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THE CONCEPTUALISATION AND EVALUATION OF A FOOD SAFETY TRAINING PROGRAMME FOR STREET FOOD VENDORS

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ABSTRACT

The purpose of this research was to design and evaluate a tailored food safety training programme for street food vendors in Ibadan, Oyo State, Nigeria. A one-group pre-/post-test quasi-experimental design was used. Forty-two vendors with at least five years' experience and no prior formal food safety training completed a three-day face-to-face programme (5–7 December, 2022). The curriculum, guided by the Health Belief Model and the WHO Five Keys to Safer Food, covered personal hygiene, food hygiene, cross-contamination, temperature control, microbial hazards, foodborne diseases, and facility sanitation. Knowledge was assessed using a validated questionnaire. Pre- and post-training scores were compared using paired statistical tests based on diagnostic checks (paired t-test or Wilcoxon signed-rank test). Significance was set at $p \leq 0.05$. Internal consistency was assessed using Cronbach's alpha. Most street food vendors were female (90.5%), over 35 years old (90.5%), predominantly unmarried (71.4%), and mainly had primary education (71.4%), with none having prior food safety training or formal qualifications. The majority (76.2%) had more than 11 years of vending experience. Post-training results showed statistically significant improvements across all knowledge domains: personal hygiene, food hygiene, temperature control, and foodborne disease awareness ($p < 0.001$). Both parametric and non-parametric analyses confirmed large effect sizes, indicating substantial learning gains. Pre-training scores were clustered at low levels, whereas post-training scores were higher and more widely distributed. All participants demonstrated improved competency, confirming the strong positive impact of the training intervention. This study confirms that street food vendors lacked formal food safety training and demonstrated low baseline knowledge, particularly in critical areas such as temperature control, posing notable public health risks. The interactive, context-specific training programme significantly improved knowledge across all domains, with median scores increasing markedly from 1.0 to 10.0. Despite variations in individual gains influenced by socio-demographic factors, overall food safety competency improved substantially. Scaling up the programme and integrating it into licensing requirements, using literacy-sensitive and tiered approaches, would enhance sustainability and inclusivity. Provision of essential infrastructure and ongoing monitoring, refresher training, and multi-stakeholder collaboration are crucial to sustain behavioural change and ensure long-term public health impact.

Key words: Health Belief Model, street food vendors, food safety training

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INTRODUCTION

Street food vending constitutes an essential sector of urban food systems in several developing countries, providing affordable meals and employment opportunities to socioeconomically disadvantaged residents [1]. The sector sustains the livelihoods of vendors and their households [2]. In Nigeria, various low-cost foods are widely available through street vendors in major urban centres [3]. Despite its socioeconomic importance, the unregulated and informal nature of street food vending renders it vulnerable to food safety risks [4]. Inadequate access to affordable, context-appropriate food safety training remains a persistent challenge [5]. For example, in the Zululand District of South Africa, 77% of vendors had not received any formal food safety training, primarily due to limited availability and high costs of industry-based courses [4]. Low risk perception among vendors and weak regulatory monitoring further constrains training uptake [6, 7].

Insufficient training is strongly associated with poor hygiene practices, including inadequate personal hygiene, improper temperature control, cross-contamination, and deficient environmental sanitation [8]. These gaps increase the likelihood of food contamination and foodborne disease outbreaks [9], which impose significant public health and economic burdens through healthcare costs, productivity losses, and, in severe cases, mortality [10]. Food safety incidents may also expose vendors to regulatory sanctions and legal liability [11]. Consequently, policy frameworks increasingly advocate mandatory food safety training as a prerequisite for licensing and operation [12]. Evidence demonstrates that structured training programmes improve vendors' knowledge, attitudes, and compliance with hygiene standards [13], while consistent inspection and clear guidelines further strengthen risk mitigation [14].

