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Assessment of Knowledge, Attitudes and Practices of Food Safety among Food Handlers at Cafeterias in UTHM Pagoh Campus

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Abstract

Food handlers play a critical role in ensuring the safety and quality of food products that are served to customers. Poor hygiene and faulty food handling practices have been identified as the leading cause of most foodborne diseases. Nonetheless, very few studies have been conducted to explore the food safety knowledge, attitudes and practices (KAP) of food handlers in colleges or universities. Therefore, this study attempted to assess the level of KAP of food handlers at cafeterias in Universiti Tun Hussein Onn Malaysia (UTHM) Pagoh branch campus regarding food safety and hygiene. The data of this study has been collected from 66 food handlers which represents 19 food premises through distribution of questionnaire and has been carefully analysed using a quantitative descriptive analysis. The result reveals the food handlers have a moderate level of knowledge, and high level of attitudes and practices. The importance of implementing preventive interventions and engineering control measures in institutional food service settings to mitigate the risk of foodborne illnesses is also highlighted. The study anticipates that individuals with better awareness on food safety have a positive mindset and attitudes towards safety and are more likely to implement safe practices in increasing the level of premises hygiene. The findings of the study significantly serve the purpose of identifying potential deficiencies in the food handlers' comprehension of food safety concepts and their adherence to appropriate practices in a university environment.

1. Introduction

A food handler is an individual who works in the food service industry and is responsible for various tasks related to food and beverage preparation, handling, and service. Proper food handling practices, along with knowledgeable personnel and a positive attitude, can, under certain conditions, aid in the prevention of contaminated illnesses. Several studies have emphasized the importance of providing education to food handlers to enhance their understanding of microbiological food dangers, contamination prevention, and personal hygiene practices [1-3]. In addition, attitude is another important factor to reduce foodborne diseases [4]. It is important to understand the interaction of common food safety beliefs, knowledge, and practices of food operators to minimize foodborne outbreaks [5]. In this context, persistent efforts are essential to assess the level of knowledge, attitudes, and practices (KAP) of food safety among food handlers towards continuously

improving food safety and reducing foodborne diseases in the food service establishments including in the university premises.

Exploring the level of KAP among food handlers towards food safety can be used as an evidence-based intervention, which subsequently can mitigate and control the risks of food borne diseases. Although, numerous research proved that the outcomes of KAP study related to safety can be a useful indicator for a good safety climate at large [6], however, very few studies have been conducted to explore the food safety knowledge and practices of food handlers among college or university. Therefore, this research study intended to assess the level of KAP of food handlers towards food safety in a selected public university, namely Universiti Tun Hussein Onn Malaysia (UTHM) with a focus on 19 food premises in the residential college and faculty area at UTHM Pagoh branch campus. In addition, this study attempted to examine the possible measures in improving food safety using engineering controls method.

2. Literature Review

The literature review serves as a critical analysis of existing research and scholarly articles on specific topics related to knowledge, attitudes, and practices (KAP) towards food safety in a university environment.

2.1 Food Service in a University Environment

Food service in a university environment involves providing dining options and culinary services to students, staff, and often visitors within the university campus. This type of food service is designed to meet the distinct needs of the university community. In other words, food service in a university setting is integral to the overall campus experience, contributing to the well-being, satisfaction, and sense of community among students and staff. The variety of options and services provided aim to meet the diverse preferences of the university community. In addition, one of the important aspects of food vendors in a university campus is related to food safety. These aspects include compliance with local health codes of practices and regulations governing food service, and ongoing training and education for food handlers to maintain high standards [7].

2.2 Food Safety and Hygiene

Food safety and hygiene are crucial aspects of the food industry to ensure the production, preparation, and consumption of safe and wholesome food. Among the key principles and practices related to food safety and hygiene include personal hygiene, food handling and preparation, storage and refrigeration, cleaning and sanitization, employee training, and compliance with regulations [7-8]. Adhering to proper food safety and hygiene practices helps prevent foodborne illnesses and maintains the quality of food.

