



ASSESSING THE HEALTH RISK OF PUBLIC HANDLING OF LIVESTOCK AND LIVESTOCK FOOD PRODUCTS IN MAKENI CITY, SIERRA LEONE

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Article History

Received: 05.05.2026
Accepted: 27.06.2026
Published: 18.07.2026

Abstract: Livestock and livestock-derived food products form a vital economic and nutritional resource across Sierra Leone, yet their public handling – from farm to market – remains largely unregulated and poses significant public health risks. This study assessed the health risks associated with the public handling of livestock and livestock food products in Makeni City, Sierra Leone, guided by three objectives: evaluating the adequacy of handling facilities, examining the impact of legislation in minimizing associated health risks, and assessing the level of health education and awareness among handlers. A descriptive survey design was employed, combining self-administered questionnaires and structured interviews with 60 purposively sampled respondents, including livestock deliverers, processors, lairage operators, and vendors of meat, milk, and poultry. Data were analysed using SPSS version 26. Findings revealed that livestock handling facilities – lairages, abattoirs, market stalls, and transport systems – are predominantly inadequate, characterized by open sheds, unsealed clay/laterite flooring, poor pest-proofing, and an absence of cold storage or veterinary laboratory access. Pre-slaughter stress was reported as largely uncontrolled, and postmortem examination relied mainly on physical rather than laboratory verification, leaving disease screening gaps. While a majority of respondents were aware that regulatory laws exist and reported the City Council as the dominant enforcement authority, compliance with specific regulations – particularly transport and licensing requirements – was weak, and punitive enforcement (fines, business closure) predominated over supportive interventions. Respondents identified direct interaction with diseased animals and zoonotic disease transmission as the principal health risks arising from weak enforcement. Encouragingly, most handlers had received some health education, primarily through training workshops emphasizing food contamination and One Health principles, with strong demand for more frequent (quarterly or monthly) sensitization. The study concludes that infrastructural deficiencies, inconsistent regulatory enforcement, and gaps in laboratory-based disease surveillance collectively heighten zoonotic and contamination risks in Makeni's livestock trade. It recommends prioritized infrastructural investment, strengthened veterinary-inclusive enforcement, and sustained, recurrent health education to safeguard public health under a One Health framework.

Keywords: Livestock handling; Zoonotic disease; Food contamination; Public health risk; Abattoir sanitation; One Health; Food safety legislation; Makeni City, Sierra Leone.

Cite this article:

Kargbo, M. B., (2026). ASSESSING THE HEALTH RISK OF PUBLIC HANDLING OF LIVESTOCK AND LIVESTOCK FOOD PRODUCTS IN MAKENI CITY, SIERRA LEONE. *ISAR Journal of Agriculture and Biology*, 4(7), 6-22.



1.0 INTRODUCTION

1.1 RESEARCH BACKGROUND

Mankind domesticated animals some 10,000 to 12,000 years ago and has since lived with them enjoying numerous advantages, though having to grapple with the associated problems (Lear, 2012). Domestication of animals has helped mankind to find new ways to control animals to better suit human needs. And man has since moved from hunter-gatherer groups to established settlements. In the process he has to change the environment to better harness resources of soil, water, air and forests for daily food acquisition to farming. This later gave way to the agricultural revolution which further impacted traveling/transportation, feeding and lifestyles. Archaeologists and scientists, by genetic evidences, are still finding out as to how this was done by ancient people. It is widely believed that animals were chosen for their human-valued products like fur, meat, milk, eggs, draught power, security or protective tendencies, predatory tendencies, etc. The animals were bred selectively with other members of their species to ensure that offspring would possess only the most useful traits for humans. As such, domestication represents a species-wide genetic change from wild animals, rather than just the taming of individual animals (National Geographic Society, 2026). Domestication of goats, sheep, cattle, poultry, was suited for sedentary lifestyles, while domestication of horses, camels, donkeys and dogs was suited for tribes that travel across vast land expanses.

Not every society began farming after learning of domesticated plants and animals, for reasons like an unsuitable environment or cultural practices. However, the domestication of plants and animals was an extraordinary tool, which had a profound impact on human development. Since the dawn of the Industrial Revolution which led to mechanization of agriculture and processing and handling of agricultural products a larger portion of society was released from agriculture for a livelihood to other occupations. By having a few people involved in agriculture means more production of food including animals and animal products for feeding the non-farming population, who for most part would live in urban settlements.

Therefore, teaming urban populations had to rely on food supplies from farms in nearby or far away rural places. In the process plant foodstuffs would suffer the risk of perishability due to poor transportation and storage. Animals that are transported often reach the urban markets in stressed conditions and this impacts the quality of meat when they are slaughtered in under such conditions. Often, these animals do not successfully go through the right sanitary examinations and may convey pests and diseases to healthy human populations along their route and at their destinations. These problems are exacerbated when the

animals are kept in poor holding structures and slaughtered under unhygienic conditions, or even when the products of meat, milk and eggs are transported, stored and sold under unsafe and unhygienic conditions. The ultimate impact is disease transmission to humans at the point of handling or consumption.

Food can be contaminated at different stages of food chain, these are: on the farm; animal feed can be contaminated with bacteria such as *Salmonella* which can cause infection in animals and potentially lead to human infection from derived food products, parasites may infect food producing animals, milk can be contaminated by coming into contact with, for example, faeces or environmental dust, animal skin and fur can be contaminated by faeces and environment. Eggs and different vegetables can also be contaminated on the farm (EFSA 2015). At slaughter; meat can be contaminated by coming into contact with intestinal contents or animal skin. It can also be contaminated during further processing; microorganisms present in another raw agricultural product or on food contact surfaces may contaminate food, infected humans handling food may also contaminate food. Also, in the kitchen; microbes can be transferred from one food to another by improper use of kitchen utensils or by infected humans handling the food (EFSA 2015).

Poor handling conditions, longer period between product preparation and presentation to buyers and unprotected shelving are major contributors to health risks that would ensue. Preslaughter stress is also a carcass and meat quality issue as it may cause carcass depreciation due to severe skin lesions, weight losses, and meat quality defects due to abnormal postmortem muscle acidification (Faucitano, 2001, 2010; Schwartzkopf-Genswein *et al.*, 2012). Lairage has been used to restore transported animals for slaughter from stress. Lairage and slaughter are extremely important for the pork-chain economy as mistakes made at these points have irreversible effects on carcass and meat quality and may offset all efforts made by the production sector to improve performance and animal welfare. Precautions must be taken to ensure adequate handling and environmental control to safeguard the benefits of lairage as a resting area enabling pigs to recover from the stress of transport and limit the effects of the slaughter procedure. The correct management of critical areas in lairage is becoming paramount in the light of the increasing need for commercial abattoirs to obtain audit approval and animal welfare certification for their meat products (Faucitano, 2018). However, studies on beef safety from abattoirs in Kenya have shown that the risk of contamination is the same irrespective of abattoir (Mwai *et al.*, 2015). Furthermore, an investigation in 'Boiling Milk Disrupts the Social Order of Communities in Mali' have shown that in poor countries valuable livestock products are not likely to be discarded

even if they fail to meet defined quality standards (Kone *et al.*, 2015). They recommended that Project officers and promoters of public health must raise awareness among consumers but these efforts should not be focused on the farmers only but on all players in the complex process of production, processing, distribution and consumption.

