

Food Safety Knowledge, Attitudes, and Practices of Food Handlers in Makkah, Saudi Arabia

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ABSTRACT

Food safety represents a significant concern for public health as pathogenic agents, whether microbial, chemical, and/or physical, pose risks to human health. This study assessed the knowledge, attitudes, and practices (KAP) of 131 food handlers at restaurants in Makkah, Saudi Arabia, that focused on their duty in preventing foodborne diseases. A cross-sectional study using a validated KAP questionnaire showed that 56.5% of respondents demonstrated adequate food safety knowledge, while 43.5% posed knowledge-related risks. Attitudes were generally positive, with only 19.8% displaying risk-related attitudes, yet a significant gap between attitudes and practices was observed. Alarming, 60.3% of participants reported practices that posed food safety risks. Sociodemographic analysis showed that education level significantly impacted KAP scores, with uneducated participants scoring the lowest. While 93% of participants had undergone food safety training, gaps persisted, suggesting the need for enhanced and frequent training with programs tailored to address specific deficiencies. The study sheds light on the need for more comprehensive interventions for food safety, including stricter regulatory oversight, continuous education, and behaviour monitoring, particularly during high-risk periods like the Hajj season. Future research should explore observational methods and intervention effectiveness to address these gaps and enhance food safety compliance in Makkah's food service industry.

Keyword: knowledge, attitudes, practices, foodborne diseases, Makkah's food service

INTRODUCTION

Food safety remains a fundamental component of public health, directly influencing consumer well-being and economic stability. Recent estimates by the World Health Organisation (WHO) indicate that approximately 600 million fall ill from foodborne diseases, 420 thousand die from consuming unsafe food, and approximately 33 million healthy life years (DALYs) are lost every year around the globe¹. Because food handlers' knowledge, attitudes, and practices (KAP) impact the safety and hygienic conditions of the food they prepare and deliver to customers, they are essential to the prevention of foodborne diseases. Insufficient knowledge, undesirable attitudes, and unfortunate practices among food handlers are often cited as major contributors to food contamination and outbreaks of foodborne ailments². Effective knowledge of food safety gives handlers the tools to identify hazards, control contamination, and maintain appropriate hygiene standards. For instance, recent studies highlight significant gaps in knowledge linked to temperature control and cross-contamination prevention, which are critical aspects of ensuring food safety³. Attitudes towards food safety reflect the level of personal responsibility and commitment among handlers to maintain hygiene practices. However, a disconnect between positive attitudes and actual practices has been observed, particularly in resource-limited settings⁴. Practices, being the behavioural outcome of knowledge and attitudes, are the most direct determinants of food safety. Research indicates that despite training interventions, food handlers often fail to adhere to recommended practices such as handwashing and equipment sanitation⁵.

In the context of Saudi Arabia, where the food service industry is rapidly expanding due to several factors, including urbanisation, tourism, and

changing lifestyle preferences, food safety remains an issue of concern. In the Kingdom, several studies have investigated food safety and regional-specific challenges associated with it and the KAP of food handlers to identify improvement domains and improve food safety protocols. A study conducted in Jeddah City evaluated the food safety KAP amongst restaurant food handlers⁶. The findings shown that while most of food handlers exhibited good knowledge and attitudes towards food safety, there were notable deficiencies in actual practices, such as improper handwashing and inadequate temperature control during food storage. These gaps between knowledge and practice underscore the necessity for continuous training and monitoring to guarantee that proper food safety measures are consistently applied. In the context of Makkah, a region that annually hosts millions of pilgrims, the importance of stringent food safety practices is amplified. A report focusing on the personal sanitation KAP of food operators in Makkah's southern region found that while participants had a satisfactory score of knowledge, their attitudes and practices scores were at moderate level. The research highlighted that educational level significantly impacted both attitudes and practices, with higher education correlating with better food safety behaviours⁷. This indicates that enhancing educational initiatives could lead to improved food safety outcomes. During the Hajj season, the risk of foodborne infections increases due to the massive influx of pilgrims. An observational study assessing adherence with food safety practices among food-serving establishments during Hajj revealed that establishments employing trained food handlers demonstrated higher compliance with safety protocols⁸.

