Research Article

Food Safety Knowledge, Attitude and Hygiene Practices Among Food Court Handlers in Batu Pahat, Johor

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Abstract
Food courts play a vital role in the food service industry as they offer diverse culinary experiences to consumers. However, ensuring food safety in such environments remains a significant challenge due to the high number of food handlers and the varying levels of hygiene practices. This study aimed to assess the knowledge, attitudes, and hygiene practices of food handlers in food courts located in Batu Pahat, Johor. A cross-sectional study was conducted using a structured questionnaire and convenience sampling of 200 food handlers. The findings indicate that food handlers generally possess a high level of food safety knowledge and demonstrate positive attitudes. However, their knowledge does not always translate into safe food handling practices. Furthermore, statistical analyses revealed no significant relationship

between food safety knowledge and food safety practices, indicating potential gaps in the application of knowledge. Additionally, demographic factors such as age, marital status, education level, and food safety training significantly influenced food safety knowledge, attitudes, and practices. The study highlights the need for continuous training and enforcement of hygiene regulations to enhance food safety practices among food handlers.

Keywords:
Food safety, food handlers, knowledge, attitude, and practice (KAP)

1 Introduction

Food courts have become a prominent feature in modern dining. They offer a wide variety of food options and serve large numbers of customers daily. However, despite their popularity and convenience, there are still concerns about food safety and hygiene, as the high turnover of food and the fast-paced environment create unique challenges that could contribute to foodborne illnesses. Research has shown that food courts are occasionally linked to outbreaks, emphasising the importance of stringent food safety practices and effective hygiene protocols. To better understand these issues, a Key Assessment of Knowledge, Attitude, and Practices (KAP) survey can be used to evaluate the level of food handlers' knowledge, belief, and actual practice regarding food safety (Andrade et al., 2020). In the context of food courts, KAP surveys provide valuable insights into food handlers' knowledge and attitudes, and how these translate into everyday practices. However, studies have indicated that even when food handlers possess basic knowledge and positive attitudes toward food safety, this does not always lead to consistent safe practices. For example, Asmawi et al. (2018) reported that food handlers demonstrated poor knowledge levels, with a mean score of only 58.3%. This gap between knowledge, attitudes, and practices highlights the need for more effective and practical training approaches to strengthen food safety compliance in food court environments. In this regard, understanding regulatory standards and compliance rates is crucial for maintaining food safety in food courts. While government regulations and industry standards set the benchmark for safe food handling and hygiene practices, research has shown that adherence to these standards can vary, with some food handlers lacking a thorough understanding of the knowledge provided during training. This indicates that while food handlers may attend food safety training sessions, their comprehension of the material is often insufficient. More effective training methods are necessary to bridge this gap and ensure that food safety knowledge is properly translated into practice. Consumer perceptions of food safety and cleanliness in food courts also play a significant role in influencing dining choices and customer trust. Patrons' dining decisions are influenced by their perceptions of the hygiene standards maintained by food establishments. Research into consumer attitudes offers valuable insights into what factors are most important to diners and how these perceptions affect their trust and confidence in food courts. For instance, poor knowledge, attitudes, and practices related to food safety and personal hygiene among food handlers in North Jakarta emphasize the need for enhanced supervision and training (Putri & Susanna, 2021).

Synthesising findings from research on food safety regulations, compliance rates, consumer attitudes, and specific hygiene practices offers a comprehensive view of the current food safety landscape in food courts. This integrated approach helps in designing targeted surveys and intervention strategies aimed at improving food safety. By addressing the identified gaps in knowledge and practice, stakeholders can develop more effective measures to enhance food safety and consumer confidence. Ultimately, ensuring that food courts maintain high standards of cleanliness and hygiene requires a collaborative effort. Effective supervision, ongoing training, and responsiveness to consumer feedback are essential components of a successful food safety strategy. By focusing on these areas, food courts can better safeguard public health and foster trust among their patrons.

Food safety is an essential component of human existence, and it involves the preservation of food products and preventing bacteria or other contaminants from affecting food products and hence health (Barkhuu et al., 2023). It involves processing, cooking, and serving of foods with the intent of controlling illnesses, something that shows a baseline human right to access healthy foods (Maestro et al., 2022). Food safety entails factors such as microbial and chemical hazards, and even personal and environmental sanitation. In the present world, the issue of food safety is significant, especially in relation to food business operations due to the high percentage of foodborne diseases in these businesses. Food safety in food courts encompasses various aspects such as food hygiene practices, knowledge, attitudes, and training of food handlers to ensure the safe production, processing, distribution, and preparation of food. Food handlers' inadequate training presents serious obstacles to food courts' efforts to preserve food safety. Many employees, especially those who work as students at universities, exhibit inadequate sanitation and hand hygiene standards. An analysis of observational data shows that less than 1 percent of cases include sanitation after crucial behaviours that require handwashing, such as handling foods that are ready to eat or touching surfaces that may be contaminated (Prado et al., 2015). A lack of adequate training and enforcement of food safety procedures is highlighted by this disparity between self-reported and real behaviours.