2.3 Foodborne Illnesses

Foodborne illnesses occur when individuals consume food or drink contaminated with harmful microorganisms, toxins, chemicals, or other contaminants. These illnesses can result in a range of symptoms, from mild discomfort to severe health complications. A study in college campus cafeterias emphasizes the potential danger posed by viral agents. Due to frequent contact between students, norovirus can quickly propagate, resulting in symptoms such as emesis and dehydration. The study highlights the necessity of implementing strict cleanliness protocols in communal dining areas [9].

2.4 Food Premise Hygiene Assessment in Malaysia

In Malaysia, food premises are graded based on a score-based grading system that varies from one local council to another [10]. The grading system is used to inform customers about the level of cleanliness in food establishments and ensure that operators maintain high standards of hygiene. The grading is carried out by the respective food premises valuation panel from City/Municipal/District Council. There are several criteria that contribute to the grading system, which are standardized across the city councils nationwide. In ensuring that business premises reach the standard of hygiene level, the government has adopted a set of food premises hygiene grading guidelines: Grade A (food premises are recognized as very clean. Re-inspection is conducted after two years or earlier if there are complaints); Grade B (food premises are recognized as clean. Re-inspection will be conducted after one year or earlier if there is a complaint); Grade C (food premises are eligible to be recognized as less clean. Re-inspection will be conducted after six months or earlier if there is a complaint); and Grade D (action under Section 11 of the Food Act 1983 - closure of unclean premises, i.e. immediate closure of premises not exceeding 14 days) [10].

2.5 Knowledge of Food Safety among Food Handlers

Food safety awareness improves practices, according to an extensive study. Evaluation of knowledge, sources, and gaps in understanding helps create effective teaching programs. Microorganisms from unclean hands, poor waste disposal, and erroneous food handling can contaminate food and threaten safety. Microbiological, chemical, and physical risks can compromise food safety and appropriateness along the supply chain. Hence, previous research identifies specific domains of knowledge that are critical for food safety, such as the importance of handwashing, proper cooking temperatures, and the prevention of cross-contamination. Analyzing these domains helps tailor training programs to address specific gaps [11].

2.6 Attitudes toward Food Safety among Food Handlers

A greater propensity for individuals to adhere to appropriate hygiene, sanitation, and handling protocols, thereby mitigating the potential for contaminated illnesses, is correlated with positive attitudes. A study on restaurant food handlers found that over 80% of the food handlers had positive attitudes toward food safety [12], and the study found a significant positive correlation among food safety knowledge, attitudes, and practices. This suggests that food handlers' attitudes play a crucial role in shaping their behavior toward food safety practices. Positive attitudes are associated with a higher likelihood of adherence to proper hygiene, sanitation, and handling procedures, reducing the risk of foodborne illnesses [12].

2.7 Practices of Food Safety among Food Handlers

Previous studies reveal that food handling practices by food handlers can be influenced by their knowledge of food safety [13-15]. In addition, the results of a systematic review found that food handlers, on average, had inadequate knowledge and practices regarding food safety. These deficiencies were linked to factors such as education, income, and previous work experience [25].

2.8 Engineering Controls in Improving Food Safety and Hygiene

Preventing and treating foodborne illnesses are critical aspects of public health, requiring comprehensive strategies and interventions. The growing correlation between risk and its expression in risk-based regulation is emphasized within the framework of food safety rules. This approach prioritizes the prevention of foodborne illnesses and the implementation of hygienic procedures by food sector owners [16]. Moreover, the importance of implementing preventive interventions and control measures in commercial and institutional food service settings to mitigate the risk of foodborne illnesses [17].

