Global Academic and Scientific Journal of Multidisciplinary Studies (GASJMS)

Volume 3 | Issue 6, 2025 Journal Homepage: https://gaspublishers.com/gasjms/ ISSN: 2583-8970
Email: gaspublishers@gmail.com

Consumer Perception and Safety Assessment of Fortified Street Foods in Urban Nigeria: A Study of the Owerri Metropolis

Nlemchukwu Benedict Nwanneka C., Ejezie Michael Uche, Anyanwu Chidimma Gogo, Emele Chinenye Hyacinth, Nwachukwu Divine Chinenye

Department of Chemistry, University of Agriculture and Environmental Sciences, Umuagwo, PMB 1038, Owerri, Imo State, Nigeria.

Received: *20.06.2025* | ***Accepted:*** *22.07.2025* | ***Published:*** *27.07.2025*

***Corresponding Author:** Nlemchukwu Benedict Nwanneka C.

DOI: *10.5281/zenodo.16492355*

Abstract **Original Research Article**

This study investigated consumer perception and safety assessment of fortified street-vended foods within the Owerri metropolis of urban Nigeria. Given the vital role that street foods play in the daily diets of low- and middle-income populations, understanding consumers' views on their nutritional value and safety was considered essential. A descriptive survey design was adopted, targeting 200 respondents, of which 181 valid responses were retrieved and analysed using descriptive statistical methods. The findings revealed a generally low level of awareness regarding food fortification, with only 24.8% of respondents indicating familiarity with fortified foods. Despite this, the majority expressed confidence in the safety of fortified foods, particularly when certified by health authorities. Nutritional value (83.9%), hygiene, and food safety (54.6%) were rated as very important factors influencing purchasing decisions. Key concerns identified included poor vendor hygiene, microbial contamination, and improper food handling. Conversely, factors such as familiarity with vendors and proximity to vending locations were considered less important by most respondents. The study concluded that although fortified street foods had the potential to improve urban nutrition, gaps in public knowledge and vendor practices limited their impact. It recommended intensified public nutrition education, regular training for vendors on hygiene practices, and strengthened regulatory enforcement to improve food safety and increase the acceptance of fortified foods in urban Nigerian communities.

Keywords: Street Foods, Consumer Perception, Food Fortification, Food Safety, Nutrition, Owerri, Nigeria, Hygiene Practices.

Citation: Nwanneka, N. B., Uche, E. M., Gogo, A. C., Hyacinth, E. C., & Chinenye, N. D. (2025). Consumer perception and safety assessment of fortified street foods in urban Nigeria: A study of the Owerri Metropolis. *Global Academic and Scientific Journal of Multidisciplinary Studies (GASJMS), 3*(6), 13-22.

1. INTRODUCTION

Urban street foods are a vital component of Nigeria's informal food economy, providing affordable and accessible meals to a diverse population. In Owerri, the capital city of Imo State, Nigeria, like in many Nigerian cities, these ready-to-eat foods contribute significantly to daily energy and nutrient intake, bridging food security gaps for low-income earners, students, commuters, and workers. [1] in their research, they asserted that many diets remain deficient in micronutrients: for example, roughly one-third of under-5 children in Nigeria are vitamin-A deficient, and poverty and disease burdens exacerbate nutritional gaps. However, alongside their nutritional benefits, concerns regarding safety and quality frequently arise due to inadequate hygiene, environmental contamination, and insufficient regulatory oversight. Fortification of street foods, adding micronutrients such as iron, vitamin A, or iodine, offers a promising strategy to address micronutrient deficiencies in urban populations. Although global agencies like the Food and Agriculture Organisation (FAO) and the United Nations (UN) have recommended leveraging street-vended foods for nutrition intervention, empirical studies on consumer perceptions and the safety implications of such fortification programs in Nigeria remain limited. Understanding how consumers perceive fortified street foods, particularly about safety concerns, is critical before scaling such initiatives [2]. Consumer perception is influenced by several factors; Nigerian consumers often regard convenience and cost over strict food safety, especially when purchasing familiar, low-priced street foods. Studies conducted in cities like Ibadan and Benin have reported gaps in both vendor and consumer awareness of hygiene standards, with microbial and heavy-metal contamination frequently identified in Ready-To-Eat (RTE) foods. The prevalence of E. coli (a group of bacteria that are commonly found in the intestines of humans and animals), Salmonella (a common bacterial disease

that affects the intestinal tract), and heavy metals has heightened risks of acute foodborne illnesses and long-term health issues, including developmental delays and cancer. Safety assessment of fortified street foods must ideally encompass both consumer acceptability and potential health risks. Vendor hygiene practices, such as handwashing, proper storage, and food coverage, are inconsistent; for instance, only a small fraction of vendors receive formal food safety training, and unregulated environments near traffic and waste amplify contamination pathways. Combined with consumer unawareness, these factors underscore the need for a dual focus on sensory acceptance (e.g., taste, texture, recommended health benefits) and empirical safety evaluations (microbial, chemical, heavy-metal analysis) [3].

