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ABSTRACT

Brucellosis is a contagious bacterial zoonotic disease that affects both humans and animals. It is one of the most widespread zoonosis in the world which is endemic in most African countries. A cross-sectional study using retrospective data collection was conducted to determine the occurrence of *Brucella* species infection in bovine in the Rukwa Region for the past five years, from January 2019 to December 2023. The study utilized Laboratory investigation and diagnosis reports for the processed serum samples from the four Local Government Authorities (Sumbawanga, Kalambo, Nkasi District Councils and Sumbawanga Municipality) of Rukwa Region at Tanzania Veterinary Laboratory Agency (TVLA) for five (5) years under review. Over the past five years, a total of 21,403 Bovine sera samples were collected and screened for Brucella species infection using Rose Bengal Plate test (RBPT) and 789 samples were reported *Brucella* positive resulting into 3.69% seroprevalence. The recorded *Brucella* seropositivity for the screened samples was higher in Nkasi District Council (61.98%) followed by Kalambo District Council (35.74%) and Sumbawanga Municipality with 1.27%. The lowest seropositivity was recorded from Sumbawanga District Council (1.01%). Also, the study indicated that there was an increase in number of *Brucella* seropositive cases over years, from 98 cases in year 2019 to 229 in year 2023. The findings of the study indicate the presence of *Brucella* antibodies in bovine in Rukwa Region especially in Nkasi District Council which reported higher seropositivity. Therefore, strengthening control measures through screening and culling, accompanied by strategic vaccination is important.

Key words: Brucella, cattle, seroprevalence, Rukwa, Tanzania

INTRODUCTION

Brucellosis is a contagious bacterial zoonotic disease that affects both humans and animals (WHO, 2006). The disease is caused by various species of the *Brucella* genus and poses significant public health and economic challenges. *B. abortus* and *B. mellitensis* are common species which causes Brucellosis in Cattle and goats respectively (Corbel *at el., 2006*). Brucellosis can be transmitted between vertebrate animals and humans via various routes. Livestock, including cattle, goats, and sheep, serve as common reservoirs for the disease. *Brucella* is usually transmitted between animals via contact with contaminated aborted tissues and vaginal discharges during grazing. Vertical transmission via the uterus or through ingestion of maternal milk and sexual transmission may also play a role in the spread of *Brucella* (Corbel *et al., 2006*). Humans can contract *Brucella* by eating raw meat or unpasteurized dairy products from infected animals, or through direct contact with these animals. Additionally, occupational risk is high for workers including veterinarians, butchers, slaughterhouse workers, meat inspectors, and livestock farmers (Kunda *et al., 2007*). Brucellosis is one of the most widespread zoonosis in the world and is endemic in most African countries (Schelling *et al.,* 2006). In Tanzania, the first outbreak of Brucellosis was reported in Arusha in 1927 (Mahlau *et al.,* 1967). Thereafter, several surveys in Tanzania have demonstrated the occurrence of the disease in cattle in various production systems, regions and zones with individual animal level seroprevalence varying from 1 to 30 % (Temba *et al., 2012*).

Brucellosis causes significant economic losses and public health threats worldwide which are associated with reduced production due to abortion, calf mortality, reduced milk production and management cost (Haileselassie et al., 2011). *Brucella* also disrupts international trade by imposing restrictions on the export and import of animals and animal by-products. Globally, billions of dollars are spent annually on the control and management of brucellosis in both humans and animals (Addis, M. 2015*)*.. In Tanzania, brucellosis has contributed to the establishment of a One Health desk within the Prime Minister's Office to oversee the implementation of control measures for six prioritized zoonotic diseases, including brucellosis. The disease imposes a significant economic burden due to high expenditures on vaccines and human treatment drugs within the public healthcare system, managed by the

Ministry of Livestock and Fisheries (MoLF) and the Ministry of Health (MoH). Early detection and the adoption of a One Health approach can support the operation of targeted interventions, with emphasis that healthier livestock contribute to healthier communities. Laboratory investigations, including screening and confirmatory tests, are integral to Tanzania's national strategy for controlling brucellosis.

