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Studies on the prevalence, cyst viability, organ distribution and public health significance of bovine cysticercosis in Ambo municipality abattoir, Western Shoa, Ethiopia

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A cross-sectional study was conducted on cattle slaughtered in Ambo municipal abattoir with the aim of determining the prevalence, cyst viability, organ distribution and public health significance of bovine cysticercosis. Of the 600 carcasses inspected, 93 (15.5%) were infected with cysticerci. A total of 122 cysts were collected of which 95 (77.87%) were viable while others 27 (22.13%) were degenerated. The anatomical distribution of cysticerci were highest in the shoulder muscles 41(85.4%) followed by masseter muscles 11(78.6%), thigh muscles 17 (77.3%), heart 14 (73.68%), tongue 7 (70%), liver 4 (66.67%) and 1(50%) in the intercostals mussels. The prevalence of cysticercosis varied significantly (P<0.05) with sex, age, breed and origin of animals. Interview was conducted on 180 residents using a structured questionnaire to know the public health significance of the disease. Forty eight (60%) out of 80 respondents from Ambo town, thirty four (68%) out of 50 respondents from Guder woreda and twenty three (46%) out of 50 respondents from Dendi woreda had contracted *the disease* at least once in their life time and maximum infestation frequency was two times per year. The infestation varied significantly (P<0.05) with sex, age, place of respondents, habit of raw meat consumption, religion, marital and educational stutas.

Key words: Ambo, bovine cysticercosis, cyst viability, Dendi, Guder, prevalence, public health, organ distribution.

INTRODUCTION

Ethiopia is one of the countries in Africa with huge livestock resources that play a crucial role in the livelihoods of the majority of Ethiopians. The cattle population for the country is estimated at 50.8 million out of which females constitute about 54.87% and the remaining 45.13% are males (CSA, 2012). Despite the

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huge resources, Ethiopia livestock productivity remains a below being adequate. The major biological constraints contributing to low productivity includes the low genetic potential of the animals, poor nutrition and prevailing disease like parasitosis (CSA, 2012).

Among the many prevalent livestock diseases parasitism represent a major drawback to livestock development in the tropic in general and *Cysticercus bovis*, which is the larvae stage of the human tapeworm, *Taenia saginata* causes significant economic losses to the beef industry and public health hazard (FAO, 2011).

Bovine cysticercosis refers to the infection of cattle with metacestodes of the human tapeworm (Ambachew and Yitagel, 2015). Ingested eggs develop into cysticerci, which can often be detected during meat inspection at the routinely inspected localization sites of the parasite, including, the skeletal muscle, heart and diaphragm. The matured cyst is grayish white vesicle about one centimeter in diameter. It is filled with fluid, in which the scolex is usually visible, like the adult parasite, it has no hooks and rostellum (Gebretsadik et al., 2016). Several authors reported that the metacestode of *T. saginata* is common in organs like the tongue, heart, masseter muscle, thigh muscle, shoulder muscle, liver, diaphragm, intercostals and kidney (Radostits et al., 2007).

The adult tape worm, *T. saginata* occurs in the small intestine of the final host, man and the metacestode (*C. bovis*) is found in cattle that serve as main intermediate host (Endiras, 2011). The epidemiology of the disease is associated with the cattle rearing system, age of cattle, meat inspection practice, and habit of consumption of raw and under cooked meat. Low awareness and poor hygiene and sanitary infrastructures may facilitate transmission of the disease between animals and human beings in the rural areas.

As per an estimate, 50 million cases of such infestations occur worldwide with 50,000 people dying from this problem annually (WHO, 2015). In humans, the disease 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 (Brown and Neva, 2010; Pal, 2012; Deressa et al., 2012). Sometimes, the mobile gravid segments may make their way to unusual sites such as the appendix and bile tract and may cause serious disorders.

Cattle infected with C*. bovis* show no symptoms, however, heavy infestation may cause myocarditis or heart failure (Gracey et al., 2011). Cysticerci can remain alive in cattle from weeks to years. Infection in human is a public health problem as the infection is acquired through consumption of raw or undercooked beef. The economic losses result from condemnation and down grading of carcasses and due to treatment of carcasses to make it fit for human consumption (Deressa et al., 2012). Inadequate health education and low availability of taenicides are the major obstacles for the control of such infections (Pawlowski, 2013). Due to these reasons, taeniasis is more common in developing countries including Ethiopia where meat is an important component of human diet and traditionally, it is consumed raw on several occasions. About 45% of Ethiopia's domestic meat consumption comes from cattle, but this income is affected due to various unimproved animal health problems, among which, *T. saginata/C. bovis* is one (FAO, 2011).

