

Multidrug-Resistant *Klebsiella* Species Isolated from Hawked Sauced Cow Skin in Umuahia and Ikwuano, LGAs of Abia State: Implications for Food Safety

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ABSTRACT

In Eastern part of Nigeria, where there is inadequate monitoring of food safety practices as well as prudent antibiotic use, hawked foods are usually exposed to contamination by antibiotic resistant bacteria owing to improper and unhygienic handling of food by street vendors. This cross-sectional study investigated the prevalence and antibiotics resistance of *Klebsiella* species isolated from street-vended sauced cow skin in Ikwuano and Umuahia LGAs of Abia State, Nigeria. A total of 360 ready to eat palm oil sauced cow skin were processed using standard microbiological techniques and isolates identified using VITEK 2 system. A total of 76 coliforms were isolated, out of which 48 (63.2%) were *Klebsiella* species. *K. oxytoca* was 32(66.7%) and *K. pneumoniae* was 16 (33.3%). Antimicrobial susceptibility of the isolates was determined by disk diffusion against a panel of 21 antibiotics. The study showed that majority of the isolates 68 (89.5%) were from samples collected from vendors practicing poor hygiene. Of the 360 vendors (participants), 100 (27.8%) responded to having incidence of diarrhea, out of which only 8(2.2%) had antibiotics prescription for treatment from clinicians, while 352(97.8) participants got from other non-professional sources. *K. oxytoca* had the highest number of isolates resistant to the tested antibiotic agents. All *Klebsiella* isolates had multiple antibiotic resistance indices (MARI) of 0.2 to 0.6. The *Klebsiella* species isolated from hawked sauced cow skin in this study were all found to be multidrug resistant which poses a serious public health challenge, implicating street food as uncommon reservoir to antibiotic resistant bacteria.

Keyword: Multidrug Resistance, Antimicrobial Resistance, *Klebsiella*, Sauced Cow Skin.

Introduction

The growing emergence of antibiotic-resistant bacteria especially multidrug-resistant (MDR) *Klebsiella* species has become one of the most pressing threats to global public health. These organisms, notably *Klebsiella pneumoniae* and closely related members of the genus, possess an exceptional ability to accumulate and spread antimicrobial resistance genes. As a result, treatment options continue to narrow, contributing to rising cases of severe illness and death worldwide (De Souza Santos Monteiro *et al.*, 2025; Ferreira *et al.*, 2019; Li *et al.*, 2023). Both the World Health Organization (WHO) and the Center for Disease Dynamics, Economics and Policy have repeatedly warned that unchecked antimicrobial resistance could

usher in a post-antibiotic era in which common infections may once again become fatal (WHO, 2015; Center for Disease Dynamics, Economics and Policy, 2015). Coliform bacteria are widely used as indicators of contamination in food and water systems. Among them, *Klebsiella* species are of particular concern because, although some coliforms are harmless, *Klebsiella* species are opportunistic pathogens capable of causing serious infections such as pneumonia, urinary tract infections, and septicemia (Podschun and Ullmann, 1998). Their detection in food is especially troubling in settings like Nigeria, where regulatory oversight and hygiene practices in street-vended foods are often inadequate, creating conditions that favor the survival and transmission of MDR strains (Podschun and Ullmann, 1998; Gupta *et al.*, 2024).

Hawked foods such as sauced cow skin remain an accessible and inexpensive protein source for many Nigerians. However, their microbiological safety is not well documented. The widespread misuse of antibiotics in humans and animals, together with poor sanitation and environmental contamination, has accelerated the spread of resistant bacteria across the food chain (Kijineh *et al.*, 2024). Existing studies have confirmed that MDR coliforms, including *Klebsiella* species, are commonly isolated from street foods, highlighting the potential for consumers to be exposed to resistant pathogens (Wang *et al.*, 2023). Despite this growing evidence, little research has focused specifically on the occurrence and resistance characteristics of *Klebsiella* species in hawked sauced cow skin within Abia State.