Comprehensive food safety training should address personal and food hygiene, cross-contamination prevention, cleaning and sanitation, temperature control, microbial hazards, allergens, and relevant food safety regulations [15, 16, 17]. Equipping vendors with this knowledge enhances their capacity to prevent foodborne hazards and protect consumer health [18]. In informal settings, tailored and context-specific interventions are particularly critical [19]. Accordingly, this study aimed to design and evaluate a contextually adapted food safety training programme for street food vendors in Oyo State, Nigeria, to strengthen hygiene practices and reduce food safety risks within this population [20].

RESEARCH METHODOLOGY

Research design and sampling

A mixed-methods, design-based research approach was used to conceptualise and evaluate a tailored food safety training programme for street food vendors in Ibadan,



Oyo State, Nigeria. The study employed a one-group pre-test/post-test quasi-experimental design to assess changes in food safety knowledge following the intervention, a design suitable for real-world informal settings where randomisation is impractical. Ibadan, a major urban centre with extensive informal food vending activities, provided the study context. Street food vendors were recruited through local vendor networks and community engagement. Inclusion criteria were ≥ 5 years of vending experience, active vending within selected areas of Ibadan, and no prior formal food safety training. Vendors unable to attend the full training or unwilling to provide consent were excluded. A total of 42 eligible vendors voluntarily participated.

The training curriculum was guided by the Health Belief Model [41] and aligned with the World Health Organisation Five Keys to Safer Food framework to ensure comprehensive coverage of essential food safety principles (Appendix 1) [32, 40]. Modules addressed personal hygiene, food hygiene, cross-contamination prevention, safe cooking and storage temperatures, microbial hazards and foodborne diseases, and cleaning and sanitation practices (Figure 1). Materials were adapted to the informal vending context using simplified language, visual aids, demonstrations, and participatory discussions to accommodate varying literacy levels. The intervention consisted of a three-day, face-to-face training programme conducted from 5–7 December, 2022, incorporating lectures, practical demonstrations, scenario-based discussions, and interactive sessions, delivered by researchers with expertise in food safety and public health. Attendance was monitored to ensure full participation.

Data collection and analysis

Food safety knowledge was assessed using a structured, validated questionnaire by three food safety research experts, covering personal hygiene, food hygiene, temperature control, foodborne diseases, and environmental sanitation (Appendix 2). Responses were scored dichotomously (1 = correct; 0 = incorrect) and administered immediately before (pre-test) and after (post-test) the training. Internal consistency reliability was assessed using Cronbach's alpha for all knowledge scales before and after training. Pre-training alpha values ranged from 0.68 to 0.73, indicating acceptable internal consistency overall, although the Cooking & Storage Temperature scale showed borderline reliability ($\alpha = 0.68$). Post-training, reliability improved across all scales, with values ranging from 0.75 to 0.81. Personal Hygiene Knowledge ($\alpha = 0.81$) and Microbial Hazard Knowledge ($\alpha = 0.80$) demonstrated good internal consistency, while Food Hygiene Knowledge ($\alpha = 0.78$) and Cooking & Storage Temperature ($\alpha = 0.75$) showed acceptable reliability. Overall, all scales met acceptable reliability thresholds, with improvement observed following the training intervention. Data were analysed using R (version 4.5.2; R Core Team). Descriptive statistics summarised participant characteristics and knowledge scores.

For pre-/post-training comparisons, assumptions for paired t-tests were assessed using the Shapiro–Wilk normality test and the 1.5×IQR rule for extreme outliers. Where assumptions were met, paired t-tests with Cohen’s d_z were applied; otherwise, Wilcoxon signed-rank tests with rank-based effect size r were used. Statistical significance was set at two-sided $\alpha = 0.05$. Ethical approval was obtained from the University of South Africa CAES Health Research Ethics Committee (Ref: 2021/CAES_HREC/037) and permission from the Oyo State Ministry of Health. Participation was voluntary, with written informed consent obtained, and confidentiality maintained throughout.

