

Food Safety Knowledge, Attitude, and Practices Among Employees: A Case Study at Food Court of Kandy City Centre, Sri Lanka.

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Abstract

Improper food handling is a major cause of food contamination, which can pose serious health risks. To prevent such contamination, food handlers must possess adequate knowledge, demonstrate a positive attitude, and consistently practice proper food handling techniques. This study aimed to evaluate the food safety knowledge, attitudes, and practices of employees working in the food court of Kandy City Centre, as well as to identify the factors influencing these aspects. Data were collected from 50 food handlers involved in the preparation, serving, and sale of readymade food between June 2023 and September 2023. A questionnaire was used to gather information on socio-demographic variables, food safety knowledge, attitudes, and practices through interviews. The majority of respondents (61.5%) were under 25 years of age, and 75% were male. Almost all food handlers were aware of critical sanitary practices, such as personal hygiene (100%) and hand washing (98%). The study found that most participants (90.4%) had received basic food safety training, and 84.6% had undergone Hazard Analysis Critical Control Point (HACCP) training. The average percentages for food safety knowledge, attitudes, and practices were 77%, 82.2%, and 87%, respectively. While the study showed that food handlers generally have satisfactory knowledge, attitudes, and practices regarding food safety, some areas, particularly cross-contamination and time/temperature control, require further emphasis. The study recommends continuous food safety training to reinforce the weaker areas, with a focus not only on theoretical knowledge but also on practical skills and the promotion of positive attitudes towards food safety.

Key Words: Food Handling, Cross-Contamination, Hazard Analysis Critical Control Point, Training, Practical Skills

Introduction

Food safety and foodborne diseases are globally recognized public health concerns that are closely interlinked. Every year, thousands of people suffer from foodborne illnesses, and many succumb to the consumption of food contaminated with biological, chemical, or physical hazards (Azanaw et al., 2021; Tewari & Abdullah, 2015). Foodborne disease outbreaks continue to be a major public health issue worldwide, exacerbated by factors such as mass-scale food production and distribution, the expansion of global food supply chains, and the growing consumption of ready-to-eat food from street vendors and (King et al., 2017; Nyachuba, 2010; Qusted et al., 2010). The emergence of new foodborne pathogens further complicates efforts to curb foodborne diseases. Governments around the world have strengthened their efforts to improve food safety standards and combat the rising number of foodborne illnesses. Populations at higher risk, including infants, young children, immunocompromised individuals, pregnant women, and the elderly, are especially vulnerable to severe health complications from unsafe food (Kendall et al., 2003). Among these, malnourished children and infants are particularly susceptible, with foodborne diarrheal diseases contributing to over one billion cases of diarrhea annually among children, resulting in more than three million deaths worldwide (World Health Organization, 2020). According to the WHO, foodborne diseases affect one in ten people globally each year. In the South-East Asia Region alone, there are an estimated 150 million illnesses, 175,000 deaths, and 12 million disability-adjusted life years (DALYs) due to foodborne diseases.

To mitigate the risks associated with foodborne illnesses, it is crucial to ensure the implementation of effective food safety standards. These standards must integrate both safety and quality throughout the food production and service processes (Van der Meer, 2015). Commercial food outlets, including food courts, play a significant role in reducing foodborne illness risks by adhering to hygiene protocols and food safety regulations. In this context, food courts and similar establishments often follow internationally recognized standards, such as ISO 22000:2018 Food Safety Management System and Hazard Analysis and Critical Control Points (HACCP), to ensure food safety, quality, and compliance with regulatory requirements (ISO, 2018). However, despite the existence of food safety regulations and training programs, there is a gap in research concerning the actual food safety knowledge, attitudes, and practices of food handlers in urban food courts in Sri Lanka. Most existing studies on food safety in Sri Lanka have focused on street vendors and small-scale food establishments (Khan et al., 2016), with limited attention given to larger, structured food service outlets that operate under internationally recognized food safety standards, such as ISO 22000:2018 and HACCP (Gaur & Singhal, 2015; López-Gálvez et al., 2018). Understanding the level of food safety knowledge and practices among food handlers in such settings is essential for evaluating the effectiveness of food safety training programs and identifying areas where further interventions are necessary.

