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One Health Approach to Control Brucellosis in Sierra Leone

Roland Suluku, Jesse P.J. Nyandebboh and Sheku Moiforay

Abstract

Brucellosis is a febrile zoonotic disease that presents a severe hazard to humans and domestic animals, which requires a One Health approach to control socio-economic consequences and public health implications on the people in the country. The majority of the cattle owners are illiterate herds' men with traditional knowledge of cattle management handed down by their ancestors. Management is free range with no supplementing or balanced diet. Access to veterinary services is almost not available, and local herdsmen treat their animals. Most of these herdsmen do not allow livestock officer visitors to have access to their animals. Processing of meat and milk uses traditional methods, and people consume fresh milk without due regard to sanitary conditions. This behavior has serious public health implications especially when the majority of the beneficiaries live in rural communities. Animals abort, while production decreases due to delayed conception. Local herdsmen confer confidence in people who are knowledgeable about cattle management. Researchers have no data on the disease in the last 50 years. Supportive action from various sectors such as human, animal and environmental health stakeholders backed by social anthropologists using the One Health Platform will provide a conducive atmosphere to engage herdsmen in initiating control measures of the disease.

Keywords: brucellosis, herdsmen, animals, community, One Health

1. Introduction

Brucellosis is a common contagious, communicable and One Health endemic zoonotic disease of public health significance with a high rate of morbidity and life sterility [1]. Brucellosis is named after Sir David Bruce because he isolated the causative agent from a soldier while working in Malta. The disease Malta fever or Mediterranean fever got its name when it affected British military personnel in 1886. Malta fever is a fever condition occasionally caused by *Brucella*, and its most common species *B. abortus* and *B. melitensis*. *B. abortus* causes premature delivery in cattle and intermittent fever in human [2, 3].

1.1 Animals affected

Brucellosis is a bacterial disease of the genus *Brucella*, and six different species exist; namely:

i. *B. abortus*

ii. *B. melitensis*

iii. *B. suis*

iv. *B. canis*

v. *B. ovis*

vi. *B. neotomae*—desert rat

The disease affects cattle, goat, sheep, pigs, buffaloes, camels and reindeer, and other animals may be less frequently affected. All the above diseases cause *brucellosis*, but of significance to man and animals worldwide are three species *Brucella suis* affecting pigs, *Brucella melitensis* affecting small ruminants and *Brucella abortus* affecting cattle. *Brucella canis* also affects dogs.

Recent research shows that *Brucella* causes *pinnipedialis* in seals and *ceti* sp. in whales [4].

1.2 Socioeconomic effect of brucellosis

Brucella causes abortion in pregnant cow or premature calving, death of young animals, birth of weak calves, stillbirth, delayed calving, sterility, retained placenta, male infertility followed by a decrease in milk yield [1, 5]. The death is due to *mastitis* and *hygromas* in African cattle. *Vesiculitis*, *epididymis* and *orchitis* are characteristic in the bull which sometimes leads to *testicular abscesses*, *metritis* and life infertility. In pregnant animals, a visible swelling of the mammary gland around the naval region followed by bleeding from the vagina is not common in pregnant animals infected with *Brucella*. Enlargement of the udder indicates a high level of bacteria in shredded milk, urine and vagina discharge.

1.3 Transmission of bovine brucellosis

1.3.1 Animal

Bacteria are excreted with the fetus, the placenta and uterine fluid during calving.

Animals' discharge the organism after parturition, abortion or via milk of infected cow [6, 7].

Infected breeding bulls transmit infection via semen.

Vertical transmission is through calves or lamb in the uterus [1, 8].

Transmission can occur through contaminated water and feed.

1.3.2 Humans

Human *brucellosis* has different names based on the region in which the disease occurred. They named it *Malta fever*, because Dr. Bruce discovered the disease in this town, *Cyprus* or *Mediterranean fever*, *rocky fever of Gibraltar*, *intermittent typhoid* and *undulant fever* [9, 10].

