



# Assessment of Food Hygiene Knowledge, Attitude and Practices of Night Street Food Vendors in Morogoro, Tanzania

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

## Article Information

DOI: <https://doi.org/10.9734/ejnf/2025/v17i61760>

## Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://pr.sdiarticle5.com/review-history/138530>

**Original Research Article**

**Received: 25/04/2025**  
**Accepted: 27/06/2025**  
**Published: 03/07/2025**

## ABSTRACT

The consumption of street food is associated with the provision of unhealthy, unsafe, and nutritionally unbalanced meals, presenting a public health concern. This study was designed to assess food safety knowledge, attitude and practices of night street food vendors in Morogoro Municipality. A cross-sectional study involving 256-night street food vendors was performed, using a structured questionnaire. The results reported that most of the vendors were females (77%) and half of the vendors were aged between 20 to 30 years. Majority of vendors, 62.9% had been vending food for 4-5 years. Generally, the study revealed medium attitudes (95.3%) and moderate

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**Cite as:** Omari, Aziza Nassoro, Abdulsudi Issa-Zacharia, and Davis Naboth Chaula. 2025. "Assessment of Food Hygiene Knowledge, Attitude and Practices of Night Street Food Vendors in Morogoro, Tanzania". *European Journal of Nutrition & Food Safety* 17 (6):319-37. <https://doi.org/10.9734/ejnf/2025/v17i61760>.

knowledge levels (73%), but significant low in self-reported practices (92.6%). Age ( $p < 0.001$ ) and previous experience in vending activities ( $p = 0.016$ ) were significantly associated with practice scores. A significant association was found between gender and attitude scores ( $p = 0.002$ ). The correlation matrix revealed that age was positively correlated with attitude score ( $r = 0.426$ ,  $p < 0.01$ ) and practice score ( $r = 0.212$ ,  $p < 0.01$ ), while previous experience was negatively correlated with attitude score ( $r = -0.467$ ,  $p < 0.01$ ). The study highlights the need for targeted training and regulatory reinforcement to improve food safety and protect public health. The findings underscore the importance of interventions tailored to the unique challenges of night street food vending in growing urban settings.

**Keywords:** Food safety; night street food vender; food hygiene knowledge; attitude and practices.

## 1. INTRODUCTION

Globally, an estimated 2.5 billion people consume street food every day (Hossen et al. 2021). Street food sellers are essential for supplying daily meals to urban residents, particularly in Low Middle Income Countries, where almost 70% of the population relies on them (Basheikh, et al., 2023). Street foods are prepared ready-to-eat food or beverages that are sold by vendors on the streets and in other public places such as marketplaces, bus stands, or exhibitions (Hossen et al. 2021). These foods and beverages are ready for consumption without the need for additional processing or preparation (Nonato et al., 2016).

Street food vending is a cultural, sociological, and economic phenomenon that may be found in almost any metropolitan area (Hossen et al. 2021). In urban societies, time spent cooking meals at home has decreased significantly (Addo-Tham et al. 2020). Street food is tempting owing to its simplicity, low cost, and savory taste, making it a daily popular eating choice (Islam et al. 2024). Street food vending is a source of income for many merchants and their families as highlighted by Basheikh et al. (2023) and the situation prevailed in developing countries especially urban areas (Abrahale et al. 2019; Ma et al. 2019). Night-market Street food vending is a popular and vibrant aspect of the food culture in many cities worldwide (Chatibura, 2021; Greenspan, 2018). It offers a wide variety of affordable and convenient food options, attracting both locals and tourists. The FAO states that street-vended meals and beverages can significantly enhance nutrition, contingent upon customers making informed choices. (Boakye et al. 2023).

The consumption of street food is associated with the provision of unhealthy, unsafe, and nutritionally unbalanced meals, presenting a public health concern (Anastasiou et al. 2023;

Basheikh et al. 2023; Tuglo et al., 2021). Every day, millions of individuals worldwide become ill due to the consumption of microbiologically and chemically contaminated food and water (Hassan & Fweja, 2020; Gupta et al., 2018; Nizame et al. 2019). Additionally, Approximately 2.2 million children die annually from diarrhea-related illnesses, many associated with contaminated food (WHO, 2015; Nonga et al. 2015; Tuholske et al. 2020), and food safety laws are often not strictly implemented (Olaimat et al., 2024). Lack of proper infrastructure (Nizame et al. 2019), limited resources, and inadequate knowledge and training among street food vendors contribute to food contamination and the transmission of foodborne diseases (Khuluse & Deen, 2020; Nkosi & Tabit, 2021). A multitude of individuals express concern regarding the safety of street food, as it is often prepared and sold in unsanitary conditions lacking appropriate regulation (Hossen et al. 2021; Tuholske et al. 2020). In Tanzania, rapid urbanization has driven the expansion of street food vending business, including dynamic night vendors to provide access to affordable meals (Basheikh et al. 2023). Ministry of Health has reported multiple disease outbreaks associated with the consumption of unsafe food, with a total of 30,000 cases recorded (Ministry of Health, United Republic of Tanzania. 2019; Mambosasa, 2022).

Research focusing on night street food vendors in urban areas remains limited, particularly in rapidly expanding municipalities with vibrant night market cultures like Morogoro. To address this gap, this study aims to assess food hygiene knowledge, attitudes, and practices among night food vendors in Morogoro. Moreover, while previous studies have often concentrated on evaluating either food hygiene knowledge or practices among street food vendors, Basheikh et al. (2023); Hossen et al. (2021), a comprehensive understanding of food safety behaviors necessitates the evaluation of all three

fundamental components: knowledge, attitudes, and practices. This study intends to evaluate the interdependence among these three factors among night street food vendors." vendors in Morogoro, Tanzania. Understanding the specific environment of street food vendors in Morogoro Municipal is essential due to the significant role night food vending play in the local food economy and the possible hazards linked to insufficient food hygiene. This study will offer a more nuanced understanding of the factors impacting food hygiene practices among night food vendors in Morogoro by analyzing food hygiene knowledge, attitudes, and practices (KAP). This thorough assessment will provide significant insights that can guide targeted initiatives and enhance food safety and public health within this evolving food landscape.