The foregoing and many more situations prevailing in the public handling of animal products from the farmers to the consumers pose many health risks including transmission of zoonotic diseases, food contamination, and toxins accumulation. They also occur in Sierra Leone under the influence of poor infrastructural and technical competencies of the actors (farmers, transporters, veterinary officers, abattoir operators, salesmen). In the light of comprehensive sustainable economic development under the guidance of the One Health Policy, it is of immense importance to investigate the associated health risks.

1.2 RESEARCH PROBLEM STATEMENT

Livestock production continues to benefit mankind for food, clothing, manure, artefacts, incomes and forex, medicines, draught power, many other socio-cultural benefits. The rapid increase in human population caused by rapid urbanization, as well as the quality of life, economic desire, and social lifestyle, have all contributed to increased pressure on LP, particularly in low-income countries. It was shown (Brears, 2017) that the effect of urbanization, along with the demographic changes that accompany it, may result in food insecurity and malnutrition. Poverty and unequal distribution of national resources are the primary reasons why millions of Africans, especially in poorer countries, turn to agriculture, particularly livestock rearing, as a means of meeting their most basic needs. For livelihoods and economic development, a large number of African countries depend heavily on livestock production. Approximately 52% of Africa's population and nearly 100% of Sub-Saharan Africa's population depend on livestock for a living (Otte & Upton, 2005). In low-income countries, livestock production is the fastest-growing portion of agriculture, with a 33% rise in GDP (Thornton, 2010). The livestock market remains a thriving business in Sierra Leone. The most common livestock species in the country are indigenous breeds of chickens, small and large ruminants, pigs, ducks, rabbits, and pigeons, and they mostly raised by traditional methods. There are, however, a few established commercial piggeries and poultries with exotic breeds raised on modern Intensive and Semi Intensive systems. And although the livestock needs for feeding the population cannot be met with local production, but by importation of foreign products of eggs, meat, milk, etc., local production still persists because of the meeting to tastes, and certainty of what is consumed. Whereas imported livestock products are delivered in seemingly safe packaging, local livestock and livestock food products are largely not cleared for good health status and

are transported and prepared for market (butchered) and sold in deplorable conditions. This exposes consumers to a plethora of diseases. In Makeni City like any other urban center in Sierra Leone livestock food products to meet with the protein requirements of diet marketing of are in high demand. Through marketing, locally produced livestock and their products, mostly produced far from the city, reach the consumers. The livestock and products may pass through many hands in by way of transportation, storage, holding units/centers, processing and sales presentation. Under the mostly unhygienic conditions of the associated facilities (trucks, carts, abattoirs, butcher markets, crates, bottling, etc.,) food contamination abound. And when coupled with events of unchecked live animals for market health, risks are compounded. As this has a potential for disease incidences and ensuing economic losses from the loss community members to death, disability from diseases, expenditures on prophylaxis, etc., it becomes of much interest to investigate the problem of the risks portrayed herein. The problem leaves these questions for researchers to ponder:

- What is the adequacy of the facilities used in the public handling of livestock and livestock food products in Makeni City?
- What is the impact of legislature (Jurisprudence) in minimizing health risks related to public handling of livestock and livestock products in Makeni City?
- What is the level of health education/awareness provided persons involved in the handling of livestock and livestock products in Makeni City?

1.3 RESEARCH AIM AND OBJECTIVES

The topic essentially communicates the aim of the research which is essentially to assess the health risks posed by the unchecked public handling of livestock and livestock food products in Makeni City, Sierra Leone, and to efficiently communicate such risks to the perpetrators, consumers, health safety actors and local government.

The research questions above efficiently translated to the objectives of the research thus:

- To assess the adequacy of the facilities used in the public handling of livestock and livestock products in Makeni City;
- To examine the impact of legislature (Jurisprudence) in minimizing health risks related to public handling of livestock and livestock products in Makeni City;
- To assess the level of health education/awareness provided to persons involved in the public handling of livestock and livestock products in Makeni City.

1.4 JUSTIFICATION OF THE RESEARCH

The research had it necessary to focus on these objectives as amplified below:

- Facilities for handling livestock and livestock food products for reaching the public must be clean and free from pathogens and contaminants and must offer protection from pathogens, contaminants and pests. Otherwise, even health cleared livestock or livestock food products will end up being unhealthy before reaching the consumers. They should also offer some preservative qualities if disposal/sale is not immediate so that shelf life of foodstuffs is prolonged and toxins from food deterioration do not get in to affect the consumers.
- Legislature on animal and animal product handling (Jurisprudence) do not only serve to express the humane treatment of animals but when fully delivered seeks to direct health and safety of the human interactors starting from the farmers/producers right on to the consumers or users of the animal and animal products.
- Health education is a cheap and lasting means of capacitating individuals and communities on issues pertaining to development, spread and transmission of diseases. In this case it is worthy to discover what prevails pertaining to health education on the health risks of public handling of livestock and livestock food products and to determine what could be done to salvage the situation.

1.5 SIGNIFICANCE OF THE RESEARCH

The research was set to expose the evident and implied risks posed by the unchecked public handling of livestock and livestock food products in Makeni City. The findings of the research could be useful to the following expressed categories of persons and instances:

- Transporters, processors and marketers of livestock and livestock food products to the Makeni market in particular and Sierra Leone at large, so that they are guided in the proper delivery, processing and presentation for sale of the livestock and livestock food products in order for these to reach the consumers/users in safe and healthy conditions.
- Health safety actors including the veterinary division, the sanitation division, and the health education division to work and prevent contamination of the food products and spread of diseases from animal to animal and from animals to humans. Their timely actions would save efforts of medics who are few and easily overwhelmed in disease outbreaks.
- Law makers and enforcers (judiciary, police, local government/authorities) in making or reviewing policies or laws pertaining to the safe public handling of livestock and livestock food products for Makeni in particular and Sierra Leone at large.

