Original Research Article

Epidemiology of *Cysticercus bovis/Taenia saginata* and community perception about meat borne zoonosis in three selected districts of West Shoa zone of Oromia Region, Ethiopia

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Abstract

A cross-sectional study was conducted on bovine cysticercosis in cattle slaughtered at Holata, Addis Alem and Ginchi municipal abattoirs in west Shoa zone of Oromia Regional State with the objective of estimates the prevalence of *Taenia saginata*/cystiercosis, associated risk factors and community knowledge about meat-borne zoonosis. Routine meat inspection and questionnaire survey on conveniently selected respondents in the study areas were used. Out of 600 carcasses examined in three municipality abattoirs 2.5 % (15/600) were infected with *C. bovis*. A prevalence of 2.5% (95% CI: 0.3%-4.7%) (5/200), 1.6% (95% CI: 0.2%-3.5%) (3/180), and 3.2% (95% CI: 0.9%-5.5%) (7/220) in Holeta, Addis Alem and Ginchi were observed, respectively. Cysts were found in heart (46.6%), tongue (33.33%) and shoulder muscle (20%). Out of the cysts 46.6 % (7/15) were viable, while 53.3% (8/15) were non-viable. The questionnaire survey revealed that *T. saginata*/taeniosis is a wide spread problem in these three towns and surrounding rural areas. Out of 110 respondents 63.6% (70/110) had contracted *T. saginata*. Age, sex, religion, occupation, education status, raw meat consumption, knowledge about the disease and presence or absence of the latrine was found to be potential risk factors. The present study indicate that *Taenia saginata*/cysticercosis is highly distributed in the study areas warranting professional intervention and community based control programs should be introduced.

Keywords: Addis Alem, Bovine, Cysticercosis, *C. bovis,* Holata, Ginchi, *T. saginata*

Introduction

In Ethiopia, the livestock sector contributes about 30% of the agricultural GDP and 19% to the export earnings. In Sub-Saharan Africa, livestock diseases, negatively affect the public health and impede economic growth by incurring direct (morbidity, mortality) and indirect economic losses (Sachs, 1999; Perry *et al*., 2002). In humans, the disease is called as taeniasis which is accompanied with symptoms like nausea, abdominal discomfort, epigastric pain, diarrhea, excessive appetite or loss of appetite, weakness, loss of weight and intestinal blockage (Neva and Brown, 1994).

Parasitic diseases are highly prevalent in Sub–Saharan Africa and incur severe economic losses by reducing productivity. *Taenia saginata /*bovine cysticercosis is one of the major parasitic diseases, which does not only lead to economic loses, but also adversely affect public health. The distribution of *Taenia saginata* is wider in developing countries, where hygienic conditions is poor and where the inhabitants traditionally consume raw or insufficiently cooked or sun cured meat (Larry*,* 2009).

Meat- borne diseases are common in developing countries including Ethiopia because of the prevailing poor food handling and sanitation practices, inadequate food safety laws, weak regulatory systems, lack of financial resources to invest in safer equipments, and lack of education for food-handlers (WHO, 2005). National Hygiene and Sanitation Strategy Program (WHO/FAO, 2005) reported that about 60% of the disease burden was related to poor hygiene and sanitation in Ethiopia. In realizing the severity of food safety problems and control of parasitic meat-borne zonoosis in Africa, the Food and Agricultural Organization (FAO) and the World Health Organizations (WHO) of the United Nations (UN), passed a resolutions to improve the food safety situation in Africa (FAO/WHO, 2005).

The problem of food borne parasitic zoonoses could be further complicated in Ethiopia by lack of efficient inspection at critical control points in abattoirs, lack of awareness and knowledge on the mode of transmission and public health hazard of these diseases as well as due to presence of widespread habit of raw meat consumption both in rural and urban communities. A number of reports in Ethiopia indicated that, certain groups who had easy access to raw meat and meat products (Butchers and abattoir workers) and those people with low level of formal education were reported to be more infected with parasitic
zoonosis than those who had low access to raw meat and those with better education. This implies that the frequency of raw beef consumption is higher in these groups of people (Nigatu *et al*., 2009; Adugna *et al*., 2012).