## 2. MATERIALS AND METHODS

### 2.1 Study Area Settings

The study was carried out in Morogoro Municipal located on the lower slopes of the Uluguru mountains. Morogoro Municipal is a rapidly growing urban center with a population of about 471,409 as reported in the census 2022 (NBS,2022) with an increase of 49.1% from 2012 where the population was 315,866 individuals (NBS, 2012) This population increment could have been caused by natural population growth, urbanization, economic opportunities and availability of education centers. This demographic shift has led to a surge in demand for affordable, readily available food, particularly during evening hours. Consequently, the number of night market food vendors has proliferated, creating a vibrant but potentially vulnerable food environment. These vendors, often specializing in popular fried foods like chips, meat, fish, and chicken, contribute significantly to the local economy and meet the dietary needs of a large consumer base. The study was conducted at eight common night-time street food vending sites within Morogoro Municipality which includes; Dodoma Stand, Kingalu Market, outside the Regional Hospital, near the Sokoine University of Agriculture (SUA), along Boma and Iringa Roads, near Kaumba Guesthouse, and around the Juwata area.

Considering the heightened dependence on al fresco dining, particularly among university students, business professionals, and other demographic groups, it is imperative to comprehend and enhance food safety protocols

in Morogoro night markets to protect public health.

### 2.2 Study Design and Sampling Procedure

A cross-sectional study utilizing quantitative methods was performed on a population-based sample from February to April 2024. The study included street food vendors as characterized by the FAO and WHO as "ready-to-eat foods and beverages prepared and/or sold by vendors or hawkers, particularly in streets and similar venues" (FAO, 1988; WHO, 1996). The study excluded mobile street food vendors. This study examined stationary vendors who consistently provide food to the community during nighttime hours. Consumers can presumably obtain meals from these vendors consistently and at any hour during the night.

A purposive sampling method was utilized to enlist the study participants. A total of 256 participants was determined using Equation 1 (Kothari, 2004).

$$n = \frac{Z^2 \cdot P \cdot (1-P)}{E^2} \quad (1)$$

where n is the desired sample size.

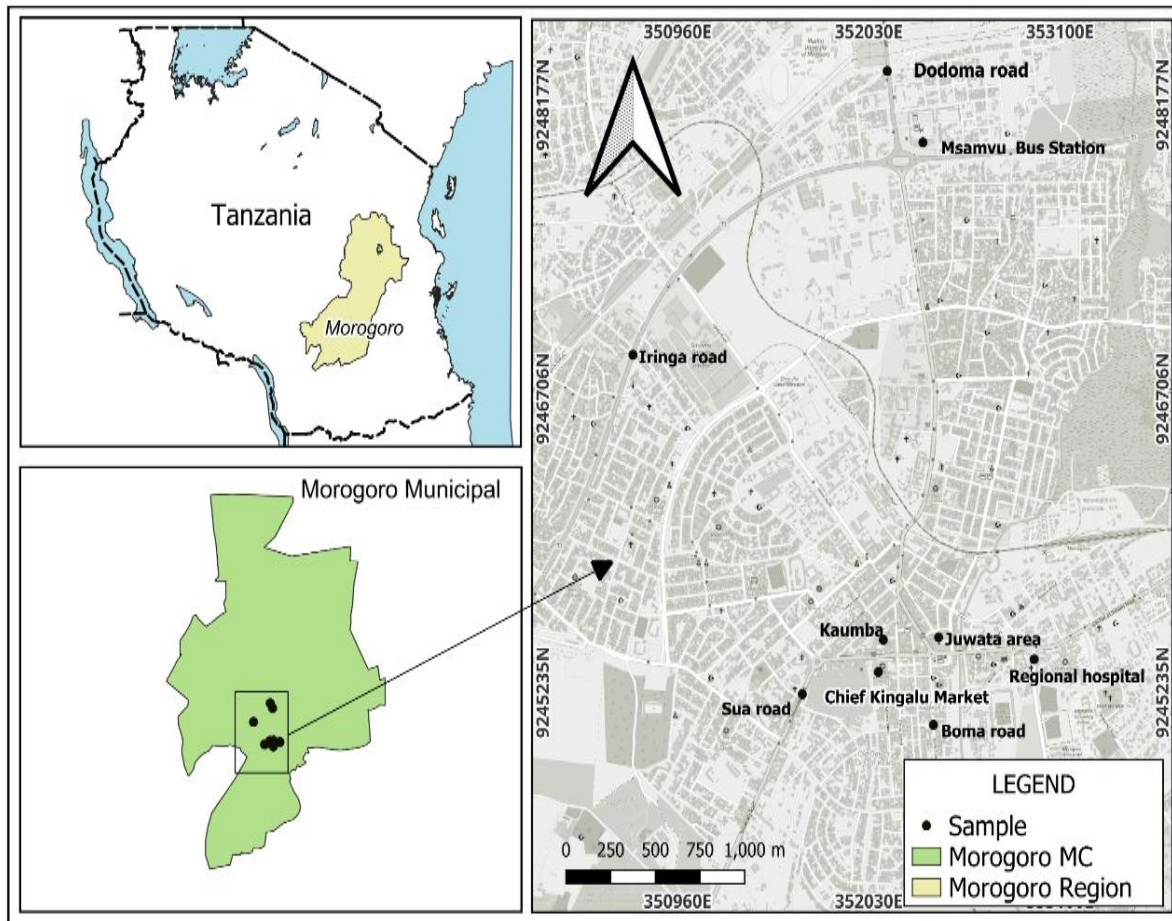
The presumptions that served as the foundation for the estimation were as follows: z is the standard normal deviation set as 1.96 corresponding to a 95% confidence interval, p is the proportion of expected KAP of street food vendors set as 50%, and E is the margin of error set at 5%.

### 2.3 Study Tools and Data Collection

A structured questionnaire was the primary tool used to collect data on food vendors' demographic characteristics, knowledge, attitudes, and self-reported practices related to food hygiene. The questionnaire was developed based on a validated instrument (COBO) from Sokoine University of Agriculture (SUA) and incorporated questions from current research on similar topics to ensure relevance to the study context.

The questionnaire was divided into four sections:

**Demographic Characteristics:** This section gathered information on vendors' age, gender, education level, years of experience, and other relevant demographic factors.



**Fig. 1. Map for the study area**

**Knowledge:** This section assessed vendors' understanding of key food hygiene principles, including safe food handling practices, cross-contamination prevention, and proper handwashing techniques. Knowledge was assessed through 20 multiple-choice questions, with correct answers awarded 1 point and incorrect or unclear responses scoring 0 points then the scores were categorized as low, moderate and good

**Attitudes:** This section measured vendors' beliefs and feelings towards food safety, using Likert scale questions (e.g., 5 strongly agree to 1 strongly disagree) with 8 positive statements

**Self-Reported Practices:** This section explored vendors' self-reported food handling practices, stall maintenance procedures, and waste management practices evaluated by using of 24 YES/NO questions with correct answer awarded 1 point and incorrect answers scoring 0 points.

