

Prevalence, Public Health and Financial Importance of Bovine Cysticercosis in Cattle Slaughtered at Debre Zeit Municipal Abattior, Ethiopia

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Abstract

A cross-sectional study was conducted from November 2010 to March 2011 with the objective of determining the prevalence of bovine cysticercosis in cattle slaughtered at Debre Zeit municipal abattoir, to estimate *T.saginata* taeniasis and the cost of treatment in Debre Zeit town. Active abattoir survey, questionnaire survey and inventory of pharmaceutical shops were performed to accomplish the study. Out of the 700 cattle slaughtered and examined at Debre Zeit municipal abattoir, 38 cattle (5.43%) were infected with *T.saginata* metacystodes. The anatomical distribution of cysticerci was observed and their relative infestation rates were recorded. The highest proportion of the cyst was observed in shoulder (2.86%) followed by heart (1.14%), tongue (0.86%) and masseter muscle (0.14%). Of the total of 126 cysts collected during the study period, 64 cysts were found to be alive while the rest were degenerative cysts. In all the positive animals, no heavy infestation was observed. There was no significant difference found for bovine cysticercosis in origin but breed and age showed significant difference. Of the total 200 interviewed respondents 69.5% (139/200) responded that they had contracted *T.saginata* infection, of which 93% and 7% reported using modern and traditional drugs, respectively. An inventory of pharmaceutical shops revealed a total of 29,272 adult taeniocidal drug doses were sold for a total worth of 114,293 ETB. Niclosamide and mebendazole were the most frequently sold drugs for the treatment of taeniasis while albendazole was the least sold drug. The findings of this study including prevalence of *C. bovis*, questionnaire survey of taeniasis prevalence and the pharmaceutical shops inventory indicated the importance of cysticercosis and taeniasis in both public health and economic aspects. Therefore, attention should be given to public awareness and environmental hygiene to safeguard the public health and further promote the beef industry in the country.

Keywords: Bovine cysticercosis and Abattoir

1. INTRODUCTION

Ethiopia has a huge size of livestock. However, its productivity remains marginal due to prevalence of diseases, malnutrition and management constraints. Parasitism represents a major setback to the development of the sub-sector. However, data on epidemiology, economic loss and relative hierarchy of individual parasitic infections are hardly available. Understanding these contexts yield paramount importance to determine the type and scope of control intervention to be investigated (Jobre *et al.*, 1996).

Among the parasites of live stock, bovine cysticercosis is a disease that affects the muscle of cattle. Bovine cysticercosis is caused by the larval stage of the beef tapeworm *Taenia saginata*. Humans are the final hosts of the parasite. Infection in man is acquired by ingestion of raw or undercooked beef containing the larval cyst, *Cysticercus bovis*, while cattle become infected by ingesting tapeworm eggs passed with human feces (Buncic, 2006). The life cycle and transmission of *T.saginata* occurs most commonly in environments characterized by poor sanitation, poor livestock husbandry practices and inadequate meat inspection and control (Andrews *et al.*, 2004).

The beef tapeworm is found almost all over the world, albeit at lower prevalence in developed countries. Moderate prevalence levels are seen in South Asia. High prevalence rates occur in Sub-Saharan Africa, especially in Eastern Africa where it causes an important economic loss due to condemnation of meat (Atkins *et al.*, 2003). In many developing countries, this disease constitutes a serious but some times less recognized public health problem (Minozzo *et al.*, 2002).

Taenia tapeworms belong to the Kingdom Animalia, Phylum Platyhelminthes, Class Cestodes, Order Cyclophallida, Family Taeniidae, Genus *Taenia*, Species *saginata*/solium. The scientific nomenclature for *Taenia* species is somewhat confusing, as with in some species, the adult and larva stages have been assigned different scientific names. This is the result of an historical assumption that the larvae and adults, found in intermediate and definitive hosts, respectively, were different species in different genera (Dawight *et al.*, 2003).