METHODOLOGY

Study area description

The study was carried out in Rukwa region which cover an area of 27,765 kilometer square, with 1,540,519 population of people of which majority depends on Agriculture specifically livestock keeping as their major economic activity according (The National Bureau of Statistics, 2022). The region has a total of four (4) Local Government Authorities (LGA's) namely Sumbawanga Municipal council, Sumbawanga District council, Nkasi District council and Kalambo District council. According to National Sample Census of Agriculture 2019/2020, Rukwa region has an estimated population of 664,471 cattle, 185,931 goats 56,291 sheep and 44,177 pigs other animals are donkey 10,824,dogs 41,159,cats 9514 and poultry 467,094.

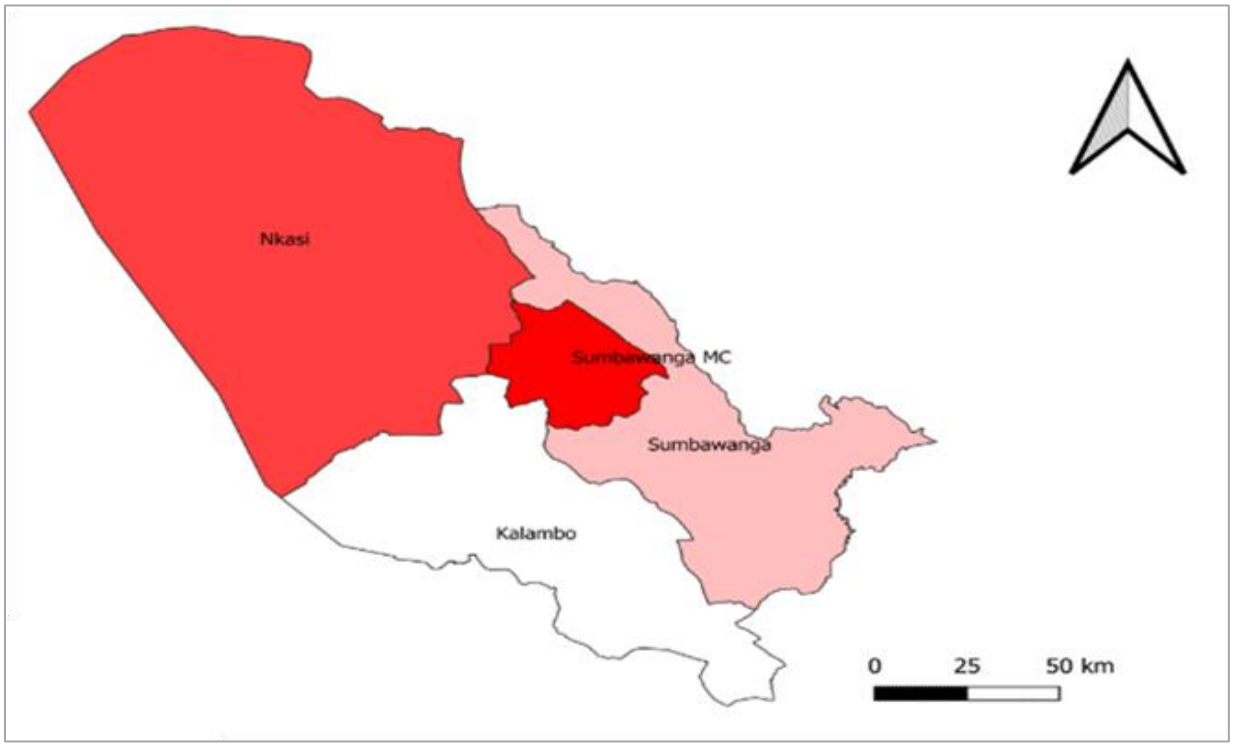

Figure 1: Map of Rukwa Region showing study area (Source EMA-*i* system).

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Study Design

A repeated cross-sectional study design was utilized, analyzing retrospective data gathered over a five-year period (2019–2023). The data was derived from laboratory investigation report forms completed following processing serum samples from the four local government areas in the Rukwa region at the Sumbawanga laboratory facility of the Tanzania Veterinary Laboratory Agency (TVLA). Names of the respective LGA, ward, and village, geographical coordinate, number of cattle at risk, number of Brucellosis cases, and date of onset of the disease were retrieved to determine the spatial and temporal distribution of the bovine brucellosis in Rukwa region.

