



PROJECT REPORT

BACTERIAL CONTAMINATION AND ANTIMICROBIAL RESISTANCE PATTERNS OF ISOLATES FROM RAW CHICKEN MEAT SOLD IN NON-SUPERMARKET RETAIL OUTLETS IN NAIROBI COUNTY



Prepared by:

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ACKNOWLEDGEMENT

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EXECUTIVE SUMMARY

Introduction: Chicken meat is a major source of animal protein in Kenya, especially in urban and peri-urban areas, but weak regulation of production and retail increases the risk of contamination with *Escherichia coli*, *Salmonella* spp., and *Staphylococcus aureus*. These pathogens cause foodborne illnesses and can carry antimicrobial resistance (AMR), posing significant public health risks. In Nairobi, human exposure is heightened by poor handling, inadequate hygiene and sub-optimal storage practices.

Overall objective: To assess the prevalence, antimicrobial resistance (AMR) profiles and drivers of bacterial contamination in raw chicken meat sold in non-supermarket retail outlets in Nairobi County.

Methodology: A total of 264 retail shops were purposively selected, and chicken meat samples collected, labeled and transported at 4 °C to the laboratory. Structured questionnaires captured vendor practices, meat handling, storage and hygiene. In the laboratory, *E. coli*, *Salmonella* spp., and *S. aureus* were isolated using selective media and confirmed with standard biochemical tests, while antimicrobial susceptibility testing was performed using the Kirby-Bauer disc diffusion method according to CLSI 2025 guidelines. Data were analyzed in STATA, calculating pathogen prevalence, susceptibility profiles and multidrug resistance, while logistic regression identified factors associated with contamination. The significance level was set at $p < 0.05$.

Results: Among the 264 surveyed chicken meat retail establishments, the attendants were predominantly male (65.8%) and young; with nearly half aged between 20–29 years (47.7%).

Majority had secondary (51.1%) or tertiary level education (38.3%) and had received informal or on-the-job training (90.5%), while few underwent formal training (3.8%). Work experience varied, with the largest proportion having 1–2 years in the business (39.4%). The majority of outlets were butcheries (95.8%), had operated for over one year (79.2%), and sold raw chicken meat exclusively. This meat was often sourced from distributors (79.2%) or local farms (47.0%) and delivered fresh and warm (92.4%) and stored in freezers (89.4%), although over half left meat at room temperature (54.6%).

Wooden chopping boards (92.8%) were the most commonly used chopping surface. Observed hygiene practices were sub-optimal, with only 9.9% of attendants wearing clean protective clothing, 19.4% of meat contact surfaces (counter-tops) clean, and 30.3% of shops having hand-washing facilities. *E. coli* was the most prevalent bacterium isolated (94.7%), followed by *S. aureus* (39.3%) and *Salmonella spp.* (8.1%), with frequent co-contamination. Antimicrobial resistance was highest in *E. coli*, with a high level of multidrug-resistance (MDR) reported in *E.coli* followed by *S.aureus* (44.7% and 28.4% respectively), while most *Salmonella spp* isolates (99.6%) were non-MDR. Logistic regression identified key factors associated with contamination, including handling meat on shared surfaces, use of wooden boards, attendant education level, freezer storage and apron use; highlighting the roles of vendor practices and environmental conditions in bacterial contamination and AMR.