The prevalence rate is excess of 20% in developing countries, where as in developed countries the prevalence of cysticercosis is low usually less than 1% (Pawlowski, 2013). Even though, *T. saginata* has a worldwide distribution, its prevalence is particularly higher in Sub-Saharan Africa (WHO, 2015). Taeniasis *c*aused by *T. saginata* is a well-known helminthic zoonotic disease in Ethiopia with prevalence ranging from 10 to 70% (Jemal and Haileleuil, 2011). However, to my knowledge in the last decades the prevalence and distribution *C. bovis* was not report for implementing control and prevention program throughout the country. Hence, the research work is aimed to determine the prevalence, cyst viability, organ distribution and public health significance of bovine cysticercosis at Ambo municipality slaughter houses.

MATERIALS AND METHODS

Study area

The study was conducted in Ambo town which was found in Western Showa zone of Oromia regional state. Ambo is located 112 km West of Addis Ababa, and the area is found at a longitude of 370 32' to 380 3' E, and latitude of 80 47' to 90 20' N and the altitude range is from 1900 to 2275 meters above sea level. The climatic condition of the area is 23% highland, 60% mid altitude, and 17% lowland. It has an annual rainfall and temperature ranging from 800 to 1000 mm and 20 to 29°C respectively (AAB, 2015).

The rainfall is bi-modal with the short rainy season from February to May and long rainy season from June to September. Agriculture is the main occupation of the population of the area. The agricultural activities are mainly mixed type with cattle rearing and crop production under taken side by side (AAB, 2015).

Study animal

Postmortem inspection was conducted on 600 cattle slaughtered at Ambo municipal abattoir for the presence of *C. bovis* which originate from neighboring marketing areas such as East Showa from Dendi woreda, West Showa from Toke kutaye (Guder) and Ambo areas. From those animals that daily came to the municipal abattoir, study animals were selected and routinely inspected for cysticercosis.

Sampling and sample size determination

Sampling was conducted using simple random sampling method. The study was cross sectional abattoir survey which includes cattle brought from different livestock markets to Ambo municipality abattoir. The total numbers of cattle required for the study was

calculated based on the formula given by Thrusfield (2007). In this study, 50% prevalence was considered to calculate the sample size using the following formula.

$N=1.96^2 \times Pexp\ (1\text{-}pexp)/d^2$

Where n=required sample size; Pexp=expected prevalence (50%); d=desired absolute precision; $N= 1.962 \times 0.5(1.0.5)/ (0.05)^2 = 384$ animals.

Actually 600 animals were sampled and inspected during the study period.

Cyst identification

During the study period, 600 cattle carcasses were examined for the presences of *C. bovis* following the meat inspection was made as the procedures of Ethiopia Ministry of Agriculture (MOA) Meat Inspection Regulation (1972), for the detection *of C. bovis.* Before inspecting the animals ante-mortems inspection was carried out and the number of each animal was recorded. It comprised data of carcass identification number, age, sex, breed and number of cyst found on the suspected predilection site. During meat inspection of each organ of an animal was strictly and separately examined to avoid mixing up of organs. The tongue, heart, liver, masseter muscles, triceps, thigh muscles, diaphragm and intercostals muscles of all slaughtered beef cattle were assessed by visual inspection, palpation followed by incisions for the detection of *C. bovis*.

Cyst evaluation (viability test)

The cyst which was found at meat inspection was removed with the surrounding tissue and taken to laboratory for viability test. The viability of the cyst were 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).

Questionnaire survey for public health significance

In order to assess the extent of human taeniasis, 180 voluntary respondents were randomly selected from three distinct *woredas'*; namely, Ambo, Guder and Dendi, and interview were made individually using semi-structured questionnaire. The potential risk factors like age, habit of raw meat consumption, religion, sex, marital status and educational level was recorded.

