

Biosecurity Measures in Meat and Milk Value Chains

A Case Study in Koinadugu District, Northern Sierra Leone

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Abstract

This study assesses the level of vulnerability to zoonotic diseases and factors influencing implementation of biosecurity measures among meat and milk value chain actors. The study was conducted in Koinadugu and Falaba Districts (main ruminant production areas) in Sierra Leone. A semi-structured questionnaire was used to test knowledge, attitude and practices of value chain actors to zoonotic diseases. A total of 87 chain actors were involved in the study including 13 livestock traders, 20 butchers, 16 slaughterhouse workers, 17 transporters and 21 milk traders. Data was analyzed by simple descriptive statistics. Chain actors in the study indicate a fair knowledge about zoonotic disease symptoms and biosecurity measures. Brucellosis, Bovine Tuberculosis, Anthrax, Salmonellosis, Cystecercosis and rabies were reported. However, adoption of biosecurity measures was very low due to low level of education, lack of training and inadequate extension services, high cost of personal protective equipment (PPE) and inadequate enforcement of regulations by local authorities.

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According to this study the use of PPEs by milk traders was 23.8%, butchers 20%, slaughterhouse workers 18.8%, transporters 11.8%, and traders 7.7%. The low level of biosecurity measures indicates high risk for the spread of zoonotic diseases. However adequate support services can help reduce the risk.

Keywords: Hygiene; Livestock; Phyto-Sanitary Measures; Vulnerability; Zoonosis.

1. Introduction

Zoonoses are defined as infectious diseases originating from animal reservoirs that can be transmitted between humans and wild or domestic animals under natural conditions and can also be transmitted through a vector. Zoonotic pathogens carried by animals infect humans through direct animal-human contact or indirectly through consumption of contaminated food of animal origin[1]. Zoonotic diseases pose a public health risk to people producing, handling, processing and consuming animal products; with value chains creating a contact networks for transmission and spread [2].

Zoonoses have gained importance in recent years due to the emergence of new diseases of animal origin including Ebola, Avian Influenza and Swine Flu, in an era of increased human-assisted movement of animals and animal products through value chains [3, 4].

Biosecurity refers to the implementation of measures which protect health by reducing the risk of introduction and spread of disease and disease agents. The outbreak and rapid spread of Ebola in Sierra Leone was a wakeup call to many in terms of preventing and or minimizing future disease outbreaks in the country [5].

Studies in developed countries showed that abattoir workers are generally low skill staff that have no control over their job tasks and may not be aware of the determinants affecting their health [6, 7]. Different factors within the poor hygiene practices such as non-washing of hands, non-wearing of protective clothing, unclean of butchery equipment, as well as transporting the meat in unclean container and others factors can lead to meat contamination. All of these factors are considered to be the major risk factors to increase foodborne illness. More specifically, good personal hygiene and food handlers training are prerequisites for food safety. In addition it can play an important role in the effective prevention of contaminated food [8].

The main objective of this study was to explore the understanding of the concept of biosecurity among value chain actors, their perceptions in controlling zoonotic diseases and the factors influencing adoption of biosecurity measures.

2. Material and Methods

The study was conducted in Koinadugu and Falaba districts in northern Sierra Leone. Data was collected from the five (5) main cattle and small ruminant marketing towns including Gbindi, Gbentu, Dogolia, Walia, Fadugu and Kabala. Gbindi cattle market is the largest and makes up about 60 to 70% of cattle trade in the country. The sample of value chain actors were selected through purposeful sampling method [2]. This resulted in a total of 87 actors being reached including 13 traders, 21 milk vendors, 20 butchers, 16

slaughterhouse workers and 17 transporters (Cowboys). A semi-structured questionnaire in addition to observations and informal discussions was used to capture information from value chain actors. The data was grouped on the basis of specific value chain sector and analyzed.

