

knowledge, attitude, and practice on brucellosis among livestock keepers in Kilosa district, Tanzania

Gilbert Mwamengele^{1*}, Christopher Sabuni², Coletha Mathew³, Claus Thomas⁴

Abstract

Background: Brucellosis is a contagious bacterial zoonotic disease that is primarily caused by *Brucella* species. The current study aims to assess knowledge, attitude, and practice towards brucellosis among livestock keepers in Kilosa District-Tanzania.

Methods: The cross-sectional study design was employed from February to March 2023 in Kilosa district, Tanzania. A semi-structured questionnaire was employed to evaluate participants' knowledge, attitudes, and practices related to brucellosis. Collected data were analyzed by using (Microsoft) MS Excel, and the chi-squared test.

Results: A total of 150 randomly selected livestock keepers participated in the study, with the majority being male. Participants' ages ranged from 20 to 70 years. While 138 out of 150 (92%) had heard about brucellosis, only 18 (12%) demonstrated good knowledge of its transmission between livestock and from livestock to humans. Most respondents (80%) were aware of the disease's clinical signs, identifying abortion in animals and headaches in humans as primary symptoms. Regarding attitudes and practices, 52 (34.7%) strongly agreed that brucellosis is a serious disease in livestock, but only 20 (13%) considered it a significant health threat to humans. Alarming, 138 (92%) reported consuming unboiled raw or soured milk. A statistically significant difference was observed in knowledge levels based on sex and education, with a p-value (**p < 0.01) for each variable. These findings highlight gaps in knowledge and risky practices that may contribute to the spread of brucellosis among livestock and humans.

Conclusion: This study has shown that there is little understanding and poor attitudes and practices towards brucellosis among livestock keepers in the Kilosa district. This can be addressed by providing community awareness campaigns about zoonotic diseases including brucellosis.

Keywords: Brucellosis, Livestock Keepers, Knowledge, Attitude, Practices, Tanzania

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Background

Brucellosis is a contagious bacterial zoonotic disease that is primarily caused by *Brucella* species. The disease mainly infects cattle, swine, goats, sheep, and dogs [1]. *B. abortus*, *B. suis*, *B. melitensis*, and *B. canis* are species that specifically infect cattle, pigs, small ruminants, and dogs, respectively [2]. Brucellosis is found to disproportionately affect poor communities in sub-Saharan African (SSA) countries such as Tanzania [3]. Being a contagious disease, the groups with a higher risk of contracting a disease are: livestock keepers, slaughterhouse and butcher workers, veterinarians, meat-packaging workers in Industries, and Laboratory workers [4]. Brucellosis is one of the world's zoonoses, it is endemic in the majority of East African regions [5]. Studies in Tanzania have indicated that the prevalence of brucellosis in cattle varies from 0.3 to 60.8% [6]. According to [7], the disease has been documented in several human populations, including Manyara, the Lake Victoria zone, the Western zone, Arusha, Tanga Municipality, Northern Tanzania, and Morogoro region, the disease's prevalence varies from 0.7% to 20.5%. Regarding wildlife, according to a study conducted in Katavi, 7.9% of the buffaloes tested positive for brucellosis, while a study conducted in the Serengeti ecosystem revealed that 24 and 17% of the populations of wildebeests and buffaloes, respectively, had been exposed to *Brucella* [8]. Humans and animals get infected through ingestion and direct contact with organisms, which are present in large numbers in aborted fetuses, fetal membranes, and uterine and amniotic fluids. Cattle may ingest contaminated feed or water or may lick the contaminated genitals of other animals. Both human-to-human transmission

