

Research Article

Knowledge Gaps in Food Safety Practices Among Street Food Vendors in the Tamale Metropolis, Ghana

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Abstract

Majority of food handlers have poor knowledge of the proper cleaning of equipment, cross-contamination prevention, foodborne diseases, food temperature danger zones, and correct procedures for thawing frozen food (Moore et al., 2019). This study aimed at assessing the knowledge gaps in food safety practices among street food vendors in Tamale Metropolis. A cross-sectional study was conducted among 384 food vendors selected using a multistage sampling technique. Data were collected using a structured questionnaire and analyzed using descriptive and inferential statistics. The results showed that the majority of food vendors had a high level of knowledge of food safety practices, and so wash their hands with soap and water before handling food, and then inspecting the quality of foodstuffs before using them. However, very few food vendors used protective gear such as gloves or aprons, indicating a gap in food safety practices. Cultural beliefs and access to resources were not significant barriers to adopting food safety practices. The study also found that more than half of vendors had good food safety practices, while a few ones had inadequate or subpar practices. According to the study's conclusions, food vendors in Tamale Metropolis must follow food safety regulations. Targeted interventions by the environmental health unit and food drug authority (EHU/FDA) are needed to improve understanding and adherence to food safety requirements, as seen by the majority of vendors who lack sufficient expertise.

Keywords

Food Safety, Food Hygiene, Knowledge, Laws, Practices

1. Introduction

Poor knowledge of the proper cleaning of equipment, cross-contamination prevention, foodborne diseases, food temperature danger zones, and correct procedures for thawing frozen food in found among majority of food handlers [29]. The growing rate and wide consumption of vendor foods

mostly on the streets around the world increases the importance of safety and health issues. Although food vending business especially on the streets is a means of generating income and a livelihood for that matter, the emergence of informal food businesses can cause health problems if the

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foods are not prepared and handled under hygienic conditions.

Millions of people worldwide have been impacted by foodborne illnesses, which have claimed thousands of lives [29]. According to research [6, 9, 3], foods found on the street may contain pathogens from a variety of global food sources. Notably, 420,000 cases of cholera, typhoid, and diarrhoea are reported as outpatient cases each year in Ghana, where foodborne illness-related deaths account for at least 65,000 deaths annually [18, 16].

Also, a study conducted by [13], on hygiene practices among street food vendors in Tamale Metropolis has less knowledge of food safety practices and information about food safety laws.

Additionally, parasitic infections are prevalent among street food vendors in Tamale, with poor environmental sanitation and hygiene practices contributing to contamination and the outbreak of foodborne illnesses [15].

Although food safety issues have been studied in Ghana, little attention has been paid to street food vendors in Tamale, highlighting the need for this research.

This study can provide recommendations for targeted education and intervention to enhance knowledge and good practices among food vendors in the Tamale Metropolis. This will not only protect the health of consumers but also ensure the sustainability of food vendors' businesses.

It is imperative to examine the knowledge of food vendors concerning food safety practices and information about food safety laws in the Northern Region of Ghana, specifically in the metropolis of Tamale.

First, without adequate food safety measures, it will be impossible to achieve the Sustainable Development Goals (SDGs) of the United Nations, especially Goal 2 (Zero Hunger) and Goal 3 (Good Health and Well-Being). Ensuring the food sold by Tamale vendors is safe can help reduce the number of foodborne illnesses, which are harmful to people's health and impede the city's economic growth. Furthermore, promoting food safety can increase consumer confidence in local food vendors, aiding in the growth of small businesses and contributing to Tamale's overall economic development. Last but not least, this research will broaden our understanding of Ghanaian food safety practices and may have an impact on practice and policy.

The current study sought to evaluate the knowledge gap of food safety practices among street food vendors in Tamale Metropolis.

2. Materials and Methods

2.1. Study Setting

The study was conducted in the Tamale Metropolitan Assembly. Tamale, the Metropolis's capital, is located between latitudes 9.16° and 9.34° North and longitudes 00.36° and 00.57° West. Tamale is in the middle of the Northern Region, 180 metres above sea level. In 2021, the Metropolis was

home to 374,744 people, 185,051 men and 189,693 women, according to the housing and population census. The Northern Region, which includes the Tamale Metropolis, is divided into seventeen districts.

2.2. Study Design

This analytical cross-sectional study employed a mixed methodology, utilising an interview guide, an observation check list, and a structured questionnaire to collect data (qualitative and quantitative). The data gathered comprised the respondents' sociodemographic characteristics and degree of familiarity with food safety protocols [4].

