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Study on Prevalence of Bovine Cysticercosis and Human Taeniasis in Jigjiga Town, Somali Region, Eastern Ethiopia

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Keywords: *bovine, cysticercosis, cyst viability, jigjiga, organ, prevalence, public health.*

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Study on Prevalence of Bovine Cysticercosis and Human Taeniasis in Jigjiga Town, Somali Region, Eastern Ethiopia

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Keywords: bovine, cysticercosis, cyst viability, jigjiga, organ, prevalence, public health.

I. Introduction

The total livestock population in Ethiopia according to 2014 estimation was 56.71 million cattle, 29.33 million sheep, and 29.11 million goats, which places Ethiopia first in Africa and ninth in the world in terms of total stock populations (CSA, 2015). Despite the reported high livestock population of the country, livestock diseases negatively affect public health and impede economic growth by incurring direct (morbidity and mortality) and indirect economic losses (EARO, 2006).

Most parasitic zoonoses are neglected diseases despite causing a considerable global burden of ill health in humans and having a substantial financial burden on livestock industries. The major contributors to the global burden of parasitic zoonoses are toxoplasmosis, foodborne trematode infections, cysticercosis, echinococcosis, leishmaniasis, and zoonotic schistosomiasis (Torgerson and Macpherson, 2011).

Cysticercus bovis is a food-borne parasitic disease caused by the immature form of the human *cestode Taenia saginata* commonly referred to as the beef tapeworm (Karshima *et al.,* 2013). Bovine cysticercosis refers to the infection of cattle with metacestodes of the human tapeworm (Ambachew and Yitagel, 2015). This parasite is universally distributed in developing as well as in developed countries (Gracey and Collins, 2011; Cabaret *et al.,* 2002; Dorny *et al.,* 2009).

Transmission of the parasite occurs most commonly in the environment characterized by poor sanitation, primitive livestock husbandry practice, and inadequate meat inspection, management, and control police (Mann, 2014). Cattle become infected through accidental ingestion of food or water which is contaminated with human feces containing viable T. *saginata* eggs. These eggs can remain viable for several weeks or months in sewage, water, or pasture. After 8-10 weeks the eggs have developed into larvae which establish in bovine skeletal and cardiac muscle and less commonly in fat and visceral organs. They develop into cysticerci (viable cysts), remaining infective for approximately nine months before they eventually die and calcify, and becoming non-infective (non-viable cysts) (Hiepe *et al*., 2005).

Humans become infected after ingestion of raw or undercooked beef containing infective cysticerci (Dorny *et al*., 2010). The disease in humans is called taeniasis which is accompanied by symptoms like nausea, abdominal discomfort, epigastric pain, diarrhea, excessive appetite or loss of appetite, weakness, loss of weight, and intestinal blockage. Sometimes, the mobile gravid segments may make their way to unusual sites

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such as the appendix and biliarytract and may cause serious disorders (WHO, 2013).In cattle, natural infections are normally asymptomatic but they cause financial losses to the cattle industry due to downgrading, condemnation, extra handling, and refrigeration of the infected carcasses.

The main intervention to control bovine cysticercosis is education on hygiene, meat inspection, followed by condemnation or freezing treatment when necessary as prescribed by European legislation, (Laranjo-González, 2000).

The larval stage (Metacestode) of this tapeworm has both public health and economic significance (Taresa *et al.,* 2011) as per an estimate, 50 million cases of such infestations occur worldwide with 50,000 people dying from this problem annually (WHO, 2015). The economic losses resulting from condemnation and downgrading of carcasses and due to treatment of carcasses to make them fit for human consumption (Deressa *et al.,* 2012).

The geographic distribution status of Taeniasis is more serious and less recognized for public health problems in developing countries (Minozzo *et al.,* 2002). Whereas, the distribution of Bovine cysticercosis is international and is very common in Africa. It is highly endemic in areas of Central and East African countries like Ethiopia, Kenya, and Zaire (Acha *et al.,* 2003). According to WHO classification, South American countries are included among the moderate prevalence of *Taenia saginata*. According to Over et al. (2013), *T. saginata* metacestode infections in cattle have been reported with higher prevalence from Senegal (20%), Nigeria (0.2-9%), Cameroon (7.2%), Tanzania (0-27%), and Kenya (38-62%).On the other hand, prevalence is very low in developed countries, such as 0.48-1.08% in Germany (Abuseir *et al*., 2006).