through sexual contact and venereal transmission from diseased bulls to vulnerable cows seem to be uncommon. In addition, humans can contract brucellosis by breathing in bacteria that cause the disease when near animals or animal products, eating undercooked meat, or consuming raw or unpasteurized dairy products from infected animals [9]. Because clinical manifestations of brucellosis and other human febrile diseases (including leptospirosis, malaria, and Q fever) are similar, misdiagnosis frequently occurs, leading to ineffective treatment and hence high costs [10]. In addition to public health concerns, brucellosis is also characterized by abortion, delayed heat, loss of calves, reduced meat and milk production, and culling in the livestock sector leading to economic losses [11]. Previous studies have reported, an accurate understanding of the source, modes of transmission, clinical manifestation, attitudes, and practices to be associated with successful population control of brucellosis, [10]. Numerous studies conducted in Tanzania have shown that farmers have poor knowledge about brucellosis and that their behaviors and attitudes put them and their vulnerable livestock in danger of getting the disease [12]. Studies conducted in the majority of African nations indicated that stakeholders needed to be made aware of the disease [13–15]. Kilosa is one of the districts in the country known for livestock keeping and is affected by brucellosis [16,17]. The current study aims to assess knowledge, attitude, and practice towards brucellosis among livestock keepers in Kilosa District-Tanzania.

Methods

Study area

The study was conducted in Kilosa District (Fig 1), Morogoro-Tanzania, from February 2023 to March 2023. The district is located in the western part of Morogoro at 6° 50' 0" S, 36° 59' 0" E, Kilosa district is bounded on the west by Dodoma region, on the north by Arusha and Tanga regions, on the south by the Kilombero district and Iringa region, on the east and south-east by Mvomero and Morogoro rural districts [18]. Kilosa district was selected because the district is the home of Mikumi National Park and the main economic activities are crop production and livestock keeping [17].

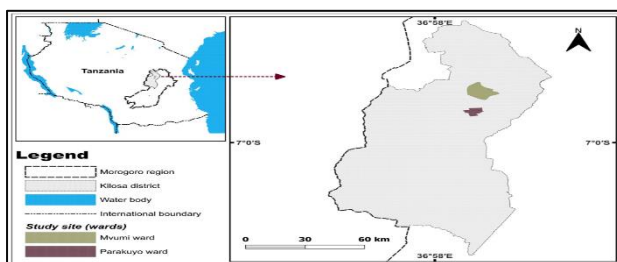


Figure 1: Map of Tanzania showing the study area. Map created in Quantum Geographic Information System (QGIS)

Sample size

The sample size was to be determined by a formula according to (19) $n = (Z^2PQ)/L^2$, where; n = number of respondents, Z = statistics corresponding to the level of confidence = 1.96, P = Expected knowledge level of the disease among individuals in Kilosa District, $Q = 1 - P$ and L is desired precision 5%. The average level of knowledge was estimated to be 10% based on previous studies [12,15,20], the estimated sample size for the

study was 139 participants, however, 150 participants were enrolled in the study.

Data collection

The study employed a semi-structured questionnaire to evaluate participants' knowledge, attitudes, and practices related to brucellosis disease. Since the majority of the population in the research area speaks Swahili, the questionnaire was first prepared in English and then translated into Swahili language. Before any participant's data was collected, consent was requested. Those who agreed to participate in the study proceeded with the data-gathering process and vice versa. An interviewer collected the data by reading the questions to the participants and explaining the purpose of the study. The interviewer then recorded the respondents' responses to make sure they understood the material being addressed. The survey was divided into four sections: Socio-demographic characteristics of the participants, knowledge about brucellosis transmission and clinical signs, attitude towards brucellosis, and practices towards brucellosis transmission, a questionnaire was pre-tested before actual data collection to increase the reliability and validity of results [10,12–14,20].

Statistical analysis

Data were entered and analyzed in MS Excel 2013. Frequencies and percentages under descriptive statistics were used to determine participants' knowledge, and practices about brucellosis. The association among the categorical variables such as the relationships between the different characteristics of participants with some variables included in the questionnaire was determined by the chi-square test. Statistically, results were considered significant at $p < 0.05$ [14].