2.2.1. Qualitative Data Sources

Qualitative methods offer a profound and holistic understanding of complex food-related phenomena, such as consumer behavior and food culture, providing rich insights into the context and motivations of stakeholders. Qualitative research allows for flexibility in design and data collection, adapting to emerging issues and offering detailed descriptions that capture the diversity of human perspectives and experiences. Qualitative methods are essential for exploring the context, culture, values, and preferences of individuals involved in food-related activities, aiding in generating new ideas and hypotheses [31].

2.2.2. Quantitative Data Sources

Quantitative methods provide precise and reliable measurements of variables related to food safety, enabling systematic testing of hypotheses and standardized analysis of food quality and safety aspects. Quantitative data sources facilitate rigorous testing of relationships and effects of variables, offering objective and generalizable results that can quantify the extent and frequency of food-related phenomena. Quantitative methods allow for efficient communication and comparison of results through numerical and graphical formats, aiding in summarizing and presenting data effectively [24].

The decision to use both quantitative and qualitative data sources is informed by the need to obtain a comprehensive understanding of food safety practices among vendors in the Tamale metropolis. Qualitative data provide insights into motivations and context, while quantitative data offer precise measurements and systematic testing of variables related to food safety. Mixed methods research allows for a comprehensive exploration of a phenomenon by integrating diverse data sources, leading to a more robust interpretation of findings [1]. Combining quantitative and qualitative approaches enhances the validity of research results by corroborating findings from different perspectives, contributing to a more nuanced understanding of the research topic [4].

By integrating both quantitative and qualitative data sources in the study of food safety practices among vendors in the Tamale metropolis, researchers can gain a holistic

view of the factors influencing food safety behaviors, leading to more informed interventions and policy recommendations.

Information for the research were collected from primary sources.

2.2.3. Primary Information Sources

The primary data sources for this study were street food vendors, residents of Tamale metropolis, and representatives from regulatory agencies. Data was gathered from street food vendors using a standardised questionnaire with closed-ended questions and an online tool called Kobo Collect. To guarantee validation, both qualitative and quantitative data were gathered. Information from the regulatory bodies was gathered through interviews. The study objectives guided the selection of the question sections. Following the recording of the interviews for analysis and interpretation, transcriptions were produced.

2.3. Techniques for Gathering Data

2.3.1. Questionnaire

The primary tool utilized to gather quantitative data was a questionnaire, as it was thought to be the most appropriate and successful means of communicating with the target audience. Given the dispersed location of the street food vendors throughout the town, a questionnaire was created. To ensure accuracy, the questionnaire was created using computer-assisted personal interviewing (CAPI).

Kobo collect, a web-based tool, was used to programme the CAPI. Due to face-to-face interviews and the interviewer only filling out forms in the respondent's presence, this method of distributing questionnaires has no non-response rate. Only vendors selling street food in Tamale Metropolis received the questionnaire.

2.3.2. Comprehensive Interviews

One method used in this study to gather qualitative data was in-depth interviews. The quantitative information gathered from the street food vendors was carefully cross-examined and validated using this tool. Ten (10) in-depth interviews in total were carried out. Participants chosen by deliberate sampling were interviewed in a semi-structured manner. As such, the focus of the study was on street food vendors who participated in the food vendor events. Using empirical saturation as a guide, the sample size was chosen. In other words, as many qualified subjects as possible were interviewed until no more information could be gathered to offer fresh viewpoints on the main research topics. In light of this, saturation was attained after ten interviews. This result is consistent with that of Creswell, who stated that 10 out of 15 interviews is sufficient to obtain high-quality data that can support an accurate interpretation or inference when heterogeneity and saturation are the focus of a study [9].

2.3.3. Firsthand Observation

For this, firsthand observation was the third method of data collection. In addition to direct observations of vendor behaviour during questionnaire administration on topics like hand washing among vendors, holding of money, serving food with bare hands, covering of hair, the use of aprons by vendors, and the environment where food is prepared and sold, a structured questionnaire and in-depth interview were employed. The merchants' professed hygiene practices were verified through direct observation of their behaviour.

2.3.4. Pretesting Instruments for Data Gathering

In this study, street food vendors in Kpalsi, a town in the Sagnarigu Municipality, pre-tested the questionnaires using smartphones running Android version 4.6 or higher. Pretesting revealed to the researcher a number of the instruments' shortcomings, including phones that would shut off from low battery life and phrasing and questionnaire design that made it impossible for the instruments to comprehend and reply to certain questions. Consequently, these mistakes were corrected in the completed questionnaire, and the field data collectors were given three new Android phones.

