Scholars Journal of Agriculture and Veterinary Sciences **e-ISSN 2348–1854**
Sch J Agric Vet Sci 2017; 4(11):442-451 **p-ISSN 2348–8883**
©Scholars Academic and Scientific Publishers (SAS Publishers)
(An International Publisher for Academic and Scientific Resources)

Knowledge, Attitude and Practices of Brucellosis among Slaughterhouse and Community Animal Health Workers in Wau, Western Bahr el Ghazal State, South Sudan

Marin P M[1], Shereen AM[2], Tumwine G[3], Kankya C[4], Nasinyama G[5], Jubara AS[6]
[1]Institute of Public and Environmental Health, University of Bahr El-Ghazal, South Sudan
[3, 4,5]College of Veterinary Medicine, Makerere University, Uganda
[2,6]College of Veterinary Science, University of Bahr El-Ghazal, South Sudan

Original Research Article

***Corresponding author**
Shereen Ahmed

Article History
Received: 01.11.2017
Accepted: 07.11.2017
Published: 30.11.2017

DOI:
10.21276/sjavs.2017.4.11.2

Abstract: Brucellosis is a global zoonotic disease of public health importance to both humans and animals. Lack of knowledge about brucellosis may increase the risk of contracting the disease. A survey was conducted to assess the knowledge, attitudes, and practices of the slaughter house and community animal health workers in Wau Municipality, South Sudan. Between December 2015 and January 2016, a survey using mixed method was carried out among slaughterhouse and community animal health workers. The study participants were interviewed using pre-tested questionnaire. The overall knowledge, attitudes and practices of the participants were assessed using the mean score of each dependent variable as a cut-off. Having score above or equal to the mean of each dependent variable was considered as having a high level of knowledge, or having positive attitude and good practices towards brucellosis prevention. Out of 77 study participants (79.2% slaughterhouse workers and 20.8% community animal health workers) only (39 %) had ever heard about brucellosis. 68.8% and 96.4% mentioned joint and leg swelling as a common sign of brucellosis in humans and animals, respectively. Taking the mean knowledge as the cut off value, 85.7% of the study participants had low level of knowledge about brucellosis, 89.6% had positive attitudes and 59.7% had good practices towards brucellosis prevention, knowledge of brucellosis was significantly associated using Chi-square test with age ($p = 0.01$), marital status ($p = 0.01$), education ($p = 0.02$), occupation ($p = 0.01$) and duration in work ($p = 0.02$) respectively. Majority of participants did not know about brucellosis in both humans and animals. Moreover, overall knowledge of respondents was low although they indicated positive attitude and good practices towards brucellosis prevention. There is a need for provision of health education that requires collaboration between public health and veterinary services to raise awareness among the study population.
Keywords: Brucellosis, slaughterhouse, community animal health workers, South Sudan

INTRODUCTION

Background

Brucellosis is a wide spread zoonotic disease of public health importance in the developing countries [1]. The disease has severe economic and health complications for both humans and animals [2]. The disease is an occupational hazard especially to abattoir workers, meat sellers, veterinarians, cattle keepers and farmers who are frequently in close contact with animals [3]. Brucellosis is transmitted to humans through direct contact with infected animals, blood, placentas, and aborted fetuses or through consumption of unpasteurized milk [4, 5]. In humans, the disease manifests clinically as fever, fatigue, headache, sweating, and joint pain, loss of appetite, muscular pain, weight loss and arthritis. Transmission of bovine brucellosis is through the placenta, uterine fluid abortion fluids, milk of infected cattle, contaminated water and feed [6]. The signs in animals are abortion, reduced fertility, weak offspring and lowered milk production [2, 7].

Studies on brucellosis among high risk groups such as abattoir workers in Africa show varying prevalence. The prevalence of brucellosis among abattoir workers in a study done in Uganda was at 10 % [8], in Egypt the prevalence among abattoir workers was 34 % [9], in Pakistan the prevalence of brucellosis among abattoir workers was 21.7 % [3]. In the Sudan, brucellosis is endemic throughout the country in cattle, sheep and goats [10].

In South Sudan, the prevalence of bovine brucellosis was estimated at 12.7% in study done in Western Equatoria State [11], meanwhile a key factor associated with human brucellosis was identified as

drinking of raw milk in Terekeka County, Central Equatoria State, although the prevalence was unknown [12]. South Sudan is one of the countries with the highest rates of functional illiteracy estimated at 80 % (*South Sudan National Bureau of Statistics*, 2012). This high level of illiteracy may contribute to lack of knowledge and awareness about brucellosis.

Therefore, the aim of this study was to assess the knowledge, attitudes and practices towards brucellosis among slaughter house and community animal health workers in Wau Municipality, South Sudan.

