

Public Health, Hygiene Practices, and Zoonotic Disease Vectors in Peri-Urban Slaughter Facilities: An Observational Case Study of Karu Abattoir, Federal Capital Territory, Nigeria

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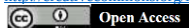
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ABSTRACT

Abattoirs serve as critical intersections between animal husbandry, food safety, occupational safety, and environmental health. In rapidly growing peri-urban centers across sub-Saharan Africa, regulatory compliance and sanitary controls in animal processing facilities often fail to keep pace with demand. To evaluate the operational structure, sanitation protocols, meat inspection procedures, waste management practices, and occupational safety measures at the Karu Abattoir in the Abuja Municipal Area Council (AMAC), Federal Capital Territory, Nigeria. An observational field study was conducted to examine operational workflows across key functional units: lairage, slaughterhouse, waste disposal systems, meat handling and storage areas, emergency facilities, and diagnostic services. Direct observations and qualitative assessments were documented regarding sanitary conditions, veterinary inspection practices, and parasite/disease identification during processing. Critical operational deficiencies were observed across all units. In the lairage, animals were routinely slaughtered without undergoing the recommended minimum 12-hour pre-slaughter rest period, and ante-mortem inspection was inconsistently applied. In the slaughterhouse, processing frequently occurred on bare floors due to a lack of functional carcass hoisting/hanging systems. Post-mortem examination of visceral organs was sporadic. Zoonotic and parasitic pathogens identified during evisceration included Cysticercosis (larval *Taenia* spp.), Fascioliasis (*Fasciola* spp.), and *Ascaris* spp. Waste management was non-compliant with standard environmental health protocols: untreated liquid waste containing blood and fecal material was directly discharged into a contiguous river, solid waste was open-dumped, and drainage channels remained blocked. There was a complete absence of dedicated cold storage facilities, on-site laboratory diagnostic infrastructure, and functional first-aid/emergency medical units for workers or animals. Personal Protective Equipment (PPE) compliance among meat handlers and butchers was negligible. The operations at Karu Abattoir present significant public health risks, including potential zoonotic transmission, foodborne pathogen exposure, environmental pollution, and occupational injury. Immediate structural upgrades, mandatory implementation of cold storage and hoisting equipment, construction of effluent treatment infrastructure, and enforcement of veterinary public health regulations are urgently needed.

Introduction

Abattoirs are essential components of urban food supply chains and environmental health frameworks, providing dedicated spaces for the humane slaughter, hygienic processing, ante- and post-mortem inspection, and distribution of livestock intended for human consumption. Beyond meat production, abattoirs function as key nodes connecting human health, animal health, food safety, occupational safety, and environmental protection. When operating under rigorous regulatory standards, these facilities isolate infectious diseases from the human food supply and prevent environmental degradation resulting from processing by-products.

When sanitary controls, infrastructure, and veterinary oversight are inadequate, meat and offal can act as vehicles for foodborne illness and zoonotic pathogens. Zoonoses such as bovine tuberculosis,

brucellosis, anthrax, salmonellosis, rabies, and various endoparasitic infections (e.g., cysticercosis and fascioliasis) pose major health risks. Systemic ante-mortem and post-mortem veterinary examinations are crucial to intercept diseased carcasses, monitor animal health trends, and isolate biological threats before meat reaches the market.

Abattoir operations generate large volumes of solid and liquid waste, including blood, paunch contents, fecal matter, bones, condemned tissue, and contaminated wash water. Uncontrolled discharge or improper disposal of these high-BOD (biological oxygen demand) wastes causes soil contamination, surface and groundwater pollution, foul odors, and rapid vector proliferation (e.g., flies and rodents). Furthermore, slaughtering without personal protective equipment (PPE), exposure to sharp implements, direct contact with biological fluids, and lack of emergency care facilities expose workers to high occupational risks.

