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Research Article

Food safety knowledge and hygiene practices of Urojo street vendors in Zanzibar: A cross-sectional study

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Abstract

Street-vended Urojo is one of the most popular ready-to-eat foods in Zanzibar. However, poor food handling practices may increase the risk of food-borne diseases. This study evaluated the level of food safety knowledge and hygienic practices of Urojo vendors in the Urban West Zanzibar region. A cross-sectional study was conducted among 90 Urojo vendors selected using a non-probability convenience sampling technique. Socio-demographic data were obtained from a pre-prepared questionnaire focusing on knowledge and practices related to food safety and hygiene. Scores for knowledge and practice were classified as low, moderate, or high. Pearson's correlation was utilized to examine the relationship between knowledge and hygiene practice scores, whereas chi-squared tests were employed to determine associations between selected vendor characteristics and hygiene practices. Statistical significance was defined as $p < 0.05$. Nearly half of the vendors (46.7%) exhibited high levels of hygiene compared to moderate (36.7%) and low (16.7%). There was a positive correlation ($r = 0.563$, $p < 0.001$) between food safety knowledge and hygiene practice. Hygienic practices were also significantly related to the education level ($\chi^2 = 27.76$, $p < 0.001$) and duration of vending ($\chi^2 = 41.44$, $p < 0.001$). Better hygienic practices were observed in vendors who completed secondary school and those with long experience in the business. No meaningful relationship existed between prior food safety training and subsequent hygiene practice ($\chi^2 = 2.00$, $p = 0.368$). Therefore, food safety improvement depends on ongoing practical training in food safety and reliable access to necessary infrastructure for maintaining hygiene, including clean water-supplies, handwashing facilities, soap, adequate waste disposal systems, and suitable food storage and preparation systems. These measures are necessary for vendors to convert food safety knowledge into appropriate hygienic practices and reduce the risk of microbial contamination of Urojo.

Keywords: Hygiene practices, Food safety, Street food, Street vendors, Urojo.

Introduction

Globally, street food plays a significant role in the provision of convenient, affordable, and culturally diverse meals to millions of people (Privitera & Nesci, 2015). It constitutes an important source of nutrition and livelihood, especially for vendors and households in both urban and rural settings (Mwove et al., 2020). Despite these benefits, street-vended foods are frequently associated with outbreaks of foodborne diseases (Ma et al., 2019; Younus et al., 2019). Poor hygienic practices and inadequate storage and preparation environments create favorable conditions for microbial contamination and proliferation. The World Health Organization (WHO, 2026) estimates that approximately 866

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million people become ill and 1.52 million die annually as a result of consuming unsafe food, highlighting the substantial global burden of foodborne diseases. The burden is disproportionately concentrated in low- and middle-income settings, with the African and South-East Asian regions accounting for nearly three-quarters of foodborne illnesses and 60% of global foodborne-disease deaths. The estimates assess 42 major foodborne hazards, including bacteria, viruses, parasites, and chemical hazards, with foodborne diarrhea pathogens contributing substantially to illness and mortality.

In Africa, food safety challenges are closely tied to diseases owing to poor hygienic practices (Adane et al., 2018; Jaffee et al., 2019). Illnesses such as diarrhea, cholera, typhoid, and dysentery are widespread (Ndunguru & Ndossi, 2020). While some low- and middle-income countries have laws and regulations to safeguard food safety, enforcement and monitoring are often insufficient. Street foods are often contaminated with pathogenic microorganisms, including *Escherichia coli*, *Salmonella* spp., and *Staphylococcus aureus*, which can cause a range of health challenges from mild gastroenteritis to severe health outcomes such as hemolytic uremic syndrome (Andrade et al., 2023). Therefore, addressing these challenges has become a pressing public health priority.

As in many low-income regions, street food in East Africa offers affordable meals and fosters cultural and social connections. Nonetheless, the informal nature of the sector contributes to limited regulatory oversight and poor food safety compliance (Sheehama & Singh, 2025). Many vendors lack proper training in hygiene and food handling, which increases the risk of contamination. Consequently, foodborne illnesses are widespread, although many cases remain undocumented due to restricted healthcare access and or failure to attend health facilities (Ma et al., 2019).

Street-vended food is an important component of the local food system in Zanzibar, providing affordable meals and supporting the livelihoods of many small-scale vendors. Among these foods, Urojo, commonly known as "Zanzibar Mix," occupies a distinctive position in Zanzibar's culinary repertoire. The dish reflects the island's historical interactions with African, Arab, and Indian culinary traditions and is widely associated with the food culture of Stone Town. Beyond its importance to local consumers, Urojo is part of the culinary experience offered to visitors, with street food markets such as Forodhani attracting both tourists and residents (USDA, 2025). Thus, the safety of Urojo has implications not only for consumer health but also for Zanzibar's culinary heritage, tourism, and the livelihoods dependent on street food vending.