- Consumers of livestock and livestock food products who must be guided on condition and presentation of foodstuff as fit for consumption.
- Scholars and academics on to whom the body of information (literature, data, arguments and findings) presented herein shall provide a thrust for further or associated studies.
- The researcher in making her more knowledgeable in the subject matter and in fulfilling the conditions for graduation.

1.6 ASSUMPTIONS OF THE RESEARCH

Assumptions are things that are accepted as true, or at least plausible, by researchers and peers who will read your dissertation or thesis. In other words, any scholar reading your paper will assume that certain aspects of your study is true given your population, statistical test, research design, or other delimitations. The assumptions of the research include:

- Makeni City flourishes with a market for livestock and livestock food products;
- The adequacy of the facilities used in the delivery, processing and presentation for sale of the livestock and livestock food products in order for these to reach the consumers/users in safe and healthy conditions have not been ascertained.
- Legislation (Jurisprudence) and Health Education provide useful and cheap means to minimizing health risks by the unchecked handling of animals and animal food products in Makeni City
- Descriptive survey research would expose the yet to be fully expressed risks.

1.7 DELIMITATIONS OF THE RESEARCH

This study was deliberately scoped in the following ways:

- **Geographic scope:** The research was confined to Makeni City, Sierra Leone, and did not extend to rural livestock production zones or other urban centres in the country, even though livestock and livestock food products consumed in Makeni often originate from outside the city.
- **Population scope:** Data were obtained exclusively from actors directly involved in the public handling chain – livestock and livestock-product deliverers (truckers, carters, head porters), lairage operators, processors (e.g., butchers), vendors of meat and milk, and poultry producers and vendors – together with relevant local government authorities. Consumers' perceptions and veterinary/regulatory personnel outside these categories were not the primary focus of data collection.

- **Temporal scope:** Fieldwork and data collection were restricted to March 2023, representing a cross-sectional snapshot rather than a longitudinal account of practices over time.
- **Thematic scope:** The study was bounded by its three stated objectives – facility adequacy, the influence of legislation/jurisprudence, and the level of health education/awareness – and did not extend into broader veterinary epidemiology, clinical diagnostics, or economic loss quantification.
- **Analytical scope:** Quantitative data generated were analyzed using SPSS (Statistical Package for Social Sciences), with the analysis techniques (descriptive statistics, frequency distributions, etc.) limited to what SPSS readily supports for a descriptive survey design.

1.8 LIMITATIONS OF THE RESEARCH

While the delimitations define the intentional boundaries of the research, the following limitations reflect constraints that may have affected the depth, generalizability, or precision of the findings:

- **Self-reported data:** Much of the data relied on respondents' self-reports regarding handling practices, hygiene behaviour, and awareness levels, which may be subject to social desirability bias – respondents may overstate compliance with safe handling practices to avoid appearing negligent.
- **Sample size and accessibility:** The informal and largely unregulated nature of livestock trading in Makeni made it difficult to establish a complete sampling frame; some actors (e.g., itinerant traders, informal slaughter points) may have been underrepresented or inaccessible during the study period.
- **Cross-sectional design:** Because data collection occurred within a single month (March 2023), the study could not capture seasonal variations in livestock supply, handling stress, or disease prevalence that might influence health risk levels at other times of the year.
- **Limited laboratory/clinical verification:** The study relied primarily on survey and observational data rather than microbiological testing of meat, milk, or egg samples, meaning that actual contamination levels could not be independently confirmed against reported practices.
- **Language and literacy barriers:** Some respondents, particularly informal traders and transporters, may have limited literacy or fluency in the language of survey administration,

potentially affecting the clarity or accuracy of responses despite translation efforts.

- **Resource and time constraints:** As an academic dissertation research effort, the study was constrained by limited time, funding, and personnel, which restricted the scope of facility inspections and the number of follow-up visits that could be conducted.
- **Generalizability:** Because the study focused solely on Makeni City, findings may not be fully generalizable to other urban centres in Sierra Leone with different market structures, infrastructure levels, or regulatory enforcement.

2.0 MATERIALS AND METHODS

2.1 INTRODUCTION

This segment explains the procedures and methods of investigation used by the researcher in carrying out this study; the research design, research population, sample population, sampling technique and source of data, description of the study area, data collection methods, measurement of variables, data processing, data analysis, and ethical considerations in the collection of data.

2.2 RESEARCH DESIGN

The research design was a descriptive survey research and include the outline of the research objectives to the final analysis of data, leading to conclusion and recommendations. The study was conducted mainly using qualitative and quantitative approach of research. The research employed the self-administered questionnaire as a tool of data collection; and to counter the shortcomings that accrued from use of the questionnaire, interviews was conducted with some of the respondents.

2.3 THE STUDY AREA

The study was conducted in Makeni City. Makeni is the largest city in the Northern Province of Sierra Leone. The city is the capital of Bombali District, and is the economic center of the Northern Province. Makeni is the fifth largest city in Sierra Leone by population. The city of Makeni had a population of 80,840 in the 2004 census (World Gezetter, 2013) and a 2013 estimate of 112,428 (Sesay I.M. *et al.*, 2006). Makeni lies approximately 110 miles east of Freetown. As with most parts of Sierra Leone, the Krio language of the Sierra Leone Creole people is the most widely spoken language in Makeni.

The city of Makeni is one of Sierra Leone's six municipalities and is governed by a city council which is headed by a mayor in whom executive authority is vested. The mayor is responsible for the general management of the city including management of markets of which livestock and livestock food products are essential.

The population of Makeni is ethnically diverse, though the Temne people make up the largest ethnic group in the city. The Krio language is used as the primary language of communication among the different ethnic groups in the city. The people of Makeni enjoy a fine social life in which sports (especially athletics and football predominate), music, clubbing, traditional secret societies, education and religious tolerance predominate.

Socio-economic activities keep the city through its development and peace. They include trading, technical skills training and works, white collar jobs mainly in the areas of Education, Security, Media and Information, Local Government, Health and Sanitation, Social Work and Agriculture (of which lowland cultivation and poultry production predominate) including agribusiness. The agribusiness sector has got livestock and livestock products business as a prominent facet. This facet needs great attention as it is faced with infrastructural and policy implementation inadequacies that places entrepreneurs and their workers and service providers, as well as consumers and inhabitants in health risks. And it is to these that the research is focused.

2.4 RESEARCH POPULATION AND SAMPLING

2.4.1 Research Population: This includes livestock and livestock food products deliverers, processors, holders/keepers and vendors.

2.4.2 Population Sample: The population sample consisted of sixty (60) respondents from the population described herein as given below.