2.4. Population and Sample Size

The target population for the study included all street food vendors operating on Tamale's main thoroughfares during the day, including restaurants and sizable chop bars that are undoubtedly supervised by the tourism board.

The two zonal councils that comprise the metropolitan area are Tamale Central and Tamale South. The traders are spread out across the city. The sample consisted of 384 + 12 = 396 street food vendors selling cooked food. After confirming that no information was available about street food vendors, the Food and Drugs Authority and the Tamale Metropolitan Assembly's environmental health unit calculated the sample size using the Cochran's sample size formula.

Cochran's sample size formula will be used to calculate the sample size for my study population.

$$no = z^2pq / e^2$$

where sample size = no Z is the 95% confidence level and the corresponding z-score is 1.96. P stands for the proportion of the population of interest, and e stands for the precision level, or margin of error, which is 5% = 0.05. $p = 1 - 0.5 = 0.5$; $q = 1$. adding the values to the formula.

$$(1.96)^2(0.5)(0.5) / (0.05)^2 = (0.9604/0.0025) = 384.16 \approx 384; 3.8416 \times 0.25).$$

2.5. Criteria for Inclusion and Exclusion

The survey only included street food vendors in and around the city of Tamale. The study did not include any

food vendors whose locations were beyond the boundaries of Tamale metropolis. Large chop houses and restaurants were included in the research. The only food vendors targeted were those who sold cooked food.

2.6. Sampling Technique

One zonal council was chosen for this study from a pair of zonal councils using the probability sampling method. Two stages made up the sampling procedure: first, the study area was divided into clusters, which led to the creation of Tamale South and Tamale Central zonal councils. In order to choose the respondents for the second stage, the purposive sampling method was used.

2.7. Variables

Food Safety Practices is the dependent variable that reflects the actual food safety practices and behaviours of the food vendors in the city of Tamale. It involves particular practices like cleaning your hands, wearing gloves and hairnets, cooking at the right temperature, keeping your utensils clean, and following rules and guidelines regarding food safety.

Separate variables: Social and Demographic Factors The food vendors' age The food vendors' gender, educational background, and several years of expertise in the food vending industry, Are the food vendors married?

2.8. Data Analyses

Both quantitative and qualitative methods were employed in this investigation.

2.8.1. Quantitative

After being cleaned up in Microsoft Excel, quantitative field data was imported into SPSS for analysis. Some of the variables were coded prior to being entered into SPSS version 25 for the analyses. Binary logit regression was used to compare the continuous variable and frequencies, respectively. P-values of 0.05 or less were considered statistically significant. Averages and percentages were also used for point estimates and comparisons.

Statistical significance for nominal 2-sided p-values was defined as a p-value of 0.05 with a 95% confidence interval. For continuous variables, the calculations were mean and standard deviation (SD); for discrete variables, the calculations were percentage or proportion. The goal that was examined with STATA version 14 was number three. The food safety practices of food vendors in Tamale Metropolis were investigated through the application of binary logit regression analysis.

The analysis was conducted in two stages. For the log likelihood, the logit regression was first generated. The marginal effects of the logit regression were then generated. The marginal effects were developed to enable the coefficients or

variables to be interpreted as probabilities because the first logit regression's results could not be interpreted as such.

2.8.2. Qualitative

To perform qualitative analysis, content analysis was employed. After playing the audio recording, it was transcribed in accordance with the study's objectives. This enables the researcher to analyze the information gathered. As a checker, the qualitative data validated the quantitative statistics. Content analysis is a research method used to systematically analyze the content of various forms of communication, such as audio recordings, texts, or images. It involves identifying patterns, themes, and meanings within the data to gain insights into the subject being studied. Transcribing the audio recording involves converting spoken words into written text. This step ensures that the data is in a format that can be easily analyzed and interpreted [4]. Following the study's objectives during transcription helps maintain focus and relevance to the research goals. Analyzing the transcribed data allows the researcher to identify key themes, patterns, and insights that emerge from the content. This process helps in understanding the underlying meanings and implications of the information gathered during the study. Qualitative data validation involves ensuring the accuracy, reliability, and credibility of the findings [8]. By cross-referencing qualitative data with quantitative statistics, researchers can confirm the consistency and validity of their results, providing a more comprehensive understanding of the research topic [4].

