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Evaluation of food safety knowledge, attitude and hygienic practices among food service workers in hotels, restaurants and street food stands in Morogoro, Tanzania

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ABSTRACT

Foodborne infections are a global problem, especially in developing nations. These infections mostly spread in homes, restaurants, and other public places. Thus, promoting food safety knowledge, attitudes, and hygienic behaviors is essential. The aim of this study was to assess the level of food safety knowledge attitude and hygienic practices among food service workers in hotels, restaurants and street food stands. A cross-sectional study carried out during February to May 2024 in Morogoro Municipality examined 75 hotel, restaurant, and street food vendors' food safety knowledge, attitudes, and hygienic practices using structured questionnaires and an observation checklist. Food service workers were tested on pathogens, cleanliness, and handling. Correct answers got points; scores below 50% indicated insufficient knowledge. Food safety attitudes contained 10 questions with 10% points for accurate answers. Food service workers in hotels had significantly ($p<0.05$) superior food safety knowledge (94.65%), attitude (95.60%), and hygienic practices (98.25%) compared to those in restaurants and street food stands. The food service workers at street food stands had the lowest ratings in terms of their knowledge (50.65%), attitude (40.40%), and hygienic practices (45.75%). Restaurant food service workers scored 66.97%, 69.2% and 83.02% for food safety knowledge, attitude, and hygienic practices, respectively, and these were significantly ($p<0.05$) higher than those obtained from street food stand and lower than hotel service workers. Hotel staff demonstrated superior food safety knowledge, attitude, and practices compared to street vendors. Food safety in Morogoro Municipality requires intense training, regulatory supervision, local authority cooperation, and continual study and monitoring.

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1. Introduction

The food and hospitality industry, including hotels and restaurants and street food stands, is particularly crucial in ensuring food safety due to the large volumes of food handled and the diverse consumers served (1). However, the standards of food safety practices may vary widely, especially in low-income countries, where regulatory oversight may be less stringent (2).

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Foodborne illness outbreaks are linked to poor food safety knowledge, bad attitudes and substandard hygienic practices among food handlers (3). Food service establishments are prevalent worldwide, including in Tanzania, and the sale of such food offers a livelihood for many individuals who may otherwise be unemployed (4). Many people in developing countries rely on food service facilities for their daily meal (5), despite the fact that these stalls have frequently been associated with sanitary issues and food poisoning. In recent years, these food enterprises have become widespread as a result of changes in people's lifestyles, such as the rise of "eating out," which is a prevalent lifestyle in urban areas (1). The operators of street food stalls are responsible for the preparation and sale of food and beverages at temporary establishments that are situated in public areas such as marketplaces and bus terminals (6), while hotels and restaurants are permanent establishments. The cost of street food is typically lower compared to that offered in restaurants and hotels (5). Research indicates a positive link between food safety knowledge and hygienic practices (7), suggesting that those with superior food safety knowledge exhibit enhanced hygienic practices.

Tanzania has experienced microbiological and chemical food safety problems, contributed by inadequate knowledge by the public including the food handler (8). Although it has been reported that there are many cases of food borne illnesses, many of which are not recorded in official statistics (9), Akabanda, Hlortsi (2) underlined that numerous foodborne illnesses and outbreaks have been linked to infected food handlers and their poor hygiene practices. Food handlers are crucial in preventing food poisoning. In order to prevent food poisoning, food handlers must have a thorough knowledge of food safety, practice good hygiene, and use proper methods for preparing and storing food (10). Nee and Sani (11) contended that a thorough understanding of food safety is essential for food handlers, and that the effective implementation of this knowledge is vital for ensuring safe food production in any institution. In addition, theories of social judgment, learning, and cognitive consistency provide light on how knowledge is understood in relation to individuals' actual knowledge, emotions, and behaviors (12). In contrast, Olufemi (12), (13) suggest that attitude encompasses evaluations related to how individuals think, feel, and act concerning any given issue. A recent study in Unguja Island, Zanzibar, found that street-vendor food was associated with a high incidence of Shigellosis in children under five (14). It was reported that poor food handling practices, such as serving food with bare hands, with 46.4% of street vendors admitting to this practice (15). This study aimed to assess the food safety knowledge, attitudes, and hygienic practices among food handlers in hotels, restaurants, and street food stands in Morogoro Municipality. This study aims to improve food safety across diverse environments by pinpointing essential areas for enhancement and offering evidence-based recommendations, thereby helping policymakers, health authorities, and the hospitality sector.