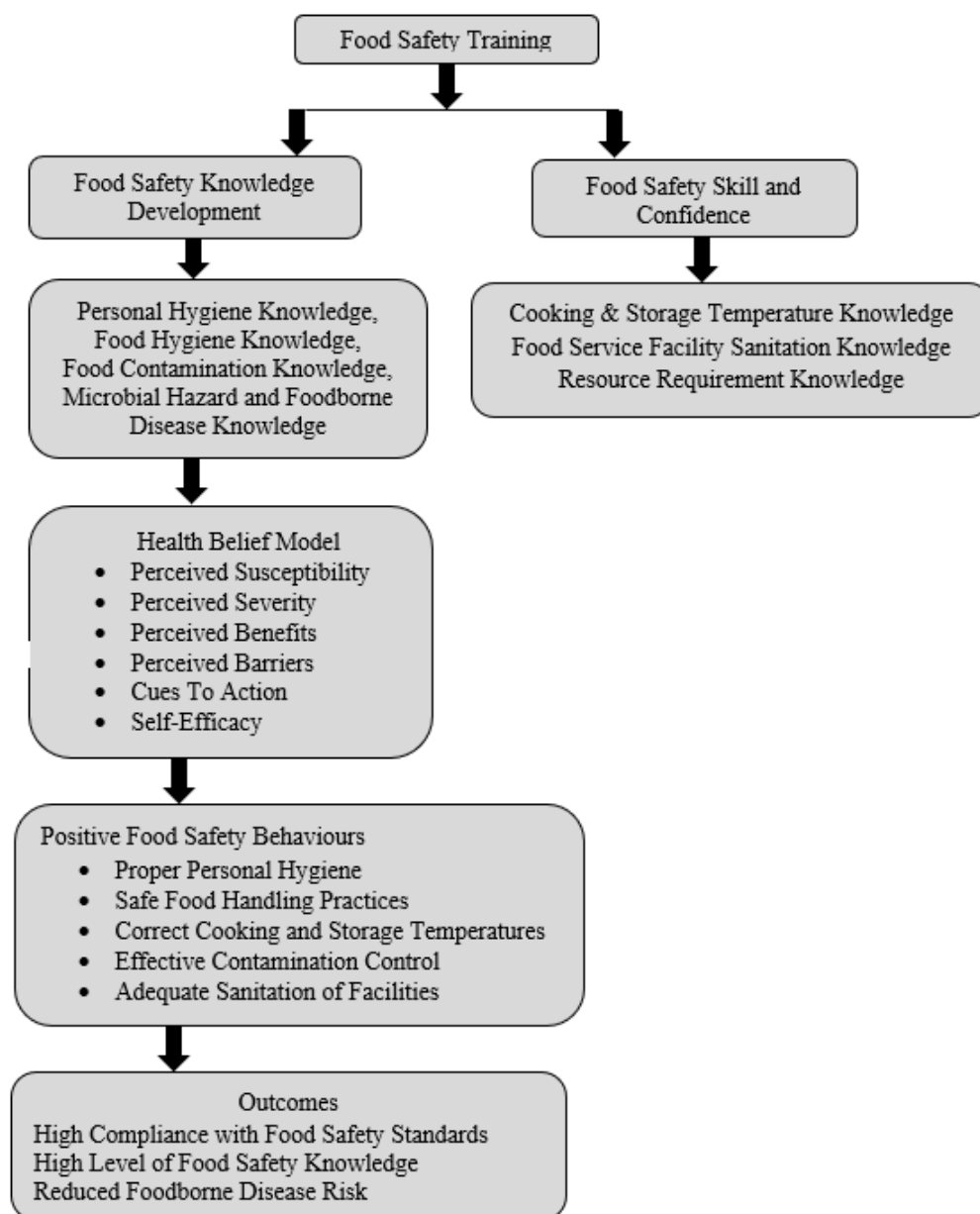


Figure 1: The Health Belief Model (HBM) (Rosenstock, Strecher & Becker) [41]