Therefore, present study aims to assess the food safety knowledge, attitudes, and practices of employees working in a selected commercial food outlet and explore the factors influencing them. We selected the food court of Kandy City Centre for our study due to its relevance. A structured, pre-tested questionnaire was used to collect data from selected employees engaged in food preparation, serving, and sales. The outcomes of this study will provide valuable insights into the gaps in food safety compliance, the effectiveness of existing training programs, and practical measures that can be taken to enhance food safety practices. Ultimately, the study seeks to contribute to improving food safety standards, reducing the risk of foodborne illness, and ensuring safer food practices in commercial food courts across Sri Lanka.

Materials and Methods

Research Design

A descriptive research design was employed to evaluate the food safety knowledge, attitudes, and practices of food handlers working at the Kandy City Centre food court. A cross-sectional study design was adopted, where data were collected from a sample of food handlers at a specific period of time (from June 2023 to September 2023). The study was primarily quantitative in nature, as the aim was to measure variables related to food safety knowledge, attitudes, and practices.

Sample Size

50 were randomly selected from 109 of food handlers engaged in food preparation, serving, and sales in the food court of Kandy City Centre. The composition of the sample was based on key demographic and work-related factors, including age, gender, educational level, and work responsibility.

Data Collection

The data collection tool for this study was a structured questionnaire, which was developed to assess the knowledge, attitudes, and self-reported practices of food handlers related to food safety. The questionnaire was developed following the principles from Hazard Analysis and Critical Control Points (HACCP), as well as elements assessed in previous studies (McIntyre et al., 2013; Rebouças et al., 2016; Sharif & Al-Malki, 2010) and Zimbabwe's food safety legislation (Ministry of Health and Child Care, 1996a, 1996b). The questionnaire was designed in English and consisted of five sections:

1. Demographic Information: Age, gender, educational level, work responsibilities.
2. Work History: Details regarding the participants' professional experience and food handling roles.
3. Food Safety Knowledge: 17 items assessing knowledge related to food spoilage, storage, contamination, and foodborne illnesses.
4. Food Safety Attitudes: 14 items focusing on food handlers' perceptions of food safety training, hygiene practices, and contamination prevention.
5. Self-Reported Practices: 21 items on food handling, sanitation, and temperature control practices.

Pre-test and Validation

The questionnaire was peer-reviewed by two professional food inspectors and was piloted with 25 respondents (24.8% of the sample size). Feedback from the pre-test led to revisions in the questionnaire to improve clarity and ensure that the questions were culturally appropriate and comprehensible. The revised version was then used for data collection.

Administration of the Questionnaire

The questionnaires were self-administered by the respondents in the presence of trained research assistants to ensure that they could not seek help from their colleagues or reference materials. In cases where respondents were unable to read or write, trained research assistants conducted the interview and completed the questionnaire for the participant. Before administering the questionnaire, participants were given a 10–15-minute orientation to explain the study's objectives, their rights, and the importance of providing accurate and complete information. The confidentiality of responses was emphasized to minimize bias, and participants were assured that their individual responses would not be shared with management.

Ethical Considerations

Prior to data collection, ethical approval for the study was obtained from the relevant institutional review board. All participants were informed about the study's objectives, their rights, and the voluntary nature of their participation. To ensure anonymity and confidentiality, participants were instructed not to include any personal identifying information on the questionnaires. Data were stored securely, and only aggregated data were analyzed and reported to prevent identification of individual respondents.