2. Materials and Methods

2.1. Study design and sampling

A cross-sectional study was performed in Morogoro Municipality to evaluate the extent of food safety

knowledge, hygienic practices, and attitudes among food service workers in hotels, restaurants, and street food stands. Data were obtained utilizing structured questionnaires and an observation checklist from February 2024 to May 2024. An observation checklist was utilized to assess the characteristics of the infrastructure for food preparation and service, together with personal hygiene considerations. A purposive sampling technique was employed to choose five hotels, five restaurants, and five street food stalls. A total of 75 respondents were obtained by randomly selecting five (5) food service workers from each hotel, restaurant, and street food stand.

2.2. Data collection

The questionnaire was designed to examine the food safety knowledge, food safety attitudes, self-reported practices of the food service workers in designated hotels, restaurants and street food stands. The food safety knowledge section assessed food service workers' knowledge on food pathogens, good hygiene and food handling practices. This part contains 12 questions, each with three alternative responses: "Yes," "No," and "Don't know." Each accurate response received one point (equivalent to 8.33%), whilst an incorrect or "Don't know" response received zero points. Food service workers scoring below 50% were classified as having "poor knowledge" of food safety, those scoring between 50% and 75% were deemed to possess "average knowledge," and individuals scoring over 75% were seen as having "good food safety knowledge." Similar scoring methodology was utilized for the food safety attitudes segment of the questionnaire, comprising 10 questions, with each correct answer yielding a score of 10%. The section designed to evaluate the hygienic practices of food service workers utilized an observational checklist. A total of 16 questions were posed concerning the practices of food handlers and the actual conditions of the food preparation and serving environment, with "Yes" and "No" as possible responses. In this section, scores were assigned based on the correctness of the food handler's actions. One point (equivalent to 6.25%) was awarded for proper practices, while zero points were given for improper practices.

2.3. Data analysis

Data were gathered and organized in Microsoft Excel. Subsequent analysis was performed using the Statistical Package for Social Sciences (SPSS) Version 20. Descriptive statistics, including frequencies and percentages, were calculated for categorical data, and means, standard deviations, medians, and percentiles were derived for numerical data. Correlation analysis employed Pearson's correlation to examine the link between the level of food safety knowledge and the hygienic practices of the food service workers. One-way analysis of variance (ANOVA) was employed to examine the means of food safety knowledge, attitudes, and sanitary practices among food service workers. A p-value of 0.05 was considered statistically significant.

3. Results

3.1. Food safety knowledge among food service workers

The food safety knowledge among food service workers in hotels, restaurants and street food stands is presented in Table 1. Most of the respondents had proper understanding that hand washing before handling food is important for reducing food

contamination and that, 100% of food service workers from hotels, 80% from restaurants and 72% from street food stands had knowledge on hand washing procedures. Moreover, 76%, 52% and 48% of food service workers from hotels, restaurants and street food stands, respectively, were knowledgeable that "Washing utensils with detergents does not necessarily leave them free of microbes". A considerable proportion of food service workers (88% from hotels, 68% from restaurants and 56% from street food stands) knew that they have to refrain from handling food while felt ill or having cut, wounds in their hands. All food service personnel from hotels (100%), a majority from restaurants (76%), and a minority from street food vendors (64%) were aware that consuming food and beverages during food preparation can lead to contamination. Moreover, a majority of food service personnel from hotels (96%), a smaller proportion from restaurants (68%), and an even lesser percentage from street food vendors (56%) were aware that germs can reside on the skin, nose, and mouth of healthy individuals.