Conclusion: Raw chicken meat sold in non-supermarket retail outlets in Nairobi County is frequently contaminated with *E. coli*, *S. aureus* and to a lesser extent, *Salmonella spp.*. There is with substantial co-contamination and notable levels of multi-drug resistance, particularly in *E. coli* and *S. aureus*. Poor hygiene practices, use of shared or wooden surfaces, limited

training of attendants, and sub-optimal storage conditions were key factors associated with bacterial contamination. These findings highlight the urgent need for improved vendor hygiene, proper meat handling, and antimicrobial stewardship interventions to reduce foodborne illness risks and limit the spread of antimicrobial resistant bacteria

**BACTERIAL CONTAMINATION AND ANTIMICROBIAL RESISTANCE
PATTERNS OF ISOLATES FROM RAW CHICKEN MEAT SOLD IN NON-
SUPERMARKET RETAIL OUTLETS IN NAIROBI COUNTY**

ABRIDGED VERSION

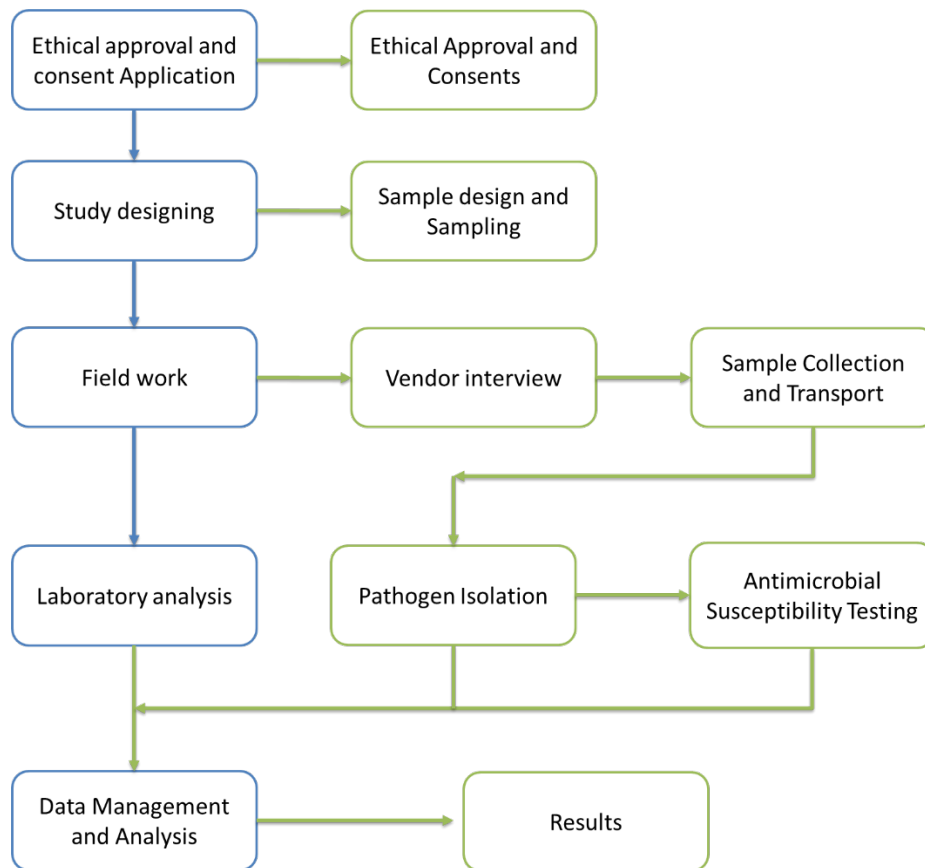
INTRODUCTION

- Raw chicken is a common food item in Nairobi, Kenya.
- However, it can harbor harmful bacteria such as *Escherichia coli*, *Salmonella* spp., and *Staphylococcus aureus* that cause foodborne illnesses.
- Human exposure to the bacteria is heightened by poor handling, inadequate hygiene and sub-optimal storage practices
- Of increasing concern is the rise of *antibiotic-resistant* bacteria, which can make infections in animals and humans harder to treat.
- This document summarizes a recent study investigating bacterial contamination and antibiotic resistance in raw chicken sold in Nairobi County.

AIM

- To assess the prevalence, antimicrobial resistance (AMR) profiles, and drivers of bacterial contamination in raw chicken meat sold in non-supermarket retail outlets in Nairobi County.