Bovine cysticercosis is widely distributed in Ethiopia and several individuals reported the prevalence of bovine cysticercosis in different parts of the country. According to these reports, a prevalence of 6.4% in Kombolcha Elfora by Alemneh (2015), 9.7% in Gondar by (Dawit, 2012), 21% in Nekemte by Ahmed (2015), 13.85% in Debre Zeit by Getachew (2013), 19.5% in Bahir Dar by (Mulugeta, 2012), and 3.2% in different agro-climatic zones by (Tembo, 2012) was recorded.

The epidemiology of human taeniasis varies from one area to another so control measures appropriate in one area are not necessarily of value in another. Hence, it is essential to have adequate knowledge of the epidemiology of the disease before contemplating control programs, (Teklemariam and Debash, 2015). In Ethiopia, some studies have been conducted on bovine cysticercus at different times. But the studies performed were limited to few parts of the country and there is a scarcity of information on the prevalence of bovine cysticercosis and human taeniasis in and around Jigjiga City. Therefore, the objectives of this study are:

- To estimate the prevalence of bovine cysticercosis and associated risk factors as well as studying the localization/organ distribution and viability/ degeneration of *c. bovis* at jigjiga municipal abattoir.
- To assess the prevalence of human taeniasis (*T. saginata*) and factors associated with its occurrence.

II. Materials and Methods

a) Study area

The study was conducted in Jigjiga municipal abattoir from November 2019 to April 2020. Jigjiga is the capital city of the Somali Regional State (SRS). Jijiga town is found within the Fafan zone and is located 675 km from Addis Ababa. It is astronomically located at 9°30' N latitude and 42°50' E longitude.20Hence, the average annual temperature of the town is 20°C indicating the existence of sub-tropical temperature condition whereas the mean monthly temperature varies from 17.34°C to 21.43°C in December and April, respectively. The hottest month is May while December is the coldest month with an average annual temperature of 20.02°C. The mean annual rainfall of Jijiga is just about 598 mm. The mean monthly amount of rainfall varies between 10.2mm to 102.2 mm in February and April, respectively (Jigjiga meteorological station, 2014).

b) Study Population

The study populations were cattle that are brought to Jigjiga municipal abattoir for slaughter purposes irrespective of their age, sex, body weight, and origin. Accordingly, those animals were subjected as a study population for an active abattoir survey. For the questionnaire survey, respondents were selected based on a systemic random sampling of individuals from Jigjiga city. Accordingly, a certain number of volunteer individuals were interviewed.

c) Study Design

A cross-sectional study was designed to perform from November 2019 to April 2020 to determine the prevalence of bovine cysticercosis and human taeniasis in Jigjiga city.

d) Sample Size Determination

The sample size (n) was determined according to Thursfield (2007) by using the following formula

$$n = \frac{(1.96)^2 \text{Pexp}\,(1 - \text{Pexp})}{\text{d}^2}$$

Where:
n = required sample size
P_{exp} = expected prevalence
d = desired absolute precision = ±5%
$(1.96)^2$ = confidence interval of 95%

There was a previous study with an expected prevalence of 2.25% (Biruk, 2009) in the study area, after the substitution, 34 carcasses were calculated to be sampled. But to increase the precision of the study the sample size was increased to 340 carcasses.

For an outcome scored 0/1 for no/yes, the standard deviation of the outcome scores is given by SD = [p (1-p)/N] $^{1/2}$ where p is the proportion obtaining a score of 1, and N is the sample size. The standard error of estimate SE (the standard deviation of the range of possible p values based on the pilot sample estimate) is given by SE= SD/N^{½}. Thus, SE is at a maximum when p = 0.5. Thus the worst-case scenario occurs when 50% agree, 50% disagree. Therefore, the questionnaire survey sample size was calculated by using the formula:

$$N = 0.25/SE^2 \text{ (Arsham, 2015).}$$

Where: N= sample size, SE (standard error) =5%

The sample size required for the questionnaire survey as per the above formula is 100 individuals.

e) Study Methodology

For the questionnaire survey, 100 volunteers in Jigjiga city were selected randomly based on different ages, sex, and working condition. During the active abattoir survey, individual animals were selected using systematic random sampling. Before ante-mortem inspection was done, each animal ID was assigned for further follow-up during the post-mortem examination and they were recorded according to their age, sex, and body condition.