3.2. Food hygienic practices of the food service workers

The results of the food hygienic practices among food service workers are presented in Table 2. All food service workers (100%) were observed to wash their hands using soap and water before handling food. Additionally, hand washing facilities are adequately equipped with soap and running water in all hotels (100%), while restaurants had relatively low (85%) adequacy of the hand washing facilities. On the other side street food stands had comparatively inadequate hand washing facilities (60%).

The findings demonstrate that all food service workers in the hotels (100%) adhere to appropriate waste disposal practices, and the waste containers were adequately covered. Nevertheless, merely 60% of food service workers in restaurants and 40% in street food stands adhered to appropriate waste disposal practices. During the visit, certain restaurants and street food stands exhibited uncovered and overfilled waste bins, while some workers improperly disposed of wastewater adjacent to the stalls, thereby attracting vectors of foodborne diseases, such as houseflies and cockroaches. Most of the food service workers from hotels (100%) stored raw and cooked foods separately to prevent cross contamination while, only 70% and 40% of food service workers from restaurants and street food stands, respectively, had correct practice against cross contamination.

3.3. Attitude towards food safety among food service workers

Results for the food safety and hygiene attitude question posed to food service workers are shown in Table 3. The perceptions of food service workers regarding raw eggs vary among hotels, restaurants, and street food stand. About 92% of food service workers from hotels agreed that it is important to wash eggs after purchasing them, while the same question was answered correctly by only 60% and 20% of food service workers from restaurants and street food stands respectively. Moreover, 100% food service staffs from hotels showed positive attitude towards wearing hair net, while only 80% restaurants' and 50% street food stands' workers showed positive attitude. In case of selection of fruits for juice making, food service workers from hotels (80%), restaurants (65%) and street

food stands (15%) showed positive attitude upon selection of fruits for juice making, the rest showing negative attitudes such choosing overripe (rotten) fruits and prioritizing size over quality.

Concerning personal hygiene, the majority of respondents indicated that the use of masks, gloves, and hairnets is a crucial practice for minimizing food contamination, with 100%, 80%, and 50% of food service workers from hotels, restaurants, and street food vendors, respectively, acknowledging its importance. Moreover, 84%, 60%, and 35% of the food service workers from hotels, restaurants, and street food stands, respectively, argued that food should be served while hot. On the other hand, they had different perceptions regarding left over foods where 84%, 55% and 30% of the food service workers from hotels, restaurants, and street food stands, respectively, argued that left over foods should be discarded, while the rest argued that left overs should be kept and reused or mixed with the new batches.

3.4. Comparison of food service workers' KAP in hotel, restaurant, and street food stand

Table 4 illustrates the food safety knowledge, attitudes, and hygiene practices (KAP) of food service workers. Food service personnel in hotels had significantly superior ($p<0.05$) levels of food safety knowledge (94.65%), attitudes (95.60%), and hygienic practices (98.25%) relative to their counterparts in restaurants and street food stands. Conversely, food service workers at street food stands demonstrated the lowest scores ($p<0.05$) in food safety knowledge (50.65%), attitudes (40.40%), and hygienic procedures (45.75%) relative to those in hotels and restaurants. Food service workers working in restaurants, however, had intermediate ratings of 66.97%, 69.2%, and 83.02% in food safety knowledge, attitudes, and hygienic practices, respectively, which were statistically superior ($p<0.05$) to those of street food stands but inferior to those of hotel staff.

3.5. Relationship between food safety knowledge and reported hygienic practices

The correlation between food safety knowledge and reported hygienic practices among food service workers in hotels, restaurants, and street food stands was assessed using Pearson's correlation analysis. The correlation coefficient for overall food safety knowledge scores and observed hygienic practices revealed a strong positive linear relationship ($r = 0.827$; $p = 0.000$). The significance value for this correlation is less than the conventional alpha level ($p<0.01$) suggesting that the observed relationship is unlikely to be due to chance.