Fever is a general symptom across all human patients. Uterus infection with fetal death accompanied by general malaise, fatigue and arthritis with chronic

and recurring febrility with joint pain are common in human beings [10, 11]. Chronic symptoms include loss of working day, high fever because of septicemia followed by emaciation, insomnia, headache, loss of appetite and sexual impotence in a human patient [12].

Human to human transmission occurs through transplacenta and breastfeeding but not through sexual intercourse, blood transfusion or transplantation of body organs [10, 13]. The disease is transmitted by direct contact with infected tissue or their products [10, 11]. Transmission by inhalation of an organism or into the conjunctiva occurs by air. In humans, transmission is not limited to the reproductive organs but the nervous system. It causes *neurobrucellosis* showing symptoms of *meningitis*, *encephalitis*, *stroke*, *myelitis* and *neuropsychiatric* features [14]. *Brucellosis* causes deafness as reported by other scientists [15].

1.4 Africa and Asia

Brucellosis is one of the most widespread bacterial zoonotic diseases in the world. It affects both humans and domestic and wild animals [16]. WHO reports about 500,000 cases of human brucellosis every year [17]. An economic impact assessment conducted in both Africa and Asia in 2013 by McDermott et al. [18] shows that the disease is endemic across Africa and Asia continents and responsible for most of the human cases. The disease worsens and deprives people in developing countries like sub-Saharan Africa of the much-needed protein. Poverty is a driving force of brucellosis especially in communities where people depend heavily on livestock for their livelihood [19].

Brucella subtype causes brucellosis in many parts of the world including West Africa. *Brucella abortus biovar 3* is a common strain that affects cattle [20]. These West African isolates are mostly characterized from autochthonous cattle and hygroma fluid samples. Data are required to assess the potential threats of public health importance both at national and regional levels.

2. Brucellosis in Sierra Leone

Sierra Leone is located in the humid tropical forest in the west coast of West Africa. It is bordered by the Republic of Guinea in the north and north-west and Liberia in the south and southwest and by the Atlantic Ocean in the west. The country has five ecological zones: the Mangrove swamp, Savannah grassland, forest vegetation, inland valley swamp and Bolland and has nine significant rivers that retain water all year round.

The high natural vegetation provides a conducive environment for rearing animals such as ruminants. Ruminant production such as cattle is confined to the northern district of Koinadugu extending north-eastward to Kono District and southward to Bombali District. These three districts were known as the cattle belt of Sierra Leone. Major cattle markets exist in these districts.

Brucellosis outbreak occurred in Sierra Leone in 1966. The veterinary division mounted a campaign, which they divided into three phases, from 1966 to 1969. About 50% of herds became infected in Bombali and Kono, and cases of abortion were reported in Njala. Strain 19 has been used over the years, but the problem persists. A nationwide vaccination and DCIP Havac strain (45/20) were anticipated, but never materialized.

Most of the veterinary structures and institutions started degenerating during this period. The status of the disease remains unknown, but abortion and stillbirth are common among ruminants throughout the country.

Estimated number of livestock by type, district and region						
Administrative units	Type					
	Cattle	Goat	Sheep	Pigs	Chickens	Ducks
District						
Kailahun	430	54,478	17,159	6924	98,894	150
Kenema	5332	73,507	50,980	11,842	200,560	25,861
Kono	101,156	44,661	22,559	5455	65,599	3675
Bombali	158,705	61,723	51,831	8553	125,451	2623
Kambia	62,223	47,053	26,503	6278	171,903	3305
Koinadugu	97,858	63,327	39,136	38,214	137,045	630
Port Loko	11,614	97,596	52,737	4909	259,212	5436
Tonkolili	36,138	76,796	31,744	5047	115,903	2398
Bo	50,930	97,920	22,640	9086	173,037	10,493
Bonthe	6840	26,987	9161	9051	60,715	12,078
Moyamba	11,629	48,101	8499	5660	146,996	7606
Pujehun	3510	36,934	28,136	5265	86,335	8352
WAR&U**	514	83,822	66,581	101,213	314,981	17,167
Total	546,881	812,906	427,667	217,497	1,956,630	99,775
Region						
Eastern	106,918	172,646	90,698	24,221	365,053	29,686
Northern	366,539	346,495	201,951	63,001	809,513	14,392
Southern	72,911	209,942	68,436	29,062	467,082	38,530
Western Area	514	83,822	66,581	101,214	314,981	17,168
Total	546,881	812,906	427,667	217,497	1,956,630	99,775