The questionnaire was translated into Kiswahili to ensure clarity and facilitate effective

communication with the vendors. Prior to the main data collection, a pilot study was conducted with a small group of vendors (n=10) to test the clarity, comprehensibility, and cultural appropriateness of the questionnaire. The questionnaire was administered through face-to-face interviews to maximize response rates and ensure that vendors understood the questions accurately.

KAP scores were established using descriptive analyses based on various socio-demographic characteristics of the subjects. The knowledge, attitude, practices scores were converted to 100 points, A score <50 was judged to represent a low, scores 50 to 75 as a medium (sufficient) and scores >75 as good scores.

## 2.4 Statistical Analysis

The gathered data were input and structured utilizing data collection software (COBO) and subsequently exported to SPSS version 27 for comprehensive statistical analysis. Descriptive

statistics, including means, standard deviations, and percentages, were employed to encapsulate demographic characteristics and the distribution of Knowledge, Attitudes, and Practices (KAP) scores among nocturnal street food vendors. Chi-square tests were utilized to ascertain significant correlations between socio-demographic characteristics (including age, education level, and experience) and KAP components, facilitating the identification of demographic factors associated with elevated or diminished food safety knowledge and behaviors. Correlation analysis was performed to evaluate the strength and direction of relationships between continuous variables, such as the association between age or years of vending experience and KAP scores. A logistic regression analysis was conducted to ascertain significant predictors and the probability (odds) of attaining elevated KAP levels based on individual attributes. KAP levels were classified into multiple groups (e.g., low, moderate, good), and multinomial logistic regression was employed to facilitate a nuanced comprehension of how diverse socio-demographic factors affected the likelihood of membership in each category.

### 3. RESULTS AND DISCUSSION

#### 3.1 Demographic Characteristics

Table 1 presents the demographic characteristics of the food vendors surveyed in Morogoro Municipality (n=256). The majority of the vendors were female (77.0%), while males constituted 23.0%. Most vendors were married (78.9%), with smaller proportions being single (16.4%) or divorced (4.7%). The age distribution showed that half of the vendors (50.0%) were between 20 and 30 years old, and 46.1% were between 31 and 40 years old, with only a small percentage being younger than 20 years (1.2%) or older than 40 years (2.7%). Regarding education, the most significant proportion of vendors had attained a secondary school level (71.5%), followed by primary school (22.3%), and a smaller proportion had a tertiary level of education (6.3%). A significant proportion of the vendors (65.6%) had no previous experience working in the food vendings. In terms of vending experience, most vendors had been vending food for 4–5 years (62.9%), 27.0% had been vending for less than 12 months, and 10.2% had been vending for over 5 years.

**Table 1. Demographic characteristics of night street food vendors in Morogoro Municipality**

Variable	Frequency	Percent
Gender		
Male	59	23.0
Female	197	77.0
Marital status		
Single	42	16.4
Married	202	78.9
Divorce	12	4.7
Age group		
< 20 years	3	1.2
20 – 30 years	128	50.0
31 – 40 years	118	46.1
> 40 years	7	2.7
Education level		
Primary school	57	22.3
Secondary School	183	71.5
Tertiary level	16	6.3
Do you have any previous experience working in the food industry		
No	168	65.6
Yes	88	34.4
For how long have you been vending food		
less than 12 months	69	27.0
4-5 years	161	62.9
over 5 years	26	10.2

**Table 2. Knowledge, attitudes, and practices scores among night street food vendors in Morogoro Municipality**

	Low	Medium	Good
Knowledge score	67(26.2%)	187(73.0%)	2(0.8%)
Attitude score	12(4.7%)	244(95.3%)	0(0.0%)
Practice score	237(92.6%)	19(7.4%)	0(0.0%)

The significant proportion of married sellers indicates that food selling serves as a means of family sustenance for numerous individuals. The age distribution reveals that the majority of sellers are within their economically productive years, aligning with the characteristics of food vending as a source of income. The educational attainment indicates that the majority of merchants possess fundamental education. The significant number of suppliers lacking prior expertise in the food sector illustrates the possible need to institute food safety training and educational programs.

The predominance of female vendors in the night market street food business aligns with findings from previous studies, which suggest that women are more engaged in informal food vending due to economic necessity and flexible working conditions (Peimani & Kamalipour, 2022). This may reflect the role of women in providing for their families and the accessibility of food vending as an income-generating activity. The vendors' educational attainment generally aligns with the average educational levels in Tanzania (Maliti, 2019). Studies indicate that lower education levels can be linked to limited knowledge of food safety regulations (Madilo et al., 2024). The significant number of vendors lacking prior food industry experience emphasizes the necessity of specialized food safety training programs, as indicated by Adane et al. (2018) and Gupta et al. (2018).

Table 2 presents the KAP scores among the night street food vendors in Morogoro Municipal. The majority of vendors (73.0%) demonstrated a medium level of knowledge regarding food safety, while only a small fraction (0.8%) had good knowledge and 26.2% had low knowledge. Attitudes towards food safety were overwhelmingly positive, with 95.3% scoring in the medium category and only 4.7% in the low category; no vendor scored in the good category. In contrast, food safety practices were generally low, with 92.6% of vendors falling into the low practice category, and only 7.4% demonstrating medium-level practices. None of the vendors exhibited good practices. The findings highlight a significant gap between knowledge and actual

practices among night street food vendors. The majority of vendors did not follow appropriate food handling or hygiene procedures, despite having a moderate level of awareness and a favorable attitude about food safety. This discrepancy implies that vendors could not have the infrastructure, resources, or reliable enforcement systems necessary to implement safe practices in their day-to-day operations, even though they are aware of how important food safety is. There is an urgent need for hands-on training and regular monitoring, as evidenced by the extremely high percentage of good knowledge and high percentage low practices. Similar trend of KAP scores were reported by the study conducted in Jashore Region in Bangladesh where the street vendors scored good knowledge, moderate attitude and low practices (Hossen et al. 2021). However this study contradict with the research done in Ethiopia where it revealed that majority (65%), (81.1%), and (58.9%) had a good level of knowledge, a positive attitude, and a good level of practice regarding food safety, respectively (Werkneh et al. 2023). Furthermore the study conducted by Elshahoryi et al. (2024) reported the presence of low knowledge and attitude with moderate practices among the street food vendors in Jordan

### 3.2 Food Safety Knowledge among Night Street Food Vendors in Morogoro Municipality

The outcome demonstrates the level of food safety and hygiene awareness and training among Morogoro Municipality's night street food vendors as shown in Table 3. About 44.1% have received formal training in food preparation, only 26.5% have undergone training specifically on food safety and hygiene, indicating a gap in specialized knowledge on food safety and hygiene Awareness of foodborne diseases varies, with 58.8% recognizing typhoid fever as foodborne. Regarding food contamination sources, the majority (97.6%) identify dirty equipment as a risk, but fewer recognize other critical factors such as food handlers (80.4%), contaminated water (82.1%), and low storage of raw materials (77.6%).