METHODOLOGY



RESULTS

Business characteristics

- The majority were butcheries (95.8%)
- Had been operating for more than one year (79.2%)
- Sold raw chicken meat (100%)
- Chicken meat was primarily obtained from distributors or wholesalers (79.2%) and local farms (47.0%)
- Most chicken meat was delivered to shops as fresh and warm meat (92.4%)

Chicken Handling and Storage

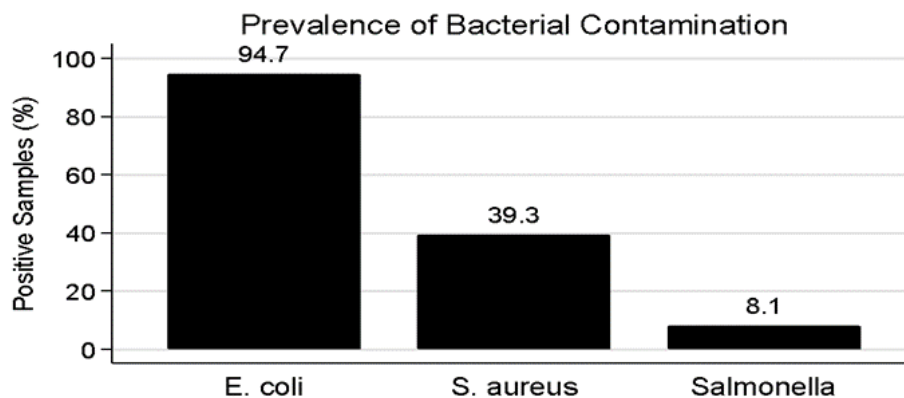
- Most outlets did not wash chicken meat before displaying or selling it (87.9%)
- Over half of the outlets stored chicken meat at room temperature (54.6%)
- Wooden chopping boards were used by the vast majority of establishments (92.8%)

Hygiene status of attendants, equipment, and working environment

- 52% of the attendants wore a dust coat
- 42 % of attendants had no separate protective clothing or wore visibly soiled protective clothing
- 75% of establishments had surfaces with minor visible meat and blood residue
- 60% of establishments had floors that were generally clean
- 62% of establishments had knives and utensils with minor meat and blood residue, reflecting intermittent cleaning practices
- Flies were not observed in the work or selling space in the majority of establishments (69%)
- 70% of establishments did not have a hand-washing facility

Prevalence of bacterial contamination in chicken meat

- *Escherichia coli* (95%) was the most frequently isolated bacterium
- *Staphylococcus aureus* was detected in 39% of samples
- *Salmonella* spp. were detected in 8% of samples
- Co-contamination with *E. coli* and *Staphylococcus aureus* was also frequent (34%)