Microbial contamination in food courts is further increased by the practices and behaviours of food handlers, who play a critical role in ensuring food safety. Food handlers are responsible for preparing, serving, and maintaining the cleanliness of shared dining facilities, including communal tables, serving counters, and utensils. However, research and observational studies have consistently shown gaps in their adherence to hygiene and sanitation protocols. For instance, despite the critical importance of hand hygiene, studies reveal that handwashing or glove-changing is often neglected after handling potentially contaminated surfaces, raw food, or personal items. Coliforms and E. Coli have been found through testing on frequently touched surfaces such as beverage dispensers, serving counters, and salad bar cutlery (Her et al., 2019). These results demonstrate insufficient cleaning procedures and disregard for hygienic guidelines. The issue is made worse by consumers' ignorance and lack of accountability, as many are unaware of the dangers these surfaces pose. Furthermore,

Sembiring et al. (2023) stated that food handlers in food courts may lack essential knowledge and training in critical areas like sanitation and food management, leading to potential food safety risks. The study involved 18 restaurants in the Minas district and found that several food handlers did not use aprons or wash their hands when processing food ingredients. Vegetables, fish, shrimp, and other food ingredients for cooking were not washed in running water, and there were still places to eat with poor hygiene and sanitation conditions. None of the food handlers interviewed knew how to manage food properly or the requirements for food hygiene and sanitation in food management.

Given these concerns, this study aims to assess the knowledge, attitudes, and hygiene practices of food handlers in food courts in Batu Pahat, Johor. By identifying existing gaps in food safety knowledge and compliance, this research will provide valuable insights into the factors influencing food handlers' behaviours. The findings will contribute to the development of targeted training programs, enhanced policy measures, and improved enforcement strategies to ensure better food safety compliance. Strengthening food safety protocols in food courts can help minimize foodborne illness risks, enhance consumer confidence, and promote a healthier dining environment for the public.

2 Literature Review

Food safety knowledge is essential for preventing foodborne illnesses and ensuring public health, as food handlers play a critical role in maintaining hygiene throughout food storage, processing, preparation, and retailing. Contaminated food poses significant health risks, making it crucial for food handlers to understand and implement proper safety measures. This includes personal hygiene, awareness of food poisoning, cross-contamination, cleanliness, and temperature control. Studies highlight that food handlers can be sources of contamination, with hands being a major factor in spreading harmful bacteria. Proper hand hygiene, frequent washing, and avoiding contact with hair or other non-food surfaces are vital. Additionally, understanding critical control points, such as maintaining the cold chain, cooking food to safe internal temperatures, and storing raw and cooked foods separately, minimizes contamination risks. Effective practices include utensil sanitisation, changing gloves, using separate tools, and handling high-risk foods like dairy, seafood, and poultry with extra caution. Training, workshops, and visual aids help reinforce food safety knowledge, protecting consumers and enhancing the reputation of food establishments by reducing foodborne illnesses.

Food safety attitudes encompass an individual's mindset, beliefs, and feelings regarding the importance of adhering to safe food handling, preparation, and storage practices, and they significantly influence the likelihood of consistently implementing these measures to prevent contamination and foodborne illnesses. According to Glanz et al. (2015), a positive attitude toward food safety fosters a proactive approach to identifying and mitigating risks, thereby promoting a culture of safety within food service environments. However, studies show that positive attitudes alone do not

always guarantee safe practices. For example, Makhunga et al. (2023) found that while South African food handlers mostly expressed positive attitudes, these did not always translate into practice due to poor working conditions, time pressures, and limited resources. Similarly, Da Vitória et al. (2021) reported that Brazilian school food handlers displayed positive attitudes but still showed gaps in adherence to best practices. These findings suggest that although attitudes are essential, they must be reinforced through supportive work environments, continuous training, and adequate supervision.

