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Knowledge and practices of brucellosis among high-risk groups in Bahr El Ghazal Region, South Sudan

Nuol Aywel Madut[1,2], George William Nasinyama[2], John Bwalya Muma[3], Adrian Muwonge[4], James Muleme[2], Jacques Godfroid[5], Ambrose Samuel Jubara[1] and Clovice Kankya[2]*

[1]Department of Clinical Studies, Faculty of Veterinary Science, University of Bahr el Ghazal, Wau, South Sudan

[2]Department of Biosecurity, Ecosystems &Veterinary Public Health (BEP), College of Vet. Animal Resources & Biosecurity (COVAB). Makerere University, Kampala, Uganda

[3]Department of Disease Control, School of Veterinary Medicine, University of Zambia, Lusaka Zambia

[4]Department of Genetics and Genomics, The Roslin Institute, University of Edinburgh, UK

[5]Department of food Safety and infection Biology, Norwegian School of Veterinary Science, Troms, Norway

Abstract

Background: Brucellosis is the most common zoonotic infections in pastoral settings. Lack of knowledge about the disease may cause devastating out come to the patients, thus sustained it in such communities. This study assessed knowledge and practices among high-risk groups in Bahr el Ghazal region, South Sudan.

Methods: Across sectional survey involving abattoir workers, febrile patients at Wau referral hospital and cattle herders from cattle camps from four states namely, Wau, Tonj, Gogrial and Aweil. By using open-ended questionnaire and key informant guideline, for triangulations by for interviews, focus group discussions and key informant interview. Data collected include knowledge on causes, symptoms, transmission, treatment, prevention and risk factors of brucellosis. Using SPSS version 24 for analysis, X^2 and Multivariable logistic regression analysis was performed.

Results: In this study, 234, 416 and 87 abattoir workers, febrile patients and herders. Brucellosis prevalence is fair among abattoir workers and the febrile patients, all workers Knows Brucellosis and Tuberculosis more than other diseases. Brucellosis among febrile patients, female more than male's respondents 23.7% (50/416), 22.9% (47/234/416) respectively, the prevalence is very high among age group 16 to 35. The disease was very high among non-educated people 25.4% (35/416). Nilotic group have high prevalence 21.8% (39/416), according to C-ELISA. In the cattle camps brucellosis prevalence among males was high than females 44.0% and 29.0% respectively. The prevalence was high among age groups 16- 35 years and 36-60years, 32.7% and 38.1 respectively, according to C- ELISA. The distribution of awareness of zoonotic diseases and brucellosis among abattoir workers, knowing zoonotic diseases 33.3% (30/90), knowing brucellosis 27.8% (25/90), knowing transmission of brucellosis 11.11% (10/25), however, knowledge of causes, signs of brucellosis in animals and signs human mode of transmission and treatment of brucellosis is very low.

Conclusions: Brucellosis prevalence is fair among abattoir workers, febrile patients and high in the cattle camps. All workers Knows Brucellosis and Tuberculosis more than other diseases.in the community the prevalence look equally between gender, knowledge about the diseases causes, signs in human and animal also mode of transmission and treatment was very low between the three groups. Community sensitization and awareness about zoonotic diseases is needed.

Abbreviations: C-ELISA: Competitive Enzyme-Linked Immuno sorbent Assay; RBPT: Rose Bengal Plate Agglutination Test; CI Confidence Interval.

Introduction

Brucellosis is an infectious bacterial disease of animal origin, circulating among animals and can be transmitted to those who live in closed proximity with their animals [1]. Brucellosis brings reproductive failure to livestock and serious health problems to humans [2,3]. It's described as neglected zoonotic disease in malaria endemic areas [4]. In many countries, zoonotic diseases are not considered as important simply because the diagnostic capacity to detect them hardly exists and equally important the focus of the clinician on the patients, not on their surroundings limited their diagnosis [5]. Where Lack of awareness the disease affects human health and as the result economic implications on animal production sector [6].

