



# Microbial Assessment and Food Hygienic Practices among Street Food Vendors in Dodoma city, Tanzania

Dr. Carolyne C. Ruhembe & Dr. Zawadi Richard Juma

St. John's University, Tanzania

Email: [zrichard@sjut.ac.tz](mailto:zrichard@sjut.ac.tz)

**Abstract:** Safe food handling in the market is an important practice to protect the people from foodborne illnesses. Bacteria count as a key factor in assessing the quality and safety of food. Therefore, this study aimed at assessing microbial and food hygienic practices among street food vendors in Dodoma city. The study employed cross-sectional observational descriptive design. The study used observation, laboratory experimentation and questionnaire for data collection. Five wards were selected randomly as research sites. A total of 50 food samples which included vegetables like tomatoes, onions, spinach, Chinese, and cabbage obtained from five different wards were tested. The findings revealed that 30% of samples were contaminated with E-coli bacteria while 70% were not contaminated with Escherichia coli. Findings show that only 29.6% of respondents/vendors had food processing and handling college level knowledge while 70. 4% didn't have any formal education related to food handling except for home and self-online learning. Overall, the findings indicated that food safety and food quality among street food vendors is still low and poorly practiced. The study recommends that basic food vending training and certificate should be provided to street food vendors to qualify them for vending businesses, regular inspection and monitoring should also be done to ensure the quality and safety food measures are followed and set into safe food code practices.

**Keywords:** Microbial assessment, food safety, Food Hygienic, Street Food Vendors, Escherichia coli.

## How to cite this work (APA):

Ruhembe, C. C. & Juma, Z. R. (2022). Microbial assessment and food hygienic practices among street food vendors in Dodoma City, Tanzania. *Journal of Research Innovation and Practices in Education*, 6(1), 433 – 440.

## 1. Introduction

Food vending refers to a business that provides prepared food for public consumption on or off its premises (FAO, 2007). These include, but not limited to, a store, shop, sales outlet, restaurant, grocery store, supermarket, catering truck or vehicle, any other person who prepares food. The street food vendors are an unofficial sector which still exists in both industrialized and unindustrialized countries (Njaya, 2014). Street food vendors are usually associated with encroachment of public spaces, causing traffic congestion, inadequate hygiene, and poor waste disposal (Rahman, Arif,

Kamaluddin & Tambi, 2012). Street food vending is viewed from different perspective while some view street food vending as a source of income, others view as a means of livelihood and others view as a source of congestion in urban centers and source of transmission or spread of food borne diseases (Tesema, Gelaye, & Cherkos, 2014).

However despite the many advantages obtained through street food vending, the evolving of unofficial food business associated with improper preparation and handling of food leads to food borne diseases and related health problems because sometimes street foods are stored at improper temperatures and sold to customers (Forkuor,

2011). Most of these vending areas sell uncovered or unprotected food and in unhygienic environment, which is unsafe either by pathogenic microorganisms, infection or spoilage (Monney, Agyei, Badzi, Campaore & Nyaw, 2014). The food sold by food street vendors are held at unacceptable temperatures, extremely handled by food vendors and sold at unhygienic environment (WHO 2018). Most of the people working in urban wards take their meal away from home thus exposing them to high risk of getting food borne diseases and illness such as diarrhea, salmonella, typhoid, noro virus and hepatitis A (Muinde & Kuria, 2015).

Food borne diseases are among the significant public health problems and the costs of which includes medical care costs, inferior quality of life comprising of lowered labor productivity and decreased life expectancy (Collin, 2014). Some of the studies indicate that it is uncommon for food borne outbreaks to occur in well-established hotels and restaurants. Most frequently, their occurrence are the outcome of the eating of cheap street vended foods, prepared with reduced care to sufficient food hygiene measures (Donko & Kayang, 2016). Therefore this study was designed to assess microbial and food hygienic practices among street food vendors in Dodoma city.