Engineering controls are physical or mechanical means of hazard control that are designed to eliminate or minimize exposure to workplace hazards and are considered among the most effective defenses under the hierarchy of controls (HOC) framework [24]. The effectiveness of engineering controls in improving food safety and hygiene is well-documented. A systematic review in previous research found that premises with comprehensive engineering controls had a significantly lower incidence of foodborne disease outbreaks compared to those relying solely on administrative controls. The integration of engineering controls with regular monitoring and maintenance ensures sustained food safety standards [18].

3. Methodology

This section describes a systematic methodology used in a field of study, providing a step-by-step explanation of the research methods and processes.

3.1 Research Design

A combination of numerical description is required to convey the data in this research study. Thus, a quantitative research design approach was employed in data collection and analysis methods, which involved different activities in several stages towards achieving the objectives of this study.

3.2 Research Subject

In this research study, the food handlers of food premises in residential college and cafeterias in faculty area of Universiti Tun Hussein Onn Malaysia (UTHM) Pagoh branch campus served as a research subject. There are a total of 19 food vendors running food businesses, each with 11 vendors in residential college and eight vendors in the faculty area.

3.3 Research Implementation Process

The implementation process of this research study involved five main phases in sequential activities, which consist of phase one: planning (literature study, formulation of problem statement, establishment of research objectives, selection of research design), phase two: development of questionnaire (development of survey questionnaire form, validation test, reliability test), phase three: data collection (distribution of questionnaire), phase four: data analysis (respondents demographic analysis, descriptive statistical analysis of KAP, engineering control measure), and phase five: conclusion (conclusion of findings and reporting).

3.4 Quantitative Data Collection Method

This section explains the quantitative data collection method used in this research study. The content covers the development of the survey questionnaire, population and sampling size, validity of the questionnaire, and reliability of the questionnaire.

3.4.1 Research Instrument using Survey Questionnaire

A survey approach using distribution of self-administered questionnaire was employed as research instrument for data collection in this research study. The developed questionnaire contained five sections (Section A, B, C, D, and E). Section A (respondent information) comprised multiple-choice questions (items) about respondent's profile and food premises including name of cafeteria, grade of food premises, age, gender, employment length, educational level, anti-typhoid vaccine, training courses attended. The questions (items) of KAP on food safety in Section B (knowledge), Section C (attitudes), and Section D (practices) are shown in Table 1. These questions have been developed based on previous studies [1] [20] [27].

Table 1 *KAP questionnaire items in Section B - D*

Item No	Questionnaire Items
Section B (knowledge):	
ITEM 1	Washing hands before work reduces the risk of food contamination.
ITEM 2	Reheating cooked foods can contribute to food contamination.
ITEM 3	Cross-contamination is when microorganisms from contaminated food are transferred by the food handler's hands or kitchen utensils to another food.
ITEM 4	Food prepared in advance reduces the risk of food contamination. Improper cooling and storage of foods prepared in advance can allow pathogenic bacteria to grow, leading to foodborne illness.
ITEM 5	Diseases such as Typhoid fever, and bloody diarrhea, can be transmitted by food.
ITEM 6	AIDS (acquired immunodeficiency syndrome) cannot be transmitted by food.
ITEM 7	When oil is reused multiple times, it can break down, become rancid, and develop harmful compounds that can cause health issues
ITEM 8	Store used oil in a sealed, light-proof container to prevent oxidation and contamination.
Section C (attitudes):	
ITEM 9	Wearing masks, caps and gloves is an important practice to reduce the risk of food contamination.
ITEM 10	Raw and cooked foods should be stored separately to reduce the risk of food contamination.
ITEM 11	The health status of workers should be evaluated before employment.
ITEM 12	I believe that there is no risk of leaving cooked food at room temperature until it is served.
ITEM 13	I believe that food-borne diseases may lead to kidney and liver failure.
ITEM 14	When dining in a restaurant, the cleanliness of the enterprise and the staff is important to me. I believe that gloves must be worn when food preparation.
Section D (practices):	
ITEM 15	Hand washing facilities are available and properly stocked with soap, single-use towels, and hand sanitizer.
ITEM 16	I always wipe my hands with a clean towel after using the toilet.
ITEM 17	I always read the label with the expiration date on packaged food before buying.
ITEM 18	I frequently replace sponges to prevent excessive bacterial growth.

