Animal and Veterinary Sciences
2025, Vol. 13, No. 5, pp. 119-124
https://doi.org/10.11648/j.avs.20251305.11

Review Article

Prevalence and Characteristics of Pathogenic Bacteria in Fresh Beef, Goat, Poultry, Pork and Sheep Meat in West Africa: A Systematic Review

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Abstract

Microbiological safety associated with fresh meat is growing a public health concern in West Africa, where meat consumption is on the rise, but regulatory systems are weak or poorly implemented. Many previous investigations have demonstrated that meat is frequently contaminated with foodborne pathogens and some of them are also carrying alarming levels of antimicrobial resistance (AMR). The objective for this systematic review was to estimate the prevalence and AMR of key bacterial pathogens from fresh meat sold in West Africa. A systematic review of literature in three databases (PubMed, ScienceDirect and Google Scholar), with peer-reviewed articles from 2010 to 2025 being selected. Analysis was based on 23 studies qualifying inclusion requirements. The information taken included: study design, sampling place, type of meat (beef, chicken, goat, and pork) and species of bacteria, and patterns of resistance. The findings reveal high contamination rates in all meat types, with Campylobacter spp. being particularly prevalent in poultry. Multidrug-resistant strains of E. coli and Salmonella spp. were also frequently reported. Contributing factors include poor hygiene during slaughter and handling, lack of cold chain infrastructure, and widespread, often unregulated, use of antibiotics in animal farming. The presence of AMR pathogens in meat not only threatens food safety but also complicates treatment options for foodborne illnesses. Given the scale and severity of these issues, urgent actions are required. These include the implementation of standardized microbiological monitoring, strict enforcement of hygiene and slaughterhouse regulations, and the development of regional guidelines for antibiotic use in livestock. Public awareness campaigns and training for food handlers should be prioritized, along with investment in infrastructure and surveillance systems. Future research should also focus on evaluating the effectiveness of mitigation strategies and improving country specific data to support policymaking. Adopting a regional "One Health" approach that integrates human, animal, and environmental health perspectives is essential for a sustainable and effective response to foodborne microbial threats in West Africa.

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Received: 31 July 2025; **Accepted:** 19 August 2025; **Published:** 3 September 2025

Keywords

West Africa, Fresh Meat, Foodborne Pathogens, Antimicrobial Resistance, One Health

1. Introduction

Fresh meat is a vital protein source in West Africa but is often contaminated by pathogenic bacteria due to inadequate hygiene, weak cold-chain systems, and lack of regulatory control. A recent meta-analysis on foodborne pathogens in West Africa (2010–2020) found *E. coli* to be the most common contaminant, followed by *Salmonella* and *Staphylococcus*, with isolates frequently harboring genes such as *tet(A)*, bla_{TEM}, and *qnr* variants [1]. In Burkina Faso, studies reviewing meat and dairy samples from 1990 to 2019 reported a pooled *E. coli* prevalence of 40 %, with Shiga toxin producing *E. coli* (STEC) detected in 6 % of samples [1]. Another Africanwide review (2002–2024) focusing on STEC reported a 5.4 % prevalence in animal samples and highlighted resistance rates exceeding 90 % against β-lactams and cefoxitin [2].

At the national level, Nigeria has reported significant findings: commercial beef and cow milk samples showed *Campylobacter coli* prevalence up to 65 % and 34.5 %, respectively, with high antibiotic resistance to tetracycline and nalidixic acid [3]. Additionally, methicillin-resistant *S. aureus* (MRSA) has been isolated in raw beef and pork from Nigeria, with prevalence rates between 9 % and 25 % [4]. In Ghana, extended spectrum β-lactamase–producing *E. coli* (ESBL-E. coli) has been found in free-range poultry, signaling widespread antimicrobial resistance [5].

In Mali, several recent studies have reported significant microbial contamination of fresh meat sold in markets. For instance, a study conducted in Bamako found that *Escherichia coli* was present in up to 48% of beef samples collected from markets [6]. Similarly, *E. coli* contamination rates of 36% in raw poultry meat sold in Commune IV of Bamako reported [7]. Furthermore, observed the presence of *Salmonella spp.* in approximately 20% of grilled chicken meat samples collected from street vendors observed [8], highlighting a major public health concern related to the hygienic handling and cooking practices of meat products in urban settings, and Salmonella was found in 66.67% of raw meat samples from markets [9]. Worrying levels of antimicrobial resistance have been reported in meat producing animals in Mali. Several studies have documented high levels of resistance to commonly used veterinary antibiotics such as ampicillin, tetracycline, and ciprofloxacin [10].