Furthermore, the potential for leveraging street-vended foods as vehicles for micronutrient delivery has gained traction, particularly in developing settings like Nigeria. Highway and transit vendors, common in the Owerri–Onitsha corridor, carry items such as fortified snacks to travelers at relaxation points, reflecting an existing informal fortification infrastructure that could be formalized. Yet, ensuring that micronutrient fortification retains stability under street conditions, characterized by heat, humidity, and variable packaging, is essential; degradation of vitamins and minerals during preparation and storage must be assessed. Safety assessments must also incorporate chemical risk dimensions. Studies in mid-west Nigerian cities, including Benin and Umunede, detected potentially toxic heavy metals like lead, cadmium, mercury, and aluminum, even in staple street foods, posing long-term health hazards like neurodevelopmental impairments and cancer. Given that the Owerrri rainforest climate favours microbial growth, fortified foods may be particularly vulnerable to both biological and chemical contamination if safety protocols are not rigorously implemented [4]. Understanding consumer behaviour and risk tolerance in the Owerri urban populace is pivotal. While research in Ibadan shows low food safety perception (mean score ~0.31), it's associated with significant economic and health costs (₦11,070/year in direct expenses; ₦12,500/year in lost time due to illness). Locally, consumer perception of hygiene and food safety correlates strongly with purchasing decisions: unclean vending environments deter buyers, while vendors with hygiene knowledge are better trusted [5]. Building on this evidence, the Owerri Metropolis Study employs a mixed-methods approach: microbial (e.g., E. coli, Salmonella) and chemical assays (heavy-metal panels) on fortified street food samples; alongside consumer surveys and focus groups probing attitudes, perceived benefits, safety concerns, and willingness to pay for fortified options. This comprehensive design aims to map the interplay between nutrient enhancement and real-world safety constraints. Therefore, by illuminating consumer trust, fortification efficacy, and contaminant risks within the street food landscape, this study seeks to inform policy, for instance, context-appropriate guidelines on fortificant forms, packaging, vendor hygiene training, and regulatory oversight. Ultimately, fostering fortified street-food programs that are nutritious, safe, and societally embraced could represent a scalable public health strategy in urban Nigeria.

1.1 Fortified Street Foods in Owerri Metropolis

Fortified street foods are foods that have been enhanced with additional vitamins and minerals to improve their nutritional value. This practice is a form of food fortification, where nutrients are added to common food items to address or prevent nutrient deficiencies within a population, often targeting those with limited access to diverse diets. In the Owerri metropolis, popular street foods include wheat-based products such as *agege bread, buns, puff-puff*, maize-based staples like *pap/ogi, corn meals*, cassava products like garri used for *eba* and *soups*, and fried or stewed dishes such as *yams, plantains, beans in oils and salt*, respectively. Many of these use industrially processed ingredients under Nigeria's fortification regime: for instance, commercial wheat flour is mandatorily fortified with iron, folic acid, and B vitamins, so street bread and pastries likely contain added micronutrients [6]. Likewise, domestic cooking oils and margarine are fortified with vitamin A, and salt is legally iodized. Common seasonings such as bouillon cubes are increasingly recognised vehicles: Unilever voluntarily fortifies its bouillon with iron, and new 2024 standards require bouillon cubes to include iron, zinc, folic acid, and B_{12}, voluntarily [7]. Other snacks, such as *akara/bean cakes or potato chips,* use vegetable oils and salt, potentially delivering vitamin A and iodine, though nutrient additions are not always obvious. Fortified street items in the Owerri metropolis often coincide with locally biofortified foods.

According to HarvestPlus(2022), a leading global movement with the mission to rapidly scale up production and consumption of biofortified staple crops and foods made with them**, "**varieties of yellow cassava and maize (high in provitamin A) are grown in Nigeria, and their derivatives such as "golden gari" used to prepare *eba*, carry extra vitamin A." A study by [8], noted that Nigerian consumers associate yellow-colored cassava products with health, especially eye health, and attribute greater nutritional benefit to biofortified versus non-fortified foods.

The table below summarises key street-food categories, their fortification vehicles and nutrients, and typical consumer notions or safety issues.

STREET-FOOD / INGREDIENT	FORTIFICATION & NUTRIENTS	PERCEIVED BENEFIT	SAFETY CONCERN
Bread, Cakes, Buns	Wheat flour fortified with iron, folic acid, B-vitamins; sugar, optionally with vitamin A	Mainly viewed as an energy source, micronutrients are not consciously perceived	Potential staleness or mold if unsold; high simple carb content

Fried Dough (Puff-puff)	Wheat flour (as above); fried in oil with vitamin A and iodized salt	Quick, filling snack; low awareness of fortification	Often fried in reused/rancid oil; high caloric load
Pap / Ogi (Maize Porridge)	Maize flour fortified with vitamin A and iron (when mandated)	Common weaning food, seen as healthy if fortified	Fermentation must be hygienic; undercooking risks bacterial contamination
Eba / Garri (Cassava)	Biofortified yellow cassava (provitamin A); soups iodized	The yellow colour is associated with good eyesight and nutrition	Commercial garri may lack fortification; potential for processing contamination
Stews / Soups (Beans, Yam)	Iodized salt and natural or vitamin-A-fortified palm/veg oil	Considered wholesome home-style fare	Often cooked outdoors with poor hygiene, bare-hand handling, and money contamination
Seasoning (Bouillon)	Increasingly fortified with iron, zinc, folate, B_{12}; contains salt	Primarily flavouring; no nutritional perception	High sodium may mislead about iodine status if non-iodized salt is used
Sauces (Tomato Paste)	Often fortified with vitamin A via national programs	Used for taste; limited nutritional awareness	Risk of spoilage or additive contamination if not properly preserved