2.9. Ethical Consideration

The University for Development Studies' ethics committee granted approval for the project. A letter of introduction was also acquired from the University for Development Studies' The School of Public Health Science's, Environmental and Occupational Health Department. Additionally, the study created informed consent for participants. This was obtained through a process that involved information disclosure, understanding, and a voluntary decision. Researchers emphasized the importance of providing potential participants with essential trial information, empowering them to make informed decisions about their participation. The process included ensuring that participants were aware of the nature of the research, the risks involved, their freedom to withdraw, and contact details of the research team. The consent process aimed to be transparent, ensuring that participants had a clear understanding of what their participation entailed and that their decision to participate was voluntary. The names of respondents and their shops were not included in the observational guide or questionnaires. Additionally, prior to the interview, the food vendors provided their informed verbal consent. Additionally, the researcher made it very evident to the participants that the study's goal was solely academic. Above all, there was

complete voluntary participation in this study.

3. Results and Discussion

3.1. Socio-demographic Characteristics of Respondents

The majority of the respondents from the study were females (366) representing 95.1% and males being 19 representing (4.9%). This clearly indicates that majority of food vendors in the Tamale metropolis are females with few males present. This also shows that majority of males have not yet found their space in the food vending business in the Tamale metropolis.

It is undoubtedly that Formal education contributes significantly to the development of people [11]. In view of this, the study considered the level of formal education attained by the respondents. The study revealed that a small proportion 14 (3.6%) of the respondents (food vendors) had their highest level of formal education being at the tertiary level. 136 (35.3%) had Senior High School and Vocational education. 156 (40.5%) of the respondents also ended their formal education at the Junior High School level with 62 (16.1%) ending their formal education at the primary level. However, 17 (4.4%) did not have any formal education. The results indicate that, majority of the respondents had at least primary education. Table 1 below provides a summary on the socio-demographic information of respondents.

Table 1. Socio-demographic Information of Respondents.

Parameter	Frequency	Percentage
Gender		
Female	366	95.1
Male	19	4.9
Level of Education		
Tertiary	14	3.6
SHS/Vocational	136	35.3
JHS	156	40.5
Primary	62	16.1
No formal Education	17	4.4

Source: field survey, 2023

3.2. Knowledge of Food Vendors Concerning Food Safety Practices

Food vendors were asked a series of yes-or-no questions to determine how well-informed they were about food safety protocols. To find out how informed food vendors were about food safety, a survey was done in the Tamale Metropolis. Many questions remain unsolved, especially concerning certain crucial aspects of food safety.

Table 2. Knowledge Level on food safety practices.

Knowledge on food safety practices	Correct		Wrong	
	Frequency	%	Frequency	%
Fresh meat always has microbes on the surface	18	4.7	387	95.3
Healthy people can cause illness by carrying germs to food	4	1	381	99
Vegetables should be disinfected before use	380	98.5	5	3
Viral illnesses that can be transmitted through food include TB, Hep B, and HIP.	52	13.5	333	86.5
Food is one way that cholera can spread.	381	99	4	1
Cutting boards can be cleaned of all dangerous microorganisms with soap and water.	375	97.4	10	2.6
Surfaces used in food preparation can contaminate food.	381	99.5	2	0.5
Even though the wound is bandaged, you shouldn't prepare food while holding a wound on your hand.	321	83.4	64	16.6
Have you ever had a medical examination done in order to sell food?	6	1.6	379	98.4

Source: Field survey, 2023

As an illustration, a startling 95.3% of vendors were ignorant of the possibility that fresh meat may harbour microbes on its surface. Likewise, 60.5% of respondents believed that cooked foods are immune to microbes, which is a miscon-

ception that can lead to unsafe food practices. Fortunately, a sizable majority (99.5%) correctly determined that canned foods generally do not contain hazardous microorganisms, demonstrating a high degree of awareness in this area. Comparably, 97.9% of participants acknowledged that microorganisms can exist on raw vegetables, demonstrating a firm understanding of this potential source of contamination.

However, the survey also identified a few concerning topics. For instance, just 13.5% of respondents were aware that viruses such as TB, Hep B, and HIP can spread through food. This demonstrates a severe ignorance of foodborne illness. Even more alarming, 83.4% of respondents claimed it was acceptable to prepare food while sporting a bandage, despite the fact that 98.7% of them thought it was essential to clean vegetables before using them. This misconception poses a serious risk to food safety. A startling 98.4% of food vendors had never had a medical exam performed expressly for the purpose of selling food, according to the results. This implies a deficiency in regulatory supervision or involvement in this crucial area to guarantee the vendors' well-being and, consequently, the food's safety.

