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Food Safety Knowledge, Attitude and Practices of Road-Side Vendors of Ready-To-Eat Grilled Catfish in Awka Metropolis, Anambra State, Nigeria

[1] UNEZE, Chijioke Uchechukwu.; [2]AHMED, M. Adewole and [3]OYIBO, A. Ameachi
[1]Department of Agricultural Education,
Federal College of Education (Technical) Umunze, Anambra State, NIGERIA
[2,3]Department of Agricultural Education, Federal College of Education (Technical) Asaba, Delta State, NIGERIA
Corresponding author's e-mail: cjuneze123@gmail.com
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Abstract

The study was conducted to determine the food safety knowledge, attitude and practices of road-side vendors of ready to eat grilled catfish in Awka metropolis, Anambra state, Nigeria. Cross-sectional survey was adopted in selecting a sample of vendors. This sample was derived from 20 entities randomly selected from four predetermined towns that were considered to have high concentration of these operators. Thereafter, a structured questionnaire comprised of items on socio-demographic factors of vendors, their food safety knowledge, attitude and practices was used in collecting data for the study. The items on food safety knowledge of vendors were adapted from the WHO's 5-keys to safer food guidelines for food handlers while those on attitude and practices were largely modified versions of relevant items that were available in literature. The food safety knowledge on keep clean (79.4%-95.6%) and cook thoroughly (72.5%-86.8%) were high amongst the 5-key areas analyzed. These vendors had high conformance attitudes (over 70% response rate) at doing well to observe proper cleaning procedure, responsibility to prevent food contamination and spoilage, expired food not to be consumed, reason for observing food hygiene standard being for fear of management/government/regulatory supervisors as well as task performance supervisors' motivation. Measures to pay concerned attention to hygienic source of catfish and vegetables and cover of wounds with plaster/bandage before preparation of grilled catfish were the only two practices on food safety observed by vendors. However, majority of the road side grilled catfish vendors were females (58.1%) and 63.1% of sample entities being less or 35years of age. Again, 73.8% of these vendors have had some training on food safety with 66.3% having less than 3years experience in catfish grilling while 85% earned income of less or equal to 200,000 naira per month. Training was found to be a significant factor for food safety knowledge, attitude and practice; whereas age and educational level are socio-demographic factors that influenced both knowledge and practice of food safety among grilled catfish vendors. Experience was only particular in influencing food safety knowledge. Finally, in order to ensure safe and wholesome grilled catfish vending on road sides, it is recommended for governments to strengthen their regulatory oversight while making regular trainings on food safety a necessity.

Keywords: *Food Safety, Knowledge, Attitude, Practice, Grilled, Catfish, Vendors*

INTRODUCTION

Food safety is key to the sustenance of a successful food value chain and Agri-trade performance. It is also an important public health issue and considered critical for food and nutrition security (Global Alliance for Improved Nutrition GAIN 2020; Federal Ministry of Health FMH 2014; Scallan et al. 2011). Food safety defines those conditions and measures necessary for food production, processing, storage and distribution in order to ensure a safe, sound, wholesome product that is fit for human consumption (Food and Agriculture Organization FAO, 2014)

Foodborne disease is a major aftermath of poor food safety. Foodborne disease or foodborne illness and sometimes called food poisoning is a common public health problem that results from ingestion of contaminated foods from many disease-causing microbes, toxins or chemicals (Centers for Disease Control and Prevention CDC, 2015). Foodborne illness takes a toll on the health of affected individual and consequently cumulate into reduced economic activity. The 2019 world bank report on economic burden of foodborne disease indicated that the total productivity loss associated with foodborne disease in low-and-middle income countries was estimated at US$93.2billion per year and the annual cost of treating foodborne illness is estimated at US$15billion (World Bank, 2019). An estimated 600million persons, which is almost 1 in 10 people in the world fall ill after eating contaminated food and 420,000 die every year resulting in loss of 33 million healthy life years. Furthermore, children under 5years of age carry 40 percent of the foodborne disease burden with 125,000 deaths every year (World Health Organization WHO,2022). In Nigeria, the prevalence and severity of foodborne illness is grossly underestimated because not every victim visits the hospital (National policy on Food Safety, 2014). However, the World Health Organization estimates that more than 200,000 people die annually in Nigeria of food poisoning (WHO,2009). The direct cost of foodborne illnesses in the country is put at $3billion, accounting for 17-25 percent of estimated costs of all illnesses (Oludare et al. 2016). Furthermore, poor food safety compliance to export market standards by Nigeria had led to rejection of some important food commodities such as melon seed, yam, beans and groundnuts (Business Day daily newspaper 19 September, 2022; This Day daily newspaper 26 October, 2021). This rejection and restriction result to enormous economic losses for actors in the various commodities value chain.