Methods of data collection and variable used

In order to conduct the study, ante mortem and postmortem examinations and laboratory characterizations of the cysts was employed. Data on species, sex, age, and origin of the study animals was collected during ante mortem examination of the animals. Data on infestation status of the animals, organs affected, cyst number and distribution were collected or recorded from postmortem examination results. Information on characteristics of each of the cysts examined in the laboratory was obtained and recorded.

Data management and analysis

The data collection from the study area was recorded in the format developed for this purpose and later on entered into Micro Soft office Excel 2007 spreadsheet computer program and analyzed using SPSS statistical software version 17.0. The prevalence of cysticercosis was calculated as the number of cattle found to be infected with *C. bovis* against to total number of examined animals expressed as a percentage of the total number of cattle slaughtered. Chi-square (x^2) test was applied to compare the infection status with regard to the hypothesized risk factors like age, sex, and cyst characteristics. A statistically significance association between variables and considered to exist if the completed P-value is less than 0.05.

RESULTS

Abattoir survey (postmortem examination)

Out of 600 cattle inspected in Ambo municipality abattoir 93 (15.5%), CI (12.6-18.4) were found infected with *Cysticercus bovis*. Male animals 76 (12.66%) had higher cysts of *C. bovis* than female animals 17 (2.83%). Although more males than females were examined, the prevalence of infections showed significant difference (OR=36.85, P= 0.001). However, more light infections and apparently lower prevalence was observed in animals originated from Ambo than those from Guder and Dendi areas (Table 1).

The infection of cattle with *C. bovis* was 34 (16.9%) in younger (<5years) and 59 (14.8%) in older (>5years) animals (OR=2.8), P=0.001). Out of 600 cattle carcasses examined, 598 (99.7%) were local breeds and infected with *C. bovis* while 2 (0.3%) cross breeds cattle carcasses failed to reveal infection.

Anatomical distributions of cyst

Seventy nine organs were found to harbor the cyst. The variation in the anatomical distribution of cysticerci were as follows shoulder, masseter, thigh, heart, tongue, liver, intercostals and diaphragm muscles were the major predilection sites with respective prevalence value of 29.11, 21.5, 16.5, 12.66, 11.4, 5.06, 2.5 and 1.3%, as presented in Table 2. The shoulder muscles were predominantly affected site in the study area.

Viability test

Out of 122 cysts encountered, 95 (77.87%) were viable while other 27 (22.13%) were non-viable (degenerative) cysts. Viability test showed that shoulder had the highest relative frequency proportion of viable cysts 41(85.4%) followed by masseter 11(78.6%), thigh 17(77.3%), heart 14(73.68%), tongue 7(70%), liver 4(66.67%) and intercostals mussels 1(50%) (Table 3).

Among 122 total cysts of carcasses, 16 (13.1%) cysts were found in female animals with 10 (62.5%) cysts were alive while 106 (86.9%) cysts were found in male animals with 89 (83.9%) cysts were alive (Table 4).

Table 1. Analysis of potential risk factors associated with the occurrence of viable cysts in carasses inspected at the Ambo municipal abattoir.

Risk factors	No. of animals examined	Infected	Chi square	*P*-value
Sex				
Male	521	82 (15.74%)	39.676	0.001
Female	79	11 (13.9%)		
Age				
<5 Years	201	34 (16.9%)	3.199	0.00
>5 Years	399	59 (14.8%)		
Breed				
Local	598	93 (15.5%)	41.134	0.000
Cross	2	-		
Origin of animals				
Ambo	116	9 (7.76%)	12.35	0.0235
Guder	273	55 (20.14)		
Dendi	211	29 (13.74%)		

Table 2. Number of organs infected and distribution of *C. bovis* on different organs at Ambo municipality abattoir.

Organs examined	No. of organs infected	Prevalence (%)	Total no. of cysts examined in each organ	Percentage (%)
Tongue	9	11.4	10	8.2
Masseter muscles	13	16.5	15	12.3
Shoulder muscles	23	29.11	48	39.34
Thigh muscles	17	21.5	22	18.0
Heart	10	12.66	18	15.6
Liver	4	5.06	6	4.9
Diaphragm m/s	1	1.3	1	0.8
Intercostal m/s	2	2.5	2	1.6
Total	**79**	**100.0**	**122**	**100.0**

Questionnaire survey on taeniasis

Survey was done at three distinct *Woredas'*; namely, Ambo, Guder and Dendi. Of the total 180 interviewed respondents who participated in this study, 48 (60%) out of 80 respondents in Ambo, 34 (68%) out of 50 respondents in Guder and 23 (46%) out of 50 respondents in Dendi *woredas'* had contracted *T. saginata* infection at least once in their life time and maximum infestation frequency was two times per year.