Researchers believe that about 2 million years ago, African hominids (our early ancestors), who scavenged for food or preyed on antelope and other bovids, were exposed to tapeworm colonization. These worms were using hyena and large cats as definitive hosts and bovids as intermediate hosts. This occurred before the origin of modern humans and substantially earlier than the domestication of swine and cattle and the development of agriculture. The conclusion was inferred from an examination of host and parasites evolutionary histories and from evidence for the rate of molecular evolution between species of *Taenia* (Pedron and Boris Szyfres., 2003)

Adult tape worms are ribbon like, flattened, segmented, hermaphroditic flatworms 15 to 20 m long, consisting of scolex, neck, and immature, mature, and ripe segments in linear sequence. The distinctive morphologic and physiologic properties of the adult tapeworm reflect on the one hand their remarkable specialization for survival in the vertebrate intestine, and on the other hand their massive reproductive powers which are made possible by the multiple sexual units, the proglottides or segments (Atkins et al., 2003). This ensures the worm species against the enormous rate of loss of the segments or eggs passed in the feces, with only the most remote probability of any one egg succeeding in reaching an intermediate host and being transferred to another human. The terminal one-third to one half of the worm's length consists of gravid (egg-filled) segments. These segments are muscular and can crawl caterpillar-fashion through the anal sphincter to the outside environment which renders them available to their herbivore intermediate hosts (Buncic, 2006).

The scolex of *T. saginata* has no rostellum or hooks, and the stobila consist of approximately 200 proglottids each with 14-32 uterine branches and measuring up to 14mm in breadth at maturity. Cysticerci are oval, approximately 0.5-1*0.5 cm in dimension and have a scolex with no rostellum or hooks (Pawlowski and Murrel, 2001).

People infected with adult taenia often are asymptomatic. Infected people may become aware of infection by noticing proglottid segments of the tapeworm in their feces. A disturbing manifestation of *T. saginata* infection is the active crawling of the muscular segments out of the anus. Rarely, intestinal perforation may occur from the scolex of *Taenia*, or proglottides may be vomited and then aspirated (Frolova, 1982).

Globalization poses an increasing threat of incursions of cysticercosis and taeniosis via the increased international movement of people and importation of animals, their products, and potentially contaminated product or other fomites from endemic regions. In theory, these infections can be eradicated (Quinn et al., 2002). Human taeniosis is the only source of cysticercosis and is easily and inexpensively treated with anthelmintics (such as nicosamide or praziquantel), cattle are the only significant reservoir of cysticercosis, and simple cooking or freezing measures render cysticerci non infective (Symyth, 1994).

A person infected with a single *T. saginata* tape worm is capable of contaminating the environment with up to half a million eggs per day over the course of infection, which, if left untreated, can persist for years (Pawlowski and Murrel, 2001). Since *T. saginata* proglottids have a tendency to spontaneously exit the anus independent of defecation, even when good hygienic facilities are available, inadvertent environmental contamination can occur. Eggs contaminating the environment via defecation or spontaneous discharge of proglottids can be disseminated by water, wind, scavenging birds such as gulls feeding on raw sewage, oribatid mites, flies, earth worms, or fomites such as boots or farm machinery. Infective *Taenia* eggs can persist under a variety of environmental conditions; cool and moist conditions favor long-term survival. They can also survive in sewage and in sludge for up to several months, and are resistant to most conventional chemical and disinfectant agents (Jubb, Kennedy and Palmers, 2007). Transmission to live stock occurs via food or waterborne ingestion of infective eggs originating from human feces.