Data Analysis

Data collected from the questionnaires were analyzed using descriptive statistical methods to summarize the responses. The analysis included the following:

1. Percentage Analysis: The responses for food safety knowledge, attitudes, and practices were calculated as percentages to determine the distribution of correct or positive responses.
 2. Frequency Distribution: The frequencies of each response across various questions were calculated to identify common trends and patterns in food safety knowledge and behavior.
 3. Graphical Representation: The results were presented using bar graphs and pie charts to visually represent the distribution of responses across different variables (e.g., knowledge of hygiene practices, attitudes toward food safety, and adherence to sanitation protocols).
- The data were summarized in tables and graphs to clearly present the distribution of food handlers' knowledge, attitudes, and practices concerning food safety.

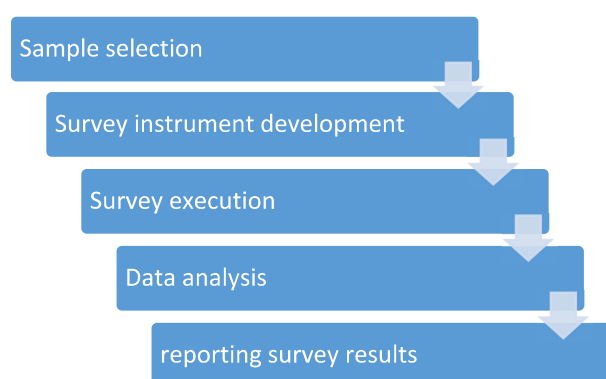


Figure 1: Methodology

Results and Discussion

Association of socio-demographic characteristics with food safety knowledge and attitudes

Results on the association between socio-demographic characteristics and food safety knowledge and attitudes are presented in Table 1. As shown, the present study found no significant differences in food safety knowledge and attitudes based on gender, age, educational level, or work experience, consistent with findings from Malaysia (Abdul-Mutalib et al., 2012). However, other research has shown that factors such as work experience and educational level were significantly associated with improved food safety knowledge in the United States (McIntyre et al., 2013). These contrasting findings can be attributed to differences in the study populations, food safety training programs, or regional food safety regulations. Specifically, McIntyre et al.'s study was conducted in a context where food safety training was more accessible or mandated, which explains the observed correlation with higher knowledge scores. The majority of participants in the current study (61.5%) were males under 25 years. This suggests that the workforce in this setting may lack the diversity in food handling experience, potentially increasing the risk of food contamination due to non-adherence to good manufacturing practices. The absence of significant associations between these demographic factors and food safety knowledge could be attributed to the relatively homogenous demographic profile of the participants in the current study. Additionally, younger workers may be more likely to follow standardized practices, as these practices are often a central part of their training and employment in such environments.

Regarding educational background, about 3.8% of food handlers had not gone beyond primary education. This highlights the importance of food safety training in improving food handlers' knowledge. The findings indicate that those who had received basic food safety training exhibited significantly higher knowledge scores compared to those who had not, which aligns with previous conclusions (McIntyre et al., 2013). In this study, a large proportion of food handlers (90.4%) had received basic food safety training, and 84.6% had received HACCP training. This suggests that structured training programs play a crucial role in improving food safety knowledge and attitudes, even though the influence of socio-demographic factors such as age and education remained minimal. To further clarify, future research should explore whether socio-demographic factors, such as age or educational level, influence actual food safety practices rather than just knowledge and attitudes. The focus on training and its potential impact on reducing foodborne risks could also be expanded, particularly by assessing the practical application of food safety standards in the workplace.