The majority of the respondents had an experience of raw meat consumption due to traditional and cultural practice. The multiple logistic regression analysis of the risk factors showed significance difference ($p<0.05$) in the prevalence of taeniasis with raw meat consumers, age, religion, sex, marital status, place and educational level of the respondents. Accordingly frequent raw meat consumers (OR=3.5, 95% CI [2.08-81.04], male individuals (OR=5.8, 95% CI [1.23-5.43], Christian (3.6) and old age (OR=3.65) had higher likelihood of acquiring taeniasis than Muslims, cooked meat eaters and female, respectively (Table 5).

DISCUSSION

Among 600 carcasses of cattle inspected in Ambo municipal abattoir, 93 carcasses were found to harbor viable or non-viable cysts of *C. bovis* with an overall prevalence of 15.5%. The infection prevalence of *T. saginata* cysticercosis was invariably high in those animals come from Guder and Dendi *woredas*'. This suggests wide occurrences of the disease throughout the study areas regardless of agro-ecological and socio-cultural differences.

The present finding on the prevalence of *C. bovis* is in agreement with earlier reports of 13.3% at Addis Ababa abattoir (Nigatu et al., 2009), 11.3% at Wolaita Soddo

Table 3. Proportion of viable and non-viable cysts in different organs.

Organs affected	Condition of cysts				
	Total no. of cyst	Viable	Percent (%)	Non-viable	Percent (%)
Tongue	10	7	70	3	30
Masseter muscles	14	11	78.57	3	25
Shoulder muscles	48	41	85.4	7	14
Thigh muscles	22	17	77.68	5	22.7
Heart	19	14	73.3	5	26.3
Liver	6	4	66.67	2	33.3
Diaphragm muscles	1	-	-	1	100
Intercostal muscles	2	1	50	1	50
Total	**122**	**95**	**62.35**	**27**	**37.75**

Table 4. Distribution of *Cysticercus bovis* cyst between male and female animals.

Predilection site	Female			Male			Total
	No. cyst	Viable	Non-viable	No. cyst	Viable	Non-viable	
Tongue	2	1	1	5	3	2	7
Masseter m/s	2	1	1	13	11	2	15
Shoulder m/s	3	2	1	45	39	6	48
Thigh m/s	3	2	1	18	16	2	21
Heart	3	2	1	10	8	2	13
Liver	2	1	1	14	12	2	16
Diaphragm m/s	-	-	-	1	-	1	1
Intercostal m/s	1	1	-	-	-	-	1
Total	**16**	**10**	**6**	**106**	**89**	**17**	**122**

municipal abattoir (Alemayehu et al., 2009) and 18.49% at Bahir Dar municipal abattoir (Nigatu, 2008), but it is far lower than the 30% prevalence report for the whole Ethiopia (Solomon, 2012) and greater than 2.7% in Gondar municipal abattoir (Ambachew and Yitagel, 2015).

Prevalence of this study is comparable to some reports from African countries, such as 20% in Senegal, 27% in Tanzania and 38 to 62% in Kenya (Over et al.,2013; Onyango-Abuje et al., 2011), and 6.2% in Namibia (Kumba et al., 2010). Likewise Opara et al. (2012) have reported comparable prevalence of 26.2% from slaughter animals in Nigeria. Conversely, lower prevalence was reported from developed countries, such as 0.26% in Croatia (Zivkovic et al., 2010), 0.48 to 1.08% in Germany (Abuseir et al., 2012) and 0.9% in Cuba (Suarez and Santizo, 2013).

Thus, *T. saginata* cysticercosis has more public health and economic significance in developing countries like Ethiopia compared with developed countries. Problems associated with poor sanitary infrastructure, low awareness and improper disposal of sewage are major factors for higher prevalence of cysticercosis in developing countries (Gebretsadik et al., 2016).

