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Assessment of Food Hygiene and Safety Among Food Vendors in Motor Parks in Maiduguri, Borno State, Nigeria

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***Abstract*: Food vending is a prevalent economic activity in many developing countries, offering affordable and convenient meals, particularly in high-traffic areas such as motor parks. However, inadequate hygiene practices among vendors pose significant public health risks, contributing to the spread of foodborne illnesses. Ensuring food hygiene and safety is critical to protecting consumer health. Objective: This study assessed the food hygiene and safety practices among food vendors in motor parks in Maiduguri, Borno State. Methods: A descriptive cross-sectional study was conducted among 400 food vendors selected via multistage sampling from major motor parks in Maiduguri. Data were collected using semi-structured interviewer-administered questionnaires and observational checklists, analyzed with SPSS version 30 ($p \leq 0.05$). Results showed that 66.2% of vendors demonstrated good knowledge, 63.2% had positive attitudes, but only 80.2% consistently applied safe practices. Gaps included inadequate handwashing duration (23.8%) and improper disposal of leftovers (67.2%). Observational data confirmed deficiencies, with only 34% of the measures effectively preventing flies. Higher income (≥₦100,000) and tertiary education were unexpectedly associated with poorer practices. Despite adequate awareness, the lack of formal training and enforcement hinders the consistent adoption of best practices. To improve food safety, regular hygiene training, adequate infrastructure such as handwashing stations, and stricter regulatory enforcement are recommended. Collaboration among health authorities, local governments, and vendor associations is essential to bridge the knowledge-practice gap and ensure the safety of street-vended food.**

***Keywords*: Food hygiene, Food safety, Street food vendors, Knowledge, Practice, Attitude.**

1. Introduction

Food vending is a prevalent economic activity in many developing countries, including Nigeria. Food vendors include restaurants, bars, grocery stores, delicatessens, bakeries, food service establishments, schools, food trucks, itinerant restaurants, pushcarts, farmers' markets, caterers, micro-enterprise home kitchens, and cottage food operations that sell prepared food for consumption on or off premises [1]. These foods are valued for convenience, affordability, and appeal to urban and low-income populations. However, if not handled hygienically, street-vended foods pose significant public health risks due to contamination hazards [2]. Ensuring food hygiene and safety is critical to mitigating these risks.

Food hygiene encompasses practices that maintain cleanliness and prevent contamination during food preparation, handling, and storage to prevent foodborne illnesses [3]. Food safety ensures food is free from hazards [4]. Small, informal food outlets ("cookri" shops) provide inexpensive meals to low-income communities but often lack hygienic spaces, with substandard sanitation practices, such as the repeated use of water for handwashing and utensil cleaning [5]. Foodborne illnesses are a significant global concern. Unsafe food causes over 200 diseases, leading to 600 million cases and 420,000 deaths annually, with the highest burden in low- and middle-income countries [2]. In Africa, inadequate food safety infrastructure exacerbates this burden. Studies in Uganda have highlighted the unsafe nature of street-vended foods due to unhygienic environments [6]. In Ghana, bacterial contaminants like Escherichia coli and Staphylococcus aureus are prevalent in street foods [7]. In Nigeria, food vending is common among urban and low-income populations, often in unsanitary conditions with limited oversight [8]. A study in Ogun State reported that only 75.3% of vendors received hygiene training [9]. In Borno State, prolonged insecurity disrupts public health systems, exacerbating food safety challenges [10].

Foodborne illnesses are a significant global public health concern, with 600 million cases and 420,000 deaths annually, disproportionately affecting low- and middle-income countries [2]. In Africa, food and waterborne diseases cause numerous deaths due to unsafe handling, poor hygiene, and inadequate sanitation. Diarrheal diseases linked to contaminated food and water kill 2.2 million people annually, especially vulnerable groups [10]. Limited evidence exists on food hygiene and safety practices among food vendors in Maiduguri's motor parks, necessitating targeted interventions to reduce the risks of foodborne diseases.

Foodborne diseases are prevalent in developing countries, where informal food vending is a common practice. Maiduguri's motor parks, busy hubs for travellers and residents, rely on vendors operating with limited access to clean water and

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sanitation, increasing contamination risks. The findings will provide data for health authorities and policymakers to design targeted interventions, reducing foodborne disease risks and protecting public health. The study will also serve as a reference for future research and contribute to national and global food safety goals. The study assesses food hygiene and safety practices among food vendors in motor parks in Maiduguri, Borno State.

2. Methodology

A. Study Area

This study was conducted in Maiduguri, the capital of Borno State, Nigeria, located at a latitude of 11°50′ N and a longitude of 13°09′ E. As a central hub for commerce and transportation, Maiduguri hosts a diverse range of socio-economic activities, with food vending being particularly vital due to the high volume of human and vehicular traffic in the motor parks. There are five motor parks: Tashan Bama, Borno Express Motor Park, Baga Road Motor Park, Monday Market Area, and Tashan Kano.

