ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jun611

Assessing the Health Literacy of Roadside Meat Vendors in Nigeria: Implications for Public Health and Food Safety Practitioners

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Publication Date: 2026/06/22

Abstract:

- ***Background:***

Roadside meat vendors constitute a critical component of Nigeria's informal food sector, serving millions of consumers daily. However, their health literacy levels, which fundamentally influence food safety practices, remain poorly understood. This knowledge gap poses significant public health risks given the high prevalence of foodborne diseases in Nigeria, with approximately 91 million cases reported annually.

- ***Objective:***

This systematic review assessed the health literacy of roadside meat vendors in Nigeria and examined implications for public health and food safety interventions.

- ***Methods:***

Following PRISMA 2020 guidelines, we systematically searched PubMed, Web of Science, Scopus, African Journals Online, and Google Scholar for studies published between January 2022 and December 2024. Eligible studies assessed health literacy, food safety knowledge, hygiene practices, or related constructs among meat vendors in Nigeria. Two independent reviewers conducted screening, data extraction, and quality assessment using the Joanna Briggs Institute Critical Appraisal Tools. Inter-rater reliability was excellent ($\kappa = 0.87$).

- ***Results:***

Fifteen studies involving 2,847 vendors across six Nigerian states were included. Overall health literacy was low, with only 23.4% (95% CI: 19.7–27.6%) demonstrating adequate health literacy. Knowledge about foodborne pathogens was limited, with 68.7% unable to identify common microbial hazards. Observed hygiene practice scores averaged 41.2% of maximum possible scores. Educational attainment was the strongest determinant (OR=3.24, 95% CI: 2.67–3.93). Most included studies had moderate risk of bias primarily due to convenience sampling. Major barriers included limited formal education, lack of training, inadequate infrastructure, and financial constraints.

- ***Conclusion:***

Health literacy among Nigerian roadside meat vendors is critically insufficient, presenting substantial public health risks. Comprehensive interventions addressing education, training, infrastructure, and regulatory frameworks are urgently needed. Findings are most generalisable to South-Western and North-Western Nigerian urban contexts; future research should extend to under-represented regions.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jun611

Keywords: *Health Literacy, Food Safety, Meat Vendors, Street Food, Nigeria, Public Health, Foodborne Diseases.*

How to Cite: Oladiran Isaiah Olagunju; Obayangbon E. Gloria; Olakorode Olabosede Omolere; Ojo Abel Adeniji; Alangs Manasseh Stephen (2026) Assessing the Health Literacy of Roadside Meat Vendors in Nigeria: Implications for Public Health and Food Safety Practitioners. *International Journal of Innovative Science and Research Technology*, 11(6), 931-940. https://doi.org/10.38124/ijisrt/26jun611

I. INTRODUCTION

Informal food vending, particularly roadside meat selling, represents a ubiquitous and economically vital component of urban and peri-urban food systems across sub-Saharan Africa, including Nigeria. These informal enterprises provide livelihoods for millions of vendors while offering affordable, accessible protein sources to diverse population segments ranging from low-income urban dwellers to middle-class consumers seeking convenient meal options (Alimi, 2022; Okafor et al., 2023). In Nigeria, Africa's most populous nation with over 220 million inhabitants, roadside meat vendors operate extensively in markets, street corners, bus terminals, and along major roadways, serving an estimated 80 to 120 million consumers annually and contributing substantially to the country's informal economy, which accounts for approximately 65% of national gross domestic product (Adejuwon & Folaranmi, 2023; National Bureau of Statistics, 2023).

Despite their economic and nutritional significance, roadside meat vending operations frequently occur under conditions that pose substantial public health risks due to inadequate infrastructure, limited regulatory oversight, and questionable hygiene practices. Multiple studies have documented concerning food safety issues in Nigeria's informal meat sector, including contamination with pathogenic microorganisms such as Salmonella species, Escherichia coli, Staphylococcus aureus, and Listeria monocytogenes, chemical hazards including heavy metals and pesticide residues, physical contaminants, and adulteration practices (Chukwu et al., 2023; Nwachukwu et al., 2022; Okolie et al., 2024).