The adult tapeworm, *T. saginata* occurs in the small intestine of the definitive host, man and the metacestode (*Cysticercus bovis*) is found in cattle that serves as main intermediate host (Soulsby, 1982). Globally, there are 77 million human carriers, out of which about 40% live in Africa (Fralova, 1985).Its prevalence is high in developing countries particularly in sub-Saharan Africa (WHO, 1995). In East African countries, prevalence rates of 30-80% have been recorded (Tembo, 2001). In developing countries, the incidence of human infection with *T. saginata* is usually high, with the prevalence of over 20 %; whereas in developed countries, the prevalence of cysticercosis is low, usually less than 1 % (Urquhart *et al.*, 1996).

Even though, *T. saginata* has worldwide distribution, its prevalence is particularly high in Sub-Saharan Africa (WHO, 1995). In Ethiopia several authors have reported the prevalence of *T. saginata* taeniasis and cysticercosis with in a wide range of 2.5 % to 89.41 % and 3.11 % to 27.6 %, respectively (Dawit, 2004; Hailu, 2005, and Abunna *et al.*, 2008). The cultural habit of eating raw meat in form of "Kourt" meat cubes and "Kitffo" minced meat in Ethiopia, has favored the spread of this disease (Dawit, 2004; Fufa, 2006).

Taenia has a debilitating effect on people who live on protein deficient diets those suffering from iron deficiency infected by hookworm (Mann, 1984). Some patients lose their appetite and thus lose weight. Sometimes, the gravid proglottids migrate to different organs such as the appendix, pancreatic duct, nasopharyngeal pathways and bile ducts producing obstruction and inflammation of the affected organs (Ortega, 2006).

Economic losses due to bovine cysticercosis are associated with total condemnation of carcasses with generalized infestation and reduced value of carcasses which are subjected to refrigeration, in addition to the cost of refrigeration and extra handling transport (WHO, 1995). In general, *Cysticercus bovis* has an impact on meat trade. It increasingly becomes important in view of the drastic measures and very strict regulations from importing countries on exporting countries. The treatment cost for human taeniasis and costs of manufacturing of drugs have significant contribution in estimation of economic loss (Feseha, 1995).

Taenia saginata taeniosis/cysticercosis has high economic and public health impacts in Ethiopia; as a result control and prevention of the disease has great importance. One of the prerequisite for implementing control and prevention action is information on prevalence and associated risk factors throughout the country, in central Oromiya, in Oromiya Regional State east Shoa Zone there is no any work that indicates the status, risk factors and public health importance of *T. saginata* taeniosis/ Cysticercosis. Hence, the current study was designed to [1] Estimate the prevalence of *T. saginata/* cysticercosis in Addis Alem, Holata and Ginchi municipality abattoirs [2] Assess the

community perception about meat-borne zoonoses [3] Estimate the financial cost of treatment in human through inventories of pharmaceutical and drug shops.

Materials and Methods

The Study area

The study was conducted in Holata, Addis Alem and Ginchi districts west Shoa Zone, which represents the Central of Oromiya Regional State. West Shoa zone is located at an altitude of 2400 meters above sea level, 09° 03'N latitude, and 38°30' E longitude. The area is located at a distance of about 29 km west of Addis Ababa along the Nekemt road. The area is characterized by a mean annual rainfall of 1100 mm, mean relative humidity of 60.6%. The main rainy season is from June to September which accounts for about 70% of the rainfall while the remaining 30% is from February to April. The average annual maximum and minimum temperatures are 22.1^0C and 6.2^0C, respectively (HARC, 2005).

The three abattoirs, namely Addis Alem, Holata and Ginchi municipality abattoirs have almost the same design and construction. The three have more or less slaughtering facilities, good light for carcasses inspection, and hooks for hanging carcasses, special site for offal and drainage tunnels for disposal of blood and other waste materials.

Holata, Addis Alem and Ginchi municipal abattoirs have a similar capacity of slaughtering about 10 to 25 local beef cattle at one shift.

