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Research Article

Knowledge Attitude and Practices towards Cystic Echinococcosis among Pastoral Communities in Greater Kapoeta South Sudan

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Abstract

Background: Cystic Echinococcosis/Hydatidosis is a parasitic zoonotic disease of major public health importance globally. The disease is endemic in pastoral communities of developing countries because of poor hygienic conditions, illegal home and backyard slaughtering of animals coupled with the presence of stray dogs and poor veterinary services among others. In South Sudan, the magnitude and factors associated with persistence of cystic echinococcosis (CE) are not well documented. The purpose of this study was to assess the knowledge attitudes and practices of the pastoral community towards persistence and maintenance of cystic echinococcosis among domestic animals and humans in Kapoeta county Eastern Equatoria state, South Sudan.

Methods: A cross sectional study was conducted and a semi-structured questionnaires, observation, focus group discussions (FGDs) and key informants interviews were used to assess the knowledge, attitude and practices (KAPs) of the pastoral community.

Results: Out of the 353 respondents, only 6(1.7%) knew about CE, 41.9% and 78.5% had seen the disease in man and animals respectively, and a larger proportion (87%) of respondents were not aware that other animals also suffer from CE. Only 41.9.% perceived themselves at risk of acquiring CE from dogs. Practices identified as potential risk factors for CE included dogs left to move freely (96.7%), presence of stray dogs (79.9%), no deworming of dogs (95.1%), home slaughtering (58.9%), lack of meat inspection (95.5%), Dogs having free access to livestock slaughter facilities (83.3%), sometimes washing hands before eating food (62.9%), use of untreated water (84.4%), dogs left to feed on their own (93.5%) and do not dispose off dogs feces (95.1%). FGDs revealed that people do not perceived themselves at risk of infection from dogs, and that people think CE is caused by witchcraft.

Conclusions: The study clearly showed that there is a knowledge gap about the disease, and the predisposing factors that are responsible for the persistence and maintenance of CE within Kapoeta pastoral community were present. These are wide range of modifiable factors, which should constitute targets for control. There is therefore a need for community education about CE through the One Health Approach.

INTRODUCTION

Echinococcosis (syn. Hydatidosis) is a parasitic zoonotic disease of global importance. Echinococcosis also known as Cystic Echinococcosis (CE) is caused by larval stages (metacestodes) of dog tapeworms of the *Echinococcus granulosus* species complex, forming fluid filled cysts called "hydatid cysts" that are usually localized in the liver, lungs and other organs of intermediate and accidental hosts [1]. Echinococcosis affects various species of animals including humans, with dogs and other canids as the definitive hosts, herbivorous animals as intermediate host, and humans being an accidental host.

Although infections are not among the leading causes of

parasite-induced mortality worldwide, the disease represents a significant hazard to many parts of the world especially in developing countries. CE causes considerable suffering for humans impacting on the economy and social welfare as well as losses in agricultural production, and may lead to major impairment in individual and societal quality of life [2]. CE is highly endemic in sub-Saharan Africa and in East Africa especially in nomadic pastoral regions [3,4].

In South Sudan limited information exists on the magnitude of cystic echinococcosis infection in humans and domestic animals. Pastoral communities in South Sudan own dogs, and yet this close interaction between dogs and humans increases the risk of transmission of CE to humans. Lack of sufficient knowledge of the disease, the absence of effective prevention and management strategies and continuous interaction of human, domestic animal and wildlife may contribute to continuous spread of the disease. As a result, appropriate interventions are difficult to formulate and implement. The aim of this study was to assess the knowledge, attitude and practices among the pastoral communities of Greater Kapoeta, towards persistence and maintenance of CE. The findings of this study may contribute to the designing of control strategies of the disease in the communities.

MATERIALS AND METHODS

Study area

Greater Kapoeta, located in the far eastern horn of Eastern Equatoria State in South Sudan was chosen for the fieldwork of this study.

Greater Kapoeta has a population of 316,485 people, segregated into 170,768 males and 145,717 females with a population density of 13.10 people per Km^2 (Sudan Population census, 2008). The population is composed of herds men and farmers who live in close contact with their domestic animals (livestock and Dogs) as well as stray dogs. The community has passionate traditions for livestock rearing (pastoralist setting) and consumes most of the livestock products locally.

Greater Kapoeta has a large number of livestock due to the agro-ecological zones that make the area suitable for animal production. The cattle population is approximately 1,610,000 (SMARF report), which is comparatively higher than other states of greater Equatoria.

Study population

The study population was household heads within pastoral communities of Greater Kapoeta. In addition veterinary officers, community animal health workers, slaughter slab workers and medical officers were also included in the study.