Sampling

Blood samples from cattle were randomly collected from farms and households by the respective district teams. The number of animals sampled varied based on the total herd size. A volume of 5–10 ml of blood was drawn from either the jugular or tail vein. The collected blood was allowed to clot, after which the serum was separated by decantation and stored at -20°C. The serum samples were then transported under a cold chain to the Tanzania Veterinary Laboratory Agency facility in Sumbawanga for further processing and analysis.

Serological analysis of brucellosis

Detection of brucellosis was done using the Rose Bengal Test (RBT) which is a rapid slide agglutination test used for the screening of brucellosis in cattle. The test detects antibodies against *Brucella abortus*, the causative agent of bovine brucellosis. Analysis procedure was done according to the kit manufacturer instructions. In short, about 30 µL of the serum is placed on a clean glass slide and an equal volume (30 µL) of Rose Bengal antigen is added. The antigen and serum are thoroughly mixed using a sterile mixing stick or pipette tip and the glass slide is rotated gently for 4 minutes at room temperature. Agglutination (clumping) indicates positive, meaning presence of Brucella antibodies.

Data analysis

The retrieved data were entered into Microsoft excel for Descriptive analysis and Quantum GIS software for mapping the area reported cases of sample collection.

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RESULTS

Collected samples

Over the five-year reporting period (January 2019 to December 2023), a total of 21,403 cattle serum samples were received and processed at TVLA Sumbawanga. Among these, 12346 samples were from Nkasi District Council, 1011 from Sumbawanga Municipal Council, and 1127 from Sumbawanga District Council, while 6919 samples were collected from Kalambo District Council (Table 1). The number of samples received and processed increased each year from 2019 (3522) to 2023 (4579).

Brucella positivity

Out of the 21,403 samples received and processed at TVLA Sumbawanga, 789 (3.69%) were *Brucella* positive with slight increasing trend observed (Figure 2). The number of *Brucella* positive sample varied over years and among districts. More positive cases were recorded from Nkasi DC (61.98%) followed by Kalambo DC (35.74%) and Sumbawanga MC which recorded 1.27% positive cases. The lowest positive cases were recorded in Sumbawanga DC (1.01%). *Brucella* positive cases were recorded in all month or throughout the year with slightly difference in the magnitude between months. The months of January, February, April, October, November and December recorded more cases than other months in year.

Table 1: Total serum sample processed and seropositivity in Rukwa region from 2019 to 2023.

	Nkasi DC		Sumbawanga DC		Sumbawanga MC		Kalambo DC	
Year	**Total samples**	**No of positives**	**Total samples**	**No of positives**	**Total samples**	**No of positives**	**Total samples**	**No of positives**
2019	1912	58	297	1	180	1	1133	39
2020	2383	91	324	1	248	3	1271	55
2021	1858	75	49	1	137	2	1227	45
2022	3864	129	131	0	128	0	1682	50
2023	2329	107	326	5	318	4	1606	93
Total	**12346**	**460**	**1127**	**8**	**1011**	**10**	**6919**	**282**