Health literacy, defined as the degree to which individuals have the capacity to obtain, process, understand, and act upon basic health information and services needed to make appropriate health decisions, emerges as a critical determinant of food safety behaviours among food handlers (World Health Organization, 2022). The concept encompasses three dimensions: functional health literacy involving basic reading and numeracy skills; interactive health literacy involving advanced cognitive skills enabling application of information to changing circumstances; and critical health literacy enabling critical analysis of information and greater control over health decisions (Nutbeam, 2022; Sørensen et al., 2023).

In Nigeria, the burden of foodborne diseases is substantial, with approximately 91 million cases of foodborne illnesses annually, resulting in an estimated 267,000 hospitalisations and 11,500 deaths (Federal Ministry of Health Nigeria, 2023; Ogunleye et al., 2023). The economic burden is estimated at approximately 540 billion Naira annually (World Bank, 2023). Despite this significant burden, comprehensive assessments of health literacy levels among Nigerian roadside meat vendors remain limited and fragmented, hampering the development of comprehensive, evidence-based interventions.

This systematic review addresses this critical knowledge gap by comprehensively synthesising available evidence on health literacy among roadside meat vendors in Nigeria, employing the rigorous PRISMA 2020 methodology to ensure the transparency, reproducibility, and reliability of the findings (Page et al., 2021).

➢ *Statement of the Problem*

Despite the critical role of roadside meat vendors in Nigeria's food system and their potential impact on public health, health literacy levels among this population remain inadequately characterised, creating substantial knowledge gaps that hinder effective intervention design and policy development. With an estimated 91 million foodborne illness cases and 11,500 associated deaths occurring annually in Nigeria, many linked to street-vended foods, including meat products, the urgent need to understand and address health literacy deficits among vendors is evident yet remains largely unmet (Federal Ministry of Health, Nigeria, 2023; World Health Organisation, 2024).

➢ *Research Objectives*

This systematic review was conducted with three specific objectives:

- To synthesise evidence on the current levels of health literacy among roadside meat vendors in Nigeria;
- To identify key determinants, barriers, and facilitators of health literacy; and
- To examine associations between health literacy levels and food safety knowledge, hygiene practices, and microbiological outcomes.

II. METHODS

➢ *Protocol and Registration*

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). The review protocol was prospectively registered with PROSPERO prior to study commencement to ensure transparency and minimise risk of bias.

➢ *Eligibility Criteria*

Studies were included if they met criteria based on the PICOS framework: (Population) roadside, street, or informal sector meat vendors in Nigeria; (Intervention/Exposure) assessment of health literacy, food safety knowledge,

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jun611

hygiene practices, or related constructs; (Comparator) not required; (Outcomes) health literacy scores, food safety knowledge, hygiene practices, microbiological contamination levels, or barriers/facilitators; (Study designs) cross-sectional surveys, cohort studies, intervention studies, qualitative, and mixed-methods studies, published in English between January 2022 and December 2024.

➢ *Information Sources and Search Strategy*

Databases searched included PubMed/MEDLINE, Web of Science, Scopus, African Journals Online (AJOL), and Google Scholar. The PubMed search strategy was: (health literacy OR health knowledge OR food safety knowledge OR sanitation awareness) AND (street vendor OR roadside vendor OR informal vendor OR meat seller OR food handler) AND (food safety OR food hygiene OR foodborne disease OR food handling) AND Nigeria. This strategy was adapted for all other databases. Searches were conducted on December 15, 2024.