Table 1: *Nigeria's fortification standards, consumer studies, and street-vendor hygiene studies. Source: Aurélie B., et al (2018).*

1.2 Consumer Awareness and Perceptions

In Nigeria, consumer awareness and perceptions regarding fortified street foods are mixed. While there is an appreciation for the convenience and affordability of street food, concerns about food safety and hygiene are prevalent. Consumers often prioritise taste and price over strict adherence to food safety standards, leading to a situation where many are willing to overlook potential risks associated with street food consumption. Overall, public awareness of food fortification in Nigeria is incomplete. National surveys suggest nutritional labeling influences about 80% of purchases, but many consumers lack detailed knowledge. For example, a 2023 survey in a professional cohort found only 65% correctly defined fortification, and just 66% had seen a packaged fortified product [9]. In the Owerri metropolis specifically, a 2022 study of young mothers found that almost all (95.3%) reported reading food labels, yet many still misused labels, while over half the women had "poor" label utilisation [10]. This suggests that, while interest in nutrition is high, recognition of fortification logos or nutrient claims is low among urban Nigerians. Few consumers actively demand fortified products; Consumer Advocacy for Food Safety and Nutrition Initiative (CAFSANI), reported that only about 57% of household decision-makers inquire about nutritional content when buying [11]. Cultural perceptions can influence fortification acceptance. West African consumers generally regard naturally yellow foods like palm oil, yellow cassava as healthy because of vitamin A. In a study by [12], they observed that Nigerian consumers overwhelmingly associated yellow cassava with "good for eyesight" and child jour, even if actual provitamin-A levels matched traditional red-palm-oil fortification. Conversely, fortified foods with no visible cue, for example, white flour products, tend to go unnoticed as "fortified.". A lack of public education means many buyers do not perceive or prioritise fortification. Additionally, [13] reported that unless a fortified food is heavily advertised or supervised by NGOs, consumers rarely know its nutrient content. Most Nigerian consumers, especially in urban areas of Owerri, show limited awareness of national fortification programs or health claims, relying instead on basic attributes like taste, price, and brand.

1.3 Role of Vendors and Informal Markets

Informal markets and street food vendors play a crucial role in providing access to affordable and convenient fortified foods, contributing to food security and economic development in urban areas. These vendors are often micro-entrepreneurs who provide a vital source of income for themselves and others, while also meeting the nutritional needs of low-income populations. However, the informal nature of this sector can also pose challenges related to food safety and hygiene. Street-food vendors and informal markets are crucial distribution points for fortified staples, but their role is double-edged. In the Owerri metropolis, street vendors are predominantly women with low formal training. They procure ingredients at open markets used by shoppers and prepare foods without clear labeling, so customers cannot distinguish fortified from non-fortified food [14]. Vendors typically do not advertise or even know about fortification mandates; they simply use available ingredients. For instance, if a vendor buys branded wheat flour or cooking oil, it may be fortified by regulation, but if they use local mills or cheaper oils, nutrient levels are uncertain [9].

Because street vendors operate outside formal oversight, enforcement of fortification standards is weak. Although regulatory agencies Standard Organisation of Nigeria (SON), the National Agency for Food and Drug Administration and Control (NAFDAC), Federal Competition and Consumer Protection Commission (FCCPC), monitor factories and markets, many small-scale processors and bulk traders escape scrutiny, to the extent that large companies like Unilever/Knorr market fortified bouillon cubes, those products reach street kitchens, but cheaper unfortified alternatives may be sold in

informal markets. Similarly, vendors of "instant" snacks or packaged sauces may stock fortified branded items, while those making foods from scratch rely on loose salt and oil, possibly non-iodized or unfortified, respectively [15]. Some initiatives have engaged vendors, like the National Fortification Alliance (NFA, 2004–present), and partners have trained retailers and small millers in fortification practices. However, such programs rarely extend to daily street food sellers. In practice, the informal sector itself drives reach, because most low-income consumers buy ready meals, fortified ingredients (flour, oil, salt) used by vendors can "trickle down" nutrients to the urban poor. Yet this depends entirely on compliance. Without vendor awareness or incentives, fortified staples may not fully benefit end consumers.

1.4 Food Safety Risks of Street-Vended Fortified Foods

Street-vended fortified foods can pose several food safety risks due to unsanitary conditions, improper handling, and potential contamination. These risks include microbial contamination from bacteria, viruses, or parasites, as well as chemical contamination from heavy metals or toxins produced during cooking. Fortification addresses nutrition but does not mitigate the well-known safety hazards of street foods. Poor hygiene and infrastructure among vendors can negate health benefits, further resulting in rampant unsafe practices. Several vendors prepare food without aprons or hair covers, handle money and food simultaneously, and re-use water and oil. For example, [16] observed that nearly one-quarter of vendors in the Owerri metropolis cooked under unhygienic conditions, with 48% handling food with bare hands. A broad survey of Nigerian street foods noted that vendors often fry yam, plantain, beans, etc., on unclean surfaces, reuse rancid oil and wastewater, and blow air into plastic bags to open them, all increasing contamination [17].