On a Likert scale, all of the right responses were affirmative (correct), and all of the wrong responses were negative

(wrong), which is the same as providing the incorrect response. At first, the responses were divided into categories for strongly agreed, agreed, disagreed, strongly disagreed, and don't know; however, they are now only divided into categories for correct and incorrect responses. "Correct" is made up of "agree" and "strongly agree," while "Wrong" is made up of "strongly disagree" and "don't know." The answers were added up for "correct" and "wrong," and the sums were used to calculate the percentages. Therefore, it was concluded that those who gave a "correct" response knew enough about food hygiene, while those who gave a "wrong" response were judged to know less. Merely 47% of street food vendors in the Tamale Metropolis possess adequate or good knowledge about food safety, according to individual knowledge level indicators, while 53% have inadequate knowledge. If the food vendor business in Tamale Metropolis is to remain profitable and protect public health, the knowledge gap among vendors needs to be closed. Improving vendor food safety protocols requires a comprehensive strategy that includes instruction, training, and strict law enforcement.

3.2.1. Knowledge Level of Food Vendors with Respect to Food Safety Practices

Knowledge LEVEL on food safety practices

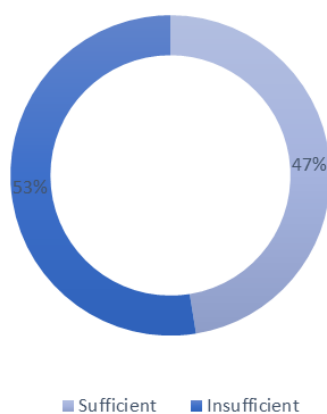


Figure 1. Knowledge Level on Food Safety Practice.

3.2.2. Environmental Law Enforcement

In the quest to solicit respondents' (food vendors) views on environmental law enforcement, a number of questions were posed to them and their views were solicited. Out of a total of 385 respondents, only 24 (6.2%) of them responded yes when they were asked the question 'Are your activities being monitored by government agency'. 360 (93.5%) responded no to the question. This indicates that majority of the food vendors have never had any environmental law enforcement agency or government agency visiting them to

monitor their activities. a. Out of the 25 (6.5%) whose activities are monitored by environmental law enforcement agency or government agency, 5 (1.3%) of them have being monitored by municipal assembly officers, 6 (1.6 %) are monitored by environmental health officers while 14 (3.6%) are being monitored by food and drugs authority. When food vendors were asked about the message or knowledge the law enforcement agencies share with them, 2 (0.5%) responded that they educate them on personal hygiene. 13 (3.4%) said they are educated on proper ways of handling food. Again, 5 (1.3%) indicated that they are educated on the need for environmental hygiene while 5 (1.3%) said the government

agency that visits them only come to collect tax from them when it is due.

With regards to the question about the frequency of the supervisory agency visit to the food vendors, 2 (0.5%) of the respondents (food vendors) indicated they visit them once in every three months while 11 (2.9%) are visited once every 6 months. However, 12 representing 3.1% are mostly visit once a year. This shows that there is the need for the law enforcement agencies to strengthen their activities to ensure compliance and help improve the wellbeing of the consumers.

For the measures put in place by the supervisory agencies to ensure compliance, 3 (0.8%) out of the 25 (who receive visits from the supervisory agencies) said that bye-laws are normally used to ensure compliance while 1 (0.3%) indicated that fines are normally imposed on those who refuse to comply. Also, 20 (5.2%) responded that vending sites of food vendors who refuse to comply are mostly closed down. However, 1 (0.3%) of the respondents (food vendors) indicated that some enforcement agencies who normally visit them only do not say or do anything to them.

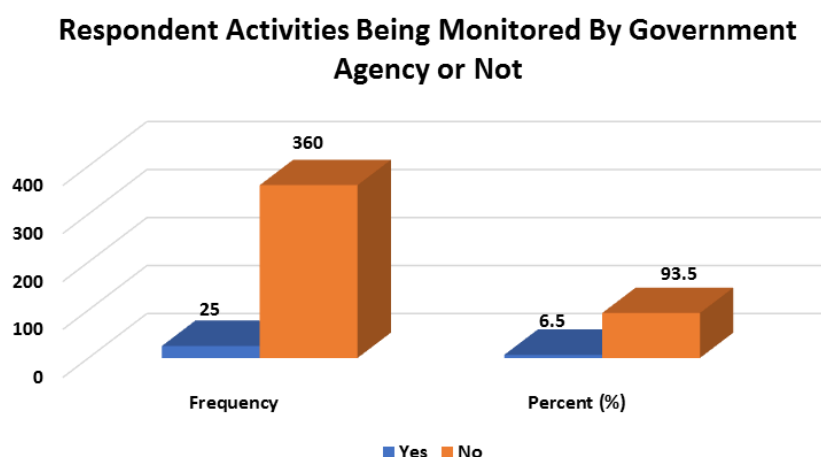


Figure 2. Respondent Activities Being Monitored By Government Agency or Not.