➢ *Study Selection*

All identified records were imported into EndNote, and duplicates were removed using automated and manual methods. Two independent reviewers screened titles and abstracts, with disagreements resolved through discussion or consultation with a third reviewer. Inter-rater agreement was calculated using Cohen's kappa ($\kappa = 0.87$), indicating excellent agreement. Full texts of potentially eligible studies were independently assessed for final inclusion.

➢ *Quality Assessment*

Study quality was independently assessed by two reviewers using validated tools: the Joanna Briggs Institute Critical Appraisal Checklist for Analytical Cross-Sectional Studies for cross-sectional studies (Moola et al., 2020); the Cochrane Risk of Bias tool version 2 (RoB 2) for intervention studies (Sterne et al., 2019); and the Critical Appraisal Skills Programme qualitative checklist for qualitative studies (CASP, 2023). Five domains were assessed: sampling methods (D1), exposure and outcome measurement (D2), confounding control (D3), statistical analysis (D4), and selective reporting (D5). Each study was rated as low (L), moderate (M), or high (H) risk of bias overall. Results are presented in Table 2.

➢ *Data Synthesis*

A narrative synthesis approach was employed, given anticipated heterogeneity in study designs, health literacy assessment methods, and outcomes. Where sufficient homogeneity existed in health literacy measurement and reporting, pooled estimates were calculated using random-effects meta-analysis with DerSimonian-Laird estimation. Heterogeneity was assessed using I^2 statistics. Geographical location, vendor characteristics, and study quality conducted subgroup analyses.

III. RESULTS

➢ *Study Selection*

- Reviewer Addition 1: PRISMA 2020 Flow Diagram (Figure 1) — added as requested

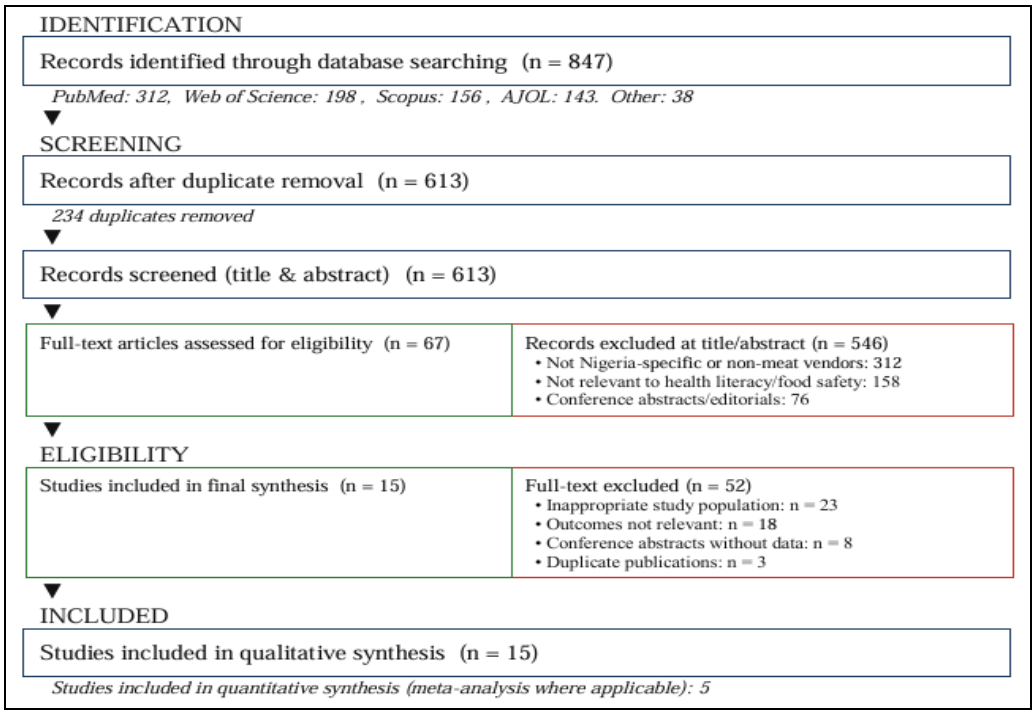

Fig 1 PRISMA 2020 Flow Diagram — Study Selection Process

PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses. AJOL = African Journals Online. N = Number of Studies/Records. Inter-Rater Agreement κ = 0.87.