RESULTS AND DISCUSSION

Socio-demographic details of street food vendors

The socio-demographic profile of the participating street food vendors is summarised in Table 1. The sample was overwhelmingly female (90.5%), with men accounting for only 9.5% of respondents. The predominance of women in this sector aligns with social and cultural expectations in many African communities, where food preparation responsibilities are typically assigned to girls and women from early childhood [21]. This trend is consistent with observations from other African contexts—for example, female representation in street food vending has been reported at 59.6% in South Africa and 90.2% in Nigeria [22]. The age distribution further indicates that a large proportion of participants were 35 years or older (90.5%). This suggests that street food vending frequently serves as a long-term livelihood strategy for adults with limited access to formal employment opportunities or advanced educational qualifications [23]. Similar age patterns have been noted in South Africa's Zululand District, where more than half of the vendors surveyed were over the age of 35 [4]. A majority of the respondents were unmarried (71.4%), a trend often associated with economic hardship and unstable employment conditions that can hinder long-term financial planning [24].

Educational attainment among the vendors was generally low. Most had completed only primary school (71.4%), with smaller proportions reporting no formal education (23.8%) or secondary schooling (4.8%). Such limited educational backgrounds are frequently linked to financial barriers and systemic socioeconomic challenges [25]. Consequently, individuals with restricted schooling often turn to informal sector activities such as food vending, which provide accessible income-earning opportunities with few entry requirements [26]. Despite the low formal education levels, most vendors had substantial experience in the trade. Approximately 76.2% had worked in the street food sector for more than 11 years, demonstrating the stability and sustainability of vending as a long-term economic activity. The relatively low start-up costs, flexible work hours, and absence of formal employment prerequisites make street vending an attractive option for many [27]. Importantly, none of the vendors reported having any formal qualifications in food service, hospitality, or food safety, nor had they attended food safety training prior to the study. This reflects a broader trend across informal food markets in low- and middle-income regions, where training opportunities are limited and often inaccessible [28, 29]. Comparable findings have been documented in Kenya's Kiambu County, where 93% of surveyed vendors had never received formal food hygiene instruction [30].

Impact of food safety training

Post-training analyses demonstrated statistically significant improvements across all four evaluated domains—personal hygiene, food hygiene, cooking and storage temperature, and microbial hazard/foodborne disease awareness. In the area of personal hygiene, the data satisfied parametric assumptions, and a paired t-test revealed a substantial improvement ($t(41) = 11.47$, $p < 0.001$, Cohen's $d_z = 1.77$). This pronounced gain is consistent with earlier research suggesting that personal hygiene behaviours are generally easier to teach and reinforce in low-resource settings, given their visibility and immediate relevance to daily routines [1,19]. For food hygiene, the distribution of paired differences was non-normal due to an extreme outlier; accordingly, a Wilcoxon signed-rank test confirmed a significant improvement ($V = 0$, $p = 4.21 \times 10^{-8}$, $r = 0.88$). This elevated performance suggests that practical demonstrations, participation, group interaction, and simplified instruction were effective in helping vendors adopt safer food-handling practices [4, 31].

Similarly, cooking and storage temperature knowledge exhibited non-normality with notable outliers, necessitating the use of a Wilcoxon test, which confirmed significant improvement ($V = 33$, $p = 2.45 \times 10^{-6}$, $r = 0.80$). Despite the clear post-training gains, temperature control remains a challenging domain for many street vendors, largely due to inconsistent electricity, the need for thermometers, and cold-chain maintenance—resources that are often limited or unreliable in informal environments [16]. For microbial hazard and foodborne disease awareness, although normality criteria were largely met, the presence of an extreme outlier justified a Wilcoxon test, which again showed a significant improvement ($V = 14.5$, $p = 9.39 \times 10^{-8}$, $r = 0.84$). The high effect size indicates that the use of relatable examples and culturally attuned explanations likely enhanced retention of pathogen-related concepts, World Health Organisation Five Keys to Safer Food framework [32]. Collectively, these findings confirm that the training intervention meaningfully improved food safety knowledge across all domains, using the Health Belief Model (HBM) as a framework (Figure 1).