In Malaysia, studies have confirmed the critical role of attitudes in shaping safe practices. Salleh et al. (2020) found that consumer attitudes had a strong positive effect on food-safety practices ($\beta = 0.534$, $p < 0.05$), while knowledge alone did not significantly predict behaviour. Supporting this, Abdul Aziz, Kamarulzaman, and Abdul Hadi (2023) reported that 89.2% of street food vendors in the Klang Valley demonstrated positive attitudes, and 91.4% showed good food-handling practices. The study reported attitudes positively correlate with both knowledge and behaviour. Likewise, a cross-sectional study of Malaysian food truck vendors during the COVID-19 pandemic found that mean attitude scores ($M = 94.8$, $SD = 5.95$) and self-reported food-safety practices ($M = 84.7$, $SD = 6.62$) were both high, suggesting that positive attitudes in times of heightened public health awareness may strengthen risk-mitigation behaviours (Rahman et al., 2022). Collectively, these findings highlight that while positive attitudes are vital, they must be paired with structural support and continuous reinforcement to ensure consistent safe practices and enhance public trust in food service establishments.

2.1 Food Knowledge

Recent studies in Malaysia highlighted both strengths and gaps in food knowledge across different population groups. For example, a 2023 study of street food vendors in the Klang Valley reported that 81.7% had adequate food safety knowledge, which was positively correlated with their attitudes and practices, particularly among those who had received training and licensing (Abdul Aziz, Kamarulzaman, & Abdul Hadi, 2023). Similarly, a 2024 study of secondary school students in Kelantan found that while many could identify preventive practices such as hygiene and basic food handling, misconceptions remained regarding the symptoms of foodborne illness, suggesting that knowledge does not always translate into correct understanding (USIM Research Repository, 2024). Broader consumer research also reflects this trend. A nationwide survey, *Unveiling Food Safety Perceptions* (2025), revealed significant gaps in public knowledge, especially in areas such as food additives, proper storage, and regulatory oversight, with only 15–20% of respondents scoring very high in these domains (QASCf, 2025).

Further evidence has indicated that knowledge alone may not guarantee safer behaviours. A structural equation modelling study of Malaysian consumers found that while respondents demonstrated high levels of food safety knowledge, knowledge itself had a negative and statistically insignificant relationship with actual practices ($\beta = -0.284$, $p > 0.05$). In contrast, attitudes had a strong positive influence ($\beta = 0.534$, $p <$

0.05), highlighting the importance of shaping positive mindsets alongside knowledge (Soon et al., 2023). A similar pattern emerged among secondary school students in Kelantan and street food consumers in Kuala Kangsar, Perak, where overall knowledge was moderate (mean ≈ 59/100) and weaknesses persisted in key areas such as cross-contamination control, storage, and time-temperature management (Mohd Suhaimi, 2024). Collectively, these findings suggest that while foundational food knowledge is present in many Malaysian communities, targeted and behaviour-focused education is still needed to close specific gaps and ensure that knowledge consistently translates into safe food practices.

2.2 Attitudes

Attitudes and practices of food handlers are vital to food safety, as positive attitudes often encourage compliance with hygiene standards. In Malaysia, Abdul Aziz, Kamarulzaman, and Abdul Hadi (2023) reported that 89.2% of street food vendors in the Klang Valley demonstrated positive attitudes toward food safety, and 91.4% engaged in good practices, showing a strong correlation between the two. However, knowledge alone does not guarantee safe practices; Salleh et al. (2020) found that while consumers and handlers had high food safety knowledge, only attitudes significantly predicted compliance. In Johor, mixed patterns of hygiene practices have been reported. A survey in Pasir Gudang revealed that while many food workers wore proper attire and maintained basic cleanliness, lapses remained in nail hygiene, jewelry removal, and handwashing routines (Al Hakim & Azman, 2022). Similarly, a study in Sekolah Menengah Sains Johor, although 70.4% of food handlers had received training and self-reported good practices, microbiological testing still detected Staphylococcus aureus contamination on 17.4% of hand swabs (Hassim, Kamal, & Mahmood, 2021). Enforcement data also reflect persistent issues: during the 2023 Ramadan bazaars, the Johor State Health Department issued 120 notices to food handlers across more than 2,400 premises for food safety violations (Johor State Health Department, 2023). These findings, consistent with international research (Makhunga et al., 2023; Da Vitória et al., 2021), highlight that while respondents generally showed positive attitudes, translating them into consistent practices requires continuous training, adequate resources, and strong regulatory monitoring.