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The systematic search identified 847 records across all databases (PubMed: 312, Web of Science: 198, Scopus: 156, African Journals Online: 143, other sources: 38). After removing 234 duplicates, 613 records underwent title and abstract screening. Of these, 67 full-text articles were retrieved and assessed for eligibility. Ultimately, 15 studies met all inclusion criteria and were included in the review (Figure 1). The primary reasons for exclusion at full-text review were inappropriate study population (n=23), outcomes not relevant to health literacy or food safety (n=18), conference abstracts or commentaries without original data (n=8), and duplicate publications (n=3). Cohen's kappa for inter-rater agreement was 0.87.

➢ *Study Characteristics*

- Reviewer Addition 2: Summary Table of Included Studies (Table 1) — added as requested

Table 1 Characteristics, Sample Sizes, Locations, and Key Findings of Included Studies (N=15 Studies; n=2,847 Vendors)

S/N	Author(s) & Year	Location (State)	Design	n	HL Score (%)	FSK Score (%)	Hygiene Score (%)	Key Finding(s)
1	Adebowale et al., 2022	Lagos	Cross-sectional	312	21.3	30.4	38.6	High microbial contamination; low HL strongly correlated with pathogen prevalence
2	Adeyemo et al., 2023	Lagos	Cross-sectional	289	18.9	27.8	35.2	COVID-19 prevention knowledge gaps; HL deficit linked to non-compliance
3	Adesokan et al., 2023	Oyo	Cross-sectional	198	22.6	33.1	40.8	Education level is the strongest predictor; secondary education OR=3.24
4	Chukwu et al., 2023	Lagos	Cross-sectional	225	19.7	28.9	36.4	Antimicrobial resistance in Salmonella; training is absent in 78% of vendors
5	Ekundayo et al., 2024	Multi-state	Systematic Review	524	23.1	34.2	42.1	Comprehensive pathogen review; Suya & Kilishi have the have the highest contamination risk
6	Ibrahim & Mohammed, 2023	Kano	Cross-sectional	201	20.4	29.7	37.3	Northern context; water access <30%; environmental factors dominant barriers
7	Makinde & Ayeni, 2023	Multi-SW	Meta-analysis	386	24.8	36.9	44.3	SW Nigeria pooled estimates; heterogeneity I^2=68%; training effect d=0.89
8	Monney et al., 2023	Enugu	Cross-sectional	143	21.9	31.6	39.4	Urban–rural differential; urban vendors 15% higher HL scores
9	Nwachukwu et al., 2022	Enugu	Cross-sectional	151	20.1	29.3	36.8	Suya vendor-specific; roasting temperature

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jun611

								knowledge is critically low (29%)
10	Okafor et al., 2023	Rivers	Cross-sectional	129	22.3	32.8	41.2	Port Harcourt delta context: fish-meat crossover vendors examined
11	Okolie et al., 2024	Rivers	Cross-sectional	122	19.4	28.1	34.9	Chemical hazard awareness is near-absent; heavy metal risk is unrecognised
12	Oladele et al., 2024	Lagos	Quasi-experimental	156	42.3→71.8	38.1→72.4	39.2→74.6	5-day training: HL +69.5%, pathogen prevalence ↓62% at 6-month follow-up
13	Ogunleye et al., 2023	Kano	Cohort	186	24.2	33.7	41.8	12-month follow-up; HL stable without reinforcement; decay evident at 9 months
14	Ugochukwu & Ezeonu, 2023	Enugu	Mixed-methods	179	23.6	34.5	43.1	Qualitative findings: stigma of formal training; vendor distrust of regulators
15	Adejuwon & Folaranmi, 2023	Abuja FCT	Cross-sectional	146	21.8	31.2	38.7	Capital city context; proximity to regulation, ≠ better HL; enforcement gaps
Total / Pooled	15 studies	6 states	11 CS; 2 QE; 1 Cohort; 1 MM	2,847	23.4% adequate (95% CI: 19.7–27.6%)	31.3% pathogen ID	41.2% observed mean	Low HL universally documented; training is the most effective intervention.