Category of respondents	Sample
livestock and livestock food products Deliverers (truckers, carters, head butters, etc)	05
Processors (e.g. butchers)	30
Lairage operators	10
Vendors of meat and milk	10
Poultry producers and vendors	05
Total	60

2.4.3 Sampling Techniques: The research population sample was selected using purposive sampling which is a function of non-probability sampling. Under purposive sampling technique, the researcher purposely selects those who are thought to be relevant to the research topic. In this case, the judgment of the researcher was more important than obtaining a probability sample. The sample size was thus selected from all the different respondents of choice in the research population.

2.5 DATA COLLECTION

2.5.1 Data Sources

Primary data was obtained by the researcher from the field. Data collection was achieved by use of questionnaire and emanated from respondents' opinions and ideas through interviewing.

2.5.2 Data Collection Methods

The researcher was the principal data collector and employed the following methods:

Interview guide: This was used for respondents who do not know how to read and write as well as those who never had time to fill the questionnaires because the researcher was able to determine what to ask with reference to the topic. The researcher conducted a face-to-face interaction with interviewees with sole aim of soliciting the required data. The researcher advantageously used structured interviews to get more in-depth information, reduce resistance and obtain personal information from the respondents.

Direct filling: For the respondents who are literate enough to fill the questionnaire on their own requiring minor guide from the researcher.

2.7 QUESTIONNAIRE

2.7.1 Outlook: This consisted of a number of questions printed in a definite order; each research objective constituted a major section. There was also a section on the respondents' personal information. Both open and closed ended questions were generated. The questionnaire was purposeful and the confidentiality of respondents was assured.

2.7.2 Validity and reliability: To establish the validity of the instrument, the researcher ensured that the questions in the questionnaire were arranged according to the objectives of the research, clearly depicting variables. These variables were largely identified from literature and a situational analysis of the problem prompting the research. To ensure the attainment of reliability, the researcher the instrument was peer reviewed and pretested; and feedbacks were used to further get it appropriate for use.

2.8 DATA ANALYSIS

The data collected was subjected to quantitative analysis using Statistics Package for Social Science - SPSS 26HS.

2.9 ETHICAL PROCEDURE

Research proposal was developed and it passed the check of ethical approval of the Research Committee of the Faculty of Agriculture and Natural Resources Management of the Ernest Bai Koroma University of Science and Technology to which the research is domicile. The interviews were

flexible to the convenience of the respondents, and confidentiality was also assured by individual interviews.

3.0 FINDINGS AND DISCUSSIONS

3.1 PERSONAL INFORMATION OF RESPONDENTS ON THE ASSESSMENT OF THE PUBLIC HEALTH RISKS IN THE HANDLING OF LIVESTOCK AND LIVESTOCK FOOD PRODUCTS IN MAKENI CITY

Table 3.1.1: Respondents by gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	43	71.7	71.7	71.7
Female	17	28.3	28.3	100.0
Total	60	100.0	100.0	

Source: Field data, 2023

Out of the 60 respondents, 43 (71.7%) are male and 17 (28.3%) are female. This suggests men predominate in livestock and livestock-product enterprises in Makeni, consistent with the male-dominated pattern of labour typically observed in abattoirs and animal holding centres (lairages) in West African livestock value chains.

Table 3.1.2: Respondents by age

Age category	Frequency	Percent
18–45	38	63.3
46–60	20	33.3
61–80	2	3.3
Total	60	100.0

Source: Field data, 2023

The majority (63.3%) fall in the 18 - 45 age bracket, followed by 33.3% in the 46 - 60 bracket, with only 3.3% aged 61 - 80. This indicates the livestock trade in Makeni is dominated by the economically active age group.

Table 4.1.3: Respondents by household headship

Household head?	Frequency	Percent
Yes	43	71.7
No	17	28.3
Total	60	100.0

Source: Field data, 2023

Most respondents (71.7%) are household heads, suggesting they are likely to be strongly invested in their livestock

enterprises as a primary livelihood source, which supports the reliability of the information they provided.

Table 3.1.4: Type of livestock business operated

Business type	Frequency	Percent
Meat selling	26	43.3
Butcher	4	6.7
Milk production	6	10.0
Poultry production	14	23.3
Pig production	7	11.7
Pork sales	3	5.0
Total	60	100.0

Source: Field data, 2023

Meat selling is the dominant enterprise (43.3%), followed by poultry production (23.3%); pork sales are least common (5.0%). This shows Makeni's livestock market is meat-centred, so a shortage or disease outbreak affecting cattle or goats – the main sources of meat here – would have outsized effects on the market.

3.2 ADEQUACY OF FACILITIES USED IN PUBLIC HANDLING OF LIVESTOCK AND LIVESTOCK PRODUCTS IN MAKENI CITY

Table 3.2.1: Physical condition of handling facilities

Facility	Component	Frequency	Percent
Lairage	Open shed	37	61.66
	Covered shed	23	38.33
	Concrete floor	27	45.00
	Clay/laterite floor	32	53.33
	Pest proofing available	13	21.66
	High ground elevation	23	38.33
	Side wall	23	38.33
	Side netting	20	33.33
Abattoir	Adequate waste disposal	25	41.66
	Open shed	12	20.00
	Covered shed	30	50.00
	Concrete floor	15	25.00
	Clay/laterite floor	21	35.00

Facility	Component	Frequency	Percent
	Pest proofing available	12	20.00
	High ground elevation	17	28.33
	Side wall	30	50.00
	Side netting	2	3.33
	Adequate waste disposal	40	66.66
Market place/stall	Open shed	17	28.33
	Covered shed	30	50.00
	Concrete floor	20	33.33
	Clay/laterite floor	6	10.00
	Pest proofing available	4	6.66
	High ground elevation	27	45.00
	Side wall	25	41.66
	Side netting	20	33.33
	Adequate waste disposal	30	50.00
Transport	Open assembly of animals/products	14	23.33
	Products sealed in containers/crates	15	25.00
	Live animals placed in crates	10	16.66
	Transported with other food products	18	30.00
	Transported with non-food products	26	43.33
	Transported alongside passengers	17	28.33
	Specialised for that animal/product only	16	26.66
	Temperature regulation available	2	3.33

Source: Field data, 2023

Data presented on lairage reveals: Open shed (61.66%) and clay/laterite floors (53.33%) predominate, while protective features – covered shed, concrete floor, high ground elevation, side wall, side netting, pest proofing – are present in a minority of facilities. This exposes animals directly to weather extremes. Pigs are particularly vulnerable to heat

because they lack functional sweat glands and rely mainly on panting and wallowing to lose heat; sustained heat exposure in unshaded, unventilated pens is a documented cause of heat stress, sunburn, and fatal heatstroke in pigs (Agriculture Victoria, 2026; The Pig Site, n.d.). Unsealed clay/laterite floors are also harder to disinfect than concrete and can harbour pathogens and parasites, elevating disease risk to held animals.