Brucellosis has been eradicated from developed countries, however it remains endemic in many parts of the developing world, including Latin America, parts of the middle east, Western Asia, some countries in the Mediterranean basin, and Africa [7]. In sub-Saharan Africa, clinicians attribute most fever to malaria, even though an estimated 50-80% of fevers result from other causes [5]. e g. rift valley fever, bird flu and Yellow fever among others may be mixed with malaria fever, which called malaria like disease including Brucellosis [8]. Many countries look at the prevention and control of zoonotic diseases as very expensive so been deleted from the priorities. Consequently, some of governments often neglect zoonotic diseases, main while

Correspondence to: Dr. Clovice Kankya, Associate Professor, Head of Department of Biosecurity, Ecosystems and Veterinary Public Health, College of Vet. Animal Resources & Biosecurity (COVAB). Makerere University, Kampala, Uganda, Tel: +256772545999; E-mail: clokankya@yahoo.com / clokankya@gmail.com

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other countries create ad hoc task forces between the concerned ministries of agriculture, livestock and health to tackle these diseases like the taskforce in Ethiopia for one health [9]. Such cooperation between sectors will be of great benefits to all sectors. Dissemination of Information between medics and veterinarians about zoonotic diseases especially in rural areas would be of great value, especially where limited laboratory capacity and infrastructure, infrastructures can easily be share between sectors. Other zoonotic diseases like Q-fever, anthrax and rabies in Wildlife would benefit from such cooperation and interlinings between sectors in line with domestic animal's disease control [10].

Knowledge about zoonotic diseases among communities would be better used for community based surveillance, risk analysis, prevention and integrated control for diseases [11]. The fight against Brucellosis as an example of zoonotic disease will provide valuable insights into current practices and serve as guiding tool for set good strategies for prevention and control of malaria and malaria like diseases in the study area and the whole country. The objectives of this study are to determine the awareness levels on brucellosis specifically on causes, symptoms, prevention, and treatment, to explore the perceptions of the communities on Brucellosis particularly in relation to causes, signs and symptoms, prevention, and treatment and to assess attitudes and practices towards Brucellosis.

Materials and methods

Study area and population

Qualitative information gathered for this study was obtained through application of questionnaire and interviews among slaughterhouses, and febrile patients in Wau hospital then in the cattle camps to compere and assess the awareness among these groups.

The survey sample comprised abattoir's worker, household's heads, Focus group discussions and key informant in the four states. Purposive selection method was employed. The FGD was selected based on group homogeneity such as occupation, and owning cattle. The group size about 6-8 individuals and discussion were done verbatim with use of both tape recorders and taking notes in the same time. Two transcriptionists were involved in data processing, transcription and entry, respectively.

Study design and sampling procedure

The study is community cross sectional study, based on work in the abattoirs and with the medical colleges in the hospitals all over the region, on the knowledge on brucellosis causes, transmission, and major symptoms of the disease.

Study design and data collection

The survey sample comprised abattoir's worker (n=234), febrile patients in the hospital (n=416), and household's heads (n=40). And 8 focus group discussions and 8 key informants from veterinary officers, medical professionals and General directors from veterinary and health ministries in four selected states. Purposive selection method was employed. The FGD was selected based on group homogeneity such as occupation, and owning cattle. The group size about 6-8 individuals and discussion were done verbatim with use of both tape recorders and taking notes in the same time. Two transcriptionists were involved in data processing, transcription and entry, respectively.

Data analysis

The analysis was performed using SPSS var. 24 software. All focus group transcripts were serving as code. Then questions and node were aggregated across all of the focus groups, and the aggregated responses analyzed and summarized to describe similarities and differences in answers to each question across all of the groups.

Ethical issues

This study involves an administration of questionnaire and blood samples collection. Therefore, the study protocol was assessed and approved by the Ethical Review Committee of the College of Veterinary Medicine, Animal Resources and Biosecurity (COVAB), Makerere University, Uganda and both ministries health (MOH) and Livestock and Fisheries Industry (MLFI), South Sudan respectively. Participant's consents were obtained prior to the start of interviews and data collection.