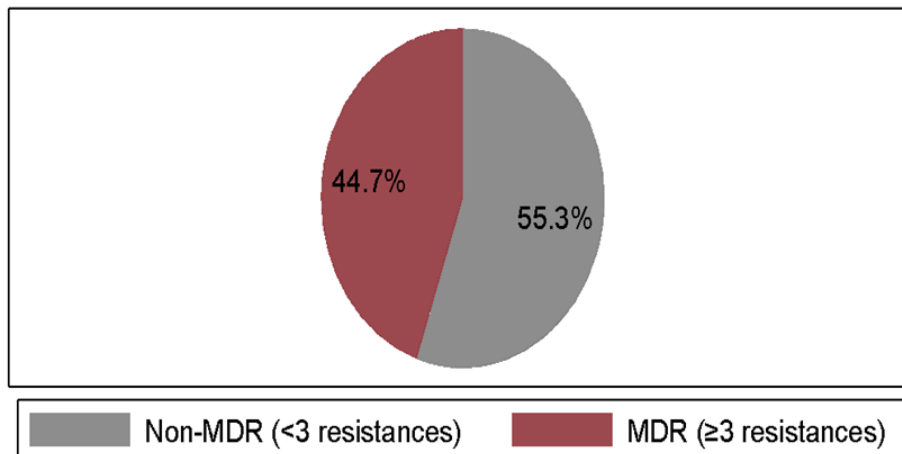


Antimicrobial Susceptibility

E. coli

- **High** resistance to cotrimoxazole (65.9%) and ampicillin (50.8%),
- **Moderate/Intermediate** resistance to ciprofloxacin (36.7%) and streptomycin (43.2%)
- **Low** resistance to ceftazidime (2.7%) and gentamicin (0.8%).
- 45% were classified as multidrug-resistant (MDR) (resistance to three or more antibiotic classes)

Multi-Drug Resistance in *E. coli*
MDR defined as resistance to ≥ 3 antibiotic classes



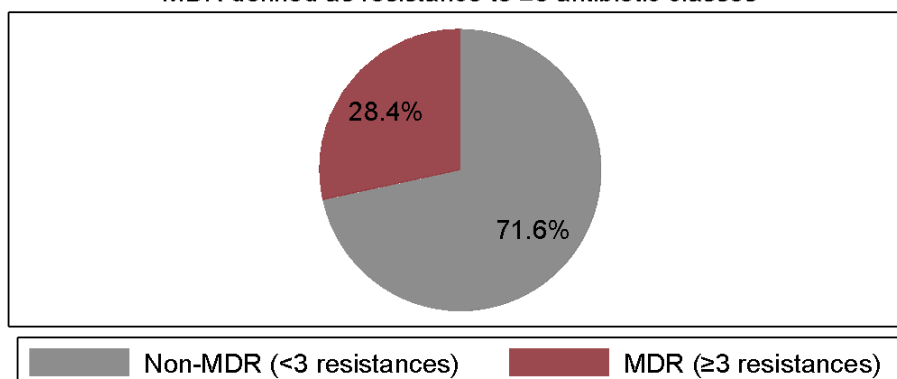
Salmonella species

- **Low** resistance was observed for all antimicrobials tested: streptomycin (2%), ciprofloxacin (2%), ceftazidime (1.1%), cotrimoxazole (1.5%), gentamicin (0.4%), and ampicillin (0%)
- 99.6% were classified as non-multidrug resistant (non-MDR)

Staphylococcus aureus

- **Moderate** resistance to tetracycline (33.3%), penicillin G (33.0%), streptomycin (26.5%), chloramphenicol (24.2%), and cotrimoxazole 22.7%.
- **Low** resistance to ciprofloxacin (10.6%), ampicillin (6.1%), and gentamicin (2.3%).
- 28.4% of isolates were multidrug resistant (MDR).

Multi-Drug Resistance in *S. aureus*
MDR defined as resistance to ≥ 3 antibiotic classes



Factors associated with contamination

E. coli

- **Handling surface:** Chicken handled on shared surfaces had more than three times the odds of contamination compared with those handled on separate surfaces
- **Education level:** Participants with primary or secondary education had higher odds of contamination compared with those with college or university education

Salmonella spp.

- **Source of chicken:** Raw chicken meat sourced from middlemen had higher odds of Salmonella contamination compared with meat not sourced from middlemen
- **Utensil cleanliness:** Use of visibly dirty knives and utensils was associated with higher odds of contamination compared with visibly clean utensils
- **Storage:** Chicken meat stored in freezers had 72% lower odds of Salmonella contamination compared with meat not stored in freezers
- **Hand-washing facility:** The presence of a hand-washing facility was significantly associated with increased odds of contamination
- **PPE:** Meat handled by attendants wearing aprons had nearly seven times higher odds of Salmonella contamination compared with those not wearing aprons
- **Education level:** Attendants with college or university education had significantly lower odds of Salmonella contamination compared with those with primary or secondary education

Staphylococcus aureus

- **Chopping surface:** Chicken handled on wooden boards had more than three times higher odds of contamination compared with non-wood boards
- **Meat handling surface:** Use of the same surface to handle other non-meat products was also significantly associated with contamination
- **Hand washing facility:** The presence of a hand-washing facility was significantly associated with higher odds of contamination

CONCLUSION

The study showed the presence of antibiotic-resistant bacteria in raw chicken, which poses a serious threat to public health. Consuming contaminated chicken can lead to foodborne illnesses that are difficult to treat. The spread of antibiotic resistance can compromise the effectiveness of antibiotics for treating other infections as well.