Research design

Between January and March 2016, a community based cross sectional survey employing both quantitative and qualitative data collection methods was conducted in randomly selected households of the three parts of Greater Kapoeta (Kapoeta North, South and East). The aim of this study was to assess the communities' knowledge, attitudes and practices towards Cystic Echinococcosis. With the help of the county clerk and county veterinary officer, the researcher obtained list of domestic animal keeping households within the pastoral communities of Greater Kapoeta. A multi-stage sampling technique, involving both purposive and simple random sampling approaches was employed. Greater Kapoeta was stratified as stage one, stage two involved profiling the number of domestic animal keeping households within pastoral communities of Greater Kapoeta, and then finally the questionnaire administration. Community focus group discussions (FGDs), interviews with key informants, as well as observation were also conducted. Study eligibility was based on willingness to be interviewed and being a household head or spouse or a person in-charge of the household aged eighteen and above in the absence of the household head and the spouse. In addition veterinary and medical doctors were interviewed. Children and the very elderly were excluded from this study. This is because such persons were assumed to be having less or no knowledge to share about CE, hence they would not be very instrumental in informing the study.

Sample size determination

Sample size was estimated at 230 participants from all the three parts of greater Kapoeta using standard survey formula $n= Z^2pq/d^2$ [5,6]. Where n= required sample size, Z= the normal curve constant that represented the level of confidence (1.96), e= 5% level of precision of the estimate, a non-response rate of 10%. p= 3.9% proportion of knowledge of CE [7] and q is the 1-p. However, a total of 353 participants were enrolled in the study.

Data collection methods

Quantitative data collection: A community-based cross sectional survey was conducted in randomly selected households of fourteen (14) villages in Greater Kapoeta, to assess the knowledge attitude and practices of the communities about echinococcosis. A total of fourteen (14) villages were purposively selected. Because villages were sparsely populated, and most herders leave their homes very early in the morning with their cattle to look for pasture and water, we had to expand the search scope (coverage) of the study by including nearby villages from Kapoeta North and Kapoeta East so as to find more interviewees.

Three research assistants with good English and Toposa spoken language (local language of the study area) were selected from the community, and were trained prior to commencement of this study, and these research assistants were used for both questionnaire pretesting and the actual survey. Information on knowledge about CE, mode of transmission, treatment, and prevention, attitude towards the disease and risk practices for echinococcosis was collected using structured interviewer administered questionnaires. Majority of the questions were closed ended questions, and few follow-up questions were in open ended and the interviews lasted only for less than 30 minutes. The questionnaire was administered in English and was directly translated from original English version into the local native language (Toposa), by research assistant.

Data collected included socio-demographic characteristic of the respondent, questions related to knowledge on CE, attitude towards the disease and finally practices towards transmission and maintenance of the disease within the community. Pictures of

hydatid disease in man and hydatid cysts in organs of slaughtered animals were used as tools to explain to participants about the disease, since there was no clear local name for CE. A total of 353 questionnaires were administered to farmers and herders.

Upon completion of the questionnaire, the interviewers provided household members with relevant information regarding the disease in both animals and humans. This included a description of *Echinococcus spp*. life cycles and its cause, symptoms, mode of transmission, treatment, and measures to prevent infection. The participants were also given the opportunity to ask questions about Echinococcosis.

The qualitative data collection: The qualitative data collection protocol was by observation of the environment for possible risk factors like presence of stray dogs, presence of water collection points, observation at the slaughter area, the disposal of infected/condemned organs, presence of dogs at the slaughter area, all aided by note taking as well as taking pictures. In addition, four (4) key informant interviews were held with two (2) veterinary doctors (2), and two (2) medical doctors in English. These were conducted using non-structured interview guides that were administered face-to-face with the participants. The interview guides were also used to probe KAPs, beliefs, and experiences depending on the persons in question.

A total of five (5) FGDs comprising of eight members in each were conducted with cattle herders, farmers, slaughter men, butchers, CAHWs and slaughter slab workers. During FGDs there was a research assistant who did translation from Toposa to English and vice versa. I used both notes taking and audio recordings for both KII and FGDs. The findings were transcribed and themes and categories generated. Overall report was finally generated based on the themes.

Upon completion of every FGD, the participants were provided with relevant information regarding the disease in both animals and humans. This included a description of *Echinococcus spp*. life cycles and its cause, symptoms, mode of transmission, treatment, and measures to prevent infection. The participants were also given the opportunity to ask questions about Echinococcosis.

Data management

Questionnaire data: The questionnaires collected raw data were coded and entered into a data base using excel spreadsheet by two different persons to help compare the error rate and mismatch during data entry for validation of data. The validated data was then exported to IBM SPSS statistical software program (version 20) for analysis.

Both knowledge and attitude towards CE were measured as dichotomous outcomes hence Yes or No question. Individuals were asked whether they know about CE, and overall knowledge (dependent variable) of human and animal echinococcosis was assessed on correct knowledge of the disease and its symptoms (in animals and humans), mode of transmission, the treatment and prevention.

Attitude was assessed by asking whether individuals would like to get screened against CE; would like to get treated if found infected; would advice a community member who is infected to consult a doctor; and thinks he/she is at risk of acquiring CE from dogs. Those who answered Yes were regarded as having good attitude, and those who answered No as bad attitude. The results were presented in the form of frequencies, percentages (in tables, figures) and narrative texts.

Qualitative data: Recorded audios were transcribed and themes and categories generated from individual statements of participants. Since the interaction was hugely complex, decisions were made about which features of the interaction to transcribed, depending on the research topics discussed. Transcription was done through thorough repeated careful listening of the audios at least 1-2 hour of each recording. Overall report was finally generated based on the themes. The qualitative data were later used to compliment the quantitative or questionnaire data.