**Table 3. Food safety knowledge among night street food vendors**

<b>Variable</b>	<b>No</b>	<b>Yes</b>
Have you received any formal training in food preparations	143(55.9%)	113(44.1%)
Have you undergone any training on food safety and hygiene	186(73.5%)	67(26.5%)
Are you aware of common food allergens	160(63.7%)	91(36.3%)
Which of the following disease (s) can be transmitted by food		
Bloody diarrhea	136(53.3%)	119(46.7%)
Typhoid fever	105(41.2%)	150(58.8%)
Which of these do you think could be the sources of food contamination		
Dirty equipment's / utensils	6(2.4%)	240(97.6%)
Lowly cooked food	49(19.5%)	202(80.5%)
Foreign matter	183(72.6%)	69(27.4%)
Stale food	153(61.9%)	94(38.1%)
Food handler	49(19.6%)	201(80.4%)
Low storage /uncovered	55(22.4%)	190(77.6%)
Food ingredient	163(64.7%)	89(35.3%)
Contaminated water	43(17.9%)	197(82.1%)
Raw food	49(20.0%)	196(80.0%)
Dish towels	43(17.8%)	199(82.2%)
Cooking well in advance	138(57.3%)	103(42.7%)
Staphylococcus aureus and Bacillus cereus are among the food borne pathogens	170(73.6%)	61(26.4%)

**Table 4. Association and effect of demographic and experience variables on knowledge scores of night street food vendors in Morogoro Municipality**

Variable		Knowledge score			Chi-square P <sup>+</sup> -value	Mean ± SD	Range	Regress model P-Value
		Low	Medium	Good				
Gender	Male	23(39.0%)	35(59.3%)	1(1.7%)	0.022	50.20 ± 13.20	76.92 - 11.54	0.02
	Female	44(22.3%)	152(77.2%)	1(0.5%)		52.95 ± 8.23	76.92 - 23.08	
Marital status	Single	14(33.3%)	27(64.3%)	1(2.4%)	0.282	50.64 ± 13.98	76.92 - 11.54	0.427
	Married	48(23.8%)	153(75.7%)	1(0.5%)		52.89 ± 8.54	76.92 - 23.08	
	Divorce	5(41.7%)	7(58.3%)	0(0.0%)		48.40 ± 7.77	61.54 - 34.62	
Age group	< 20 years	2(66.7%)	1(33.3%)	0(0.0%)	0.132	42.31 ± 10.18	50.00 - 30.77	0.573
	20 – 30 years	42(32.8%)	85(66.4%)	1(0.8%)		51.08 ± 10.33	76.92 - 11.54	
	31 – 40 years	21(17.8%)	96(81.4%)	1(0.8%)		54.01 ± 8.64	76.92 - 26.92	
	> 40 years	2(28.6%)	5(71.4%)	0(0.0%)		50.55 ± 7.83	65.38 - 42.31	
Education level	Primary school	20(35.1%)	37(64.9%)	0(0.0%)	0.046	49.53 ± 8.72	65.38 - 23.08	<0.001
	Secondary School	43(23.5%)	139(76.0%)	1(0.5%)		52.52 ± 8.89	76.92 - 11.54	
	Tertiary level	4(25.0%)	11(68.8%)	1(6.3%)		59.86 ± 15.70	76.92 - 30.77	
previous experience working in the food industry	No	29(17.3%)	137(81.5%)	2(1.2%)	<0.001	53.69 ± 9.67	76.92 - 15.38	0.022
	Yes	38(43.2%)	50(56.8%)	0(0.0%)		49.69 ± 9.08	65.38 - 11.54	
For how long have you been vending food	less than 12 months	25(36.2%)	43(62.3%)	1(1.4%)	0.103	50.67 ± 11.10	76.92 - 15.38	0.101
	4-5 years	39(24.2%)	121(75.2%)	1(0.6%)		52.44 ± 9.11	76.92 - 11.54	
	over 5 years	3(11.5%)	23(88.5%)	0(0.0%)		55.92 ± 7.86	73.08 - 42.31	

Over half of the vendors (55.9%), indicated that they had received formal food preparation training, whereas 44.1% reported not having received such training. A total of 186 participants (73.5%), reported having received training in food safety and hygiene, while 67 participants (26.5%), indicated they had not received such training. A total of 160 vendors (63.7%) reported awareness of common food allergens, while 91 vendors (36.3%) indicated a lack of awareness.

A varying proportion of respondents realized that certain diseases can be transmitted through food; for example, 53.3% recognized that food could result in bloody diarrhea. Only 58.8% of respondents acknowledged that typhoid can be transmitted through food. Almost all of them are cooking utensils (97.6%), with the majority (99.2%) developed via gentle cooking techniques. The majority of vendors exhibited a thorough understanding of the various sources of foodborne illness: contaminated equipment and food (80.5%), food handlers (84%), water pollution (82.1%), dish towels (82.2%), low storage/uncovered (77.6%) and uncooked or raw foods (80%). A minority (73.6%) accurately recognized *Staphylococcus aureus* and *Bacillus cereus* as foodborne pathogens.

Numerous studies indicate that street food vendors globally have no official training on food safety. In South Africa, the majority of sellers lacked proper training in food preparation (Marutha & Chelule, 2020). In Ethiopia, merchants possessing food safety training shown a higher propensity for safe food handling (Tesfaye & Tegene, 2020). Street food vendors frequently possess disparate levels of food safety awareness. Certain studies indicate a strong awareness of handwashing (Hossen et al. 2021), whilst others reveal considerable knowledge deficiencies about cross-contamination, temperature regulation, and foodborne illnesses (Salifu et al., 2025). Insufficient training obstructs food safety instruction. The literature emphatically advocates for food safety education and training for street food vendors. Training approaches have demonstrated efficacy in enhancing food safety knowledge and practices (Insfran et al., 2020). Street food can lead to foodborne illnesses due to improper preparation and inadequate food safety measures (WHO, 1996). Contamination may occur from the processing of raw materials until the point of service. The results indicate practices that lead to pollution. Furthermore, while the majority of vendors comprehend that unclean equipment

can lead to contamination, less recognize the dangers of raw food, inadequate storage, and food handlers all of which are crucial for maintaining food safety (Oduro-Yeboah et al., 2020; Wallace et al., 2022).