Earlier reports cited in the Zanzibar street-food literature documented hundreds of food-poisoning cases annually during 2012–2014, while research has also associated street-vended food consumption with *Shigella* infection among children in Zanzibar (Hassan & Fweja, 2020). More recently, The Citizen (2024) reported that Zanzibar continues to experience serious food-poisoning events, including the 2024 outbreak associated with consumption of sea turtle meat, in which eight people died and 78 were hospitalized. Although this outbreak was unrelated to Urojo, it illustrates the potential severity of foodborne hazards in the Zanzibar context. Therefore, this study aimed to assess the level of food safety knowledge and hygienic practices among Urojo vendors. Understanding the indicators of microbial risks associated with Urojo is critical for improving consumer protection and strengthening food safety standards. By identifying gaps in vendor practices, this study sought to propose practical recommendations that can enhance the safety of Zanzibar's street food sector.

Materials and Methods

Study area

The study was conducted in the Urban West Region (UWR) of Zanzibar (ZNZ), focusing on vendors selling Urojo. The region provided a diverse sampling environment because of its mix of different sociodemographic populations in urban areas, which helped in understanding various contamination and food safety dynamics. The varied environment allowed for the capture of a broad spectrum of handling practices, vendor hygiene standards, and consumer habits.

Research design

A cross-sectional study design was employed using quantitative approaches. This design allowed for a comprehensive analysis of both microbial contamination and the sociocultural aspects of food safety practices. The study involved the assessment of food safety knowledge and hygienic practices among vendors and consumers of Urojo through structured questionnaires.

Study population

The study population included Urojo vendors from different age groups, genders, and socioeconomic backgrounds, selected from various vending areas in the Urban West Region, Zanzibar.

Sampling procedures

A sample size of 90 Urojo vendors was determined using the Cochran (1977) formula. Vendors were recruited from identified Urojo vending locations within the Urban West Region during the data collection period. We invited eligible vendors present at the selected vending locations and willing to participate in the study. Recruitment continued until the required sample size of 90 vendors was achieved. Thus, the study used a random sampling approach, with recruitment conducted across different vending locations to cover the study area. Data were collected through face-to-face interviews using a structured questionnaire.

Assessment of food safety knowledge and handling practices among Urojo vendors

A structured questionnaire, available as an online Kobo Toolbox version 20 and in hard copy, was developed to assess the food safety knowledge and practices of the Urojo vendors. It covers several aspects, including hygienic practices, food safety knowledge, ingredient sourcing, and storage and handling conditions. The questionnaire was pretested and revised for clarity and relevance. Face-to-face interviews were conducted with the vendors.

Analysis and interpretation

Scores from the questionnaire were categorized into three levels: low, moderate, and high. Scores for the knowledge section ranged from 5–50. The levels of scores were divided into low (5-20), moderate (21-35), and high (36-50). In terms of the practice for hygienic factors, scores ranged from 7 to 62. The categories were low (7-31), moderate (32-49), and high (50-62). This classification system, using the proportion of the total possible score to help assess food safety knowledge and behavior among participants, is helpful. These categories were used as operational classifications to facilitate the interpretation and comparison of respondents' knowledge and hygienic practice scores. This classification is also typical of knowledge, attitude, and practice (KAP) type research as illustrated by Sani and Siow (2014), who classified food handlers' knowledge on food safety in a similar manner to the above using ranges for scores. The relationship between knowledge and practice was explored using a chi-square (χ^2) test. Specifically, we investigated how well knowledge, education level, and food safety training predict food safety practices among Urojo vendors.

Results and Discussion

Demographic characteristics of vendors

The study included both male (53.3%) and female (46.7%) Urojo vendors. Most vendors belonged to the youth age group of 26–35 years (56.7%), whereas only 6.7% were aged above 45 years (**Table 1**). Regarding education, none of the vendors had tertiary education; 73.3% had completed secondary education, while the remainder had primary education. Only 10% of vendors received food safety training, and one-third of the vendors (33.3%) had more than six years of vending experience. Most vendors (63.3%) served between 50 and 149 customers per day. Although 77.8% of vendors held registration, 22.2% operated without registration.