Study population

The study animals were beef cattle coming mainly from central of Oromiya, Meta Robe, Dandi and Ilu districts. During the study period a total of 600 beef cattle (200 from Holata 180 from Addis Alem and 220 from Ginchi) were examined for the presence of *C. bovis*.

For questionnaire survey the target population was people living in Ginchi Addis Alem and Holata towns. The later mainly considered as high production of beef cattle. The study populations were people of one kebele in Ginchi town, one kebele in Addis Alem town, two kebeles in Holata

town and seven kebeles from rural area, from a total of 11 kebeles, 110 respondents were interviewed during this study.

Study design and sampling methodology

Active abattoir survey was conducted in Holata, Ginchi and Addis Alem municipal abattoirs on slaughtered cattle using postmortem examination for the presence of *C. bovis.*

In addition cross sectional type of study design was employed using questionnaire survey to assess the prevalence of *T. saginata*, associated potential risk factors and its public health importance.

Both surveys were supported with retrospective data collected from concerned agricultural, public health organizations, veterinary clinics and government offices in Holata, Addis Alem and Ginchi.

Sample size

The sample size for all abattoirs and questionnaire survey was determined using the formula described in Thrusfield (2005) the prevalence in a large (theoretically infinite) population at 95% confidence interval and 4% absolute precision with an expected prevalence of 30%. With this assumption 504 cattle were required. To increase the possible chance of getting cysts 10% of the sample size were added getting a total of 554 cattle that could be inspected. In due course of time enough cysts were not obtained and within the study time frame additional 46 cattle were inspected.

$N = 1.96^2$ pexp (1-pexp)/d^2; Where:
N = required sample size
Pexp = expected prevalence
d = desired absolute precision

Abattoir survey

Prior to sampling each animal was given an identification code like name of the owner and the color of the cattle. During meat inspection, each organ of an animal was strictly and separately examined to avoid mixing up of organs. The butcher and meat inspector also gave due attention to avoid mixing up of organs from different animals. On visiting days of each abattoir all slaughtered cattle were examined.

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The predilection sites such as heart, tongue, masseter diaphragm, oesophagus, triceps, liver and lung were inspected for the presence of *C. bovis* (OIE, 2004). Meat inspection was made as per the procedures of Ethiopian ministry of agriculture meat inspection regulation (1972) for the detection of *C. bovis*. The heart, tongue, masseter, diaphragm, esophagus, triceps brachi, thigh muscles, liver, lung, kidney and spleen of all slaughtered beef cattle were assessed by visual inspection, palpation and followed one to three incisions except for oesophagus for the detection of *T. saginata* cysticercus. Live and dead cysticerci were carefully dissected from the tissues and the number in each organ recorded for each animal. At the end of the examination, the cysts were collected properly labeled and brought to Debre zeit parasitology laboratory for further investigations. The viability of cysts were examined by placing them in a normal saline solution with 30% Ox bile and incubated at 32^{0c}. evagintion of the un armed scolex in viable cysts normally takes place within 1-2 hours (Gracy, 1999). The cysts were then identified as *C. bovis* if they lack hooks and rostellum on the evaginated scolex with four suckers (Opara, 2006).

Questionnaire survey

In the selected study areas 110 voluntaries were selected as convenient and participated to assess the community perception. Socio-demographic information, occupation and educational level were included in this particular study.

Data analysis

All the data obtained from the study were entered into MS Excel data sheets, coded and analyzed using SPSS (15.0 versions). The data were described using percentages to determine *C. bovis* infection in examined carcass; Chi square test (x^2) was used to see the strength of association; Odds Ratio (OR) was used to determine the effect of different risk factors and logistic regression analysis was used to determine the most significant independent variables

Results

Abattoirs survey results

In the present study an overall prevalence of 2.5% (95%CI: 1.3%-3.7.0%) *C. bovis* was recorded. Out of this 2.5% (95%CI: 0.3%-4.7%), 1.6 % (95%CI: 0.2%-3.5%) and 3.2% (95%CI: 0.9%-5.5%) prevalence in Holata, Addis Alem and Ginchi municipality abattoirs were recorded, respectively (Table-6).