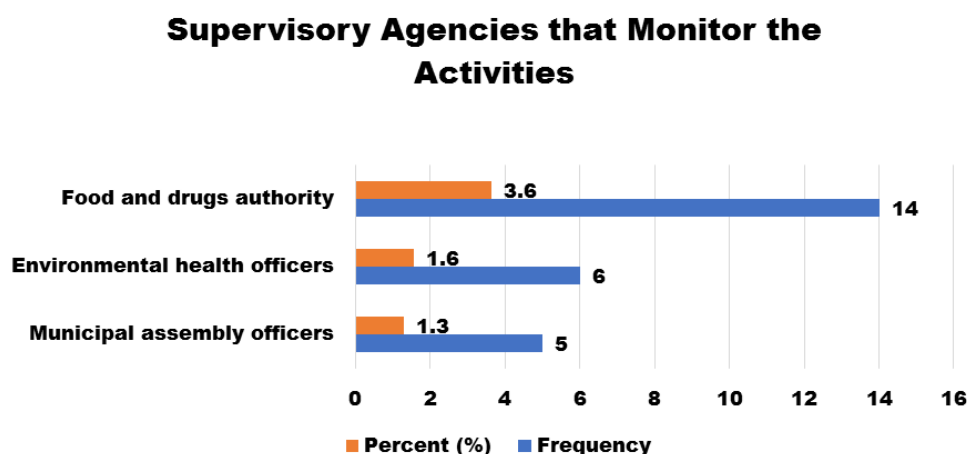


Figure 3. Supervisory Agencies that Monitor the Activities.

3.2.3. The State of Food Safety Practices

When asked about their processes for ensuring food safety, food vendors in the Tamale Metropolis responded to the survey mostly favorably. By following safety procedures, vendors demonstrate a praiseworthy dedication to guaranteeing the safety of the food they sell in several significant ways.

To begin with, a staggering 99.2% of vendors consistently

wash their hands with soap and water before handling food, indicating a strong awareness of the critical role that personal hygiene plays in guaranteeing food safety. Similarly, 98.4% of respondents make sure the food they have bought is of a high enough quality, indicating that they take precautions to use safe raw materials and lower the risk of contamination at the source.

However, some things still require improvement. In order to lower the risk of contamination from direct contact with

food, only 15.3% of vendors, for instance, wear gloves or aprons. This low usage suggests an area where targeted education and intervention could greatly improve safety practices.

Cultural beliefs and the accessibility of resources don't appear to be significant barriers. The vast majority of vendors (97.4%) assert that cultural values have no appreciable influence on their food safety protocols, indicating that they are prepared to adopt safer practices despite cultural norms. In addition, 94.3% of participants do not think that access to resources such as soap and clean water poses a barrier, suggesting that these essentials for food safety are generally available. Vendors have a strong sense of faith in continuing education and information sources. The fact that almost all respondents (99.2%) regularly refresh their knowledge of food safety procedures demonstrates a strong commitment to staying current on the most recent safety standards.

Furthermore, 99% of respondents state that they trust the information they learn about food safety, indicating that reliable and accurate information is being disseminated and that vendors are being incentivized to adhere to food safety laws.

Crucially, 98.7% of respondents consistently store cooked and raw food apart, a widely accepted practice required to prevent cross-contamination and ensure the safety of prepared food products.

In summary, although there are some areas that need improvement, like the regular use of protective gear, the general food safety procedures followed by vendors in the Tamale Metropolis are commendable. Together with the positive practices that are already in place, focused interventions in specific areas and continuous education can enhance the state of food safety and safeguard the interests of both customers and vendors. Table 3 below summarizes the data:

Table 3. Food safety practices among food vendors in Tamale Metropolis.