With regard to abattoir the data shows: Waste disposal is reported adequate by two-thirds of respondents (66.66%), and covered shed/side wall by half, but pest proofing (20.00%), high ground elevation (28.33%) and especially side netting (3.33%) are rare. This pattern is consistent with findings from a scoping review of abattoirs across Eastern Africa, which found that backyard and small-scale abattoirs with substandard infrastructure carry the highest risk of pathogen transmission to workers and surrounding communities (Fair *et al.*, 2023). The reasonably good waste-disposal figure is a positive counterweight, but the low pest-proofing and netting figures still leave meat vulnerable to fly-borne and rodent-borne contamination.

With regard to Market place/stall, only half of the respondents reported adequacy of covered sheds and waste disposal, while adequacy of pest proofing is reported by just 6.66%. Poor market infrastructure of this kind is a recurring theme in the informal food-market literature across Sub-Saharan Africa, where limited water, sanitation and cold-chain infrastructure is repeatedly identified as a structural driver of product spoilage and contamination risk (Alonso, as cited in ILRI, 2024; Cook, Trevenen-Jones & Sivasubramanian, 2024).

Concerning transport, a substantial share of respondents (43.33%) transport livestock/products together with non-food items, and only 3.33% have temperature-regulated vehicles. Where live animals travel unrestrained in open assembly rather than in crates, this is consistent with documented sources of pre-slaughter stress (fighting, physical trauma, thermal stress) that are known to degrade subsequent meat quality (Warriss, 1990; Faucitano, 2018) – see the discussion on Table 3.2.2 below for the specific quality outcomes this produces.

Contending with availability versus adequacy, across all four facility types, the data show a common pattern: a small set of basic components (safe drinking water, tables, water supply, plane surfaces) are reported present by roughly a third to half of respondents, while components requiring capital investment – cold storage/refrigeration, rail systems, exhaust systems, veterinary laboratories, fire-extinguishing apparatus – are reported present by fewer than 10%, and considered adequate by fewer still. This gap between “available” and “adequate” recurs throughout the table (e.g., lairage safe drinking water: 50.00% available vs 38.33%

adequate; abattoir water supply: 55.00% vs 15.00%), indicating that even where a component nominally exists, respondents judge it as functioning below an acceptable standard far more often than not. This matches broader findings that informal-sector food handlers in low- and middle-income countries frequently operate with infrastructure that is present in name but insufficient for consistent food-safety practice (Nyokabi *et al.*, on Ethiopian dairy value chains).

Table 3.2.2: Efficiency of delivery for product quality

Item/Activity	Alternative	Frequency	Percent
Period from preparation to display	Relatively short	11	18.33
	Timely	30	50.00
	Relatively long	0	0.00
Condition of product delivered	Fresh	44	73.33
	Processed	3	5.00
	Preserved	0	0.00
Shelving	Protected	19	31.66
	Unprotected	20	33.33
Pre-slaughter stress	Controlled	7	11.66
	Uncontrolled	27	45.00
Postmortem/carcass examination	Physical analysis	40	66.66
	Laboratory analysis	2	3.33
	No analysis	18	30.00

Source: Field data, 2023

The data on Table 3.2.2 shows that half of respondents (50.00%) say products reach market within a timely period and 73.33% say products are delivered fresh – favourable for minimising spoilage risk. Shelving is slightly more often unprotected (33.33%) than protected (31.66%).

Most notably, pre-slaughter stress is reported as uncontrolled by 45.00% of respondents, versus only 11.66% who report it as controlled. This matters because poorly controlled pre-slaughter handling including vices like rough handling, fighting among unfamiliar animals, inadequate lairage time, and thermal stress, is well documented to compromise meat quality and animal welfare. Short, acute stress immediately before slaughter is associated with pale,

soft, exudative (PSE) meat, while prolonged or chronic stress is associated with dark, firm, dry (DFD) meat, both of which reduce consumer acceptability and carcass value (Warriss, 2000, 2003; Faucitano, 2018). Independent of meat-quality effects, uncontrolled pre-slaughter stress is also linked to bruising, carcass trim losses, reduced live weight, and animal welfare harms (Warriss, 1990).

Postmortem/carcass examination is conducted mainly by physical (visual/manual) analysis (66.66%), rather than laboratory analysis (3.33%), while 30.00% of respondents report no analysis at all. Physical inspection, which is mostly by visual checks of the carcass, offal and lymph nodes, is a legitimate and low-cost first line of meat inspection, but it depends on the inspector's expertise and cannot detect subclinical infections (e.g., early-stage brucellosis or bovine tuberculosis) that require serological or laboratory confirmation (Sa'idu *et al.*, 2015; Gomsu *et al.*, 2026). The near-absence of laboratory-based verification, combined with the fact that 30% of products undergo no postmortem check at all, leaves an appreciable share of the Makeni meat supply without any formal disease-screening safeguard.

Table 3.2.3: Action taken toward sick animals in facilities

Action	Male f (%)	Female f (%)	Total f (%)
Kill and dispose	9 (15.00)	2 (3.33)	11 (18.33)
Isolate and treat	16 (26.66)	6 (10.00)	22 (36.66)
Report to public health personnel	18 (30.00)	9 (15.00)	27 (45.00)
Total	43 (71.66)	17 (28.33)	60 (100.0)

Source: Field data, 2023

Table 3.2.3. reveals: Reporting to public health personnel is the most common response overall (45.00%), followed by isolation/treatment (36.66%) and culling (18.33%). Having a worth noting proportion of respondents defaulting to reporting, rather than unilaterally treating or destroying sick animals, is a positive indicator for disease surveillance, since early reporting is the entry point for controlling zoonotic outbreaks at the animal-human interface (Fair *et al.*, 2023; Hossain *et al.*, 2025, on the One Health approach to zoonoses). However, more than half of respondents (55.00%) still handle sick animals themselves (killing or isolating) without necessarily involving veterinary or public-health authorities, which – combined with the low rates of pest proofing and lairage sanitation shown in Tables 4.2.1–4.2.2 – sustains a pathway for zoonotic exposure among handlers themselves (Ngcobo *et al.*, 2026; Gomsu *et al.*, 2026 on limited biosecurity awareness among African livestock traders).