Results

Socio-Demographic Characteristics of the Participants

A total of 150 participants were enrolled in this study, all of the participants were livestock keepers. Majority of the participants were male, 92% (138/150). A large percentage of the participants had a primary education level, 46% (69/150). Participants' ages ranged from 20 to 70 years; participants had experience in livestock keeping ranging from 5 to more than 20 years. The socio-demographic characteristics of the patients are summarized in Table 1.

Participants' knowledge regarding brucellosis

The majority of the livestock keepers 138/150 (92%) reported that they heard and had knowledge about brucellosis. They noted that the primary information sources were: 65/150 (43.33%) from veterinary care providers; 35/150 (23.33%) from neighbors or family members; 23/150 (15.33%) from community events or speeches; 10/150 (6.67%) from radio or television; and 5/150 (3.33%) from reading books or brochures (Table 2).

Knowledge level among participants based on sex

The majority of male respondents 96.37% (133/138) had good knowledge about a disease while only 41.67% (5/12) of the female respondents knew about a disease, this difference was significant upon Chi-square test with a p -value of ($**P < 0.01$) (Table 1).

Table 1: Showing frequencies and knowledge of participants concerning age, sex, level of education, and experience of livestock keeping.

Variable	Categories	Number in each category, N (%)	Number of knowledgeable people in the category. N (%)	Chi-squared p-value
Sex	Male	138 (92)	133 (96.37)	0.00
	Female	12 (8)	5 (41.67)	
Age	20-30	30 (20)	28 (93.33)	0.09
	30-40	36 (24)	35 (97.22)	
	40-60	42 (28)	40 (95.20)	
	60-70	42 (28)	35 (83.33)	
Level of education	Informal education	7 (4.67)	2 (28.57)	0.00
	Primary level education	69 (46)	63 (91.30)	
	Secondary level education	51 (34)	50 (98.04)	
	Post-secondary education	23 (15.33)	23 (100)	
Experience in livestock keeping	<10 years	30 (20)	26 (86.67)	0.37
	10-20 years	45 (30)	41 (91.11)	
	>20 years	75 (50)	71 (94.67)	

Table 2: Showing Participants' knowledge regarding brucellosis

Question	Responses	N	%
Have you heard about a disease known as brucellosis?	Yes	138	92
	No	12	8
From which source did you hear about a disease?	veterinary care providers	65	43.33
	neighbors or family members	35	23.33
	community events or speeches	23	15.33
	radio or television	10	6.67
	reading books or brochures	5	3.33
	Heard nowhere	12	8
What are the modes of transmission of a disease between livestock?	Mating	50	33.33
	Placenta	32	21.33
	Shared grazing area	29	19.33
	Unaware	39	26
What are the clinical signs of a disease in livestock?	Abortion	90	60
	Birth of weak calves	20	13.33
	Decrease in milk production	10	6.67
	Unaware	30	20
What are the ways in which brucellosis is spread to humans?	Drinking raw milk	49	32.67
	Handling placentas	31	20.67
	Handling abortion cases		13.33
	Unaware	50	33.33
What are the clinical signs of a disease in humans?	Unaware	40	26.67
	Fever	20	13.33
	Headaches	61	40.67
	flu-like symptoms	29	19.33

Knowledge level among participants based on age groups

Respondents' awareness of brucellosis based on age groups were 93.33% (28/30), 97.22% (35/36), 95.2% (40/42), and 83.33% (35/42) by 20-30, 30-40, 40-60, and 60-70 age groups, respectively. However, the difference between groups was not statistically significant with a p-value of 0.09 (Table 1).

Knowledge level among participants based on level of education

Respondents' awareness of brucellosis based on education levels was 28.57% (2/7), 91.30% (63/69), 98.04% (50/51), and 100% (23/23) by informal, primary, secondary, and post-secondary education levels, respectively. The differences were statistically significant with a p-value (**P<0.01) (Table 1).