2.3 Hygiene Practices

Studies of food handlers in Johor reveal both improvements and persistent gaps in hygiene compliance, particularly in rural and semi-urban areas. For example, a survey of 300 food workers from P3 category premises in Pasir Gudang during the COVID-19 era found that while many handlers wore proper attire and maintained basic cleanliness, lapses were observed in nail hygiene, jewellery removal, and consistent handwashing routines (Al Hakim & Azman, 2022). Similarly, at Sekolah Menengah Sains Johor, although 70.4% of 72 food handlers reported having received official training and self-rated their hygiene practices as “good,” microbiological testing of hand swabs revealed that 17.4% were contaminated with coagulase-positive *Staphylococcus aureus*,

highlighting a discrepancy between self-reported practices and actual behaviours (Hassim, Kamal, & Mahmood, 2021).

Regulatory inspections further illustrate these challenges. During the month of Ramadan in 2023, the Johor State Health Department inspected more than 2,400 premises in Ramadan Bazaars and issued 120 notices for hygiene and food safety violations (Johor State Health Department, 2023). There have been positive changes, in 2025, inspections of 1,240 stalls in Ramadan Bazaars found that all achieved cleanliness scores above 80%, with most vendors using aprons, gloves, and caps appropriately (The Sun, 2025). Nonetheless, enforcement remains necessary; for instance, an eatery in Johor Bahru was ordered closed for two weeks in 2024 due to poor hygiene and untrained food handlers (Suara, 2024). To further raise standards, the Johor Bahru City Council has introduced the "Bersih, Menawan dan Wangi" (BMW) campaign, requiring all food premises to maintain toilets with a minimum four-star rating as a condition for licence renewal, impacting more than 7,400 outlets (Batam News Asia, 2024). Collectively, these findings suggest that while hygiene practices and regulatory oversight in Johor have improved, consistent behavioural reinforcement, stricter monitoring, and infrastructure upgrades remain essential to sustaining high food safety standards.

Food courts, as popular dining venues, face unique food safety challenges due to their fast-paced operations and high customer turnover, which can increase risks of foodborne illnesses. Studies have linked such settings to outbreaks, highlighting the need for strict hygiene and safety protocols. Knowledge, Attitude, and Practices (KAP) surveys are commonly used to evaluate food handlers, yet findings reveal a gap between knowledge and actual practices. For instance, Malaysian food handlers scored only 58.3% in food safety knowledge, reflecting limited understanding (Asmawi et al., 2018). More recent research also indicates that while attitudes strongly influence practices, knowledge alone does not ensure compliance, suggesting the need for training that reinforces behaviour change (Salleh et al., 2020).

3 Methodology

3.1 Sample of Study

The study was conducted in Batu Pahat, Johor, a rapidly urbanising town and the capital of Batu Pahat District. Under the jurisdiction of the Batu Pahat Municipal Council (MPBP), the town has seen significant growth due to the presence of public and private hospitals, entertainment venues, and a university, all of which contributed to increased urbanisation and a rising trend of dining out. The study focused on food courts operating in Batu Pahat, which serve as popular dining establishments catering to the growing demand for outdoor dining experiences. The survey was conducted face-to-face with 200 food handlers in selected food courts (Batu Pahat Mall and Lotus, Parit Raja) aged 20 and above. among 200 food handlers. This fulfils the minimum requirement for sample size required for Pearson Correlation analysis (Guilford, 1954). This study employed convenience sampling, the non-probability sampling method commonly used

in both qualitative and quantitative research (Etikan, 2016). Convenience sampling involves selecting participants based on accessibility, which may limit the generalizability of the findings but allows for practical data collection within the study's constraints. Data collection was conducted during the operation hours of the selected food courts in shopping malls around Batu Pahat. Data were gathered from 10:00 a.m. to 9:00 p.m. on both weekdays and weekends to ensure a comprehensive representation of food handling practices across different time periods and customer traffic levels.

3.3 Questionnaire Method

This study used a structured questionnaire to assess food safety knowledge, attitudes, and practices among respondents. Based on earlier research, data were collected using a guided, self-administered, closed-ended questionnaire, provided in both English and Bahasa Malaysia to ensure clarity and comprehension. Food handlers at food courts completed the questionnaire during their working hours. The final questionnaire comprised four sections: Section A (Socio-Demographic Profile), Section B (Food Safety Knowledge), Section C (Food Safety Attitudes), and Section D (Food Safety Practices).

Section A collected demographic details such as gender, age, marital status, nationality, education level, work experience, and food safety training period (Ahmed et al., 2021), using categorical questions. Section B evaluated food safety knowledge, including foodborne diseases, temperature danger zones, cross-contamination, personal hygiene, and pathogenic bacteria transmission (Halim-Lim et al., 2023), using dichotomous "True" or "False" questions, with an additional "Not Sure" option to reduce respondent burden. The knowledge score for each respondent was recorded by calculating how many questions out of 15 were answered correctly. This knowledge score becomes continuous data. Section C assessed food handlers' attitudes toward hygiene, cross-contamination prevention, food storage, smoking in preparation areas, reliance on antibacterial soap, protective measures, worker health evaluations, and chemical storage (Halim-Lim et al., 2023) using a 5-point Likert scale (1-Strongly Disagree to 5-Strongly Agree). Lastly, Section D examined food safety practices, including hand hygiene, thawing frozen foods, working while ill, appropriate attire, smoking during food preparation, and cleaning and drying of hands and surfaces (Asmawi et al., 2018), also using a 5-point Likert scale (1-Never to 5-Always).