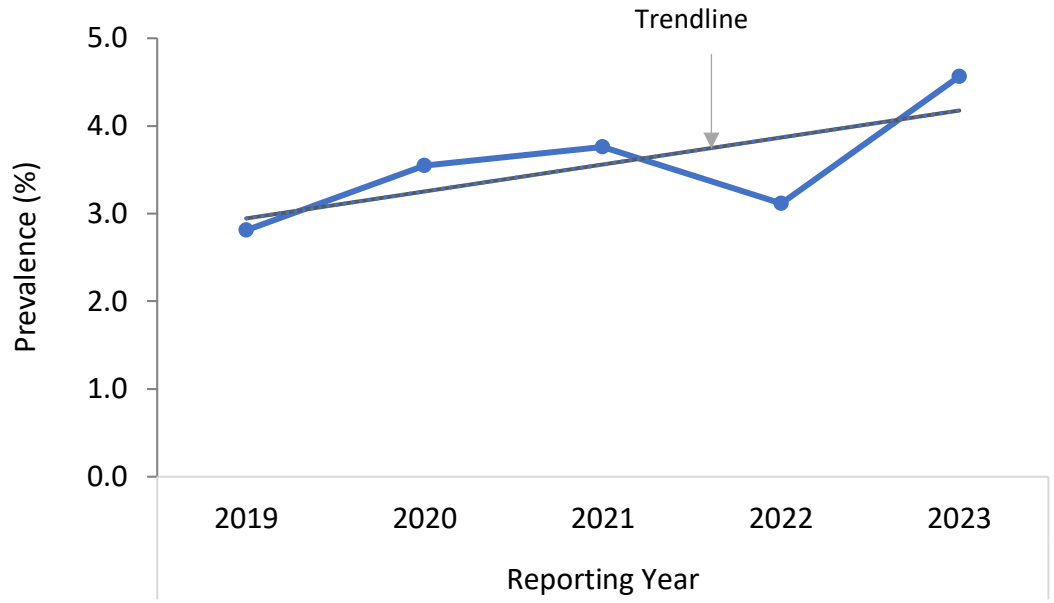

Figure 2. Trend of Brucellosis prevalence in Rukwa region over the five reporting years (2019 – 2023)

Spatial distribution of *Brucella* infection

Brucella positive cases was reported from all four LGAs of Rukwa region during the reporting period with variation in the intensity of infection among LGAs (Figure 2).

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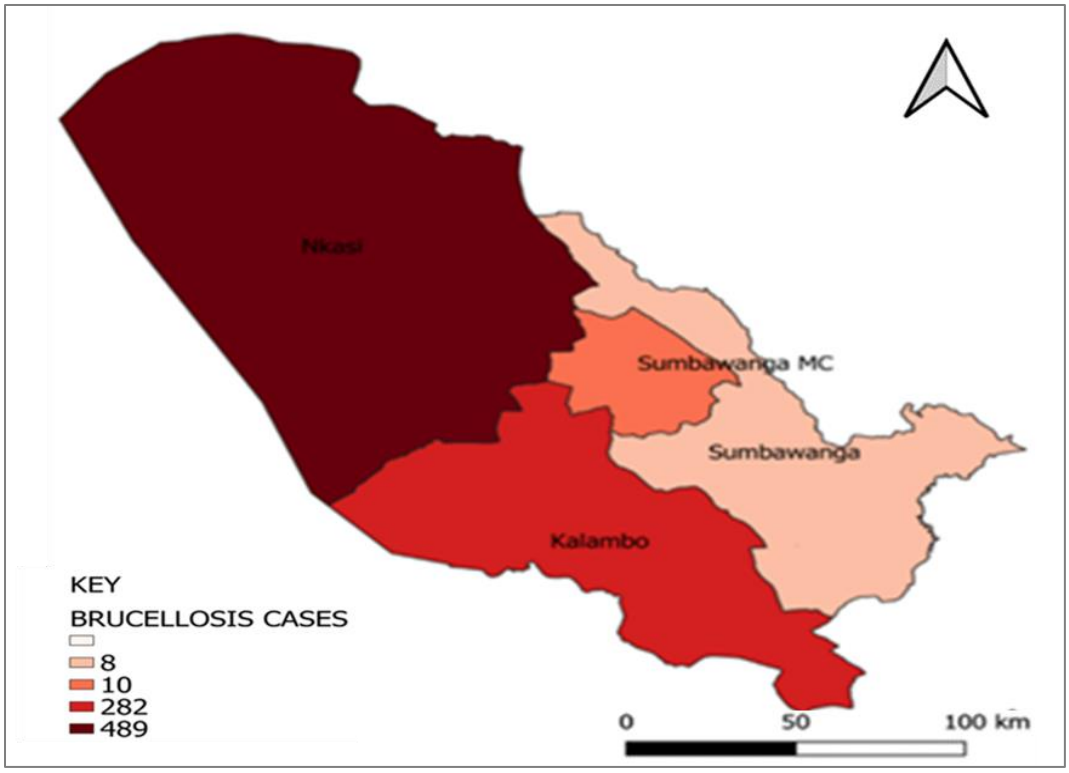