B. Study Design

A descriptive cross-sectional study was used.

C. Study Population

The study population comprised food vendors selling ready-to-eat food items in Maiduguri's motor parks. Food vendors aged 11 years and above, as well as those who handle, prepare, or serve food to consumers, were included in the study. Food vendors who are sick or mentally ill were excluded.

D. Sample Size Determination

The sample size was calculated using Cochran's formula:

$$n = (Z\alpha^2\ pq)/d^2$$

Where: Z = 1.96, p = 0.803 (from Ujah et al., 2024), q = 0.197, d = 0.05.

$$n = (1.96)^2 \times 0.803 \times 0.197 / 0.0025 = 243.$$

With a 10% non-response rate, n = 267.3, approximated to 267. To increase the study power, 400 vendors were selected for sampling.

E. Sampling Technique

A multistage sampling technique was used:

Stage one (Selection of Local Government Areas): Purposive sampling was used to select Jere and Maiduguri Metropolitan Council Local Government Areas (LGA). Stage two (Selection of wards)**:** A Purposive method was used to select wards from the designated Local Government Areas (LGAs) with motor parks. Stage three (Selection of Motor Parks): Cluster. sampling was used to select motor parks. Stage four (Selection of respondents): Simple random sampling was employed to select respondents until the target sample size was achieved.

F. Study Tool and Data Collection

Data were collected through a structured, interviewer-led questionnaire with Four sections: socio-demographics, knowledge, attitudes, and practices related to food. Hygiene and safety. Observational checklists were used to assess food hygiene and safety practices.

G. Data Analysis

Data were analyzed using SPSS version 30 with descriptive and inferential statistics. Chi-square and Fisher's tests were applied, with significance set at $p \leq 0.05$.

H. Ethical Considerations

Ethical approval was obtained from the University of Maiduguri Research and Ethics Committee (SHREC No. 84/2025). Informed consent, confidentiality, and voluntary participation were ensured.

3. Results

A total of 400 food vendors operating in motor parks across Maiduguri, Borno State, completed the questionnaire, yielding a 100% response rate.

More than one-third of vendors (37%) were aged 26–35 years, followed by those aged 36–45 years (32 %), with 11–25 years and 46–65 years each representing 15.8% and 15.2%, respectively. The sample was predominantly female (89.5%), with males comprising 10.5%. Marital status distribution showed 45.2% married, 24% single, 18.3% divorced, and 12.5% widowed. Most vendors (69.8%) practiced Islam, 29% were Christian, and 1.2% followed other denominations. The Kanuri ethnic group was the most significant (36.3%), followed by Hausa (20.5%), Marghi (15.2%), Fulani (8.3%), Babur (6.3%), and others (13.5%). Education levels indicated that 37.5% had secondary education, 28% had primary education, and a smaller proportion, 5% had tertiary education. Monthly income varied: 16% earned <₦30,000, 38.5% earned ₦30,000–49,999, 20.7% earned ₦50,000–99,999, and 24.8% earned ≥₦100,000.

The knowledge assessment showed that 93.2% of vendors had heard of foodborne diseases. Major recognised causes of foodborne illnesses included dirty hands (19.1%), contaminated water (18.2%), spoiled food (15.7%), flies (15.6%), and improper food preparation (15.4%). Common illnesses identified were cholera (26.4%), diarrhoea (25.4%), typhoid (21.9%), and malaria (26.4%), although 6.9% incorrectly linked malaria to foodborne illness. Sensory spoilage signs were well recognised: bad smell (26.9%), colour changes (24.7%), and slimy texture (24.3%). However, 23.7% believed the taste stays the same in spoiled food. Moreover, 98% recognised the importance of handwashing before preparing food, and 91% understood the need to separate raw and cooked foods. Yet, only 19.8% had received formal training in the past year. The overall knowledge score indicated that 66.2% of vendors had good knowledge, whereas 33.8% had poor knowledge.

Vendors demonstrated a generally positive outlook, with 64.2% strongly agreeing and 33.8% agreeing (total 98%) that hygiene helps prevent illness. Additionally, 55.5% strongly agreed and 41% agreed (total 96.5%) that customers value cleanliness. For items that are reverse-coded, 43.5% disagreed

that hygiene is too expensive, and 55.5% disagreed that hygiene is only performed during inspections. The median attitude score was 10 out of 11, with 63.2% of participants having positive attitudes (scores of 10 or higher) and 36.8% having negative attitudes (scores below 10).

Most respondents, 98%, knew handwashing procedures and cleaned utensils daily. However, only 23.8% practised adequate handwashing duration, 45.5% avoided contact with customer food, and 31.5% refrained from handling food when ill. Additionally, 67.2% disposed of leftovers improperly, 74% re-heated leftovers, and 82.8% separated raw from cooked foods.