3.4 Statistical Analysis

The data was analysed by using IBM Statistical Package for the Social Sciences (SPSS) version 27. Data cleaning was carried out before doing other analyses. Since n of this study is 200 which is more than 30, the Central Limit Theorem was used in this study. According to the Central Limit Theorem, if the sample size is $n > 30$, the sampling distribution is approximately to the standard normal distribution, and the sampling is considered normal (Kwak & Kim, 2017). Thus, the parametric statistical analysis was performed.

4 Findings

Food handlers in food courts in Batu Pahat were the respondents of this study. The total number of respondents who took part in this study was 200. Basic descriptive analyses (frequency and percentage) were used to analyse data in the socio demographic profile section. Table 1 shows the socio-demographic profile of the respondents by frequency and percentage.

Table 1: Socio-demographic characteristics of respondents

Characteristics	Categories	Frequency (n)	Percentage (%)
Gender	Male	126	63
	Female	74	37
Age*	30 years old and below	109	54.5
	31 years old and above	91	45.5
Marital status	Single	104	52
	Married	88	44
	Divorced	8	4
Nationality*	Malay	185	92.5
	Non-Malay	15	7.5
Level of education*	No formal education	14	7
	STPM/Diploma and below	90	45
	Degree and above	96	48
Work experience*	5 years and below	150	75
	6 years and above	50	25
Food safety training*	Not trained	63	31.5
	6 hours and below period of training	112	56
	7 hours and above period of training	25	12.5

**Age, nationality, level of education, work experience and food safety training has been re-classified based on actual data*

Table 1 indicates that male respondents dominated the food handling sector, accounting for 63% of the workforce, while female respondents made up 37%. This aligns with findings from Halim-Lim et al. (2023), which reported that 84.8% of food handlers were male, consistent with the low participation from women in the accommodation and food industries. Women may face challenges such as balancing family responsibilities with the demanding and often irregular schedules typical of food handling jobs, which may explain their lower representation in this field. In terms of age distribution, half of the respondents (50%) were aged between 21-30, followed by 41.5% aged between 31-40, while only 4% were aged 41-50. This trend suggests that younger individuals tend to enter the workforce early, often after graduation, to earn a living and support their families. The data also shows that Malays dominate the food court business in Batu Pahat, with 92.5% of food handlers identifying as Malay, while non-Malay respondents accounted for only 7.5%.

Marital status data revealed that the majority of respondents were single (52%), 44% were married, and 4% were divorced. The demanding and irregular hours

associated with food handling jobs may make them more appealing to single individuals with less family obligations. Additionally, as many food-handling positions are entry-level, they tend to attract a younger workforce, which is more likely to be unmarried (Seyitoğlu et al., 2023). In terms of education, 46.5% of respondents had obtained tertiary education, while 22.5% had secondary education, such as SPM or STPM/Diploma. However, 7% of respondents lacked any formal education, which is concerning as it may hinder their ability to understand food safety regulations and hygiene practices, potentially affecting public health (Ncube et al., 2019). Work experience data highlighted that most respondents (61.5%) had between 1-5 years of experience, reflecting the temporary nature of food-handling jobs, which often attract younger individuals or those seeking entry-level employment. Alarmingly, nearly one-third (31.5%) of respondents had never received any food safety training, presenting a significant knowledge gap in ensuring public health. A study by Al-Akash et al. (2022) supported this concern, reporting that only 8.2% of food handlers had received formal food safety training. Implementing targeted training programs could significantly enhance food safety knowledge and practices across various settings, including food courts, hotels, and hospitals.

The data in Table 2 shows the frequency and percentage of correct and wrong answered of question in section B, food safety knowledge. Table 2 reveals that all respondents (100%) correctly answered items related to handwashing before work and recognising food contamination through changes in colour, odour, or taste. Additionally, over 60% of respondents answered correctly for most items, except for two key areas: Hepatitis A as a foodborne pathogen and the misconception that a visibly clean cutting board can be used for both raw and cooked foods. Only 50% of respondents correctly identified the risk of cross-contamination from improper cutting board use, which can lead to foodborne illnesses like Salmonella and E. coli (Shahid et al., 2022). Similarly, while 67.5% of respondents recognised Salmonella as a foodborne pathogen, only 51% identified Hepatitis A, likely due to greater public awareness of bacterial pathogens over viral ones (Koire, 2024). This gap underscores the need for stronger public health messaging about Hepatitis A and foodborne virus prevention.