The predominance of vendors with secondary or lower education and the presence of unregistered vendors may increase the potential for inadequate food-handling practices and exposure of consumers to food-safety hazards. Similar patterns have been reported in other low- and middle-income countries. For example, Salamandane et al. (2021) reported that women constituted 79.5% of street-food vendors and that most vendors had only primary-level education. Studies conducted in Ghana and

Nigeria documented relatively low levels of educational attainment among street-food vendors, with substantial proportions having no formal education (Nortey et al., 2024; Alawode & Tabit, 2025). In Kenya, Mwove et al. (2020) reported that only 10.6% of vendors had not completed primary education. To strengthen food safety and public health, tailored training programs for street food vendors on proper handling practices is highly recommended.

Table 1. Demographic characteristics of Urojo vendors.

Variable	Category	Frequency (n)	Percent (%)
Age (years)	Below 26	15	16.7
	26–35	51	56.7
	36–45	18	20
	46–55	6	6.7
Gender	Male	48	53.3
	Female	42	46.7
Education level	Tertiary education	0	0
	Secondary	66	73.3
	Primary	24	26.7
Years in selling Urojo	Less than 1 year	8	8.9
	1–3 years	26	28.9
	4–6 years	26	28.9
	More than 6 years	30	33.3
Registration (license)	Yes	70	77.8
	No	20	22.2
Food safety training	Yes	9	10
	No	81	90

Food safety knowledge levels among Urojo vendors

As shown in **Figure 1**, 22 (24.4%) vendors had a low level of food safety knowledge, 31 (34.4%) had a moderate level, and 37 (41.1%) had a high level. This suggests that, although a large fraction of vendors had adequate knowledge concerning food safety, a large group of vendors making up 58.8% had moderate to low knowledge, leading to important gaps in safe food delivery. This emphasizes the need for specific food safety education and training to be delivered to street food vendors in Zanzibar. The comparatively greater number of vendors with good knowledge may be due to various factors such as awareness campaigns, previous training on food hygiene, exposure to inspections, or practical experience after long-term practice in food vending.

The current findings are consistent with studies conducted in other developing settings. Islam et al. (2024) In Bangladesh, a significant proportion of street food vendors had basic knowledge of food hygiene, but knowledge gaps on crucial practices such as contamination prevention and personal hygiene were identified. In an analogous study, Alimi (2016) showed that knowledge of food safety among street food vendors did not provide sufficient assurance for the continuity of safe hygienic handling of foods because knowledge alone does not guarantee safe practice without routine inspection and reinforcement by the authority.

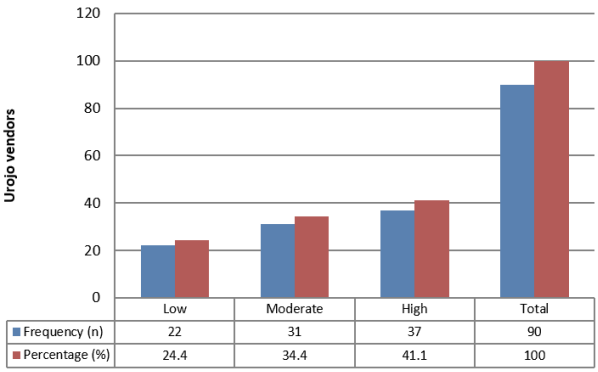


Figure 1. Food safety knowledge levels of the participants.

Comparable findings by Akabanda et al. (2017) in Ghana reported that even if a large proportion of street food vendors had reasonable knowledge of food hygiene, substantial gaps continued concerning foodborne pathogens, temperature control, and contamination prevention. These deficits contributed to hazardous food handling practices and increased microbial contamination of ready-to-eat foods. In addition, insufficient food safety knowledge among street food vendors remained an important factor in poor hygienic practices and increased food contamination risks in developing countries (Koumassa et al., 2025). The WHO (2022) emphasizes effective food safety management through unceasing training, helpful supervisory systems, repetitive monitoring, and consistent health inspections to emphasize proper practices throughout the food supply chain.

Food hygiene and handling practices among Urojo vendors

Table 2 presents food hygiene and handling practices among the 90 Urojo vendors. Regarding hand washing during food preparation and serving, half of the vendors (50.0%, n = 45) reported washing their hands sometimes, while 34.4% (n = 31) and 15.6 % (n = 14) did so often and rarely, respectively.