Despite these concerning data, no systematic review has consolidated evidence on the prevalence and microbiological characteristics of pathogenic bacteria in fresh meat across West Africa, particularly regarding antimicrobial resistance patterns and molecular traits. This gap impedes regional comparisons and comprehensive risk assessments. The aim of this systematic review is twofold: (i) to determine the prevalence of major bacterial pathogens in fresh meat encompassing beef, poultry, goat, sheep, and pork across West African countries, and (ii) to characterize their microbiological profiles, with an emphasis on antimicrobial resistance and molecular markers. By synthesizing existing studies, this review seeks to inform food safety policy, highlight surveillance deficiencies, and guide future research priorities in West Africa.

2. Research Methodology

2.1. Study Design

This systematic review followed the PRISMA 2020 guidelines for transparent reporting of systematic reviews [11]. The protocol was developed to ensure consistent and reproducible selection, appraisal, and synthesis of studies in which pathogens detected in meat were examined for their antimicrobial resistance profiles.

2.2. Literature Search Strategy

A comprehensive literature search was conducted between February and April 2025 across five electronic databases: PubMed, Scopus, Web of Science, Google Scholar, and African Journals Online (AJOL). Keywords were used in combination with Boolean operators:

1) ("pathogenic bacteria" OR "foodborne pathogens" OR "microbiological contamination")
2) AND ("fresh meat" OR "raw meat" OR "beef" OR "poultry" OR "goat meat" OR "pork")
3) AND ("West Africa" OR "Nigeria" OR "Ghana" OR "Mali" OR "Senegal" OR "Côte d'Ivoire" OR "Burkina Faso" OR "Benin" OR "Togo" OR "Guinea" OR "Niger")

No restrictions were applied regarding publication language. The reference lists of included articles were manually screened to identify additional eligible studies.

2.3. Inclusion and Exclusion Criteria

Included studies met the following criteria:

1) Conducted in West African countries;
2) Investigated fresh meat samples (not processed or cooked);

3) Reported presence and prevalence of bacterial pathogens;
4) Provided laboratory diagnostic details (culture, PCR, biochemical tests);
5) Published in peer-reviewed journals.

Excluded studies:

1) Focused on processed foods, fish, or dairy products;
2) Reviews, editorials, or commentaries;
3) Experimental lab studies without field based sampling;
4) Lacked sufficient microbiological data or duplicated content.

2.4. Data Extraction

Two independent reviewers extracted data using a standardized Excel spreadsheet. Extracted data included:

1) Author(s), year of publication, and country;
2) Sample type and number;
3) Sampling location (e.g., market, abattoir);
4) Detected bacterial pathogens and prevalence rates;
5) Diagnostic and confirmation methods;
6) Antimicrobial resistance data and genetic characterization (if available).

Disagreements between reviewers were resolved through consensus or a third party adjudicator.

2.5. Schemes

The quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for prevalence studies [11]. The checklist evaluated sampling strategies, diagnostic reliability, and data reporting. Studies were categorized as low, moderate, or high quality.

2.6. Data Synthesis

Due to heterogeneity in study design, sampling, and laboratory techniques, a narrative synthesis was performed. Due to heterogeneity in study designs, sampling, and laboratory techniques, a narrative synthesis was performed. Several methods were used by the sources in this review to better explain antimicrobial resistance in meat. These consisted of isolating pathogenic bacteria from fresh meat samples, followed by antimicrobial susceptibility testing to assess their ability to grow in the presence of these agents, and finally, using molecular techniques such as PCR to identify specific resistance genes. Tables and figures were used to summarize prevalence data and resistance patterns across studies.

3. Results and Discussion

3.1. Study Characteristics

A total of 23 studies published between 2010 and 2025 were included in this review. These studies covered nine West African countries: Nigeria, Ghana, Mali, Burkina Faso, Côte d'Ivoire, Senegal, Benin, Togo, and Niger. The reviewed articles investigated fresh meat types including beef, poultry, goat, sheep, and pork, collected from abattoirs, markets, and retail outlets.

3.2. Prevalence of Pathogens by Meat Type

The analysis revealed a widespread presence of bacterial pathogens in fresh meat across the region. Escherichia coli was the most frequently reported contaminant, with prevalence ranging from 25% to 48% depending on the meat type and sampling location. In poultry meat, Campylobacter spp. showed high prevalence, particularly in Nigeria (up to 65%) and Ghana (around 50%). Salmonella spp. were also consistently detected, with rates between 10% and 30% in beef, poultry, and pork. The following figure (Figure 1) summarizes the prevalence, expressed as a percentage, of pathogens detected in different types of meat, with each type of meat represented by a specific color (orange/beef, dark orange/poultry, red/pork, purple/goat, blue/sheep).