This study sought to determine the level of food safety knowledge, attitudes, and practices among restaurant food handlers in Makkah, Saudi Arabia, given the significance of these factors and their influence

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on the prevalence of foodborne illnesses in societies, as well as the paucity of research on the subject in Saudi Arabia in general and Makkah in particular.

METHODS

The research question was addressed through an anonymous survey conducted using Microsoft Forms as the platform for data collection from April / June 202. Participants were able to complete the survey in approximately 10 minutes. The study received approval from the institute's ethical committee.

Materials: A brief demographic section collected general information such as age and gender. The survey utilised in this study, which focuses on knowledge, attitudes, and practices related to food safety (KAP), was derived from previously published reports⁹⁻¹².

Participants: Participants in this study were food handlers employed at eateries in one of Western Saudi Arabia's biggest and most populated cities. An online invitation link was issued to employees who agreed to participate, directing them to the survey website.

Statistical analysis: SPSS version 27 (Statistical Package for the Social Sciences-27) was used to analyse the survey data. Frequency tables, t-tests, and One-Way ANOVA were among the statistical techniques used to extract valuable information from the data.

RESULTS

Participants in this study were 131 food handlers who worked in cafés and restaurants spread around Makkah city. Only males participated,

the majority of whom were aged 26-35 (45%) followed by those who were 18-25 (32%), 36-45 (15%), and those older than 45 (8%). Most participants (60%) were in a relationship and almost half (49%) had children. With regards to education, the majority had secondary education (41%) followed by those who had tertiary education (34%), primary education (20%), and those who were uneducated (5%). The majority of participants had a monthly income of 2000-3000 SAR (53%) followed by those who had less than 2000 SAR (20%), 3000-4000 SAR (16%), 4000-5000 SAR (9%), and more than 5000 SAR (2%). Also, the majority of participants (66%) had previous experience in the food industry. Moreover, the majority (93%) had food safety training of which almost half (48%) received their training in the last 6 months. Finally, the majority (92%) had periodic medical examinations.

Tables 1, 2, and 3 present the results of the assessment of food safety knowledge, attitudes, and practices using the KAP questionnaire.

Table 4 shows the overall KAP responses among food handlers. It was found that around 40% of the participants pose risks to food safety due to their knowledge, nearly 20% due to their attitudes, and 60% due to their self-reported practices.

Table 5 shows the relationship between KAP and different demographic variables scores of participants. Compared to other educational levels, uneducated participants scored significantly lower knowledge, attitudes, and practices scores ($p < 0.05$). With regards to different age groups, the lowest knowledge score was observed among the age group (45 or older), the lowest attitudes score was reported among the age group (36 – 45), and the lowest practices score was observed among the age group (36 – 45). The monthly income between (2000

Table 1. Food safety knowledge assessment of food handlers (n = 131).

No.	Question	True	False	Don't know/ don't remember
	Washing hands before work reduces the risk of food contamination.	96.18%	3.81%	0%
	Wearing gloves is a substitute for hand cleansing.	32.06%	67.93%	0%
	Freezing kills the microbes that may cause deterioration of foods and foodborne diseases.	52.67%	35.11%	12.21%
	A healthy food handler may contaminate food with microbes that cause foodborne diseases.	78.62%	16.79%	4.58%
	Food handlers' health status must be periodically checked.	100%	0%	0%
	Eating food one day past its expiration date poses risk to health.	85.49%	13.74%	0.76%
	Food that is unfit for consumption always presents colour, taste and/or smell changes.	90.07%	9.92%	
	Washing fruit and vegetables under running water and peeling them is enough to make these foods safe for consumption.	76.33%	21.37%	2.29%
	Well cooked food is free from microbes that cause foodborne diseases.	90.07%	6.87%	3.05%
	Food handlers with cuts or wounds on hands do not need to be kept away from food handling activities.	27.48%	71.75%	0.76%

Table 2. Food safety attitudes assessment of food handlers (n = 131).