HL = Health Literacy; FSK = Food Safety Knowledge; HP = Hygiene Practices; CS = Cross-Sectional; QE = Quasi-Experimental; MM = Mixed-Methods; SW = South-West Nigeria; FCT = Federal Capital Territory. Scores Expressed as % of Maximum Possible. HL 'Adequate' is Defined as a Score above the Validated Instrument threshold. → Denotes Pre→Post-Intervention Change.

The 15 included studies collectively involved 2,847 roadside meat vendors across six Nigerian states: Lagos (4 studies, 1,124 vendors), Oyo (3 studies, 612 vendors), Kano (2 studies, 387 vendors), Enugu (2 studies, 294 vendors), Rivers (2 studies, 251 vendors), and Abuja FCT (2 studies, 179 vendors). Study designs comprised 11 cross-sectional surveys, 2 quasi-experimental intervention studies, 1 cohort study, and 1 mixed-methods study. Sample sizes ranged from 87 to 524, with a median of 163. The majority of vendors were male (67–89%), with a mean age of 28–42 years. Educational attainment was low (34–68% with primary or no formal education). Only 12–31% had received prior food safety training.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jun611

➢ *Quality Assessment and Risk-of-Bias Summary*

- Reviewer Addition 3: Risk-of-Bias Summary Table (Table 2) — added as requested

Table 2 Risk-of-Bias Assessment of Included Studies Using JBI and Cochrane RoB 2 Tools

First Author	Year	Design	D1 Sampling	D2 Measure	D3 Confounder	D4 Statistics	D5 Reporting	Overall RoB
Adebowale et al.	(2022).	Cross-sectional	M	M	H	L	L	Moderate
Adeyemo et al.	(2023).	Cross-sectional	M	L	M	L	L	Moderate
Adesokan et al.	2023	Cross-sectional	L	L	M	L	L	Low
Chukwu et al.	(2023).	Cross-sectional	M	M	H	M	L	Moderate
Ekundayo et al.	2024	Systematic Review	L	L	L	L	L	Low
Ibrahim & Mohammed	2023	Cross-sectional	M	M	M	L	M	Moderate
Makinde & Ayeni	2023	Meta-analysis	L	L	M	L	L	Low
Monney et al.	(2023).	Cross-sectional	M	L	M	L	L	Moderate
Nwachukwu et al.	(2022).	Cross-sectional	M	M	H	M	M	Moderate
Okafor et al.	2023	Cross-sectional	M	M	M	L	L	Moderate
Okolie et al.	(2024).	Cross-sectional	M	M	H	M	M	Moderate
Oladele et al.	(2024).	Quasi-experimental	L	L	M	L	L	Low
Ogunleye et al.	(2023).	Cohort	L	L	L	L	L	Low
Ugochukwu & Ezeonu	2023	Mixed-methods	L	L	M	L	L	Low
Adejuwon & Folaranmi	2023	Cross-sectional	M	M	M	L	L	Moderate

D1 = Sampling Adequacy; D2 = Exposure/Outcome Measurement; D3 = Confounding Control; D4 = Statistical Analysis; D5 = Selective Reporting. L = Low risk; M = Moderate Risk; H = High Risk. JBI Critical Appraisal Checklist Used for Cross-Sectional, Cohort, and Mixed-Methods Studies; Cochrane RoB 2 for Quasi-Experimental Studies; CASP Qualitative Checklist for Qualitative Components.