In order to ensure effective coordination in food safety regulation, the country's federal ministry of health developed the National Policy on Food Safety and its Implementation strategy in 2014 (Federal Ministry of Health, 2014). Globally, WHO in her five keys to safer foods had provided guidance on safer foods at home or when selling at restaurants or at local markets. In this framework, the core components of the five keys to safer foods are (1) Keep clean, (2) Separate raw and Cooked, (3) Cook thoroughly, (4) Keep food at safe temperature, and (5) Use safe water and raw materials (WHO, 2006). Additionally, the Codex Alimentarius International food standards, guidelines and codes of practice as established by the WHO and FAO contributes to the safety, quality and fairness in international food trade. In Nigeria, food safety laws include Public Health Ordinance Cap 164 of 1958 replaced by the Public Health laws of 1917; 1974's Food and Drug Decree NO.35; The Standard of Organization of Nigeria(SON) Decree NO.56 of 1971; The 1988 Animal Diseases Control Decree NO.10; Decree NO.41 of 1990 on the marketing of breast milk substitutes (WHO,2017).

Catfish (*Clarias gariepinus*) is the most popular and widely cultivated fish in Nigeria (Adewumi and Olaleye, 2011). It functions as a major supply of protein of high biological value, providing livelihood to actors in the value chain and serving as a commodity of high trade value (Payne, 2000). In Nigeria, the industry's estimated annual production of one million ton is worth around US$2.6billion with about one million direct jobs along the value chain and providing over 40 percent of country's protein intake of per capita consumption at 13.3kg per year (FAO,2023). It had been noted that catfish matures quickly and has a wide range of tolerance to climatic conditions (Huisman and Richiter, 1987).

In recent time, catfish is grilled by processors and retailed directly as ready-to-eat in streets and road sides of cities by vendors as special delicacy. This fish processing and handling activity has become a common occurrence in Nigeria. The emergence of numerous operators in food street vending is linked to its profitability and high propensity to create readily source of livelihood (Adeosun et al. 2022). However, the current scenario comes with concern over the hygiene and safety of the food product. Fish, generally had been implicated in the outbreak of foodborne infections (such as Listeriosis, Salmonellosis), illnesses and death (Costa 2013; Popovic et al. 2010; Akande and Dei-Quad 2010). Smoked fish is also noted as a public health issue in Nigeria (Ayadeji, Oni and Sanyaolu 2023). Heterolytic aromatic amines HAAs and Polycyclic aromatic hydrocarbons PAHs arise from cooking fish at high temperatures such as grilling (Linda et al. 2019; Akpambang et al. 2019). These PAHs and HAAs have been identified as being carcinogenic and mutagenic while causing several health problems such as damage to important organs, mutation, reproduction abnormalities, immunosuppression and growth retardation (Ikeogu et al.2023; EKSA 2008; Rivindraa, Ranjeet and Rene 2008; Chen and Chen 2001).

Additionally, several studies of food safety conducted on food vendors' operational activities, identify poor practices on knowledge they have regarding standards of hygiene (Moreb et al. 2017; Stratev et al. 2017). Other studies equally have suggested the lack of knowledge among food handlers (Nkosi and Tabit 2021; Asmawi et al.2018; Osaili 2018). In a similar manner, some studies reveal the poor attitudes of food vendors towards implementing food safety standards (Baser et al. 2017; Kunadu et al. 2016). Knowledge is believed to be the precondition to improved practices, as any information gained is expected to lead to a change in attitude and consequent change in behavior of operators in food chain (Bas et al., 2006). This relationship underscores the need for understanding the knowledge, attitude and practices (KAP) of food handlers and operators in relation to food safety. Good knowledge, a positive attitude and proper food handling practices relate significantly to curtailing foodborne diseases (Sharif and Al-Malki 2010). Nonetheless, several previous works of scholars relating to KAP had focused majorly at food vendors in restaurants, schools and disadvantaged groups (migrants, youth) in selected geographical enclaves (Barnabas et al. 2024; Madaki and Bavorova 2021; Asmawi et al. 2018; Who et al. 2016). There is rarely available study that specifically addressed KAP on food safety of grilled catfish from vendors operating openly at road sides and streets. More so, this growing appeal for ready-to-eat grilled catfish as special delicacy in Nigerian cities and the attendant consequence for foodborne illness provide an urgency for a study on food safety knowledge, attitude and practices of these food handlers. It is in the light of the foregoing gap and need that the present study aims to broadly examine the food safety knowledge, attitude and practices of roadside vendors of ready-to-eat grilled catfish (*Clarias gariepinus*) in Awka metropolis of Anambra State, Nigeria. The specific objectives were to:

1. Determine the socio-demographic factors of vendors of roadside ready-to-eat grilled catfish
2. Find out the kinds of knowledge, attitudes and compliance to food safety practices of these catfish vendors in the Awka Metropolis
3. Identify how socio-demographic factors of these grilled catfish vendors relate to their knowledge, attitudes and practices of food safety

The findings of the current study would help to strengthen regulatory policies that will ameliorate the prevalent and severe incidences of foodborne illnesses and consequently engender good hygiene among actors in catfish handling chain. The empirical evidence from the work would highlight necessary hygienic practices and knowledge urgently needed to close any gaps through a demand-led and effective training programs of relevant operators. Overall, the study will make significant contribution to the body of existing knowledge on the subject matter as well contribute to the economic growth of Nigeria.