Table 3.2.4: Availability/adequacy of sanitation practices

Practice	Available f (%)	Adequate f (%)
Cleaning	47 (78.33)	27 (45.00)
Disinfecting	42 (70.00)	27 (45.00)
Pest proofing	13 (21.66)	11 (18.33)
Pest repellent use	3 (5.00)	2 (3.33)
Pest killer use	4 (6.66)	4 (6.66)
Waste disposal	41 (68.33)	30 (50.00)

Source: Field data, 2023

The data on Table 3.2.4 shows that cleaning (78.33%) and disinfecting (70.00%) are widely practiced but judged adequate by fewer than half of respondents in both cases, while pest control measures are rare and even more rarely adequate. This “practiced-but-inadequate” pattern is consistent with the resource constraints (water access, labour cost, poor floor/wall construction) documented in other informal-market studies, where basic hygiene routines exist but fall short of the standard needed to fully interrupt contamination and pest-borne disease pathways (Foluuu, 2025; ILRI, 2024).

Table 3.2.5: Product display practice

Practice	Frequency	Percent
Sell only livestock products	39	65.0
Livestock products alongside other foodstuffs	21	35.0
Total	60	100.0

Source: Field data, 2023

It is shown in Table 3.2.5 that the majority (65.0%) of the livestock food products handlers/dealers sell livestock products exclusively, which reduces the risk of cross-contamination between animal-derived and non-animal-derived foods on the same stall – a recognised food-safety benefit, since designated single-category zones are one of the practical interventions recommended for improving informal-market food safety (Foluuu, 2025).

3.3 IMPACT OF LEGISLATION (JURISPRUDENCE) IN MINIMISING HEALTH RISKS IN THE HANDLING OF LIVESTOCK AND LIVESTOCK FOOD PRODUCTS IN MAKENI CITY

Table 3.3.1: Knowledge of public health laws

Statement	Agree f (%)	Disagree f (%)
Aware laws exist	45 (75.00)	15 (25.00)
Noticed law implementation	40 (66.66)	20 (33.33)
Feel no guide is needed	42 (70.00)	18 (30.00)

Source: Field data, 2023

It is shown in Table 3.3.1 that three-quarters of respondents (75.00%) are aware that laws exist, and two-thirds (66.66%) have noticed some implementation; yet 70.00% feel they need no further guidance on selling/dealing in livestock products. Read together, this suggests handlers are informed of the law's existence but not necessarily compliant with its detail, and may under-estimate their own need for guidance relative to the infrastructural gaps earlier documented in the section of availability and adequacy of facilities for handling animal food products.

Table 3.3.2: Business Regulations Adhered to

Regulation	Frequency	Percent
Business registration	13	21.7
Licensing of establishment	2	3.3
Transport regulations	5	8.3
Food safety requirement	14	23.3
Responsibility of business operator	13	21.7
Presentation/standardisation	13	21.7
Total	60	100.0

Source: Field data, 2023

It is evident in Table 3.3.2 that no single regulatory area (amongst: Transport regulations; Food safety requirement; Responsibility of business operator; and Presentation/standardization) is adhered to by more than a quarter of respondents, and licensing (3.3%) and transport regulation (8.3%) are especially weak. This mirrors a well-documented regional pattern which shows that informal food-sector operators across Africa typically comply unevenly with formal food-safety regulation because Western-style compliance regimes assume documentation and capital resources most informal traders lack (Henson & Jaffee, cited in Food for Mzansi, 2023).

Table 3.3.3: Offences Frequently Committed on the Handling of Livestock and Livestock Food Products

Offence	Frequency	Percent
Selling unlawfully produced meat	20	33.3
Failure to meet production/transport/sales standards	22	36.7
Failure to register business	7	11.7
Running business without licence	9	15.0
Failure to meet public responsibilities	2	3.3

Source: Field data, 2023

As evidenced from Table 3.3.3, the most frequently observed offences are failure to meet production/transport/sales standards (36.7%) and selling unlawfully produced meat (33.3%) – together accounting for 70% of reported offences. These are the two offence types most directly tied to the physical/health risks quantified in the data presented for the adequacy of facilities used in public handling of livestock and livestock products in this study, since standards failures and unlawful production are the practical mechanisms by which contaminated or diseased product reaches consumers.

Table 4.3.4: Penalties instituted for Infractions on the Handling of Livestock and Livestock Food Products

Penalty	Frequency	Percent
Fines	28	46.7
Closure of business	14	23.3
Seizure of license	5	8.3
Court summons	13	21.7

Source: Field data, 2023

It can be seen from Table 4.3.4 that fines are the dominant penalty (46.7%), followed by closure of business (23.3%). Punitive, fine-based enforcement of this kind is exactly the model that recent African food-safety policy analysis argues is poorly suited to informal-sector realities, since fines and closures can push small, resource-poor vendors further into informality rather than improving practice, whereas supportive/incremental approaches (training, phased upgrades) have shown more durable improvements in similar informal food-market contexts (Henson & Jaffee, cited in Food For Mzansi, 2023; ILRI, 2024).

Table 3.3.5: Predominant law-enforcing authority on the Handling of Livestock and Livestock Food Products

Authority	Frequency	Percent
City Council administration	51	85.0
Sierra Leone Police	4	6.7
Chiefdom Local Administration	1	1.7
Quarantine officers	3	5.0
Law courts	1	1.7

Source: Field data, 2023

Table 3.3.4 describes the predominant law-enforcing authority on the handling of livestock and livestock food products in Makeni City. It can be observed that the City Council administration is overwhelmingly the dominant enforcement body (85.0%), consistent with its sanitation and infrastructural mandate over city markets; quarantine officers – the actors with specific animal/zoonotic-disease expertise – are involved in only 5.0% of cases, suggesting animal-health expertise is under-represented in day-to-day enforcement relative to municipal administration.

Table 3.3.6: Expression of Health Risk From Ineffective Law Enforcement on Livestock Business Type

Health risk	Meat selling	Butcher	Milk	Poultry	Pig	Pork	Total
Direct interaction w/ diseased animals	10	3	5	3	2	1	24 (40.00%)
Exposure of products to contamination	0	0	1	1	2	1	5 (8.33%)
Contamination of water/other food	1	0	0	1	0	0	2 (3.33%)
Transfer of zoonotic disease	15	1	0	9	3	1	29 (48.33%)
Total	26	4	6	14	7	3	60

Source: Field data, 2023

It is shown in Table 3.3.6 that transfer of zoonotic disease (48.33%) and direct interaction with diseased animals (40.00%) together account for nearly 90% of the perceived health risk from weak law enforcement, concentrated heavily in meat selling and poultry production. This is consistent with the broader zoonotic-disease literature on live-animal and informal meat markets, where direct animal contact and inadequate pre-sale disease screening are repeatedly identified as the principal transmission pathways for pathogens such as brucellosis, bovine tuberculosis, and other zoonoses (Gomsu *et al.*; Kolo *et al.*; Frontiers, 2026).