RECOMMENDATIONS

For Government, regulators, and policy makers:

- Mandate formal food safety training for all meat handlers, coupled with competency-based assessments, in light of the consistently protective effect of education across all investigated pathogens.
- Implement antimicrobial stewardship programs in poultry production, with restrictions on prophylactic antimicrobial use, alongside routine microbial surveillance and antimicrobial susceptibility testing to monitor resistance trends.
- Strengthen enforcement of retail licensing requirements through regular, risk-based inspections and compliance monitoring.
- Introduce targeted risk-reduction measures for middleman-sourced meat, such as temperature monitoring, traceability, and standardized handling protocols.

For Retailers:

- Replace wooden cutting boards with non-porous, easily sanitizable surfaces such as stainless steel or food-grade plastic to minimize cross-contamination.
- Establish and enforce cold-chain standards, including chilled transportation and continuous refrigeration from slaughter to retail.
- Ensure the availability and use of functional handwashing facilities with adequate soap and clean water, and recommend hand-wash procedure and frequency at identified critical control points.
- Standardize apron use protocols, requiring daily replacement and laundering between uses, and mandate hand hygiene immediately after apron contact.
- Invest in cold-chain infrastructure, including refrigerated transport systems and mandatory temperature-controlled storage at non-supermarket retail.
- There is a need to emphasize the separation of red and white meat at retail points to minimize cross-contamination and associated antimicrobial resistance risks.

Annexes

Annex 1: Project Team

Below is a list of the Project Team members:

1. Dr. Peter Kimeli – Project Lead
2. Dr. Ceasar Asiba – Assistant Project Lead and Master's Student
3. Dr. Kelvin Osore – Member
4. Dr. Ambrose Kipyegon – Member
5. Dr. Agnes Maina – Member
6. Dr. Joyce Thaiya – Member
7. Dr. Coleta Sang – Member
8. Dr. David Kemboi – Member

Annex 2: TWG Members

Below is a list of the TWG Members:

1. Dr. Joyce Thaiya – Convener, TWG
2. Dr. Coleta Sang – Secretary
3. Dr. Kelvin Osore – Member
4. Dr. Ambrose Kipyegon – Member
5. Dr. Agnes Maina – Liason, TWG-NEC
6. Dr. Peter Kimeli – Member
7. Dr. Sakwa Kamama - Member
8. Dr. Ceasar Asiba – Member
9. Dr. David Kemboi – Member
10. Dr. Beatrice Abutto – Member
11. Dr. Joel Memusi – Member
12. Dr. Nelly Bargoiyet – Member

Annex 3: KVA National Executive Council Members

The table below provides a list of the KVA National Executive Council members (who provided overall oversight of the Project) and their designations:

Name	Designation
Dr. Kelvin Osore	President
Dr. Flookie Owino	Vice President
Dr. Ambrose Kipyegon	Honorary Secretary
Dr. Godfrey Wamae	Honorary Treasurer
Dr. Agnes Maina	Assistant Secretary
Dr. Carol Khaemba	Council Member
Prof. Charles Kimwele	Council Member
Dr. Samantha Opere	Council Member
Dr. Nick Langat	Council Member
Dr. Joel Ruto	Council Member
Dr. Sakwa Kamama	Council Member
Dr. Daniel Muasya	Council Member
Dr. Samson Muchelule	Chief Executive Officer