MATERIAL AND METHODS

Study design, sampling and data collection

A cross-sectional survey was carried out between December 2015 and January 2016 where mixed methods were employed. Non-probability sampling was used purposively to select sixty- one (61) slaughter house workers and sixteen (16) community animal health workers in Wau Municipality. The study inclusion was based on willingness and individual consent to be interviewed and being a slaughterhouse or community animal health worker.

Information on knowledge, attitude and practices towards brucellosis i.e. causes, mode of transmission, symptoms, risk factors, treatment and prevention of brucellosis in humans and animals was collected using pre-tested structured questionnaires. The questionnaires were prepared in English and asked directly by translating into Arabic language verbally by two trained public health officers who were fluent in speaking and writing of both English and Arabic Languages. To complement this, a qualitative approach employed key informant Interviews (KIIs) and Focus Group Discussions (FGDs) were carried out to explore and generate more information to understand the reasons behind such attitudes and practices.

Data management and analysis

The collected quantitative data were coded and double checked to ensure consistency of information then entered into Excel spread sheet before exported into Statistical Package for Social Sciences SPSS version 18 software for analysis. Univar ate analysis was carried out to generate frequencies, percentages and chi-square test was use to describe the association between socio-demographic characteristics and outcome variables and p-value < 0.05 was considered statistically significant. The knowledge of respondents was measured using the scoring method from previous study [13], each correct responses were scored one and for "incorrect" and "don't know" responses were scores zero. The overall knowledge score was calculated by summing up all responses giving the range between (0-15).The composite score was dichotomized using mean obtained from the data (i.e. mean=8). The respondents who have scored above and equal to the mean were considered as having high level of knowledge and those who scored below the mean were classified as having low level of knowledge. For attitudes a total of 11 questions were assessed using Likert's scale based on positive and negative statements [14], The total overall attitudes scores was 11 * 4= 44 and the mean obtained was (i.e. mean = 22). Participants who have scored above or equal to the mean were considered as having positive attitudes and those who scored below the mean were categorized as having negative attitudes towards brucellosis. Practices towards brucellosis had 9 questions and was assessed by scoring responses as follows: (Always) option 2 scores, (Sometimes) option scored 1 and (Never) option scored zero. All scores were summed up for total scoring (18), 2*9= 18 scores and the mean obtained was (i.e. mean = 9.5). Respondents who have scored above and equal the mean were classify as having good practices and those who scored below the mean were considered as having poor level of practices.

For qualitative data, four (4) key informant interviews (KIIs) and two (2) focus group discussions (FGDs) were recorded using audio tape recording and note taker for those who are not comfortable with audio tape recording. Then manually transcribed and translated into English by expert from Department of Languages, University of Bahr el Ghazal, and were read through many times by researchers to make sense of the texts and the quotes that best described the theme and frequently repeated from different groups were chosen.

RESULTS

Quantitative data

Socio – demographic characteristics of the study participants

A total of 77 participants 61 (79.2%) slaughterhouse workers and 16 (20.8%) community animal health workers were interviewed. Majority (96.1%) of the participants were males. The mean age of the participants was 29.9 (±8.87) ranging from 15-58 years with most 41.6% belonging in age group 21-30 years? Majority (67.5%) of the participants reported to be married. More than a half (53.2%) of the participants was uneducated, while With regard to duration in the work they do, 67.6 % of respondents had spent more than a year working at the slaughter house and as a animal health worker Table 1.

Participant's overall knowledge about brucellosis

The level of overall knowledge using the mean scores is summarized in Table 1. Of the total study participants 11(14.3%) had high overall knowledge about brucellosis. Female participants (p = 0.373) and being a single (p= 0.013) had low overall knowledge. Participants in the age group 41-50 years old (p = 0.011) and being relatively educated (p = 0.036) had good overall knowledge about brucellosis.

Table 1: Association between respondent socio-demographic characteristics and overall knowledge (n=77)