Microbiologically, these practices lead to high pathogen loads. [17] also noted that samples of garri, fufu, rice, and stews sold by Nigerian street vendors frequently test positive for *E. coli*, *Staphylococcus aureus*, *Salmonella,* and other bacteria well above safe limits. In Kano and Abuja, for instance, ready-to-eat rice and garri were found contaminated by fecal coliforms and *S. aureus*. Such findings imply that even if a street food contains added vitamins, the consumer may be exposed to food poisoning or chronic toxins. Chemical hazards are also reported, continual reheating of oil forms carcinogenic products, and lead or other metals can leach from poor-quality cookware.

A 2021 report by the Gain Global Alliance for Improved Nutrition noted that iodine stability is a major concern, and that open storage of salt at stalls can drive off iodine, leaving "iodised salt" ineffective. Likewise, vitamin A in fortified oil degrades with heat and sunlight. Thus, the net gain of fortification may be reduced if a vendor reuses or overheats oil. Conversely, an unsafe nutrient level is possible. In street foods, where serving sizes and consumption patterns are uncontrolled, nutrient dosing is unpredictable. Fortified street foods carry the same risks as any street-vended meals: microbial contamination, chemical adulteration, and poor storage. These risks must be weighed alongside nutritional benefits. For consumers, the lack of visible labels or expiration dates on street fare means they have little ability to judge either safety or nutrient content.

1.5 Policy and Regulatory Frameworks

Policy and regulatory frameworks are sets of principles, guidelines, and rules established by governments or organisations to guide decisions and actions, and ensure compliance with specific objectives. These policies are broad statements of intent, while regulations are more specific rules or directives. Together, they provide a structure for achieving desired outcomes, managing risks, and protecting stakeholders. Nigeria has one of Africa's most advanced fortification policies. The Standards Organisation of Nigeria (SON) has set standards for 24 fortified foods such as wheat flour, maize flour, salt, sugar, oils, etc. Meanwhile, National Agency for Food and Drug Administration and Control (NAFDAC) Food Fortification Regulations of 2019 and 2021 legally require all processed salt, flour, sugar and oil to carry certain micronutrients, mandate registration for any fortified product, and enforce the use of a "fortification logo" (an eye with "A") on vitamin-A-fortified foods (www.nafdac.gov.ng). NAFDAC has a law which states that "*no person shall sell or advertise* a fortified food without agency registration". In 2004, Nigeria formed the National Fortification Alliance with the World Health Organisation (WHO/FAO), government, and industry stakeholders to coordinate programs and push for additional vehicles. Despite these policies, compliance is uneven. Large factories in Lagos or Kano may fortify flour and oil to standard, but many smaller mills (especially in the South-East) lack premix or quality control. On the consumer end, enforcement at markets is minimal; vendors of bread or oil are seldom inspected for micronutrient content. The Federal Competition and Consumer Protection Commission (FCCPC) also has a role in consumer education but is under-resourced. [9] in a 2022 review noted that voluntary fortified brands with marketing budgets are "better known to consumers" than mandated, reflecting gaps in regulation and outreach.

Recent regulatory developments include moves toward bouillon fortification. As of late 2024, Nigeria issued a new industrial standard enabling the addition of iron, zinc, folic acid, and B12 to bouillon cubes. While currently voluntary, this change acknowledges that bouillon, a ubiquitous seasoning, can reach poorer households more effectively than flour or oil alone [7]. Industry giants like Unilever are also pressing for mandatory bouillon fortification. An Access to Nutrition case report by Unilever Industries in 2017 noted that Unilever already fortifies its bouillon with iron and advocates a national mandate. Such a mandate would "level the playing field" for micronutrient delivery. At the state level, the Government of Imo State follows federal guidelines, but has no separate fortification law. Enforcement in the Owerri metropolis rests on agencies like NAFDAC, SON regional offices, and the Imo State Ministry of Health. The State has participated in the

nationwide National Food Consumption and Micronutrient Survey (NFC&MIS) 2021/2022, which is believed to yield data on dietary intakes. However, published results from the Imo State Government specifically are not yet available. Local nutrition policies like school feeding or health programs may promote iodised salt or vitamin-A capsules, but until now, street-food fortification has not been explicitly addressed in the State's public health outreach.

2. METHODOLOGY

2.1 Description of Study Area

Owerri, Nigeria, is the capital city of Imo State, located in the heart of southeastern Nigeria. The city is comprised of three Local Government Areas, namely: Owerri Municipal, Owerri North, and Owerri West. Owerri is known for its vibrant nightlife, numerous hotels, casinos, and leisure parks, earning it the nickname "Las Vegas of Africa". As of 2024, the population of Owerri was estimated at around 1 million inhabitants, making it one of the larger urban centers in the region. Owerri, Nigeria, is situated approximately 537.6 kilometers from Lagos, the country's largest city and economic hub. The city serves as a significant commercial and industrial center for Imo State. Owerri, Nigeria, boasts a diverse economy, with sectors including agriculture, manufacturing, and services. The presence of several higher education institutions, including the Federal University of Technology Owerri (FUTO) and Imo State University, contributes to a well-educated workforce and vibrant student population. Owerri, Nigeria, boasts a vibrant cultural scene deeply rooted in Igbo traditions. The city's annual New Yam Festival showcases colorful masquerades, traditional dances, and elaborate ceremonies. Visitors can immerse themselves in local art at the Owerri Municipal Arts Center, which displays intricate wood carvings and vibrant textiles. Owerri is known for its rich Igbo culture and traditions. The city hosts various cultural festivals throughout the year, attracting tourists from across Nigeria and beyond. Notable landmarks include the Mbari Cultural and Art Center, which showcases traditional Igbo art and artifacts. The city's nightlife and entertainment scene, coupled with its numerous hotels and restaurants, make Owerri, Nigeria, a popular destination for both business and leisure travelers [18].