METHODOLOGY

Study Area

The study was carried out in Awka Metropolis. Awka Metropolis includes Awka town which is the major city and capital of Anambra state in Nigeria and its surrounding towns to which it exercises economic and social influence. These suburbs include Okpuno, Amawbia, Nibo, Nise, Amansea, Ishiagu, Mbaukwu, Umuawulu, Ezinator and Nawfia. Awka Metropolis is located some 50km from Onitsha and about 110km from Enugu (Mbah, Mgbemena and Ejike,2016). Its location is at latitude 8.2069 N and longitude 7.06780 E (see figure1) and has a population of 361,657 (National Population Commission NPC, 2006). Major hotels and recreational centers are located around Abakiliki street in Awka, the state capital.

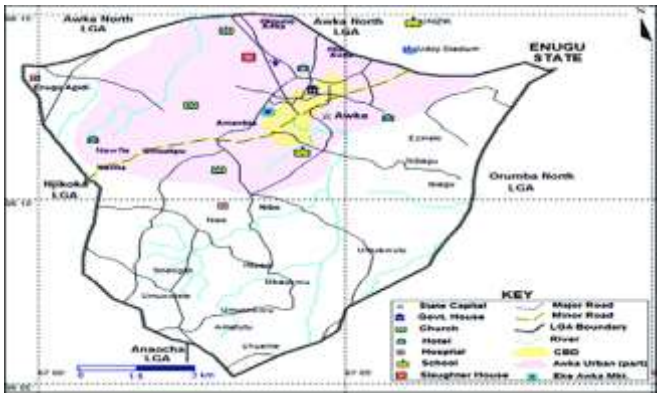

Figure1: Map of Awka Metropolis; source: Department of Geography, University of Nigeria

Sampling technique and data collection

A cross sectional survey was employed in this study to examine the food safety knowledge, attitude and practices of ready to eat grilled catfish vendors in Awka metropolis. Cross-sectional surveys are notably cost effective and provides for a large survey distribution that lead to more accurate responses (Singh, 2006). A total of 160 vendors who were engaged in

preparation, serving and sale of grilled catfish were selected for the study. These vendors operated with locally fabricated kiln for their fresh catfish grilling. The grilled catfish were prepared and usually served with vegetable salad. All these vendors operated along streets and roadside were the food product is displayed in the open. A multistage sampling was adopted to select these subjects. The first stage was to purposively select 4 towns in Awka metropolis considered to have high concentration of these entities. These selected towns were Awka, Okpuno, Amawbia and Nibo. The next stage was to randomly select 40 vendors from each of the chosen 4 towns.

The survey was conducted face to face with entities in selected towns. A structured Questionnaire was designed and used to collect data for the study. The instrument was divided into 4 sections (A to D). Section A was used to capture the socio-demographic characteristics of vendors, while Sections B to D contained statements on Knowledge, Attitude and Practices of food safety respectively.

Section B (food safety knowledge) contained 20 items of statements with a dichotomous response of Yes or No. These statements were specifically adapted from the WHO's 5-keys to safer food guidelines for food handlers (WHO,2006).

Section C (food safety attitude) involved attitude assessment with 15 items with response options of Yes or No. These items were largely adapted from Ncube et al. (2020).

Section D (food safety practices) contained 10 items of statements regarding vendors extent of compliance to food safety which were to be responded under 5 levels of Strongly agree, Agree, Neutral, Disagree and Strongly disagree. These statements were largely adapted from previous studies on KAP (Luo et al. 2019; Osaili et al.2018). Some modifications were made to reflect their specificity to catfish grilling. However, the questionnaires were administered to the respondents on the spot and retrieved immediately after their completion by trained research assistants. This ensured that there was a100 percent return rate of the questionnaire.

To ensure the reliability of the instrument, 20 entities who were not involved as respondents in study were used as pilot. A Cronbach's alpha test was conducted in order to determine how consistently these participants respond to set of test items in a group. The value determined was at 0.86. The internal consistency of the study was more than 0.70 and therefore acceptable. To assure content validity and construct validity of the work, the initial drafts of the instrument was sent to experts in food science and research methods respectively for their inputs and modification.