Knowledge level among participants based on experience

Respondent's awareness of brucellosis based on several years of experience in livestock keeping was 86.67% (26/30), 91.11%

(41/45), and 94.67% (71/75), by less than ten years, ten to twenty years, and more than twenty years, respectively. However, the difference between groups was statistically insignificant with a p-value (P=0.37) (Table 1).

Participants' attitude towards brucellosis

A total of 52/150(34.67%) strongly agreed that brucellosis is a serious disease in livestock whilst only 20/150 (13%) thought that brucellosis is a serious disease in humans. Only 18/150 (12%) participants strongly agreed that brucellosis can be prevented, they mentioned vaccination, quarantine, and seeking help from the veterinary office as prevention methods. About treatment, only 36/150 (24%) strongly agreed that brucellosis could be treated in livestock, out of these 18/150 (12%) mentioned that brucellosis can be treated through veterinary care while 18/150 (12%) mentioned the use of herbal medicine. Only 18 (12%) thought that brucellosis might be treated in humans, out of these 12/150 (8%) thought that brucellosis could be treated in

humans through consuming herbal medicine whilst only 6/150(4%) mentioned that brucellosis could be treated through seeking of medical care. When asked about aborting an animal, 60/150 (40%) said that would do nothing, 30/150 (24%) said

would slaughter the animal, 25/150(24%) said would sell the animal,

whilst only 18 (12%) said would seek help from veterinary office to treat the animal. The results of participant's attitudes are summarized in Table 3.

Table 3: Participants' attitude towards brucellosis

Participants' attitude	SA N (%)	A N (%)	DA N (%)	ID N (%)
Brucellosis is a serious disease in livestock	52 (34)	40 (26)	13 (8)	45 (30)
Brucellosis is a serious disease in humans	20 (13)	35 (23)	75 (50)	20 (13)
Brucellosis can be prevented	18 (12)	45 (30)	64 (42)	23 (15)
Brucellosis can be treated in livestock	36 (24)	64 (42)	35 (23)	15 (10)
Brucellosis can be treated in humans	18 (12)	46 (30)	36 (24)	50 (33)
Seek help from a veterinary office to treat an aborting animal	18 (17)	17 (11)	55 (36)	60 (40)

Key: SA= strongly agree, A= Agree, DA= Disagree, ID= I don't know

Participants practices towards brucellosis

Concerning participants' practices towards brucellosis, a total of 138/150 (92%) consumed unboiled raw or soured milk, Majority of participants 144/150 (96%) admitted that family members aid in animal childbirth or removal of retained placenta and only few 10/150 (6.67%) used protective gears during the process. A total of 132/150 (88%) disposed of fetal material by burying it on the ground and only a few 12/150 (8%) used protective gear during

the process, The Majority of participants 144/150 (96%) admitted to trading animals with other herds and none of them admitted to screening the animals for Brucella before trading. A total of 75/150 (50%) admitted to lending their male animals to other farmers for breeding. A total of 30/150 (20%) participants were involved in animal slaughtering or butchering. A total of 139/150 (92.66%) livestock keepers used shared grazing land (Table 4).

Table 4: Showing participants' practices towards brucellosis

Participants practices	Categories	N (%)
Do you consume unboiled raw or soured milk?	Yes	138 (92)
	No	12 (8)
Who assists animals during parturition or removal of retained placenta?	Family members	144 (96)
	Veterinary officer	6 (4)
Do you use protective gear during assisting animal's parturition?	Do wear	10 (6.67)
	Do not wear	140 (93.33)
How do you dispose of fetal material?	Burying	132 (88)
	Feeding dogs	12 (8)
	Dumping	6 (4)
Do you wear of protective gears during disposal of fetal material?	Do wear	12 (8)
	Do not wear	138 (92)
Do you separate animals during parturition?	Yes	90 (60)
	No	60 (40)
Do you sell animals to other herds?	Yes	144 (96)
	No	6 (4)
Do you screen animals before selling or before bringing in to your herd?	Yes	0 (0)
	No	150 (100)
Do you share breeding bulls with other farmers?	Yes	75 (50)
	No	75 (50)
Do you do slaughter or butchering?	Yes	30 (20)
	No	120 (80)
How do you feed your animals	Feeding at home	11 (7.33)
	Shared grazing	139 (92.66)