The highest prevalence *of C. bovis* in young cattle in the present study is in line with the works of Gracey et al. (2011) who described that in countries where *T. saginata* is common in cattle frequency ingest tapeworm ova. An active immunity develops and the prevalence, which decreases progressively with age. Adult cattle have also indicated that in Africa are resistant to re-infection because they acquire cysticercosis at a young age. With subsequent development of active immunity since the animals slaughtered are old, the majority of cysticerci from initial calf hood infection may degenerate or disappear (Deressa et al., 2012).

Minozzo et al. (2015) have demonstrated a wide distribution of *T. saginata* metacestode infection throughout bovine muscles showing inefficiency of routine meat inspection. Thus, higher prevalence in the present study might be attributed to the variation in the method and quality of meat inspection, human use of non-latrine as well as personal and environmental contamination of the study areas. Furthermore, the study animals were from outside of the town and managed under extensive farming system, where contamination of grazing fields by human excreta is common, especially in Guder *woreda.*

Table 5. Questionnaire survey for public health significance in three distinct woredas'.

Risk factor	Interviewed no.	Infested no.	Prevalence (%) (95% CI)	OR(95% CI)	P-value
Age (years)					
<30	48	17	35.4 (28.4-42.4)	3.65	0.022
>30	132	88	66.67(59.8-73.6)		
Sex					
Male	128	91	68.25 (61.4-75)	5.8	0.000
Female	52	14	26.9 (20.4-33.4)		
Religion					
Muslim	17	4	23.53(18.87-29.7)	5.3	0.001
Christian	163	101	61.96 (54.86-69)		
Place of respondents					
Ambo	80	48	60 (52.8-67)	1.8	
Guder	50	34	68 (61.2-74.8)	2.5	0.04214
Dendi	50	23	46 (38.7-53.3)		
Habit of raw meat consumption					
Not consume	75	36	48 (40.7-55.3)	3.5	0.0313
Consume	105	80	76.2 (69.9-82.4)		
Marital status					
Un married	80	42	52.5 (45.2-59.8)	1.5	0.040
Married	100	63	63 (55.9-70)		
Education					
Educated	83	45	54.2 (46.9-61.5)	1.3	0.023
Non educate	97	60	61.85 (54.7-68.9)		

More light infections were observed animals came from Ambo areas, perhaps due to the less habitual raw meat consumption among the local community and less conducive environment for the parasite. Secondly, the practical limitations to the number of incisions allowed in skeletal muscles might have reduced the efficiency of cyst detection. Thirdly, human used toilet.

The prevalence of *T. saginata* cysticercosis in sex, origin, local and crossbred of animals varied significantly (P< 0.05). One possible explanation for this significant difference between local and crossbred of cattle in the study area is might be due to the fact that; crossbred animals are kept indoor, they are fed only with feed guaranteed free from *cysticerci* eggs (this means that no feed from pastures or crops can be used, unless treated) and less exposed to human excreta than local breed. Jemal and Haileluil (2011) reported that the existence of difference in geographical isolates of the parasite and in the breed of cattle as a possible factor affecting the distribution and prevalence of *T. saginata* cysticercosis.

Sex-related distribution of *C. bovis* infection of the slaughtered cattle in this study showed that incidence rate was significantly (P=0.001, OR=36.85) higher in males than in females. The variations in prevalence rate might be because higher number of males (86.83%) of total slaughtered than number that were females (13.16%). This finding is in agreement with the report of Ahmed (Endiras, 2011).

During the study period, the most frequently affected organs with the highest number of cysts of *C. bovis* was recorded in shoulder muscles followed by masseter muscles, thigh muscles, heart, tongue and liver. The variations in anatomical distribution depend on a number of 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 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 (2014). Thus, there is no particular "predilection site" which could be acceptable for all cattle.

Viability test showed that shoulder muscles had the highest relative frequency proportion of viable cysts 41 (85.4%) followed by masseter 11(78.6%), thigh 17

(77.3%), heart 14 (73.68%), tongue 7 (70%), liver 4 (66.67%) and intercostal mussels 1 (50%). This observation goes parallel with the findings of Opara et al. (2012) who recovered 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).