Results

In this study, 234 abattoir workers from four areas, 416 febrile patients from Wau referral hospital and 87 herders also included and 28FGD and at last we interviewed 12 veterinary and health officers to confirm and verified the information. The work conducted by team consists of medics and vets along with health workers. Socio-demographic characteristics Table 1.

According to the results from Tables 1, and figures 1; brucellosis is fair among abattoir workers and the febrile patients from Wau referral hospital.

Consumption of raw milk, meat, and other factors $P > 0.05$ Table 2.

Brucellosis among febrile patients, female more than male's respondents 23.7%(50/416), 22.9%(47/234/416) respectively, the prevalence is very high among age group 16 to 35. The disease was very high among non-educated people25.4% (35/416), students have high prevalence 20.8%(25/416). Nilotic group have high prevalence 21.8% (39/416), according to C-ELISA Table 3.

Also this group knows Brucellosis and Tuberculosis more than other zoonotic diseases figure 2 below.

All factors like consumption of raw milk, meat, and using urine found were not significant $P < 0.05$ Table 4.

In the cattle camps brucellosis prevalence among males was high than females 44.0% and 29.0% respectively. The prevalence was high among age groups 16- 35 years and 36- 60years, 32.7% and 38.1 respectively, according to C- ELISA Table 5.

Table 6 below showing the knowledge of brucellosis and zoonotic diseases is very poor.

Awareness of causes, signs, symptoms and ways of transmission of brucellosis

The distribution of awareness of zoonotic diseases and brucellosis among abattoir workers as follows, knowing zoonotic diseases 33.3%(30/90), knowing brucellosis 27.8% (25/90), knowing transmission of brucellosis 11.11% (10/25), no one knows the cause of brucellosis, knowing the signs of brucellosis in animals 11.11% (10/25) and signs in human 27.8% (25/90), no one knows about mode of transmission and treatment of brucellosis table 7.

Discussion

In this study we camper knowledge of brucellosis as zoonotic disease in term of causes, transmission, signs and prevention and control between three group namely abattoir workers, febrile patients

Table 1. Brucellosis sero- prevalence against the demographics among abattoir workers December 2015-May 2016.

Factor	Description	RBPT (%)	c-Elisa (%)	X^2	P-Value
Sex	Female	9 (36)	8 (32)	**< 0**	**0.995**
	Male	89 (42.6)	67 (32.1)		
Age	5-15	1 (25)	1 (25)	**6.231**	**0.101**
	16 - 35	61 (40.4)	42 (27.8)		
	36 - 60	33 (44)	29 (38.7)		
	> 60	3 (75)	3 (75)		
Education	Illiterate	39 (38.2)	33 (32.4)	**3.898**	**0.420**
	Higher Education	4 (33.3)	3(25)		
	Intermediate	3 (75)	3 (75)		
	Primary	43 (45.7)	30 (31.9)		
	Secondary	9 (40.9)	6 (27.3)		
Occupation	Vet assistant	12 (57.1)	10 (47.6)	**18.516**	**0. 010***
	Butcher	45 (47.9)	34 (36.2)		
	Health worker	9 (64.3)	5 (35.7)		
	Meat handler	25 (43.9)	21 (36.8)		
	Administrator	2 (50)	2 (50)		
	Casual worker	3 (27.3)	2 (18.2)		
	Cooks (Tea/ food)	1 (4)	0		
	Cattle trader	1 (12.5)	1(12.5)		
	Others	0	0		
	Total	**98 (41.9)**	**75 (32.1)**		

Table 2. Multivariate logistic regression model (of the known risk factor variables).