3.4 LEVEL OF HEALTH EDUCATION/AWARENESS ON THE HANDLING OF LIVESTOCK AND LIVESTOCK FOOD PRODUCTS

Table 3.4.1: Determining Whether Livestock/Livestock Products Handlers/Dealers have Ever Been Sensitised/Informed on Health Ensuring Practices

Response	Frequency	Percent
Have been sensitised/informed	47	78.3
Have not been sensitised/informed	13	21.7

Source: Field data, 2023

Table 3.4.2: Sensitisation Method Used for Enhancing Proper Public Handling of Livestock and Livestock food Products

Method	Frequency	Percent
Public campaign	17	28.3
Seminar	6	10.0
Training workshop	32	53.3
Course work/modular	5	8.3

Source: Field data, 2023

As disclosed in Table 3.4.2, training workshops are the dominant method (53.3%). Participatory formats such as workshops are generally considered more effective for practice change than one-off campaigns, particularly when paired with periodic refreshers.

Table 3.4.3: Emphasis of the Education/Awareness for Enhancing Proper Public Handling of Livestock and Livestock food Products

Emphasis area	Frequency	Percent
Disease spread	2	3.3
Food contamination	26	43.3
Disease prevention	2	3.3
Sanitation	2	3.3
Crating, packaging and shelving	2	3.3
Standards and measures	1	1.7
Environmental protection of animals	4	6.7
One Health	10	16.7
All of the above	11	18.3
Total	60	100.0

Source: Field data, 2023

As evident from Table 3.4.3, food contamination is the dominant training emphasis (43.3%), with One Health as a distinct, integrated framing reaching 16.7% of respondents. This could mean that food contamination prevention is not an entirely new concept to the respondents, or if food contamination awareness is inadvertently neglected, food contamination from market abound in Makeni. The emergence of “One Health” as its own category is notable, since recent literature frames coordinated human-animal-environmental health approaches as the appropriate model for addressing zoonotic risk in exactly this kind of mixed live-animal/meat-market setting (Hossain *et al.*, 2025).

Table 3.4.4: Impact of Education/Awareness and Desired Frequency of Sensitisation on Techniques of Proper Public Handling of Livestock and Livestock Food Products

Category	Level	Frequency	Percent
Impact of Education/Awareness	Rarely	9	15.00
	Moderately	19	31.66
	Highly	32	53.33
Frequency of Sensitisation Wanted	Monthly	15	25.00
	Quarterly	39	65.00
	Annually	6	10.00
	Bi-annually	0	0.00

Source: Field data, 2023

It can be shown in Table 3.4.4 that a majority (65.00%) of the respondents want quarterly sensitisation, and a further 25.00% want it monthly – i.e., 90% want refreshers at least quarterly. Given that 53.33% already report training has “highly” impacted their handling techniques, this signals demand for continued, not first-time, training – an argument for scheduled refresher cycles rather than one-off interventions, in line with training-frequency recommendations from informal-sector food-safety capacity-building programmes elsewhere in West Africa (ILRI, 2024, citing the Burkina Faso “push-pull” chicken-hygiene programme).

4.0 SUMMARY, CONCLUSION, AND RECOMMENDATIONS

4.1 INTRODUCTION

This segment presents a brief summary of the findings of the study, conclusions and the recommendations on how the health sector and the local government can overcome some of the challenges highlighted in this survey on the health risks associated with the public handling of livestock and livestock products in Makeni City in particular and Sierra Leone in general, and in the process responding to health improvements in tandem with the One Health policy.

4.2 SUMMARY

The study and the research problem sought to probe into the challenges on the health risks associated with the public handling of livestock and livestock products in Makeni City and to in order to give insights into the amelioration of the status quo. Findings of the Study are here revealed:

4.2.1 Demographic Characteristics of the Livestock and Livestock Products Entrepreneurs in Makeni City

The study revealed that males are overwhelmingly involved in the livestock and livestock products enterprises in Makeni City. By marital status distribution, it was also shown that married men are the greatest proportion of the entrepreneurs. It was also clearly shown that many of the entrepreneurs are in the active age bracket of 18-45 than any other category. Further, most people who do livestock and livestock product business are household heads. Finally, meat selling is the predominant livestock/livestock product enterprise in Makeni City. These findings were discussed in the light of their capacity to ameliorate the challenges.

4.2.2 Assessing the Adequacy of the Facilities Used in the Public Handling of Livestock and Livestock Products

The study revealed that the entrepreneurs are faced by a number of challenges *with the physical condition of the facilities used for handling livestock and livestock products*, including:

- *Lairages* are not well constructed because protective components like shed cover, concrete floor, high ground elevation, side wall, and side netting are reported to be present in only a few facilities. They are further dominated with open shed and clay/laterite floors.
- *Abattoirs* are of a fairly good construction, being inadequate mostly for the low prevalence of pest proofing, lacking high ground elevation, and lacking side netting. This can allow for entrance of pests into the facility and infest/infect meat, the facility could be prone to flooding and its ensuing contamination, and prone to pest entry, respectively.
- The majority of the *market places/stalls* are not adequately constructed because covered sheds and adequate waste disposal systems are both shown to be moderately available, while the rest of the other components including open shed, concrete floor, clay/laterite floor, pest proofing, high ground elevation, side netting are indicated to be of a lesser presence in the facilities.
- *Transport facility (vehicle, tricycle, cart, wheelbarrow, etc)*: Livestock and livestock products could be seen to be transported together with other food and non-food products, And data gives an indication that transport facilities for delivering livestock and livestock products from farm gate to their destinations are generally poor.

The study also revealed that the entrepreneurs are faced by a number of challenges with the *availability/adequacy of the facility components for handling livestock and livestock products*:

- *Liarages (Animal holding centers/units)*: Liarages are shown to have a fairly high availability of safe drinking water (water troughs), but not that badequate. Liarages are deficient in vehicle approachable entrances, waste disposal systems, cistern/running taps, drainages on floor, wash facility for washing or drenching animals, feed troughs, and vehicular passages inside, and hay/forage racks.
- *Abattoir (slaughter house)*: Abbatoirs are shown to have an abundance of slaughter halls and a fairly high availability Water supply. Electricity supply, lairage (small holding units) cutting room, gut & tripe, detained meat room, condemned meat room, drainage system, veterinary laboratory, hide & skin room, disinfection facilities, first-aid room, rail system, and cold room are on the very low side of availability and all components of the slaughter houses, ranging from Slaughter halls to Rail

systems, are inadequate. The overall effect is poor sanitation and poor meat quality.