Cattle with cysticercosis are unlikely to exhibit clinical signs. In most cases, however, detection is made during post mortem carcass examination. In most parts of the world where regulated post mortem screening for these parasites occurs, examination of so-called "predilection sites" is conducted during routine meat inspection. However, such procedures are insensitive, particularly for lightly infected carcasses (Taylor et al., 2007). Viable cysticerci can be easily missed on meat inspection since the translucent cyst blend with the surrounding host tissue. Only upon death and degeneration of the parasite, there will be a sufficient host inflammatory response to create a more detectable lesion. Moreover, cysticercosis infection can consist of both viable and degenerative cysticerci (Buncic, 2006), thus detection of only degenerate cysts does not imply the absence of infective cysts elsewhere in the carcass. Depending on the extent of degeneration, the end result of which is a mineralised or fibrotic lesion, definitive parasite features may not be evident on gross examination or histology. The recent development of an immune histochemical assay for parasite excretory-secretory antigen in degenerate *C. bovis* lesion will help in this regard. Molecular methods for characterizing adult *Taenia* (Gonzalez et al., 2001) have been applied to cysticerci, but required further validation before use in regulatory diagnosis can be recommended. Once identified as acysticercus host species and tissue location of the cysticercus can suggest a more specific etiology (Taylor et al., 2007).

Immunity to taeniids is predominately antibody mediated. Thus, there is no serological assay available commercially for use in animals. Currently, such an assay may have value as an epidemiological tool for screening herds for cysticercosis but would not be applicable for individual animal diagnosis (Wanzala et al., 2003). Reliable methods for recovering *Taenia* eggs from various environmental matrices, including livestock feed and water, are not available.

Bovine cysticercosis, is less amenable to eradication due to the greater biological potential of the *T. saginata* tape worm, greater difficulty in detecting animals that are often lightly infected, and a global propensity to consume raw or semi cooked beef (Pawlowski and Murrel, 2001). In spite of its low sensitivity, regulated postmortem inspection of cattle carcasses at slaughter for bovine cysticercosis helps to reduce transmission of the

parasite affected carcasses are condemned, or treated by cooking or freezing to kill the parasite (Hurtmut et al., 2003). Disease control regulations often dictate that epidemiological investigation and quarantine of the suspect herd to be conducted, with significant economic impact on both regulators and affected producers. Anthelmintic treatment of live stock is effective but does not reliably eliminate cysticerci, and is often not practical, particularly for cattle (Gonzalez et al., 2000).

Vaccination of animals at risk holds more promise. Immunization of cattle with preparation of crude parasite antigen reduce infection in animals exposed to sewage on pasture (Hartmut et al., 2003). More recently, recombinant sub unit vaccines based on oncosphere antigens have proven highly effective in protecting cattle from experimental challenge with *T.saginata* and *T.solium* eggs, respectively (Gonzalez et al., 2000). Since *Taenia* eggs are inherently resistant to many environmental conditions and most practical and conventional chemical treatments, efforts should be aimed at prevalence of human taeniasis, and preventing exposure of live stock to human feces and sewage. If sewage must be used as fertilizer, measures such as delayed grazing of cattle on treated pasture can be used to reduce the number of viable eggs in the applied sludge (Radiostits et al., 2007).

Detection of *taenia saginata* cysticerci by postmortem carcass inspection control measures rely on detection of cysts in affected carcass during routine gross (Organoleptic) postmortem inspection procedures. Cysts can be viewed grossly as early as 11 days post infection, at which time they are about 2.5mm in diameter (Dawight et al., 2003). It has been proposed that a variety of factors, such as muscle activity, breed, age, and geographic area may affect localization of cysts (Dawight et al., 2003).

People infected with adult *taenia* often are asymptomatic. Infected people may become aware of infection by noticing proglottid segments of the tape worm in their feces. Symptoms of infection, if any, are general; nausea, intestinal upset, vague abdominal symptoms such as hunger pains, diarrhea and/or constipation, or chronic indigestion. Increased eosinophilia may be a sign of infection (Taylor et al., 2007).