Quality assurance and control: Data collection tools and protocols were pretested and corrected before actual data collection. Documentation of procedures and methods was employed to ensure data quality. Data collected were evaluated routinely and constantly reviewed on a daily basis for completeness and coherency prior to entry into any data analysis tool.

Three Research Assistants were trained and selection was based on competence. Selection criteria were based on level of education (At least a diploma holder in animal health), fluent in both English and Toposa language, and experience working with the community.

Research ethical clearance

The study protocol was approval by Makerere University College of Veterinary Medicine Animal Resources and Biosecurity (COVAB) Institutional Review Board before data collection. In addition, permission to conduct the study was got from Eastern Equatoria State Ministry of Animal Resources and Fisheries and the commissioner's office Greater Kapoeta authorities. The study objective was explained to participants in their local language (Toposa) and informed consent was obtained from each study participant who agreed to participate. Each participant was interviewed independently the collected information was kept confidential, and for the purpose of confidentiality, numbers were used instead of participants' names.

RESULTS

Knowledge attitude and practices towards cystic Echinococcosis (CE)

Demographic characteristics: A total of 353 participants from Greater Kapoeta pastoral communities of 14 villages were randomly selected. The age of the respondents ranged from 18 to over 60 years. The proportion of male respondents was (54.7%; CI, 49.3,60.1) compared to females (45.3%; CI, 39.9,50.7). Regarding their level of education the majority (93.5%; CI, 90.9,96.0) had received no formal education, with only (2.0%; CI, 0.8, 3.7) and (4.5%; CI, 2.3,6.8) had received secondary level and primary level education, respectively. With regards to religion (89.5%; CI, 86.1, 92.6) were Catholics, (7.4%; CI, 4.8,10.2) Protestants, (2.3%; CI, 0.8, 4.0) Muslims and (0.8%; CI, 0.0, 2.0) had no belief in any religion (atheists). With regards to occupation, it was observed that herdsmen constitute (58%; CI, 53.0, 63.5) of the

study participants, followed by farmers (33.1%; CI, 28.6, 38.2), hunter (1.1%; CI, 0.3, 2.3), slaughterhouse worker (0.3%; CI, 0.0, 0.8), and others, that include students and housewives (6.8%; CI, 4.2, 9.6).

Knowledge of cystic Echinococcosis (CE) among study participants: An investigation into whether or not the participants have seen clinical signs associated with Echinococcosis like ascites, and emaciation showed that (41.9%; CI, 37.1, 46.7) of the respondents knew and had seen at least one person who showed such clinical signs. Only (1.7%; CI, 0.6, 3.1) knew what the condition is, however (98.3%; CI, 96.9, 99.4) didn't know Echinococcosis, (98.3%; CI, 96.9, 99.4) did not know how its transmitted to humans, and (98.3%; CI, 96.9, 99.4) did not know how human can prevent its transmission.

Whilst a larger proportion (87%; CI, 83.3, 90.4) of respondents were not aware if other animals also suffer from Echinococcosis, (78.5%; CI, 74.2, 82.7) of respondents reported to have seen hydatid cysts in visceral organs of slaughtered livestock or dead ones. In addition only (5.1%; CI, 2.8, 7.4) of the respondents knew that dogs and ruminants also suffer from Echinococcosis, and (60.6%; CI, 55.2, 65.7) were not aware of the dangers of eating raw vegetables. The level of knowledge on CE among study participants is shown in Table 1.

The study findings clearly showed that majority of the respondents during FGDs reported to have seen clinical signs related to Echinococcosis in humans, however they did not know what causes the condition and the treatment for the disease. The disease is locally known as *"Agwaigwai"* meaning 'a disease that causes distended stomach like for a pregnant woman, loss of weight and death'.

FGD participants also described CE in humans and its symptoms;

"It is a serious disease, it kills after a long time, It came unknowingly but it is serious and it has killed so many people, The signs and symptoms they mentioned include; very big stomach, you might think it is pregnancy but pregnancy for over nine months, the legs and hands are very thin, a very big head, then later the legs become swollen, coughing, and finally death".

FGD participants also described CE in animals, the mode of transmission and its symptoms. These findings also indicated that community members were not knowledgeable about the cause of the disease in animals;

"It came unknowingly but it is a serious disease and it killed many of our animals, we don't know what this is, in fact veterinary doctors should bring the exact vaccine for this disease. The signs and symptoms they mentioned include; high fever, salivation, foaming, recumbency, loss of appetite, lacrimation, round vesicles in different organs, filled with water, some are very hard like stones" (FGD with farmers and herders).

One female participant added;

"It is a serious disease in this community, it kills in a short time, It is a serious disease affecting our animals, when an animal dies, you find all the amanyas (meaning organs) are infected, It is a transmitted disease caused by worms, (FGD with farmers)".

Majority also reported to have seen hydatid cysts-like signs in the organs of animals (cattle sheep, and goats). The condition in animals is called "Etokgizei Amanya" (meaning disease of organs).