This study was therefore designed to address this knowledge gap by investigating the prevalence, resistance, and food safety implications of MDR *Klebsiella* species contaminating hawked sauced cow skin in Umuahia and Ikwuano. The outcomes of this research are expected to provide essential data for public health planning and to support the One Health framework, which emphasizes the interconnectedness of human, animal, and environmental health in combating antimicrobial resistance.

Materials and Methods

Sample Collection

Hawked ready-to-eat Palm oil-sauced cow skin samples were collected from various street vendors across major markets, streets and schools (n = 360) in Umuahia North and Ikwuano LGAs of Abia State, Nigeria. Samples were collected aseptically using sterile containers and transported to the laboratory in a cooler with ice packs to maintain a temperature of approximately 4°C. Samples were processed within 24 hours of collection.

Sample processing, Bacterial Cultures and Identification

Sample Processing: Each food sample (10 g) was homogenized in 100 mL of Lauryl sulphate broth (LB) and incubated at 37°C for 18-24 hours (BAM, 2002). This was plated on MacConkey Agar and incubated at 37°C for 24 hours.

Colonies on MacConkey Agar with significant growth (pink to red colonies) were sub-cultured on Eosin Methylene Blue (EMB) (Downes, 2001; Harley and Prescott, 2013) and incubated for 24 hours. Colony growth on the agar was primarily identified using colony colour and other characteristics, then sub-cultured on nutrient agar plates for purity used for gram staining and microscopy. Isolated coliforms were stored in nutrient agar slants overlaid with liquid paraffin oil for further analyses. The identification of the isolates was confirmed using the VITEK 2 system using the Gram-negative (GN) card.

Antibiotics Susceptibility Testing of Isolates

Antibiotics susceptibility testing of isolates was performed, the in vitro activities of Penicillin and its derivatives (ampicillin, ticarcillin, piperacillin and amoxicillin/clavulanic acid); cephalosporins (cefoxitin, cefotaxime, cefpodoxime, ceftazidime, cefuroxime, ceftriaxone and cefepime); quinolones (ciprofloxacin, ofloxacin, levofloxacin, pefloxacin and nalidixic acid); carbapenems (ertapenem, meropenem, imipenem) and others (amikacin, gentamicin, tetracycline, and nitrofurantoin [Oxoid; Basingstoke, UK]) were ascertained by the disc diffusion technique (modified version of Kirby-Bauer method) on Mueller Hinton agar [Oxoid; Basingstoke, UK] according to the zone size criteria recommended by the Clinical and Laboratory Standard Institute (CLSI, 2019). A pure colony of the test isolate was inoculated into a 5ml sterile tryptone soy broth in glass tube and incubated at 37°C. It was allowed to grow for 2-3 hours to achieve 0.5 McFarland standard. A sterile swab stick was dipped into the tryptone soy broth culture and streaked onto the surface of already prepared Mueller Hinton agar to obtain a lawn growth of the isolate. After a few minutes, a pair of sterile forceps was used to place the antibiotics discs onto the agar surface and the plate was incubated at 37°C for 18 hours. The result was recorded by measuring the diameter of the zone of inhibition with a ruler placed behind the plate. The result was recorded and reported as either “S” or “R” for resistance after consulting the CLSI (2020a) performance standard for AST. Isolate was considered multidrug-resistant (MDR) when isolate resistant to ≥ 1 agent in ≥ 3 antimicrobial categories and extensively-drug-resistant (XDR) when isolate resistant to ≥ 1 agent in all but ≤ 2 antimicrobial categories (CLSI, 2020b).

Multiple Antibiotic Resistance (MAR) Index was calculated using the formula below:

$$\text{MAR Index} = \frac{a}{b}$$

Where

'a' is the number of antibiotics an isolate is resistant to, and 'b' is the total number of antibiotics tested against that isolate.

Results

A total of 76 coliforms were isolated from 360 ready to eat palm oil sauced cow skin samples. Of the 76 coliform isolates in Figure 1, 48 (63.2%) were *Klebsiella* species which formed the majority of the isolates. Of the *Klebsiella* species, 32 (66.7%) were *K. oxytoca* while the rest were *K. pneumoniae pneumoniae*.

