Factors associated with cross-contamination among food handlers at Munuki Payam, Juba, South Sudan

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ABSTRACT

Introduction: Cross-contamination is a major contributor to foodborne illnesses, particularly in rapidly growing urban areas such as Munuki Payam in Juba. This cross-sectional study examined the human factors associated with cross-contamination among food handlers in this setting.

Method: Data were gathered from 50 randomly selected food handlers in Munuki Payam using structured questionnaires, between 1 February and 28 February 2024. We randomly selected 50 restaurants from two zones in Munuki Payam. Within each selected restaurant, all eligible food handlers were invited to participate voluntarily, and one was selected for the study. The restaurant manager gave permission before data collection, and all participants provided informed consent. Respondents were assured of confidentiality and that the data would be used only for academic research.

Results: Of the 50 participants, most were aged between 31 and 40 years and had been living in Munuki for 6 – 10 years. Common practices that respondents said contributed to cross-contamination of food included using cutting boards for raw and cooked food without washing, reported by 19 (38.0%) of participants; not washing fruits and vegetables, reported by 14 (28.0%); and not keeping kitchen surfaces clean, reported by 13 (26.0%). Two (4.0%) participants attributed cross-contamination to not cooking foods thoroughly, especially meat, poultry, and eggs, and not storing food at the correct temperature. Half of respondents said proper handwashing is the best way to prevent cross-contamination in food service settings, while a quarter said cleaning and sanitizing surfaces. When asked about the best methods for educating and training food handlers, 19 (38.0%) respondents said being supervised by trained professionals, 17 (34.0%) opted for regular evaluation of food handler education, and 10 (20.0%) opted for providing training on food safety practices.

Conclusion: Many food handlers in Munuki Payam had limited knowledge regarding proper food handling and sanitation procedures. Despite this, some demonstrated satisfactory knowledge of personal hygiene and proper food storage practices during food preparation.

Keywords: cross-contamination, food handlers, food hygiene, food safety practices, hand hygiene, Juba.

Introduction

Cross-contamination refers to the transfer of harmful microorganisms, such as bacteria, viruses, and other pathogens, from one surface, object, or substance to another, particularly when food is involved. This transfer may occur through contact with contaminated hands, utensils, equipment, countertops, cutting boards, other foods, or even people.[1] Contaminants associated with cross-contamination can be classified as physical, chemical, or biological.[1]

Cross-contamination often results from improper food handling and poor hygiene practices, posing major food safety risks and increasing the likelihood of foodborne diseases, which often begin with diarrhoeal illnesses and may progress to more serious health conditions. The term also describes the movement of harmful substances, including chemicals, allergens, and toxins, between different environments or food products. The accidental presence or transfer of allergens into food products where they are not intended is also considered a form of cross-contamination.[2,3] As a result, pathogens in raw ingredients can transfer to cooked food, causing contamination.[4] Cross- contamination can occur at any point along the food supply chain. It may begin with the improper handling of raw foods, which often contain high levels of bacteria. Knowing which contaminants pose the greatest risk to food, along with proper food-handling practices, is essential to addressing this concern. Cross-contamination can be effectively prevented through appropriate training and education of food handlers.[5]

The Government of South Sudan has published guidelines for controlling food safety, including the "National Food Safety Control Systems in South Sudan, 2020."[6]

Method

The study was done in Munuki Payam, Juba City, which is divided into four zones. The study selected two zones, Nyokuron and Munuki. The study area has 410 licensed restaurants, from which 50 were randomly selected. Data were collected from one food handler in each selected restaurant.

These restaurants are small informal or semi-formal food establishments, including street food stalls, that prepare and serve ready-to-eat meals and beverages in the market with limited infrastructure, including poor access to water, electricity, and sanitation. Refrigeration facilities were limited and mainly used for storing beverages, resulting in inadequate storage of perishable foods. These establishments employed several workers who prepared food, served customers, and cleaned. Disposable gloves were used inconsistently, and cleaning primarily used water and detergent, with limited use of disinfectants.