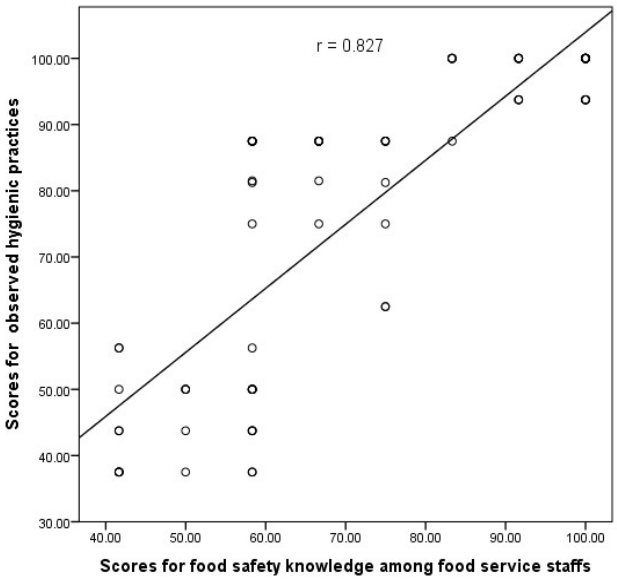

Figure 1. Correlation between food safety knowledge and hygienic practices among food service workers in hotels, restaurants and street food stands.

Table 1. Food service workers knowledge related to food safety.

	Percentage Correct responses, % (N)		
Questions	**Hotels**	**Restaurants**	**Street food**
Washing hands properly before handling food to reduce the risk of food contamination	100 (25)	80 (20)	72 (18)
Wearing gloves when handling food reduce the risk of food contamination	96 (24)	64 (16)	56 (14)
Eating and drinking while preparing food increases the risk of food contamination	100 (25)	76 (19)	64 (16)
Reheating cooked food could cause contamination	92 (23)	60 (15)	52 (13)
Typhoid fever can be transmitted through food	100 (25)	72 (18)	60 (15)
Swelling cans contain microorganisms	84 (21)	56 (14)	44 (11)
Bacteria can be found on the skin, nose and mouth of healthy people	96 (24)	68 (17)	56 (14)
Food poisoning can cause abortion in pregnant women	80 (20)	48(12)	40(10)
Washing utensils with detergents necessarily leave them free of microbes	76 (19)	52 (13)	48 (12)
You have to take time off from work if you have a contagious skin disease or wounds	88 (22)	68 (17)	56 (14)
Who is responsible for food safety	68 (17)	60 (15)	52 (13)
What should be done on food that has passed the expire date	84 (21)	60 (15)	56 (14)

Table 2. Food hygienic practices by the food service workers at the hotels, restaurants and street food stands.

Questions	Percentage Correct practices (%) [N]		
	Hotels	Restaurants	Street food stands
Staff wash their hands with soap/sanitizer and water before handling food	100 (25)	100 (25)	100 (25)
Staff wear clean and appropriate attire (e.g., aprons, hairnets) during food preparation.	96 (24)	80 (20)	60 (15)
Staff avoid touching their face, hair, or body while preparing food.	92 (23)	75 (19)	50 (12)
Staffs use separate cutting boards and knives for raw and cooked foods.	88 (22)	65 (16)	45 (11)
Staff store raw and cooked foods separately?	100 (25)	70 (17)	40 (10)
The food preparation area is clean and well-maintained.	100 (5)	60 (3)	40 (2)
Staff use food coverings to protect against contamination.	100 (25)	80 (20)	50 (12)
Hand washing facilities are adequately equipped with soap and running water.	100 (5)	60 (3)	40(2)
Staff properly wash and sanitize all kitchen utensils and equipment after use.	92(23)	70(17)	45(11)
Waste is disposed of properly and waste bins are covered.	100 (5)	60 (3)	40 (2)
Staff exhibit knowledge of basic food safety principles during food handling.	100 (25)	65 (16)	35 (9)
Staff report any symptoms of illness and refrain from handling food if sick.	100 (25)	90 (23)	55 (14)
Food handling training certificates are up-to-date for all staff.	100 (25)	70 (17)	40 (10)
Staff practice proper coughing or sneezing etiquette (e.g., into elbow or tissue, not near food).	96 (24)	80 (20)	45 (11)
Surfaces that come into contact with food (e.g., countertops, cutting boards) are cleaned and sanitized before and after use.	92 (23)	75 (19)	50 (12)
Staff avoid cross-contamination by using gloves or utensils when handling ready-to-eat foods.	96 (24)	70 (17)	45 (11)

Table 3. Food safety attitude of the food service workers.