In Section E (engineering controls), the first three questions (items) are related to the respondents' feedback on the effectiveness of engineering controls in improving food safety as highlighted in Table 2. Meanwhile, the fourth question emphasized on the respondents' preference for selecting one design from three different design options of container (Design A, B, and C) for storing wet sponges as an engineering control measure as further explained in Section 3.6. In terms of rating scale, the questions in Section B (all items), Section C (all items), Section D (all items), and Section E (first three items) were rated using 5-point Likert scale (1: strongly disagree; 2: disagree; 3: agree; 4: neutral, 5: strongly agree). The questionnaire was prepared in *Bahasa Malaysia* and English language.

Table 2 *Questionnaire items in Section E (engineering controls)*

Item No	Questionnaire Items
ITEM 19	Commonly used ventilation systems in commercial kitchens effectively remove smoke, steam, and cooking odors.
ITEM 20	The following materials should be used for equipment and surfaces to ensure they are corrosion-resistant and easy to clean to prevent contamination: a) Stainless Steel; b) Glass; c) Ceramic; d) Plastic.
ITEM 21	Store used oil in a sealed, light-proof container to prevent oxidation and contamination.
ITEM 22	To store a wet sponge used for washing pots, you can consider several suitable design options of a sponge container. Choose one preferable design: Design A, Design B, and Design C.

3.4.2 Population and Sample Size

In this research study, a total of 80 food handlers (N = 80), which represent 11 food premises in residential college and eight food vendors in faculty area were chosen as the study's target population. A sample of 66 food handlers (n = 66) was randomly selected based on sample size from a given population. A sample size of 30 is considered appropriate as the minimum number of cases for research involving statistical analysis [21].

3.4.3 Validity of Questionnaire

Validity of the acquired data reveals how effectively it covers the actual area of research [22]. Face and content validity approaches were often used to establish the validity of questionnaire. The questionnaire in this research study was validated by two academicians as an expert panel. The selected academicians are experts in the field of safety, in addition to having more than six years of industry experience in the related fields. The questionnaire has been validated through a content validation method to measure the level of questions on each item and the suitability of the questions.

3.4.4 Reliability of Questionnaire

Reliability is a term used to describe a declaration that is used to evaluate the coherence of research findings, which involves the stability and consistency of the data. In this study, a pilot test was conducted to measure the reliability of the questionnaire. The sample size for a pilot study should be 10% of the sample size anticipated for the larger parent study [22]. Therefore, a total of seven food handlers (n_p = 7) were chosen as sample size of pilot study in this research study. In addition, the reliability coefficient values obtained were assessed and compared with Cronbach's alpha reliability value (α) to identify elements that need improvement, modification, or deletion from the specified question. A Cronbach's alpha value of 0.90 and above is excellent, 0.80-0.89 is good, 0.60-0.79 is acceptable, 0.40-0.59 is poor, and 0.00-0.39 is unacceptable level of reliability [26].

3.5 Quantitative Data Analysis Method

This section describes the quantitative data analysis method employed in this research study. The content includes the demographic profile of respondents, descriptive statistical analysis of KAP, and the engineering controls method.

3.5.1 Demographic Profile of Respondents

The demographic profile of respondents refers to specific characteristics and information about selected individuals that participate in a survey or research. It often consists of several demographic factors which help in categorizing and analyzing data based on specific population characteristics. In this research study, the demographic information of respondents in Section A (respondent information) of the questionnaire contained eight questions: name of cafeteria, grade of food premises, gender, age, employment length, education level, anti-typhoid vaccine, and training courses attended, were measured using discrete nominal scale. The data gathered were analyzed and presented in the form of frequency and percentage.