Table 4 illustrates the correlation between demographic and experience-related characteristics and the knowledge evaluations of night street food vendors in Morogoro Municipality. Gender shows a significant association with knowledge scores ( $\chi^2 p = 0.022$ ), with females generally scoring higher than males. Similarly, education level plays a crucial role ( $\chi^2 p = 0.046$ ), where vendors with tertiary education have the highest mean knowledge score ( $59.86 \pm 15.70$ ). Previous experience in the food industry significantly impacts knowledge ( $\chi^2 p < 0.001$ ), as those with prior experience tend to have lower scores compared to those without. The duration of vending food, though not significantly associated ( $\chi^2 p = 0.103$ ), shows a trend where vendors with over five years of experience have the highest mean knowledge score ( $55.92 \pm 7.86$ ). However, the regression model indicates that gender has a substantial positive effect on knowledge, with  $p = 0.02$ , suggesting that male and female sellers may possess varying levels of food safety expertise. The highest level of education achieved significantly positively influences food safety knowledge ( $p < 0.001$ ), indicating that further education improves this information. Conversely, prior experience in the food industry negatively affects knowledge scores ( $p = 0.022$ ), suggesting that vendors with previous industry experience may rely on outdated or informal food safety practices. Other variables, such as marital status, age group, and duration of vending experience, show no statistically significant effect on knowledge.

In line with the findings, night street food vendors' awareness of food safety is greatly influenced by demographic factors including gender and educational level (Addo-Tham et al., 2020). According to earlier studies on gender differences in food safety knowledge, the higher scores among female vendors may reflect increased exposure to food handling duties or health consciousness (Rifat et al., 2022). Furthermore, the noteworthy impact of educational attainment underscores the function of formal education in augmenting comprehension of foodborne hazards and hygienic behaviors (Addo-Tham et al., 2020). It's interesting to note that vendors with no prior

**Table 5. Food vendors' attitudes towards food safety in Morogoro Municipal**

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
Food safety is an important component of food catering service	0(0.0%)	0(0.0%)	0(0.0%)	20(7.8%)	235(92.2%)	4.92	0.27
Proper hand hygiene can prevent food-borne diseases	0(0.0%)	6(2.3%)	0(0.0%)	130(50.8%)	120(46.9%)	4.42	0.62
Thorough hand washing is important and necessary after every toilet visit	1(0.4%)	44(17.2%)	0(0.0%)	80(31.3%)	131(51.2%)	4.16	1.1
Raw and cooked foods should be stored separately to reduce the risk of food contamination	3(1.2%)	7(2.8%)	0(0.0%)	74(29.1%)	170(66.9%)	4.58	0.74
The health status of workers should be evaluated (screened) before Employment and after every six months	1(0.4%)	13(5.1%)	0(0.0%)	99(39.0%)	141(55.5%)	4.44	0.78
Do you believe that consumers prioritize food safety when choosing where to purchase street food	1(0.4%)	13(5.1%)	0(0.0%)	99(39.1%)	140(55.3%)	4.44	0.78

**Table 6. Association and effect of demographic and on attitude scores of night street food vendors in Morogoro Municipality**

Variable	Attitude score			Chi-square	Mean ± SD	Range	Regress model	
	Low	Medium	Good	P <sup>+</sup> -value			P-Value	
Gender	Male	3(5.1%)	56(94.9%)	0(0.0%)	0.869	58.80 ± 6.93	67.35 - 42.86	0.002
	Female	9(4.6%)	188(95.4%)	0(0.0%)				
Marital status	Single	2(4.8%)	40(95.2%)	0(0.0%)	0.826	59.38 ± 6.80	69.39 - 42.86	0.009
	Married	9(4.5%)	193(95.5%)	0(0.0%)				
	Divorce	1(8.3%)	11(91.7%)	0(0.0%)				
Age group	< 20 years	0(0.0%)	3(100.0%)	0(0.0%)	0.137	57.82 ± 6.23	63.27 - 51.02	<0.001
	20 – 30 years	9(7.0%)	119(93.0%)	0(0.0%)				
	31 – 40 years	2(1.7%)	116(98.3%)	0(0.0%)				
	> 40 years	1(14.3%)	6(85.7%)	0(0.0%)				
Education level	Primary school	2(3.5%)	55(96.5%)	0(0.0%)	0.546	60.76 ± 5.87	67.35 - 44.90	0.121
	Secondary School	10(5.5%)	173(94.5%)	0(0.0%)				
	Tertiary level	0(0.0%)	16(100.0%)	0(0.0%)				
previous experience working in the food industry	No	6(3.6%)	162(96.4%)	0(0.0%)	0.243	63.31 ± 6.56	69.39 - 32.65	<0.001
Yes	6(6.8%)	82(93.2%)	0(0.0%)					
For how long have you been vending food	less than 12 months	7(10.1%)	62(89.9%)	0(0.0%)	0.034	57.70 ± 7.28	69.39 - 32.65	0.006
	4-5 years	5(3.1%)	156(96.9%)	0(0.0%)				
	over 5 years	0(0.0%)	26(100.0%)	0(0.0%)				

experience in the food sector scored higher. This could be because they were recently trained or because new vendors were more complying than those with established practices (Huq & Stevenson, 2020; Kundu et al., 2021).

### 3.3 Food Vendors' Attitudes Towards Food Safety in Morogoro Municipal

Table 5 presents food vendors' attitudes towards food safety in Morogoro Municipal. Vendors generally expressed positive attitudes towards food safety practices. A significant majority (92.2%) strongly concurred that food safety is a critical element of food catering services (mean = 4.92, SD = 0.27). The majority of vendors agreed or strongly agreed that adequate hand hygiene may prevent food-borne illnesses (97.7%, mean = 4.42, SD = 0.62) and that comprehensive hand washing is imperative following each restroom visit (82.5%, mean = 4.16, SD = 1.1). Nonetheless, there was marginally less consensus on handwashing following toilet use, as indicated by the elevated standard deviation. A significant majority (96%) concurred or strongly concurred that raw and cooked foods had to be stored separately to mitigate the risk of food contamination (mean = 4.58, SD = 0.74). Vendors concurred or strongly concurred that the health state of workers should be assessed (screened) prior to employment and biannually (94.5%, mean = 4.44, SD = 0.78). Similarly, most vendors (94.4%, mean = 4.44, SD = 0.78) believed that consumers prioritize food safety when choosing where to purchase street food. The data suggests that food vendors in Morogoro Municipal generally hold a strong positive attitude towards food safety. They recognize its significance in catering services and acknowledge the role of hand hygiene and proper food storage in preventing foodborne illnesses. Vendors also understand the necessity of health screening for food handlers and believe consumers prioritize food safety (Trandafir & Lotrean, 2025).