In Nigeria, rapid urban expansion and population growth have driven a high demand for animal protein. In peri-urban centers like the Federal Capital Territory (FCT), infrastructure development in livestock processing facilities often lags behind volume demands. Karu Abattoir, located in the Karu district within the Abuja Municipal Area Council (AMAC), serves as a major source of meat for surrounding urban communities. Assessing operational practices at Karu Abattoir provides empirical insight into local environmental health, veterinary inspection efficacy, and public health safeguards.

2. Materials and Methods

2.1 Study Site

The study was conducted at the Karu Abattoir, located in Karu within the Abuja Municipal Area Council (AMAC), Federal Capital Territory (FCT), Nigeria. The facility handles cattle, sheep, and goats, servicing local meat markets and regional consumers across the peri-urban FCT corridor.

2.2 Study Design and Data Collection

An observational research methodology was used during a field assessment of the facility. Data were collected via direct, structured non-participant observation and physical inspection across six primary functional units:

1. Lairage Unit: Assessment of animal resting capacity, water availability, crowding density, structural integrity, and pre-slaughter inspection protocols.

2. Slaughterhouse Unit: Evaluation of slaughter protocols, bleeding procedures, hoisting/hanging equipment availability, evisceration techniques, post-mortem inspection, floor sanitation, and PPE usage.

3. Waste Management Unit: Examination of liquid effluent pathways, solid waste storage and disposal sites, drainage infrastructure, vector infestation, and discharge outlets into nearby water bodies.

4. Meat Handling & Storage Area: Assessment of processing surfaces, cold storage availability, vector protection, and packaging conditions

5. Emergency & First Aid Unit: Verification of medical kits, worker injury response facilities, occupational health protocols, and animal isolate quarters.

6. Diagnostic Laboratory Facilities: Verification of on-site diagnostic tools, sample collection hardware, and rapid testing capabilities.

Interactive observations were also conducted with present personnel, including butchers, meat handlers, cleaners, and attending veterinary officers.

3. Results

A summary of observed operational deficiencies across all evaluated units is presented in Table 1 below:

Table 1: Summary of Operational and Sanitary Deficiencies Identified at Karu Abattoir.

Functional Unit	Observed Deficiencies & Operational Gaps
Lairage Unit	<ul style="list-style-type: none"> • Lack of 12-hour resting period prior to slaughter • Severe overcrowding and inadequate clean water supply • Inconsistent ante-mortem veterinary inspection • Stagnant wastewater and high accumulation of manure
Slaughterhouse Unit	<ul style="list-style-type: none"> • Frequent processing on bare concrete/floors without hoisting • Inconsistent post-mortem inspection of visceral organs • Inadequate supply of clean running water for washing carcasses • Low compliance with PPE (gloves, boots, aprons)
Waste Management Unit	<ul style="list-style-type: none"> • Direct effluent discharge into nearby river without prior treatment • Open dumping of solid waste (bones, hides, offal, dung) • Blocked, open drainage channels causing standing wastewater • High density of disease vectors (flies, rodents) and foul odors
Handling & Storage Area	<ul style="list-style-type: none"> • Absence of cold storage or refrigeration facilities • Direct exposure of meat to open air, dust, and mechanical vectors
Emergency & First Aid Unit	<ul style="list-style-type: none"> • No functional first-aid station or medical personnel for workers • No triage/isolation area for sick or severely injured livestock
Diagnostic Laboratory Unit	<ul style="list-style-type: none"> • Complete absence of on-site diagnostic equipment or testing facilities

3.1 Lairage Operations and Ante-Mortem Inspection

Animals arriving at the facility were held in open, outdoor pens. The lairage lacked adequate shelter, structured separation, and consistent access to clean drinking water. Animals were frequently brought directly from transit to the slaughter floor without undergoing the recommended 12-hour rest period. Ante-mortem examination by veterinary staff was performed inconsistently. Sick, injured, or exhausted livestock were often processed without preliminary isolation or diagnostic clearance. Unsanitary lairage conditions characterized by accumulated manure and standing water—increased stress and cross-contamination risks prior to slaughter.