3.5.2 Descriptive Statistical Analysis

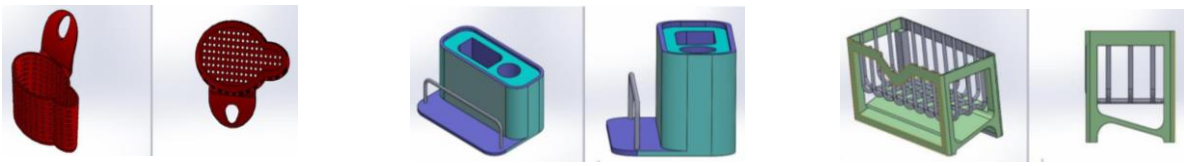
Descriptive analysis is a sort of data analysis that assists in clarifying, demonstrating, or effectively summarizing data points so that patterns that fit each state of the data can emerge. It is one of the most significant processes in statistical data analysis since it provides conclusions about the data distribution. In this research study, a descriptive statistical analysis on the level of KAP towards food safety among food handlers has been conducted using a software of Statistical Package for Social Science (SPSS) version 27. The collected data based on the questionnaire in Section B-D (KAP: all items) and E (engineering controls: first three items), were computed as measures of central tendency such as means, medians, standard deviation, various percentiles, and mean score. This research study has adopted the guideline of mean score level as suggested by previous study [23]: mean 4.30 - 5.00 (very high level); mean 3.50 - 4.29 (high level); mean 2.70 - 3.49 (moderate level); mean 1.90 - 2.69 (low level); and mean 1.00 - 1.89 (very low level).

Progress in Engineering Application and Technology Vol. 5 No. 2 (2024) p. 396-404

3.6 Engineering Controls Method

There are various types of engineering controls approach based on the hierarchy of controls (HOC) framework [24], including barriers, ventilation systems, machine guards, and enclosures. Barriers are used to physically separate workers from hazards, while ventilation systems remove hazardous substances from the air. Machine guards and enclosures are used to protect workers from moving parts and hazardous equipment. In this research study, the first three questions in Section E (engineering controls: first three items) were inclusive of food handler's understanding on how to improve the hygiene of food area using engineering controls by means of ventilation system in the kitchen, materials used for equipment in preventing surfaces corrosion and contamination, and the effectiveness of engineering controls for hands-free operation of water taps.

Meanwhile, in the fourth question, the respondents were asked to select the most favorable design of container (bucket/holder) for storing wet sponges in the kitchen from three design options (Design A, B, and C). All the proposed 3D models of the container have been designed using SolidWorks software as illustrated in Fig. 1. Design A focuses on optimal airflow and efficient water drainage with bottom holes for direct sink placement, ensuring hygiene and prolonging the lifespan of cleaning tools. Design B uses wall-mounted suction cups to keep sponges upright, promoting better airflow and reducing sink clutter, with compartments for organized storage. Design C offers superior airflow and versatile placement, allowing efficient drainage and quick drying of sponges, making it adaptable to various sink configurations for optimal kitchen hygiene and maintenance.



(a) **(b)** **(c)**

Fig. 1 *Design options of container for storing wet sponges: (a) Design A; (b) Design B; (c) Design C*

4. Results and Discussion

This section presents the results of the research study, and discussion of the results obtained including validity test, reliability test, demographic information of respondents, descriptive statistical analysis of KAP, and descriptive analysis of engineering controls.

4.1 Validity Test

The content validity has been carried out in this research to assess the questionnaire's contents and identify the words and structure of the specific inquiry item. Two experts reviewed the questionnaire's content. Both have extensive expertise and experience from academia as well as in related industries. In this research, the experts provided positive feedback in terms of the suitability of the questions, which proved that the content of the questionnaire can be understood, and therefore maintained as it is.