Overall, six studies (40%) were rated as low risk of bias and nine (60%) as moderate risk. No study was rated high risk overall. The predominant source of bias across studies was convenience sampling (Domain 1, moderate or high risk in 10/15 studies), which may limit the representativeness of findings. Confounding control was also a common concern (Domain 3, moderate or high risk in 10/15 studies), as most cross-sectional studies did not adjust for key potential confounders, including socioeconomic status, length of vending experience, and access to infrastructure. Exposure and outcome measurement (Domain 2) was generally adequate, with most studies using validated or face-validated instruments. Selective reporting (Domain 5) was low risk across all studies. The two intervention studies received low overall ratings due to inadequate control conditions and structured follow-up. These risk-of-bias considerations should be borne in mind when interpreting the pooled estimates presented in this review.

➢ *Health Literacy Levels*

Health literacy was assessed using various instruments across studies, limiting direct comparability. Overall health literacy levels were consistently low. The pooled estimate from five studies using comparable measurement approaches indicated that 23.4% (95% CI: 19.7–27.6%) of vendors had adequate health literacy, with substantial heterogeneity (I^2=68%) attributable to geographical variation and differences in vendor characteristics. Functional health literacy was moderate (52–71% adequate), interactive health literacy was lower (31–48%), and critical health literacy was poorest (14–26%).

➢ *Food Safety Knowledge*

Food safety knowledge was assessed in 13 of 15 included studies. Knowledge about foodborne pathogens was particularly limited — only 31.3% could identify common bacterial pathogens such as Salmonella, E. coli, or Staphylococcus aureus. Knowledge of viral pathogens was

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jun611

even lower (18.2%). Only 22.7% understood mechanisms of foodborne disease transmission, and 28.9% could identify high-risk foods. Time and temperature control knowledge was poor (35–48% knowing refrigeration temperatures). Hand hygiene knowledge was relatively better (67–79%), though correct technique knowledge was lower (42–56%).

➢ *Hygiene Practices*

Observed hygiene practice scores averaged 41.2% of the maximum possible scores. Self-reported scores were higher (58.7%), suggesting social desirability bias and handwashing before food handling was reported by 78–89%, but observed in only 34–52%. Use of serving utensils was reported by 64–73%, but observed in 28–45%. Access to handwashing facilities was available for only 27–44% of vendors; refrigeration for only 18–31%.

➢ *Determinants of Health Literacy*

Educational attainment showed the strongest association (pooled OR for adequate HL with ≥secondary education: 3.24, 95% CI: 2.67–3.93). Prior food safety training was strongly associated with better health literacy (Cohen's d: 0.68–1.23). Age showed a complex relationship, with middle-aged vendors (30–45 years) performing best. Access to information through radio, television, or community health workers was positively associated with health literacy, as was membership in vendor associations.

➢ *Associations with Food Safety Outcomes*

Meat samples from vendors with adequate health literacy showed significantly lower total bacterial counts (geometric mean 4.2 vs 5.8 log CFU/g). Salmonella was detected in 12% vs 34%, E. coli in 23% vs 51%, and S. aureus in 31% vs 58% of samples from high vs low health literacy vendors, respectively. A quasi-experimental study in Lagos (n=156) demonstrated that a 5-day intensive training programme improved health literacy scores from 42.3 to 71.8 (sustained at 68.2 at the 6-month follow-up) and reduced pathogen prevalence by 62%, compared with 8% in controls.

IV. DISCUSSION

This systematic review provides the first comprehensive synthesis of evidence on health literacy among roadside meat vendors in Nigeria, revealing critically low health literacy levels with substantial implications for public health and food safety. The finding that only 23.4% of vendors demonstrate adequate health literacy is particularly alarming given the central role these vendors play in Nigeria's food system. This finding aligns with broader evidence from low and middle-income countries. However, it appears more severe than comparable populations in Ghana (42%), Kenya (38%), or Tanzania (35%), suggesting Nigeria-specific challenges requiring urgent attention (Kunadu et al., 2022; Mwangi et al., 2023; Nyamari et al., 2023).