Both descriptive and inferential statistics were used to analyze data from the study. Descriptive analytical tools of frequency and percentages were used to respectively relate the distribution of items on the knowledge, attitude and practices of food safety of respondents. Further, a 5-point scale was used to evaluate these respondents' food safety practices on the 10 items that reflect the extent of their compliance scaled as Strongly Agree (SA) -5points; Agree(A) – 4points; Neutral (N) – 3points; Disagree (D) – 2 points; and Strongly Disagree(SD) – 1 point. Thereafter, means of these responses were calculated using their interval and range. There were 5 ranges for interpreting these determined means: 1.00 – 1.80 for strongly agree, 1.81-2.60 for agree, 2.61-3.40 for neutral, 3.41– 4.20 for disagree and 4.21 – 5.00 for strongly disagree (Chua & Yunus, 2020). The inferential statistics used were Chi-square and Cramer's V. Chi-square was used to measure the statistical significance of the association of individual grilled catfish

vendor's socio-demographic factors with their respective KAP on food safety. Their Cramer's V values were used to express the strength of the association between those entities' socio-demographic factors and their knowledge, attitude and practices of food safety. The Chi-square test statistic $\times^2$was mathematically determined as:

$\times^2 = \sum[(O_i-E_i)^2/E_i]$

Where Oi = Observed frequency

Ei= Expected frequency

Degree of freedom = (r-1) (c-1) for independence test and (no of categories-1) degree of freedom for goodness of fit test while r is the number of rows and c is the number of columns.

Cramer's V was mathematically determined as:

$V = \sqrt{\times^2/n.(c-1)}$

Where n= sample size and c= min(m,n) is the minimum of the number of rows m and column in the contingency table. The following approach was used to interpret the Cramer's V coefficient, $V\epsilon$[0.25; 1.00]: very strong association, $V\epsilon$[0.15; 0.25]: strong association, $V\epsilon$[0.10; 0.15]: moderate association, $V\epsilon$[0.05; 0.10]: weak association, $V\epsilon$[0; 0.05]: very weak association (Akoglu, 2018).

RESULTS AND DISCUSSION

Vendors' Knowledge on food safety

Vendors' knowledge of food safety is divided into five categories of keep clean, separate raw and cooked, cook thoroughly, keep food at safe temperature, safe water and raw materials (WHO,2006). Table 1 presents result of the 21 items that provide core information on these 5 key areas.

	Knowledge items (N=160)	Yes n (%)	No n (%)
A	Keep Clean		
	• Wash hands before handling food and during preparation	146(91.3)*	14(8.7)
	• Wash your hands after going to toilet	153(95.6)*	7(4.4)
	• Wash and sanitize all surfaces and equipment for food preparation	127(79.4)*	33(20.6)
	• Protect kitchen and food from insects, pests and other animals	133(83.1)*	27(16.9)
B	Separate raw and cooked		
	• Separate raw meat, poultry and sea food from other foods	43(26.9)	117(73.1)
	• Use separate equipment and utensils such as knives and cutting boards when handling raw foods	38(23.8)	122(76.2)
	• Store foods in containers to avoid contacts between raw and prepared foods	33(20.6)	127(79.4)
C	Cook thoroughly		
	• Cook food thoroughly especially meat, poultry, egg and sea food	139(86.8)*	21(13.2)
	• Bring foods like soups and stews to boiling to make sure they reach 70^{o}C	116(72.5)*	44(27.5)
	• Re-heat cooked food thoroughly	128(80.0)*	32(20.0)
D	Keep food at safe temperature		
	• Do not leave cooked food at room temperature for more than 2hours	16(10.0)	144(90)
	• Refrigerate promptly all cooked and perishable food (preferably below 5^{o}C)	55(34.4)	105(65.6)
	• Keep cooked food piping hot (more than 60^{o}C) prior to serving	82(51.3)	78(48.7)
	• Do not store too long even in the refrigeration	73(45.6)	87(54.4)
	• Do not thaw frozen food at room temperature	26(16.3)	134(83.7)
E	Use safe water and raw materials		
	• Use safe water or treat bit to make safe	58(36.3)	102(63.7)
	• Select fresh and wholesome foods	109(68.1)	51(31.9)
	• Choose foods processed for safety, such as pasteurized milk	33(20.6)	127(79.4)
	• Wash fruits and vegetables, especially if eaten raw	106(66.3)	54(33.7)
	• Do not use food beyond its expiry dates	92(57.5)	68(42.5)

Table 1: Road-side grilled catfish vendors' responses on food safety knowledge

Source: field survey, 2024; * good knowledge responses with percentages of over 70 percent

Most vendors had good knowledge on several aspects required to keep food handling clean. The percentage responses from grilled catfish vendors in the composing items of keep clean were washing hands before handling food product (91.3%); washing hands after going to toilet (95.6%); washing and sanitizing of all surfaces and equipment (79.4%) and protecting kitchen and food from insects, pests and other animals (83. 1%).This result meant that grilled catfish vendors have considerable knowledge on personal hygiene and incidences that may lead to transmission foodborne diseases. Previous studies had shown that food handlers' poor personal hygiene practices such as inadequate hand washing and filthy surroundings can lead to avenues to foodborne illnesses (Islam, et al. 2024; Akabanda et al. 2017). The finding of the current work is consistent with a study conducted in Malaysia which uncovered that food handlers had good knowledge in food hygiene (Sani and Siow, 2014)

The knowledge of respondents on 'separating of raw and cooked food product' was poor as can be seen in Table1. The percentage responses of vendors on the composing items of this category ranged from 20.6% to 26.9%. The indication is that grilled catfish vendors' knowledge on: separating raw catfish from other food; using separate equipment and utensils such as knives and cutting boards for raw food; as well as storage of food in containers to avoid contacts between raw and prepared food could be enhanced through effective training on food handling. Several researchers had noted the relevance of training in enhancing knowledge of food safety (Adesokan, Akinseye and Adesokan 2015; Lynch et al.2003).