Source: [22]. ** Western Area Rural & Urban.

Table 1.
Projections for national livestock populations by species, by district and by region.

Table 1 explains the increase and spread of cattle production from the north and east in 1966 [21] to every district in the country [22]. This spread of cattle production corresponds to an increase in the spread of brucellosis. The majority of cattle owners or herders are Fulani nomads with little or no formal education. Pastoral Fulani who own approximately 90% of the national herd [23] own cattle production.

The majority of the cattle owners practice a free-range animal production system, which encourages animals to move into large areas of land in search of food. Pastoralists utilize an extensive range of land as common pool resources through movement from one location to another making full use of their character and cultural practices [24]. In Nigeria, land use management is characterized by the transhumant system due to vegetation variations, agricultural practices and tsetse fly infestation [25]. Fulani pastoralists migrated to Hausa land from Senegalese valley in western Sudan but were forced to move due to deteriorating environmental conditions, land degradation and recurrent draught, thus accounting for the exodus to Guinea savannah to the forest fringes in the southern parts of Nigeria [26].

Illiteracy is a significant factor among cattle herds or agropastoralists exacerbating brucellosis or other cattle diseases in West Africa and Sierra Leone in particular. Cattle rearers or agropastoralists use knowledge passed onto them by

their accentors. Studies conducted in northern Nigeria reported a common feature of rural farming, as about 42% of cattle rearers or agropastoralists are illiterate or had no formal education [27]. The majority of pastoralists (58%) had no western formal education compared to 66.2% who had acquired Islamic education [28]. As a result, they have no balanced diet prepared for their animals, nor supplementation of the ration. Kassam [29] opined that the livestock sector lacks adequate supplies of quality feed and pasture.

Animals became malnourished, emaciated and exposed to diseases. Compounding the situation further is the lack of adequate veterinary service to attend to the needed problems of the cattle herds. One of the main problems highlighted by cattle farmers is the lack of poor veterinary services available in their communities [30]. Cattle farmers purchase drugs from foot peddlers to treat their animals. All the cattle ranches visited in Sierra Leone have drugs to treat their animals. Cattle farmers refuse government officials or livestock officer access to their animals.

Cattle milk is a significant source of brucellosis. When people pasteurize milk, they reduce human infection. Resource-limited or poor communities do not pasteurize milk due to their long-standing traditional beliefs and cultural practices and the complete lack of public health implications of raw milk consumption [31]. These food products from the informal sector escape formal health and safety practices, thereby increasing the spread of brucellosis to the general public [32].

3. How do we control brucellosis in Sierra Leone?

The strategy to prevent brucellosis is much dependent on the production system. Two methods used include test and slaughter and vaccination. The former requires a laboratory facility, which is lacking in the rural communities. The latter option involves not only the administration of vaccines but also many other techniques and includes various sectors of people.

A large percentage of the adult population in Sierra Leone is illiterate and live in rural communities where cattle farmers exist. Any change or transformation in the cattle sector to control brucellosis will require the involvement of the entire cattle rearers and the community people. This approach is known as One Health.

One Health approach is any benefit to the complete well-being of humans, animals and their environment because of the synergy of integrated humans, and veterinary is a positive step toward the One Health approach. Such vale can even include financial savings and environmental services [33].