## 1.1 Statement of the problem

Worldwide, street food vendors is a popular business to both developed and developing countries. Studies indicate that street food vending can be used as a source of income to sellers as well as means of livelihood to people in the society (Njaya, 2014; Arif *et al.*, 2012). Nevertheless sellers need to take careful observation in doing this business so as to ensure safety and health of their customers while doing the business. Nowadays, statistics indicate that foodborne illnesses in various countries is up to 60% of cases may be caused by poor food handling techniques, and by contaminated food served in food service establishments (Ali & Immanuel, 2017). This condition might cause ill-health as well as death of productive people in the society. Hence it might affect the economic activities and development of countries.

In Tanzania, street food vending is common business conducted all over the country. There is a need to make sure that foodborne disease outbreaks are associate with inadequate individual hygiene of street food vendors and food handlers in food settings. This implies street-vended foods might cause major civic health problems due to absence of basic facilities and services, such as safe water provisions, their short duration nature, and insufficient knowledge of basic food safety protections. In this regard, few studies have been conducted in Dodoma region to assess microbial presence and food hygienic practice among street food vendors. Therefore, this study intends to do so in some of Dodoma wards in order to find out to what extent microbes are in some of the food and what hygienic practice are conducted among street food vendors.

## 2. Literature Review

Street food vendors is a business conducted all over the world to sustain people's livelihood. They usually sell food preparations, dishes and products on organized outdoor or indoor market places, or on the streets (FAO, 2007). The business not only provides convenience for many people, but is also the livelihood for millions of low income people, making a great contribution to the economy of many developing countries (Tessema *et al.*, 2014). Moreover, street food safety is essential to ensure that people buy and eat food which is clean and healthy.

However, people are seriously concerned about effects of consuming unhygienic and unsafe food. Consumption of unhygienic and unsafe food may cause foodborne diseases (Ali & Immanuel, 2017). Foodborne diseases result from eating foods that contain infectious or toxic substances (Ali & Immanuel, 2017). Bacteria, such as *Escherichia coli* (*E.coli*) may contaminate food and cause some infections (Ali & Immanuel, 2017). *E.coli* is one of the most frequent causes of many common bacterial infections, including cholecystitis, bacteremia, cholangitis, urinary tract infection (UTI), and traveler's diarrhea, and other clinical infections such as neonatal meningitis and pneumonia. Therefore, people need to be careful when handling food substances in order to avoid eating food contaminated with *E.coli*.

The food people eat should be free from contaminants such as microorganisms. There is need to emphasize on good hygienic practices to prevent and control foodborne diseases. Foodborne diseases result from eating foods that contain infectious or toxic substances (WHO, 2007). This implies street food vendors need to learn about food control, food inspection and supportive enforcement measures that could contribute to food hygiene and safety (WHO, 2007). Street food vendor training should be prioritized to improve the safety of street food. Other policies and measures should also be propagated to improve the food safety knowledge, attitudes, and behavior of vendors (WHO, 2007). Steps should be taken to improve street food stall operating conditions and facilities, including providing clean protected structures, access to potable water, and efficient waste collection and disposal systems.

### 2.1 Conceptual Framework

The study used two conceptual frameworks to conduct research. To identify behaviors likely to cause risk of pathogen transfer, the study used a modified version of the Hazard Analysis and Critical Control Points (HACCP) approach. This is a systematic approach to the identification, assessment, and control of food-related hazards. To understand food hygiene-related behavior in context, the study used Behavior Centered Design, a systematic approach to designing behavior change

interventions. The approach has five steps: A-Assess, B-Build, C-Create, D-Deliver and E-Evaluate. Formative research was the B-Build step in the process; the approach pinpoints key behaviors; seeks to identify causes for the behaviors that are psychological (habitual, motivated, or planned), bodily, and environmental (social, biological, and physical); and pays attention to behavioral settings, which are akin to theaters of performance of regularly occurring routine behaviors with roles, scripts, props, norms, and purposes.

### 3. Methodology

This section elaborates how data collected using various research methods.