Table 6: Prevalence of *C. bovis* in the three municipal abattoirs **(N=600)**

Abattoirs carcass	No. of inspected negatives	No of positive	No of (%)	Prevalence
Holata	200	195	5	2.5
Addis Alem	180	177	3	1.7
Ginchi	220	213	7	3.2
Total	600	585	15	2.5

x^2= 0.93; df 2 (n-1) p=0.63: Fisher's exact test.

The monthly inspection indicated that, in Ginchi municipality abattoir, a relatively higher prevalence was recorded in December and the least in November and March. Similarly, in Holata abattoir, the highest prevalence of *C. bovis* was found in December and the least was in November and February while it was in November, February and March in Adis Alem (Table-7)

Table 7: Monthly occurrence of *C. bovis* in Holata, Addis alem and Ginchi abattoir

Months	Abattoir	Nov	Dec	Jan	Feb	March
Holata	Slaughtered cattle	10	80	47	18	45
	C. bovis	0	3	1	0	1
	Prevalence (%)	0	3.75	2.1	0	2.2
A.Alem	Slaughtered cattle	17	72	61	20	30
	C. bovis	0	2	1	0	0
	Prevalence (%)	0	2.7	1.6	0	0
Ginchi	Slaughtered cattle	45	62	49	32	12
	C. bovis	1	3	2	1	0
	Prevalence %	2.2	4.8	4.0	3.1	0
	Slaughtered-cattle	72	214	157	70	87
	C. bovis	1	8	4	1	1
	Prevalence %	1.3	3.7	2.5	1.4	1.1

Table 8: Status of cysts in different organs of inspected cattle

No. of viable cysts	No. of non viable cysts
3	2
3	4
1	2
7(46.6)	8(53.33)

Table 9: Proportion of infected, viable and non-viable cysts in different organs

Infected organs	Organs affected	Tongue	Heart	S. muscle	Liver
Percentage (%)	Tongue	33.3	46.6	20	0
Viable cyst (%)	Heart	60.0	42.9	33.3	0
Non- viable cyst (%)	S. muscle	40	57.2	66.6	0

In the present study out of the total 15 affected organs, *Taenia saginata* cysticerci occurred in the proportion of 46.6% in heart, 33.3% in tongue, and 20.0% in masseter. The heart was the most frequently affected organ; this observation is in agreement with the work of Abuna *et al*. (2008) who reported *C. bovis* in Hawassa with proportion of 43% and Dawit at Gondor abattoir (37.84%). However, it is slightly higher than the findings of Hailu (2005), 21.54% in East Showa zone.

The current study showed that tongue, heart and shoulder muscle were organs infected with *Cysticerus bovis* with the prevalence of 33.3%, 46.6% and 20%, respectively (Table 9). An overall proportion of 8 (53.3%) viable and 7 (46.6%) non viable *C. bovis* cysts were exposed (Table 8). During the present survey cysts were not encountered in other organs like liver, kidney, lung and diaphragm. Even though butchers were not allowed to incise some important muscles during inspection, the shoulder muscle and the tongue were the most infected organs with *C. bovis*.

Questionnaire survey results

In the selected study areas 110 voluntary respondents participated which have different occupation and educational level; farmers, merchants civil servants, students, butchers and abattoir workers were included in this particular study. Convenient sampling method was used during the survey. Out of 110 respondents 70 (63.64%) was positive for *Taenia saginata*.

Responses to questionnaires based on age respondents

There was strong association (P=0.003 and $x^2 = 14.17$) between prevalence of *Taenia sagenata* infection and age distribution. Among the respondents age groups of 27-40 years old (73.91%) had relatively higher infection rates than youngsters.