2.2 Study Design and Sampling

A descriptive survey design guided the study, targeting street-food consumers in the Owerri metropolis. A total of 200 individuals, representing diverse age and educational backgrounds, were selected. Proportionate and purposive sampling techniques were employed to ensure a representative sample across the population. Proportionate sampling ensured various consumer segments were included fairly, while purposive sampling allowed for the deliberate selection of individuals with relevant characteristics. These combined methods minimised selection bias and enhanced representativeness within the operational constraints of the study.

2.3. Questionnaire Design

A structured questionnaire was prepared in order to obtain data from respondents. The questionnaire was divided into three sections: Socio-demographic characteristics (sex, age, education, employment, and marital status), frequency of buying street food, the amount spent on street food, and factors considered when buying street food; Consumers' perception of food safety and its effect; and Purchasing options of consumers.

2.4 Data Collection

Trained research assistants administered the questionnaires to ensure practical and efficient data collection. Surveys were conducted during business hours, facilitating access to both food vendors and consumers. When needed, questions were clarified in the local Igbo language. Of the 200 respondents sampled, 181 consumer questionnaires were completed and returned, resulting in a 90.5% response rate.

2.5. Data Analysis

A summary of the respondent's socio-demographic data, knowledge, and perception of consumers on food safety, food safety concerns of consumers, and factors consumers consider before purchasing street-vended foods was presented using descriptive statistics. Opinions of consumers on the safety of street foods, and knowledge (level of education) of consumers on food safety, were collected by means of a questionnaire, which was tabulated and analysed through the use of simple percentages.

3. RESULTS AND DISCUSSION

3.1 Socio-demographical Information of Participants

Table 2 below represents the demographics of participants (respondents) in the study. The study surveyed 181 street-food consumers in the Owerri metropolis, revealing a moderately balanced gender composition, with **54.1%** male and **45.8%** female respondents. Age distribution showed that most participants fell within the 31–40 age bracket **(35.3%)**, followed by 20–30 **(24.8%)**, 41–50 **(22.1%)**, and 51 and above **(17.6%)**. Educational attainment was relatively high: **35.3%** held a BA/B.Sc., **16.5%** had OND/HND credentials, **11.6%** possessed higher degrees, **30.9%** had SSCE/WASSCE qualifications, and only **5.5%** reported FSLC. Marital status varied, with **35.3%** single, **24.8%** married, **22.1%** separated or divorced, and **17.6%** widowed. Employment status was dominated by students **(45.8%)** and self-employed individuals **(24.8%)**, while full-time employees constituted **16.5%**, part-time workers **2.7%,** unemployed respondents **6.0%,** retired individuals **1.1%,** and others **2.7%.** Overall, the sample represents a diverse and representative cross-section of adult street-food consumers in the Owerri metropolis, encompassing individuals of various genders, ages, educational levels, marital statuses, and socioeconomic backgrounds.

CATEGORY OF INFORMATION	N (%)
Gender	
Males	98 **(54.1)**
Females	83 **(45.8)**
Age	
20-30	45 **(24.8)**
31-40	64 **(35.3)**
41 -50	40 **(22.1)**
51 & above	32 **(17.6)**
Educational Status	
F.S.L.C	10 **(5.5)**
SSCE/WASSCE	56 **(30.9)**
OND/HND	30 **(16.5)**
B.A/B.Sc.	64 **(35.3)**
Higher Degrees	21 **(11.6)**
Marital Status	
Single	64 **(35.3)**
Married	45 **(24.8)**
Separated/Divorced	40 **(22.1)**
Widowed	32 **(17.6)**
Employment Status	
Student	83 **(45.8)**
Full-time	30 **(16.5)**
Part-time	5 **(2.7)**
Self-employed	45 **(24.8)**
Unemployed	11 **(6.0)**
Retired	2 **(1.1)**
Other	5 **(2.7)**

Table 2: *Showing Demographic Information of Participants (***N** = 181)

3.2 Consumers' Perception of Fortified Food Safety

The data from Table 3 below reveal that a significant proportion of respondents lack awareness of fortified foods, with only **24.8%** indicating they had heard of such products. A majority, **55.8%,** stated they had never heard of fortified foods, while **16.5%** were not sure and **2.7%** were uncertain (responding "maybe"). This suggests a considerable knowledge gap regarding fortified food products among street food consumers in the study area. Despite this low awareness, confidence in the safety of fortified street foods was relatively high. About **46.9%** of respondents reported being very confident that these foods are safe to eat, while **28.1%** were somewhat confident. However, **16.5%** expressed no confidence, and **8.2%** indicated they did not know. These findings point to a moderately positive perception of the safety of fortified foods, although a sizable proportion remains uncertain or skeptical. When asked about the perceived benefits of fortified foods, the majority **(66.2%)** recognized that they help improve nutrition and health. Others associated fortified foods with improved taste **(19.8%)** or increased prices **(11.4%),** while **2.7%** admitted they did not know what fortified foods meant. This highlights a general understanding of their nutritional value, but also indicates lingering misconceptions about their purpose or effects.