Findings on food storage practices were more positive, with 99% and 94% of respondents correctly identifying the proper temperatures for hot, ready-to-eat food (≥65°C) and perishable food storage (≤5°C), respectively, reflecting strong foundational food safety knowledge. These temperatures are crucial in preventing bacterial growth (WHO, 2015). Furthermore, 87.5% of respondents were aware that typhoid fever can be transmitted through contaminated food, indicating their understanding of disease transmission risks (Carver et al., 2019). However, the 12.5% who lacked this awareness highlight the need for continuous public health education to ensure food handlers fully grasp the consequences of unsafe food handling.

Table 2: The total of correct and wrong answer stated by respondents

No.	Knowledge Items	Desired response	Correct, n (%)	Wrong, n (%)
1	Washing hands before work reduces the risk of food contamination.	Yes	200 (100)	0 (0)
2	Using gloves while handling food reduces the risk of food contamination.	Yes	198 (98)	2 (1)
3	Typhoid fever can be transmitted by food.	Yes	175 (87.5)	25 (12.5)
4	Salmonella is among the food-borne pathogens.	Yes	135 (67.5)	65 (32.5)
5	Hepatitis A virus is among the food-borne pathogens.	Yes	102 (51)	98 (49)
6	Cross contamination is when microorganisms from a contaminated food are transferred by the food handler's hands or kitchen utensils to another food.	Yes	198 (99)	2 (1)
7	Freezing kills all the bacteria that may cause food-borne illness.	Yes	195 (97.5)	5 (2.5)
8	The correct temperature for storing perishable foods is 5°C.	Yes	188 (94)	12 (6)
9	Hot, ready-to-eat food should be kept at a temperature of 65°C.	Yes	198 (99)	2 (1)
10	During infectious diseases of the skin, it is necessary to take leave from work.	Yes	199 (99.5)	1 (0.5)
11	The same cutting board can be used for raw and cooked foods if it looks clean.	Yes	100 (50)	100 (50)
12	Eating and drinking in the workplace increase the risk of food contamination.	Yes	199 (99.5)	1 (0.5)
13	Microbes are in the skin, nose and mouth of healthy handlers.	Yes	194 (97)	6 (3)
14	Contaminated foods always have some change in colour, odour or taste.	Yes	200 (100)	0 (0)
15	Raw vegetables are at higher risk of contamination than undercooked beef.	Yes	187 (93.5)	13 (6.5)

Table 3 shows food handlers' attitudes toward hygiene, cross-contamination, storage, and safety in the form of mean and standard deviation of each item in section C - food safety attitudes. From the table, food handlers generally showed positive attitudes toward food safety, with all items scoring above 4 except for raw meat storage. The highest agreement (94%) was on smoking being unsafe in food prep areas, aligning with findings from Pakistan (Ahmed et al., 2021). The second highest mean score (4.68 ± 0.47) was for well-cooked food being contamination-free, highlighting strong awareness of proper food preparation to eliminate harmful pathogens. Overall, respondents demonstrated a stronger commitment to food safety than those in a Maldives study (Halim-Lim et al., 2023). Over 90% of respondents recognised the

importance of wearing masks and gloves to prevent food contamination, aligning with Ali et al. (2022), where 98% showed similar awareness. Additionally, 90.8% had a positive attitude toward keeping cleaning products separate from food, demonstrating strong safety awareness. However, only 65.8% agreed that raw meat should be stored on the bottom shelf to prevent cross-contamination, indicating a gap in knowledge that needs further reinforcement.