Finding regarding the knowledge of vendors on 'cooking thoroughly', revealed response rates on this category items that ranged from 72.5-86.8 percent. These items' specific response percentages were: cook food thoroughly (86.8%); bring foods like soup and stews to boiling to make sure they reach 70^0C (72.5%); and reheat cooked food thoroughly (80.1%). This result points to the fact that these vendors understand that uncooked/poorly cooked food products may inhabit pathogenic organisms that may predispose humans to food poisoning if eventually consumed. Proper cooking is a significant way to ensure that pathogens are eliminated. It had been reported that cooking at temperature of 70^0C will generally lessen the risk of foodborne illnesses (Tuglo et al. 2021). This basic fact of knowing that food products would necessarily be required to reach temperatures which ensure that pathogens are killed is in tandem with several previous studies on KAP (Muharnis and Dewi 2021; Tuglo et al.2021). However, some other studies did not corroborate this current result establishing adequate knowledge of food handlers on thoroughly cooking food products at relevant temperatures (Sarkodie et al. 2014; Rahman et al .2012).

Result showing respondents' knowledge on 'keep food at safe temperature' were generally inadequate when items in this category are viewed in Table 1. These items and their respective response percentages were: do not leave cooked food at room temperature for more than 2hours (10%); do not thaw frozen food at room temperature (16.3%); refrigerate promptly all cooked and perishable food (34.4%); do not store too long even in refrigeration (45.6%); and keep cooked food piping hot before serving (51.3%). This lack of knowledge of food vendors in keeping food at safe temperature agrees with findings of some previous studies (Pichler et al. 2014; Martins et al. 2012). This reflects the need for appropriate training and awareness to enhance their knowledge on proper cold storage of perishable food products.

Grilled catfish vendors' knowledge to choose food processed for safety and use of safe water or make it safe were inadequate. The expressed response percentages were 20.6 percent and

36.3 percent respectively as seen from category on 'use of safe water and raw material'. However, vendors showed satisfactory knowledge on need to select fresh and wholesome foods (68.1%); wash fruits and vegetables, especially of those eaten raw (66.3%); and not use food beyond its expiry date (57.5%).

Vendors' attitude to food safety

Table 2 shows the result of participants' responses on their attitudes regarding food safety. Data analyzed showed that majority of these grilled catfish vendors had responded negatively(No) to stated attitude items that conform to good food safety and hygiene in their food handling operations.

Table 2: Road-side grilled catfish vendors' attitude to food safety

	Statements on attitudes to food safety (N=160)	n (%)	n (%)
1	I am willing to learn the basics of food hygiene and safety	68(42.5)	92(57.5) *
2	I think there is a need to organize trainings on hazard analysis critical control for food handlers	57(35.6)	103(64.4) *
3	I will inform my supervisor if I have diarrhea, wounds or cuts	62(38.7)	98(61.3) *
4	I will take sick leave if I have diarrhea, wound or cuts	76(47.5)	84(52.5) *
5	I try to do my best to always observe proper cleaning procedure	82(51.3) **	78(48.7)
6	I am willing to observe cutlery color codes for different uses e.g. red for cat fish, green for vegetables	77(48.1)	83(51.9) *
7	Preventing food contamination and spoilage is my key responsibility	89(55.6) **	71(44.4)
8	Expired food should never be consumed	96(60.0) **	64(40.0)
9	I consistently use gloves to handle non-packed food even if my supervisor is absent	36(22.5)	124(77.5) *
10	I do not need incentive to do my best to prevent food contamination	67(41.9)	93(58.1) *
11	My main reason for observing set food hygiene standards is not the fear of management/government regulatory supervisors	83(51.9) **	77(48.1)
12	Swabbing of food handlers' palms and nails is useful for assessing the effectiveness of hand washing	68(42.5)	92(57.5) *
13	Physical assessment of food handlers' personal hygiene is important for minimizing food contamination	73(45.6)	87(54.4) *
14	Task performance supervision motivates me	99(61.9) **	61(38.1)
15	To be certain that food is safe to eat, one should cook it for the duration of the recommended time than smell or taste it	59(36.9)	101(63.1)*

Source: field survey, 2024 * non- conformance Attitudes to food safety **conformance Attitudes to food safety