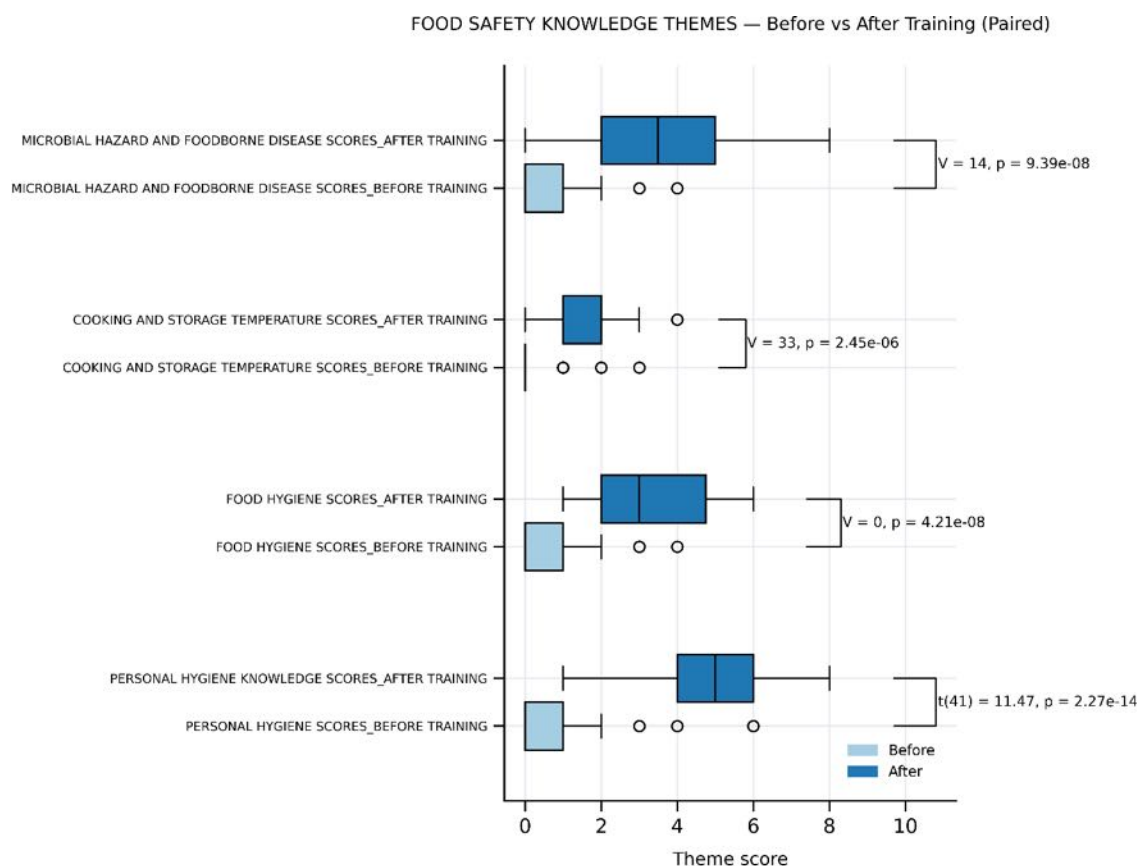


Figure 2: Effect of food safety training on knowledge scores of street food vendors across personal hygiene, food hygiene, temperature control, and foodborne disease awareness, analysed using paired t-tests and Wilcoxon signed-rank tests (N=42)

The distribution of knowledge scores before and after training also changed markedly. Pre-training scores clustered tightly between 0 and 5, revealing a uniformly low baseline knowledge, likely influenced by participants' similar socio-demographic backgrounds and limited exposure to formal food safety instruction [31]. This narrow distribution highlights a clear need for dedicated training interventions to address the risks associated with foodborne illnesses and to strengthen professional competence within the street food sector [4]. After the training, scores were more widely dispersed, ranging from approximately 7 to 15, indicating that although all participants benefited, the extent of learning varied among individuals (Figure 2). Such variation is commonly linked to differences in education level, literacy, and prior experience in food vending [26].