Questions	Percentage Correct Responses %(N)		
	Hotels	**Restaurants**	**Street food**
What should a food service personnel do if he or she has an abrasion	100 (25)	80 (20)	40 (10)
Is it necessary to wash eggs after purchasing them	92 (23)	60 (15)	20 (5)
Can kitchen towels be a source of contamination	96 (24)	70 (17)	30 (8)
Is it mandatory to wear a hair net, gloves and mask when handling food	100 (25)	80 (20)	50 (12)
Where is the ideal place to store raw meat	88 (22)	50 (12)	25 (6)
How do you choose fresh fruit for juice making	80 (20)	65 (16)	15 (4)
A well-cooked food does not contain any microorganisms	70 (17)	45 (11)	20 (5)
What do you do with left over foods	84 (21)	55 (14)	30 (8)
Do you have to work in kitchen if you have coughing and sneezing symptoms?	96(24)	70(17)	40(10)
Is it necessary to serve food while hot?	84 (21)	60 (15)	35 (9)

Table 4. Food safety knowledge, attitude and hygienic practices in food establishments.

Groups	**N**	**Food Safety Knowledge (%)**	**Attitude (%)**	**Hygienic Practice (%)**
Hotels	25	94.65[a]	95.60[a]	98.25[a]
Restaurants	25	66.97[b]	69.20[b]	83.02[b]
Street food stands	25	50.65[c]	40.40[c]	45.75[c]

4. Discussion

As a result of the fact that the majority of street food vendors are low-income, uneducated, and have little to no care for food safety, there has been a growing number of serious issues over the safety of street food. The current study indicated that 100% of the food service workers in hotels, 70% in restaurants, and 40% in street food stands receive regular training in food safety. Research has substantiated these concerns, indicating that street meals might harbor potentially harmful bacteria, which can result in outbreaks of foodborne diseases (16). Such contamination and food poisoning arise from poor sanitation, ineffective cooking techniques, cross-contamination (both direct and indirect), handling of raw or cooked meals with unclean hands or surfaces, and other sources of contamination (such as animal or human excrement) (3). Salads and fruits sold on the street are often eaten raw, putting them at danger of contamination from either irrigation water, manure, or water used to rinse and sprinkle them after harvest to keep them fresh (17, 18). Consequently, customers are increasingly concerned about the food-related risks linked with vended food. Preharvest contamination is not influenced by vendors' knowledge or practices; instead, inadequate temperature control, extended storage duration, and the use of improper packaging are observed to be some vendor behaviors that could encourage pathogen growth and proliferation (19).

4.1. Food safety knowledge

Knowledge of food safety is paramount for preventing foodborne illnesses. This study revealed that food service workers at the hotel possessed the highest level of food safety knowledge. This might be ascribed to more strict training programs and rigorous regulatory control commonly present in hotel settings. Previous research substantiates these findings, emphasizing the need of extensive training in improving food safety knowledge among food workers in formal settings (20, 21). In contrast, food service staff working at the restaurant exhibited moderate levels of knowledge, which may be due to less stringent training and regulatory frameworks compared to hotels. Food service workers at the street food stands vendors had the lowest knowledge levels, reflecting the informal nature of this sector and the lack of access to formal training programs (22). Given that street food constitutes a substantial portion of the urban food supply in numerous developing nations, including Tanzania, this information gap is alarming. Additionally, the current study found formal training as the independent determinant or predictor of knowledge among food service workers since those who attain regular training had the excellent scores in hygienic practices. A study conducted by Cempaka et al. (23) in Indonesia demonstrated a substantial correlation between participation in food hygiene training and the levels of food knowledge, attitudes, and hygienic practices. The study indicated that food service workers possessing superior knowledge were three times more likely to exhibit excellent food hygiene practices (23).