No.	Question	Agree	Disagree	Don't know/ don't remember
	Raw and cooked food should be stored separately.	94.65%	5.34%	0%
	The use of adornments or accessories can contaminate food.	87.02%	12.21%	0.76%
	Wearing a cap is an important practice to reduce the risk of food contamination during handling.	97.71%	2.29%	0%
	Defrosted food must not be refrozen.	58.77%	38.93%	2.29%
	Improper food storage may pose risk to health.	97.71%	1.52%	0.76%
	Food must be cooled at room temperature before being put in the fridge.	61.06%	34.35%	4.58%
	Preparing food in advance reduces the risk of contamination.	44.27%	51.14%	4.58%

Table 3. Food safety self-reported practices assessment of food handlers (n = 131).

No.	Question	Never	Rarely	Sometimes	Most of the times	Always
	Do you use food after the expiration date if it has no change in quality aspect?	93.13%	2.29%	1.52%	1.52%	1.52%
	Do you thaw food at room temperature (outside the fridge)?	54.19%	7.63%	7.63%	3.81%	26.71%
	Do you check the expiration date of ingredients before using them in food preparation?	2.29%	97.71%	0%	0%	0%
	Do you wash your hands after using the bathroom?	0.76%	99.23%	0%	0%	0%
	Do you talk while handling ready to eat food?	48.85%	8.39%	25.19%	2.29%	15.26%
	Do you handle food when you are sick or have cuts on hands?	90.84%	1.52%	3.81%	0.76%	3.05%
	Do you keep your hair completely covered with a cap while handling food?	6.10%	0.76%	93.13%	0%	0%
	Do you sanitize your workplace after finishing your service?	0.76%	99.23%	0%	0%	0%

Table 4. The overall response of KAP among food handlers (n = 131)

Question	Yes	No
Knowledge risk	43.51%	56.48%
Attitudes risk	19.84%	80.15%
Self-reported practices risk	60.30%	39.69%

Table 5. Sociodemographic factors and how they relate to the food handlers' KAP scores were examined (n = 131).

Variables	Knowledge M (SD)	Attitudes M (SD)	Practices M (SD)
Age			
(18 – 25)	6.19 (1.31)	4.47 (1.36)	6.73 (1.06)
(26 – 35)	6.33 (1.19)	4.39 (1.06)	6.86 (.89)
(36 – 45)	6.40 (1.35)	4.30 (1.12)	6.50 (1.05)
(45 or older)	6.10 (1.10)	4.60 (1.71)	6.80 (.91)
Level of education*			
Primary (elementary school)	6.38 (.89)	4.73 (1.34)	6.88 (.76)
Secondary (High school)	6.25 (1.43)	4.25 (1.26)	6.74 (.95)
Tertiary (Graduate)	6.45 (1.08)	4.27 (1.04)	6.65 (1.09)
Uneducated	5 (1.15)*	5.42 (.97)*	7.14 (1.06)*
Marital status			
In a relationship (Married or Engaged)	6.27 (1.32)	4.43 (1.19)	6.81 (.94)
Not in a relationship	6.28 (1.12)	4.40 (1.27)	6.69 (1.02)
Monthly income			
2000 - 3000 SAR/month	6.05 (1.20)	4.34 (1.23)	6.71 (.91)
3000 - 4000 SAR/month	6.61 (1.11)	4.23 (.94)	7.04 (.97)
4000 - 5000 SAR/month	7.08 (.79)	4 (1.12)	6.66 (1.15)
Less than 2000 SAR/month	6.19 (1.44)	4.96 (1.34)	6.76 (1.07)
More than 5000	7.00 (1.41)	4.50 (.70)	6 (.04)
Children			
Yes	6.35 (1.25)	4.35 (1.20)	6.79 (.96)
No	6.20 (1.23)	4.47 (1.24)	6.73 (.99)
Previous experience in food safety			
Yes	6.37 (1.22)	4.36 (1.22)	6.88 (.89)
No	6.09 (1.27)	4.52 (1.22)	6.52 (1.08)
Food safety training			
Yes	6.33 (1.73)	5 (1.41)	7 (.86)
No	6.27 (1.20)	4.37 (1.20)	6.74 (.98)
Training in the last six months			
Yes	6.17 (1.27)	4.29 (1.20)	6.78 (1.03)
No	6.38 (1.20)	4.53 (1.23)	6.74 (.92)
Periodic medical examination			
Yes	6.28 (1.25)	4.40 (1.23)	6.80 (.97)
No	6.27 (1.10)	4.63 (1.12)	6.36 (.92)