Prior to data collection, participants were informed about the purpose of the study and provided consent for their responses to be used for research purposes. The 50 selected participants completed structured, closed-ended questionnaires in English. The collected data were analyzed to identify key themes and patterns.

Results

Of the 50 participants, 21 (42.0%) were male, and 29 (58.0%) were female. Of these, 17 (34.0%) had no formal education, 13 (26.0%) had primary education, 15 (30.0%) had secondary education, and 5 (10.0%) had tertiary education. Most respondents understood and responded effectively to the questionnaires.

Two-thirds of respondents (32; 64.0%) had heard about food cross-contamination, while 10 (20.0%) were not sure and 8 (16.0%) reported they had not heard about it.

Figure 1 shows that most respondents, 30 (60.0%), reported health workers as their source of information about food cross-contamination; 3(6.0%) reported obtaining information from radio or friends, while 14 (28.0%) cited other sources of information. Three (6.0 %) respondents did not provide a response.

Table 1 shows the main sources of food cross-contamination reported by respondents. When asked how food safety could be improved, 22 (44.0%) chose learning to wash hands thoroughly before handling food as the most important measure, 17 (34.0%) opted for regular training and education on food safety procedures, and 11 (22.0%) said maintaining a safe food environment.

Respondents were asked to select, from the options in Figure 2, the common practices that contribute to food

Table 1. Main source of cross-contamination in food (N=50)

Variables	n (%)
Unwashed hands and surfaces	30 (60.0)
Handling raw meat improperly	10 (20.0)
Storing raw meat improperly	10 (20.0)

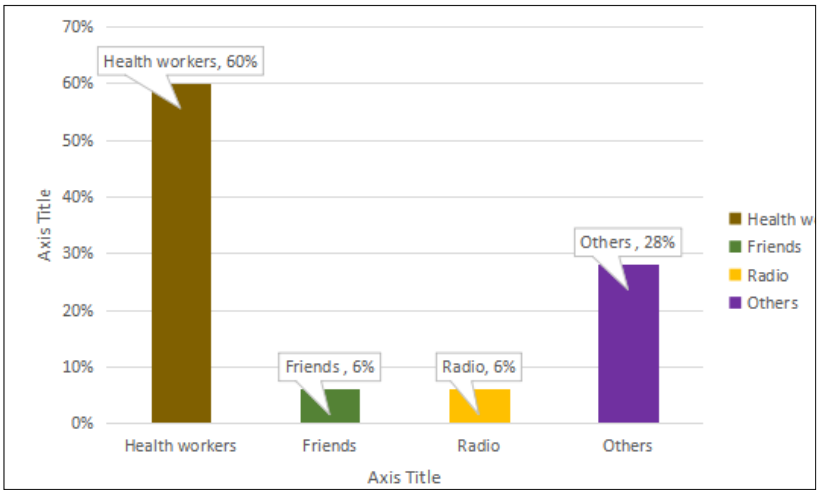

Figure 1. Respondents' sources of information on cross-contamination.