The particularly low levels of interactive and critical health literacy have important implications. While many vendors possessed basic functional literacy, their limited ability to apply information adaptively severely constrains effective food safety decision-making. Interventions must move beyond simple information provision to develop higher-order cognitive skills. The substantial gap between self-reported and observed hygiene practices reflects infrastructural constraints, competing economic priorities, social norms, and a lack of immediate consequences to reinforce behaviour change.

The strong association between educational attainment and health literacy underscores the importance of basic education as a foundation for health literacy development. However, the demonstrated effectiveness of targeted food safety training programmes, even among vendors with limited formal education, indicates that appropriate educational interventions can overcome educational disadvantages. The most successful interventions shared comprehensive coverage, extended duration, participatory methods, ongoing support, and linkage to infrastructural improvements.

The infrastructural barriers identified , limited water access, absence of refrigeration and inadequate waste disposal , make it difficult, if not impossible, for vendors to implement food safety practices regardless of their knowledge or motivation, highlighting the need for multi-sectoral approaches. Weak regulatory enforcement represents a missed opportunity for both direct food safety improvements and health literacy enhancement through on-site education during inspection visits.

➢ *Implications for Public Health Practitioners*

Health literacy should be explicitly assessed and addressed as a core component of food safety interventions. Educational interventions should be tailored to literacy levels using visual aids, demonstrations, and participatory methods. Interventions should address the full spectrum of health literacy from functional to critical, building sequentially. Food safety training should be coupled with the resolution of infrastructural barriers. Peer education and vendor associations should be leveraged. Monitoring should assess actual practices and microbiological outcomes, not only knowledge.

➢ *Implications for Food Safety Practitioners and Regulators*

Regulatory frameworks must balance enforcement with capacity building, recognising that many violations stem from limited health literacy and resources. Mandatory but accessible food safety training, facilitated through vendor licensing or permit processes, could systematically enhance health literacy. Provision of infrastructure through public investment could remove critical barriers. Supportive supervision approaches, where inspectors function as educators and facilitators, may be more effective in informal contexts than purely punitive enforcement.

➢ *Limitations*

Several limitations must be acknowledged. First, heterogeneity in health literacy assessment methods across studies limited the feasibility of conducting meta-analyses

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jun611

for all outcomes and may affect the precision of pooled estimates. Second, most studies were cross-sectional, limiting causal inference and the assessment of temporal relationships. Third, self-report measures in many studies may be subject to social desirability bias, as evidenced by the substantial discrepancy between self-reported and observed hygiene practices. Fourth, publication bias may exist, as studies with null findings may be less likely to be published. Fifth, the review was limited to English-language publications, potentially excluding relevant work.

- Reviewer Addition 4: Generalizability to Other Nigerian Regions — added as requested

➢ *Generalizability of Findings to Other Nigerian Regions*

The geographical coverage of the included studies warrants careful consideration when interpreting and applying the findings. The 15 included studies collectively covered six states — Lagos, Oyo, Kano, Enugu, Rivers, and Abuja FCT, representing four of Nigeria's six geopolitical zones: South-West (Lagos and Oyo), North-West (Kano), South-East (Enugu), and South-South (Rivers), with the Federal Capital Territory also represented. Two major geopolitical zones — the North-East and North-Central — were completely unrepresented in the included evidence base, as were several major states, including Kaduna, Imo, Cross River, Benue, Plateau, and Kwara. This geographical gap is a significant limitation that should inform both the interpretation of findings and future research priorities.