Items	Yes		No	
	Frequency	%	Frequency	%
Does respondent regularly wash hands with soap before handling and water food?	382	99.2	3	0.8
Do you regularly inspect the quality of the foodstuff you purchase before using it?	379	98.4	6	1.6
Does the food vendor regularly use protective gear such as gloves or aprons?	59	15.3	326	84.7
Do cultural beliefs influence food vendor's decision to adopt food safety practices?	10	2.6	375	97.4
Does the availability of resources influence vendor's decision to adopt food safety?	22	5.7	363	94.3
Does food vendor regularly update his/her knowledge on food safety practices?	382	99.2	3	0.8
Does vendor trust the information he/she receives about food safety practices?	381	99	4	1
Does Food Vendor always store raw and cooked food separately?	380	98.7	5	1.3

Source: Field Survey, 2023

3.3. The State of Food Safety Practices Among Food Vendors in Tamale Metropolis

In order to create a binary system from the survey results, the previous categories of strongly agree, agree, disagree, disagree, and don't know were combined. Comments were categorized as either negative (no) or positive (yes). 'No' included disagree and don't know, while 'yes' included the first two responses of agree and strongly agree. The total number of "yes" and "no" responses to each question were

then added up, and percentages could be found by summing these numbers. In the Tamale Metropolis, 64.77% of street food vendors were judged to have good food safety practices based on a consistent "yes" response to the survey questions. However, since 35.23% of them gave a "no" response, it was presumed that their food safety protocols were inadequate or subpar. This implies that a significant portion of vendors lack knowledge about essential food safety protocols, which could jeopardize the health of the public as well as the sustainability of their businesses.

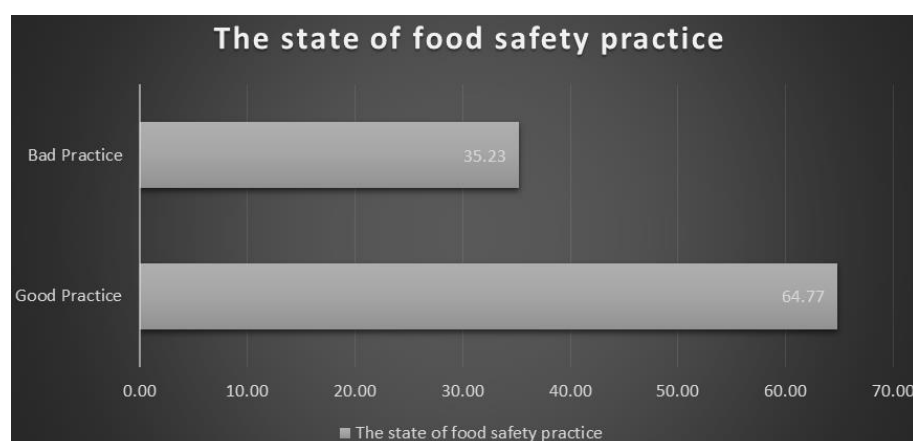


Figure 4. The State of Food Safety Practices.

4. Discussion

4.1. Sociodemographic Characteristics

Gender of Respondents

The study's results, which show that 95.1% of respondents were women, are consistent with studies primarily carried out in African nations, where women are customarily assigned to the role of cook. Marutha and Chelule observe that a considerable proportion of African women head their households as the primary breadwinners [18]. This is consistent with findings published by Dajaan, who discovered that 97% of their participants were female [10]. The results are also consistent with a different study that found that female street food vendors were more prevalent overall [5]. This could be explained by the belief that women are better at taking care of their families and handling kitchen duties. Additionally, stereotypes implying that women in this profession have lower skill and educational levels may have an impact on the preponderance of women in the street food vendor sector [29]. These results corroborate FAO data from 2012 and confirm that the primary goals of most women working in the food vending industry are to make food more accessible to their families and, to a greater extent, to make their families more financially independent [12].

Respondents level of Formal Education Attained

By revealing the participants' formal education levels, the study shed light on the educational background of food vendors in Tamale. The results showed that only a small percentage of participants—3.6%—had finished their higher education, indicating a dearth of people with advanced degrees in the food vending sector.

35.3% of the respondents, or the majority, had finished both high school and vocational training. This indicates that a sizable portion of food vendors have completed secondary school, which may improve their comprehension of different facets of food safety procedures. Furthermore, a significant

percentage of food vendors only had a basic education, with 40.5% having finished junior high school.