- *Market place/stall:* Tables are shown to be moderately available. Sun, wind and rain protection, and Handling aids (tongs, forks, gloves, and spoons) are not of a very low unavailability. Shelves, lighting/electricity, refrigerator, wash facility, airy display trays, waste food storage/disposal units, and cutters, pest proofing, fire extinguishing apparatus are reported of a very low availability. The overall effect is possibility for rapid product quality deterioration and low capacity to control fire outbreaks.
- *Transport facility (vehicle, tricycle, wheelbarrow, and cart):* Transport facilities herein are moderately shown to have plane and clean internal surfaces. However, they are found to be lacking in garbage storage and waste water use, and adequate flooring. Further, walls and ceilings, lighting, water supply, sinks and hand-wash basins, and fire extinguishing apparatus, fixtures, fittings and equipment, and pest proofing are of a far less availability. And worse, they are acutely lacking in exhaust systems refrigeration. These do not provide the ambience for livestock and livestock products safety, and they increase the propensity for product deterioration and disease transmission.

It was shown on the *efficiency of livestock and livestock products delivery for quality of consumption* that:

- Period from product preparation to market display could be seen to be timely or relatively short.
- Livestock products are mostly delivered in fresh condition to market.
- Shelving of products is done but slightly more of unprotected forms than protected is used.
- Many more respondents affirmed that pre-slaughter stress is mostly uncontrolled, implying utilization of poor practices.
- Meat/product post mortem analysis is shown to be done by physical/traditional analysis by a satisfactorily high number of respondents.
- All of this imply health risks to consumers and economic loss to sellers if buyers/consumers refuse to buy.

It was shown on the *action to sick animals in livestock facilities* that:

- Majority of the people who detected sick animals in their facilities either report it to the public health personnel or kill and dispose the sick animals.

It was revealed on the *availability/adequacy of the sanitation practices in the livestock and livestock products handling facilities* that:

- Cleaning and disinfecting are carried out but not adequately done. This can be due to the expressed unavailability/inadequacy of the water supply in the facilities and the associated labour costs involved. The structural make-up of the facilities in which laterite/clay floors, open sheds without solid walls and side netting predominate can also be a hindrance.
- Pest proofing, pest repellent use, pest killer use in the facilities used are presented available/practiced only by a few respondents who even attested such to be grossly inadequate.
- Waste disposal is shown practiced by a majority of the respondents but with mixed feelings of the adequacy.

It was revealed on the *product display practice at market* that:

- Livestock products are mostly sold solely on stalls without other goods on board, while in some observable instances they are sold alongside other foodstuffs.

4.2.3 Examining the Impact of Legislature (Jurisprudence) in Minimizing Health Risks Related to Public Handling of Livestock and Livestock Products

- A majority of the livestock and livestock products entrepreneurs are aware of the existence of laws guiding the public handling of livestock and livestock products. Further, a satisfactorily high number of respondents have noticed the implementation of laws guiding the public handling of livestock and livestock products in Makeni City. This leaves an impression that laws are not implemented accordingly, that is, they are not implemented timely and fairly – to apply equally to every defaulter every time. However, a great majority of the respondents agreed that they need no guide in selling/dealing with livestock and livestock products.
- Food safety requirement, responsibility of business operator, presentation and standardization – labelling, measures, etc., and business registration are the business regulations mostly adhere to by even a low number of livestock and livestock product entrepreneurs, while transport regulations and licensing of establishment are adhered to by just a few
- Frequently observed livestock and livestock product business offences include the failure of dealers to meet with the standards of production,

transport and sales; and the selling of meat that is not lawfully produced for consumption. On the low side occur the running of businesses without licenses; failure to register a business; and least, the offence of failure to meet to operator public responsibilities.

- Fines and closure of business are the most frequently instituted penalty for the livestock and livestock product business offences in Makeni City.
- The City Council administration is shown to be the predominant law enforcing authority, and can raise funds through fines to meet to its obligations of sanitation of the city and effectively monitor actions of closed businesses.
- The main risks posed by the inefficient implementation of laws and regulations on public handling of livestock and livestock products are shown to be the direct human interaction with disease animals, and transfer of zoonotic diseases. Therefore, it is prudent that live animals and livestock products are screened for diseases before they leave farm gates and right through reaching consumers.

5.2.4 Assessing the Level of Health Education/Awareness Provided to Persons Involved in the Public Handling of Livestock and Livestock Products in Makeni City

- A Majority of the livestock and livestock products entrepreneurs affirmed that have been sensitized/informed on the public handling of livestock and of livestock products, indicating therefore that they have knowledge on the operations of the enterprises.
- The sensitization method used were mostly training workshop and was public campaign.
- Emphasis of the education/awareness was mostly on Food Contamination and One Health., which are trending.
- The education/awareness was shown to have highly or moderately impacted their techniques in public handling of livestock and livestock products
- The sensitization in point is shown to be needed to be done more frequently – Quarterly and monthly.

5.3 CONCLUSION

Livestock and livestock product business in Makeni City is male household heads dominated with meat selling contributing largely for aggregate establishments. Notwithstanding, the facilities used – liarage (animal holding centers/units), abbatoirs (slaughter houses), market places/stalls, transport facilities (vehicles, tricycles, carts, wheelbarrows, etc.) – are overwhelmingly inadequate or mostly traditional impairing the appropriate handling

measures and posing problems with sanitation, in that they have structural and components (equipment and or conveniences) in adequacies. Risks of contamination of livestock products by pathogens and other foreign organic or in inorganic materials is thus increased. As well, the transfer of zoonotic diseases is equally heightened. However, awareness of the laws pertaining to the public handling of livestock and livestock products and the implementation of these laws by the City Council administration are positive pointers to an avenue for minimizing health risks posed as exposed in this research. Further in support is the satisfactory level of education/awareness that is provided for the entrepreneurs of Livestock and livestock product businesses.

5.4 RECOMMENDATIONS

The data provided herein and the resulting discussions give way to these recommendations:

- The fundamental infrastructure in the livestock and livestock product business in Makeni City and Sierra Leone should be prioritized. For example, liarages, transport facilities, abbatoirs, and market places/stalls should be built or provided to meet improved standards that inherently combat sanitation and with precision of delivery and presentation forms to consumers. Routine maintenance of such facilities must also be of high priority. This can allow for better means of transportation, processing, packaging and sales, culminating in efficient livestock resource delivery, time management and increased productivity and investment returns.
- The local government must continue to direct its resources to providing the adequate facilities, the enforcement of laws, and the provision of education/awareness that relate to the public handling of livestock and livestock products nationwide.
- Consumer alertness is of a great essence also in minimizing the risks associated with the public handling of livestock and livestock products. This must be emphasized in our curricular and other social settings.
- Livestock and livestock product entrepreneurs must endeavor to plough back a fair share of their investments into the right infrastructural and managerial efforts that would positively aid the minimization of risks associated with the public handling of livestock and livestock products.

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