"I always see this disease in my cattle that died, especially in the liver and lungs' reported one participant from FGD while a local butcher stated that "we see this disease every day whenever we slaughter cows, sheep and goats".

In addition, the veterinary doctor who carries out meat inspection in Kapoeta South slaughter slab reported that the frequency of hydatid cysts in organs (liver, lungs spleen, kidney, heart and mesentery) of animals slaughtered was 50%-70% on daily basis; with four to five times more occurrence in liver, and lungs than other visceral organs. He concluded that, on rare occasions, some cysts were encountered in the hind and fore limbs.

Attitude of study participants towards cystic Echinococcosis (CE): Four questions from the questionnaire assessed the attitude of the study participants towards CE. (31.4%; CI, 63.7-73.4) of the respondents would not like to be screened against CE, while (10.5%; CI, 7.4-13.6) would not like to get treated against the disease. An investigation on whether the respondents think they were at risk of contracting CE from dogs showed that (58.1%; CI, 53.3-63.7) of the respondents do not think they can acquire disease from dogs. Table 2 shows attitude of respondents towards CE.

From the FGDs, most participants claimed that a majority of suspected hydatid disease human cases (out of 10 cases, 7 go to native healers) usually go to witch doctors/traditional healers first for primary treatment then they use herbal medicine if primary treatment fails. FGDs further revealed that usually going to the hospital is the last resort.

"I had a relative who died recently from this disease. We first took her to a traditional healer, but it didn't help her. We later gave her some herbal medicine got from Singata River, usually good at treating all sorts of diseases, but that also did not work. We finally took her to the hospital, but nothing was done. They were referring her to Torit, and they wanted lots of money for operation, which we didn't have, and Torit was very far" says one elderly man, who participated in both male and female FGD-(farmers).

In Kapoeta, hydatid disease is a taboo, the communities usually associate it to be a disease caused by "witch-craft," or misbehaving around "Singata River". People infected are usually chased away from the house, or abandoned without care.

"It is a serious disease, when you misbehave around Singata river you get this disease immediately, it is also caused by witchraft, and people fear the sick, when someone gets sick, he/she could get isolated", (FGD with farmers and herders).

"I want you to treat me from this disease doctor. My uncle chased me out of his house, that he does not want "Fagara" meaning (problems associated with bad luck)", reported a teen age boy who was showing signs quite similar to that of hydatid disease. Community members were also asked whether they were at risk of contracting CE from dogs. Some people did not

Table 1: Knowledge of cystic Echinococcosis (CE) among study participants.

Variable	Category	Frequency	Proportion (%)	95% CI	
		n=353		Lower	Upper
Knowledge about the condition /Echinococcosis	Yes	6	1.7	0.6	3.1
	No	347	98.3	96.9	99.4
Knowledge about CE transmission	Yes	6	1.7	0.6	3.1
	No	347	98.3	96.9	99.4
Knowledge about CE prevention	Yes	6	1.7	.6	3.1
	No	347	98.3	96.9	99.4
Awareness that animals also suffer	Yes	46	13.0	9.6	16.7
	No	307	87.0	83.3	90.4
Knowledge about species of animals affected	Don't know	307	87.0	83.6	90.6
	Dogs	18	5.1	2.8	7.4
	Cattle and shoats	18	5.1	2.8	7.4
	Camel	1	0.3	0.0	0.8
	All animals	9	2.5	1.1	4.2
Aware of the dangers of eating raw vegetables	Yes	140	39.7	35.1	44.5
	No	213	60.3	55.5	64.9
Dangers associated with eating raw vegetables	Don't know	213	60.3	55.2	65.7
	Diseases	108	30.6	25.8	35.1
	Worms	19	5.4	3.1	7.9
	Diarrhea	9	2.5	0.8	4.2
	All of above	4	1.1	0.3	2.3
Seen hydatid cyst in slaughtered animals	Yes	277	78.5	74.2	82.7
	No	76	21.5	17.3	25.8
Seen CE disease in human	Yes	148	41.9	37.1	46.7
	No	205	58.1	53.3	62.9
Spotted stray dogs around village	Yes	282	79.9	75.9	84.1
	No	71	20.1	15.9	24.1

Table 2: Attitude towards cystic echinococcosis (CE) among study participants.

Variable	Category	Frequency n=353	Proportions (%)	95% CI	
				Lower	Upper
Would you like to be screened against CE	Yes	242	68.6	63.7	73.4
	No	111	31.4	26.6	36.3
Would you like to get treated if found infected	Yes	316	89.5	86.4	92.6
	No	37	10.5	7.4	13.6
Would you advice a suspected community member to consult a medical doctor	Yes	293	83.0	79.3	87.0
	No	59	16.7	13.0	20.7
Think you can acquire CE from dogs	Yes	148	41.9	36.3	46.7
	No	205	58.1	53.3	63.7

Table 3: Practices of study participants related to hygiene, management system of animals and slaughter of animals.