Table 1 Comparison between Attitudes and food safety practices

Variable	%	Food safety knowledge		Food safety practice	
		Satisfactory(%)	Inadequate(%)	Negative(%)	Positive(%)
Gender					
Male	75	31	8	5	34
Female	25	10	3	2	11
Age					
<= 25	61.5	21	9	6	24
>25	38.5	18	2	1	19
Educational level					
Primary and below	3.8	0	2	1	1
Secondary and above	96.2	39	9	6	42
Work Experience					
<=2	19.2	6	6	0	12
>2	80.8	33	5	7	31
Basic Training on Food safety					
Trained	90.4	37	6	1	42
Not Trained	9.6	2	5	6	1
HACCP trained					
Trained	84.6	36	4	1	39
Not Trained	15.4	3	7	6	4

Knowledge of participants on food safety

Food safety knowledge among participants showed in the table 2 highlights both strengths and areas for improvement. A significant portion of the food handlers demonstrated strong knowledge in critical aspects of food safety. For instance, 100% of participants were aware that food handlers suffering from illnesses like diarrhoea, sore throat, and flu pose a contamination risk, indicating a clear understanding of the importance of maintaining good health to prevent foodborne diseases. Similarly, a large majority of participants, 86% to 95%, correctly identified key practices that minimize contamination, such as avoiding cross-contact between raw and cooked foods, maintaining personal hygiene by not wearing jewelry, and ensuring proper nail care.

However, despite these positive aspects, several gaps in knowledge were observed that require further attention. For example, 20% of food handlers did not recognize the risks associated with refreezing defrosted food, a critical issue in food safety. Additionally, although 85% of respondents correctly identified the safe operating temperature for refrigerators (1–5°C), this still leaves room for improvement, as previous studies have similarly highlighted deficiencies in this area (Martins et al., 2012; McIntyre et al., 2013). The results suggest that food handlers may not fully grasp the importance of correct refrigeration practices in preventing bacterial growth and foodborne illness.

These findings underscore the need for ongoing education and more targeted training. As demonstrated by previous studies, regular and hands-on food safety training can significantly enhance food handlers' knowledge, particularly in areas like proper food storage and handling practices (da Cunha et al., 2014; McIntyre et al., 2013). The study also points to the potential benefits of advanced training, such as HACCP and ISO 22000:2018, for food handlers working in high-risk environments like food courts and restaurants, where the risk of contamination is elevated due to the volume of food prepared and served. While the overall average knowledge score of 77% reflects a good foundational understanding of food safety, it also highlights the need for continuous learning to ensure that food handlers are equipped with the necessary skills and knowledge to minimize foodborne risks effectively. Moving forward, training programs should address specific gaps identified in this study, particularly concerning refrigeration practices, defrosting, and the use of proper equipment, to further strengthen food safety practices.

Table 2 Food handlers Knowledge on food safety

Statement	Agree n (%)
Reheating rice contributes to bacterial food poisoning (BFP)	20
Refrigeration and freezing do not destroy most bacteria	75
Refreezing defrosted food contributes to BFP	88
The safe operating temperature for a refrigerator is 1–5°C	85
Use of separate cutlery to prepare or handle raw and cooked foods minimizes food contamination	76
Not wearing rings, watches, necklaces minimizes food contamination	87
Contact between raw and cooked foods contributes to food contamination	86
The temperature range 5–47°C is suitable for the growth of most bacteria that spoil food	65
Pets in food premises can contaminate food	86
Cleaning and sanitizing utensils reduces the risk of food contamination	75
Wooden chopping boards are a high risk for food contamination	60
Using gloves to handle raw foods reduces the risk of food contamination	77
Eating, drinking, talking, and smoking when preparing or serving food increase the risk of food contamination.	65
Use of dish towels to wipe hands can contaminate food	82
Handwashing in sinks for washing cutlery increases the risk of food contamination	80
Keeping nails short and unpainted reduces the risk of food contamination	95
A healthy food handler can be a carrier of infectious food-borne diseases	82
A food handler suffering from diseases such as diarrhea, sore throat, syphilis and flu poses a risk of food contamination	100
Average	77

Food Safety Attitudes of Food Handlers

The attitudes of food handlers toward food safety, as presented in Table 3, reveal several important insights into their approach to food safety practices. The majority of participants (over 80%) exhibited positive attitudes towards key food safety measures, such as food safety training, proper cleaning procedures, adhering to cutlery color codes, and preventing food contamination. These findings are encouraging, as they suggest that a strong base of food handlers recognizes the importance of these critical practices.