In this current study, of the 15 items composed on attitudes, 10 items had non-conformance responses (No) with percentage responses that were over 50 percent whereas 5 items had conformance attitudes (Yes) with response rate of over 50 percent. Sadly, the implication is that majority of those experienced (66.3%), trained (73.8%) and considerably educated vendors with secondary level and above school attendance (70%) had very negative attitudes to food safety. Unfortunately, the knowledge had already by these entities on food safety may not have translated into a positive attitude towards food safety. Al-Shabib et al. (2016) in their study found that education and training alone were not sufficient to enhance hygienic attitudes of food handlers. Besides, about 51 percent of the study's sample will always ensure proper cleaning procedure. Just as 60% of the vendors show positive attitude that expired food should never be consumed; 55.6% on preventing contamination and spoilage as key responsibility. On negative attitudes to food safety, items and their percentage responses were: willingness to learn about the basics of food hygiene and safety (57.5%); need to organize training on hazard analysis critical control points for food handlers (64.4%); informing supervisor if they had diarrhea, wound or cut (61.3%); take sick leave if I have diarrhea, wound or cut (52.5%); willing to observe cutlery color codes (51.9%); consistently use gloves to handle non packed food even if my supervisor is absent(77.5%); do not need incentive to do my best to prevent food contamination (58.1%); swabbing of food handlers' palms and nails for assessing the effectiveness of hand washing (57.5%); physical assessment of food handlers' personal hygiene is important for minimizing food contamination (54.4%); for food to be safe to eat, one should cook it for the recommended time than smell or taste it (63.1%).

Vendors' compliance to food safety practices

These participants' level of compliance to food safety practices is shown in Table 3. Grilled catfish vendors did not strongly agree to any of these 10 indicators of practice in food safety.

s/n	Food safety practice items	SA n (%)	A n (%)	N n (%)	D n (%)	SD n (%)	Mean
1	I wear gloves during preparation and distribution of unwrapped grilled fish	12(7.5)	33(20.6)	29(18.1)	40(25.0)	46(28.7)	1.52
2	I pay concerned attention on hygienic sources of catfish and vegetable ingredients	26(78.7)	16(10.0)	15(9.4)	0(0.0)	3(1.8)	3.64
3	I dispose-off fresh/grilled catfish when it develops odor or its taste changes	98(61.2)	40(25.0)	10(6.3)	6(3.7)	6(3.7)	3.36
4	I wash my hands with soap and warm water before preparing grilled catfish	106(66.3)	27(16.8)	7(4.3)	9(5.6)	11(6.8)	3.30
5	I cover my wound with plaster and bandage during preparation of grilled catfish	123(76.9)	18(11.2)	12(7.5)	2(1.2)	5(3.1)	3.56
6	I use protective body and hair cover when preparing and distributing grilled catfish	53(33.1)	23(14.4)	46(28.7)	16(10.0)	22(13.7)	2.43
7	I sterilize my tables, utensils and cutting boards	66(41.3)	80(50.0)	10(6.3)	4(2.5)	0(0.0)	3.30
8	I go for regular medical checks	15(9.4)	28(17.5)	21(13.1)	30(18.7)	66(41.3)	1.35
9	I bath regularly (at least 2times a day)	58(36.3)	42(26.2)	36(22.5)	10(6.3)	14(8.7)	2.75
10	I keep clean finger nails	77(48.1)	31(19.4)	41(25.6)	4(2.5)	6(3.7)	3.04

Table 3: Vendors' responses on compliance to food safety practices

Source: field survey, 2024

Key to remark on mean responses -Strongly Agree [4.21-5.00]; Agree [3.41-4.20]; Neither [2.61-3.40]; Disagree [1.81-2.60]; Strongly Disagree [1.00-1.80]

However, when their mean values are considered, respondents Agree (means between 3.41-4.20) with practice measures to pay concerned attention on hygienic sources of catfish and vegetable ingredients (3.64); cover wound with plaster/bandage before preparation of grilled catfish (3.56). The proper food safety practices of these vendors from indicators in the current study are consistent with earlier findings of Adesokan, Akinseye and Adesokan (2015). These road-side grilled catfish vendors were Neutral regarding the practice to – dispose-off fresh/grilled catfish when it develops odor or its taste changes (3.36); bath regularly (2.75) and keep clean fingers (3.04). Surprisingly, these vendors Strongly Disagree (means between 1.00 – 1.80) with food safety practices to wear gloves during preparation and distributing unwrapped grilled catfish (1.52) and going for regular medical checks (1.35). Their inability to undergo