Table 3: Mean and standard deviation for food safety attitudes

No.	Attitude Items	Mean (SD)
1	I believe that well-cooked foods are free of contamination.	4.68 (0.47)
2	I believe that food-borne diseases can be prevented by proper hand hygiene.	4.63 (0.49)
3	I believe that cleaning products can be stored with closed cans and jars of food when they are closed.	4.54 (0.50)
4	I believe that the risk of food contamination is reduced by storing raw and cooked foods separately.	4.57 (0.50)
5	I believe that periodically checking the temperature of refrigerators/freezers can reduce the risk of food contamination.	4.46 (0.51)
6	I believe that defrosted foods can be refrozen.	4.01 (0.71)
7	I believe that the bottom shelf is the ideal place for storing raw meat in the refrigerator.	3.29 (1.15)
8	I believe that proper sanitation of knives and cutting boards prevents cross-contamination.	4.37 (0.48)
9	I believe that foods should not be touched by food handlers with abrasions or cuts on their hands without gloves.	4.57 (0.50)
10	I believe that wearing gloves is an important practice to reduce the risk of food contamination.	4.57 (0.52)
11	I believe that frozen raw meat can be kept in the freezer along with other food.	4.12 (0.90)
12	I believe that wearing masks is an important practice to reduce the risk of food contamination.	4.53 (0.52)
13	I believe that health status of the workers should be evaluated before employment.	4.62 (0.49)
14	I believe that smoking is unsafe in an area where food is being prepared.	4.70 (0.52)
15	I believe that toxic chemicals and cleaning solutions should be stored at a safe distance from the food preparation area.	4.65 (0.48)

**5-point Likert scale; 1- strongly disagree, 2-disagree, 3-neutral, 4-agree, 5- strongly agree, SD= Standard Deviation*

Next, food safety practices section was used to determine responses of food handlers in food court in practices such as hand hygiene, thawing of frozen foods, working while ill, appropriate attire and footwear, smoking during food preparation, and cleaning and drying of hands and work surfaces. Table 4 shows the mean and standard deviation of each item in section D - food safety practices.

Table 4: Mean and standard deviation for food safety practices

No.	Practice Items	Mean (SD)
1	Do you wash your hands before and during food preparation?	4.74 (0.45)
2	Do you wash your hands after touching the garbage?	4.69 (0.48)
3	Do you clean work surfaces before and after food handling?	4.64 (0.48)
4	Do you thaw frozen food (e.g., chicken, beef, and fish) by keeping it at room temperature for more than 2 hours?	4.25 (0.69)
5	Do you take sick leave when you have a fever, cough, or cold?	4.53 (0.52)
6	Do you wear a clean and suitable uniform before working?	4.56 (0.50)
7	Do you wear proper shoes before you begin working?	4.60 (0.49)
8	Do you wear an apron before working?	4.48 (0.58)
9	Do you smoke as you prepare food?	1.98 (1.46)
10	Do you make sure that your hands are dry and clean every time you are handling food?	4.50 (0.50)
11	Do you wear a mask when you distribute unwrapped foods?	4.38 (0.72)
12	Do you use cutting boards of different colours or do you sanitise a cutting board between preparation of raw foods and cooked foods?	4.22 (0.73)
13	Do you check the internal temperature of meat with a thermometer?	3.40 (0.90)
14	Do you properly clean the food storage area before storing new products?	4.37 (0.49)
15	Do you use the sanitiser when washing service utensils (plates, mugs and spoons)?	4.56 (0.51)

**5-point Likert scale; 1- strongly disagree, 2-disagree, 3-neutral, 4-agree, 5- strongly agree, SD= Standard Deviation*

Table 4 highlights that most food handlers follow proper food safety practices, with all items recording the mean score of 4 and above, except for smoking during food preparation and checking meat temperature with a thermometer. Handwashing had the highest mean score, with 94.8% of respondents practicing it consistently, similar to findings in the Maldives (Halim-Lim et al., 2023). This reinforces the importance of hand hygiene in minimising microbial contamination and ensuring food safety. A study in Iran found an acceptable level of food safety practices among food handlers, with an average mean score of 4.38 ± 0.56 (Salehi et al., 2022). On the other hand, while most respondents demonstrated good food safety habits, gaps remain in time and temperature control. Only 68% consistently checked meat temperatures with a thermometer, and 85% improperly thawed frozen food at room temperature for over two hours, increasing the risk of bacterial growth (Auad et al., 2019). Smoking during food preparation was rare, aligning with good safety practices, as it can introduce contaminants and increase bacterial transfer risks (Iulietto & Evers, 2020). In this sense, addressing these gaps through targeted training can further enhance food safety compliance.

4.1 Relationship between Food Handlers Score of Food Safety Knowledge, Attitude and Practices

Pearson correlation was used to analyse the relationship between the score of food safety knowledge and food safety attitudes, food safety knowledge and practices, and food safety attitudes and practices. All of them were continuous variables and the results are tabulated in Table 5, Table 6 and Table 7.