Observations indicated that 82.5% had clean hands/nails, 75.5% wore clean aprons, 34% prevented flies, and 65.2% covered waste bins, with 82.8% having bins available. Good practice prevalence was 80.2% (self-reported: 87%, observed: 73.4%).

Educational level was significantly linked to knowledge ($\chi^2 = 17.147$, $p = 0.002$), with vendors who had a tertiary education showing the highest proportion of poor knowledge (75%) compared to 72.9% of those with no formal education who displayed good knowledge. Monthly income was also associated with knowledge ($\chi^2 = 14.325$, $p = 0.003$), with 88.9% of vendors earning ≥₦100,000 demonstrating good knowledge, compared to 53.1% of those earning less than ₦30,000. No significant associations were observed with age ($\chi^2 = 7.075$, $p = 0.070$), sex ($p = 0.251$), marital status ($p = 0.145$), religion ($p = 0.798$), ethnicity ($p = 0.359$), or experience ($p = 0.140$).

Age was significantly linked to attitudes ($\chi^2 = 8.834$, $p = 0.032$), with the 46–65 age group showing the highest positive attitudes (77%) compared to 55.6% for the 11–25 years group. Sex was also associated ($p = 0.040$), with females exhibiting 65.1% positive attitudes compared to males at 47.6%. Ethnicity was also linked ($\chi^2 = 13.165$, $p = 0.022$), with Hausa (70.7%) and Kanuri (69%) having the highest rates, and Fulani the lowest (45.5%). Monthly income had a strong association ($\chi^2 = 46.778$, $p < 0.001$), with 88.9% of those earning ≥₦100,000 expressing positive attitudes, compared to 46.8% of those earning ₦30,000–₦ 49,999. No relationships were found with marital status, religion, experience, or education.

4. Discussions

The age distribution aligns with studies in Sokoto [12], Ibadan [13], and Calabar [11]. However, it differs from Bangladesh [14] and Bahir Dar [15]. Female dominance (89.5%) is consistent with findings in Sokoto, Bahir Dar, Bangladesh, Calabar, and Ibadan, reflecting food vending as a predominantly female-led activity. Marital status findings align with those in Calabar and Ogun State [9], but contrast with those in Sokoto and Bahir Dar. The religious and ethnic compositions reflect Maiduguri's demographics, similar to those of Sokoto, but differing from Calabar.

The findings from knowledge align with those of Calabar [11], Bangladesh [16], and Sokoto [12]. Misconceptions about malaria echo the confusion surrounding hepatitis A in Calabar [11]. Despite high awareness (93.2%), limited training (19.8%), and knowledge gaps (33.8%), these findings highlight the need for targeted education, consistent with Ethiopia [15] and Ibadan [13].

The 98% agreement on hygiene preventing illness aligns with Calabar [11] and Bangladesh [16]. The 96.5% endorsement of customer concern for cleanliness mirrors Calabar's emphasis on handwashing [11]. Reverse-coded items suggest genuine commitment to hygiene; a depth not explored in other studies. The 63.2% positive attitude rate is lower than Calabar's 94.7% [11] but higher than Bangladesh's 33% "positive" attitudes [16], indicating a favorable outlook with gaps.

High awareness (98%) aligns with Bangladesh [16] and Sokoto [12], but practice gaps persist. The 23.8% handwashing duration rate is lower than Calabar's 67.2% [11]. In contrast, the 67.2% improper leftover disposal rate is higher than Calabar's 98.5% [11] and Ethiopia's 50% [15]. The 82.5% clean hands/nails rate exceeds Imo State's 52% [17], but fly control (34%) is poorer than Imo's 62.5% [17]. These gaps underscore the need for training and infrastructure development.

The high poor knowledge rate among tertiary-educated vendors (75%) contrasts with Rivers State [18] but aligns with Kaduna's lack of education-knowledge link [19]. The income-knowledge association suggests that economic stability aids access to training. The lack of associations with other factors aligns with Kaduna [19] but contrasts with the findings from Rivers State [18]. Context-specific training is needed.

The age-attitude association aligns with findings from Rivers State [18], suggesting that experience enhances attitudes. The sex-based difference is similar to that observed in Rivers State [18], reflecting the traditional roles of women in food preparation. The ethnicity-attitude link is unique, possibly due to cultural practices. The income-attitude link suggests that economic stability fosters positive attitudes, although poorer practices indicate that awareness alone is insufficient. The lack of association with other factors aligns with findings from Bangladesh [16] but contrasts with those from Rivers State [18]. Region-specific training is needed.

5. Conclusion

Food vendors demonstrated high knowledge and positive attitudes, but their practices were inconsistent due to limited training (19.8%) and enforcement, which pose risks. Bridging this gap is crucial. Providing training, installing handwashing stations and covered bins, strengthening inspections and linking permits to compliance, launching awareness campaigns via radio and community leaders, and studying consumer behaviours to boost demand for safe food.

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