regular medical checks and not wearing gloves during preparation of grilled catfish portends serious danger to health of consumers because of poor hygiene and severe consequence of food poisoning and transmission of contagious infections that may result from these practices. In absolute term, only 7.5% Strongly Agree to wearing gloves during preparation of grilled catfish whereas 9.4% of these participants Strongly Agree to going for regular medical checks. Many pathogens inhabit the hands and in bodily fluids and may become pathways to contaminating food products (Kadariya, Smith and Thapaliya 2014). However, the practice of concerned attention to hygienic sources of catfish as well as vegetables and cover of wounds with plaster/bandages prior to handling catfish showed up with Strongly Agree responses at 78.7% and 76.9 % respectively. Also, 66% of grilled catfish handlers Strongly Agree that they sterilize their utensils, tables and cutting boards. Generally, poor safety practices have been highlighted in several studies as the major cause of food contamination (Akabanda et al. 2024; Bou-Mitri, Mahmoud ELGerges and Jaoude 2018) Food handlers who are carriers of S.aureus bacteria through contact, sneezing or coughing contaminate food along the process chain (Muharnis and Dewi 2018). Studies equally show the presence of Staphylococcus aureus and Salmonella on food handlers' hands (Lee et al. 2017; Soares et al. 2012). These bacteria eventually contaminate foods from unwashed hands leading to production of a wide variety of toxins that cause food poisoning. Symptoms of Staphylococcus food poisoning include nausea, violent vomiting, abdominal cramping with or without diarrhea (Murray, 2005).

Socio-demographic factors of grilled catfish vendors and their relationships to food safety knowledge, attitude and practices

Table 4 shows the socio-demographic factors of road side ready-to-eat grilled catfish vendors and how they relate to their knowledge, attitudes and practices of food safety.

Table 4: vendors' socio-demographic variables and their relationship to food safety knowledge, food safety attitude and food safety practices

		FSK					FSA					FSP				
Variables	**N (%)**	**satisfacto**	**inadequ**	**X^2**	**p**	**crame**	**negative**	**positive**	**X^2**	**p**	**cramer**	**high**	**low**	**X^2**	**p**	**crame**
Gender																
Male	67(41	30(44.8)	37(55.2)	1.93	0.1644	0.10	25(37.3)	42(62.7)	0.00	0.9669	0.00	26(38	41(61	1.44	0.2288	0.0951
Female	93(58	52(55.9)	41(44.1)				35(37.6)	58(62.4)				45(48	48(51			
Age																
< 35	101(63	87(86.1)	14(13.9)	14.7	0.0001	0.3	39(38.6)	62(61.4)	0.45	0.4979	0.05	71(70	30(29	30	0.0000	0.4342
≥ 35	59(36	35(59.3)	24(40.7)				26(44.1)	33(55.9)				15(25	44(74			
Education																
Primary	48(30	11(22.9)	37(77.1)	49.4	0.0001	0.5	22(45.8)	26(54.2)	0.44	0.5064	0.05	19(39	29(60	20.6	0.0000	0.3589
Secondary&	112(70	91(81.3)	21(18.7)				45(40.2)	67(59.2)				86(76	26(23			
Experience(																
≤ 3	106(66	20(18.9)	86(81.1)	49.3	0.0001	0.55	40(37.7)	66(62.3)	1.57	0.2098	0.09	88(83	18(17	2.54	0.1104	0.1261
≥ 3	54(33	41(75.9)	13(24.1)				15(27.8)	39(72.2)				39(72	15(27			
Training																
Trained	118(73	92(77.9)	26(22.1)	42.5	0.0001	0.51	41(34.7)	77(65.3)	32	0.0001	0.44	86(72	32(27	23.0	0.0000	0.3798
Not Trained	42((26	9(21.4)	33(78.6)				36(85.7)	6(14.3)				13(30	29(69			
Income(₦)/																
<200,000	136(85	68(50.0)	68(50.0)	0.56	0.4514	0.05	47(34.6)	89(65.4)	0.07	0.7806	0.0	80(58	56(41	2.24	0.1336	0.1185
≥200,000																
Marital																
Single	99(61	42(42.4)	57(57.6)	2.0	0.1506	0.35	48(48.5)	51(51.5)	3.0	0.8116	0.13	33(33	66(66	35.7	0.0000	0.4728
Married	61(38	33(54.1)	28(45.9)				21(34.4)	40(65.6)				50(82	11(18			

*significant at p<.05 NS- not significant at p<.05 FSK-Food Safety Knowledge FSA-Food Safety Attitude FSP-Food Safety Practices

Key to remarks: If percentage of total response in category is ≥ 50 percent of correct response (FSK-satisfactory; FSA-positive; FSP-high), when response is < 50 percent of correct response (FSK- inadequate; FSA- negative; FSP-low)