Table 10. The risk factors for Taenia *saginata/* taeniosis infections in human respondents

Variables (%) Respondents	No. of	No.Infected Value	x^2	*P-*	OR	95% CI)
Sex						
Male	65	50(76.92)	10.76	0.001	4.17	1.7- 10.4
Female	45	20(44.44)				
Age						
<15 years	12	2 (16.67)				
15-26 years	38	26(68.42)				
27-40 years	46	34 (73.91)	14.17	0.003	----	--
>40 years	14	8 (57.14)				
Religion						
Muslim	18	6 (33.33)				
Christian	92	64 (70.33)	7.05	0.008	0.22	0.06-0.71
Marital Status						
Single	38	24 (63.15)	0.02	0.9	0.97	0.4-2.37
Married	72	46 (63.89)				
Occupation						
Low risk	50	23 (46.0)				
High risk	60	47 (78.3)	10.96	0.0009	0.24	0.09-0.58
Educated						
Informal	20	17(85.00)	0.08	0.008	3.95	1.45-3.7
formal	90	53 (58.88)				
Meat eating						
Cooked meat	51	21 (41.18)				
Raw meat	59	49 (83.05)	18.96	0.000	0.14	0.05-0.4
Spices usage						
No spices	63	46 (73.02)	4.7	0.03	2.6	1.1- 6.24
Use spices	47	24 (51.06)				

Among the respondents age groups of 27-40 years old (73.91%), raw meat consumers (83.05%, Christian (70.33%), male (76.92%), married (63.89%), people who were not educated (85%, those who were not using spices (73.02%) and High risk (78.3%) were showing higher percentage of *T.saginata* infections. Comparing from spices users the higher percentage of *T. saginata* infections in non-spices users could serve as an indicator as to the possible role of using spices while eating raw meat in the prevention of *T. saginata* infection.

Responses to questionnaires based on s ex of respondents

The prevalence on sex basis indicated that males (50%) were more prone than females (20%) and the difference was statistically significant, (, 10.76; p<0.05, 0.001). The analysis indicated that males were more than 4 times (95% CI: 1.7-10.4) at a higher risk than females for *Taenia saginata* infections**.**

Responses to questionnaires based on religion basis o f respondents

The prevalence on religion basis indicated that Christians were more affected with the disease (70.33%) and the difference was significant, (^{2}7.05; p<0.05, 0.008) and they were having 22% of higher infections compared to Muslims**.**

Responses to questionnaires based on the professional occupations o f respondents

The respondents were classified in two working environments i.e. high risk (farmers, animal handlers, butchers and abattoir workers and (low risk) students and civil servants. Accordingly, two groups were formed. Analysis showed there was significant statistical association between occupation

so that high risk (78.3%) were contracting taeniosis higher than low risk (46%) (P< 0.05, 0.0009 and 2 10.96)

Responses to questionnaires based on the educational level o f respondents

For the purpose of statistical analysis, the education level were divided in to two categories i.e. those who did not attend school were coded as informal, those who attended from elementary up to senior high school and who graduate from colleges and universities were coded as formal. In this particular study, education level had statistical significance (P<0.05, 0.008 and $^{2=}$ 0.08) on prevalence of *Taenia saginata* infection (Table-10)

Responses to questionnaires on the meat consumption habits o f respondents

The present study showed that the majority of the respondents had consumed raw meat. Eating raw meat is usually traditional and cultural practice in the study area. Among interviewed, 49 (83 .05%) indicates the respondents had the practice of consuming raw meat and had contracted taeniosis more than once in their life time. It was observed that raw meat consumption and prevalence of taeniosis had strong association (2=18.96 and p=0.000).

Results on Drug Inventory

Drug inventories of seven from ten requested drug shops and pharmacies revealed that human *Taenia saginata* taeniosis is an important disease among the residents of Holata, Addis Alem and guinchi. Four taenicidal drugs were used in the study areas and the total amount of money invested for the treatment of *T.saginata* in human for the year 2013 was estimated about 380,032 Ethiopian birr for 68,181doses.