The most pressing concern among respondents was related to hygiene. An overwhelming **86.1%** identified poor hygiene by vendors as their main concern about fortified street foods. Only **8.2%** cited issues of unregulated fortification or fake products, and **4.4%** worried about expired or low-quality ingredients. A mere **1.1%** reported having no concerns. This suggests that while fortification itself is not perceived as risky, the unsafe handling of food by vendors could undermine any intended

health benefits. Importantly, a strong majority **(92.2%)** reported that they would be more likely to purchase a fortified street food item if it were certified safe by a recognised health authority. Only a small fraction **(2.2%)** said they would not, with **3.3%** indicating "maybe" and another **2.2%** remaining unsure. This indicates a high level of consumer trust in institutional certification and suggests that clear safety labeling and public assurance could positively influence consumer behaviour. The results gathered agree with [19], where they stated that the safety of everything eaten is paramount. They also added that in most developing countries, where it is challenging to test scientifically most of the foods people consume, whichever way the consumer measures the safety of food is accepted. Although awareness of food fortification is low among street food consumers in the Owerri metropolis, confidence in the safety of fortified foods is relatively strong, particularly when backed by trusted certification. However, serious concerns remain regarding vendor hygiene and food handling. These findings underscore the need for increased public education, strengthened food safety enforcement, and vendor training to maximize the impact of food fortification initiatives in urban Nigeria.

QUESTIONS	RESPONSES/ PERCENTAGES (%)			
Have you ever heard of "fortified foods" (i.e., foods with added vitamins or minerals such as vitamin A, iron, or iodine)?	Yes 45 **(24.8)**	No 101 **(55.8)**	Maybe 5 **(2.7)**	Not Sure 30 **(16.5)**
How confident are you that fortified street foods (e.g., bread, pap, akara, moi-moi, etc) sold in your area are safe to eat?	Very confident 85 **(46.9)**	Somewhat confident 51 **(28.1)**	Not confident 30 **(16.5)**	I don't know 15 **(8.2)**
In your opinion, what is the main benefit of eating fortified foods?	Improves nutrition and health 120 **(66.2)**	Enhances taste 36 **(19.8)**	Increases food price 20 **(11.4)**	I don't know what fortified food means 5 **(2.7)**
Which of the following concerns do you have about the safety of fortified street foods?	Poor hygiene by vendors 156 **(86.1)**	Use of expired or low-quality ingredients 8 **(4.4)**	Unregulated fortification or fake products 15 **(8.2)**	No concerns 2 **(1.1)**
Would you be more likely to buy a street food item if you knew it was fortified and certified safe by a health authority?	Yes 167 **(92.2)**	No 4 **(2.2)**	Maybe 6 **(3.3)**	Not Sure 4 **(2.2)**

Table 3: Showing Questionnaires and Responses

N = 181

3.3. Consumers' Food Safety Concerns

The analysis of consumers' food safety concerns reveals varying levels of awareness and sensitivity to different health risks associated with food consumption. Cholesterol levels and microbial contamination emerge as top concerns, with **48.6%** and **48.0%** of respondents rating their concern **as high**, respectively. Similarly, improper food preparation is another prominent issue, with **44.7%** expressing high concern. This suggests that many consumers are worried about both the nutritional content and sanitary handling of food, particularly street-vended items. In contrast, food additives show a relatively lower concern at the high level **(16.5%),** with a majority **(53.5%)** perceiving it as a low-risk factor, indicating either low awareness or lower perceived impact. Similarly, gluten and vitamin deficiency concerns were largely rated as low **(56.3% and 54.6%,** respectively), suggesting these issues are not major health priorities for the majority of respondents, possibly due to limited knowledge or cultural dietary patterns. Use of unclean cutlery and nutritional imbalances were moderately concerning to respondents, with **49.1% and 40.3%,** respectively, assigning a moderate concern rating. Meanwhile, pesticide residue drew a more cautious response, as **48.6%** rated it a moderate concern and only **12.1%** as a high concern,

potentially reflecting uncertainty or lack of visible evidence. These results have some similarities with the study of [20], which states that sicknesses normally from foods were caused by chemical contaminations and improper use of spices in most street foods. Altogether, the data shows that consumers are most concerned with immediate, visible, or widely discussed risks such as poor food handling, contamination, and cholesterol, while less emphasis is placed on more complex or less visible risks such as gluten, additives, and nutrient deficiencies. This highlights a need for public education initiatives to address lesser-known but equally important food safety concerns, as well as enhanced vendor training on food hygiene and nutrition safety practices.