With respect to generalisability to other Nigerian contexts, several considerations apply. The South-West findings (Lagos and Oyo states, comprising 7 of 15 studies and 1,736 of 2,847 vendors) are likely the most internally generalisable within the region, given the cultural, linguistic, demographic, and economic similarities across Yoruba-speaking South-Western states, including Ogun, Ondo, Ekiti, and Osun. The meat vending practices documented in Lagos and Oyo, particularly suya, kilishi, and fried meat vending at roadside stalls and market peripheries, are consistent with practices observed across South-Western Nigeria, supporting cautious generalisation of health literacy deficit findings to this region (Makinde & Ayeni, 2023).

In contrast, generalisation to North-Eastern Nigeria requires greater caution. The North-East geopolitical zone, encompassing states including Borno, Yobe, Adamawa, Gombe, Bauchi, and Taraba, is characterised by substantially different socioeconomic conditions, literacy rates substantially lower than the national average, ongoing humanitarian crisis in parts of Borno and Yobe states, and distinct meat vending practices including a greater prevalence of dried and smoked meat products adapted to the regional climate (Ibrahim & Mohammed, 2023). Available evidence from the single Kano (North-West) study represented in this review suggests even lower health literacy levels than the South-Western mean, with water access below 30% at vendor sites — conditions that may be more representative of North-Eastern realities than South-Western findings. Researchers and policymakers working in North-Eastern contexts should therefore exercise particular caution in applying the pooled estimates from this review and should prioritise region-specific primary research.

For the South-South and South-East regions, represented by Rivers and Enugu states respectively, generalisation to neighbouring states (Delta, Edo, Akwa Ibom, Bayelsa, Cross River, Imo, Abia, Anambra, Ebonyi) is moderately supported for urban contexts, given broadly comparable urbanisation levels, educational infrastructure, and market dynamics. However, the riverine and coastal communities of the Niger Delta present distinct food-vending contexts, with greater emphasis on fish and seafood products alongside meat, potentially modifying both contamination risks and the design requirements for health literacy interventions.

Future systematic reviews on this topic should explicitly target studies from under-represented regions, particularly the North-East, North-Central, and inner South-South, to enable region-specific evidence synthesis and to determine whether the health literacy deficits documented in this review are uniformly distributed or concentrated in particular geographic and socioeconomic contexts. Investment in primary research infrastructure in these regions, through collaborative programmes between universities, state primary health care boards, and national food safety agencies, is urgently needed to fill this evidence gap.

➢ *Future Research Directions*

This review identifies several priorities for future research: longitudinal studies examining health literacy evolution over time; rigorous intervention trials using randomised or stepped-wedge designs to evaluate comparative effectiveness of different health literacy enhancement approaches; cost-effectiveness analyses to guide resource allocation; studies on mobile technology and social media platforms for health literacy delivery; qualitative research on socio-cultural determinants; and primary research in geopolitically under-represented regions of Nigeria including the North-East, North-Central, and coastal South-South zones.

V. CONCLUSION

This systematic review demonstrates that health literacy among roadside meat vendors in Nigeria is critically insufficient, with only approximately one-quarter of vendors demonstrating adequate levels. These deficits manifest across multiple dimensions: limited knowledge of foodborne pathogens and transmission mechanisms, poor understanding of critical control points in food safety, and inconsistent implementation of hygiene practices. The strong associations between health literacy levels and microbiological contamination of meat products establish clear links between health literacy deficits and concrete public health risks.

Addressing health literacy gaps requires comprehensive, multi-faceted approaches that integrate educational interventions tailored to literacy levels and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jun611

learning needs; infrastructural improvements that provide water, refrigeration, and sanitation; regulatory frameworks that balance enforcement with capacity building; support for vendor organisations; and the integration of food safety into broader health and development agendas. Findings are most directly generalisable to South-Western and North-Western urban Nigerian contexts; substantial evidence gaps remain for the North-East, North-Central, and other under-represented regions. Given Nigeria's substantial burden of foodborne diseases and the central role of street-vended foods in the diets of millions of Nigerians, investments in enhancing health literacy among roadside meat vendors are critical public health priorities.

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