The use of gloves or other protective gear was generally low, with more than half of the vendors (54.4%, n = 49) reporting that they never used protective gear. Only 15.6% (n = 14) reported always using gloves or protective gear, while 24.4% (n = 22) used them sometimes. Most vendors (80.0%, n = 72) reported using clean utensils, and 74.4% (n = 67) reported properly storing their ingredients. However, avoiding cross-contamination was poorly practiced, as 81.1% (n = 73) reported not taking measures to avoid cross-contamination. In addition, 60.0% (n = 54) reported thoroughly cooking Urojo, whereas 40.0% (n = 36) did not. Most vendors (68.9%, n = 62) always used detergent when washing utensils, while 11.1% (n = 10) used it sometimes and 20.0% (n = 18) did not use detergent. Almost all vendors cleaned their food preparation utensils and equipment immediately after every use (93.3%, n = 84), and all vendors (100.0%, n = 90) reported immediately cleaning serving utensils after use. Similarly, appropriate waste disposal practices were commonly reported, with 98.9% (n = 89) using waste bins. Regarding food storage and temperature control, most vendors (87.8%, n = 79) stored ready-to-use ingredients in glass cabinets, while 12.2% (n = 11) stored them in basins at room temperature. Most vendors (71.1%, n = 64) maintained food holding temperatures between 60 °C and 75 °C, whereas 25.6% (n = 23) held food below 60 °C. The majority of vendors (85.6%, n = 77) reheated Urojo over a stove or fire.

Heat treatment of salads was uncommon, with 93.3% (n = 84) of the participants reporting that they did not apply heat treatment. Overall, although several vendors demonstrated good practices related to utensil cleaning, waste disposal, and food storage, important gaps were observed in hand hygiene, use of protective gear, prevention of cross-contamination, and the heat treatment of salads.

Association of food safety knowledge and hygiene practice

A statistically significant moderate positive correlation was observed between food safety knowledge and hygiene practice scores among the vendors ($r = 0.563$, $p < 0.001$) (**Table 3**). This indicates that higher food safety knowledge scores are associated with better hygiene practices. The association may be positive, but the modest strength shows that knowledge alone does not determine hygienic behavior; numerous other factors, such as access to clean water, availability of sanitation facilities, financial resources, workload, and regulatory enforcement, may also play a crucial role

in daily food handling practices. This observation adds to the growing evidence that behavioral change requires not only awareness but also an enabling vending environment.

Table 2. Food hygiene and handling practices among Urojo vendors.

Hygienic practice indicator	Response	n	%
Hand washing during preparation/serving	Often	31	34.4
	Sometimes	45	50.0
	Rarely	14	15.6
Use of gloves/protective gear	Always	14	15.6
	Sometimes	22	24.4
	Rarely	5	5.6
	Never	49	54.4
Use of clean utensils	Yes	72	80.0
	No	18	20.0
Proper storage of ingredients	Yes	67	74.4
	No	23	25.6
Avoiding cross-contamination	Yes	17	18.9
	No	73	81.1
Thorough cooking	Yes	54	60.0
	No	36	40.0
Use of detergent for washing utensils	Always	62	68.9
	Sometimes	10	11.1
	No	18	20.0
Cleaning preparation utensils/equipment	Immediately after every use	84	93.3
	Few hours after use	6	6.7
Cleaning serving utensils	Immediately after every use	90	100.0
Waste disposal	Waste bins	89	98.9
	Drains/grounds	1	1.1
Reheating Urojo	Over stove/fire	77	85.6
	Do not reheat	13	14.4
Storage of ready-to-use ingredients	Glass cabinet	79	87.8
	Room temperature in basin	11	12.2
Food holding temperature	60–75 °C	64	71.1
	Below 60 °C	23	25.6
	Not sure	3	3.3
Heat treatment of salads	Yes	6	6.7
	No	84	93.3

Association between education level and hygiene practice

The study found a statistically significant association between educational level and hygiene practice of the vendors ($\chi^2 = 27.76$, $p < 0.001$) as presented in **Table 4.** Vendors who completed secondary schooling were more likely to demonstrate good hygiene practices than those who completed primary schooling. These findings suggest a relationship between a higher level of formal education and hygienic practices among food vendors. Previous studies have indicated that higher educational attainment may be related to a better understanding of food safety ethics and their application throughout food preparation and serving.

The current finding is in line with that of Faremi et al. (2018). A study conducted in Nigeria found that

the educational level of food vendors was significantly related to their food safety and hygiene practices. The authors believe that this is due to a better understanding of food safety information and increased awareness of the health risks of unsafe food handling. Nkosi and Tabit (2021) reported a similar trend among informal food vendors in South Africa, with education functioning as an important determinant of hygienic behavior.

Table 3. Correlation between food safety knowledge and hygiene practice scores.