Characteristics	% of respondents	Level of knowledge scores High (score ≥8)	Low (score < 8)	p- value
Sex				
Male	74(96.1%)	10(13.5%)	64(86.5%)	
Female	3(3.9%)	1(33.3%)	2(66.7%)	0.374
Age (in years)				
15-20	11(14.3%)	0(0.0%)	11(100.0%)	
21-30	32(41.6%)	2(6.3%)	30(93.7%)	
31-40	24(31.2%)	5(20.8%)	19(79.2%)	
41-50	8(10.4%)	4(50.0%)	4(50.0%)	
Above 50	2(2.6%)	0(0.0%)	2(100.0%)	0.011*
Marital status				
Single	25(32.5%)	0(0.0%)	25(100.0%)	
Married	52(67.5%)	11(21.2%)	41(78.8%)	0.013*
Formal education				
None	41(53.2%)	2(4.9%)	39(95.1%)	
Primary(basic)	26(33.8%)	7(26.9%)	19(73.1%)	
Secondary	10(13.0%)	2(20.0%)	8(80.0%)	0.036*
Occupation				
Slaughterer	29(37.7%)	1(3.5%)	28(96.5%)	
Meat seller	10(13.0%)	0(0.0%)	10(100.0%)	
Cleaner	9(11.7%)	0(0.0%)	9(100.0%)	
Animal trader	1(1.3%)	0(0.0%)	1(100.0%)	
Animal worker	16(20.8%)	10(62.5%)	6(37.5%)	
Dresser	11(14.3%)	0(0.0%)	11(100.0%)	
Skin collector	1(1.3%)	0(0.0%)	1(100.0%)	0.000*
Duration(in years)				
Less than a year	25(32.5%)	5(20.0%)	20(80.0%)	
From 1 to 5yrs	26(33.8%)	0(0.0%)	26(100.0%)	
Above 5 yrs	26(33.8%)	6(23.1%)	20(76.9%)	0.036*

* Chi-square test p-value < 0.05 was statistically significant.

Participants' knowledge/awareness about brucellosis

The participants knowledge about brucellosis is summarized in Table 2.The majority 47 (61%) of the participants had heard about brucellosis which is commonly known among Dinka cattle keepers as "Cual", and among Lou as "Amol".

Knowledge about the cause, symptoms, transmission and treatment of brucellosis

The majority 66 (85.7%) of participants did not know the causes of brucellosis, while 68.8% of participants mentioned joint swelling as the major symptom of brucellosis in humans. Nearly two thirds 49(63.6%) of participants did not know about signs and symptoms of brucellosis in animals, and those who knew about the signs and symptoms in animals, 96.4% of participants mentioned leg swelling as a sign in animals. It was also reported that 58 (75.3%) of participants were not aware of the mode of transmission of brucellosis in humans. Factors that were reported to be responsible for transmission of brucellosis in humans were consumption of un-cooked meat and drinking of raw milk reported by 68.4% and 63.2% of the participants respectively. Majority 62(80.5%) of participants did not know the mode of transmission of brucellosis in animals. About 73.3% and 33.3% of participants mentioned infected animals and poisoned grass as a way of transmission of brucellosis to others respectively (Table 2).

The majority of the respondents (79.2%, n=77) were not knowledgeable about the signs and symptoms of brucellosis in humans, while more than two thirds (68.8%) of participants mentioned joint swelling, and few respondents (37.5% or less) suggested persistent fever, joint pain, weight loss and loss of appetite (Figure 1).

The majority 64, (83.1%) of participants believed that brucellosis was not treatable in humans. Among those who believed the disease was treatable 13(16.9%), majority (69.2%) of participants mentioned use of modern medicine and 23.1% of participants suggested the traditional medicine for treatment in humans' and only one respondent mentioned both modern and traditional medicine for treatment of brucellosis in humans (Table 2).

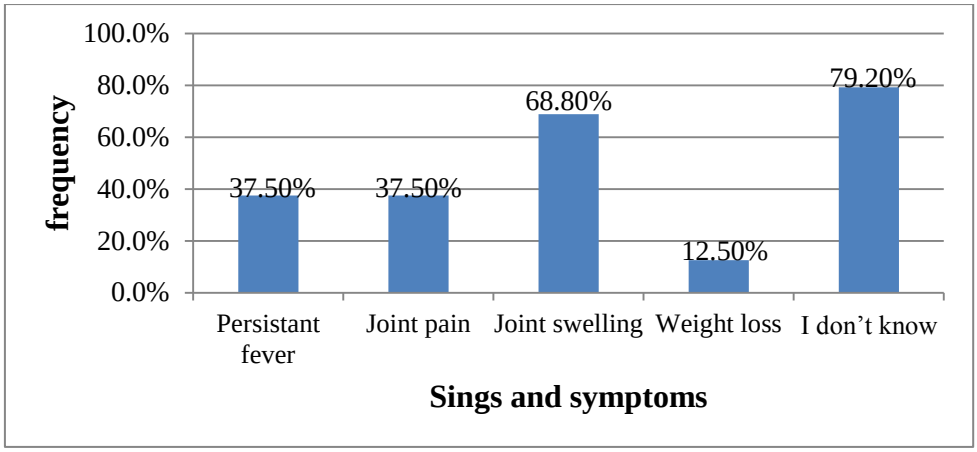


Fig-1: Signs and symptoms of brucellosis in humans

Table 2: Participants' knowledge on brucellosis (cause, symptoms, transmission and treatment) in humans and animals