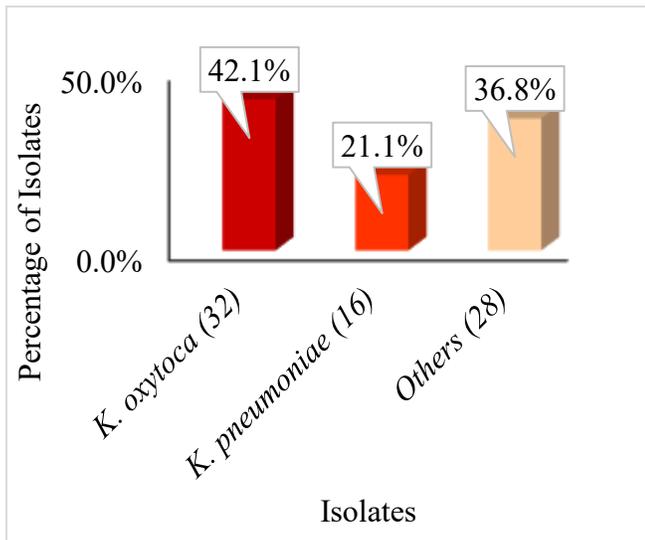
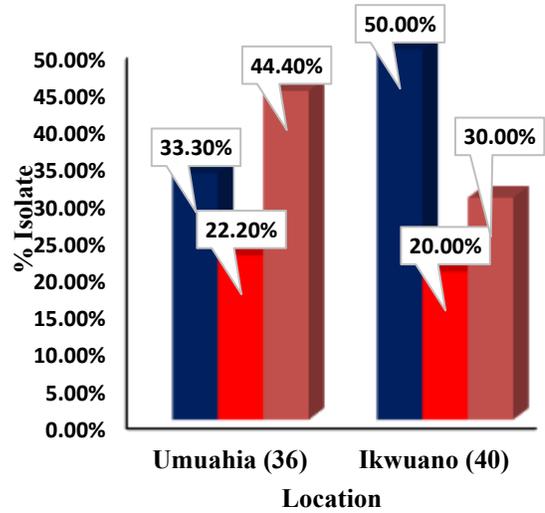


Fig. 1: Frequency Occurrence of Isolates

Of all the isolates, *Klebsiella* species occurred the most in both locations, having 28 (70%) in Ikwuano and 20 (55.6%) in Umuahia while the remaining isolates shared the remaining 30% and 44.4% respectively as displayed in Figure 2.

Considering the association between vendors' hygiene and the coliforms isolated in Figure 3, it was observed that majority of the isolates 68 (89.5%) were obtained from vendors practicing poor hygiene but the few 8 (10.5%) isolated from the vendors' practicing good hygiene were all *Klebsiella* species, *K. pneumoniae pneumoniae* to be precise.

Fig. 2: Distribution of isolates from hawked sauced meat by location

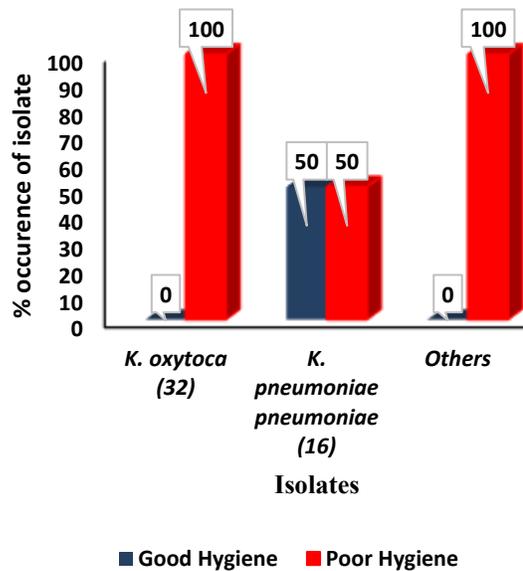


Fig. 3: Association of Isolates with hygiene practices of the food vendors

Out of the 16 isolates from samples prepared with pipe-borne water in Figure 4, 12 (75.0%) were *Klebsiella* species with *K. oxytoca* occurring more 8 (50%). For the association between isolated coliform and incidence of diarrhea among the food vendors, 16 (66.7%) of 24 coliforms isolated from the samples of those having diarrhea were *Klebsiella* species while the remaining 8 (33.3%) was made up of other coliforms as shown in Figure 5.