	OR	p-value	95% CI
Risk factors			
Consumes raw meat	1.382	0.309	0.740 - 2.582
Consumes raw milk	1.036	0.916	0.536- 2.002
Consumes urine from animals	1.066	0.873	0.484 - 2.349
Has hand abrasions	0.791	0.467	0.421 - 1.487
Wash hands after work	0.599	0.227	0.261 - 1.376

admitted to Wau referral hospital outpatient clinic and animal's herders in the cattle camps from Bahr El Ghazal region. The study recruit 234-abattoir workers, 416 febrile patients, and 87 individual represent house holed from cattle camps from Tonj and Aweil states. Brucellosis prevalence between these groups was 32.1%(75/234), 23.3%(97/416) and 33.3%(29/87) for abattoir workers, febrile patients and cattle herders respectively, according to C- ELISA.

This study, also include 28FGD and interviewed 12 veterinary and health officers to confirm and verified the information.

Sudan is one of the malaria endemic areas in Sub-Saharan African, also there are many malaria like diseases endemic in Sudan, brucellosis is one of these group of diseases endemic in Sudan. This group of malaria like diseases always underreported and misdiagnosed in Sudan and many other countries in Africa especially in Sub- Saharan Africa due to lack of basic infrastructures facilities, diagnostic materials and well-trained personnel to perform the diagnosis [5]. Most of the time the diagnostic facilities if available were to far to reach by the nomads and cattle herders. Also there were many traditional behaviors and perceptions among animal's keeps may expose them to be infected by one of this malaria like diseases. Brucellosis is the most zoonotic disease widely distributed among animal's keeping communities due to food intake behaviors like consumption of unpasteurized milk, eating raw meat and offal's, and poor hygiene in the cattle camps, abattoirs and in the houses especially when they deal with animals and animal's products [12]. In South Sudan, people depend on livestock for their livelihood, also Livestock play essential role in their social life. However, this attitude exposed them to many zoonotic diseases as well as to brucellosis. Animal herders in all parts of South Sudan are at risk of exposure to brucellosis due to they live close proximity with their animals in cattle camps and drink raw milk, assess animals on delivery and in some cases treat retained placenta with their pear hands without any protection [13]. No serological and microscopic diagnosis is preform in most health clinics for brucellosis especially in pastoral areas, moreover no any control strategy to tackle the disease in the country due to the devastating situation created by the long civil war. Lack of awareness about brucellosis among abattoir workers, animal's herders and the whole community. As a consequence brucellosis remains a largely neglected disease with little attention given to control and prevention. In addition, the effect of brucellosis on human health in Southern Sudan is unknown [14].

Knowledge of brucellosis among abattoir workers and febrile patients admitted to Wau referral hospital in the Bahr el Ghazal region is fair, however the knowledge of the disease among herders in cattle camps is poor this results inline with [15] and this results contradict the results obtained by A Catley, et al. [16] that could be attributed to poor education, poor hygiene measures adopted in the camps and also the consumption of raw milk and it is raw products like soar milk. Also in addition to this their activities in the cattle camps like milking, assess animals on delivery and retained placenta and spreading dungs with pear hands could be one of the factors.

In South Sudan many factors could make transmission of brucellosis between livestock and humans. The practice of assembling animals into one big cattle camp with close livestock- human interaction is one of the key factors.

(Most of the cattle herders in the region prefer to keep infected animals within the herd without slaughtering or selling. Moreover, there were many signs of the disease among animals like hygroma, abortions and retained placenta that could be attributed to their traditions and norms of keeping large herds even if diseases were there), (DG Wau vet. hospital).

(Mixing infected animals and healthy one in the pastors and in the camp closely means that spreading of diseases very easy among and between herds). (vet. Officer).

Moreover, poor awareness among herders could be a risk of brucellosis. Further, animal herder's practice of vulva blowing, to facilitate milk let down during cow milking and udder- to –mouth consumption of milk could exacerbate human brucellosis.