Variable	Category	Frequency n=353	Proportion (%)	95% CI	
				Lower	Upper
Consume fresh raw blood	Yes	289	81.9	77.9	86.1
	No	64	18.1	13.9	22.1
Washing of hands before eating food	Always	92	26.1	21.5	30.6
	Sometimes	222	62.9	57.5	68.3
	Never	39	11.0	7.9	14.2
Water for use treated	Yes	55	15.6	11.9	19.5
	No	298	84.4	80.5	88.1

Source of water	Tap	55	15.6	1.9	11.9
	Stream	63	17.8	2.0	13.9
	Any pool of water	187	53.0	2.6	47.9
	Bore hole	48	13.6	1.8	10.2
Grow vegetables within the compound	Yes	171	48.4	2.8	53.5
	No	182	51.6	46.5	57.2
Management system of keeping animals	Nomadism	218	61.8	56.4	67.1
	Zero-grazing	7	2.0	0.6	3.7
	Tethering	3	0.8	0.0	2.0
	Agro-pastoral	125	35.4	30.0	40.8
Where animals are slaughtered	Slaughter slab	14	4.0	2.0	6.2
	Under the tree	131	37.1	32.0	42.5
	At home	208	58.9	53.5	63.7
Meat inspection practice	Yes	16	4.5	2.3	6.8
	No	337	95.5	93.2	97.7
Dogs have free access to livestock slaughter facilities	Yes	294	83.3	79.6	87.3
	No	131	37.1	12.7	20.4

Table 4: Practices related to dog ownership.

Variable	Category	Frequency n= 123	Proportions (%)	95% CI	
				Lower	Upper
Dog ownership	Yes	123	34.8	29.7	39.7
	No	230	65.2	60.3	70.3
Reason for keeping dogs	Security	84	68.3	60.6	70.0
	Security and Companion/pet	2	1.6	19.0	28.3
	Security and hunting	37	30.1	0.0	1.4
How dogs are kept	Confined	4	3.3	0.8	6.5
	Left to move freely	119	96.7	93.5	99.2
Source of food for dogs	Kitchen leftovers	5	4.1	0.6	0.3
	Purchase from market	3	2.4	0.5	0.0
	Feeds on its own	115	93.5	2.5	27.8
Disposal of dog's feces	Yes	6	4.9	1.6	8.9
	No	117	95.1	91.1	98.4
Disposal method of dogs feces	Do not dispose off dogs feces	117	95.1	91.1	98.4
	Deep burial	1	0.8	0.0	2.4
	Thrown to the bush	5	4.1	0.8	8.1
Treatment of dogs	Yes	6	4.9	1.6	8.9
	No	117	95.1	91.1	98.4
How often dogs are treated	Frequently	1	0.8	0.0	2.4
	Occasionally	5	4.1	0.8	8.1
	Never	117	95.1	91.1	98.4
Dogs accompany grazing animals	Yes	100	81.3	74.0	87.8
	No	23	18.7	12.2	26.0
Yes Use dogs to guard livestock	Yes	102	82.9	76.4	90.2
	No	21	17.1	9.8	23.6

Table 5: Number of dogs owned and duration of ownership years per interviewed household.

	n	Range	Mean	Std. Deviation
No of dogs owned	123	1-6	1.9	1.2
No. Males	97	1-4	1.4	0.7
No. Females	54	0-5	1.4	0.9
Dog keeping (yrs.)		0-3	0.7	1.1

believe they could acquire this disease from dogs; "I thought dogs only cause rabies?" one participant during FGD observed.

Practices towards maintenance and persistence of cystic echinococcosis (CE): An investigation on the different practices that are risk factors for CE infection revealed consumption of fresh raw blood (81.9%; CI, 77.9-86.1)), not washing hands always (62.9%; CI, 57.5-68.3), dogs having free access to livestock slaughter places (83.3%; CI, 79.6-87.3), do not use treated water (84.4%; CI, 80.5-88.1) and home slaughter of livestock (58.9%; CI, 53.5-63.7) as some of the high risk practices. Table 3 shows the different practices towards CE infection .

With regards to disposal of infected offal/organs, (39.9%; CI, 33.2-46.6) reported throwing away infected offal/organ, (25.5%; CI, 19.7-31.3) feed dogs directly with infected offal/organ and (20.2%; CI, 14.9-25.5) of respondents reported eating the infected organs as well. In addition, (9.6%; CI, 5.8-13.5) of respondents would throw away infected part and eat the clean uninfected part; while (4.8%; CI, 2.4-8.2) respondents reported to eat the clean un- infected part and feed dogs with infected (Figure 1).

From observations during the slaughterhouse survey for CE in cattle, the workers/inspectors usually trim the infected part with a hydatid cyst and throw away, and then the other clean parts passed for human consumption. In addition, other workers do come with their dogs, and this are usually fed infected offal. Any attempt to properly dispose off the infected organs is considered wasteful;

"Give them to the dogs, don't take away, and why take away when there are hungry dogs around desperate for food'? One female worker at the slaughterhouse said.

FGDs also revealed that the practice of feeding dogs infected organs not only exists at slaughter slab, but also common at home state level; "I have also seen this disease in organs of animals that we slaughter or the once that die. What we usually do is, to cut off the infected parts and feed to dogs, and then cook the other clean parts", reported one participant during FGD with farmers.