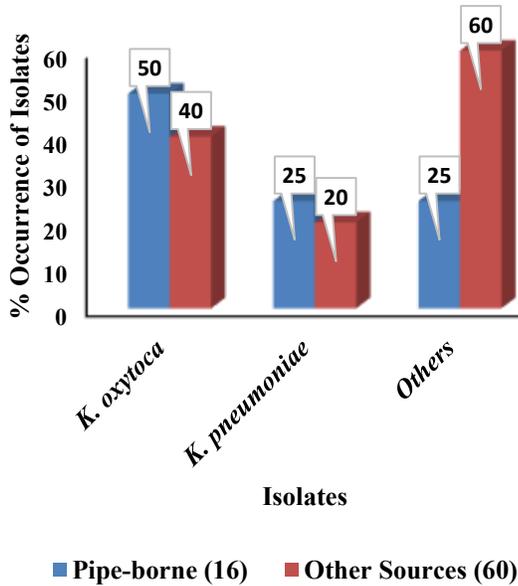


Fig. 4: Association of Isolates with source of water used for sample preparation

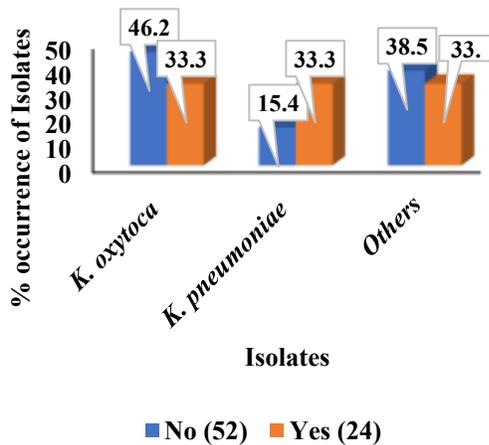


Fig. 5: Association of Isolates with incidence of diarrhea among hawkers

The result of the occurrence of current diarrhea and antibiotic use among the hawkers as displayed in Table 1. Of the 360 participants, 100 (27.8%) responded to having a recent diarrhea in the last one months. With respect to sources of antibiotics used, only 8(2.2%) had antibiotics prescription from clinicians while more participants got from other non-professional sources including self-medication.

Table 1: Occurrence of diarrhea and antibiotic use among hawkers

Variable	Group	Frequency	Percent (%)
Recent case of diarrhoea	Yes	100	27.8
	No	260	72.2
n = 360		360	100
Antibiotic prescription	None	256	71.1
	Self-medi	48	13.3
	Patent M shop	48	13.3
	Clinician	8	2.2
n = 360		360	100

Key: Self-medi = Self medication; Patient M shop = Patient medicine shop.

Result of antibiotic resistogram of coliforms within species is presented in Table 2, with *K. oxytoca* having the highest number of isolates resistant to each of the antibiotic agents, with more resistance for pefloxacin (PEF) 28 (87.5%) observed than for others. This was followed by *K. pneumoniae* with its highest resistance 16 (100.0%) observed for Ceftazidime (CAZ) and Nitrofurantoin 16 (100.0%). *Klebsiella* species expressed no resistance to all the carbapenems (imipenem, ertapenem, meropenem, doripenem). Antibiotic resistance indices of isolates in terms of being multidrug resistant (MDR), extensively drug resistant (XDR) and Pan-drug (PDR) is displayed in Table 3. All isolates were observed to be both multidrug and extensively-drug resistant, but no pan-drug resistant isolate was observed. All *Klebsiella* isolates had multiple antibiotic resistance indices (MARI) of 0.2 to 0.6 as displayed in Figure 6