The majority of street food vendors understand the significance of food safety, especially when it comes to things like worker health screening, appropriate food storage, and hand cleanliness. Similar trend has been highlighted by other researches (Ghartey & Antwi, 2019). The broad consensus on these points is consistent with research indicating that while vendors may be aware of food safety regulations, they may not always follow them (de Freitas et al., 2019).

However, there may be behavioral gaps that could present hygiene problems, as indicated by the decreased agreement on thorough handwashing after using the lavatory (Hammerschmidt & Manser, 2019). To improve compliance and guarantee safer street food vending situations, food safety laws should be enforced more strictly and educational programs should be used to encourage behavioral change (Brown & Tommasi, 2024).

Table 6 illustrates the correlation and impact of demographic and experiential characteristics on the attitude scores of nocturnal street food vendors in Morogoro Municipality. The table shows the distribution of vendors across three attitude score categories (Low, Medium, and Good), though no vendors fell into the "Low" or "Good" category. It also displays the mean attitude scores, standard deviations, and ranges for each demographic and experience group, along with chi-square and p-values indicating the statistical significance associations. A statistically significant association was found between gender and attitude scores ( $p = 0.002$ ). Female vendors had a slightly higher mean attitude score ( $61.63 \pm 6.80$ ) than male vendors ( $58.80 \pm 6.93$ ). Marital status was significantly associated with attitude scores ( $p = 0.009$ ). Single vendors had a mean score of ( $59.38 \pm 6.80$ ), married vendors had a mean score of ( $61.51 \pm 6.90$ ) and divorced vendors had a mean score of ( $57.65 \pm 6.28$ ). Age group was significantly associated with attitude scores ( $p < 0.001$ ). Vendors in the 31-40 age group had the highest mean attitude score ( $64.42 \pm 5.45$ ), while those in the 20-30 age group had a mean score of ( $57.81 \pm 6.61$ ). Previous experience working in the food industry was significantly associated with attitude scores ( $p < 0.001$ ). Vendors with no prior experience had higher mean attitude scores ( $63.31 \pm 6.56$ ) than those with experience ( $56.52 \pm 5.19$ ). The time vendors had been vending food was significantly associated with attitude scores ( $p = 0.006$ ). Vendors who had been vending for over 5 years had the highest mean attitude score ( $64.60 \pm 4.36$ ), while those who had been vending for less than 12 months had the lowest ( $57.70 \pm 7.28$ ).

Female vendors demonstrated slightly more positive attitudes towards food safety than male vendors. Vendors in the 31-40 age group exhibited the most positive attitudes, suggesting that experience and maturity may shape food safety perspectives. Interestingly, vendors with no prior experience working in the food industry

reported more positive attitudes towards food safety. This could indicate that those without prior experience are more receptive to training and education, or that negative experiences in the food industry may negatively impact attitudes. Vendors with more years of experience in food vending also demonstrated more positive attitudes. This could be attributed to increased awareness of the importance of food safety over time, or a form of survivorship bias, where those with low food safety practices are less likely to remain in business long-term. The results imply that vendors' Attitude of food safety are influenced by demographic and experiential factors. The finding that female vendors have more positive attitudes towards food safety aligns with some studies that have reported similar gender differences in health-related attitudes and practices (Adane et al. 2018; Ma et al. 2019). The significant effect of gender on attitude scores implies that male and female vendors may have differing perceptions of food safety, potentially due to variations in exposure to food handling practices (Boakye et al., 2023). Similarly, the

influence of age and marital status indicates that personal and social responsibilities may shape vendors' attitudes toward food safety (Hossen et al., 2020). The negative effect of previous food industry experience on attitude scores may be due to vendors relying on informal or traditional practices rather than standardized food safety guidelines (Dzudzor & Gerber, 2023). This finding aligns with previous studies that highlight how experience alone does not necessarily improve adherence to food safety practices but may reinforce existing habits, whether correct or incorrect as reported by Okpala & Korzeniowska, (2023) based on, the significant impact of vending experience on attitude scores suggests that longer time in the trade fosters a more positive approach to food safety (Insfran et al., 2020;). However, the lack of significant association between education level and attitude scores suggests that formal education alone may not be sufficient to influence food safety attitudes, emphasizing the need for targeted and practical training programs (Al-Kandari et al., 2019).

**Table 7. Practice toward food safety among night street food vendors in Morogoro Municipality**

**I. Personal Hygiene Practices:**

Statement/Question	No (%)	Yes (%)
Do you cover your hair (wear a cap) during working	83 (32.9%)	169(67.1%)
Do you have a culture of wearing protective clothing (e.g. apron) during work hours	81 (32.3%)	170(67.7%)
Is there a provision of hand washing after toilet visit	52 (21.0%)	196(79.0%)
Do you wash your hands after every toilet visit	72 (28.9%)	177(71.1%)
Do you smoke while working	235(92.9%)	18 (7.1%)
Are food handlers using proper hand hygiene practices, such as washing hands before handling food	181(84.2%)	34 (15.8%)
Are gloves or utensils used when handling ready-to-eat foods	173(87.4%)	25 (12.6%)
Is there any evidence of illness among food handlers, and do they know the importance of reporting illnesses	198(85.7%)	33 (14.3%)

**II. Food Handling and Preparation Practices:**

Statement/Question	No (%)	Yes (%)
Do you cover food during storage?	50 (19.8%)	203(80.2%)
Is there a system in place to prevent cross-contamination between raw and cooked foods	160(79.6%)	41 (20.4%)
Does the preparation of food conducted here or it is cooked elsewhere	197(90.4%)	21 (9.6%)
Food equipment, utensils and food contact surface are properly washed, rinsed and sanitized before use	213(91.0%)	21 (9.0%)