The clinical manifestation of infection with adult *T.saginata* tapeworms are confined to occasional nausea or vomiting, appetite loss, epigastric or umbilical pain, and weight loss. Moderate eosinophilia may develop. A disturbing manifestation of *T.saginata* infection is the active crawling of the muscular segments out of the anus. Rarely, intestinal perforation may occur from the scolex of *Taenia*, or proglottides may be vomited and aspirated (Dawight et al., 2003).

Financial losses can be considerable when large numbers of animals are affected, such as in feed lot. Most incidents arise as a result of direct exposure to proglottids shed from farm workers. There are also some reports of large scale outbreak resulting from sewage contaminated feed or forage. Hence, cysticercosis is an important public health and economic problem because of its consequence on human nutrition and economy of some countries (Wanzala et al., 2003).

Globally, carriers of bovine taeniasis are 77 million and about 40% of them live in Africa. In relation to developed countries even if the disease has a very low prevalence, the problem with removal and treatment facilities in their sewage system plays a role in distribution of eggs (Abuna et al., 2008), since it is shown that the egg can survive in sewage. The larvae of *T.saginata* still cause significant problems in many parts of the world. In Ethiopia the adult parasite in human and the cyst in cattle population is wide spread but differs from region to region. The prevalence of taeniasis is 64.2% reported by (Abunna et al., 2008), and 51.1% by (Regassa et al., 2008) based on questionnaire survey revealed it is a known disease in Ethiopia. On the other hand the prevalence of cysticercosis reported to be 26.3% in cattle slaughtered at Hawassa municipality abattoir (Abunna et al., 2008), 13.3% in Wolaita sodo abattoir (Regassa et al., 2008), 13.8% in Debrezeit (Getachew., 1990), 3.11% in central Ethiopia (Tembo., 2001), 4.9% in Gondar (Dawight (2004) and 7.5% in Addis Abeba (Nigatu 2004). The incidence of *C.bovis* varies greatly between and within countries and even between meat plants a possible reflection of the competence and diligence of meat inspectors.

The objectives of the study:

To determine Prevalence, public health and financial importance of bovine cysticercosis in cattle slaughtered at Debre Zeit municipal Abattoir

2. Materials and methods

2.1 Description of the study area

The study was conducted at Debre Zeit municipal abattoir from December 2010 up to March 2011. The abattoir is found in Debre Zeit town located between 9°N and 4°E., with human population of about 95,000. Its altitude is about 1880m above sea level at 47km South East of Addis Abeba. It has annual rainfall of 1151.6mm of which 84% falls during the long rainy season that extends from June to September, and the remaining during the short rainy season that extends from March to May. The mean annual minimum and maximum temperatures are 12.3°C and 27.7°C respectively, and the mean relative humidity is 61.3% (NMSA, 2003). The farmers in the vicinity of Debre Zeit follow a mixed crop livestock farming system and cereal legume cropping system. The heavy black

clay(Koticha) and light soil types on which teff, wheat, and high land pulses are grown more over Debre Zeit and its surrounding has representing variable agro ecologies of the country (NMSA.,2003). According to CACC,2003 the live stock population of Debre Zeit registered cattle 160,697, sheep,22181 ,goat,37510,horse,5660,donkey,38726,mule 268,poultry191,380.beehives,3274.

2.2 study population

The populations for the study are those animals brought to slaughter house in Debre Zeit abattoir from different towns such as Bale, Asela, Borena, and Harar. The breeds of animals used in this study were almost all local breeds and some of them were crossbreeds.

2.3 study design

Across-sectional study was conducted on bovine cysticercosis from november2010 to march 2011 in which active abattoir survey, questioner and drug shop inventory were conducted.