i. *Ante-Mortem Examination*

The ante-mortem examination was conducted on individual animals' levels, while the animals were in the lairage. Both sides of the animals were inspected at rest and in motion. Moreover, the general behavior of the animals, cleanness, and sign of diseases, and abnormality of any type were recorded according to the standard ante-mortem inspection procedures (FAO, 2006). Additionally, an ID number was given to each animal to identify for the study. Then, data on the origin, age, sex, and body condition score of the animals were recorded. The body condition of cattle was classified as poor (hidebound with obvious bony prominences and deep sunk tail base), medium (ribs and other bony prominences noticeable on visual inspection but have the fair fleshy background on palpation), or good (bony structures notable only on palpation). Animal age was also based on dentition (Alemu *et al.,* 2013).

ii. *Post-Mortem Examination*

During post mortem inspection, palpation of the organs followed by incision of organs was made to examine for the presence of *C. bovis*, according to the guideline by the Ministry of Agriculture (1972), for masseter muscles, the deep linear incision was made according to the guideline by Ministry of Agriculture by making parallel to the mandible; the heart was incised from base to apex to open the pericardium and incision of the cardiac muscle for detail examination. Deep, adjacent, and parallel incisions were made above the pointed elbow in the shoulder muscle. Examination of the kidney, liver, and lung was also being conducted accordingly.

iii. *Cyst evaluation and viability test*

The cyst which was found at meat inspection was removed with the surrounding tissue and taken to the laboratory for viability test. The viability of the cyst was examined by placing them in a normal saline solution with 40% ox-bile and incubated at 37°C for 1 to 2 h. A cyst was regarded as viable if the scolex evaginated during this period (Gracey *et al.,* 2011).Cysts were carefully dissected and numbers and the nature of cysts in each organ were recorded for each animal. The nature of the cyst was recorded as calcified and viable by visual observation of its appearance, as (Ashwani and Gebrehiwot, 2011) dead degenerated or calcified cysticerci from identifiable spots of white and have fibrotic lesions, while the viable cysticerci are pinkish-red in color.

f) Data Management and Analysis

The data collected from ante-mortem, post-mortem, and laboratory findings were entered into an MS Excel spreadsheet and analyzed by using SPSS release 14.0 software (Stata Corp., College Station, Texas). Descriptive statistics were carried out to summarize the prevalence and relative percentage of the disease in each organ. Logistic regression was used to determine the level of significance among different risk factors contributing to the prevalence of bovine cysticercosis and human taeniasis. A level of significance of P $\leq$0.05 was used.

III. Results

In the study period, a total of 340 cattle were inspected in Jigjiga city municipal abattoir from November 2019 to April 2020. From a total of examined cattle, 11(3.24%) were found to be infected by *Cysticercus bovis* as shown in Table 1. comparative higher prevalence was observed 8(3.4%) in females than 3(2.9%) in male. (p = 0.825, (95% CI=0. 142-3.161).Regarding age group prevalence result showed that significantly higher prevalence (p<0.05) was detected in old animals 9(3.7%) than in adult2 (2.4%) (95% CI=0. 303-4.481). The present study also revealed that the body condition of cattle's had a significant effect on the occurrence of Cysticercus infection (p<0.05) with the highest prevalence of 9(3.7%) in Poor followed by medium and good body condition score with a prevalence of 1(1.6%) and 1(1.1%). Concerning origin, the prevalence result showed that the comparative higher prevalence was observed in animals brought from outside the Fafan zone with7(2.7%) than in around

Jigjiga 3(10.0%) and Fafan zone 1(1.9%) as shown in Table 1.

Table 1: Prevalence of Cysticercus bovis and associated risk factors

Risk factors	Categories	No. examined animal	Prevalence (No. positive)	Odds ratio (95% CI)	P-value
Sex	Male	103	3(2.9%)		
	Female	237	8(3.4%)	0.67 (CI=0.142-3.161)	0.825
	Total	**340**	**11**		
Age	Adult	84	2(2.4%)		
	Old	256	9(3.7%)	1.164 (CI=0. 303-4.481)	0.016
	Total	**340**	**11**		
Body condition	Good	62	1(1.6%)		
	Medium	90	1(1.1%)	0.685 (95% CI=.0.042-11.169)	0.003
	Poor	188	9(3.7%)	3.067 (95% CI=.0.381-24.706	
	Total	**340**	**11**		
Origin	Jigjiga	30	3(10.0%)		
	Fafan	100	1(1.9%)	3.968 (CI=0.969.-16.247)	0.086
	Outside Fafan of Zone	210	7(2.7%)	0. .687 (CI=.083-5.702)	
	Total	**340**	**11**		

Regarding the distribution of *C.bovis* in different organs assessed and the result revealed that shoulder muscle was the most frequently infected organ with a prevalence of 6(1.76%) followed by masseter muscles 5(1.47%), tongue 5(1.47%), heart 4(1.17%), (Table 2). Moreover, from the total of 21 cysts, 10(2.94%) were viable the remaining 11(3.23%) were calcified (Table 2).

