safety programs, and knowing food safety procedures are essential in preventing foodborne diseases [59].

## 4. CONCLUSION

In most studies, the three aspects of KAP have positive relationship. It is indicating that knowledge food handlers who receive safety training have a higher chance than those who do not receive training because food handlers are trained and have good food awareness quality. Therefore, it is necessary to

prioritize expanding the knowledge and attitudes of food safety from food handlers, through measures such as providing basic and advanced food safety training programs. This paper provides various findings that can be used as reference for further research.

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