Variables	Frequencies	Percentages (%)
Ever heard about brucellosis		
Yes	47	61
No	30	30
Cause of brucellosis *		
Modern medicine	2	2.6
Polluted water	2	2.6
Poisoned grass	1	1.3
Direct contact with infected animal	1	1.3
Raw milk and meat	2	2.6
Insect bite	2	2.6
Polluted feed and water	1	1.3
I don't know	66	85.7
Signs & symptoms of brucellosis in animal		
Abortion	13	46.4
Reduced fertility	3	10.7
Leg swelling	27	96.4
I don't know	49	63.6
How do people get brucellosis		
Direct contact with infected animal	10	52.6
Aborted fetuses or placenta	2	10.5
Drinking of raw milk	12	63.2
Consumption of uncooked meat	13	68.4
Polluted water	2	10.5
I don't know	58	75.3
How do animals get brucellosis		
From infected animal to another one	11	73.3
Poisoning grass	5	33.3
I don't know	62	80.5
Is brucellosis treatable in humans		
Yes	13	16.9
No	64	83.1
Kind of treatment sought for humans		
Modern medicine	9	69.2
Traditional medicine	3	23.1
Both (Modern and traditional medicine)	1	7.7

*Not multiple responses question

Participants' knowledge about treatment and prevention of brucellosis

Up to 56 (72.7%)of the participants were not aware that brucellosis was treatable in animals, and only 23.4% of participants knew that brucellosis was treatable and half or less mentioned treatment with traditional medicine (50.0%) and (33.3%) mentioned modern medicine and low proportion (5.6%) suggested both modern and traditional medicine for treatment of brucellosis in animals, (Table 3).

Only 19(24.7%) of the participants were aware that brucellosis was preventable in humans. The preventive measures mentioned included drinking of boiled milk (58.8%), consumption of well cooked meat (52.9%), use of gloves when handling aborted materials (35.3%), isolation of sick person from others (11.8%) and avoiding cuts on exposed body parts (5.9%). On prevention of brucellosis in animals only 20(26%) of respondents knew that brucellosis was preventable. However, most methods of prevention mentioned isolation of infected animals (80%) and vaccination (30%), (Table 3).

Table 3: Participants' knowledge of brucellosis treatment and prevention in humans and animals

Variables	Frequencies (n = 77)	Percentages (%)
Is brucellosis treatable in animals		
Yes	17	22.1
No	4	5.2
I don't know	56	72.7
Kind of treatment sought for animals		
Modern medicine	6	35.3
Traditional medicine	10	58.8
Both	1	5.9
Is brucellosis preventable in humans		
Yes	19	24.7
No	0	0.0
I don't know	58	75.3
Kind of prevention sought in humans		
Drinking of boiled milk	10	58.8
Consumption of well cooked meat	9	52.9
Use of gloves while contact with aborted materials	6	35.3
Avoid cuts on exposed body parts	1	5.9
Isolation of sick person from others	2	11.8
Is brucellosis preventable in animals		
Yes	20	26.0
No	2	2.6
I don't know	55	71.4
Kind of prevention sought in animals		
Isolation of infected animal	16	80.0
Vaccination	6	30.0
Avoiding sharing water with other wild animal	1	5.0
Using cloves while in contact with animal	1	5.0
Ever seen a person suffering from brucellosis		
Yes	21	27.3
No	56	72.7

Participants' overall attitudes and perception towards brucellosis

The overall attitude and perception of study participants towards brucellosis is summarize in Table 4. The majority 69(89.6%) of participants had "positive" attitude towards brucellosis while 8(10.4%) of respondents had "negative" attitude towards brucellosis.

Table 4: Association between respondent socio-demographic characteristics and overall attitudes (n=77)

Variable	Proportion (%) of respondents	Attitudes scores Positive (≥22)	Negative (< 22)	p- value
Sex				
Male	74(96.1%)	66(89.2%)	8(10.8%)	
Female	3(3.9%)	3(33.3%)	0(66.7%)	0.72
Age				
15-20	11(14.3%)	11(100.0%)	0(0.0%)	
21-30	32(41.6%)	28(87.5%)	4(12.5%)	
31-40	24(31.2%)	21(87.5%)	3(12.5%)	
41-50	8(10.4%)	8(100.0%)	0(0.0%)	
Above 50	2(2.6%)	1(50.0%)	1(50.0%)	0.21
Marital status				
Single	25(32.5%)	22(88.0%)	3(12.0%)	
Married	52(67.5%)	47(90.4%)	5(9.6%)	0.71
Formal education				
None	41(53.2%)	36(87.8%)	5(12.2%)	
Primary(basic)	26(33.8%)	24(92.3%)	2(7.7%)	
Secondary	10(13.0%)	9(90.0%)	1(10.0%)	0.84
Occupation				
Slaughterer	29(37.7%)	24(3.5%)	5(96.5%)	
Meat seller	10(13.0%)	8(0.0%)	2(100.0%)	
Cleaner	9(11.7%)	9(100.0%)	0(0.0%)	
Animal trader	1(1.3%)	1(100.0%)	0(0.0%)	
Animal worker	16(20.8%)	16(100.0%)	0(0.0%)	
Dresser	11(14.3%)	10(90.9%)	1(9.1%)	
Animal skin collector	1(1.3%)	1(100.0%)	0(0.0%)	0.47
Duration (SH)*				
<1 year	25(32.5%)	23(92.0%)	2(8.0%)	
1-5 yrs	26(33.8%)	21(80.8%)	5(19.2%)	
> 5 yrs	26(33.8%)	25(96.2%)	1(3.8%)	0.17