(*Sometimes herders share their bulls for purpose of insemination could be one of the means of spreading the disease. In Bahr el Ghazal region every year herders migrate looking for water and pastors, this could bring herds in contact with other herds or wildlife animals and that could maintain the presence of the disease in the region), (DG Wau vet.hospital*).

Bahr El Ghazal region annually host transhumance from other countries could be source of infection among herds.

(Transhumance herds like Fulani red Mbororo and cattle herds from northern Sudan also could be a reason for spreading the disease among herds. Moreover, in South Sudan there is no implementation of control strategy for competing the disease. All in all brucellosis is endemic in

Table 3. Demographic characteristics Brucellosis Sero- prevalence among febrile patients December 2015 –May 2016.

Factor	N (%)	RBPT (%)	SAT (%)	cElisa (%)	X^2	P-Value
Sex						
Female	211 (50.7)	138 (65.4)	87 (41.2)	50 (23.7)	0.034	0.853
Male	205 (49.3)	144 (70.2)	96 (46.8)	47 (22.9)		
Age						
5-15	26 (6.2)	20 (76.9)	14 (53.8)	5 (19.2)	48.130	0.764
16 - 35	272 (65.4)	185 (68.0)	119 (43.8)	62 (22.8)		
36 - 60	107 (25.7)	71 (66.4)	46 (43.0)	29 (27.1)		
>60	11 (2.6)	6 (54.5)	4 (36.4)	1 (9.1)		
Education						
Illiterate	138 (33.2)	99(71.7)	66 (47.8)	35 (25.4)	0.953	0.917
Higher Education	66 (15.9)	44 (66.7)	23 (34.8)	14 (21.2)		
Intermediate	77 (18.5)	50 (64.9)	35 (45.5)	17 (22.1)		
Primary	72 (17.3)	46 (63.9)	30 (41.7)	15 (20.8)		
Secondary	63 (15.1)	43 (68.3)	29 (46.0)	16 (25.4)		
Occupation						
Butcher	3 (0.7)	2 (66.7)	1 (33.3)	1 (33.3)	10.277	0.329
Business/Trader	15 (3.6)	8 (53.3)	7 (46.7)	1 (6.7)		
Nurse/Midwife	4 (1.0)	1 (25.0)	1 (25.0)	0		
House wife	35 (8.4)	25 (71.4)	16 (45.7)	6 (17.1)		
Student	120 (28.8)	84 (70.0	50 (41.7)	25 (20.8)		
Restaurant worker	29 (7.0)	19 (65.5)	14 (48.3)	5 (17.2)		
Veterinary Officer	5 (1.2)	4 (80.0)	1 (20.0)	2 (40.0)		
Farmer	9 (2.2)	6 (66.7)	4 (44.4)	3 (33.3)		
Jobless	40 (9.6)	26 (65.0)	12 (30.0)	14 (35.0)		
Others	156 (37.5)	107 (68.6)	77 (49.4)	40 (25.6)		