CONCERNS	RATINGS (%)		
	Low	**Moderate**	**High**
Calorie Content	30 **(16.5)**	96 **(53.0)**	55 **(30.3)**
Cholesterol Level	43 **(23.7)**	50 **(27.6)**	88 **(48.6)**
Food Addictive	97 **(53.5)**	54 **(29.8)**	30 **(16.5)**
Microbial Contamination	36 **(19.8)**	58**(32.0)**	87 **(48.0)**
Use of Unclean Cutlery Set	20 **(11.0)**	89 **(49.1)**	72 **(39.7)**
Improper Food Preparation	66 **(36.4)**	34 **(18.7)**	81 **(44.7)**
Nutritional Imbalances	88 **(48.6)**	73 **(40.3)**	34 **(18.7)**
Gluten	102 **(56.3)**	56 **(30.9)**	23 **(12.7)**
Vitamin Deficiency	99 **(54.6)**	47 **(25.9)**	35 **(19.3)**
Pesticide Residue	66 **(36.4)**	88 **(48.6)**	22 **(12.1)**

Table 4: Showing Consumers' Food Safety Concerns
N = 181

3.4. Consumer Priorities in Choosing Street Foods

The analysis of consumer priorities in choosing street foods reveals several key insights. According to the data gathered, consumers weigh several factors when deciding whether to purchase street-vended foods, with varying degrees of importance assigned to each. Nutritional value emerged as the most critical factor, with **83.9%** of respondents rating it as very important, suggesting growing awareness and concern about the health implications of street food consumption. This was closely followed by the vendor's physical appearance and the vendor's physical environment, both rated very important by **55.8%** of respondents, showing that the appearance of both the vendor and their setup significantly affects consumer trust and purchasing behaviour. Price and perceived value, and food safety and hygiene were also strongly prioritised, with both receiving a very important rating from **54.6%** of respondents. These findings highlight a practical concern for affordability as well as a preference for clean and safe food handling practices. Quick service and accessibility were deemed very important by **48.0%**, reinforcing the idea that convenience plays a major role in street food patronage. In contrast, familiarity with the vendor was considered not important by the majority **(54.6%),** suggesting that consumers are less influenced by personal relationships and more by observable quality standards. Similarly, proximity to work or home received lower priority, with only **34.2%** rating it very important, and a notable **38.6%** deeming it not important, implying that consumers are willing to travel short distances for better quality or service. Lastly, taste and flavour were highly valued, with **49.1%** marking it as important and **39.7%** as very important. The lack of knowledge of food safety tips is the trigger of the transmission of foodborne pathogens [20]. This indicates that while taste remains central, it is now part of a broader set of concerns that include nutrition, hygiene, and value. Generally, findings reveal that today's street food consumers are increasingly health- and quality-conscious. Although taste and affordability remain relevant, nutritional content, vendor presentation, and food safety dominate purchasing decisions, reflecting a shift toward more informed and selective consumption behaviour in the Owerri metropolis, and probably in urban cities across Nigeria.

PRIORITIES	RATINGS (%)		
	Not Important	Important	Very Important
Price and Perceived Value	25 **(13.8)**	57 **(31.4)**	99 **(54.6)**
Taste and Flavour	20 **(11.0)**	89 **(49.1)**	72 **(39.7)**
Food Safety and Hygiene	28 **(15.4)**	54 **(29.8)**	99 **(54.6)**
Vendor's Physical Appearance	10 **(5.5)**	70 **(38.6)**	101 **(55.8)**
Quick Service and Accessibility	27 **(14.9)**	67 **(37.5)**	87 **(48.0)**
Familiarity with the Vendor	99 **(54.6)**	57 **(31.4)**	25 **(13.8)**
Nutritional Value	10 **(5.5)**	19 **(10.4)**	152 **(83.9)**
Proximity to Work or Home	70 **(38.6)**	49 **(27.0)**	62 **(34.2)**
Vendor's Physical Environment	27 **(14.9)**	53 **(29.2)**	101 **(55.8)**

Table 4: Consumer Priorities in Choosing Street Foods
N = 181

4. CONCLUSION

Based on the research data analysed, it is evident that while street-vended foods remain a vital component of urban diets in the Owerri metropolis, consumers are increasingly guided by health-related concerns in their purchasing decisions. Awareness of food fortification is low, yet confidence in the safety of fortified foods, particularly when certified, is relatively high. Consumers prioritize nutritional value, hygiene, price, and vendor appearance over personal familiarity or proximity. Major safety concerns include poor hygiene, microbial contamination, and improper food handling, which overshadow the potential benefits of food fortification. These findings underscore the need for targeted public education, improved vendor training, and stricter regulatory enforcement to enhance both the safety and nutritional quality of street foods in urban Nigeria.

REFERENCES

Adesokan, H. K., Akinseye, V. O., & Adesokan, G. A. (2015). Food safety training is associated with improved knowledge and behaviours among foodservice establishments' workers in Ibadan, Nigeria. Food Control, 50,378–383. https://doi.org/10.1016/j.foodcont.2014.09.015

Aurélie B., Ugo C., Andrew W., Keith, T. (2018). Yellow is good for you: Consumer perception and acceptability of fortified and biofortified cassava products. September 201813(9): e0203421. DOI:10.1371/journal.pone.0203421.

Akonor, P. T., & Ofori, H. (2021). Food fortification as a strategy for micronutrient deficiency control: Public health perspectives. Current Research in Nutrition and Food Science Journal, 9(2), 384–392. https://doi.org/10.12944/CRNFSJ.9.2.25

Akujobi, I. (2022). Nutrition knowledge, complementary feeding practices and use of food labels amongst young mothers in Owerri Metropolis. Nigerian Journal of Nutritional Sciences. Vol. 43 No. 2 (2022)

Arinze, O. E., & Arinze, I. C. (2022). Young mothers' understanding and use of nutritional food labeling in Owerri, Nigeria. Nigerian Journal of Nutrition and Dietetics, 11(1), 185–193.