* Chi-square test p-value < 0.05 was statistically significant. * SH in slaughterhouse

Participants' overall practices regarding prevention and control of brucellosis

The summary of overall practice towards prevention of brucellosis indicated that above half of the participants 46(59.7%) had "good" practices. Significant association was identified between practices of respondents towards brucellosis and occupation (p = 0.01), and duration in work (p = 0.01). Clearly, slaughter personnel were more likely to have "good" practices compared to meat sellers. Workers with experiences above 5 years in slaughterhouse were more likely to have "good" practices compared to workers with experiences less than a year, (Table 5).

Table 5: Association between respondents practices towards prevention of brucellosis and socio-demographic characteristics (n=77)

Variable	Proportion (%) of respondents	Level of practices scores Good (score ≥ 9.5)	Poor (score < 9.5)	p- value
Sex				
Male	74(96.1%)	44(59.5%)	30(40.5%)	
Female	3(3.9%)	2(66.7%)	1(33.3%)	0.65
Age				
15-20	11(14.3%)	5(45.5%)	6(54.5%)	
21-30	32(41.6%)	20(62.5%)	12(37.5%)	
31-40	24(31.2%)	13(54.2%)	11(45.8%)	
41-50	8(10.4%)	6(75.0%)	2(25.0%)	
Above 50	2(2.6%)	2(100.0%)	0(0.0%)	0.48
Marital status				
Single	25(32.5%)	14(56.0%)	11(44.0%)	
Married	52(67.5%)	32(61.5%)	20(38.5%)	0.80
Formal education				

None	41(53.2%)	23(56.1%)	18(43.9%)	
Primary(basic)	26(33.8%)	16(61.5%)	10(38.5%)	
Secondary	10(13.0%)	7(70.0%)	3(30.0%)	0.71
Occupation				
Slaughterer	29(37.7%)	23(79.3%)	6(20.7%)	
Meat seller	10(13.0%)	0(0.0%)	10(100.0%)	
Cleaner	9(11.7%)	5(55.6%)	4(44.4%)	
Animal trader	1(1.3%)	1(100.0%)	0(0.0%)	
Animal worker	16(20.8%)	12(75.0%)	4(25.0%)	
Dresser	11(14.3%)	4(36.4%)	7(63.6%)	
Animal Skin collector	1(1.3%)	1(100.0%)	0(0.0%)	0.01*
Duration(SH)*				
< 1 year	25(32.5%)	9(36.0%)	16(64.0%)	
1-5 yrs	26(33.8%)	16(61.5%)	10(38.5%)	
> 5 yrs	26(33.8%)	21(80.8%)	5(19.2%)	0.01*

* Chi-square test p-value < 0.05 was statistically significant. * SH in slaughterhouse

Qualitative data

A total of two (2) key informants were all males in addition to two (2) focus group discussions with community animal health workers were undertaken. Although of their different professional backgrounds, all key informants agreed on lack of knowledge and awareness about brucellosis among the study population.

Knowledge about brucellosis

The knowledge of brucellosis among slaughterhouse and community animal health workers is crucial for the improvement of practices and promotion of health. During the interview the key informant (Veterinary officer) complained that all workers in slaughterhouse lacked proper training and awareness about zoonotic diseases that left them vulnerable during their work.

"*Well, all the workers were brought to us by the public health officer after giving them health certificate without training. They don't have any idea and awareness about zoonotic diseases including brucellosis. So we give them some awareness about these diseases and how to deal with animals during slaughtering and how to protect themselves from injuries during slaughtering process"* **Informant # 1**

On other hand, community animal health workers from their FGDs sessions confirmed the lack of knowledge about brucellosis and admitted that their training was not enough to understand the disease and demands for more training.

Risky Practices that expose to brucellosis

The informant reported that some of the slaughterhouse workers did not wear any protective clothing or gum boots while carrying out their work which exposes them to risk of contracting brucellosis especially among skin collectors and slaughterers.