An investigation to assess whether they practice hand washing before and after eating food revealed that, most participants do not believe in washing hands; "We eat food once a day, and in groups, by the time one goes to wash hands, food would have gotten finished. Washing hands is a waste of time, besides the water is even dirty"; states some participants during FGDs. Some cultural norms were observed during this study, that included drinking fresh raw blood mixed with milk and ghee; "We move long distance for cattle grazing and to look for water, this is energy for us, reported one cattle herder", reported one herder during FGD.

The association between livestock with humans and close contact between dogs and various domestic animals, especially small ruminants is a common practice. Another observation that stems out of this association was that, many families had small plots of land and lived in close proximity with their livestock and dogs, and the dogs were often left to feed for themselves (Figure 2).

Observations revealed many illegal backyard slaughters occurring deep in the villages without formal meat inspection as a common practice. More often, both stray and domesticated dogs do access those points (Figure 3). Other practices observed were dogs cleaning young children bottoms especially after defecation, dogs accompanying cattle during grazing; and dogs left to freely roam looking for their own food have also been observed (Figure 3).

The study also described aspects related to dog ownership, management and treatment (Table 4). Out of 353 respondents, (34.8%; CI, 29.7-39.7) owned dogs that also provided security for (68.3%; CI, 60.6-70.0) of the respondents; those left to move freely comprised (96.7%; CI, 93.5-99.2); while (93.5%; CI, 2.5-27.8) of the dog owners left them to scavenge for food. This study also revealed other risk practices that included lack of disposal of dog feces (95.1%; CI, 91.1-98.4) and only one respondent (0.8%; CI, 0.0-2.4) reportedly used deep burial as means of fecal disposal method Furthermore, (95.1%; CI, 91.1-98.4) of the dog owners never treat their dogs; (81.3%; CI, 74.0-87.8) of them reported that dogs accompanied them during grazing of animals, and a similar number (82.9%; CI, 76.4-90.2) used dogs to guard their livestock (Table 5).

This study also revealed the number of dogs kept by interviewed household to be 1-6, with the total maximum number of 3 years of keeping dogs (Table 3).

Dealing with hydatid disease as a challenge: Another area of improvement as stated by a medical doctor (key Informant) was the need to address the challenges of continuing hydatid disease (CE) stigma. "As a county we have received a number of cases, some of which needed an emergency operation, but we could not do anything because we do not have an operational theatre. We always refer suspected cases to Torit Referal hospital, which is like five hours drive from Greater Kapoeta, which makes follow-up very difficult. In addition to that, most suspected patients are reluctant to travel because of issues to do with finances". He added, "We need to provide services specifically for CE under the same roof; these are service like diagnosis, treatment, operation and prevention and control of this disease to Kapoeta community"

Interviews with key informants also confirmed and stressed the need to supply hydatid disease diagnostic equipment, "Just like HIV programs, Epilepsy program, Polio programs, there

is a need to introduce hydatid disease program, which will specifically handle this disease and even create awareness to the entire community". A community member who lost a relative from hydatid disease also concurred with the need to give special attention to hydatid disease in Greater Kapoeta during FGD. "We are a poor community, and most times lack of money prevents us from seeking medical care. My aunt died from this disease, not because of ignorance but because of lack of money. Here it's a taboo, and relatives will never come to your help".

Construction of a standard Abattoir: The need to construct a quality abattoir that is well fenced with adequate working space and availability of holding ground emerged as another area of improvement for controlling hydatid disease transmission to both the definitive hosts and intermediate hosts. "It is good you have been here with us; you have seen that we do not carry out the normal routine inspection. Secondly, you have seen so many dogs roaming around here looking for meat; it is very difficult to control them, because this place is not fenced" said one public health assistant. Discussion with key informants also revealed that indeed they do not carry out ante mortem inspection because of lack of space for holding animals prior to slaughter.

There were a large number of stray dogs accessing the slaughter area, and efforts done to chase them away were unsuccessful. On average there were about 30 dogs daily around the slaughter area. These dogs always fed on infected offal and sometimes had access to condemned offal. The slaughter slab is not fenced and situated within the vicinity/human dwellings, and hence is frequented by stray dogs and has the potential of sustaining the parasite in dogs that would in turn infect cattle and humans through contamination of the environment (Figure 4).

The need to enforce the policies and regulations governing veterinary services: An interview with some key informants (veterinary doctors) revealed that, there were yet no official policies and regulations governing veterinary services including meat inspection regulations in the country. Due to lack of the policies and regulations governing veterinary services, the veterinary doctors feel insecure, as such consumers as well as other animals are exposed to pathogens including zoonotic parasites, as well as certainly increasing the risk for malpractice.

"Why would I risk my life for the sake of meat inspection to people who don't even understand what am doing? What if I get shot for condemning their meat, which is responsible", stated one veterinarian.