Table 11: Inventory of annual taenicidal drug doses and their worth in the study area

Taenicidal Drugs	Holata		Addis Alem		Ginchi		Total	
	Doses	Price in (Birr)	Doses	Price in (Birr)	Doses	Price in (Birr)	Doses	Price in (Birr)
Albendazole	1,460	8,760	3,825	22,950	4,526	27,576	9,811	59286
Mebendazole	9,711	58,587	3,442	20,652	11,187	67,092	24,340	146,331
Niclosamide	10,219	51,095	7,720	38,600	6,882	34,410	24,821	124,105
Praziquantel	853	8,530	4,278	21,390	4,078	20,390	9,209	50,310
	22,243	126,972	19,265	103,592	26,673	149,468	68,181	380,032

Source: Collected and summarized by investigator

Four taenicidal drugs were used in the study areas and the total amount of money invested for the treatment of *T.saginata* in human for the year 2013 was estimated about 380,032 Ethiopian birr for 68,181doses.

Table 12: Taeniacidal traditional medicaments used in the study area
N= 100

Name of the Medicament in Amharic	Scientific name	Part used	No of respondents	%
Kosso	*Hagenica abyssinica*	Fruits	70	70
Enkoko	*Embelia schimperi*	Seeds	62	62
Meterie	*Glinus lattoides*	Flower	58	58
Duba Frie	*Cucurbita pepo*	Seed	42	42
Tosigne	*Thymus serrulantus*	Leaf	20	20

Source: from respondents

Of these traditional herbs, Kosso, Enkokko and Meterie were commonly used; in addition, Duba-fre (pumpkin seed) and Tosigne were also used.

Discussion

Abattoirs survey of Cysisercosis in the study areas

The highest recorded prevalence might be due to slaughter of large number of cattle in holydays that is Christmas in December and Ethiopian Epiphany in January months.

Abattoir survey result of the present study revealed an overall prevalence of 2.5% cysticercosis in slaughtered cattle in all three abattoirs. The prevalence of cysticercosis was found to be 2.5%, 1.6% and 3.2% in Holata, Addis alem and Ginchi municipality abattoir, respectively. Statistical analysis showed that there was no statistical significant variation between these three abattoirs in the prevalence of cysticercosis. The possible reason for relatively higher number of cystcicerci in Ginchi and Holata than Addis alem may be due to more number of examined carcasses, better lighting, cleanness of the abattoirs and very good facilities compared to Addis Alem abattoir. This fact is confirmed with the work in Victoria where the marked increase in the number of cases of *Taenia sagianta* cysticerei were found, due to the correction of few simple inspection procedures, such as checking and correcting the amount of light available at inspection stations, to ensure that the heart and head could be properly inspected.

Staff employed on inspecting heads had to be trained in the desired method of incision of the master muscle (Tolosa *et al*., 2009). The majority of the findings in Ethiopia were based on surveys carried out on carcasses subjected to the routine meat inspection procedures. Hence the same limitations with which meat inspection shares globally were reflected in the results of the present study, the present finding is similar to reports from different parts of Ethiopia, such as, 3.1% in central Ethiopia (Tembo, 2001); 4.9% at Gonder (Dawit, 2004); 7.5% in Addis Ababa (Nigatu, 2004).

Higher prevalence was reported from other abattoirs in the country; 18.49% in north western Ethiopia (Kebede 2008), 21% in Nekemt (Ahmad, 1990) 26.25% in awassa (Abunna *et al.,* 2008) and 27.6% in Luna export abattoir in East Showa (Hailu, 2005).

Out of a total of 600 *C. bovis* cysts that were collected from different organs harboring them, 46.6% in heart, 33.3% tongue and shoulder muscle 20%. The Heart was the most frequently affected organ; this observation is in agreement with the work of Abuna *et al*. (2008) who reported *C. bovis* in Hawassa with proportion of 43% and Dawit at Gondor abattoir (37.84%). However, it is slightly higher than the findings of Hailu (2005), 21.54% in East Showa zone. The viability tests of cysts revealed that it was the tongue, which harbored the highest number of viable cysts (60%) and this is in agreement with the reports of Amsalu (1989) at Gondor abattoir. The present study indicated that *Taenia saginata* cysticerci occurred in the proportion of 14.3% in masseter which coincided with the work of Opara *et al.,* (2006) 15.6%.