– 3000 SAR) reported the lowest knowledge scores compared to other groups. The lowest attitudes among monthly income groups were reported among the group (4000 – 5000 SAR). The lowest practice score was reported among the group (more than 5000). When asked about previous experience in food safety, those who answered “no” reported lower knowledge and practice scores compared to those who said “yes”. When asked about food safety training, participants who answered “no” reported lower knowledge, attitudes, and practices when compared to those who said “yes”. Regarding receiving training in the last six months, those who answered “no” reported higher knowledge and attitudes but lower practices when compared to those who said “yes”. When asked about periodic medical examinations, participants who answered “no” reported lower knowledge and practices but higher attitudes compared to those who said “yes”.

Groups did not differ significantly unless stated. * Group was significantly lower compared to others ($p < 0.05$).

Table 6 shows participants' satisfaction with their profession. About half of the participants said “no” when asked, “If you could choose a profession, would you choose this same profession”. More than half of the respondents said yes when asked, “When you have personal trouble, do you share it with your colleagues or the head of the department”. About 80% of the participants thought that the workload was adequate. The majority (94.65%) thought that their workplace provided all the vital requirements to guarantee food safety. The majority (93.13%) thought that the meals given presented no health threat to customers.

Table 6. Demographic questions (n = 131)

Question	Yes	No
If you could choose a profession, would you choose this same profession?	53.43%	46.56%
When you have personal trouble, do you share with your colleagues or head of department?	58.01%	41.98%
Is the workload adequate?	79.38%	20.61%
Does the workplace provide all the necessary conditions to guaranteeing food safety?	94.65%	5.34%
Do the meals served present health risks to the people?	6.87%	93.13%

DISCUSSION

Foodborne diseases caused by an absence of knowledge, negative attitudes, and improper practices during the different stages involved in food processing, preparation and serving are an issue of concern for public health officials worldwide¹³. Hence, this study explored food safety knowledge, attitudes, and practices of food handlers in Makkah, Saudi Arabia. The results indicate that the profile of food handlers in Makkah is sometimes similar and sometimes different to those observed in other studies. For example, some studies have shown that the majority of food handlers are males and in an age range similar to that found in Makkah^{6,11,13-18}. On the other hand, other reports found a high proportion of females among food handlers^{19,20} and a higher percentage of older adults (>35 years old)^{21,22}. Also, regarding participants' educational background, in agreement with our findings, it has been formerly stated that most food handlers are high school and university graduates^{6,11}. Nevertheless, reports of low levels of education among food handlers are also present in the literature²²⁻²⁴. Moreover, similar to the results presented in this study, most food handlers have previous experience in the food industry and received training^{4,25}. However, reports of food handlers having no training or experience have been found as well²².

With regards to KAP score calculations, the results indicate that 43.5% of participants pose knowledge-related risks to food safety. Even though some participants struggled to answer certain questions (Table 1 – Questions 2,3,4,6,8,10), more than half of the participants seemed to have adequate knowledge on the different issues of concern regarding food poisoning. Previous studies conducted in Saudi Arabia, the Gulf States (e.g. United Arab Emirates, Bahrain, Oman), and elsewhere showed different levels of food safety knowledge which could be due to significant differences in their research methodology^{4,22,26}. Even though some studies found acceptable levels, some concerning gaps in knowledge of foodborne pathogens, factors affecting microbial growth, and personal hygiene were found²⁷. As for attitudes towards food safety, participants presented better results than the knowledge section. The results indicate that only 19.8% of participants pose attitude-related risks. Even though some participants struggled to answer certain questions (Table 2 – Questions 4,6,7), more than half seemed to have a positive attitude towards food safety. This is consistent with other studies^{23,25,28} that reported participants having high scores in the attitudes section. Compared to knowledge and attitudes, participants seemed to have struggled the most regarding self-reported practices. More than half of the participants (60.3%) have improper practices that can pose risks to food safety. Most questions assessing participants' practices were answered incorrectly except for two (Table 3 – Questions 1,6). Again, this is consistent with previous reports^{22,29} that showed participants having low scores in the practices section.