3. Results and Discussion

3.1. Socio-demography of the chain actors

The socio-demographic situation of the chain actors was captured to understand the feasibility of promoting and adopting biosecurity measures. The composition of study sample shows a 100% male domination for (traders, transporters, butchers, and slaughterhouse workers) in the meat value chain, while the milk value chain was female dominated. The mean age and gender distribution of chain actors considered in this study are shown in table 1. Livestock production and trade especially ruminants is dominated by the Fula Ethnic tribe who are predominantly Muslims. There is a gender participation gap with well-defined roles and responsibilities as dictated by social, cultural and religious norms. This result is similar to previous studies of livestock value chains in Kenya [9,10,11] and also another researcher [12] who found that the slaughterhouse industry, in particular, tends to be male dominated with women excluded in slaughtering activities.

Table 1: Gender and age distribution of chain actors

	Sample size	% Male	% Female	Mean age
Traders	13	100	0	39.8
Butchers	20	100	0	33.4
Transporters	17	100	0	27.6
Slaughterhouse workers	16	100	0	34.4
Milk traders	21	0	100	34

Result obtained from the study shows that the level of illiteracy is very high for all chain actors - 82.4% of slaughterhouse workers, 77% of traders, 66.7% milk traders, 65% of butchers, and 58.8% of transporters. All chain actors consider their occupation as a family business enterprise acquired over time from parents. Majority of value chain actors have not received formal training in their various activities. This may therefore limit their perception of the severity of the biosecurity risks they face as a consequence of their workplace practices. Majority of actors engaged in the milk and meat value chains have not received formal training to undertake the activities for which they are responsible. This may limit their perception of the severity of the biosecurity risks they face as a consequence of their workplace practices. Most actors are not trained in handling of food and animals, recognizing disease symptoms, disease reporting, and are not informed in the use of personal protection equipment, food laws and regulations which can serve as very important biosecurity measures when well understood, adopted and implemented.

Information on livestock by chain actors is obtained mostly from Livestock and Veterinary Services Division

(LVSD) staff of the Ministry of Agriculture, Forestry and Food Security (MAFFS), and a few NGOs. The flow and dissemination of information within the livestock and milk value chains are weak as this undermines actors' ability to learn about and adopt biosecurity measures in their day to day activities. Almost all chain actors in the study have heard about zoonotic diseases and that they could be infected by livestock or livestock products. There appears to be high level of awareness of zoonotic diseases and the importance of biosecurity measures. This can be explained due to the recent outbreak of EVD which has led to increased sensitization programs by a number of NGOs, veterinary officers operating in the area. However, milk chain actors who are mostly women are less knowledgeable about zoonotic diseases as they seldom make contact with information providers on such issues.

As evidenced by the results of this study, adoption of bio-security measures related to sanitation and hygiene constitutes a major challenge for chain actors who lack access to the financial capital required for investments. One of the reasons for value chain actors' low levels of sanitation and hygiene may be the fact that infrastructural development is limited in marginal areas such as Koinadugu district.

3.2. Biosecurity risk assessment

Biosecurity risks exist at different levels in the milk and livestock value chain in Koinadugu district along the whole value chain.

3.2.1. Community Level Risks

There are several biosecurity risks at community level which require urgent intervention to curb transmission and spread of zoonotic diseases. Open defecation is common, and a very large proportion of the local population does not have access to latrines. Social-cultural practice influences latrine-use, with some households having access but still preferring to use the open and bushes for defecation. The town of Kabala lacks a waste management system therefore majority of the population practices open dumping of wastes. Garbage and faecal wastes contaminate the water wells (figure 3) on which majority of households are dependent for household water use.

Many households do not treat the water which they use - meaning that it is a key source of waterborne zoonoses. Lack of infrastructure puts the local population at risk as individuals are sometimes transported in the same vehicles which carry animals, exposing them to airborne zoonotic diseases as well as diseases which can be spread through contact or via body fluids. [13]. Gbindi market lacks an isolation ground to hold animals and consequently, different animal species from different source of origins end up mixing. This can in some cases create the perfect conditions for diseases spread, as there are healthy and sick animals present, and most importantly, the vectors required for disease transmission.

3.2.2. Production level risks

This study identified a number of risks which contribute to zoonotic disease transmission and spread. Most animals are not vaccinated which makes them vulnerable to diseases; while the purchase of untested animals

can lead to infection of the entire herd into which these animals are subsequently introduced. There is no control as regards to animal movement, which makes it hard to implement animal traceability system and tracking of zoonotic disease incidents and outbreaks.