Human taeniasis was a widespread health problem in the study area with prevalence of 68% (34/50), 60% (48/80) and 46% (23/50) in Guder, Ambo and Dendi *woredas'* respectively. The occurrence of the disease had significant association (P=0.04214, OR=2.5) with habit of raw meat consumption. Thus, infection of human being by *T. saginata* is mainly due to the habit of eating raw '*kurt*' or semi-raw '*kitifo*' meat dishes in Ethiopia (Pal, 2012).

Taeniasis prevalence was higher among the Christian community than Muslims in the study area. Similar to the reports of 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 (Pal, 2012).

This presentation revealed that males 91 (68.25%) were highly affected than females 14 (26.9%) (OR=5.8, P=0.001). This observation is similar to the finding of Ambachew and Yitagel (2015) who reported higher prevalence of taeniasis among males than females in Gondar. The difference in the rate of infection between males and females in the study area could be due to the fact that males enjoy eating raw beef with local drink ''*Tej* and *Catukela*", as it is traditionally described ''*Arada Tej*'' at Ambo town, "*Kubaya sefar Tej*" at Dendi woreda and "*Kub-lame* or *Catukela*" at Guder woreda. The second reason might be males have the access to eat raw tongue and rumen folds locally called ''*Milas-Sember"* during ''*Kircha*'', this is common in the study area. The third reason might be males provide and control the finance and hence, they can eat raw beef in the butcher house.

T. saginata was observed among old aged people (> 30 years) as compared to young age people (< 30 years). This agrees with Alemayehu et al. (2009) observation that the older people greater chance of eating raw beef and hence contracting taeniasis. Therefore, the two age groups might be due to the fact that older people have the finance to eat raw beef in the butchers house and generally the tradition of consuming ''*Arada-Tej"* and "*Catukela"* is common among older people and also might be it is the older males individuals who participates in ''*Kircha*'' and hence having the opportunity to eat raw beef particularly tongue and rumen fold ''*Milas-Sember"* in the field.

Based on the place of respondents at the three woredas' survey showed that Guder *woreda* was the highest infection rates (68%), followed by Ambo (60%) and less infection rates was observed in Dendi *woredas'* (46%). The difference of the infection rates in different areas was due to the fact that the difference of cultural, religion and use of latrine. The majority of the communities in Guder *woreda* were Christian with feeding habit of raw meat and non-use of sanitary latrine than in Ambo and Dendi *woredas'*.

Depending on the marital status, married peoples were more infected than unmarried ones. This might be due to the fact that married peoples have the finance to eat raw beef in the butcher's house than unmarried peoples. The results indicated that uneducated had higher prevalence than those of educated ones (OR=1.3, P=0.023). Most of the peoples in the study area were uneducated and with low level of awareness about this helminthic zoonotic disease.

The study showed that the existence of higher prevalence of cysticercosis throughout the edible organs together with deep-rooted tradition of raw meat consumption, which magnifies the public health hazards of taeniasis in the study area. Therefore, attention must be given to the revision of routine meat inspection, public awareness on improving personal and environmental hygiene.

CONFLICT OF INTERESTS

The author confirms you there is no any conflict of interest related with the research paper.

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REFERENCES

Abuseir S, Schniede T, Kelein G, Kuhene M (2012). Visual diagnosis of *T. Saginata* cysticercosis during meat inspection. Parasitol. Res. 99:405-409.

Alemayehu R, Hailu A, Gedissa F, Biniyam M (2009). Cysticercosis of slaughtered cattle in Wolaita Soddo, Ethiopia. Res. Vet. Sci. 47:322-346.

Ambachew, Yitagel (2015). Prevalence and public health significance of *C. bovis* among cattle slaughtered at Gondar manucipality abattoir. DVM Thesis. Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.

Ambo Agricultural Bureau (AAB) (2015). West showa zone. Available at: https://en.wikipedia.org/wiki/Ambo,_Ethiopia.

Brown WH, Neva AF (2010). Basic Clinical Parasitology. 6th ed. Prentic Hall. J. Med. Assoc. Thai. 50:666-670

Central Statistical Agency (CSA) (2012). Federal Democratic Republic of Ethiopia. Agricultural Sample Survey Report on Livestock and Livestock Characteristics, Addis Ababa, Ethiopia.

Deressa A, Yohannes M, Alemayehu M, Degefu H, Tolosa T, Pal M (2012). Human teaniasis in health centers and bovine cysticercosis in selected abattoir in Addis Ababa and Modjo, Ethiopia. In. J. Livest. Res. 2:206-216.