Table 2: Frequency distribution of C.bovis in different organs examined

Inspected Organs	No. viable	No. calcified	Total No. cysts
Heart	1(0.29%)	3(0.88%)	4(1.17%)
Tongue	2(0.59%)	3(0.88%)	5(1.47%)
Shoulder muscle	4(1.17%)	2(0.59%)	6(1.76%)
Messer muscle	3(0.88%)	2(0.59%)	5(1.47%)
Liver	0	1(0.29%)	1(0.29%)
Total	10(2.94%)	11(3.23%)	21(6.18%)

The result of the Questionnaire Survey: Of the total 100 voluntary respondents interviewed, 13(13%) of them said they were infected with Taeniasis (*T. saginata*) at least once in their lifetime. There was no statistically significant association ($p>0.05$) was observed in the prevalence of Taeniasis between age, sex, Marital status, educational status, as shown in Table 3. Statistical analysis showed that human taeniasis prevalence is statistically significant $p<0.05$) among the categories of the considered risk factors like raw meat consumption, Religion. In addition, among interviewed respondents 17 had the habit of raw consumption, and 83 had the habit of cooked meat consumption and there is a significant association be out of this 9 (52.94%) and 4 (4.82%) of them were infected respectively as indicated in (Table 3).

Table 3: Prevalence of Human Taeniasis with Risk Factors

Variables	Categories	No of interviewees	No. infected	Prevalence%	P –value
Age	<25 years	27	4	14.81	0.743
	>25 years	73	9	12.33	
Sex	Male	67	10	14.92	0.415
	Female	33	3	9.1	
Religion	Muslim	54	1	1.85	0.000
	Christian	46	12	26.08	
Marital status	Married	60	11	18.33	0.903
	Unmarried	40	2	5	
Habit of raw meat consumption	Consumed	17	9	52.94	0.000
	Not consumed	83	4	4.82	
Educational	Literate	81	12	14.81	0.055
	Illiterate	19	1	5.26	

IV. Discussion

The prevalence of *Cysticercus bovis* in the current study was 3.24% at Jigjiga municipal abattoir. This finding is comparable with the findings of 3% (Bedu, 2011) in Zeway Municipal Abattoir, 3.6% (Nuraddis and Frew, 2012) in Addis Ababa abattoir, 3.65% (Taresa, *et al*., 2011) in Jimma municipal abattoir, 3.11% (Tembo, 2012) in different agro-climatic zones of Ethiopia. However, this prevalence was higher than several studies conducted in different parts of the country such as 1.2% (Bekele *et al.*2017) in Asella municipal abattoir, 2.5% (Dawit Tesfaye *et al.,* 2012) in Wolaita Sodo municipal abattoir, 2.58% (Birhanu, *et al*., 2013) in Bahir Dar Municipal Abattoir, (Abate Worku, 2014) in west Shewa zone, 2.6% (Yacob *et al.,* 2015) in Adama town, 0.2% (Blessing *et al*., 2011) in South Africa and 1.05% (Leonardo *et al*. 2012) in Brazil. Nevertheless lower than the finding of 4.9% (Dawit Saddo, 2004) in Gondar, 4.4% (Bekele *et al.,* 2010) in Jimma municipal abattoir, 4.8% (Karshima *et al*., 2013) in Nigeria, 5.1% (Fetene and Nibret, 2014) in Jimma municipal abattoir, 5.2% (Belay, 2014) in Municipal Abbatoir of Shire, 5.4% (Alula, 2010) in Konbolcha, 5.6% (Lielt Emiru *et al.,* 2015) in Bishoftu, 5.73% Hylegebriel (Tesfay and Alembrehan Assefa, 2014) in Adigrat, 6.4% (Tewodros Alemneh *et al*., 2010) in Kombolcha meat processing factory in the same study area, 12% (Abunna, 2013) in Yirgalem abattoir, 17.5% (Hailu, 2005) in East Shoa, 18.49% (Kebede, 2008) in North West Ethiopia, and 26.3% (Abunna *et al.,* 2008) in Hawassa municipal abattoir. A possible reason for the difference in the prevalence of cysticerci might be due to factors like difference in culture, in environmental conditions, livestock stocking intensity, and livestock movement and social activities in different regions that may contribute to these variations in prevalence (Kebede *et al*., 2009).Moreover, another possible reason for the variation in prevalence rate might be due to the variation of personal and environmental hygiene from area to area (Ngwu *et al.,* 2004).