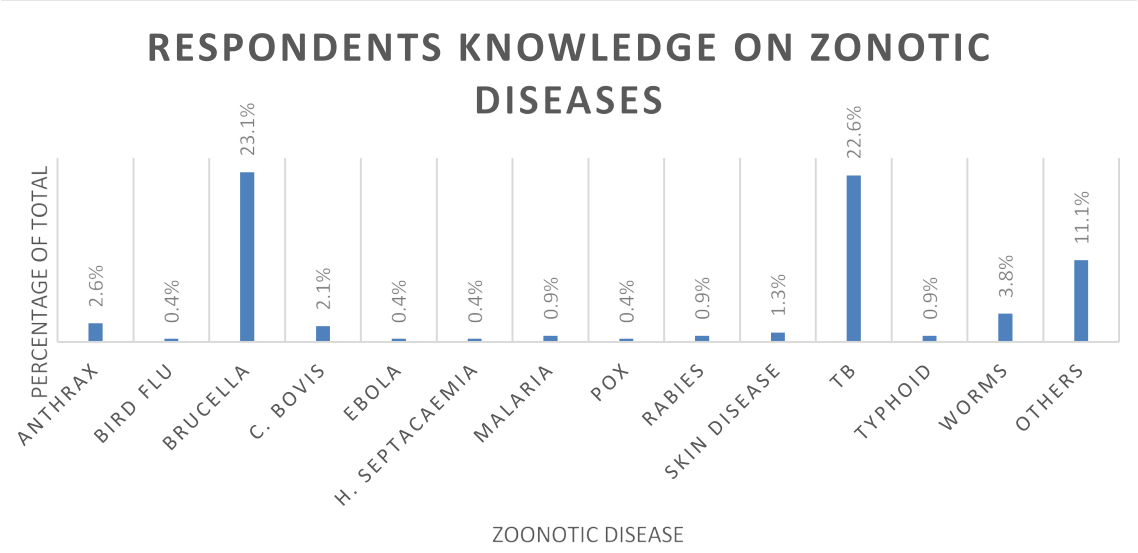

Figure 1. All workers Know Brucellosis and Tuberculosis more than other diseases.

this country from along time because of the open borders and the long war that bring animals from all over to one place. Other reasons no vaccination program for the disease in the country), (vet. officer).

Traditionally herders treat their animals without consultation from veterinary authority, and that could be one of the reasons behind early detection of the disease.

(I have veterinary pharmacy in the market and most of the time nomads come to my place asked about certain drugs without explaining the disease or signs that their animals suffered from), (vet. Officer).

Since the disease is endemic in the region from along time why the veterinary authority conduct surveillance and set prevention strategies for the disease.

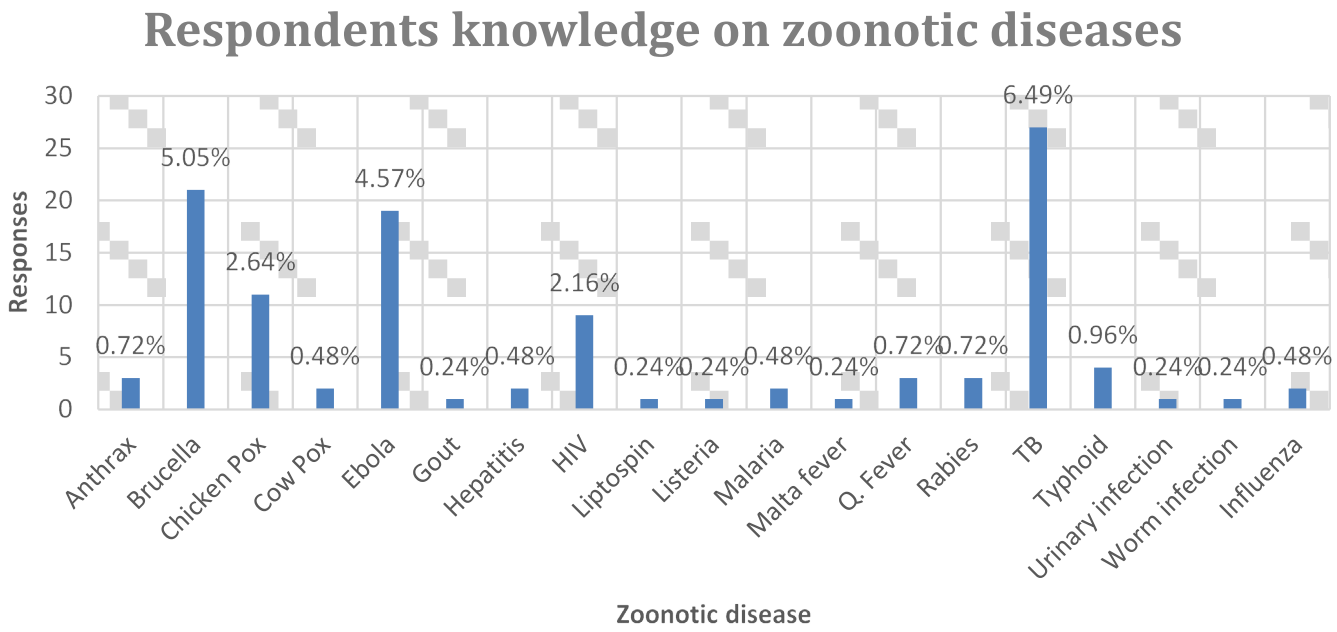

Figure 2. Showing the respondents knowledge on zoonotic diseases.