Lairage

3.2 Slaughterhouse Workflow and Meat Inspection

The main slaughter hall exhibited several operational vulnerabilities:

- **Slaughtering Practices:** Stunning was rarely implemented prior to bleeding. Animals were slaughtered via classical neck incision.



Slaughter House

- **Carcass Processing:** Carcass hoisting mechanisms (overhead rails or mechanical winches) were either absent or non-functional. Consequently, skinning, flaying, and evisceration were frequently conducted directly on the bare floor or partially elevated, unsterilized concrete slabs. This exposed meat directly to blood, dirt, and gastrointestinal residue.

- **Post-Mortem Inspection:** Inspection of carcasses and visceral organs (liver, lungs, heart, intestines) was performed sporadically. Butchers routinely removed and handled offal without systematic veterinary examination.

- **Sanitation and Water:** Clean water supply within the slaughter hall was insufficient for continuous rinsing. Rinsing was often done using standing water in buckets, leading to microbial cross-contamination.

3.3 Waste Management Infrastructure

The waste management unit lacked functional treatment mechanisms:

- **Liquid Waste:** Wastewater containing blood, washings, and paunch contents flowed into open, unlined, and frequently clogged channels. This untreated liquid waste discharged directly into a nearby river running along the perimeter of the facility.

- **Solid Waste:** Solid wastes, including condemned parts, bone fragments, dung, and scrap tissues, were openly dumped along the riverbanks and perimeter grounds. There were no active rendering plants, incinerators, or sanitary burial pits in operation.

- **Vector & Environmental Impact:** Uncontrolled waste accumulation produced intense, foul odors and provided breeding habitats for flies, rodents, and scavenging animals.



Solid Waste

3.4 Meat Handling, Storage, and Diagnostic Infrastructure

- **Storage Facilities:** The abattoir lacked functional cold storage rooms, chilling units, or refrigerated holding areas. Meat was held at ambient tropical temperatures prior to transportation to retail outlets, accelerating bacterial multiplication.

- **Emergency/First-Aid Support:** The facility lacked a functional first-aid station, medical equipment, or trained emergency personnel. Workers who sustained knife cuts or blunt force injuries had no on-site medical resources. Similarly, there was no isolation or veterinary triage area for severely injured or acutely ill animals.

- **Laboratory Diagnostics:** There was no on-site diagnostic laboratory or sample collection facility. Biological samples requiring diagnostic verification had to be sent to external institutions, delaying disease identification and reporting.



Meat Handling Unit

3.5 Identified Parasitic Pathogens and Zoonotic Risks

Post-mortem inspections and evisceration observations confirmed several parasitic pathogens in processed livestock:

- **Cysticercosis (Larval Taenia species):** Cystic structures were observed in the muscular and visceral tissues of slaughtered caprines. Ingestion of undercooked infected meat poses a direct threat of human tapeworm infection.



Cysticercosis (Larval *Taenia* species)

- **Fascioliasis (*Fasciola* species):** Liver fluke infestations were observed during hepatic sectioning. Affected livers showed gross pathology, bile duct hyperplasia, and adult flukes, requiring tissue condemnation.
- ***Ascaris* species:** Intestinal roundworms were recovered from caprine digestive tracts during evisceration.



Ascaris lumbricoides

- **Other Zoonotic Pathogens:** Unsafe handling, combined with the lack of diagnostic clearance, presents risks for broader zoonotic pathogens, including Bovine Tuberculosis (*Mycobacterium bovis*), Brucellosis (*Brucella* spp.), Salmonellosis (*Salmonella* spp.), Anthrax (*Bacillus anthracis*), and Rabies.

4. Discussion

The observations at Karu Abattoir highlight significant systemic vulnerabilities in food safety, environmental health, and occupational safety. These findings align with challenges documented in peri-urban slaughter facilities across developing regions, where rapid urbanization outpaces regulatory oversight and infrastructure development.