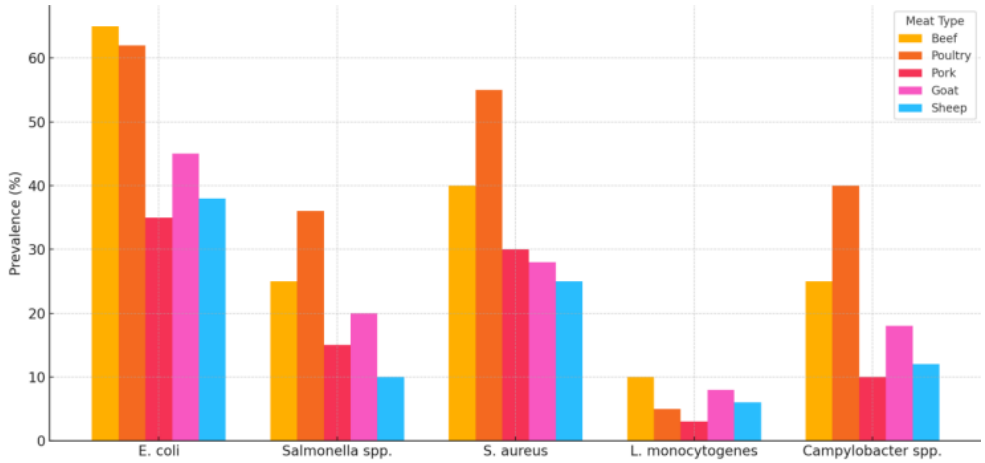

Figure 1. *Prevalence of Bacterial Pathogens in Different Meat Types in West Africa.*

This figure illustrates the distribution of five major bacterial pathogens across different types of meat commonly consumed in West Africa. Poultry and beef were most frequently contaminated, particularly with E. coli and S. aureus. The most frequently reported pathogen was *E. coli*, with the highest prevalence in beef (65%) and poultry (62%), This prevalence is consistent with that found in similar studies [12, 13]. Also findings align with reports from Burkina Faso, where pooled *E. coli* prevalence reached 40% and shiga toxin-producing strains (STEC) were detected in 6% of meat and dairy samples [1]. *Salmonella* spp. also showed high prevalence in poultry (36%) and moderate levels in beef and goat meat. *Staphylococcus aureus*, including methicillin resistant strains (MRSA), had the highest presence in poultry (55%). Though less frequently isolated, *Listeria monocytogenes* and *Campylobacter* spp. are of significant concern due to their potential impact on vulnerable populations [14, 15].

3.3. Antimicrobial Resistance and Molecular Profiles

One of the most alarming findings of this review is the widespread antimicrobial resistance (AMR) observed among bacterial isolates from fresh meat across West Africa. Multiple studies have reported high resistance levels to commonly used antibiotics in veterinary and human medicine, including tetracycline, ampicillin, and ciprofloxacin.

Antimicrobial resistance (AMR) among foodborne bacteria remains a growing concern across West Africa. Recent studies indicate that more than 80% of *Escherichia coli* strains isolated from meat products in the region are resistant to tetracycline and ampicillin. Additionally, 40% to 60% of isolates exhibit resistance to ciprofloxacin and third generation cephalosporins [13-15].

Indeed, a recent study conducted in Mali provides additional evidence of high antimicrobial resistance (AMR) levels in *Escherichia coli* and *Salmonella* strains isolated from poultry. The research, published in *BMC Microbiology* in 2024, found that *E. coli* strains exhibited resistance rates of 93.8% to amoxicillin, 92.6% to cotrimoxazole, 55.7% to ciprofloxacin, and 33% to gentamicin. These antibiotics are commonly prescribed, often empirically, in pediatric care. The study also reported a 50% rate of multidrug resistance among the isolates, highlighting the significant public health concern posed by these resistant strains [17]. Similar findings have emerged from Ghana, where *E. coli* isolated from free range poultry have been found to produce extended-spectrum β-lactamases (ESBL), highlighting the circulation of critical AMR determinants in foods of animal origin [5].