However, the study also identified areas of concern. About 25% of participants reported that they would not inform their supervisors if they were suffering from diarrhoea, wounds, or cuts, and an equal proportion indicated they would not take sick leave in such circumstances. These attitudes pose a significant risk for the spread of foodborne illnesses during food preparation, handling, and serving. It is essential that these issues are addressed promptly to ensure that food handlers adhere to health and safety standards. Encouragingly, it is recommended that restaurant managers foster a Positive Food Safety Culture (PFSC) within their teams. PFSC refers to an environment where food safety is prioritized and embraced as a shared value by all members of the team, promoting proactive behaviors such as reporting illness and adhering to health protocols. This culture emphasizes open communication, mutual respect, and accountability, which can significantly enhance adherence to safety standards and reduce the risk of contamination. Building a Positive Food Safety Culture (PFSC) involves managers actively influencing attitudes and behaviors through leadership and creating a supportive atmosphere where food handlers are encouraged to follow food safety practices, including taking sick leave when necessary (Lück & Barros, 2019). Promoting positive attitudes toward health and safety can contribute significantly to minimizing contamination risks.

Another noteworthy finding was that approximately 20% of participants did not see the value in microbiological swabbing of palms and nails to assess the effectiveness of handwashing. Previous research underscores the importance of this practice, as hand contamination, particularly with bacteria like *Staphylococcus aureus* and *Salmonella*, remains a significant risk factor for foodborne illness. Studies have reported contamination in food handlers' hands with coagulase-positive staphylococci and found that a substantial proportion of food handlers tested positive for *Salmonella* or had high levels of total aerobic bacteria (Lee et al., 2017; Soares et al., 2012). These findings suggest that further education on the importance of hand hygiene and its microbiological implications is necessary.

To address these gaps, restaurant managers must focus on motivating food handlers to adopt positive food safety attitudes, which has been shown to be linked to better adherence to safe food handling practices (Seaman, 2010). Additionally, from a public health perspective, regular health inspections are critical in identifying and correcting

any lapses in food safety practices. In cases of non-compliance with health and safety standards, authorities may need to consider the closure of non-compliant food premises to prevent the spread of foodborne diseases (Woh et al., 2016).

Statement	Agree n (%)
I am willing to learn about the basics of food hygiene and safety	95
I think restaurant managers should organize advanced training such as hazard analysis critical control point for food handlers	85
I will inform my supervisor if I have diarrhea, wounds or cuts	75
I will take sick leave if I have diarrhea, wounds or cuts	80
I try do my level best to always observe proper cleaning procedures	75
I am willing to observe cutlery color codes for different uses e.g. red for red meat, green for vegetables.	90
Preventing food contamination and spoilage is my key responsibility	75
Expired food should never be consumed	90
I consistently use gloves to handle no packed food even if my supervisor is absent	75
I do not need incentives to do my best to prevent food contamination	90
My number one reason for observing set food hygiene standards is not the fear of management's disciplinary measures	95
Swabbing of food handlers' palms and nails is useful for assessing the effectiveness of handwashing	80
Physical assessment of food handlers' personal hygiene is important for minimizing food contamination	89
Task performance supervision motivates me	67
Average	82.8

Table 3 Food Handlers Food Safety Attitude

Self- Reported Food Hygiene Practices of Food Handlers

The self-reported food safety practices of food handlers, as shown in Table 8, reveal both positive and concerning trends regarding hygiene practices in food preparation. While many food handlers reported adhering to proper hygiene protocols, there were notable discrepancies between self-reported practices and actual field observations. The majority of food handlers (98%) indicated that they wash their hands using detergent or disinfectant before handling food, which reflects good hand hygiene practice. However, field observations revealed a significant gap between self-reports and actual practices. A large proportion of food handlers were found not to use detergent or disinfectant when washing their hands before handling food or after contact with potentially contaminated materials. Non-sanitation of hands can lead to the transfer of pathogenic bacteria to food, posing a risk for foodborne illness (Abdul-Mutalib et al., 2012). Handwashing with antibacterial soap can effectively remove over 95% of coliform bacteria (Toshima et al., 2001), underscoring the importance of improved hand hygiene practices to reduce bacterial contamination risks.