Moreover, 16.1% of participants finished their formal education at the elementary school level, suggesting that people with little formal education could still work in the food vending business. Surprisingly, 4.4% of respondents had never attended school, suggesting that some people learned their skills and knowledge through other non-formal methods or through experience. According to the findings of a study conducted in Ghana by Dajaan and co. on "Food Hygiene Awareness and Environmental Practices among Food Vendors in Basic Schools at Kintampo Township, Ghana," 16.1% of street vendors in Tamale lacked a formal education [10]. This survey found that 86.7% of vendors learned their trade through apprenticeships, personal institutions, and informal education, while 13.3% received formal education in senior high school or vocational schools. Remarkably, 58% of the vendors had no college experience. This stands in contrast to the situation in Ghana, where up to 55% of food vendors had completed secondary education, according to a study done in Jamaica [30]. According to the study's findings, street food vendors in Ghana may not be following proper food handling protocols, such as obtaining a license to prepare and sell food and getting screened for diseases, because of their low educational attainment. The observed lack of hand washing during food service may also be connected to the low educational levels of the vendors.

Research from developing countries consistently indicates that two major factors that contribute to the entrepreneurship of street vending are low levels of education and unemployment. According to earlier studies, the results of this study regarding the educational background of street food vendors are consistent [20, 13, 23, 22, 6, 12].

Similar vendor profiles were found in a descriptive study conducted in Nigeria, where 14% of respondents had no formal education (13% in this study), 27% had completed elementary school, and 52% had completed secondary school (58%) [14]. But in Nigeria, a significantly higher proportion (29%) had finished their tertiary (college) education [7].

Similar education profiles have been reported in studies conducted in Liberia, Nigeria, Kenya, India, and Sudan [20, 13, 23, 22, 6]. However, tertiary education levels were not as high for the Nigerian street vendor population as observed in this study.

It is important to know the educational background of food vendors because it can affect their ability to understand food safety principles, follow regulations, and adopt and implement best practices. Additionally, it offers insights into possible knowledge gaps that can be filled with focused training and instruction programmes.

Taking into account the respondents' formal education levels, policymakers, health authorities, and stakeholders can create suitable educational initiatives and interventions to improve food safety practices, offer pertinent training opportunities, and encourage ongoing learning among food vendors in the Tamale metropolis.

4.2. Knowledge of Food Vendors with Respect to Food Safety Practices

Based on the measures of respondents' individual knowledge levels, the study's findings show that 53% of participants don't know enough about food safety, while 47% know enough or well enough. There is a sharp contrast in a study by Yakubu in Sagnarigu indicate that 79.9% of food handlers in Sagnarigu have sufficient knowledge on food safety [31]. Although this study findings aligns with previous studies showing that most food handlers do not have a basic understanding of food safety procedures like preventing cross-contamination, preventing foodborne illnesses, keeping food at safe operating temperatures, and using the right techniques to thaw frozen food [21]. Studies carried out in Malaysia and Iran provided similar insights [32, 26]. An average score of 49.3 out of 100 points was reported in another Korean study, indicating a lack of knowledge regarding food safety [25]. Furthermore, a Thai study discovered that only 13.0% of participants demonstrated a thorough understanding of food safety [2]. This stands in contrast to a different study in which participants obtained a mean score of 57.8%, indicating a moderate level of understanding about food safety and cleanliness [2].

4.3. The State of Food Safety Practices Among Food Vendors in Tamale Metropolis

The study's findings, which indicate that 64.77% of street food vendors in Tamale Metropolis were thought to have good food safety practices, are in line with other research in the same area. The hypothesis that a significant portion of street food vendors usually demonstrate excellent adherence to food safety regulations is supported by research on their food safety protocols.

In a study conducted in a similar setting, for instance, 59.1% of participants showed satisfactory food safety practices,

supporting the idea that the majority of street food vendors can maintain adequate safety measures [19]. However, studies showing gaps in food vendors' food safety procedures also correspond with the 35.23% of participants in the present study who indicated that they did not know [28].

This finding is consistent with a 2019 Oumer study done in Malaysia, which discovered that half of the 302 food handlers employed incorrect food handling techniques. The literature supports the variety of food safety practices observed among street food vendors and emphasizes the need for targeted interventions to improve practices where gaps exist [14, 11, 17, 27]. The agreement between the current study and existing literature improves the validity of the findings and suggests a wider range of food safety practices among street vendors. A study found that 70.1% of food vendors in Ethiopia have unsatisfactory food practices which is a contradiction to this study [24].

5. Conclusion

This study highlights the need for targeted interventions to improve food safety practices among street vendors in Tamale. Regular training and stricter enforcement by health authorities could close the knowledge gap and improve public health outcomes.”

Further studies could explore the long-term impact of training programs on food vendors' behavior towards food safety practices, as well as towards food safety laws.

Abbreviations

EHU	Environmental Health Unit
CAPi	Computer-Assisted Personal Interviewing
FAO	Food and Agricultural Organization

Conflicts of Interest

The authors declare no conflicts of interest.

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