In Burkina Faso, shiga toxin-producing *E. coli* (STEC) strains have been detected in 6% of meat samples, with resistance rates exceeding 90% for β-lactams including cefoxitin [15-18]. In Nigeria, over 60% of *Campylobacter coli* strains isolated from beef and milk showed resistance to tetracyclines and fluoroquinolones [13]. Methicillin-resistant *Staphylococcus aureus* (MRSA) strains identified in raw beef and pork were also resistant to cefoxitin and erythromycin [4].

Molecular analyses have confirmed the widespread presence of resistance genes such as tet (A), qnrB, qnrS, and bla_{TEM}, particularly in *E. coli*, *Salmonella* spp, and *Staphylococcus aureus*. These genes are frequently carried on mobile genetic elements, allowing for horizontal transfer between bacterial species and facilitating the spread of MDR strains along the food chain.

The results clearly indicate that fresh meat is a significant reservoir of antimicrobial-resistant bacteria, posing major public health concerns, especially in settings where diagnostic infrastructure is limited and the misuse of antibiotics in animal production is widespread. However, to improve understanding and management of this issue, it would be beneficial to conduct research and surveys that assess the presence of antibiotic residues and microbial isolates in animals prior to slaughter. This would not only allow for a better assessment of the risk of microbial contamination in meat, but also enable the implementation of effective measures to eliminate this contamination during the meat processing process. At the same time, it is essential to strengthen antimicrobial resistance surveillance systems, use antibiotics responsibly in veterinary practice, and apply appropriate hygiene and food safety measures throughout the value chain.

3.4. Contributing Factors to Contamination

1) *Environmental Conditions:* Informal markets and unregulated slaughter sites had higher levels of contamination due to inadequate sanitation and poor meat handling practices [19].
2) *Methodological Variations:* Studies using molecular tools (e.g., PCR or whole genome sequencing) reported higher detection rates than conventional culture based methods [20].
3) *Geographical Gaps:* Francophone countries were underrepresented, likely due to limited laboratory infrastructure and challenges in accessing international publication platforms [14].

3.5. Limitations of the Review

1) Significant heterogeneity in laboratory methods, sample sizes, and reporting formats limited the possibility of performing a meta-analysis.
2) A lack of molecular characterization restricted the understanding of resistance transmission dynamics.
3) Few studies reported full antimicrobial susceptibility profiles or resistance gene data.

4. Conclusion and Recommendations

This review confirms the widespread presence of pathogenic bacteria including Campylobacter spp., Escherichia coli, and Salmonella spp. in fresh meat sold across various West African countries. The persistent occurrence of these pathogens, often coupled with high levels of antimicrobial resistance, poses a serious and ongoing public health threat in the region. The findings underscore the urgent need to strengthen food safety systems in West Africa. This includes the implementation of standardized and routine microbiological monitoring of meat products, enforcement of sanitary regulations, and the development of regional guidelines for antibiotic use in livestock. Public awareness campaigns, capacity building for food handlers, and investment in modern slaughter and distribution infrastructure are also essential to reducing contamination risks and ensuring safer meat supply chains. Addressing these challenges requires coordinated efforts between governments, research institutions, and stakeholders in the meat production and distribution sectors. Future research should focus on evaluating intervention strategies, improving surveillance systems, and generating more country specific data to guide evidence based policy-making. Ultimately, a One Health approach that integrates human, animal, and environmental health perspectives is crucial for tackling foodborne bacterial threats in West Africa.

Abbreviations

AJOL	African Journals Online
AMR	Antimicrobial Resistance
E. coli	Escherichia Coli
ESBL	Extended-Spectrum Beta-Lactamase
JBI	Joanna Briggs Institute
MRSA	Methicillin-Resistant Staphylococcus Aureus
PCR	Polymerase Chain Reaction
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
STEC	Shiga Toxin-Producing Escherichia Coli

Acknowledgments

The authors would like to express their sincere gratitude to the Central Veterinary Laboratory (LCV), the National Directorate of Veterinary Services (DNSV), and the Ministry of Livestock and Fisheries of Mali for their institutional support and encouragement throughout the development of this literature review. Their contributions were instrumental in facilitating access to scientific resources and in providing a favorable environment for the completion of this work.

Author Contributions

Aminata Sissoko: Conceptualization, Investigation, methodology, writing original draft, writing review & editing

Boubacar Madio Dit Aladiogo Maiga: Supervision, investigation, methodology

Mamadou Abdoulaye Konare: Methodology, supervision

Amadou Hamadoun Dicko: Supervision

Aminata Diallo: Supervision

Samake Fasse: Supervision

Ibrahima Mariko: Data curation, writing review & editing

Funding

This work is not supported by any external funding.

Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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