Table 2: Antibiotic resistogram of Isolates

Antibiotics	<i>K. oxytoca</i> (32)	<i>K. pneumoniae</i> (16)	Others (28)
	Resistance (%)	Resistance (%)	Resistance (%)
Amoxicillin/Clavulanic acid (20/10ug)	11(34.38)	8(50.00)	7 (25.00)
Ticarcillin (75ug)	11(34.38)	3(18.75)	11 (39.3)
Ampicillin (10ug)	8(25.00)	1(6.25)	11 (39.3)
Cefoxitin (30ug)	25(78.13)	10(62.50)	23 (82.1)
Cefuroxime (30ug)	15(46.88)	6(37.50)	13 (46.4)
Cefotaxime (30ug)	11(34.38)	4(25.00)	15 (53.6)
Ceftriaxone (30ug)	6(18.75)	1(6.25)	2 (7.1)
Ceftazidime (30ug)	26(81.25)	16(100.00)	19(67.9)
Ofloxacin (5ug)	9(28.13)	4(25.00)	15 (53.6)
Pefloxacin (5ug)	28(87.50)	13(81.25)	24 (85.7)
Levofloxacin (5ug)	0(00.00)	0(00.00)	0 (0)
Ciprofloxacin (5ug)	3(9.38)	1(6.25)	9 (32.1)
Nalidixic acid (30ug)	9(28.13)	8(50.00)	5 (17.9)
Imipenem (10ug)	0(00.00)	0(00.00)	0 (0)
Ertapenem (10ug)	0(00.00)	0(00.00)	1 (3.6)
Meropenem (10ug)	0(00.00)	0(00.00)	0 (0)
Doripenem (10ug)	0(00.00)	0(00.00)	0 (0)
Amikacin (30ug)	5(15.63)	0(0.00)	4 (14.3)
Tetracycline (30ug)	12(37.50)	1(6.25)	13 (46.4)
Gentamicin (10ug)	2(6.25)	0(0.00)	3 (10.7)
Nitrofurantoin (300ug)	24(75.00)	16(100.00)	19 (67.9)

Note: Percentages are calculated based on the number of coliforms resistant to individual antibiotics across all species

Table 3: Antibiotic resistance indices of isolates

Isolates	MDR (No./%)	XDR (No./%)	PDR (No./%)
<i>K. oxytoca</i> (n = 32)	32 (100.0)	32 (100.0)	0 (0.0)
<i>K. pneumoniae</i> (n = 16)	16 (100.0)	16 (100.0)	0 (0.0)
Others (n = 28)	28 (100.0)	28 (100.0)	0 (0.0)

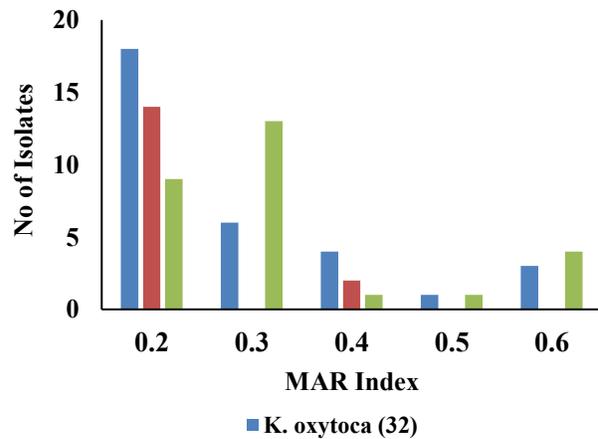


Fig. 6: Multiple Antibiotics Resistance Indices showing the organisms

Discussion

This study investigated coliform contamination of hawked, sauced cow skin (a delicacy in the South Eastern State of Abia) with the aim of establishing its role as a reservoir of infectious pathogenic, antibiotic resistance bacteria. A total of 360 food samples were collected from the study participants.