Variables	Pearson correlation (r)	p-value
Knowledge score vs practice score	0.563	< 0.001

Not all studies have shown this same connection. Karg et al. (2019) In Ghana, studies determined that the educational level alone did not greatly impact food hygiene practices. These results recommend that although formal education can provide a good base for food safety knowledge, it is not enough to guarantee that street vendors apply correct hygiene. Local authorities in Zanzibar should consider implementing practical, low-cost interventions tailored to vendors' working conditions and educational backgrounds, such as installing portable hand-washing stations with clean water and soap at vending stands; creating pictorial-based educational materials on food safety issues in a simple native language to communicate safe handling practices for foods to vendors who have limited literacy skills; and establishing peer-led monitoring groups that monitor compliance with safe food handling practices.

Table 4. Association between education level and hygiene practice.

Education level	Low n (%)	Moderate n (%)	High n (%)	χ^2	p-value
Primary	11	11	2	27.76	< 0.001
Secondary	4	22	40		
Total	15	33	42		

Association between the duration of selling Urojo and hygiene practice

A strong link was found between the length of time that Urojo has been sold and good hygiene practice (χ^2 = 41.44, p < 0.01), as presented in **Table 5**. Vendors who had been in the business for more than six years tended to have better hygiene than those who had been in the business for less than one year, which seemed mostly represented within low-practice. This trend indicates that vendors' accumulation of experience may strengthen their capacity to adopt safer food handling behavior by being repeatedly exposed to daily food preparation activities and relationships with customers and regulatory agencies.

Consistent findings were reported by Lema et al. (2020) In Ethiopia, experienced food handlers were observed to be more likely to comply with hygiene requirements than newly employed workers. In addition, Olaimat et al. (2022) reported that longer work experience was related to improved food safety practices because workers had more opportunities to become familiar with hygienic procedures and have greater confidence in applying them.

However, this relationship has not been consistently observed across all settings in the literature. Negassa et al. (2022) reported no significant influence of work experience on food hygiene practices among Ethiopian food handlers, arguing that years of service do not necessarily translate into safe practices without regular training, attitude changes, and supervision. These disparities could be caused by differences in food safety regulations, workplace culture, and availability of standard operating procedures. The present results indicate that practical experience leads to better hygiene practices; however, such improvement might be enhanced by sustained training, routine inspections, and strict compliance with current food safety guidelines.

Table 5. Association between duration of selling Urojo and hygiene practice.

Years of vending	Low	Moderate	High	χ^2	p-value
Less than 1 year	6	2	0	41.44	< 0.001
1–3 years	4	8	14		
4–6 years	2	18	6		
More than 6 years	3	5	22		
Total	**15**	**33**	**42**		

Pre-testing of the questionnaire before the main data collection to determine if questions were understandable and clear to respondents did not include a formal content validity assessment by subject matter experts. Additionally, no reliability tests, such as Cronbach's alpha, were conducted to determine the internal consistency of the knowledge or hygienic practice scales used to construct the questionnaire. Therefore, the validity and reliability of these scales have not been formally demonstrated.

Conclusion

This study demonstrates that Urojo vending is largely dominated by young adults, highlighting its role as a vital livelihood option for individuals in their productive years. Hygiene practices among Urojo street food vendors are influenced by multiple factors, rather than food safety training alone. Knowledge of food safety, educational attainment, and experience in street food vending operations positively influenced hygienic behavior, whereas previous participation in food safety training had no significant effect. Based on these results, it is inferred that both formal education and acquired practical experience are more influential than a one-time training course for safe food handling. The lack of association between food safety training and hygiene practice shows that existing training programs need to be re-evaluated for their content, delivery, and follow-up. Continued mentoring, routine regulatory supervision, and practical demonstrations are three ways to ensure that knowledge is reinforced in such a way that promotes long-term behavioral change. Improving access to sanitary facilities and enforcing compliance with food hygiene regulations are equally critical for converting knowledge into practice. For food safety to improve among Urojo vendors, a comprehensive strategy that incorporates education, builds practical skills, provides supportive supervision, and creates an appropriate working environment must be adopted. These measures can help ensure that street food is safer, reduce the risk of disease spread via food, and provide a better level of health protection for consumers in Zanzibar.

Conflicts of interest

The authors have no known financial or non-financial competing interests that could have potentially affected the work described in this manuscript.

Disclaimer

Artificial Intelligence (AI)-assisted tools, including Grammarly, were used during the preparation of this manuscript to support language editing, grammar correction, improvement of academic writing, and

refinement of sentence structure and clarity. The authors take full responsibility for the originality, accuracy, integrity, and final content of this manuscript, including any errors or omissions that may remain.

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