Discussion

The findings from this study showed that the majority of the livestock keepers (92%) reported that they had heard about brucellosis. However, the overall findings showed that the respondents had a poor understanding of various aspects of the disease including transmission, clinical symptoms, control, prevention, and treatment of the disease. This could be attributed to a lack of education about disease in the community. This study is in line with a study conducted by Maruchu et al. [20] which also reported awareness of the existence of brucellosis by the majority of the livestock keepers in the Rungwe district. However, the results are contrary to those of Sijapenda et al. [12], who found that the majority of the livestock keepers (85%) were

unaware of the existence of brucellosis in the Lindi district. However, the term "Homa ya kutupa mimba" was used by livestock keepers to refer to the syndrome of abortion in general rather than specifically to brucellosis as a disease, which may have confused the presence of other abortive diseases in the area. Previous studies have identified that community health workers, neighbors, friends, or family members are the main sources of information [13,14,20,21]. Nevertheless, this study indicated that most livestock keepers had heard about the disease through veterinary care providers. These results underline the importance of government veterinary services in this regard and are consistent with those of Cloete et al. [22] in South Africa and Begna et al. [23] in Ethiopia. However, the results show the need

for several avenues for communication to spread and enhance brucellosis awareness in the community. Respondents had average knowledge about disease transmission routes which they mentioned: drinking raw milk or eating raw meat, handling placentas and abortion cases in humans, while mating and contact with infected placenta in animals, however eating contaminated pasture, eating game meat, inhalation of contaminated dust, artificial insemination, slaughtering infected animals and contact with infected wild animals were less known by study respondents. These findings are inconsistent with Begna et al. [23] who highlighted handling abortion cases and drinking raw milk as the main routes of transmission to humans but also Kansime et al. [14] who highlighted less community knowledge on the following disease transmission routes: artificial insemination, contact with infected wild animals, and inhalation of contaminated dust. The majority of respondents to this study were knowledgeable about the clinical symptoms of the disease in livestock and humans; most of them mentioned abortion as a clinical symptom in livestock, while only a small percentage mentioned weak calves born and decreased milk production, thus our results are similar to Obonyo M [13] who also reported abortion as the main clinical symptom pointed out by pastoral communities in Kenya but contrary to Kansime et al. [14] who reported lower knowledge about clinical symptoms of a disease in livestock in Uganda. Concerning clinical symptoms of a disease in humans, respondents reported fever, headache, and flu-like symptoms as human brucellosis symptoms. This finding is similar to a study conducted in Uganda [14] where pastoral community mentioned fever and aches as symptoms of brucellosis in humans, contrary to this, a study done by Kwasi Addo et al. [24] among herdsmen in Ghana found that only 4.5% knew at least one symptom of brucellosis in humans. This study found that male respondents were more knowledgeable compared to female respondents about the occurrence, transmission, and clinical symptoms of brucellosis and therefore this study is in line with Alqahtani et al. [25] who reported similar results in Saudi Arabia. The tendency of male respondents to be more knowledgeable than female respondents can be attributed to the fact that women are poorly included in social and educational matters that concern their communities though more studies are needed to prove that assumption. Respondent's awareness concerning the level of education was lower in respondents with informal education and higher in respondents with post-secondary education, these findings are consistent with Lindahl et al. [26] who reported similar results in Tajikistan. These findings show that respondents with informal and lower education are at higher risk of contracting brucellosis therefore educational campaigns should be done especially for people with informal and lower education. Respondents with more than 20 years of experience demonstrated a good understanding of the transmission of brucellosis and its clinical symptoms compared to respondents with fewer years of experience. Those with more than twenty years of experience in animal husbandry have a greater understanding of brucellosis than those without a long experience in animal husbandry because they have encountered the disease many times and been given information about the disease by experts several times compared to those who do not have long experience with animal husbandry. Regarding the attitude about a disease, almost 34.67% (52/150) of the respondents strongly agreed that brucellosis is a serious disease