The One Health approach involves the following:

- i. Conducting a scoping mission to ascertain the prevalence and incidence of the disease in the community. It involves visiting communities where the disease has occurred and identifying stakeholders for future discussion on an agreed date based on their farming calendar. It also includes gaining knowledge about the sociocultural and traditional customs of the people in a defined community.
- ii. Holding stakeholder meetings with animal rearers and owners including local administrative authorities in the community. In this forum, the scoping team meets the local administration to tell them about the etiology and epidemiology of the disease, its mode of transmission, signs and symptoms and how to prevent and control. The local authorities will put a mechanism in place to ensure compliance by all people. This involves both animals' owners and community people, hence the One Health concept.

- iii. Engaging community people to identify control and preventive strategies, and ensuring that they understand the process. At this stage, the scoping team members ask community people about existing strategies they have used in the past and how do they intend to control and prevent subsequent outbreaks. Scoping team members equally provide alternative ways based on their experience to control and prevent the disease. Community people select those among various alternatives that suit their needs the most. Local authorities will now engage their people and animal owners to ensure that they understand the controlled strategy. Defaulters pay minimum fine proposed by all.
- iv. Identifying the leading players in the prevention of brucellosis. In any community, some people can mobilize the people. Such people known as critical stakeholders command respect in the community; scoping team work with local authorities to identify such people, charge them with the responsibility of passing the message across the community and encourage people to implement the decision of the community in full.
- v. Dividing the group into various units or components. Key stakeholders and scoping team members work together and spread the message in the community on the disease which includes the following:
 - Print and electronic media. Identifying people within and outside the community to write about the disease and intervention by the community people. Such interventions could be flyers on various aspects of the disease as an awareness-raising process strategy to inform the people and country as a whole.
 - Play/drama committee: Identifying people within and outside the community, to act a play on brucellosis. Such play focuses mainly on how people contract the disease, signs and symptoms, mode of transmission, prevention and control. The drama target public health aspects of eating dead animals with the disease. Such interventions will educate the public and communities will put the disease under control.
 - Songs: They composed songs in their local dialect as a means of understanding the disease correctly.
 - Quiz committee for schoolchildren. Quiz competitions are held in various schools where the outbreak has occurred; children pass the message to their parents and neighbors from the competitions held. Such actions will educate the general populace and help reduce or eradicate it from the community.
 - Bike riders, taxi/poda poda drivers: These are a group or community of people who aid in killing and stealing of these animals in the community. Involving them in the awareness campaign and the implementation of the provisions of the by-laws will reduce stealing and minimize the spread of the disease. In such communities no bike rider transports animals after 6:00 pm.
 - Vaccination and registration committee. This committee is charged with the responsibility of educating the people and animal owners about

the need to vaccinate their animals. They mount such campaign for about a month or 2 weeks depending on the availability of funds. People bring their animals in large numbers during the vaccination exercise. People register their animals in order to track them during subsequent registration.

- Engaging the radio in massive sensitization and education about brucellosis. The 11 year old civil war made the majority of Sierra Leoneans learn to love to listen to the radio. Such a medium has been used to pass information to the broader public, while at the same time allows them to ask a question. The outbreak of disease has reduced due to increase in knowledge of the people on a particular disease.
- vi. Formulating by-laws to ensure compliance by all categories of people and conducting routine vaccination on yearly basis. This bottom-top approach will help in the prevention of brucellosis in Sierra Leone.
- vii. The above process benefits people by engaging them all in fighting disease outbreaks. Such gathering of people to fight the common enemy called disease is known as ONE HEALTH.

4. Conclusions

Brucellosis is a zoonotic disease ravaging resource-poor communities in the world including Africa and Asia. Vaccination campaigns in Sierra Leone had not eradicated the disease since 1966. The One Health approach which adds value to people's lives by the involvement of all partners with a strong medium of communication is a step in the right direction toward controlling the disease in Sierra Leone.

Conflict of interest


The authors have not declared any conflict of interest.

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