Table 4. Multivariate Logistic Regression of risk factors for occurrence of Brucellosis among human participants.

Risk factors	OR	p-value	95% CI
Consumes raw meat	1.368	0.396	0.663 - 2.82
Consumes raw milk	1.124	0.722	0.589 - 2.146
Consumes urine from animals	2.552	0.056	0.978 - 6.66
Has hand abrasions	0.671	0.183	0.373 - 1.2069
Wash hands after work	0.599	0.211	0.268 – 1.338

Table 5. Demographic characteristics and brucellosis seropositive among herders in Bahr el Ghazal region December 2015-May 2016.

Variable/ description		RBPT		SAT		C-ELISA		Total
		Negative	Positive	Negative	Positive	Negative	Positive	
Gender	Male	48.0% (12)	52.0% (13)	44.0% (11)	56.0% (14)	56.0% (14)	44.0% (11)	25
	Female	64.5% (40)	35.5% (22)	59.7% (37)	40.3% (25)	71.0% (44)	29.0% (18)	62
Age Group	0-5	100.0% (2)	0.0% (0)	100.0% (2)	0.0% (0)	100.0% (2)	0.0% (0)	2
	6-15	76.9% (10)	23.1% (3)	61.5% (8)	38.5% (5)	76.9% (10)	23.1% (3)	13
	16-35	57.1% (28)	42.9% (21)	55.1% (27)	44.9% (22)	67.3% (33)	32.7% (16)	49
	36-60	57.1% (12)	42.9% (9)	52.4% (11)	47.6% (10)	61.9% (13)	38.1% (8)	21
	>61	0.0% (0)	100.0% (2)	0.0% (0)	100.0% (2)	0.0% (0)	100.0% (2)	2
Occupation	Farmer	63.6% (21)	36.4% (12)	57.6% (19)	42.4% (14)	63.6% (21)	36.4% (12)	33
	Milking	56.5% (26)	43.5% (20)	52.2% (24)	47.8% (22)	67.4% (31)	32.6% (15)	46
Education	Illiterate	57.8% (48)	42.2% (35)	53.0% (44)	47.0% (39)	65.1% (54)	34.9% (29)	83
	Literate	100.0% (4)	0.0% (0)	100.0% (4)	0.0% (0)	100.0% (4)	0.0% (0)	4
Total		59.8% (52)	40.2% (35)	55.2% (48)	44.8% (39)	66.7% (58)	33.3% (29)	87

Table 6. Below showing the knowledge of brucellosis and zoonotic diseases is very poor.

		RBPT		SAT		C-ELISA		
Factors	Responds	Negative	Positive	Negative	Positive	Negative	Positive	Total
Zoonotic diseases Awareness	No	59.8% (52)	40.2% (35)	55.2% (48)	44.8% (39)	66.7% (58)	33.3% (29)	87
	Yes	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0
Aware of brucella	No	59.8% (52)	40.2%(35	55.2% (48)	44.8%(39)	66.7% (58)	33.3%(29)	87
	Yes	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0
Animal signs	No	59.8% (52)	40.2%(35	55.2% (48)	44.8%(39)	66.7% (58)	33.3%(29)	87
	Yes	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0
Human signs	No	59.8% (52)	40.2%(35	55.2% (48)	44.8%(39)	66.7% (58)	33.3%(29)	87
	Yes	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0

Table 7. Awareness among abattoir workers & febrile patients from the hospital.