in livestock whilst only 20/150 (13%) thought that brucellosis is a serious disease in humans. The results are inconsistent with Madzingira et al. [10] where farmers identified brucellosis as a serious disease-causing abortion in cattle while denying human risk towards a disease. A small proportion of respondents believed that brucellosis can be treated (24%) and prevented (12%) but also only 12% of respondents strongly admitted to seeking for veterinary office to treat the aborting animal. These poor attitudes toward disease can be attributed to their ignorance towards the transmission, clinical signs, control, and prevention of the respondents as it has been reported by this study. A similar reason has been mentioned by other studies such as a study reported by Buhari HU [27] in Kaduna State, Nigeria. Concerning the practices of livestock keepers concerning brucellosis, almost 92% of respondents consumed raw or soured milk, the higher proportion of individuals drinking raw milk was also reported by Obonyo M [13] who reported that 96% of livestock keepers consumed raw milk in pastoral communities in Kenya. Out of all respondents, only 4% were aided by a veterinary officer during parturition but most livestock keepers were aided by family members during parturition, our results are worse compared to a study by Obonyo M [13] who reported 76% of livestock keepers using family members for animal childbirth. This study also found that the majority of livestock keepers: did not use protective clothing during animal childbirth or disposal of fetal materials; traded animals with other herds and none of them admitted to screening the animals for *Brucella* before trading; improperly disposed of aborted fetuses and placenta; lent their male animals with other farmers for breeding; involved in animal slaughtering or butchering; and used shared grazing. All of these risky practices put humans and susceptible animals at higher risk of contracting a disease. Similar risk practices were reported by previous studies [10,13,14,20]. The findings of this study have demonstrated a lower level of knowledge and poor attitudes of livestock keepers in Kilosa. Inadequate knowledge and poor attitudes suggest risky practices that are done by livestock keepers and therefore put livestock keepers in danger of contracting brucellosis disease [28].

Conclusion

This study has shown that there is little understanding as well as poor attitudes and practices regarding brucellosis for livestock keepers in the Kilosa district. This increases the risk of disease transmission to humans and between animals. We recommend community educational programs targeting zoonotic diseases including brucellosis and more studies should be done to determine the specific risk behaviors that cause the spread of brucellosis in the related community.

Abbreviation

MS: Microsoft; X2: Chi-squared test; SSA: sub-Saharan African; TZ: Tanzania; SUA: Sokoine University of Agriculture; ACE: African Centre of excellence

Declaration

Acknowledgment

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Availability of data and materials

Data will be available by emailing mwamengelega3@gmail.com

Authors' contributions

Gilbert Mwamengele (GM) is the primary investigator (PI) who contributed to the conceptualization, data curation, formal analysis, and manuscript drafting. Coletha Mathew (CM) contributed to the conceptualization of the project; supervision of the fieldwork; and reviewing, editing, and re-writing of the manuscript. Christopher Sabuni (CS) contributed to supervising the field work, reviewing, editing, and re-writing of the manuscript. Claus Thomas (CT) contributed to the reviewing, editing, and re-writing of the manuscript. All authors have read and accepted to be published final version of the manuscript.

Ethics approval and consent to participate

The study followed appropriate research clearance and ethical protocols to ensure the protection of participants' rights and compliance with regulations. The research clearance was approved by SUA under reference number SUA/DPRTC/R/186/25.

Consent for publication

Not applicable

Competing interest

The authors declare that they have no competing interests.

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