Majority of these vendors were female (58.1%) compared to males (41.9%). Respondents whose ages were less than or equal to 35 years constituted 63.1percent whereas those above 35years were 36.9 percent. This indicates that the youth population in the study area is widely engaged in this enterprise and as such may offer a choice area for any empowerment program geared at reducing high unemployment among this group. These results on gender and age were similar to the findings of Barnabas at al. (2023), who in their work found that vendors who participated in Nigeria's school feeding program were majorly below 40 years old and constituted by 88.7% females. Nearly all grilled catfish vendors (70% at secondary and above vs 30% at primary and below) in the study were literate and had some form of education that would enable them read and understand at least the fundamentals in food safety. Surprisingly, 73.8% of these vendors have had some form of training on food safety with 66.3 % having less or 3years experience in catfish grilling. This strengthens the fact that catfish grilling is of new and emerging interest among the youth who are receptive to training as necessity for success in entrepreneurship. Income earned from this enterprise by respondents, suggest that many operated as small and medium enterprises (85% earned ≤ ₦200,000/month while 15% earned > ₦200,000/month). This study also showed that 61.9% were single (not yet married). The result reflects a scenario where majority of the respondents were also less than 35years of age. Amongst those socio-demographic factors of this study, Age ($\times^2$ =14.78; p=0.0001), Educational level ($\times^2$ =49.47; p=0.0001), Experience ($\times^2$ =49.37; p=0.0001) and Training ($\times^2$ =42.53; p=0.00001) were found to have significant ($p<0.05$) relationship with the respondents' knowledge on food safety. Human capital (education, experience and training) is presupposed to be an essential to knowledge. The more educated and trained the vendor were, the more likely they are able to comprehend food safety information and consequently expands their knowledge in food safety. This finding is consistent with studies of Luo et al. (2019); Osaili et al. (2018) who found that education exerts a positive influence on food safety knowledge. Besides, Adesokan et al. (2015) in a study on food training among food service workers in south western Nigeria showed that training was not significantly associated with knowledge levels on food safety among trained food handlers. Age is often considered a major drive for entrepreneurship in business. The higher number of young people engaged in catfish grilling establishes the basis of age as a driver for increased knowledge on food safety. The Cramer's V coefficients of these factors which depict their effect sizes, in descending order are: education level (0.5560), experience (0.5555), training (0.5156) and age (0.3040). From these values, except for age with a weak association (V lies within 0.1—0.35); educational level, experience and training maintained strong association (V >0.5) with the vendors' knowledge on food safety. This result describes the extent to which these socio-demographic factors of these respondents relate to their knowledge on food safety.

Training ($\times^2$ =32.23; p=0.0001) had a significant ($p<0.05$) relationship with vendors' attitude on food safety. The greater percentage (73.8%) of these entities involved in catfish grilling that have had a form training in this study signifies its role in modifying the disposition, orientation and positions regarding reception to food safety knowledge. Training of food handlers is long proven as an important way to generally enhance food safety (Smith, 1994). The aforementioned finding from this work consistent with Elobeid et al. (2019) that found a significant direct association of training with attitude on food safety among food handlers working in fast food restaurants in Qatar. The Cramer's V of 0.4405 equally suggests that training of these entities has a strong positive influence on their attitudes to food safety. However, all the other socio-demographic factors considered in this study (gender, age,

educational level experience, income and marital status) did not have significant ($p>0.05$) influence on vendors' attitude to food safety. Their Cramers' V ranged from 0.0220-0.1378 implying that their influence on attitudes of vendors to food safety were very weak.

As equally shown in Table 4, gender ($\times^2$ =1.44; p=0.228); experience ($\times^2$ =2.547; p=0.1104); and income ($\times^2$ =2.349; p=0.1336) were not significant ($p>0.05$) in determining grilled catfish vendors' compliances to food safety practices. Aside experience, all the other socio-demographic factors that were significant in influencing knowledge on food safety equally had significant ($p<0.05$) influence on practice compliance. This underscores the importance of knowledge as a veritable means to how food handlers necessarily comply to practice codes on food safety. For instance, Alemayehu, et al. (2021) in a study of institution-based cross-sectional study in Debre Markos, Northwest Ethiopia showed using bivariate logistic regression analysis that trained food handlers were two times more likely to have good food safety practices than non-trained food handlers. Similarly, knowledgeable food handlers were 1.68 times more likely to practice good safety than non-knowledgeable. Besides, previous studies had shown a strong positive strong relationship between food handlers' socio-demographic factors of age, education, training and income on food safety practices (Tuglo et al. 2021; Muharnis and Dewi 2018). In considering their Cramer's V: age (0.4342); educational level (0.3589); training (0.3795); and (0.4728), these factors individual influences on food safety practices can be said to be very strong.

CONCLUSION

The goal of maintaining food safety in the product handling chain is increasingly being of great concern. This present study on food safety knowledge, attitude and practices of road-side vendors of ready-to-eat grilled catfish had highlighted the state of these three food safety variables along with how they relate to socio-demographic factors of these participants in Awka metropolis of Anambra state. It brought to focus what food handlers and consumers need to understand in relation to safety of grilled catfish. It had empirically isolated their knowledge, attitudes and practices with focus largely from the WHO's five keys to safer food. In order to ensure the delivery of safe, sound and wholesome grilled catfish that is fit for human consumption, it is necessary for governments at the local level to strengthen their regulatory expertise while urgently revising policies that ensure effectiveness for result. The federal government on its part would need to clarify responsibilities of many of her agencies that have overlapping mandates and are currently working at cross purposes. Finally, regular trainings and establishment of practice codes must draw from international protocols and standards particularly as provided in Codex Alimentarius and HACCP codes.

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