4.2 Reliability Test

A set of seven questionnaires (n_p = 7) were distributed to food handlers as samples in a pilot study to evaluate the reliability of the questionnaires. In this research, the sample size in the actual study is 66 food handlers (n = 66). A prior study suggested that the sample size in a pilot study should be 10% of the sample size anticipated for the larger parent study [22]. Meanwhile, the Cronbach alpha (α) coefficient has been used to evaluate the whole scale's reliability, in which the alpha value of 0.60 is often considered as the acceptable level of reliability [26]. As shown in Table 3, the results of the pilot test show that the reliability of all variables is at an acceptable level and above.

Table 3 *Reliability test results*

Section	Variable	Number of Items	Cronbach Alpha (α) Value	Level of Reliability
B	Knowledge	8 (ITEM 1-8)	0.76	Acceptable
C	Attitudes	6 (ITEM 7-14)	0.81	Good
D	Practices	4 (ITEM 15-18)	0.61	Acceptable
E	Engineering Controls	3 (ITEM 19-21)	0.69	Acceptable

4.3 Demographic Information of Respondents

Demographic analysis has been performed to analyze the background information of the respondents. Table 4 presents a summary of demographic profiles of respondents (n = 66) in the form of frequency and percentage with regards to Section A of the questionnaire. In addition to vendors' name and premise hygiene grade, the demographic information details of respondent include gender, age, length of employment, anti-typhoid vaccine and training courses attended. This demographic breakdown provides a clear understanding of the composition of the respondents in the study.

Table 4 *Demographic profiles of respondents*

n = 66	Frequency (f)	Percentage (%)
Food premises grade:		
A	2	10.5
B	8	42.2
No Grade Available	9	47.3
Age:		
20 – 30	44	66.7
30 – 40	12	18.2
40 – 50	8	12.1
Above 50	2	3.0
Gender:		
Male	26	39.4
Female	40	60.6
Years of Work:		
1-5	51	77.3
6-10	13	19.7
11-15	1	1.5
Above 15	1	1.5
Highest Educational Level:		
Primary	3	4.5
Secondary	28	42.4
STPM/Diploma	19	28.8
Bachelor and above	16	24.2
Received anti-typhoid vaccine:		
Yes	52	78.8
No	14	21.2
Training Courses Attended (last 2 years):		
Yes	21	31.8
No	45	68.2

4.4 Descriptive Statistical Analysis of KAP

The descriptive statistical analysis of knowledge, attitudes, and practices (KAP) related to food safety for Section A, B, and C has been carried out, and the results are presented using mean score as summarized in Table 5. The findings of KAP assessment indicate that the respondents have a moderate level of knowledge (mean score of 3.47 for ITEM 7-14), and a high level of attitudes knowledge (mean score of 3.94 for ITEM 15-18) and practices knowledge (mean score of 4.15 for ITEM 1-8) towards food safety. This implies a positive outlook and good practical adherence to food safety protocols, although enhancing knowledge further could help in solidifying and improving both attitudes and practices even more. This mixed level of KAP suggests targeted educational and training interventions could be beneficial in raising overall knowledge and ensuring sustained high standards in food safety practices.

Table 5 *Mean score of KAP related to food safety*

KAP	Mean Score	Level of KAP
Knowledge	3.47	Moderate
Attitudes	3.94	High
Practices	4.15	High

4.5 Descriptive Analysis of Engineering Controls

The mean score of 3.45 in Section E for ITEM 19-21 as shown in Table 6 indicates a moderate level, pointing to a general but not comprehensive understanding and practice of food safety measures among the handlers. The mean scores suggest the need for a comprehensive training program to address all aspects of food safety uniformly. In addition, periodic evaluations and feedback sessions can identify challenges and allow for continuous improvement and adaptation of engineering controls.