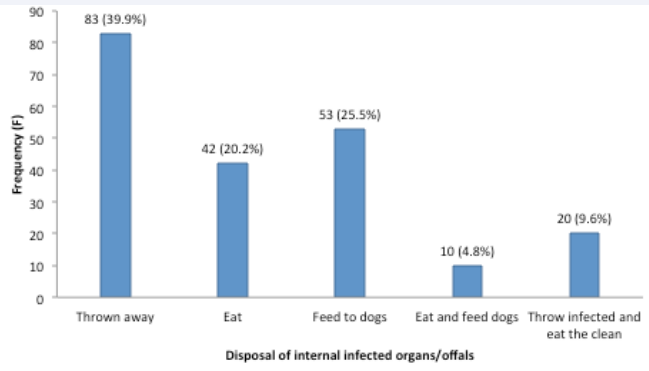

Figure 1 Methods of disposal of condemned internal infected organs.

Figure 2 Close association between humans and dogs at household.

Figure 3 Illegal home/under the tree slaughter of animals in presence of dogs with no meat inspection.

Figure 4 Unfenced slaughter slab, accessed by dogs, and dogs fed infected organs.

One of the informant indeed revealed that, instituting strict rules and regulations could only change some cultural norms within the community. He added, any attempt to condemn and properly dispose off the infected organs is considered wasteful. "When you condemn, they get so agitated, they think it is malicious intent, some are so aggressive that they threaten to shoot, even when you throw the condemn organs in a pit, or burry, they will still go and get it out and eat". One key informant added that most community members even don't fear that it's risky to eat dead animals. He further reported that his community members are so adamant that they don't understand that it is dangerous to eat a dead animal, even when the animal has died two days ago, they will celebrate and still eat it.

DISCUSSION

Factors associated with socio-demographics: From our present study, the results revealed that most of the study

participants did not attend any formal education 330 (93.5%), and none had tertiary education qualification. This finding is very important, as it has been shown that to a larger extent; education does influence occupation choice and lifestyle [8-10].

From this study, it was observed that cattle herding was a predominant activity. This is evident in a typical pastoralist community, and most studies in East Africa have documented occurrence of CE in pastoralist community [3,7,11,12]. The Kapoeta communities are a nomadic pastoralist community whose main occupation is livestock herding. The community's wealth is measured in terms of the herd population owned by an individual and they have a special attachment to their livestock. Occupation of an individual has been found to be one of the most important factors in the epidemiology of cystic echinococcosis. Cattle herding has long been considered an occupational risk factor for human CE because of its association with domestic dogs and livestock, hence an important factor in the epidemiology of CE. Several studies have shown increased risk of CE among herdsmen. Studies in China, reported herdsmen having the highest risk for CE infection [13-17]. However, other studies reported farmers and hunters as risk factors for CE [18,19].

With regards to religion, 316 (89.5%) were Catholics, 26 (7.4%) Protestants, 8 (2.3%) Muslims and 3(0.8%) do not believe in any religion (atheists). Religion was found to influence the occurrence of CE in some communities like in China. For example; Buddhist practice forbids killing any animal, including dogs [16], and this practice leads to large numbers of stray dogs, which mainly scavenge freely including accessing of livestock slaughter points, where they are fed on hydatid cyst infected visceral organs by herdsmen and slaughter personnel.

Factors associated with knowledge about Cystic Echinococcosis: This study revealed that the level of knowledge on CE was very low. Out of 353 respondents, only 6 (1.7%) knew about CE and 347(98.3%) had no knowledge about CE. Despite the health and economic importance of CE, there is a knowledge gap and these low levels of knowledge about the disease could be attributed to several factors including lack of cooperation among public health, agriculture and local authorities, and lack of diagnostic tools for CE in this county among others. Thus, the disease is given less attention. This is consistent with findings of Luke and others (2013), who reported a significant association between knowledge about hydatidosis with education levels and pastoralism [7]. The knowledge gap about the disease among Kapoeta communities implies that, cystic echinococcosis is rightfully considered a neglected tropical disease, and this may predispose the population to high risk of infection. Also the findings of this study are consistent with reports from Tanzania [20], Ethiopia [10] and report from Jordan [21] which also revealed a significant association between knowledge about Echinococcosis and education level.

Attitude towards Cystic Echinococcosis: From this study, the attitude of the study participants towards CE was also assessed and found that 111 (31.4%) of the respondents would not like to be screened against hydatid disease. In addition, 205 (58.1%) of the respondents do not think they can acquire disease from dogs, whereas only 37 (10.5%) do not like to get treated against the disease. This attitude poses a high risk of infection by echinococcosis and other zoonotic diseases like Rabies, and Leishmaniasis to the pastoral communities of Kapoeta, because respondents do not perceive themselves at risk and hence are not likely to guard against getting the disease or even to seek medical attention.

The findings from this study clearly show the lack of sensitization about CE disease in kapoeta. Many people would be willing to get screened and this could be influenced by knowledge about the disease and its associated risks. Knowledge about Echinococcosis and the attitude towards the disease among high-risk groups are crucial in influencing the health seeking behavior of patients as well as controlling its transmission in animals and humans in communities [8]. In this study as well, FGDs highlighted poverty, accessibility, and lack of knowledge to be factors that influence attitude. FGDs further confirmed that the communities are only aware of the role of dogs in rabies infection but not cystic echinococcosis. This findings conforms to a study done by Luke and co-workers (2013) in Kasese district, Uganda, which also established that the pastoralist communities had no idea of other zoonoses from dogs such as CE, and also found out that education is a key determinant of perception about CE [7,8].