3.2.3. Livestock Market level risks

There was no restriction in access to marketing facilities (Figure 1). An inspection post is available with few staff conducting minimal animal health inspection. Isolation of sick animals is very rare or non-existent as there are no quarantine facilities. Death of animals is hardly reported by either the owners or by the health inspectors. A deep is available which is however non-functional mainly due to unavailability of running water and drugs. Livestock are not sprayed for vector control. There is no routine vaccination programme against common infectious diseases. Vaccination is often sporadic as and when vaccines are available either through the LVSD or by NGOs.



Figure 1: Gbindi Livestock market

Non-isolation of animals in live animal markets allows for transmission of disease from sick to healthy animals. This poses a risk especially to farmers who buy animals for the purpose of restocking their herds. About 80% of animal traded at the Gbindi market are obtained from neighboring Republic of Guinea through the many porous borders. Trans-boundary animal trade brings new disease, pests and parasites which pose a risk to the local herd population. Most livestock value chain actors do not use PPE while handling animals, undertaking body scoring or inspection which can be a source of infection. Most animal deaths are never reported, making it difficult for the relevant authorities to maintain surveillance and diagnose zoonotic diseases early enough when an outbreak occurs. Dead animals are not properly disposed of, contributing to environmental pollution and providing a source of infection through accessibility to scavengers and vectors of the disease [14].

3.2.4. Livestock Transport of live animals and carcasses

Animals are often trekked by cowboys from the farms to market centres and from market centres to towns where vehicles are available for transport of livestock to the rest of the country. Cowboys are also involved in the transport of carcasses from slaughter houses to meat retail outlets. There are no specialized vehicles available for the transport of live animals or carcasses (Figure 2). Vaccination of transporters against common infectious diseases is not available and these transporters have little or no protective gears. Carcass in Koinadugu district is mostly transported on head (80%) from the slaughterhouse to retail markets, while few used wheelbarrows.



Figure 2: Hired vehicle for transporting Cattle

Trekking exposes animals to pests and disease vectors along movement corridors especially if they pass through areas where there is wildlife. Transport in Lorries often lead to the mixing of species (goats, sheep and cows) and often animals are so crowded in the vehicles that it facilitates disease transmission. Animals which are transported are often not inspected or only visual inspection is undertaken and it is difficult to identify animals which are asymptomatic yet nevertheless sick. Traders rarely obtain animal movement certificates and some choose instead to bribe their way to major towns.

Animals are often transported along with other human consumables due to limited availability of transport, which exposes human food to contamination by pathogens. In some cases, humans travel in the same vehicles as animals, therefore also putting themselves at risk of infection. Vehicles are rarely disinfected during cleaning and individuals who undertake cleaning activities are never protected against zoonotic disease as they do not wear PPE.

3.2.5. Slaughter house facilities

Physical slaughter facilities are very basic mostly an open floor with very limited restriction. Observations recorded for the purpose of this study indicated that floor surfaces used are often dirty, with small pools of blood found on the floor, as well as pools of water used to clean animal offals such as intestines. This method of slaughtering facilitates expose animal products to heavy contamination. Use of PPEs is very limited and there is no disinfection of slaughtering premises and equipment. Post mortem inspection is quite often limited and has always being a tussle between staff of the LVSD and Ministry of health and Sanitation MHS.

Water used in a slaughterhouse is typically fetched from water well dug by the Koinadugu district council and NGOs. These water wells, however, are not properly taken care of and the surrounding of the well is very dirty (Figure 3). Waste from the slaughter house and the market are dumped indiscriminately. Therefore, the use of such water poses a risk to workers' health and contributes to food contamination. Value chain actors' failure to use treated water is not a case of lack of resources but rather a sociocultural practice and problem.



Figure 3: Community well near a butchery in Kabala

e) Meat retail stores

Use of PPEs and disinfection of premises and equipment by meat retailers is very minimal. There is no adequate storage facility due to lack of electricity and refrigeration. Screening of flies is not available (Figure 4).