Table 6 *Mean score of engineering controls*

KAP	Mean Score	Level
Engineering Controls	3.45	Moderate

Meanwhile, Table 7 shows the respondents' preferences of container design for storing wet sponges as engineering controls measure for ITEM 22. The results reveal that most of the respondents prioritize designs that ensure the sponge stays dry and hygienic, with a strong preference for Design A (Sponge Holder with Drainage) and Design C (Self-Cleaning Sponge Holder).

Table 7 *Respondents' preferences of container design for storing wet sponges*

KAP	Frequency
Design A	30
Design B	6
Design C	30

5. Conclusion and Recommendations

This project attempts to provide empirical evidence on the level of KAP related to food safety among food handlers. Specifically, this project extensively identifies varying levels of KAP in relation to food safety among food handlers in a university premises. Overall, the results of the study reveal the food handlers have a moderate level of knowledge, high level of attitudes and practices of food safety, and moderate level of engineering controls measure in food safety. The study anticipates that individuals with better awareness on food safety have an affirmative attitude towards safety and are more likely to perform safe practices in increasing the level of premises hygiene. The findings of the study significantly serve the purpose of identifying potential deficiencies in the food handlers' comprehension of food safety concepts and their adherence to appropriate practices in a university environment. In addition, several recommendations for future improvement include on-site observations and audits to directly assess food handling practices, and tailoring KAP assessments to specific food service settings and local contexts involves several key steps to ensure the assessments accurately reflect the unique challenges and requirements of each environment.

References

[1] Al-Shabib, N.A., Husain, F.M, & Khan, J.M. (2017). Study on food safety concerns, knowledge and practices among university students in Saudi Arabia, *Food Control, 73,* 202–208.
[2] Luo, X., Xu, X., Chen, H., Bai, R., Zhang, Y., Hou, X., Zhang, F., Zhang, Y., Sharma, M., Zeng, & H., Zhao, Y. (2019). Food safety related knowledge, attitudes, and practices (KAP) among the students from nursing, education and medical college in Chongqing, China, *Food Control, 95,* 181–188.
[3] Azanaw, J., Dagne, H., Andualem, Z., Adane, T., & Angelillo, I.F. (2021). Food safety knowledge, attitude, and practice of college students, Ethiopia 2019: A cross-sectional study, *Biomed Res. Int.,* 1–10.
[4] Osaili, T., Shaker Obaid, R., Taha, S., Kayyaal, S., Ali, R., Osama, M., Alajmi, R., Al-Nabulsi, A.A., Olaimat, A., Hasan, F., & Ayyash, M. (2022). A cross-sectional study on food safety knowledge amongst domestic workers in the UAE, *British Food J., 124(3)*, 1009–1021.
[5] WHO (2021). *Food safety*. World Health Organization of the United Nation (WHO). Retrieved April 7, 2024, from https://www.who.int/health-topics/food-safety
[6] Ishanuddin, N.M., Sukadarin, E. H., Aziz, H.A., & Zakaria, J. (2019). An investigation of knowledge, attitude and practice of occupational safety and health (OSH) on safety climate at workplace in manufacturing industry, *Journal of Occupational Safety and Health (JOSH), 16(2)*, 21-29.
[7] Ali, A.N., William, A.F., Prajapati, S.K., & Ahmed, N.Z. (2018). A KAP study on food safety and hygiene among private university students in Kedah State, Malaysia*, J. Natural Remed., 18(3),* 113–121.
[8] Yeargin, T.A., Gibson, K.E., & Fraser, A.M. (2021). New approach to food safety training: A review of a six-step knowledge-sharing model, *Journal of Food Protection, 84(11),* 1852-1862.