Endiras Z (2011). Helmiths, Arthropods and Protozoa of Domestic Animals. 7thed. BaillereTindall, London. Lead and Febiger. Philadelphia. pp. 90-113.

Food and Agricultural Organization (FAO) (2011). Agrostat data, statistics division, Rome, Italy.

Gebratsadik K, Bemrew A, Belete H, (2016). Prevalence and economic importance of Cysticercosis in Gondor Elfora abattoir. DVM Thesi. Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.

Gracey J, Collins DS, Huey R (2011). Meat Hygiene. 10thed. W.B.Saunders Company Ltd. London. P 674.

Hailu M (2010). *Taenia Saginata* Taeniasis/Bovine cysticercosis in cattle slaughtered at Nekemte municipal abattoir: prevalence, economic and public health importance. DVM Thesis. Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.

Jemal E, Haileluil W (2011). Prevalence, organ distribution and public health significance of *Cysticercus bovis* among slaughtered cattle at Kombolcha Elfora meat factory. MSC Thesis. Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.

Kumba F, Shicongo T, Mate I (2010). Prevalence of bovine cysticercosis in the North of Nambia: Retrospectives study based on abattoir records. Zim. Vet. J. 32:69-74.

Ministry of Agriculture (MOA) (1972). Meat Inspection Regulations. Legal notice No. 428 Negarite Gazeta, Addis Ababa, Ethiopia.

Minozzo JC, Gusso RLF, De Castro EA, Lago O, Soccoi VT (2015). Experimental bovine infection with *Taenia saginata* eggs: Recovery rates and cysticerci location. Braz. Arch. Biol. Technol. 45**:**44-61.

Nigatu K (2008). Cysticercosis of slaughtered cattle in Northwestern Ethiopia. Res. Vet. Sci. 85:522-576.

Nigatu K, Tilahun G, Hailu A (2009). Current status of bovine cysticercosis slaughtered cattle in Addis Ababa Abattoir, Ethiopia. Trop. Anim. Health Prod. 41:291-294.

Onyargo-Abuje A, Ngingi M, Rugutt K, Wright N, Lamuba P, Hughes G, Harrison S (2011). Sero-epidemiological survey of *Taenia saginata* cysticercosis in Kenya. Vet. Parasitol. 64:177-185.

Opara M, Ukpong C, Okoli A, Anosike J (2012). Cysticercosis of slaughtered cattle in southeastern Nigeria. Ann. New York Acad. Sci. 10:339-346.

Over J, Jansen A, Van O (2013). Distribution and Impact of Helminthes Diseases of Livestock in Developing Countries. Animal Production and Health Center FAO (Food and Agriculture Organization). Rome, Italy. P 96.

Pal M (2012). Raw meat poses public health risks. The Ethiopian Herard. May 15, 2012. pp. 2-3.

Pawlowski S (2013). Helminthes Zoonoses Affecting Humans in Africa. Veterinary Medicine, Impacts on Human Health and Nutrition in Africa, Proceedings of an International Conference, Lindberg. September 23, 1996. pp. 50-71.

Radostits O, Blood D, Gay C (2007). Veterinary Medicine, 10thed, Billiere-Tindal London. pp. 224-225.

Solomon H (2012). Animal Health Review 1972-1979. Addis Ababa, Ethiopia. Pp. 85-87.

Suarez M, Santizo R (2013). Epidemiology of the *Taenia saginata* complex and *C.bovis* in Ciego de Avila, province of Cuba. Rev. Patolog. Trop. 34:43-52.

Tembo A (2014). Epidemiology of *Teania saginata* taeniasis and cysticercosis in three selected agro climatic zones in Central Ethiopia. MSc Thesis. Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.

Thrusfield M (2007).Veterinary Epidemiology .2nd ed. Edinburgh, Black well Science. pp. 178-197.

World Health Organization (WHO) (2015). Investing in health research and development Report of the committee on health research relating to future intervention options. Geneva, Switzerland. P 278.

Zivkovic D, Velimirovic P, Dzaja H, Grabarevic Z (2010). Prevalence of *Cysticercus bovis* in muscles with particular reference to histo pathological changes in meat. Arch. Leben mittelhyg. 47:66-68.