The result in the prevalence of *c. bovis* between sexes revealed slightly higher in female (3.4%) than male (2.9 %) but significant variation was not observed; this argument is supported by (Wanzala, 2003). who reported that the prevalence of *c. bovis* was slightly higher in female than male cattle. This could be due to the similarity in the socio-economic status and animal husbandry practices of the community in all areas from where animals were bought for slaughter. (Gemmell *et al.,* 2001). In the present study, the age-wise analysis showed that there was a significant difference in prevalence among the age of animals and the highest infection rate was recorded in old the adult. This finding

is similar to the report of (Nuradis and Few, 2012) and (Wondimagegnei and Belete, 2015). This might be due to their longer exposure to infection and to lower immunity to combat infection and these results are concurrent with that of other studies in Ethiopia. (Azlaf and Dakkak, 2006).The present study also showed that there was a strong association between the body condition of cattle and *C. bovis* infection. Significantly poor conditioned cattle were more infected by *C. bovis* than a medium and good one. This is in line with the study of Meseret (Kassaw *et al.,* 2017), this might be due to moderate to severe infection, the parasite may cause retarded performance and growth, reduced quality of meat and milk as well as live weight loss. (Melaku *et al*. 2012).This indicates that body condition loss might be a consequence of infection (Battelli 1997).

During the study period, the most frequently affected organs with the highest prevalence of cysts of *C. bovis* were recorded in shoulder muscles (1.76%) followed by masseter muscles, tongue, heart, and liver. The variations in anatomical distribution depend on several factors, such as blood kinetics and animals" daily activities. Any geographical and environmental factors affecting blood kinetics in the animal affect the distribution of oncospheres as well and hence the predilection sites during meat inspection (Gracey *et al.,* 2011). The finding of the current study is in agreement with the reports of (Bekele *et al.,* 2017) (Opara *et al.,* 2012), (Alemayehu *et al,* 2009) and (Hailu, 2010) who indicated that examination of the shoulder muscles is the most effective means of detection of bovine cysticercosis, while the heart and liver are described as the most frequently infected organ by (Tembo, 2012). Thus, there is no particular "predilection site" which could be acceptable for all cattle. The viability test showed that shoulder muscles had the highest relative frequency proportion of viable cysts 4(1.17%) followed by masseter muscles, tongue, heart, and liver. This observation goes parallel with the findings of (Opara *et al.,* 2012) and (Bekele *et al.,* 2017) who recovered a higher proportion of cysts from shoulder muscles that had the highest proportion of viable cyst. The explanation for this may lie in the fact that muscle activity receives more blood than a muscle at rest, and that the distribution of the cysts is controlled by the volume and intensity of the arterial blood (Gracey *et al.,* 2011).

The prevalence of human taeniasis was recorded based on the questionnaire and indicated an overall of 13% which demonstrates the importance of taeniasis in the study area.

The result of this study was lower when compared to (Mesfin and Nuraddis, 2012) 44% in Hawassa town and (Dawit and Temesgen, 2013) 44.44% in Shire Indasilassie district, (Lielt *et al.,* 2015) 64% in Bishoftu, (Dawit, 2012) 62.5% in Wolaittasoddo, (Fetene and Nibret, 2014) 58%,(Abunna, 2013) 70% in Yirgalem, (Bedu *et al*., 2011)56.7% at Zeway, (Abunna *et al*., 2008) 64.2% in Awassa town and (Megersa *et al*., 2015) 56.7% in Jimma town. The reason for reporting the lower prevalence of human taeniasis in the current study area could be due to the difference in the religious composition of the respondents, and the sample size is taken. Out of the total respondents of the current study, 54% were Muslims that have no traditional habit of consuming raw meat and from the total respondents, only 17% were raw meat consumers. The reason is well known that in the consumption of raw meat the degree of ingesting *C. bovis* with meat is higher (Gajadhar *et al.,* 2012; Garcia *et al.,* 2011). Therefore, as raw meat consumption is low in the area the infection also is low. The other is sample size difference and as sample size increases the precision will also increase. In the present study, the sample size is very low (100) while in the above finding is very high, more than 220. The other point is that some respondents shy to openly tell about taeniasis and this could also end up with the low recovery of positive people in the study area.