#### 3.1 Study area and design

A cross-sectional observational descriptive study was conducted around Dodoma city, Tanzania from June 2021 to July 2021 in order to assess microbes' presence and hygiene practices of vendors of street-vended foods towards the food safety. The Dodoma city is within these coordinates 6 ° 10'19 "S35 ° 44'29" E. Dodoma city is characterized by a semi-arid climate. The study was carried out within five wards which were purposively selected to represent urban characteristics. These included, Kikuyu, Makole, Uhuru, Majengo and Hazina wards. These are areas where the street food vendors business are conducted. The estimated current population of Dodoma is 324,347.

A multistage random sampling technique was used to obtain representative wards in Dodoma city as described by (Louis, Manion & Morrison, 2007). Five wards were randomly selected. From each ward, two streets were randomly selected and from each street 10 food vendors were randomly selected by using random table numbers. Moreover from each selected food vendors 5 loyal consumers were purposively selected to provide their opinions about street food through questionnaire. A total of 50 street vendors and 50 consumers of street foods were randomly selected to participate in the study.

#### 3.2 Data collection procedures

In this study data were collected using questionnaire, observation and laboratory analysis of collected food samples (Gaikwad, Saxena, Kamble & Upadhyay, 2017). Field survey began for a period of about one month to fifty street food vendors from five selected wards. The street food vendors chosen were informed about the purpose of the study and their written consent of their voluntary participation was obtained.

Each vendor and their vending site were observed to assess their food safety practices, their personal hygiene,

and environmental condition around their stalls. For easy collection of data a checklist was designed containing the questions to be filled in during observation (Collin, 2014). Observed information were entered immediately in the prepared checklist, where by some questions were prepared to be delivered to the participants or food vendors.

A pre designed and pre tested questionnaire were used. The questionnaire were prepared according to participant's education level and whether a person has attained any course on food handling, the challenges facing street food vendors, kind of water used for washing and cooking, whether they sterilize their utensils or not, cleanliness of their surroundings and so on. In addition, the participants were requested to provide the sample of vegetables and salads to the researchers to do bacteriology testing whereas the vegetables and salads were taken for further microbial testing in the biology laboratory at St John's University of Tanzania.

#### 3.3 Microorganisms Analysis

Food samples analyzed included vegetables like tomatoes, onions, spinach, Chinese, and cabbage. The food samples were mixed with pre autoclaved distilled water to induce suspension. Sodium laury sulfate broth was used as a media for growth of thermo-tolerant coli forms. About 5mls of prepared sulfate broth were added on the test tubes containing Durham tubes and sterilized by autoclaving at 121 °c for 15 minutes. The sterilized broth was left to cool and inoculated by 1ml of sample and incubated at 35 °c for 24 hrs. Some samples showed positive results after incubation in 24hrs but some which showed negative results were prolonged incubated for another 24 hrs to obtained results. For every tube showing fermentation and gas production a loop full sample were taken and inoculated to other tubes containing laury sulfate broth and durham tube and incubated at 44°c for 24hrs and 48 hrs. The tubes showing gas production and fermentation confirmed the presence of Escherichia coli by indole test using tryptophan broth and kovac reagent.

#### 3.4 Data analysis

Data were analyzed using Statistical Package for Social Science (SPSS) version 16. Descriptive statistics of demographic information, food safety practices, personal hygiene, and environmental condition around the vending stalls were computed and expressed as frequency distribution and percentages.

### 4. Results and Discussion

The findings of this study were analyzing and interpreted and presented in this section with different sub-sections depending of the themes obtained during analysis.

## 4.1 Demographic characteristics

Table 1 indicates demographic characteristics of the respondents.

**Table 1: Demographic characteristics of food vendors**

Demographic characteristics	Response	Frequencies (n)	Percentages (%)
Gender	Male	11	40.7
	Female	16	59.3
Age	12-18	1	3.7
	19-35	24	88.9
	35-60	2	7.4
Food Handling and Processing Knowledge	Home	14	51.9
	College	8	29.6
	Home and online learning	5	18.5

The demographic information (Table 1) indicates the dominance of female food street vendors which is 59.3%, while male food street vendors were about 40.7%. Mostly of the street food vendors were aged between 19-35 years which takes about 88.9% followed by age group between 36-60 which takes about 7.4%, and finally the age group between 12-18 which takes about 3.7% of street food vendors.