Table 5: Result of the relationship between score of food safety knowledge and score of food safety attitudes

Variables	Mean	SD	Correlation coefficient	P value
Knowledge score	13.34	1.43	0.240*	<0.001
Attitude score	4.42	0.31		

*Correlation is significant at the 0.01 level (2-tailed)
Scale for knowledge: The score range was between 1-15 | Scale for attitude: The score range was between 1-5 | SD= Standard Deviation

Table 6: Result of the relationship between score of food safety knowledge and score of food safety practices

Variables	Mean	SD	Correlation coefficient	P value
Knowledge score	13.34	1.43	-0.027*	0.703
Practice score	4.26	0.27		

*Correlation is significant at the 0.01 level (2-tailed)
Scale for knowledge: The score range was between 1-15 | Scale for practice: The score range was between 1-5 | SD= Standard Deviation

Table 7: Result of the relationship between score of food safety attitudes and score of food safety practices

Variables	Mean	SD	Correlation coefficient	P value
Attitude score	4.42	0.31	0.348*	<0.001
Practice score	4.26	0.27		

*Correlation is significant at the 0.01 level (2-tailed)
Scale for attitude: The score range was between 1-5 |Scale for practice: The score range was between 1-5 | SD= Standard Deviation

4.2 Discussion

Table 5 shows a positive correlation between knowledge score and attitude score the correlation coefficient (r = 0.240) and p. value (<0.001). The r value shows the relationship between food safety knowledge and food safety attitudes of the food handlers is not significant. Therefore, this finding indicates that food safety knowledge does not influence food handlers' attitudes towards safety in food handling. This finding contradicts a study by Samaradiwakara et al. (2024) which found that good knowledge leads to good attitude in food safety as indicated by the significant relationship between attitude and knowledge concerning food safety, with a path coefficient of 0.643. The study showed that food handlers were able to use their food safety knowledge in food handling.

Table 6 shows the correlation coefficient value of -0.027 with p value of 0.703 for score on knowledge and practices, respectively. This suggests a negative correlation between food safety knowledge and food safety practices, implying that improvements in food safety practices may not always occur in a predictable way when knowledge about food safety increases. There is no significant relationship between food safety knowledge of food handlers and food safety practices of food handlers. As supported by Elsherbiny et al. (2019), the study found a significant gap in food safety knowledge and practices among food handlers, with 82.6% unaware of proper handwashing duration and only 40.9% consistently wash their hands before food handling. These results indicate a weak correlation between knowledge and practices. Therefore, further studies are required to understand the factors hindering the transfer of knowledge into safe food practice among food handlers in food courts.

Table 7 shows correlation coefficient value of 0.348 with p value of <0.001 for the scores on attitude and practices. This indicates that the correlation between the two variables is significant at the level of 0.05. Hence, there is a significant relationship between food handlers' food safety attitudes and food safety practices. This means that improvements in attitudes towards food safety probably result in improvements in food safety practices as well. Attitude has an effect on practice, as reflected by the good food safety practices shown in this study despite there being a moderate level of attitude (Halim-Lim et al., 2023). To sum up, food safety practices seem to be significantly influenced by attitudes about food safety. This emphasises the importance of cultivating good attitudes through education, training, and adjustments to workplace culture.

5 Conclusion

The findings reveal that food handlers generally possess a relatively high level of food safety knowledge and demonstrate positive attitudes. Nonetheless, this knowledge does not always translate into consistent safe food handling practices. Statistical analysis showed no significant relationship between food safety knowledge and practices, highlighting potential gaps in the application of knowledge to real-life food handling situations. Instead, food safety practices were found to be significantly associated with food safety attitudes, suggesting that positive attitudes are a stronger predictor of safe behaviour than knowledge alone.

Furthermore, demographic factors such as age, marital status, education level, and prior food safety training were found to significantly influence the knowledge, attitudes, and practices of food handlers. These findings indicate that socio-demographic characteristics and workplace training play an important role in shaping food safety behaviours.

Overall, this study underscores the need for continuous and targeted training programs that go beyond knowledge transfer to focus on shaping positive attitudes and reinforcing safe practices. In addition, stricter enforcement of hygiene regulations and supportive workplace cultures are essential to bridge the gap between knowledge and practice, thereby enhancing food safety standards in food courts.

6 About the authors

The authors are dedicated academics and researchers from UiTM Cawangan Terengganu and Universiti Malaysia Terengganu, Malaysia with a shared passion for advancing knowledge in food safety and hospitality. Their collective expertise spans food hygiene, foodservice management, customer service, and hospitality education. With extensive experience in both research and industry engagement, they have contributed valuable insights into food handling practices, training effectiveness, and the role of demographic factors in shaping food safety behaviours. Through their work, the authors aim to bridge the gap between theory and practice, promoting safer food environments and enhancing service quality in Malaysia's vibrant foodservice industry.

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