Abattoir workers				Febrile patients		
Question	Response among herders	Number of respondent	Responders %	Response among herders	Number of respondent	Responders %
Have you heard about zoonotic diseases?	Yes	83	35.5%	Yes	371	89.2%
	No	151	64.5%	No	45	10.8%
Have you heard about disease called Brucellosis?	Yes	25	30.1%	Yes	221	59.6%
	No	58	69.9%	No	150	40.4%
If yes, do you know how its spread?	Yes	10	11.11%	Yes	221	59.6%
	No	15	16.7%	No	150	40.4%
Do you know the cause?	Yes	0	00.00	Yes	221	59.6%
	No	25	100%	No	150	40.4%
Do you know the signs in animals?	Yes	10	11.11%	Yes	221	59.6%
	No	15	16.7%	No	150	40.4%
Are you aware that brucellosis infects human?	Yes	25	27.8%	Yes	221	59.6%
	No	65	72.2%	No	150	40.4%
If yes, do you know the signs in human?	Yes	0	00.00	Yes	221	59.6%
	No	25	100%	No	150	40.4%
Do you aware of the mode of transmission?	Yes	0	00.00	Yes	221	59.6%
	No	25	100%	No	150	40.4%
Do you know the treatment?	Yes	0	00.00	Yes	221	59.6%
	No	25	100%	No	150	40.4%

(The herders them self their revenues from the herds are very limited and their herds for social status not for economic benefits), (DG Wau vet.hospital).

(The way out for the national herds is to educate these communities about the correct way of keeping animals and motivate them to adopt selling and buying animals instead of keeping animals without economic significant), (DG Wau vet.hospital).

For the government, the national herds contribute about 15% from the total GDP of the country, and also the herders are not co-operative in this issue, so the government counts on oil revenue mostly.

(We conduct vaccination campaigns annually before the dry season for vaccinate for BQ, Anthrax, CBBP and HS however brucellosis not included),(DG Wau vet.hospital).

(Actually brucellosis vaccination since we are one country with Sudan not included in the vaccination campaigns, every farmer vaccinates alone his herd, and moreover the disease some time appears in veterinarians and their assistance), *(DG Wau vet.hospital*).

Conclusion

This study reveals that a large proportion of high-risk groups (abattoir workers, febrile patients) having broad Knowledge of brucellosis. Knowledge of the disease causes, signs, and mode of transmission were very poor. Living in close proximity with their animals, sharing water source with animals and poor hygiene in their environment were identified as possible transmission routes for the disease. Consumption of untreated milk and meat were perceived to be exposed routes for acquiring the disease among pastoralists. Diseases management by the herders themselves or traditional healers could transform the animal into carrier stage. Therefore, there is need to strengthen public awareness about zoonotic diseases and implements prevention and control for brucellosis by the authorities.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

NM contributed to the design, data collection, drafting and writing of the manuscript. AM, GWN contributed to data analysis and drafting of the manuscript. AJ contributed to design, data analysis and drafting of the manuscript. CK, JBM contributed to conception, design, and drafting and writing of the manuscript. J G: contributed to the design, drafting and writing of the manuscript. JM contributed on drafting and editing the manuscript. All authors have read and approved the final manuscript.

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Ethical approval

This study involves an administration of questionnaire and blood samples collection. Therefore, the study protocol was assessed and approved by the Ethical Review Committee of the College of Veterinary Medicine, Animal Resources and Biosecurity (COVAB), Makerere University, Uganda vide the reference number of SBLS/NA/2015 and ethical approved from both ministries health (MOH) and Livestock and Fisheries Industry (MLFI), South Sudan respectively. Participant's consents were obtained prior to the start of interviews and data collection. Moreover, import and export permits of the biological samples were obtained from Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) - LHE 46/172/406, Uganda and Ministry of Livestock and Fisheries Industry (MLFI), South Sudan - RSS/MLFI/DVS/J/39, respectively, prior to shipment from and to designate country.

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