In the area of food handling and processing knowledge results shows the dominant response were those who received informal knowledge of cooking at home which covers 51.9%, followed by those who have knowledge of food handling and processing knowledge obtained from the colleges which covered 29.6% likewise for the vendors who got training both at home and online learning covered about 18.5%. From the results, more women engaged

themselves in street food vending because of low education level for them to get employed in other sectors which requires high knowledge and skills (Thanh, 2016). Moreover, due to lack of employment currently boys are engaging themselves in this business while waiting for formal employment, especially those who currently graduated. Mostly of the people who are engaged in this business are doing it out of hobby and not skills that they have learnt in formal schooling.

## 4.2 Hygienic practices of Food vendors

Table 2 below elaborates findings of hygienic practices of food vendors during observations

**Table 2: Hygienic Practices of Food Vendors**

Environmental hygienic practice	Response	Frequency (n=30)	Percentage (%)
Food rooms and equipment's in a good condition and well maintained.	Yes	24	80
	No	6	20
Staff toilets and changing facilities clean and tidy.	Yes	17	56.7
	No	13	43.3
Washing hands, basins clean with hot water, soap and hygiene.	Yes	19	63.3
	No	11	36.7
Waste in food room stored correctly.	Yes	23	76.7
	No	7	23.3
Protected hair.	Yes	12	39.6
	No	18	60.4
Presence of apron	Yes	17	56.1
	No	13	43.9
Regular proper hand washing	Yes	17	56.1
	No	13	43.9

The results on environmental hygiene of food vending sites (Table 2) show that 80% of respondents had food rooms and equipment's in a good condition and well maintained while 20% were not. About 56.7% had staff toilets and changing facilities clean while 43.3% did not have staff toilet and changing facilities. Also, results showed that 63.3% had system of washing hands, basins clean with hot water and soap while about 36.7% had no washing hands facilities. Unclean hands of food handlers are often the culprit in transmission of microorganisms to the food (Dudeja, 2018). About 76.7% of the respondents store waste in the food room correctly compared to 36.7% who do not store food wastes properly in the room, which can lead to attraction of flies in the sites which carry

disease pathogens. About 60.4% of respondents do not cover their hairs during preparation and handling of foods. Hair not properly covered may contaminate the food since it carries a lot of microorganisms. Moreover, personal hygiene and cleanliness of food handlers is essential for food preparations to avoid foodborne illnesses.

### 4.3 Vendors' Food Handling Practices

During observation, researchers were able to collect the following data using checklist. Table 3 indicates the findings obtained through observation using checklist.

**Table 3: Food Handling Practices by Vendors**

Food handling practice	Response option	Frequency (n)	Percentage (%)
If food in fridge or freezers are covered	Yes	11	36.7
	No	19	63.3
If foods are generally covered	Yes	14	46.7
	No	16	53.3
If ready to eat food are prepared in separate clean area	Yes	21	70.0
	No	9	30.0
If high risk food prepared in small batches and placed in the fridge immediately after handling or preparation	Yes	16	53.3
	No	14	46.7
If food are cooled as quickly as possible away from raw food and other sources of contamination	Yes	9	30
	No	21	70
Presence of food debris on their hands	Yes	10	30.3
	No	20	69.7

The food handling practices among food vendors show that foods stored in fridge or freezers were not covered (63.6%). The results imply that a significant fraction of vendors did not consider food covering as a necessity and an important aspect for ensuring safety; only (36.7%) of the vendors kept food in covered containers. It is also further indicated that less than a half (46.7%) of the vendors provided adequate protection of food from flies and dust. Lack of covering and improper protections of foods increases the risk of contamination. About 46.7% of food vendors do not prepare high risk foods in small batches and placed in the fridge immediately after preparations. Also about 70% of respondents do not practice cooling food as quickly as possible away from raw foods and other sources of contaminations all these show gaps for contaminations. Dust carries many microbes that may be pathogenic if left to settle onto prepared foods. Similar observations were reported by earlier researchers. This may increase the possibility for pathogen transmission and the prevalence of food borne diseases. Food and Agriculture Organization recommend that foods should be prepared in a place set aside entirely and be kept clean at all times and be far from any source of contamination (rubbish, waste water, dust and animals) (WHO, 2017). Vending stalls are desired to be designed and constructed in such a way to enable easy cleaning and maintenance.