Taeniasis prevalence was higher among the Christian community than Muslims in the study area.

Similar to the reports of (Tembo, 2012; Hailu, 2005; Deressa *et al.,* 2012) taeniasis prevalence was higher among the Christian community than Muslims. Because raw meat consumption is not common in Muslims as in Christians and Christians also celebrate several annual festivals with the tradition of raw meat consumption (Teka, 1997). T. saginata infection is highly prevalent in the literate than illiterate respondents and this might be because literate peoples have more chance to occupational status than illiterate which allows them to have the finance to eat raw beef in the butcher"s house than illiterate peoples.

This presentation revealed that males were highly affected than females. This observation is similar to the finding of (Abunna *et al.,* 2007) who reported a higher prevalence of taeniasis among males than females in Awassa town. The difference in the rate of infection between males and females in the study area could be due lead to human feces (Nigatu, 2004). To the fact that males enjoy eating raw beef with local drink ''Tella". The second reason might be males provide and control the finance hence; they can eat raw beef in the butcher house.

T. saginata was observed among old aged people (> 25 years) as compared to young age people (< 25 years). This agrees with (Alemayehu *et al.,* 2009) and (Dejene Bekele *et al.,* 2017). The observation that the older people greater chance of eating raw beef and hence contracting taeniasis. Therefore, the two age groups might be because older people have the finance to eat raw beef in the butcher's house *Taenia saginata* was observed among old aged people as compared to young age people. This agrees with (Tembo, 2001), (Alemayehu, *et al.,* 2009), and (Shimeles, 2004)

observation that older people were greater the chance of eating raw beef and hence contracting taeniasis. Depending on the marital status, married peoples were more infected than unmarried ones. This might be because married peoples have the finance to eat raw beef in the butcher‟s house than unmarried peoples.

The questionnaire survey result showed that the prevalence of taeniasis in the human population is decreasing and it also indicated that there was a strong relationship between the occurrence of *T.saginata* infection and age, sex, the habit of raw meat consumption, Marital status, and educational status of the respondents. Therefore, continues public education should be provided to avoid consumption of raw meat and encourage the use of latrines and improved standards of human hygiene and backyard slaughtering of cattle should be restricted and slaughterhouse which fulfills the necessary facilities and with qualified meat inspector should be constructed.

V. Conclusions

The abattoir survey evidence of the present investigation showed that *C.bovis* is prevalent in cattle slaughtered at Jigjiga municipal abattoir the prevalence of *C.bovis* was affected by different risk factors such as age and body condition score but not affected by the sex and origin of animals. The most frequently affected organ with the highest number of cysts was the shoulder muscles followed by masseter muscles, tongue, heart, and liver, regarding the questionnaire survey *T. seginata* was an important parasitic cattle disease and in terms of its public health implication in the study area. The viability test showed that shoulder muscles had the highest relative frequency proportion of viable cystsshoulder muscle followed by masseter muscles, tongue, heart, and liver. The questionnaire survey finding indicated that the infection rate of taeniasis was higher in the study area and deserves due attention on control and prevention of the disease. Finally, the finding of the present study reflects the zoonotic and economic impact of the disease which needs serious attention by the various stakeholders to safeguard public health.

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References Références Referencias