2.4. sample size determination

The sample size was determined using the formula given by Thrusfield(2005). According to the previous study conducted by Getachew in 1990 the prevalence of bovine cysticercosis at Debre Zeit municipal abattoir was 49 %. therefore ,with 95% confidence interval, and absolute precision 5% the sample size was calculated to be 183. But in order to increase the accuracy of the study, the sample size was increased to 700 cattle. Thus a total of 700 cattle were selected by systematic random sampling and examined for the presence of cysticercus bovis. The formula for sample size determination was;

$$N = \frac{1.96 * PEXP(1 - PEXP)}{D^2} = \frac{1.96 \times 0.138(1 - 0.138)}{(0.05)^2} = 93.26 = 94$$

Where N=required sample size

pexp= expected prevalence

d= desired absolute precision

2.5. Study methodology

Abattoir survey

The cross-sectional study, was conducted during detail meat inspection on randomly selected 700 cattle slaughtered at Debre Zeit municipal abattoir .Before slaughtering the animals ante mortem inspection was carried out and code number of each animal was recorded. During post mortem inspection ,palpation of the organs followed by incision of organs was made to examine for the presence of cysticercus bovis, according to the regulation by ministry of agriculture (1972), for masseter muscle, deep linear incision were made parallel to the mandible; the heart were incised from base to apex to open the pericardium and incision were made above the point of elbow in the shoulder muscle .Examination of the kidney ,liver and the lung was also conducted accordingly.all positive samples were transported to the parasitology laboratory of addis ababa university ,school of veterinary medicine for confirmation of the cyst viability. The cyst were incubated in ox bile at 37°C for 1-2 hrs using 40% ox bile solution diluted in normal saline. The cyst was regarded as viable if the scolex everts during the incubation period.

Questioner survey:

Identification of respondents for questioner survey was made on random selection of volunteers from Debre Zeit town. The selection was based on different age, sex and working conditions. Accordingly, 200 volunteer individual were selected and interviewed. Questioner survey on the disease occurrence and risk factors was administered to the 200 volunteer respondents. The potential risk factors of teniasis such as habit of raw meat consumption, age, sex, religion, occupation, education levels, presence and usage of sanitary facilities especially toilet and knowledge of T.saginata and use of traditional and modern taeniocidal drugs were included in the questioner to estimate the risk factors associated with taeniasis. By doing so the risk factors associated for the occurrence of the disease in human and the public health impact of the disease was assessed.

Inventory of pharmaceutical shops; regarding the drug inventory, relevant information was gathered from volunteer pharmaceutical shops in Debre Zeit town. Different human pharmacies located in Debre Zeit town were inventoried for the amount of drugs sold and cost of drug sold for treatment of human taeniasis. Drug inventory was conducted on 6 volunteer pharmaceutical shops out of the existing 19 drug shops. In line with this annual adult dose of taeniocidal drug sales (based on prescription and patient complaint) in 2010 were gathered to analyse the socio economic significance of taeniasis in the area.

2.4 Data collection

During the study period 700 cattle were examined. Data including sex, age, breed and origin of animal, visceral organs and carcass especially predilection site of the cyst for presence and absence of cyst and type of the

cyst(viable or calcified) were collected on the record sheet. Additionally drug shop inventory and annual dose of drug sold for treatment of taeniasis and questioner survey data also included.

2.5 Data management and analysis

Abattoir survey, questioner data and drug shop inventory data were recorded and entered in to ms excel and analyzed using STATA version11.0 statistical package. The questioner data were also summarized and analyzed to assess the association of potential risk factors for taeniasis among different respondents.

3. Results

Abattoir survey: A total of 700 animals were examined at debre zeit municipil abattior for five months starting from November to early March,of which , 38 animals were found infected with *C.bovis* and 662 animals were found free of *C.bovis*.