#### **4.4 Significance of food from the restaurants to the consumer**

Results from questionnaire analysis indicated that 51.9% of respondents eat food from restaurant because they want to save time, because they have no time to prepare food. About 28.85% of the respondents eat from the restaurants because food is cheap and affordable. About 17.31% of the respondents eat foods prepared by street vendors because they don't like to cook while 1.92% they don't know how to cook. Moreover results from questionnaire analysis indicated that most of the respondents were found to associate diseases like diarrhea and typhoid to the foods that are eaten on the streets. Almost 48.6% respondents were experiencing diarrhea while 32.69% were suffering from typhoid during the time of survey. Studies conducted elsewhere showed that street foods are popular because they are relatively cheap and very tasty and of good quality and allowed consumers to try new foods (Tefal, 2017)

#### **4.5 Presence of *Escherichia Coli* in laboratory tested foods**

The food samples collected from different street food vendors at Kikuyu, Majengo, Hazina, Umoja and Makole were submitted to the biology laboratory at St John's University of Tanzania for experiments and the results obtained from the laboratory experiment after five tests in different temperatures are shown in Table 4.

**Table 4: Biological Analysis of food samples from studied wards**

Street name	Contamination status	Frequency (n)	Percentage (%)
KIKUYU	Positive	3	30
	Negative	7	70
MAJENGO	Positive	4	40
	Negative	6	60
UHURU	Positive	2	20
	Negative	8	80
MAKOLE	Positive	3	30
	Negative	7	70
HAZINA	Positive	3	30
	Negative	7	70

A total of 50 food samples from five different wards were tested. About 15 samples (30%) were contaminated with *E.coli* bacteria and 35 (70%) samples were fresh food with no *E.coli* bacteria. The presence of *E.coli* in tested food samples show the indicative of the potential presence of other more pathogenic organisms which are dangerous to human health. These foods were probably contaminated with other thermo tolerant coli forms like *salmonella typhinurium* and others. Moreover the presence of this organisms showed that there must be fecal or sewage contamination of food (Price & Wildeboer, 2017).

The results indicate that poor hygiene and sanitary practices were recorded among majority vendors in Dodoma region, which included presence of food debris on their hands, unprotected hair, lack of apron, lack of hot water for washing utensils and irregular or non-hand washing with soap after toilet visit. Occasional adherence and none adherence at all to proper hand washing reflects the dangers consumers are exposed to such as contracting food borne illnesses since hands are prone to contamination (Onyeneho, 2013). None use of soap during hand washing implies inadequate removal of food soils which could in turn facilitate microbial growth (WHO, 2018). Most food vendors did not wash their hands at all and others only used water to wash their hands. The presence food debris on the hands of some vendors may further signify poor and unsafe food handling practice. This could explain the hygienic and unhygienic food practices among street food vendors in Dodoma region also money handling between food handling services without washing hands could also lead to cross contamination of diseases (Adane, Teka, Gismu, Halefom. & Ademe, 2018). Apart from the hygienic practices observed in some food vendors, there were a lot of food

vendors who followed good hygienic procedures washing utensils with soap and hot water, wearing aprons, wearing head wraps, short finger nails and used of tape water supply.

## 5. Conclusion and Recommendations

### 5.1 Conclusion

Based on the findings of the study, it can be concluded that food safety and food quality among street food vendors is still low and poorly practiced in some place in Dodoma region. The results of this study underlined key food safety and quality issues can possibly cause foodborne diseases emanating from these street food vending sites. Many of the food vending sites are poorly maintained and vendors' exercises moderate adherence to both food safety and quality practices. The greatest risk is food exposure to temperature danger zone for example exposure of the salads and vegetables in the food vending sites.