"*From my experience, I have observed that the boy who collect skins work without any protection or wear gloves and that is very dangerous to them. Some workers get knife injuries continue working, but for me I used to stop them immediately and tell them to go to hospital for treatment. So we need training or workshops for all workers here"* Informant **# 2**

DISCUSSION

The findings from this mixed approach survey showed clearly that the majority of respondents had limited knowledge on brucellosis regarding the cause, sings/symptoms, mode of transmission, treatment and prevention on both humans and animals. This finding is similar to that done in Tajikistan by Elisabeth, L *et al.*, which showed that the knowledge of brucellosis was poor among the dairy farmers, and a study in Nigeria [16] that found nearly two thirds of participants had poor knowledge. More than half of slaughterhouse workers and community animal health workers had heard about brucellosis which was commonly known as "Cual" in "Dinka" language and "Amol" among "Lou" cattle keepers and this may be due to the fact that the majority of participants either were working in slaughterhouse and frequently hear about brucellosis from veterinary officers during inspection and slaughtering or were community animal health workers who had a minimum understanding about zoonotic diseases including brucellosis . In regard to this, the findings from the current study concur to a study in Uganda by Kansiime *et al.*, [7], that found a majority of respondents had ever heard about brucellosis. It also disagrees with study in Tajikistan by Elisabeth Lindahl *et al.*, [15], which found that, the majority of farmers had never heard of brucellosis. The results of this study are similar to the findings of study in Egypt [17], which found the majority of respondents had heard about brucellosis.

The findings from this study show that majority of the participants did not know the etiology of

brucellosis in both humans and animals and this is similar to the study in Nigeria [16] that found the majority of livestock workers did not know the cause of brucellosis.

Our findings revealed that nearly two thirds of the respondents did not know the correct symptoms of brucellosis in humans; this could be associated to the lack of awareness and misdiagnoses in most cases to Malaria or Typhoid fever. Meanwhile low proportion of respondents mentioned joint swelling, persistent fever, and joint pain, loss of appetite and weight loss. These results were similar to the study in Nigeria [16] that found out that the majority of livestock workers did not know symptoms of brucellosis in humans. In contrast, our findings disagree with study in Tajikistan that found all participants had a high level of knowledge about brucellosis signs and symptoms and most of the respondents mentioned fever and joint and muscle pains, this may be contributed to the fact that in our study human brucellosis was misdiagnosed and underreporting by health workers and was not common among study participants mostly referred to malaria or typhoid. The findings from this study were vital because understanding of the signs and symptoms helps medical personnel in determining the correct diagnoses and treatment.

Nearly half of respondents did not know brucellosis signs and symptoms in animals while low proportion of respondents mentioned leg swelling, abortion and reduced fertility as a signs and symptoms in animals. These findings were consistent to the study done in Nigeria [16] that found the majority of participants did not know the signs and symptoms in animals. On other hand our findings were contrary to the study in Uganda [7], which found out that a low proportion of respondents knew about brucellosis signs and symptoms in animals. The significance of this finding poses public health threat that needs intervention on health awareness among study population on zoonotic diseases.

Few participants from this study suggested many routes of brucellosis transmission in humans including consumption of uncooked meat, drinking of raw milk, direct contact with infected animal, aborted fetuses or placenta and polluted water. In this study, more than 25% of respondents used to drink unboiled milk, which was very common among cattle keepers, and this poses a public health threat. These findings were similar to study in Ethiopia [19] that found out that Majority of human infection cases were resulting from consumption of raw milk. Our findings revealed that nearly two thirds of participants used to eat half cooked offals known as "umfitfit and marara" with spices which is a social and common practice in Sudan and South Sudan and this practice exposed people to brucellosis. These findings were in agreement with studies in Sudan [20] which found out that eating of half cooked "umfitfit" and " marara" puts people at risk of getting brucellosis and similarly a study from Tanzania [21] has similar findings.

This study finding found that the majority of participants did not know the transmission of brucellosis in animals meanwhile few respondents mentioned transmission from infected animal to another one and poisoned pasture as a route for transmission of brucellosis in animals. These findings were similar to studies in Nigeria [16] showed that, majority of livestock workers did not know the route of transmission. This was contrary to the research done in Uganda [7] that found out that, the respondents had high knowledge on route of transmission in animals that include eating of contaminated pasture. The limited knowledge on transmission of brucellosis calls for urgent intervention from health authorities to apply health awareness on zoonotic diseases and management.

The majority of the respondents believed that brucellosis was not treatable in humans while a few respondents agreed that brucellosis was treatable. Almost half of the respondents mentioned the use of modern medicine, nearly a quarters of participants suggested traditional medicine and only very few believed in both modern and traditional medicine for treatment of brucellosis in humans. These results did not agreed with that reported by [7] in Uganda that showed that, almost all respondents were knowledgeable about treatment in both humans and animals and this may be in Uganda brucellosis was properly diagnosed and reported. Most (95%) of the respondents mentioned the use of modern medicine in humans, this study findings reported only (52.9%) of respondents suggested that, the reasons may be in our study area very little was known about brucellosis in humans due to misdiagnoses and underreporting.