Factors associated with practices towards transmission and persistence of Cystic Echinococcosis: Questionnaire results revealed that; under the tree 131 (37.1%) and home slaughtering 208 (58.9%) of animals was a common practice, 53 (25.5%) of respondents reported to feed dogs directly with infected offal/organ, or thrown away 83 (39.9%). This alone constitute a serious problem due to the large amount of infected offal/organs discarded; a situation that may lead to the increased environmental parasitic load and the risk of infection could be high considering the illegal slaughters that are un inspected.

The lack of knowledge about echinococcus and its transmission among the population explains the frequent practice of feeding dogs with hydatid-infected offal [22]. In addition, it is quite obvious and chances are high that stray dogs will eventually scavenge this infected offals that are being thrown away as well as neighboring domesticated dogs.

Similar results were observed in Tanzania, where majority of community had their dogs managed freely and fed raw condemned offal [20], and other authors have documented high prevalence of cystic echinococcosis in livestock and dogs due to this kind of practice [3,23-25]. Home slaughtering has been found in previous studies to be positively associated with coproantigen positivity [26-28].

Home slaughtering likely increases the risk of feeding unwanted infected offal to dogs, and this kind of association would be expected to represent *E. granulosus.*

Furthermore, majority of dog owners 117(95.1%) reported not to treat their dogs. This means that a very high risk of transmission of *E. granulosus* from intermediate to definitive hosts and vice versa is present in this pastoral community, considering the endemic status of CE in Kapoeta [23]. *Echinococcus granulosus*, the cause of CE in humans, is maintained throughout most of its worldwide distribution in dogs (definitive hosts) and domestic ungulates (intermediate hosts) and exposure and risk of infection in humans is strongly influenced by human behavior

in relation to husbandry practices and contact with these hosts [29].

Assessment of hygienic practices revealed that only 55 (15.6%) of the study participants use treated water, where as 298 (84.4%) do not use treated water. In addition to that, 171 (48.4%) grow vegetables in compound but only 92 (26.1%) wash hands before eating food. An unhygienic practice also emphasizes the poor knowledge that Kapoeta communities have about Echinococcosis. This in turn will aid in sustaining the active transmission of *E. granulosus* since infection in humans is through accidental ingestion of contaminated (vegetables, contaminated soil, water) with *E. granulosus* eggs. The communities of Kapoeta should be educated about washing of hands before and after eating food, washing of vegetables, and drinking of clean water.

This study also revealed the total maximum number of dogs kept by interviewed household to be 6, with the total of 3 maximum numbers of years of keeping dogs. Livestock keeping households own more dogs because they rely on dogs to guard and herd their livestock. From this we could infer that the more the number of years of contacts with dogs the higher the chances of human infection accidentally.

This close association between humans, livestock and dogs poses a triple CE risk factor for successful completion of the parasite lifecycle through co-habitation of accidental, intermediate and definitive hosts.

This is consistent with previous studies that having owned 3 or more dogs were associated with eightfold increased odds of CE, highlighting the importance of dogs as definitive hosts in the life cycle of *E. granulosus* in endemic areas (Moro et al., 2007; Moro et al., 1999).

Furthermore, these dogs are often left to move freely 119 (96.7%); are left to feed on their own 115 (93.5%), and 117 (95.1%) of the owners reported not to deworm or treat their dogs. This uncontrolled roaming of dogs poses a high risk of persistent infection with E. granulosus, because chances are high that these dogs scavenge on condemned infected offals. In addition, 282 (79.9%) of the respondents reported to have seen stray dogs freely roaming around the villages, 294 (83.3%) have confirmed that dogs have free access to livestock slaughter places/facilities. This will pose high risk to other livestock species; through possible contamination of pasture with viable *E. granulosus* eggs as well as accessing contaminated condemned offals especially from unfenced slaughter points (Eckert and Deplazes, 2004). The abundance of infected definitive host and a high stocking rate of livestock contributed to the transmission of CE and to the differences in prevalence in different areas.

CONCLUSIONS AND RECOMMENDATION

The results obtained through questionnaire survey and the qualitative data clearly showed that CE is a very serious public health and socio-economic problem, which requires an integrated control measures to resolve the situation. The close association of people to livestock and dogs, combined with low levels of hygiene and lack of knowledge of the disease contribute to the maintenance and transmission cycles of these zoonotic tapeworms.

The findings from this study also confirm the continued occurrence of certain practices such as feeding of dogs infected and condemned offals, free access of dogs to slaughter points and lack of deworming of dogs. These practices may facilitate the transmission of *E. granulosus* in endemic areas. Consequently, improving the knowledge and awareness of the disease among the Kapoeta pastoral community is imperative in any future control or prevention strategies. It is therefore recommended that a One Health Approach be encouraged in the provision of health education and information on the cause, symptoms, transmission and prevention of Echinococcosis.

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