Figure 4: meat retail shop in Kabala

Most butchers do not use any PPE and have poor food handling practices. Workplaces in most cases are unclean and the walls are not plastered and painted. Butcherries are not well equipped to prevent deterioration in the quality of meat stored as they do not have refrigerators. Materials used for meat packaging are often of poor quality - polythene and old newspapers are used in most cases. Newspapers are used to pack foodstuffs and this increase the risk of food products contamination. Most butcheries use untreated water to clean utensils and other equipment used for meat processing.

3.2.6. Milk collectors and retailers

Milk collectors and retailers are not vaccinated against common infectious diseases nor do they undergo regular medical checks. Proper hygienic milking practices are not carried out therefore and therefore most Sierra Leoneans are scared of consuming local milk. Most transporters lacks food handling hygiene protocols therefore can expose the milk to contamination.(Figure5)



Figure 5: milk retail by the roadside in Kabala

Milk available for sale from the farm is fermented milk as there is no fresh milk sale and no boiling of milk before consumption. Risky practices such as milk testing through tasting are commonplace, and exposes milk traders and consumers to zoonotic diseases on daily basis. Plastic containers used for milk transport is often not of food-grade quality and difficult to sterilize during washing. They occasionally use soap; however, this alone is not enough to ensure the sterilization of containers and other equipment used. Traders often operate in open areas and milk is exposed to dirt, flies and other contaminants. Consumption of fermented raw milk and in some case offal exposes value chain actors and the local population to zoonotic diseases.

4. Institutional Capacity

At its present state, the LVSD cannot respond adequately and effectively to an incursion of any type of disease outbreak. A total of five Veterinarians, fifteen Animal Production Officers and seventy livestock assistants are currently in the Civil service. In order to remedy the situation, the Ministry in collaboration with FAO, BRAC SL and GIZ developed a training programme for Community Animal Health Workers to provide animal health services at community level and to complement the livestock assistants in the field. The Community Animal Health Workers are volunteers and are provided with basic training in animal health and production and it is envisaged that these CAHWS will complement the effort of the LVSD.

Budgetary allocation to the LVSD is very low compared to other units at MAFFS affecting the implementation of planned activities or programmes. Surveillance at the borders by the LSVD exists but it is weak and passive. The division does not have the required number of staff to cover all the key areas in border districts. In areas

where there are staff, the pre-requisite facilities are not available. Currently, only thirteen (13) out of the 68 Livestock Inspection Posts (LIP) along livestock routes are functional manned by Livestock Assistants charged with the responsibility of monitoring the movement of animals in the country. *Those posts are ill equipped and lack quarantine and related facilities. Until quite recently, passive surveillance* was the system used in the Veterinary services division. After the Ebola Disease outbreak, some amount of surveillance is being carried out in collaboration with Meta-biota and FAO under the Emerging Pandemic Threat Project (EPT-2 project).

5. Conclusion

There are quite number of gaps in the implementation of biosecurity measures among value chain actors in Koinadugu district which clearly show a potential risk for the spread of zoonotic diseases in case of any outbreak in the area. Avoiding the spread of an outbreak will require adequate support services in providing PPEs, training, credit, marketing facilities and proper enforcement of existing regulation by the local authorities. Education and training programs, aimed at increasing actors' understanding of zoonotic diseases and their transmission routes, and awareness of biosecurity measures can be adopted to reduce occupational risks faced in day to day activities and improve food safety. In addition, information could be provided and disseminated to the local population on sanitation, hygiene, waste disposal and food preparation.

6. Recommendations

1. The Sierra Leone government should invest in basic public health and sanitation infrastructures such as toilets and market sheds in the marketplace and near slaughterhouses or along road reserves to improve value chain actors' hygiene and sanitation practices, as well to curb environmental pollution and in particular, contamination of water bodies.
2. Improvements in the provision of extension services are required to expand coverage and ensure availability of essential resources - both material and personnel - in remote and marginalized predominantly pastoral areas such as Koinadugu District.
3. Research collaboration between institutions responsible for human and animal health and related issues should be encouraged as envisaged under a so-called 'One Health' approach.

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