Another concerning issue is the method of hand drying. While 89% of food handlers reported drying their hands using approved methods (such as disposable towels, air driers, or frisk drying), some were found to be using dish towels, which are not suitable for hand drying. Dish towels can harbor harmful bacteria, including *Staphylococcus aureus* and *Salmonella* (Lee et al., 2017; Stepanović et al., 2005), which can be transferred to food during preparation. In some cases, food handlers did not dry their hands at all. These practices highlight the need for training food handlers on proper hand-drying techniques to prevent contamination.

Additionally, approximately 50% of food handlers were observed washing their hands in sinks intended for washing cutlery, which is an unhygienic practice that can lead to cross-contamination. Previous studies have highlighted the risks associated with using the same utensils for both raw and cooked foods, as this can contribute to contamination (Abdul-Mutalib et al., 2012). The current study found that 94% of food handlers self-reported using separate cutlery for raw and cooked foods, but field observations showed that this practice was not always followed.

Despite these concerns, the self-reported data also indicated several positive hygiene practices. For instance, 96% of food handlers reported using detergent to clean food preparation areas, and 95% indicated that they rinse food preparation areas with clean water to remove detergent residues. Furthermore, a substantial percentage of handlers (92%) claimed to store raw and cooked foods separately, and 95% reported that raw vegetables and meat were stored separately in cold storage, which are essential practices for preventing cross-contamination.

Interestingly, the study found that 100% of food handlers reported having valid medical certificates, keeping their nails short and clean, and wearing clean aprons. These practices suggest a high level of awareness regarding personal hygiene and food safety standards.

In conclusion, while food handlers in this study demonstrated positive attitudes toward food safety and reported engaging in some good practices, there remain several critical areas that require attention. Specifically, discrepancies between self-reported practices and actual behaviors highlight the need for more robust training programs focused on improving hand hygiene, proper hand-drying methods, and the appropriate handling of utensils and food. By addressing these gaps, food establishments can better mitigate the risks of foodborne illness and promote a safer food environment.

Table 4 Food Handlers Food Safety Practices

Statement	Agree n (%)
Food preparation areas (FPAs) cleaned with at least a detergent prior to food preparation	96
FPAs rinsed with clean water to remove residues of detergents and disinfectants	95
Handwashing done using a detergent or disinfectant before handling food	98
Hands dried using approved method (e.g., disposable towels, air drier, frisk drying)	89
Smoking, sneezing and nose-poking not done when preparing food	70
Eating not done when preparing food	81
Separate storage of raw and cooked foods	92
Separate cold storage of raw vegetables and meat	95
Separate cutlery used for raw and cooked foods	94
Expired food should not be consumed	100
Handwashing not done in sinks for washing cutlery	72
Cutlery (e.g., knives, spoons, cups) not handled by surfaces that come into contact with food	96
Non refreezing of defrosted foods	83
adequate thawing of food	89
No hand jewelry (e.g., necklaces, rings and watch)	100
Valid food handlers medical exam certificates	100
Hand nails kept clean and short	96
Hair covered with a cap or hairnet	100
Apron washed and clean	100
Protective gear not taken to potentially contaminated areas (e.g., toilet and home)	98
To be certain that food is safe to eat, one should cook it for the duration of the recommended time than smell or taste it	86
Average	87

Percentage distribution of respondents ' Knowledge, Attitudes, and Practices on Food Safety

The majority of food handlers were under 25 years of age (61.5%), with 75% of respondents being male. Food handlers demonstrated high awareness of sanitary practices in the workplace, including personal hygiene (100%) and handwashing (98%). The study revealed that food handlers had a strong understanding of basic food hygiene, as the majority of participants had received basic food safety training (90.4%) and HACCP training (84.6%). On average, the food safety knowledge, attitudes, and practices of food handlers were 77%, 82.2%, and 87%, respectively.