### 5.2 Recommendations

From this study, it is recommended that basic food vending training and certificate should be provided to street food vendors to qualify them for vending businesses, regular inspection and monitoring should also be done to ensure the quality and safety food measures are followed and set into safe food code practices. Further, more studies need to be conducted in other areas in Dodoma region to find out the status of the region as whole in issue of food safety especially on food vending.

## References

Adane, M., Teka, B., Gismu, Y., Halefom. G. & Ademe, M. (2018). *Food hygiene and safety measures among food handlers in street food shops and food establishments of Dessie town,*

*Ethiopia: a community- based cross-sectional study.* doi: 10.1371/journal.pone.0196919

Ali A.I. & Immanuel, G. (2017). Assessment of hygienic practices and microbiological quality of food in an institutional food service

- establishment. *Journal of Food Process Technology*, 8(8), 685. doi: 10.4172/2157-7110.1000685
- Collins, D. (2014). "Factors associated with poor food safety compliance among street food vendors". Ghana, African food publishers.
- Donkor, B. & Kayang, J. (2016). "Application of the WHO keys of safer food to improve food handling practices of food vendors in a poor resource community in Ghana" Environmental research.
- Food and Agriculture Organization (2007). *Improving the nutritional quality of street foods to better meet the micronutrient needs of schoolchildren in urban areas*. Rome, Italy: FAO.
- Forkuor, B. J. (2011). Factors influencing consumption of street vended local foods (SVLFs) in Urban Ghana. *African Journal of food Science*, 14(11), 395-406.
- Forkuor, B. J. (2017). "Effective and inclusive regulation of street foods, promoting food safety" Ghana: Kwame Nkrumah University of science and Technology.
- Gaikwad, S. T., Saxena, V., Kamble, D. B. & Upadhyay, A. (2017). Assessment of microbial load of fasting foods available in street side, mid-level restaurants and high-level restaurants during Navratri. *International Journal Curriculum Microbiology*, 6(2), 1484-1495.
- Louis, C., Manion, L. & Morrison, K. (2007). *Research Methods in Education*. Taylor and Francis group, London and New York.
- Monney, I., Agyei, D., Badzi, S. E., Campaore, P., & Nyaw, S. (2014). Food hygiene and safety practices among street food vendors: An assessment of compliance, institutional and legislative framework in Ghana. *Food and Public Health*, 4, 306-315.
- Muinde, OK, & Kuria E. (2015). Hygienic and sanitary practices of vendors of street foods in Nairobi, Kenya. *Africa Journal of Food, Agriculture, Nutrition & Development*, 5, 1- 15.
- Njaya, T. (2014). Operations of street food vendors and their impact on sustainable urban life in high density suburbs of Harare, in Zimbabwe. *Asian Journal of economic modelling*, 2(1), 18-31.
- Onyeneho, C. W. (2013). An assessment of food safety needs of restaurants in Owerri, Imo State, Nigeria. *International Journal Environmental Research Public Health*, 10(8), 3296–3309.
- Price, R. C & Wildeboer, D. ( 2017). *E. coli as an Indicator of Contamination and Health Risk in Environmental Waters*. Intech, Open Science open minds. In book: Recent Advances on Physiology, Pathogenesis and Biotechnological Applications.
- Rahman, A. T. M., Arif, M. T., Kamaluddin, B. & Tambi, Z. (2012). Food safety knowledge, attitude and hygiene practices among the street food vendors in Northern Kuching city, Sarawak. *Borneo Science*, 31, 95-103.
- Tefal (2017). *Why do we love street food so much*. Retrieved 28<sup>th</sup> Jan 2022. [Http://blog.tefal.co.uk](http://blog.tefal.co.uk). site
- Tesema, A. G., Gelaye, K. A. & Cherkos, D. H. (2014). Factors affecting food handling practices among food handlers of Dangila town food and drink establishments, North West Ethiopia. *BMC Public Health*, 14 (571), 1-5.
- Thanh, T. N. C. (2016) "Food safety practices and attitudes and practices of street food vendors and consumers; Network; World Health Science
- World Health Organization. (2007). "Food safety and foodborne illness". World Health Organization, Geneva, Switzerland.
- World Health Organization. (2018). "Essential safety requirements for street vended foods" Geneva: World Health Organization.