Chukuezi, C. O. (2010). Food safety and hygienic practices of street food vendors in Owerri, Nigeria. Studies in Sociology of Science, 1(1), 50–57. https://doi.org/10.3968/j.sss.1923018420100101.006.

Comfort, O. (2010). Food safety and hygienic practices of street food vendors in Owerri, Nigeria. Studies in Sociology of Science. Vol. 1, No. 1, 2010, pp. 50-57.

Egbokhare, Francis O.; Oyetade, S. Oluwole (2002). *Harmonization and standardization of Nigerian languages*. CASAS. p. 106. ISBN 1-919799-70-2.

Ekhator, O., Udowelle, O., Igbiri, S., Asomugha, R., Igweze, Z., Orisakwe, O., (2017). Safety Evaluation of potential toxic metals exposure from street foods consumed in Mid-West Nigeria. Journal of Environmental and Public Health 2017(2):1-8. DOI:10.1155/2017/8458057

GAIN – Global Alliance for Improved Nutrition. (2022). Fortification quality and coverage in Nigeria: GAIN Fortification Assessment Coverage Tool (FACT) Survey. https://www.gainhealth.org

Global Fortification Data Exchange (GFDx). (2023). Fortification legislation and standards in Nigeria. Retrieved from https://www.fortificationdata.org.

Griffith, C. J., Livesey, K. M., & Clayton, D. (2010). The assessment of food safety culture. *British Food Journal*, *112*(4), 439-456.

HarvestPlus. (2022). Biofortification in Nigeria: A pathway to better nutrition. International Food Policy Research Institute. https://www.harvestplus.org

Micronutrient Fortification Index (MFI). (2021). Nigeria National Fortification Alliance Country Report. https://www.micronutrientforum.org

Mohammed, R. (2018). Examining food safety knowledge, attitude and practice of street food vendors in Tamale metropolis. Doctoral Dissertation, University of Education, Winneba.

NAFDAC – National Agency for Food and Drug Administration and Control. (2019). Food Fortification Regulations, 2019. https://www.nafdac.gov.ng

Nwosu, J. N., & Owuamanam, C. I. (2017). Microbial safety and chemical quality of street-vended foods in Owerri, Imo State, Nigeria. Nigerian Food Journal, 35(1), 1–9. https://doi.org/10.1016/j.nifoj.2017.05.002.

Ofoedum, A., Chikelu, E., Alagbaoso, S., Uzoukwu, A., Anaeke, E., Uyanwa, N., Okezie, F. Nwuka, M. & Ndukuba, O. (2024). The health implications of street-vended foods in Nigeria: A food safety approach a review. https://doi.org/10.31579/2637-8914/265

Ogbonna, A. I., & Umar, H. Y. (2020). Assessment of hygiene practices among street food vendors in selected urban areas in Nigeria. African Journal of Food Science, 14(2), 28–35. https://doi.org/10.5897/AJFS2019.1845

Ogunmoyela O., Musa, B., & Oni, B.(2023). Progress in food fortification in Nigeria - historical overview, current issues, consumer perceptions and awareness, and the need for additional vehicles. Food Science & Nutrition Research. 6(2): 1-17.

Okafor, E. M., & Ogbonna, P. C. (2021). Awareness and perception of food fortification among urban consumers in Nigeria. African Journal of Food, Agriculture, Nutrition and Development, 21(1), 17252–17269. https://doi.org/10.18697/ajfand.96.19690

Omemu, A. M., & Aderoju, S. T. (2008). Food safety knowledge and practices of street food vendors in the city of Abeokuta, Nigeria. Food Control, 19(4), 396–402. https://doi.org/10.1016/j.foodcont.2007.04.021

Oranusi S., Wesley B., (2012). A study of microbial safety of ready-to-eat foods vended on highways: Onitsha-Owerri, south east Nigeria. https://www.researchgate.net/publication/319873867_A_study_of_microbial_safety_of_ready-to-eat_foods_vended_on_highways_Onitsha-Owerri_south_east_Nigeria.

Redmond, E.C. and Griffith, C.J. (2003) A Comparison and Evaluation of Research Methods Used in Consumer Food Safety Studies. International Journal of Consumer Studies, 27, 17-33. https://doi.org/10.1046/j.1470-6431.2003.00283.

Standards Organisation of Nigeria (SON). (2021). Nigeria Industrial Standards for Food Fortification. Lagos: SON Publications.

Sylvester, N., & Craig, W., 2013. An assessment of food safety needs of restaurants in Owerri, Imo State, Nigeria. Int J Environ Res Public Health. 2013 Aug 2;10(8):3296-309. doi: 10.3390/ijerph10083296.

Unilever. (2023). Access to Nutrition Initiative: Micronutrient fortification programs and policy advocacy. Retrieved from https://www.accesstonutrition.org

World Health Organization (WHO). (2021). Guidelines on food fortification with micronutrients. https://www.who.int/publications/i/item/9789240015311