[9] Ezzatpanah, H., Gomez-Lopez, V. M., Koutchma, T., Lavafpour, F., Moerman, F., Mohammadi, M., & Raheem, D. (2022). Risks and new challenges in the food chain: Viral contamination and decontamination from a global perspective, guidelines, and cleaning, *Comprehensive Reviews in Food Science and Food Safety, 21(2),* 868-903.
[10] KKBPKT (Kementerian Kesejahteraan Bandar, Perumahan dan Kerajaan Tempatan, Malaysia). (2014). *Garis Panduan Sistem Penggredan Premis Makanan di Kawasan Pihak Berkuasa Tempatan*, Bil. 2, Tahun 2014.
[11] Fariba, R., Gholamreza, J. K., Saharnaz, N., Ehsan, H., & Masoud, Y. (2018). Knowledge, attitude, and practice among food handlers of semi-industrial catering: A cross-sectional study at one of the governmental organizations in Tehran, *Journal of Environmental Health Science and Engineering, 16,* 249-256.
[12] Kanda, N.F., Chijokwe, A., Mabaya, M.G., & Nyamugure, T. (2020). Food safety knowledge, attitudes, and practices of restaurant food handlers in a lower-middle-income country, *Food Science & Nutrition, 8(3),* 1677-1687.
[13] Brown, E., Dessai, U., McGarry, S. & Gerner-Smidt, P. (2019). Use of whole-genome sequencing for food safety and public health in the United States, *Foodborne Pathogens, 16,* 441-450.
[14] Htway, T.A.S. (2019). *Factors associated with food safety knowledge and practice among street food vendors in Taunggyi township, Myanmar: A cross-sectional study*. Master's Thesis, Chulalongkorn University.
[15] da Vitoria, A.G., de Souza Couto Oliveira, J., de Almeida Pereira, L.C., de Faria, C.P., & de Sao Jose, J.F.B. (2021). Food safety knowledge, attitudes and practices of food handlers: A cross-sectional study in school kitchens in Espirito Santo, Brazil, *BMC Public Health, 21,* 1-10.
[16] Hutter, B.M. (2011). *Managing food safety and hygiene: Governance and regulation as risk management*. Cheltenham: Edward Elgar.
[17] Iftekhar, A., & Cui, X. (2021). Blockchain-based traceability system that ensures food safety measures to protect consumer safety and COVID-19 free supply chains, *Foods, 10(6),* 1289.
[18] Zhang, H., Wu, L., Huang, X., & Liu, C. (2021). Systematic review of engineering controls for food safety: Impacts and cost-effectiveness, *Journal of Food Protection, 84(7),* 1245-1258.
[19] Moreb, N.A., Priyadarshini, A., & Jaiswal, A.K. (2017). Knowledge of food safety and food handling practices amongst food handlers in the Republic of Ireland, *Food Control, 80,* 341–349.
[20] Taha, S., Osaili, T.M., Saddal, N.K., Al-Nabulsi, A.A., Ayyash, M.M., & Obaid, R.S. (2020). Food safety knowledge among food handlers in food service establishments in United Arab Emirates, *Food Control, 110*.
[21] Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education*. London: Routledge.
[22] Bougie, R., & Sekaran, U. (2019). *Research methods for business: A skill-building approach (8th ed.)*. USA: John Wiley & Sons Inc.
[23] Zaki, A.S. & Ahmad, A. (2019). The level of integration among students at secondary school: A study in Limbang, Sarawak, *The International Journal of Social Sciences and Humanities Invention, 4(2),* 3284-3288.
[24] NIOSH (2015). *Hierarchy of controls*. National Institute of Occupational Safety and Health (NIOSH). Washington, DC, USA: NIOSH.
[25] Rifat, M.A., Talukdar, I.H., Lamichhane, N., Atarodi, V., & Alam, S.S. (2022). Food safety knowledge and practices among food handlers in Bangladesh: A systematic review, *Food Control, 142*.
[26] Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2019). *Multivariate data analysis (8th ed.)*. Cengage.
[27] Putri, M.S., & Susanna, D. (2021). Food safety knowledge, attitudes, and practices of food handlers at kitchen premises in the Port 'X' area, North Jakarta, Indonesia, *Italian Journal of Food Safety, 10(4)*: 9215. Published online 2021 Nov 22.