4.2. Food service workers' attitudes towards food safety

The attitude of food handler towards food safety significantly influences their practices. The present study towards food safety attitude shows that food service worker in hotel displayed the most positive attitudes, likely due to continuous professional

development and the high standards expected in hotel settings. Studies have shown that positive attitudes towards food safety are often linked to better hygienic practices and compliance with safety protocols (24). Restaurant staff had moderately positive attitudes, while street food vendors exhibited the least positive attitudes. The informal nature of street food vending, coupled with limited enforcement of food safety regulations, may contribute to this disparity. Improving attitudes towards food safety in the street food sector requires targeted interventions, including education and sensitization programs (25).

4.3. Hygienic practices

Hygienic practices represent the practical application of food safety knowledge and attitudes. The research indicated that hotel personnel maintained the utmost hygiene standards. This aligns with findings from other areas, where formal facilities such as hotels and upscale restaurants uphold superior cleanliness standards due to client expectations and regulatory mandates (26). Restaurant staffs demonstrated moderate adherence to hygienic practices, which reflects their intermediate knowledge and attitudes. Street food vendors, however, showed the lowest adherence to hygienic practices. This is particularly concerning given the high volume of consumers relying on street food for their daily meals. Poor hygienic practices in this sector pose significant health risks, as they are often linked to outbreaks of foodborne diseases (27).

4.4. Relationship between food safety knowledge and food hygienic practices

From the results shown in the current study, food safety knowledge displayed a strong positively correlation with food hygienic practice ($r = 0.827$; $p = 0.000$). This implies that higher food safety knowledge is associated with better performance on the hygienic practices. A better food handlers' hygiene practices will improve with better food safety knowledge and translated from positive food safety attitude. The results of the current study align with the findings of Toh and Birchenough (28) which demonstrated a substantial association between food safety awareness and the food handling practices of hawkers.

Previous studies have also shown a strong positive correlation between food safety knowledge, attitude and hygienic practices (29, 30). Another study by Abdul-Mutalib et al. (31) indicated a positive link between food hygiene practices and knowledge. Furthermore, Abd Lataf Dora-Liyana et al. (32) shown that self-reported food safety and hygiene practices have a substantial positive correlation with overall food safety knowledge. Previous study has demonstrated that errors in food handling are the principal causes to global foodborne diseases (33). The primary approach for preventing foodborne illnesses is training food handlers in food safety (34).

5. Conclusion

The study reveals the critical importance of food safety in urban areas especially in areas where street food plays a significant role in daily nutrition. This study highlights substantial disparities in food safety knowledge, attitude and hygienic practices in hotels, restaurants and street food stands. Hotel staff generally exhibit superior food safety standards due to rigorous training and oversight, while restaurants and street food stands showed lower standards due to lack of sufficient knowledge and resources. These findings have profound implication for public health.

6. Recommendations for public health implications

The significant differences in food safety knowledge, attitudes, and practices among food handler in hotels, restaurants, and street food stands highlight the need for tailored interventions. Hotels, due to their superior performance, can serve as benchmarks for best practices. Regulatory bodies should enforce stringent food safety standards across all food service sectors, ensuring that even informal vendors comply with basic hygiene requirements. For restaurants, enhancing training programs and promoting a culture of food safety can bridge the gap between their practices and those of hotels. Street food stands require more comprehensive support, including access to training, resources for maintaining hygiene, and regular inspections to ensure compliance with food safety standards.

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Author contributions

Regina Mewasa Soingei: Methodology, Analyses, and Writing-Original draft preparation

Anold Richard: Methodology, Analyses, and Writing-Original draft preparation

Abdulsudi Issa-Zacharia: Writing, Editing, Reviewing, and Supervision

Declaration of competing interest

The authors declare that there are no conflicts of interest related to this study.

Data availability

The data produced and used in this work can be obtained from the corresponding author upon areasonable request.

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