The majority of participants in this study did not know brucellosis is treatable in animals, meanwhile half of participants mentioned traditional medicine for treatment of brucellosis and low proportion of respondents suggested the use of modern medicine and very few respondents mentioned both modern and traditional drugs for treatment of brucellosis in animals. These findings were in disagreement with a study in Uganda [7].

Nearly three quarters of the respondents did not know that brucellosis was preventable in humans. Approximately, two thirds of the respondents did not know any kind of prevention sought for humans, and few proportion of the respondents mentioned drinking of boiled milk, consumption of well cooked meat, use of gloves while in contact with aborted materials and isolation of sick person from others or avoiding cuts on exposed body parts as a way to prevent brucellosis in humans. These findings were contrary to study in

Uganda [7] that found majority of respondents were knowledgeable about brucellosis prevention in both humans and animals, meanwhile only two ways of prevention were mentioned by respondents in both humans and animals included pasteurization of dairy products and proper cooking of meat which was in agreement with our findings that mentioned drinking of unboiled milk and consumption of well cooked meat. However, our findings also revealed that majority of the respondents used to eat half cooked meat locally known as "marara" and "umfitfit" and (36.4%) of participants preferred drinking of unboiled milk which is a common practice among most of the population. These practices exposed them to contract brucellosis. On other hand very few participants mentioned the use of gloves while in contact with aborted materials, this finding was similar to a study in Tajikistan [15] that found the majority of respondents did not wear gloves when in contact with animal aborted and other study from Egypt [17]. This was practically not sustainable and it was observed that most of respondents lack gloves but depend on washing hands with soap or ash after dealing with animals or aborted materials.

Majority of the participants did not know that brucellosis was preventable in animals, In contrast majority of participants did not know the way of prevention of brucellosis in animals, while few proportion mentioned isolation of infected animal and vaccination in contrary to study by [7] that found out majority of respondents were aware that brucellosis was preventable.

Majority of respondents had positive attitudes towards brucellosis prevention and this level of attitude creates an opportunity for health education to divert these attitudes into good practices .On other hand the majority of respondents agreed that they went to hospital when had persistent fever and this is positive health seeking behavior that promotes health and wellbeing of respondents. Concerning the existence of brucellosis almost majority of participants believed that brucellosis was not a common disease in the area and this was confirmed through KIIs and FGDs sessions.

Our findings revealed the majority (59.7%) of respondents had good practices towards brucellosis prevention while the most of the participants (93.5%) used to washed their hands with soap or ash after contact with animal remains, and this was due to lack of gloves. Our findings revealed that there was little knowledge and positive attitudes with good practices towards prevention of brucellosis which was contrary to study in Egypt [22] among veterinary doctors that found despite a high knowledge and positive attitudes was not necessarily translated into sound practices due to lack of gloves and to study from Nigeria [16] that found low knowledge and poor practices. This study had some limitations among them was that interviews and questionnaires addressed self perception and reporting, the possibility of miss reporting or biases cannot be ruled out however, we applied FGDs and KIIs to complement the quantitative method, secondly, the community animal health workers in Wau municipality were few in number and the majority of them were in Jur River county that why we include some of them to increased the sample size.

CONCLUSIONS

The study concluded that the majority of study participants were not aware of brucellosis causes, signs/symptoms, and mode of transmission, treatment and prevention in both humans and animals although they indicated positive attitude and good practices towards brucellosis prevention.

RECOMMENDATIONS

Sensitization of slaughterhouse and community animal health workers about brucellosis prevention in both humans and animals. Collaboration between public health and veterinary services for the better management of brucellosis.

ACKNOWLEDGMENTS

This study was funded through NORHED project No. UGA-13/0031. We would like to acknowledge the support of study participants and research assistants.

AVAILABILITY OF DATA

Data are available when it requested.

ETHICAL CONSIDERATIONS

The study protocol was approved by Institutional Review Board (IRB) of the School of Biosecurity, Biotechnical and Laboratory Sciences, Makerere University (Ref No.SBLS.PM.2015). Permission was obtained from Ministry of Health and Ministry of Agriculture, Animal Resources and Fisheries in Western Bahr el Ghazal State. The objectives of the study were explained to the study participants and written consent was obtained for each participant prior to answering the questions. Individual names of the respondents were not used; instead codes were used for confidentiality.