Six coliform species isolated from hawked sauced cow skin were identified in this study. The most frequently isolated coliform was *K. oxytoca* 32 (42.11%), followed by *Klebsiella pneumoniae* 16 (21.05%), *E. coli* 8(10.53%), *Enterobacter cloacae* 4 (5.26%), and eight (10.53%) each of *Serratia fonticola* and *Serratia rubidaea*. The presence of *Klebsiella* species in ready-to-eat foods has been documented by local studies investigating contamination of street vended food in other parts of Nigeria. Igene and Okoh (2020) reported *Klebsiella pneumoniae* prevalence ranging between 10% and 30% in Nigerian street foods, which is consistent with the 21.05% found here; Osuagwu et al. (2019) confirmed the presence of a range of coliform species including *Klebsiella* in street foods in Umuahia, supporting the local relevance of this microbial profile.

However, Osuagwu et al. (2019) reported a lower prevalence (15%) of *Klebsiella pneumoniae* when they sampled street foods in Umuahia. This suggests that there may be temporal or spatial differences in local microbial contamination, which could be caused by variations in sample types, sanitation, or vending practices.

According to studies conducted in Southeast Asia and Europe by Budiarso et al. (2020) and López et al. (2022), respectively, the prevalence of *Klebsiella oxytoca* in street foods is typically lower ranging between 2% and 10% compared to the reported 42.11% in this study. This implies that the current study area has a higher local burden or contamination risk. On the other hand, the 21.05% *K. pneumoniae* prevalence is lower than the 27.12% prevalence in Indian street food samples (Kumar et al., 2021), and 30% prevalence in a variety of food products in Europe (López et al., 2022). However, *Escherichia coli* frequently predominates globally; for example, in some ready-to-eat food meta-analyses reported by Ali et al. (2021), *E. coli* was found in approximately 33.8% of samples in developing countries.

The prevalence of the coliform species in Umuahia and Ikwuano reveals both location-specific differences and similarities. *Klebsiella oxytoca* was the most prevalent isolate, constituting 33.33% of isolates in Ikwuano and 50.00% in Umuahia. *Klebsiella pneumoniae* showed comparable prevalence at 20.00% and 22.22%, respectively. These findings are consistent with a study by Chukwu et al. (2019) which reported *Klebsiella* species prevalence at the rate of 40% to 60% in three street-vended foods in Owerri, Imo State, supporting the prominence of this genus as observed in this study. The distribution of the coliform isolates by location in this study underscores the heterogeneity of coliform contamination in Nigerian street foods, reinforcing the need for location-specific surveillance and targeted food safety interventions.

With respect to water sources, the noteworthy correlation ($\chi^2 = 22.210$, $p = 0.001$) between the type of water used and the prevalence of coliform highlights the importance of water quality in ensuring the safety of street food. There was a risk of contamination because 21.1% of isolates were linked to stream water, even though 87.8% relied on pipe-borne water. According to Chigbo and Udoka (2020), 30% of food vendors in Owerri, Southeast Nigeria, used non-piped water sources, which were strongly linked to food samples containing microbiological contamination. Vendors using improved water sources had significantly lower coliform counts than those using surface water ($p < 0.05$), according to Adeyanju et al. (2025) in Ife East, Southwestern Nigeria. In a thorough analysis spanning seven low- and middle-income nations, Mensah et al. (2022) pointed out that, even in cases where pipe-borne water was accessible, contamination frequently happened as a result of inadequate water handling and storage. This emphasizes how intricately food contamination, hygiene habits, and water sources are related. According to occurrence of diarrhea and antibiotic use data, 71.1% of 360 participants reported no recent use of antibiotics, while 27.8% reported recent diarrhea. A total of 13.3% of the study participants affirmed that they were involved in self-medication, purchasing antibiotics from patent medicine stores to treat diarrhea. Given the close connection between diarrheal illnesses and the spread of enteric pathogens that can contaminate food and water, the finding that 27.8% of participants reported recent diarrhea is noteworthy in the context of food contamination risks.