4.1 Food Safety and Zoonotic Disease Transmission

The practice of slaughtering animals on bare concrete floors, combined with inadequate water supply and inconsistent post-mortem inspection, poses direct food contamination risks. Biological contaminants from the floor, intestinal contents, and contaminated wash water can contaminate meat surfaces with enteropathogens like *E. coli*, *Salmonella* spp., and *Campylobacter* spp. Furthermore, the

lack of pre-slaughter rest subjects animals to acute stress, elevating cortisol levels, depleting muscle glycogen, and altering post-mortem pH, which compromises meat preservation and quality.

The confirmation of Cysticercosis, Fascioliasis, and Ascaris during evisceration underscores the continuous risk of zoonotic parasite transmission. In the absence of an on-site laboratory or systematic organ inspection, infected tissue can easily enter the consumer market.

4.2 Environmental Contamination and Vector Dynamics

The direct discharge of untreated liquid effluent into an adjacent river violates basic environmental health protocols. High concentrations of organic matter, blood, and pathogens deplete aquatic dissolved oxygen and introduce enteropathogens into downstream water sources used by local communities. Open dumping of solid organic waste fosters vector populations, including *Musca domestica* (houseflies) and rodents, which can mechanically transport pathogens from abattoir waste to nearby residential areas.

4.3 Occupational Health Vulnerabilities

Abattoir personnel work in high-risk environments with minimal protection. The near-total absence of basic PPE (gloves, aprons, chainmail cut-resistant gloves, steel-toe boots) increases exposure to lacerations, zoonotic infections, and skin disorders. The lack of a functional on-site first-aid unit exacerbates the severity of occupational injuries.

5. Recommendations

1. Water Supply & Sanitation: Install high-capacity boreholes and overhead storage tanks to supply continuous running water to all units. Institute mandatory end-of-day cleaning and disinfection protocols using industrial-grade sanitizers.

2. Structural Improvements: Repair and mandate the use of mechanical carcass hoisting (rail/hook) systems to eliminate floor contact during skinning and evisceration. Construct stainless-steel or elevated tile processing surfaces to simplify cleaning.

3. Waste Management & Environmental Protection: Construct multi-stage biological wastewater treatment facilities (e.g., settling basins and anaerobic digestion tanks) prior to river discharge. Implement controlled waste rendering or high-temperature incineration for condemned tissues, bones, and solid organic by-products.

4. Cold Chain & Storage Facilities: Construct temperature-controlled holding and cold storage rooms (0°C to 4°C) to prevent rapid microbial growth prior to distribution.

5. Diagnostic Infrastructure & Inspection Protocols: Establish an on-site veterinary field laboratory equipped for basic microscopy, rapid diagnostic test (RDT) kits, and sample collection/preservation. Enforce mandatory 12-hour lairage rest periods and systematic ante- and post-mortem examination of all carcasses.

6. Occupational Safety & First Aid: Supply and mandate appropriate PPE (waterproof boots, cut-resistant gloves, aprons, hairnets) for all operational personnel. Establish a fully equipped on-site medical first-aid station staffed by trained healthcare personnel.

7. Regulatory Enforcement: Strengthen enforcement mechanisms by regulatory agencies (e.g., AMAC, Environmental Health Officers, and Veterinary Public Health departments) with regular inspections and strict penalties for non-compliance.

6. Conclusion

This evaluation of Karu Abattoir identifies critical gaps across operational structure, hygiene practices, meat inspection, waste disposal, and occupational safety. Deficiencies such as direct effluent discharge into water bodies, floor processing of carcasses, lack of cold storage, absent diagnostic infrastructure, and minimal PPE usage create pathways for zoonotic disease transmission, foodborne illness, environmental pollution, and occupational injury. Upgrading infrastructure, establishing

functional waste treatment and cold chain facilities, restoring diagnostic capabilities, and strictly enforcing public health regulations are necessary to safeguard meat safety and protect community health.

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