Figure 3: Histogram of Pre- and Post-Training Food Safety Competency Scores of street food vendors(N=42)

Participant-level score trajectories show consistent improvements across individuals, with most pre-training scores between 0 and 4 and post-training scores ranging from about 7 to 15 (Figure 3). This confirms that the training effectively enhanced food safety competency across the entire cohort. Paired comparisons further revealed that post-training scores were consistently higher than pre-training scores for every vendor. A Wilcoxon signed-rank test confirmed that this shift was statistically significant ($V = 0$, $p < 0.001$), demonstrating a pronounced improvement in overall knowledge following the intervention (Figure 4). The median score rose sharply from 1.0 to 10.0, with a maximum of 10.0, eliminating the near-zero baseline and reflecting the benefits of interactive, culturally tailored training approaches that combine demonstrations with guided practice [32, 33].

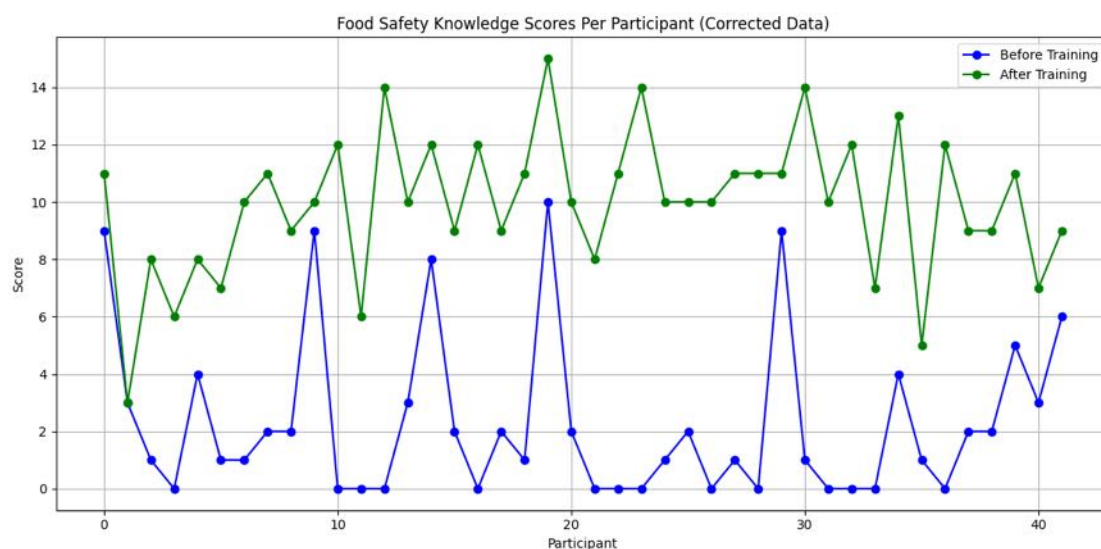


Figure 4: Food Safety Knowledge Scores Per Participant Before and After Training (N=42)

Pre- vs Post-Training Knowledge Scores (Paired)