Diarrhea-stricken Street food vendors may unintentionally serve tainted food, raising the possibility that customers will contract Salmonella, Shigella, and *Escherichia coli* (Mensah et al., 2002; Tambekar et al., 2009). In street food vending settings, the use of unsafe water, inadequate sanitation facilities, and poor hand hygiene are common practices that increase this risk by allowing pathogens from diarrheal cases to persist and spread (WHO, 2024). The urgent need for health screening, education, and improved hygiene infrastructure among street food handlers to reduce foodborne illness outbreaks is highlighted by studies conducted in developing countries by Chigbo and Udoka (2020) and Mabaso et al. (2021). These studies demonstrate that vendors who have recently experienced gastrointestinal infections are more likely to be carriers of foodborne microorganisms. Our study population had high rates of bacterial contamination, including drug-resistant species, suggesting the possible spread of resistant bacteria. Important epidemiological connections between particular coliform species and gastrointestinal illness are highlighted by the noteworthy correlation between the prevalence of coliform isolates and recent diarrheal episodes among food vendors. Adeyanju et al. (2025)'s findings in Ife East, Southwestern Nigeria, where asymptomatic carriage of *Klebsiella oxytoca* was common despite its known opportunistic infection potential are consistent with the prevalence of *Klebsiella oxytoca* among the non-diarrheal hawkers. According to Mabaso et al. (2021) in Zululand District, South Africa, *Klebsiella pneumoniae* is equally distributed among food vendors who cause diarrhea and those who do not, indicating that it serves as both a colonizer and a pathogen.

However, Okafor and Ojo (2021) discovered no correlation between the prevalence of *Klebsiella* species among food vendors and diarrheal symptoms in Lagos, Nigeria. This suggests that asymptomatic carriage makes it more difficult to clinically attribute diarrheal illness.

This study also found high rates of self-medication and little clinical consultation. Antibiotic self-medication is still a major problem, as evidenced by multiple studies showing that non-prescription antibiotic use is common and mostly comes from patent medicine vendors due to cost and accessibility considerations (Abdulraheem et al., 2016; Suleiman et al., 2018).

Similar trends have been noted regionally in West Africa, where antibiotic abuse and self-medication exacerbate antibiotic resistance and make treating infections like diarrhea more difficult (Agyeman and Mensah, 2021). Globally, low- and middle-income countries continue to have high rates of diarrheal disease and irrational antibiotic use, necessitating immediate public health interventions such as education, stewardship programs, and enforcement of regulations to improve sanitation and decrease self-medication (WHO, 2022). These results underline how important it is to implement focused public health initiatives to reduce antibiotic resistance and diarrheal illnesses in these susceptible groups.

A troubling pattern of multidrug resistance is revealed by the antibiotic resistance profile displayed by the coliform genera especially *Klebsiella species* in this study. According to Iroha et al. (2021) and Eze et al. (2020), who reported rising resistance among coliform isolates from clinical and environmental sources in Nigeria, this pattern reflects the increasing ineffectiveness of the antibiotics in use in the locality.

An earlier study by Oji et al. (2019) had reported low to moderate resistance in other Nigerian settings including secondary and tertiary healthcare facilities across Nigeria where isolates were tested for antimicrobial susceptibility. This could indicate that antibiotic exposure or resistance mechanisms vary with geographic location. Ceftriaxone resistance was comparatively low, which is in line with a Nigerian study (Mabeku et al., 2023) that indicate ceftriaxone maintains moderate efficacy, perhaps as a result of usage patterns and selective antibiotic pressures. In contrast to new global reports that show growing antibiotic susceptibility, *Klebsiella pneumoniae's* total ceftazidime resistance reflects reports of regional resistance hotspots (World Health Organization, 2023).

Levofloxacin, a quinolone maintained full activity against all isolates, supporting research by Mashao et al. (2021) in Nigeria and other African nations, where some fluoroquinolones continue to be effective despite growing resistance. However, Mabeku et al. (2023) reported high rates of pefloxacin resistance and variable resistance to ciprofloxacin, indicating the persistent threat of quinolone resistance associated with overuse.