The overall prevalence of bovine cysticercosis in the study area was recorded as 5.43% (38/700). Analysis of the abattior survey showed that there was very significant variation ($p,0.05$) with regard to the anatomical distribution of cysticercus cysts in the organs inspected. The highest proportion of *C.bovis* cyst was observed in shoulder(2.86%) followed by heart (1.14%), tongue (0.86%) and masseter muscle (0.14%).(table 1)
 Table 1. Frequency of infection by type of organ and cyst status among insfected organs Debirbe Zeyite Munsfalty Abattoir, 2010

organ	No of examaned	organs	No of infected	Prevalence(%)	Cyst status (%)		
					Viable(V)	Calcified(c)	V and C
Tongue	700		6	0.86	0.28	0.14	0.42
Shoulder(S)	700		20	2.86	0.28	0.28	0.28
Masseter(M)	700		1	0.14	0.00	0.00	0.14
Heart (H)	700		8	1.14	0.14	0.00	1.00
S &M	700		1	0.14	0.00	0.00	0.14
H &M	700		2	0.28	0.00	0.00	0.28
Total	700		38	5.42	0.71	0.43	4.29

A total of 126 cysts were collected during the inspection .Of the total of 126 cysts collected during the study period 64(50.79%)cysts were found to be alive while other (49.2%)were degenerative cysts. There is significant difference between age group and breed of animals infected.

Out of 390 adult animals, 29 animals have been found infected by *C.bovis* which consist 7.43% where as among 21 young animals 5 animals was infected with which consist of 23.8% and out of 289 animals that are examined 4 of them are infected by *C.bovis* and the analysis shows there is significance association ($p,0.05$)between age and rate of infection(table).

Table 2. Age wise prevalence of bovine cysticercosis at Debirbe Zeyite Municipality Abattoir, 2010 .

Age group	Total	Positive	Negative	Prevalence %
Young (<=2 years)	21	5	16	23.80
Adult (2-5 years)	390	29	361	7.43
Old (>5 years)	289	4	285	1.38
Total	700	38	662	5.43

Twenty seven animals were found to be infected from 674 local breed animals which consist 4.00% and out of 26 cross breed animals 11(42.3%) of them were infected.

Table3.prevalence of bovine cysticercosis on local and exotic breeds

Breed	No.of animals examined	posotive	Prevalence(%)
Local	674	27	4.00
Cross	26	11	42.30
Total	700	38	5.43

Questioner survey:Of the total 200 interviewed respondents who participateD in this study 69.5%(139/200) had contracted *T.saginata* infection ,of which93% and 7% reported using modern and traditional drugs respectively . the majority of respondents (81%) had an experiance of raw meat consumption as aresult of traditional and cultural practice. The logistic regrassion analysis of the risk factors showed no significant difference ($p,0.05$) between sex, religion, occupational risk ,marital status and education status respectively. Majority of the respondents (97.5) buy meat from the butcher shop but the disease prevalence is high which indicate that routine meat inspection method are insensitive.

Inventory of pharmaceutical shops:An inventory of pharmaceutical shop (pharmacies and drug stores)was conducted in Debre Zeit town. Estimates of yearly adult taeniacidal drugs dose and its worth were collected through personel interview with individuals in charge of pharmacies and using their records for the year2010.

This revealed a total of 29,272 adult taeniocidal drug doses were sold for a total worth of 114,293ETB. Niclosamide and Mebendazole were the most frequently sold drugs for the treatment of taeniasis while Albendazole was the list sold drug. (table4)

Drugs	Dose	Cost in ETB
iclosamide	8992	26976
Praziquantel	3814	22884
Mebendazole(bol)	12009	24018
Mebendazole(syr)	982	11784
Albendazole(bol)	1774	14286
Albendazole(syr)	1701	14345
Total	29272	114293

4. Discussion

The prevalence of bovine cysticercosis during the abattoir survey conducted at Debre Zeit municipal abattoir was recorded as 5.43% which is relatively similar to the findings of Dawit (2004) (4.9%) prevalence in Gonder, Tembo (2001) (3.11%) in central Ethiopia, and 7.5 in Addis Ababa (Nigatu, 2004). However, it is less than the findings of other authors such as 26.35 in Debre Zeit, Getachew (1990), 17.5% in East Shoa, Hailu (2005), 21% in Nekemt, Ahmed (1990). The findings of this study are also in contrast to the high prevalence in some parts of African countries such as 20% in Senegal, 27% in Tanzania and 38-62% in Kenya (Over et al., 1992).