REFERENCES

1. Nasinyama G, Ssekawojwa E, Opuda J, Grimaud P, Etter E, Bellinguez A. Brucella sero-prevalence and modifiable risk factors among predisposed cattle keepers and consumers of un-pasteurized milk in Mbarara and Kampala districts, Uganda. African health sciences. 2014;14(4):790-6.
2. FAO, 2009.
3. Mukhtar F, Kokab F. Brucella serology in abattoir workers. J Ayub Med Coll Abbottabad. 2008;20(3):57-61.
4. Organization WH. Brucellosis in humans and animals: WHO guidance: Geneva, 2005.

5. Tumwine G, Matovu E, Kabasa JD, Owiny DO, Majalija S. Human brucellosis: sero-prevalence and associated risk factors in agro-pastoral communities of Kiboga District, Central Uganda. BMC public health. 2015 Sep 15;15(1):900.
6. Mangen MJ, Otte J, Pfeiffer D, Chilonda P. Bovine brucellosis in sub-Saharan Africa: estimation of sero-prevalence and impact on meat and milk offtake potential. Food and Agriculture Organisation of the United nations, Rome. 2002 Dec.
7. Kansiime C, Mugisha A, Makumbi F, Mugisha S, Rwego IB, Sempa J, Kiwanuka SN, Asiimwe BB, Rutebemberwa E. Knowledge and perceptions of brucellosis in the pastoral communities adjacent to Lake Mburo National Park, Uganda. BMC Public Health. 2014 Mar 10;14(1):242.
8. Nabukenya I, Kaddu-Mulindwa D, Nasinyama GW. Survey of Brucella infection and malaria among Abattoir workers in Kampala and Mbarara Districts, Uganda. BMC public health. 2013 Sep 30;13(1):901.
9. Mohamed MSE. Seroprevalence of brucellosis among abattoir house and butcher shops workers in Assiut City, 2001.
10. Refai M. Incidence and control of brucellosis in the Near East region. Veterinary microbiology. 2002; 90(1): 81-110.
11. Jok DAK. Epidemiological Study of Bovine Brucellosis in Western Equatoria State, Republic of South Sudan. Sudan Uiversity of Scienceand Technology, 2015.
12. Lado D, Maina N, Lado M, Abade A, Amwayi S, Omolo J, Oundo J. Brucellosis in Terekeka counTy, cenTral equaToria sTaTe, souThern sudan. East African medical journal. 2012;89(1):28-33.
13. Bati J, Legesse M, Medhin G. Community's knowledge, attitudes and practices about tuberculosis in itang special district, gambella region, south western Ethiopia. BMC public health. 2013 Aug 7;13(1):734.
14. Truong CD, Siriwong W, Robson MG. Assessment of knowledge, attitude and practice on using of personal protective equipment in rattan craftsmen at trade village, Kienxuong district, Thaibinh province, Vietnam. Warasan wichai witthayasat kanphaet= Thai journal of health research. 2009 Jan 1;23(suppl):1.
15. Lindahl E, Sattorov N, Boqvist S, Magnusson U. A study of knowledge, attitudes and practices relating to brucellosis among small-scale dairy farmers in an urban and peri-urban area of Tajikistan. PloS one. 2015 Feb 10;10(2):e0117318.
16. Adesokan HK, Alabi PI, Stack JA, Cadmus SI. Knowledge and practices related to bovine brucellosis transmission amongst livestock workers in Yewa, south-western Nigeria. Journal of the South African Veterinary Association. 2013 Jan;84(1):1-5.
17. Holt HR, Eltholth MM, Hegazy YM, El-Tras WF, Tayel AA, Guitian J. Brucella spp. infection in large ruminants in an endemic area of Egypt: cross-sectional study investigating seroprevalence, risk factors and livestock owner's knowledge, attitudes and practices (KAPs). BMC public health. 2011 May 19;11(1):341.
18. Organization WH. The control of neglected zoonotic diseases: a route to poverty alleviation: report of a joint WH, 2006.
19. Genene R, Desalew M, Yamuah L, Hiwot T, Teshome G, Asfawesen G, Abraham A, Abdoel TH, Smits HL. Human brucellosis in traditional pastoral communities in Ethiopia. International Journal of Tropical Medicine. 2009;4(2):59-64.
20. Mohd MG. Brucellosis in the Gezira area, Central Sudan. The Journal of tropical medicine and hygiene. 1989; 92(2): 86-88.
21. John K, Fitzpatrick J, French N, Kazwala R, Kambarage D, Mfinanga GS, MacMillan A, Cleaveland S. Quantifying risk factors for human brucellosis in rural northern Tanzania. PloS one. 2010 Apr 1;5(4):e9968.
22. El Hameed HS, El Hameed LT, Zayan KA. Awareness of Personnel in Direct Contact with Animals Regarding Brucellosis. J Am Sci. 2012;8(6):790-6.
23. SSNBS. South Sudan National Bureau of Statistics report, 2015.