1. Abate, W. 2014. *Cysticercus bovis* and *Taenia saginata* prevalence, public health significance and community perception about meat bornzoonosis in three selected district of west Shoazone of Oromia region, Ethiopia.
2. Abunna, F., G, Tilahun., B, Megersa., A, Regassaa. 2007. Taeniasis and Its Socio-Economic Implication in Hawassa Town and Its Surroundings, Southern Ethiopia. *East African Journal of Public Health*. 4: 73-79.
3. Abunna, F., Prevalence. 2013. organ distribution, viability and socioeconomic implication of *bovinecysticercosis*/teniasis, Ethiopia *Revue d'élevageetde médecinevétérinaire des pays tropicaux*. 66: (2)530.
4. Abunna, F., Tilahun, G., Megersa, B., Kumsa,B., Regassa, A. 2008. Bovine cysticercosis in cattle slaughtered at Awassa municipal abattoir, Ethiopia: Prevalence, cyst viability, distribution and its public health implication. *Zoon and Publ. Health*. 55: 82–88.
5. Alemayehu, R., A, Hailu., F, Gadisa., M, Biniyam. 2009. Cysticercosis of slaughtered cattle in Wolaita Soddo, Ethiopia. *Research of Veterinary Sciences.* 47: 322-346.
6. Alula, A. 2010. Major Metacestodes in Cattle Slaughtered at Kombolcha ELFORA Abattoir, North East Ethiopia: prevalence, cyst viability organ distribution and socio economic implication. Faculty of Veterinary Medicine, Hawassa University,. Hawassa, Ethiopia. DVM Thesis.
7. Battelli, G. 1997. Evaluation of the economic costs of Echinococcosis. Int. Arch Hydatid 32:337.
8. Belay, S., Mekelle, BA. 2014. Prevalence of *Cysticercusbovis* in Cattle at Municipal Abbatoir of Shire. *J.Vet. Sci.Technol*; *5*:196.
9. Blessing, MD., Ethel KS, Mphane., M., Lebogang, E., Francis RB, Rendani, VN., Mathew, N. 2011. Prevalence of Bovine Cysticercosis in the North West Province of South Africa from 2000 to2010, *J. Hum. Ecol.* 36: 9-12.
10. Dawit G, Temesgen M. 2010. Risk Factors and Public Health Significance of Cysticercosis in Cattle and Human in Shire Indasilassie District, Northern Ethiopia *Adv. Biolog. Res*x; 7: 282-287.
11. Dawit S. 2004. Epidemiology of *Taenia saginata,* taeniasis and cysticercosis in North Gondar zone Northwestern Ethiopia., Faculty of Veterinary Medicine, Addis Ababa University: DebreZeit, Ethiopia. DVM thesis.
12. Dejene, Bekele., Barecha, Berhanu., Mahindra, Pal. 2017. Studies on the prevalence, cyst viability,