**III. Cleaning and Sanitation Practices:**

Statement/Question	No (%)	Yes (%)
Do you have water access points at your food vending point	51 (20.4%)	199(79.6%)
Is there a designated area for handwashing with soap and running water	21 (8.3%) 33(14.8%)	232(9.7%)
Are the storage facilities free from dust and dirt	190(85.2%)	
Are the storage utensils regularly sanitized?	169 (82.8%)	35 (17.2%)
Is the vending stall maintained in a clean condition	122 (59.2%)	84 (40.8%)
Are there adequate waste water or food disposal facilities available	200 (87.3%)	29 (12.7%)
Are food contact surfaces regularly cleaned and sanitized	80 (31.6%)	173(68.4%)
Are the animals or pests flies etc. evident around the vending stall	69 (80.9%)	40 (19.1%)

**IV. Storage Practices**

Statement/Question	No(%)	Yes (%)
Is storage area free of pests	87 (34.7%)	164(65.3%)

**V. Customer Facilities**

Statement/Question	No (%)	Yes (%)
Are there gender segregated toilets provided for Clients	170 (80.2%)	42(19.8%)
Are the toilet for Clients clean and well-maintained	129 (81.1%)	30 (18.9%)

**3.4 Self-reported Food Safety Practices of Night Street Food Vendors in Morogoro Municipality.**

Table 7 illustrates the self-reported food safety practices of night street food vendors in Morogoro Municipality. It emphasizes positive and negative practices and offers a comprehensive overview of the vendors' compliance with food safety guidelines. The results show that night street food vendors in Morogoro Municipality have differing degrees of commitment to food safety and hygiene regulations. While a majority of vendors report adherence to key practices such as covering food during storage (80.2%), having access to water at vending points (79.6%), and ensuring handwashing facilities with soap and running water (91.7%), some critical areas require improvement. For example, only 40.8% of vending stalls are maintained in a clean condition, and 19.1% of stalls have evidence of pests. Also, only 12.6% of vendors use gloves or utensils when handling ready-to-eat foods, highlighting a potential risk for contamination. The data also show that 67.1% of vendors wear caps, and 67.7% wear protective clothing, suggesting a moderate commitment to hygiene standards. Then, the low percentage of vendors sanitizing storage utensils (17.2%) and properly maintaining client toilets (18.9%) suggests gaps

in hygiene compliance that could affect overall food safety.

It appears that vendors understand the significance of certain hygienic standards based on the high adherence to covering food, handwashing stations, and water access points as reported by Al-Kandari *et al.* (2019). The fact that over one-fifth of vending stalls have bugs highlights the possible dangers of improper waste disposal and unhygienic surroundings as similar reported by Mani & Kathirvel, (2019). Public health issues are also brought up by the absence of designated and clean restrooms for customers, since low sanitation can lead to the spread of foodborne infections (Augustin *et al.*, 2020).

Table 8 shows the association and effect of demographic and experience variables on the practice scores of night street food vendors in Morogoro Municipality. The table presents the distribution of vendors across practice score categories (Low, Medium, and Good), although no vendors fell into the "Good" category. It also shows the mean practice scores, standard deviations, and ranges for each demographic and experience group, along with chi-square and p-values. The analysis assesses the association and effect of demographic and experiential variables on the practice scores of night street

**Table 8. Association and effect of demographic and on practice scores of night street food vendors in Morogoro Municipality**

Variable		Practice score			Chi-square	Mean ± SD	Range	Regress model
		Low	Medium	Good	P*-value			P-Value
Gender	Male	54(91.5%)	5(8.5%)	0(0.0)	0.725	36.70 ± 9.60	56.52 - 17.39	0.77
	Female	183(92.9)	14(7.1%)	0(0.0)		36.86 ± 9.84	73.91 - 8.70	
Marital status	Single	40(95.2%)	2(4.8%)	0(0.0)	0.382	34.06 ± 9.69	52.17 - 8.70	0.646
	Married	187(92.6)	15(7.4%)	0(0.0)		37.41 ± 9.74	73.91 - 8.70	
	Divorce	10(83.3%)	2(16.7%)	0(0.0)		36.59 ± 9.54	52.17 - 21.74	
Age group	< 20 years	2(66.7%)	1(33.3%)	0(0.0)	0.281	33.33 ± 22.31	52.17 - 8.70	0.003
	20 – 30 years	118(92.2)	10(7.8%)	0(0.0)		34.82 ± 10.59	73.91 - 8.70	
	31 – 40 years	111(94.1)	7(5.9%)	0(0.0)		38.87 ± 7.92	69.57 - 17.39	
	> 40 years	6(85.7%)	1(14.3%)	0(0.0)		40.37 ± 9.95	56.52 - 26.09	
Education level	Primary school	50(87.7%)	7(12.3%)	0(0.0)	0.284	35.85 ± 11.74	56.52 - 8.70	0.226
	Secondary School	172(94.0)	11(6.0%)	0(0.0)		36.99 ± 9.00	73.91 - 17.39	
	Tertiary level	15(93.8%)	1(6.3%)	0(0.0)		38.32 ± 10.79	69.57 - 26.09	
previous experience working in the food industry	No	160(95.2)	8(4.8%)	0(0.0)	0.025	36.39 ± 9.15	69.57 - 8.70	0.016
	Yes	77(87.5%)	11(12.5)	0(0.0)		37.65 ± 10.85	73.91 - 17.39	
For how long have you been vending food	less than 12 months	63(91.3%)	6(8.7%)	0(0.0)	0.563	34.03 ± 11.26	56.52 - 8.70	0.223
	4-5 years	151(93.8)	10(6.2%)	0(0.0)		37.67 ± 8.67	69.57 - 17.39	
	over 5 years	23(88.5%)	3(11.5%)	0(0.0)		38.96 ± 10.75	73.91 - 21.74	

food vendors in Morogoro Municipality. Chi-square results indicate that previous experience in the food industry is significantly associated with practice scores ( $p = 0.025$ ), suggesting that vendors with prior industry experience may have different food handling practices compared to those without experience. However, other demographic factors, including gender, marital status, age, education level, and duration of vending, show no significant association with practice scores ( $p > 0.05$ ). Regression results further reveal that previous food industry experience significantly influences practice scores ( $p = 0.016$ ), with vendors who had prior experience scoring slightly higher (Mean =  $37.65 \pm 10.85$ ) than those without experience (Mean =  $36.39 \pm 9.15$ ). Age group also has a significant effect on practice scores ( $p = 0.003$ ), indicating that older vendors tend to have better food handling practices. However, other variables, such as gender, education level, and length of vending experience, do not significantly affect practice scores.