Notwithstanding growing resistance concerns, aminoglycosides like gentamicin and amikacin continued in consistence with this study, to exhibit low to moderate resistance levels, in line with worldwide trends showing these remain effective treatment options (WHO, 2023). Remarkably, total resistance to nitrofurantoin was observed in *Serratia fonticola* and *Klebsiella pneumoniae*, indicating exceptionally high resistance. This stands in contrast to research conducted by Akinjogunla and Anibijuwon (2018) and Oluwafemi *et al.* (2019), in Lagos which documented moderate resistance. Numerous studies conducted worldwide continue to report good nitrofurantoin efficacy. This disparity most likely results from particular genetic factors influencing resistance or from localized selective pressures.

Similarly, *Klebsiella pneumoniae* showed a relatively high level of nalidixic acid resistance, which partially supported reports from Nigeria. A study by Alabi *et al.* (2025) summarizes recent antimicrobial resistance challenges in Nigeria and notes elevated resistance levels in coliforms, including nalidixic acid resistance in these pathogens. Similarly, Ojulong *et al.* (2024) report high multidrug resistance patterns among *Klebsiella pneumoniae* isolated in Nigerian settings, with significant resistance against fluoroquinolones and related quinolone antibiotics, which includes nalidixic acid. These findings are in contrast to the global trend reported by the World Health Organization (2023), which notes a declining prevalence of nalidixic acid resistance globally due to decreased clinical use and stewardship efforts

The high level of antibiotic resistance of the *Klebsiella* species, especially *K. oxytoca* in this study reveals its importance as a reservoir for antimicrobial resistance genes in foods sold on the street. Multiple Antibiotic Resistance Index (MARI) values as seen in this investigation are indicative of high use of antibiotics in an environment. The values in this study range from 0.2 to 0.6. *Klebsiella oxytoca* and *Klebsiella pneumoniae* made up the majority of the isolates (53.95%) that had MARI of 0.2 and above. These results are consistent with those of Mwangi *et al.* (2020) and Akinjogunla *et al.* (2018), who found that environmental and clinical Enterobacteriaceae isolates often have MAR indices above 0.2, indicating exposure to environments that are frequently contaminated or use antibiotics.

The presence of isolates with higher MARI values up to 0.6 is concerning, despite being less common; studies from South Africa and other African regions have reported similar ranges, where elevated MARI values reflect multidrug resistance likely caused by antibiotic misuse and overuse (Karakawa *et al.*, 2016; Mabeku *et al.*, 2023).

The findings from this study show that hawked sauced cow skin serves as an important reservoir for multidrug-resistant coliforms especially *Klebsiella* species in South-Eastern Nigeria. The high prevalence of *Klebsiella oxytoca* and *Klebsiella pneumoniae*, coupled with their strong resistance to tested antibiotic agents, indicates a clear public health concern for individuals who consume these ready-to-eat foods. The results further demonstrate a strong association between contamination levels and factors such as the quality of water used during preparation and the health status of food vendors. These observations highlight the urgent need for improved hygiene practices, routine surveillance, and targeted food safety measures among street food vendors. The high Multiple Antibiotic Resistance Index (MARI) values recorded, particularly among the *Klebsiella* isolates, reflect ongoing patterns of antibiotic misuse and widespread environmental contamination. This trend mirrors what has been documented in clinical and environmental studies across Nigeria and other parts of Africa. The variation in resistance across different antibiotic groups including complete resistance to nitrofurantoin in some isolates shows the complexity and locality of antimicrobial resistance challenges, underscoring the need for immediate public health interventions.

Conclusion

This research establishes that hawked sauced cow skin sold in Umuahia and Ikwuano_LGAs of Abia State in Nigeria is contaminated with pathogenic, multidrug-resistant coliforms particularly *Klebsiella* species which can facilitate the spread of resistant bacteria along the food chain. Addressing this issue will require a holistic One Health approach that prioritizes vendor hygiene education, routine medical screening, access to clean water, strong antibiotic stewardship, and stricter food safety regulations. The data generated from this study provide essential local evidence that can support policy development aimed at reducing both foodborne infections and the growing burden of antimicrobial resistance in Nigeria.

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