Figure 2: A map showing spatial distribution of *Brucella* infection in Rukwa region (2019-2023). **Source:** ZTVLA – Sumbawanga

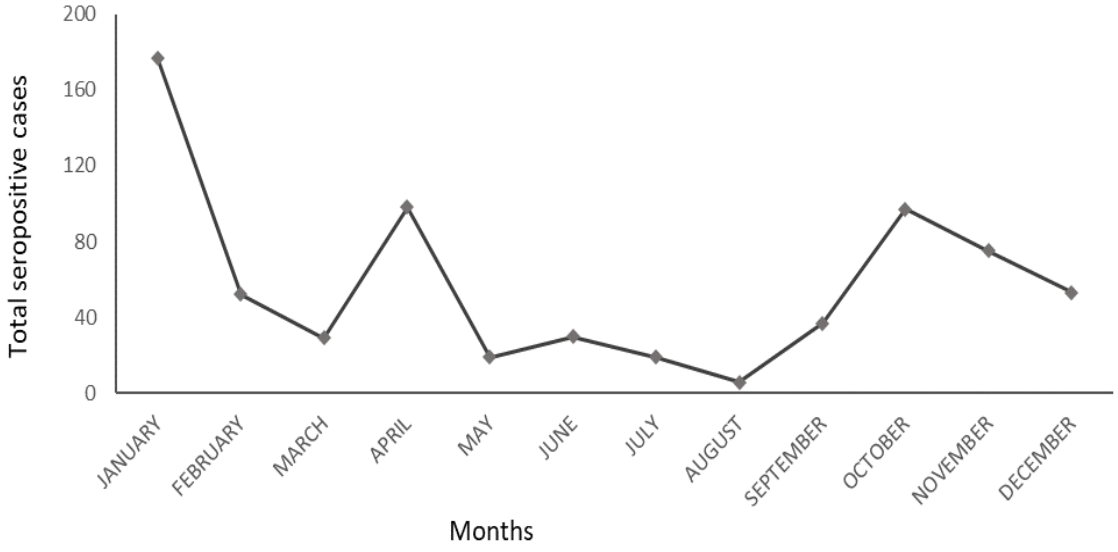

Figure 3: Monthly trend of positive samples for bovine brucella infection in Rukwa region from 2019-2023

DISCUSSION

The study identified that Brucellosis is an important disease in Rukwa region which is distributed throughout the four LGAs of the region. The distribution of Brucellosis throughout the entire Rukwa region might be influenced by similar livestock management system practiced in all LGAs hence having or sharing similar risk factors. Our findings are comparable to the findings of another study which was conducted in Katavi-Rukwa ecosystem and identified that areas with similar management system shares same risk factors for disease predispositions and transmission (Assenga *at el .,2015*). The findings also determines cattle Brucella seropositivity at 3.69% (789/21403) from all analyzed Bovine serum samples from 2019 to 2023 which is within the range of 1-30% obtained by other studies in Tanzania (Temba *et al., 2012*). The results also indicate variation in the Brucella seropositivity between LGAs with Nkasi DC having higher number of *Brucella* positive cases than all. The difference on *Brucella* positive cases between LGAs might be attributed by the difference on the number of samples received from each LGA in different years. The results also show an increasing trend of the number of samples received and processed over years from 2019 to 2023.

The increased number of samples might be due to community awareness on the presence and accessibility of TVLA Sumbawanga. Also, affordable diagnostic costs at TVLA encourage farmers to use the laboratory. The study indicated that the disease had a peak of occurrence in different months in each year (January, October, April, November, December and February for the year 2023, 2019, 2021, 2022, and 2020 respectively) The peak in some of these months could be due to rain season at which many livestock keeper tends to breed their animals during availability of pasture. Therefore, contamination of pasture act as the source of the spread and lack of formal education among herders and a history of retained fetal membranes were significantly associated with Brucella seropositivity according (Assenga *at el.,2015*)

The findings of the study insist that by adopting a one health perspective and implementing targeted interventions, healthier livestock contribute to healthier communities. Laboratory investigation using screening test and confirmation test for Brucellosis work better for implementation strategies to control Brucellosis.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

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