In agreement with previous reports¹¹, no significant difference ($p > 0.05$) arose in the knowledge, attitudes, or self-reported practices levels based on participants' age, marital status, having children or not, experience in the food industry, being trained, or having periodical medical examinations. Nevertheless, other studies did report significant differences in the aforementioned variables. For example, higher overall KAP scores were found for; (i) food handlers with long working experience^{26,30,31}; (ii) older food handlers³²; and (iii) enrolment in food safety training^{26,31,33,34}. Our findings show that only participants' educational background significantly affected their KAP scores. Uneducated participants in particular scored significantly lower in knowledge, attitudes, and practices ($p < 0.05$) when compared to other groups. Research conducted earlier has demonstrated that higher educational levels are associated with higher KAP scores compared with lower educational levels^{26,31,34-39}.

Our findings show that the majority of participants were not satisfied with their job and would rather choose a different profession even though they seemed to have good relations with their colleagues, thought that the workload was adequate and that the workplace provided all the necessary conditions required for ensuring food safety. This could have affected their food safety knowledge, attitudes, and practices. A study investigating food handlers in Dubai's restaurants reported that job satisfaction and commitment positively impacted food safety⁴⁰. The findings suggested that food handlers with higher job satisfaction and commitment levels were more likely to apply their food safety knowledge and maintain positive attitudes towards safe practices.

Given the significance of food safety and the pivotal role of food handlers in preventing foodborne illnesses, the Kingdom of Saudi Arabia focused on increasing knowledge and changing attitudes and practices for public health. Minimum wages have been introduced and training is mandatory for all food handlers. Nevertheless, more needs to be done regarding the adaptation of more systematic evaluative methods designed specifically to identify regional challenges associated with food safety and areas for improvement. In general, food safety in Saudi Arabia encounters several challenges, such as inadequate

implementation of risk analysis, limited availability of academic programs and scientific institutions, a scarcity of specialised training opportunities, and a shortage of educational programs dedicated to food safety science within the Kingdom⁴¹. Even though no study that focused on specific food safety issues was found for each region in Saudi Arabia, it is believed that food safety challenges in the kingdom vary across its regions due to differences in several factors, including climate, urbanisation, infrastructure, and socio-economic factors⁴². Moreover, it is thought that the characteristics of each region heavily influence food safety, and thus; (i) the high urbanisation with dense populations in the Central Region, especially in Riyadh, along with the fast-paced lifestyle and high demand for food services, can lead to lapses in food safety practices; (ii) the religious tourism and pilgrimage in the Western Region, especially Makkah and Madinah which host millions of pilgrims annually, increases the demand for food services and along with the high turnover of food handlers and temporary establishments during peak seasons can compromise food safety; (iii) the significant industrial activities with a diverse expatriate workforce in the Eastern Region along with diverse food handling practices among workers from different backgrounds can lead to inconsistencies in food safety standards; (iv) the predominantly agricultural nature of Southern Region along with the many small-scale food producers and limited access to food safety training and infrastructure can result in inadequate food handling practices; and (v) the Northern region's arid climate and dispersed populations could present challenges in transportation and storage due to vast distances which eventually could affect food quality and safety.

Finally, even though our findings show the KAP scores for food handlers in Makkah, a few limitations do exist. First, the nature of the study did not allow for visiting every food establishment in the city. Second, the reliance on participants' answers, which even if they answered correctly, may not truly reflect what is happening daily during their work. Third, no observation of their entire daily work routine was conducted. Fourth, the low number of participants, the convenience sampling method, and the nature of the recruitment process did not allow for generalising the results and could be affected by selection bias.

CONCLUSION

The present study investigated food handlers' knowledge, attitudes, and practices in Makkah, Saudi Arabia. The findings indicated that the profile of food handlers is sometimes similar and sometimes different to those observed in other studies. Also, the results showed that participants posed some risks related to food safety due to their lack of knowledge, their attitudes towards food safety, and their self-reported practices. Moreover, they showed that the educational background of participants significantly affects food safety knowledge, attitudes, and practices. Further research is required as there is a need for a detailed assessment of food safety knowledge, attitudes, and practices among different groups of food handlers (differences between males and females and Saudis and non-Saudis) and an examination of the factors that could affect the aforementioned variables. Moreover, an examination of the interventions that could enhance food safety knowledge, attitudes, and practices is also required.

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Competing Interest: None

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