The findings suggest that previous food vending experience positively influences vendors' food safety practices, which may be attributed to prior exposure to food handling procedures and hygiene standards as previously reported by Kwol et al. (2020). Furthermore, current work supports existing research that emphasizes the role of hands-on experience in improving compliance with food safety regulations (Al-Kandari et al. 2019). However, the significant impact of age group on practice scores suggests that older vendors may have developed better food handling behaviors over time, possibly due to accumulated experience and increased awareness of the importance of food safety. The

lack of significant associations for education level and duration of vending experience implies that formal education alone may not necessarily lead to better food safety practices, reinforcing the need for targeted and continuous training programs (Yeargin et al, 2021). These findings highlight the importance of both experience-based learning and structured food safety training to enhance compliance among night street food vendors

### 3.5 Correlation of Socio-Demographic Factors, Knowledge, Attitude, and Practice Scores of Night Street Food Vendors in Morogoro Municipality

Table 9 presents the correlation matrix showing the relationships between socio-demographic factors (Gender, Marital Status, Age, Education Level, Previous Experience, Vending Frequency), and the scores for Knowledge, Attitude, and Practice among night street food vendors in Morogoro Municipality. The table indicates the strength and direction of the correlations, with asterisks denoting statistical significance ( $*p < 0.05$ ,  $**p < 0.01$ ). The correlation analysis reveals several significant relationships among the study variables. Gender shows a positive correlation with marital status ( $r=.336$ ,  $p<0.01$ ) and age ( $r=.158$ ,  $p<0.05$ ), indicating that men are more likely to be married and older. Age is positively associated with marital status ( $r=.432$ ,  $p<0.01$ ) and length of time vending food ( $r=.497$ ,  $p<0.01$ ), suggesting that older individuals tend to have more experience in food vending. Education level has a weak but significant positive correlation with knowledge score ( $r=.223$ ,  $p<0.01$ ), implying that higher education levels contribute to better food safety

**Table 9. Correlation matrix of socio-demographic factors, knowledge, attitude, and practice scores of night street food vendors in Morogoro Municipality**

Correlations	Gender	MS	Age	ED	PE	VF	KS	AS	PS
Gender	1								
MS	.336**	1							
Age	.158*	.432**	1						
ED	-.136*	-0.066	-0.031	1					
PE	-0.014	0.08	-.350**	-0.031	1				
VF	.128*	.330**	.497**	-0.051	-.129*	1			
KS	0.12	0.021	.146*	.223**	-.197**	.144*	1		
AS	.172**	0.035	.426**	0.061	-.467**	.309**	.374**	1	
PS	0.007	0.102	.212**	0.062	0.061	.170**	.135*	.197**	1

Note: MS -Marital status, ED – Higher education level, PE- previous experience working in the food industry, VF- For how long have you been vending food, KS- knowledge score, AS-attitude score, PS-Practice score, \*\* - Correlation is significant at the 0.01 level (2-tailed), \* - Correlation is significant at the 0.05 level (2-tailed)

knowledge. Previous experience in the food industry is negatively correlated with age ( $r=-.350$ ,  $p<0.01$ ) and attitude score ( $r=-.467$ ,  $p<0.01$ ), suggesting that younger individuals and those with lower attitude scores are more likely to have prior industry experience. Attitude score is positively correlated with both knowledge score ( $r=.374$ ,  $p<0.01$ ) and practice score ( $r=.197$ ,  $p<0.01$ ), indicating that better attitudes toward food safety are associated with higher knowledge and improved food safety practices.

The results demonstrate the complex interrelationships among street food vendors' demographic traits, knowledge, attitudes, and practices. The claim that formal education raises awareness of food safety is supported by the substantial link between knowledge score and education level as highlighted by Hossen et al. (2021) Experience by itself, however, may not always result in favorable attitudes towards food safety, as seen by the negative association found between attitude score and prior industrial experience. This can suggest that risky behaviors have become more commonplace over time or that food safety standards are not being reinforced in real-world situations (Addo-Tham et al. 2020). Given these findings, training programs should not only focus on knowledge dissemination but also emphasize attitudinal changes to enhance overall food safety compliance.

#### 4. CONCLUSION

This study in Morogoro Municipal revealed a mixed landscape of food hygiene knowledge, attitudes, and practices among night street food vendors. While vendors demonstrated generally positive attitudes and a reasonable level of knowledge regarding food safety, significant gaps were observed in their actual practices. Key findings highlighted the influence of demographic factors, particularly age and previous experience, on vendors' food safety behaviors. Notably, a substantial proportion of vendors reported low food handling practices, underscoring the urgent need for targeted interventions. These findings underscore the critical role of continuous training and regulatory reinforcement in enhancing food safety standards and safeguarding public health within Morogoro's vibrant night market environment.

#### 4.1 Recommendations

The Morogoro Municipal Council should develop multilayer food safety training for midnight street

vendors. Hand hygiene, cross-contamination avoidance, safe food storage, quarterly refresher courses, and specialist modules on Morogoro's street food risks (e.g., handling local ingredients, safe charcoal grilling) should be included in this project. In the first year, evaluate vendor participation and knowledge retention pre- and post-training to attain 90% participation and 20% improvement in average post-training assessment scores. Morogoro Municipal Council should form a task force to audit night market street food vendors monthly using a standardized checklist that meets national food safety requirements and tackles mobile vending concerns. The council must also work with relevant groups to offer safe water within 50 meters of selling zones and empty garbage bins, one per five sellers, every six months. Suppliers must post inspection results and have detailed corrective action plans with follow-up inspections. The government should provide permanent vending sites, clean facilities, and adequate waste disposal for street food vendors. The strategy would improve Morogoro Municipal food safety and environmental cleanliness over time.

#### 4.2 Study Limitations

The singular focus on nighttime street food sellers may not accurately represent the knowledge, attitudes, and practices of daytime vendors or those operating in more formal settings. Further study incorporating both daytime and nighttime vendors are essential.

The study relied on self-reported practices from vendors, which may have been susceptible to social desirability bias or inaccuracies, perhaps leading to an overestimation or underestimation of actual food safety practices.

#### FUNDING

The authors received no specific funding for this work.

#### ETHICAL APPROVAL AND CONSENT

The Municipal Director of Morogoro authorized the execution of this study. The Vice Chancellor of Sokoine University of Agriculture (SUA) issued a letter granting a research approval. Prior to initiating the research, the study protocol was developed, submitted to, and approved by the SUA ethical committee. Written agreement was secured from each food seller after elucidating the study's goal and significance before initiating data collection. Participation in the study was

voluntary. The confidentiality of participant data was maintained throughout the investigation.

## DATA AVAILABILITY

The data supporting the findings of this study are available upon request from the Corresponding author.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

## ACKNOWLEDGMENTS

The authors express gratitude to all individuals who contributed to the completion of this work in various capacities.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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