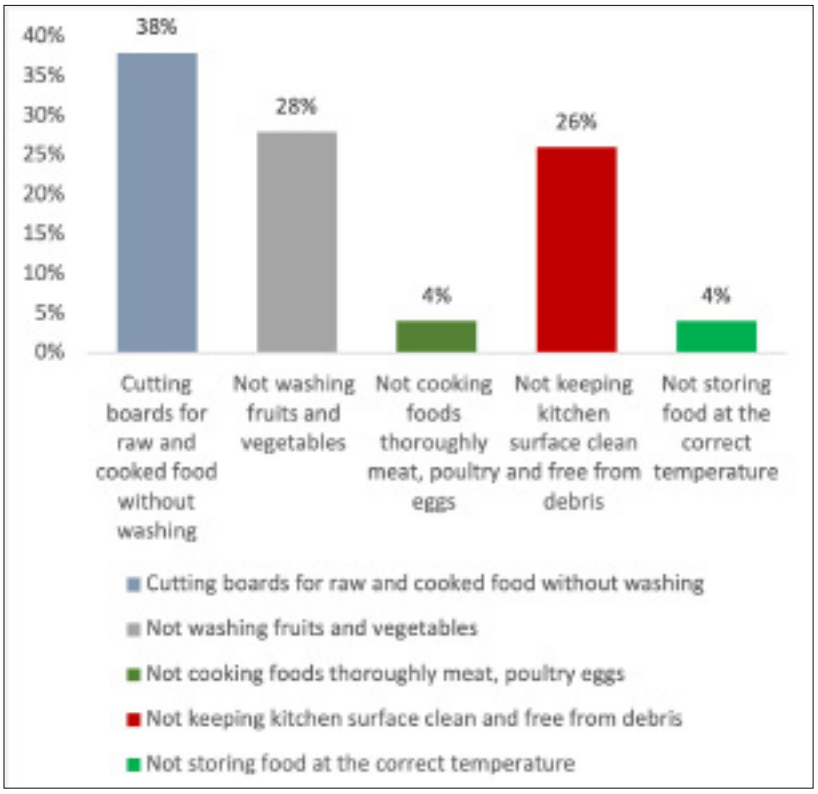

Figure 2. Common practices contributing to cross-contamination of food

cross-contamination. Figure 2 shows that 19 (38.0%) cited using the same cutting boards for raw and cooked foods without washing them as the most common practice contributing to cross-contamination. Fourteen (28.0%) identified not washing fruits and vegetables, while 13 (26.0%) reported not keeping kitchen surfaces clean and free from debris. Two (4.0%) identified inadequate cooking of foods, particularly meat, poultry, and eggs, and another 2 (4.0%) reported improper food storage at incorrect temperatures.

When asked how cross-contamination affects food hygiene and safety, 20 (40.0%) respondents reported that it can cause food spoilage, 19 (38.0%) indicated that it can spread foodborne illnesses, and 11 (22.0%) stated that it can result in hospitalization or even death.

When asked to select, from a given list, the pathogen most commonly transmitted through cross-contamination, 33 (66.0%) respondents identified *Escherichia coli* (E.coli), 8 (16.0%) identified *Campylobacter*, 5 (10.0%) identified pathogens causing hepatitis and 4 (8.0%) identified *Salmonella*.

The majority of the respondents, 25 (50%), identified proper handwashing as the best way to prevent cross-contamination in food service settings. Twelve (24.0%) selected cleaning and sanitizing surfaces, 8 (16.0%) said regular maintenance of the food environment, 3 (6.0%) identified cleaning and sanitizing equipment, and 2 (4.0%) opted for separating raw and cooked foods.

When asked the best methods for educating and training food handlers, 19 (38.0%) respondents identified supervision by trained professionals, 17 (34.0%) selected regular evaluation of food handlers' knowledge and practices, and 10 (20.0%) opted for providing training on food safety practices, and 4 (8.0%) selected posters and signs in the workplace as reminders of food safety practices. (Figure 3)

Discussion

Respondents reported that unwashed hands and surfaces were the major factors contributing to food cross-contamination. Data on previous training in food hygiene were not collected. However, the findings suggest that,