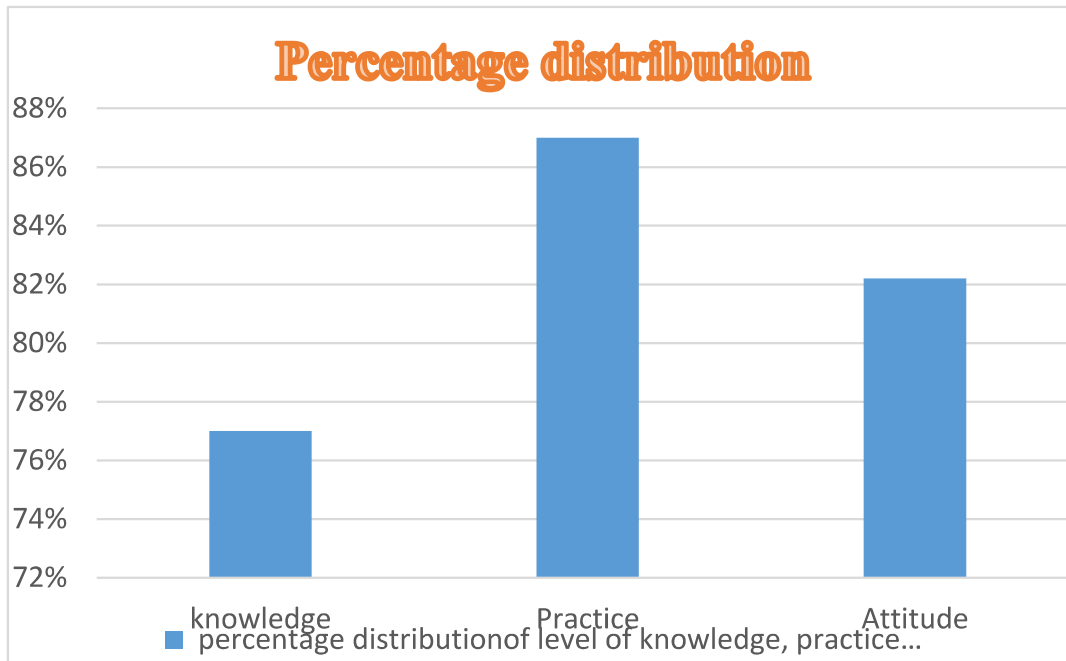


Figure 5 percentage Distribution of Level of Knowledge, Practices and Attitudes

Conclusion and Recommendations

The present study indicates that food handlers at Kandy City Centre generally exhibited satisfactory levels of food safety knowledge, attitudes, and practices. However, certain critical areas, particularly those related to cross-contamination control and time-temperature management, require further attention. While the handlers displayed good awareness of basic food hygiene practices, there is a need to strengthen the application of these practices, especially in areas where gaps were identified. These findings suggest that ongoing efforts are necessary to maintain and improve food safety standards in the workplace.

To address the identified gaps, it is recommended that food safety training programs be enhanced with a stronger focus on cross-contamination control and proper time-temperature management, which are essential for preventing foodborne illnesses. Additionally, training should move beyond theoretical knowledge and incorporate practical, hands-on learning experiences to better instill correct food safety practices. Building a positive food safety culture is crucial, where food handlers are encouraged to adopt proactive attitudes toward hygiene, report illnesses, and maintain a clean and safe working environment. Regular evaluations, updates on food safety regulations, and continuous monitoring and supervision by management are necessary to ensure that food safety standards are consistently met and followed.

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