organ distribution and public health significance of bovine cysticercosis in Ambo municipality abattoir, Western Shoa, Ethiopia. *Journal of Parasitology and Vector Biology*. 9(5), 73-80.
13. Ethiopia Agriculture Research and Organization. 2006. Poverty and the rural nonfarm economy in Oromia, Ethiopia. *Agricultural Economics*. 35: 469-475.
14. Fetene, F., Nibret, M. 2014. Prevalence of Bovine Cysticercosis in Cattle and Zoonotic Significance in Jimma Town, Ethiopia. *Acta Parasitol Glob*; 5: 214-222.
15. Gajadhar, AA., Scandrett, WB., Forbes, LB. 2006. Overview of food- and water-borne zoonotic parasites at the farm level. *Revue Scientifique ET Technique International Office of Epizootics.* 25: 595-606.
16. Gallie, G.J.,Sewell, M,M.1983.Duration of immunity and absorption of cysticerci in calves after treatment of Taenia saginata cysticercosis with praziquantel, *Res Vet Sci.*2004 Mar: 34(2):127-30
17. Garcia, LS., Jimenez, JA. 2007Escalante H. Cestodes: In Manual of Clinical Microbiology 9th ed., Washington, D.C.: ASM Press.: p 2166.
18. Garedaghi, Y., Rezaii, A., Saberie, M. 2012. Prevalence of bovine cysticercosis of slaughtered cattle in Meshkinshahr abattoir, Iran, *Journal of animal and veterinary Advances, Islamic Azad University, Tabriz branch, Tabriz, Iran.* 11: 785 -788.
19. Gemmell, M.A., Roberts, M.G., Beard, T.C., Campano, Diaz, S., Lawson, J.R., Nonnemaker, J.M.2001. Control of Echinococcus granulosus. In: Eckert, J., Gemmell. M.A., Meslin, F.X., Pawlowski, Z.S. Eds. WHO/OIE Manual on Echinococcosis in Humans and Animals: A Public Health Problem of Global Concern. World Organisation for Animal Health, Paris. pp. 195-203.
20. Hailu, D. 2005. Prevalence and Risk Factors for Taenia Saginata Cysticercosis in three selected areas of Eastern Shoa. Faculty of Veterinary Medicine, Addis Ababa University, Debrezeit, Ethiopia, MSc.
21. Hylegebriel, T., Alembrehan, A. 2012. Cysticercus bovis in Eastern Tigray, Northern Ethiopia. *International Journal of Innovation 1 and Scientific Research* ISSN, pp: 2351-8014.
22. Kebede, N., G. Tilahun and A. Hailu, 2008. Prevalence of Tania saginata cysticercosis in cattle slaughtered for meat in Addis Ababa abattoir. J. Tropical Animal Health and Production, 41: 291-29.
23. Kebede, N., Abuhay A., Tilahun G., Wossene A. 2009. Financial loss estimation, prevalence and characterization of hydatidosis of cattle slaughtered at Debre Markos municipality abattoir, Ethiopia. *Tropical Animal Health Production* 41:1787-1789.
24. Leonardo, H., Rafael, F., Thállitha, S., Amanda, F., Francisco, A., Selwyn, A., Odilon, V. 2012. The prevalence and spatial epidemiology of cysticercosis in slaughtered cattle from Brazil, Department of Vet. Medicine 5:1887-1896.
25. Leonardo, H., Rafael, F., Thállitha, S., Amanda, F., Francisco, A., Selwyn, A., Odilon, V. 2012. The prevalence and spatial epidemiology of cysticercosis in slaughtered cattle from Brazil, Department of Vet. Medicine 5:1887-1896.
26. Liel,t E., Desalew, T., Tsegabirhan, K., Teshale, S., Yohannes, H. 2015. Prevalence andpublic health significance of bovine cysticercosis at Elfora abattoir, Bishoftu, Ethiopia, *journal of public health and epidemiology.* 7: 32-40.
27. Megersa, B., Tesfaye, E., Regassa, A., Abebe, R., Abunna, F. 2015. Bovine Cysticercosis In Cattle Slaughtered at Jimma Municipal Abattoir, South Western Ethiopia: Prevalence, Cyst Viability and Its Socio Economic Importance. *Vet. World.* 3: 257-262.
28. Melaku, A., Luka,s B., Bogale, B. 2012. Cyst viability, organ distribution and financial losses due to hydatidosis in cattle slaughtered at Dessie municipal abattoir, north eastern Ethiopia. Vet. World 5(4): 213-218.
29. Meron, T. 2012. Study on the risk of human taeniasis and prevalence of bovine cysticercosis in Jimma town, southwestern Oromia Addis Ababa University, College of Veterinary Medicine and Agriculture, MSc thesis Debre-zeit, Ethiopia.
30. Mesfin, B., Nuradddis, I. 2012. Prevalence of Cysticercus Bovis in Hawassa Municipal Abattoir and its Public Health Implication, *American-Eurasian J. Sci. Res*: 238-245.
31. Ngwu, G., Ohaegbula, A., Okafar, F. 2004. Prevalence of Faciola gigantica, Cysticercus bovis and some other disease conditions of cattle slaughtered in Nsukka urban abattoir, Animal research international 1: 7 – 11.
32. Nigatu, K. 2004. Cysticercus Bovis: Development and evaluation of serological tests and prevalence at Addis Ababa Abattoir. Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia. MSc Thesis.
33. NS, Pam., VA, Bobbo, AA., Obalisa, A. 2013. Occurrence of Cysticercus bovis in Cattle Slaughtered at the Ibi Slaughter House, Ibi Local Government Area of Taraba State, Nigeria. *J. Vet. Adv*., 3(3): 130-134.
34. Opara M, Ukpong C, Okoli A, Anosike J. 2012. Cysticercosis of slaughtered cattle in southeastern Nigeria. Ann. New York Acad. Sci. 10: 39-346.
35. Shimeles, D. 2004. Epidemiology of Taenia saginata taeniasis and cysticercosis in North Gondar Zone. Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia. DVM Thesis.
36. Teka, G. 1997. Food Hygiene Principles and Food Borne Disease Control with Special Reference to Ethiopia. Faculty of Medicine, Department of

Community Health, Addis Ababa University, Ethiopia.
37. Tewodros, A., Annania, T., Sara, T. 2010. Study on the prevalence of *Cysticercusbovis* in Kombolcha ELFORA, North -Eastern Ethiopia. European *Journal of Applied Sciences* Faculty of Veterinary Medicine, University of Gonder 7: 152– 157.
38. Wanzala, W., Onyango-Abuje, J., Kang`Ethe, E., Zessin, K., Kyule, N., Bauman, M., Ochanda. H., Harrison. 2003. Analysis of Post-Mortem Diagnosis of Bovine Cysticercosis in Kenyan Cattle, *Onderstepoort. J.Vet. Res*; 1: 28-31.
39. Wondimagegnei,K., Belete, S. 2015. Prevalence and public health significance of cysticercus bovis in and around debreberhan City, *European Journal of Applied Science* 7 (5): 199-208, 2015.
40. Yacob, H., Ahmed, T., Getachew, T., Tariku, J. 2015. Bovine cysticercosis and human teaniosis in Adama town, Oromia region, Ethiopia. Addis Abeba University, College of Veterinary Medicine, Debrezet, Ethiopia.