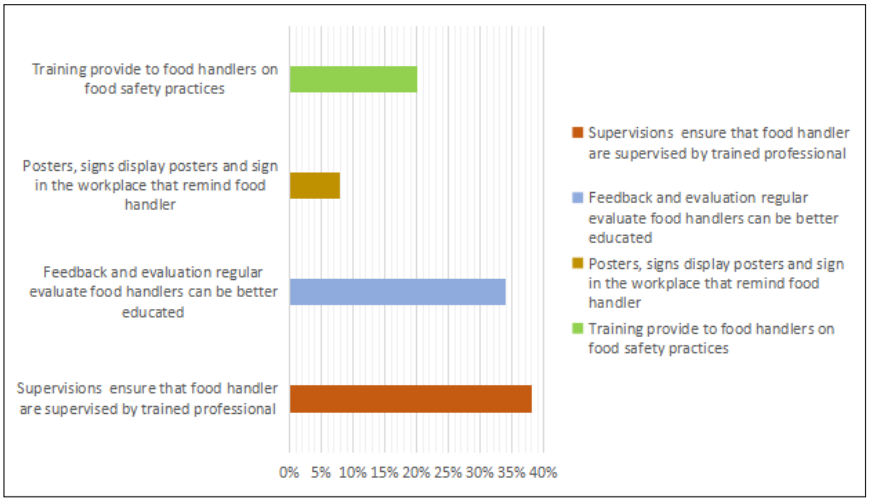

Figure 3. Best methods for educating and training food handlers

even in the absence of formal food safety and hygiene training, food handlers may have applied food safety practices based on knowledge acquired at home or through observing others.[7]

Food handlers frequently prepare food using water from unsafe sources, largely due to the location of their restaurants and limited access to safe water infrastructure.[8] In resource-limited settings, inadequate access to safe water supplies may increase the risk of food contamination and the transmission of foodborne diseases among consumers.[9] Although this study did not assess previous food safety training, some participants demonstrated awareness of basic food hygiene practices. Similar studies show that food handlers' knowledge and practices may be influenced by their education, training, and prior food preparation experience.[10,11]

Studies conducted in Greece and Lebanon have demonstrated that inadequate food safety knowledge and poor food-handling practices among food handlers are associated with an increased risk of foodborne illness.[12,13] These findings highlight the importance of targeted food safety education, regular training programmes, and improved hygiene practices among food handlers.[14,15]

Recommendations

To improve food safety and hygiene practices in food establishments within Munuki Payam, it is recommended that:

1. Food handlers are encouraged to wash their hands regularly with soap and clean water before and after handling food, after using the toilet, and after contact with raw meat, fish, or poultry.

2. Utensils, cutting boards, dishes, and countertops are cleaned and sanitized regularly to minimize the risk of contamination.

3. Fruits and vegetables are thoroughly washed before preparation and consumption using water from a reliable source.

4. There are continuous training programmes on food hygiene and safe food handling practices for all food handlers.[4]

5. Hazard Analysis and Critical Control Points (HACCP) principles are implemented to assist food establishments in identifying, monitoring, and controlling potential contamination risks.[14]

6. Store raw meat and dairy products separately from ready-to-eat foods such as fruits and vegetables.

7. During food preparation, workers wear clean aprons, hair coverings and, where practical, disposable gloves, to reduce contamination risks. Workers should change gloves when handling different foods.

The South Sudan government has published guidelines for controlling food safety.[6] Public health awareness campaigns and food safety training programmes for food handlers should be promoted. Additionally, collaboration among the government, non-governmental organizations (NGOs), and other stakeholders is necessary to improve sanitation facilities and strengthen food safety systems in Munuki Payam, in line with the recommendations from the World Health Organization (2022) and the Food and Agriculture Organization.[4,14]

Limitations

The study had several limitations. The small sample size (N = 50) may limit the generalizability of the findings. The cross-sectional design did not establish causal relationships, and the study covered only selected areas of Munuki Payam. Limited time and resources may also have affected data collection and observation.

Conclusion

Many food handlers in Munuki Payam had limited knowledge of proper food handling and sanitation procedures. However, some demonstrated satisfactory knowledge of personal hygiene and proper food storage practices during food preparation.

There is a need to strengthen food safety training programmes, improve awareness among food handlers, and enforce food safety regulations to minimize the risk of cross-contamination and protect public health in Munuki Payam.

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