The lower prevalence of bovine cysticercosis in this study might be attributed to the variation in the personal and environmental hygiene, sample size, type of live stock management of the stock holders and practical limitations to the number of incisions allowed and many infestations could be undetected as gross mutilation lowers the marketability of carcass and introduce contamination, owners do not allow multiple incisions for the detail investigation. It is also important to note that slaughtering carried out at night and lighting system also plays a role in investigating the parasite cyst.

Analysis of the abattoir survey showed that there was very significant variation ($p < 0.05$) with regard to the anatomical distribution of cysticercus cysts in the organs inspected. The highest proportion of *C. bovis* cyst was observed in shoulder (2.86%) followed by heart (1.14%), tongue (0.86) and masseter muscle (0.14%). It has been assumed that a variety of factors, such as muscle activity, breed, age, and geographic area may affect localization of cysts. In cattle throughout Africa, important predilection sites are the muscle of the shoulder (triceps brachii), a region advanced for the frequent involvement of the muscle, being the increased blood supply due to the long journeys undertaken by these animals (Gracey et al., 1999). There is significant difference between age group and breed of animal ($p < 0.05$) but no difference was observed in origin of animal. One possible explanation for this is young animals are highly affected since no previous exposure to the disease and cross breed animals are more susceptible to infection than local zebu breeds when exposed to infection. Pawloski and Murrell (2001) reported the existence of difference in geographical isolation of the parasite and in the breed of cattle as possible factors affecting the distribution prevalence of *T. saginata*. It is also now recognized that local breeds are resistant to parasitic disease infections (Gracey et al., 1990).

The prevalence of taeniasis recorded in this study based on questionnaire survey was 69.5% illustrating the significance of the taeniasis in the population of Debre Zeit town and agrees with the findings of others such as 69.2% in Gonder by Dawit (2004), 64.2% in Awassa by Abunna et al. (2008). The present study indicated that there was no significant association between the prevalence of taeniasis by age, sex, religion, education, marital status and occupation. This is due to raw or undercooked meat like "kurt", "kitfo", and "lebleb" were the most known and acceptable type of food by all people and available in all restaurants and hotels due to deep rooted culture of eating raw or undercooked meat even in those having awareness about the disease (163/200).

Human taeniasis has importance both in socio-economical and health aspects. However, the evaluation of economic aspect is very difficult in countries like Ethiopia, where infected people treat themselves with traditional herbal drugs and lack of accurate information with the amount of financial losses associated with condemnation and downgrading of carcass due to bovine cysticercosis. One of the possible sources of information to evaluate the financial loss is to carry out inventories of pharmaceutical shops which may not reflect the actual economic impact of the disease. However, inventories of 9 out of the 19 pharmaceutical shops which comprise one year record of 2010 in Debre Zeit town during the study period indicate that 14,345 ETB. This indicates that taeniasis diminishes the household resources which could be easily avoided by eating well cooked meat and using toilet.

5. Conclusion and recommendations

Taenia saginata is a medically and economically important cestode parasite. Most adult and larval tapeworm infections cause little or no disease to animals. However, cysticercosis causes economic loss through condemnation of infected meat and offal's. Bovine cysticercosis usually does not cause much morbidity and mortality among

cattle, but it does cause serious economic problem in the endemic area due to the condemnation of meat or down greeding of carcass in light infections contributing constraint in food security and safety and due to heat treatment or processing of carcasses for human consumption and incurring considerable cost of human treatment is substantial.

Therefore, based on the above result and earlier works the following recommendations are forwarded:

- Attention must be given to routine meat inspection procedures
- Educational approach in humans should be geared to change their sewage disposal system not to contaminate grazing fields by human excreta.
- Awareness should be created at childhood level to bring change in culture of raw meat consumption.
- Improvement of personal hygiene is also recommended to decrease transmission of disease by contaminated land.

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