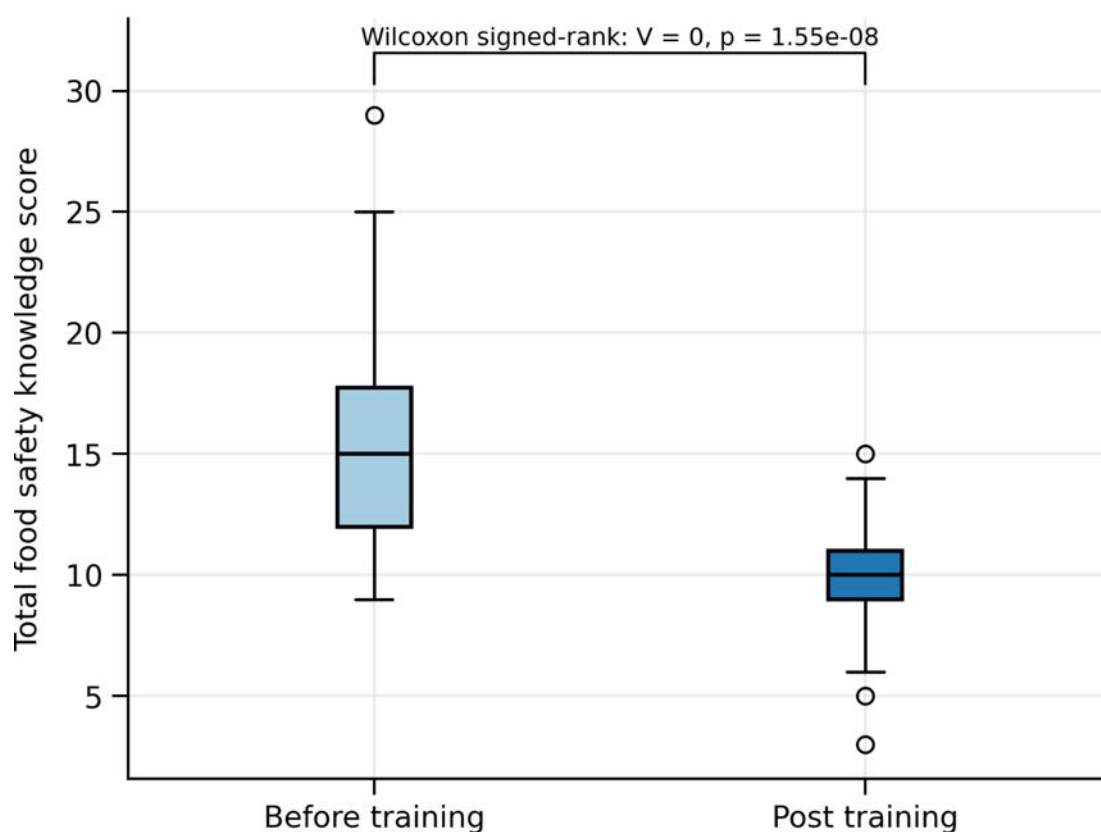


Figure 5: Boxplot of pre- and post-training food safety knowledge scores (N = 42). The Wilcoxon signed-rank test indicated a significant change ($V = 0$, $p < 0.001$). Values are paired per participant

Despite the general improvement, some variability persisted. Higher pre-training scores (approximately 8–10) suggest that a few participants may have had prior informal exposure to food safety concepts. Conversely, one post-training low outlier (approximately 3) indicates potential barriers such as functional illiteracy, learning difficulties, or a disconnect between instructional methods and participant needs [34]. These patterns highlight the limitations of standardised instruction and suggest the need for multi-tiered, literacy-independent training strategies supported by ongoing reinforcement [35, 36].

The study clearly demonstrates that structured, targeted food safety training can significantly improve the knowledge and practices of street food vendors, thereby contributing to better public health outcomes [37, 38]. However, persistent gaps—particularly in temperature control and storage—underscore the importance of complementing educational efforts with infrastructural support, regulatory oversight, and continuous community engagement. Addressing these barriers may require a combination of practical, low-cost tools, periodic refresher sessions, and stronger integration of training programmes into local food safety governance frameworks [1, 39]. By tackling both knowledge limitations and structural constraints, future interventions will be better positioned to promote sustainable, long-term improvements in food safety within the informal street food environment.

CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

This study demonstrates that street food vendors in the study population largely lack formal training in food service or food safety, with most having only primary education and no prior exposure to food safety instruction. However, these results only measure vendors' short-term retention, and a small sample size was used to confirm the effectiveness of the food safety training programme. Baseline assessments revealed consistently low knowledge, particularly in cooking and storage temperature control, posing significant public health risks. The conceptualised, interactive, and context-specific food safety training programme significantly improved participants' knowledge across all domains, with the median score rising from 1.0 to 10.0. Although individual improvements varied due to socio-demographic factors, the programme effectively elevated overall food safety competency. To sustain and expand these gains, the training should be scaled up and integrated into licensing requirements, using literacy-independent, tiered instruction to accommodate diverse educational backgrounds. Complementary infrastructure support, including access to thermometers, refrigeration, potable water, and sanitation facilities, is essential to enable practical implementation. Regular monitoring, refresher courses, and collaboration between regulatory authorities, health departments, and vendor associations are recommended to reinforce learning, promote peer support, and establish a culture of food safety.

Continuous evaluation of knowledge and practices will ensure the programme's relevance, effectiveness, and long-term impact on public health.

Author contributions

Oluwatoyin Wumi Alawode: The PhD student who, under supervision, conceptualised the research, carried out data collection, interpreted the results, and wrote the manuscript. Frederick Tawi Tabit: The supervisor who guided the student through the conceptualisation of the research, data collection, results interpretation and writing of the manuscript.

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Conflict of interest

The authors declare no conflict of interest.

Table 1: Socio-demographic characteristics of street food vendors (N=42)

Demographic Characteristics		N (%)
1 Gender	Male	4 (9.5)
	Female	38 (90.5)
2 Age:	18-35	4 (9.5)
	36-55	28 (66.7)
	56-65	10 (23.8)
3 Marital Status	Married	10 (23.8)
	Not married	30 (71.4)
	Separated	0 (0.0)
	Divorced	2 (4.8)
	Widowed	0 (0.0)
4 Level of education	No formal education	10 (23.8)
	Primary school (grades 1-7)	30 (71.4)
	High school (grades 8-12)	2 (4.8)
	Tertiary education	0 (0.0)
5 Period of selling food (years)	Less than 5 years	0 (0.0)
	5–10 years	10 (23.8)
	11–15 years	20 (47.6)
	More than 15 years	12 (28.6)
6 Foodservice/ hospitality diploma/degree	Yes	0 (0.0)
	No	42 (100.0)
7 Food safety training attended	Yes	0 (0.0)
	No	42 (100.0)

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Appendix



UNISA-CAES HEALTH RESEARCH ETHICS COMMITTEE

Date: 16/11/2023

Dear Ms Alawode

NHREC Registration # : REC-170616-051
REC Reference # : 2021/CAES_HREC/037
Name : Ms OW Alawode
Student # : 49371347

**Decision: Ethics Approval
Confirmation after First Review
from 04/03/2021 to 28/02/2026**

Researcher(s): Ms OW Alawode
49371347@mylife.unisa.ac.za

Supervisor (s): Prof FT Tabit
tabitft@unisa.ac.za; 011-471-2080

Working title of research:

The food safety knowledge of street food vendors and the implementation of food safety policies and procedures in Oyo State, Nigeria

Qualification: PhD Consumer Science

Thank you for the submission of your yearly progress report to the Unisa-CAES Health Research Ethics Committee for the above mentioned research. Ethics approval is confirmed to continue for the originally approved period, subject to submission of yearly progress reports. **Failure to submit the progress report will lead to withdrawal of the ethics clearance until the report has been submitted.**

Due date for next progress report: 31 October 2024

The progress report form can be downloaded from the college ethics webpage:

<https://www.unisa.ac.za/sites/corporate/default/Colleges/Agriculture-&-Environmental-Sciences/Research/Research-Ethics>

*The **medium risk application** was originally **reviewed** by the UNISA-CAES Health Research Ethics Committee on 04 March 2021 in compliance with the Unisa Policy on*



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Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No field work activities may continue after the expiry date. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **2021/CAES_HREC/037** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,



Prof MA Antwi
Chair of UNISA-CAES Health REC

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