The present findings in the viability of cyst is in agreement with the work of Abunna *et al* (2008) who reported 44.2% live and 65.8% dead cysts in Hawassa abattoir. On the other hand, it is not in agreement with the work of Kebede (2008) who recorded 85.6% viable cysts.

Perception and risk factors

The quality of questionnaire is an important tool in individual cases and in mass investigation for the detection of *Taenia saginata* in carrier individuals (Fralova, 1985).

A cross sectional questionnaire survey revealed that the overall prevalence of *Taenia saginata* in respondents during the interview was 70 (63.64%). Prevalence of present study slightly was close to the findings of Abunna *et al.,* (2008) who reported 64.2%, Dawit 2004 (69.2%), Tembo (2001) 68%. On the other hand this findings is greater than the reports of Woldemichael *et al.,* (1990) 13.5% in Wonji Showa and *Wondimagnehu et al*., (1992) in Wonji 2.5%. Study sites as risk factor have no significant effect on the occurrence of *Taenia saginta*. The present Study showed that there was strong association between age of the respondents and the prevalence of *Taenia saginta* infection (P=0.000) and it is in agreement with the finding Hailu (2005), Dawit (2004), Abunna *et al.,* (2008) who reported higher prevalence in adults with age more than twenty. The probable explanation could be the chance of contracting the infection in this age category is higher since they frequently visit butchers for raw beef which is the favorite dish for the most respondents. The rest of respondents with the age less than twenty even they do not have the chance to visit butchers, because of financial constraints and to some extent due cultural restriction.

Among the different age groups, those between 15 and 26, 27 and 40, and above 40 years were 68.42 % (95% CI = 53.6-83.21), 73.91% (95% CI = 61.2-86.6), 57.14 % (95% CI = 31.2-83.1) more infected, respectively than those below 15 years 16.67% (95% CI = 4.4- 37.8). In conformity with this finding, Regassa *et al.,* (2009), Taresa *et al.,* (2011) and Tesfaye *et al.,* (2012) have reported that the disease is more common in adults than in children and youth. The possible explanation for the presence of age-wise variation in the prevalence of taeniosis is attributed to frequent raw meat eating habit of adults as compared to those below 15 years (Megersa *et al*., 2010). Nevertheless, Abunna *et al*., (2011) and Bedu *et al.,* (2011) didn't observe age-wise variation in the proportion of taeniosis (Adugna, 2012).

In this study the interaction between sex and the prevalence of *Taenia saginata* was slightly statistically significant (P=0.046) this is in agreement with the findings of Hailu (2005), Dawit (2004) and Temb (2001) in Ethiopia. The possible explanation for the present finding was that male frequently visit butchers and there is cultural limitation for females especially, for those who lived in the rural area (Megersa *et al*., 2010).

Statistical analysis showed that there was an association between the prevalence of taeniosis and religion. The study revealed that the proportion of taeniosis infection was higher in the Christian community. This finding is in Agreement with findings of Hailu (2005), Dawit (2004), Tembo (2001), Abunn et al., (2008), Regassa et al., (2009) and Taresa et al., (2011). Regassa et al., (2009) and Taresa et al., (2011). The higher proportion of infection in Christian Community could be due to the fact that raw meat (beef) is their favorite dish. During festivals and holidays, they prefer beef to mutton; therefore they are prone to *T.saginata*. Properly cooked meat is very popular among Muslims and they prefer mutton and goat meats to beef.

High risk groups that have frequent exposure too cattle meat and their products, raw meat eaters, and those who no use spice showed 72%, 83.05% and 80.85% respectively more infected with *C. bovis* than low risk groups, cooked meat eaters and those who use spice respectively. Groups who had close contact with meat and meat products were infected more than those who had low access to meat and meat by products. The result of this study was in agreement with findings of Hailu (2005), Endris and Negussie (2011), Dawit (2004), Tembo (2001), Abunna et al., (2008), Taresa et al., (2011) and Tesfaye et al., (2012) in Ethiopia and majority of researches in most countries this is due to the fact that those who eat raw or undercooked meat had the chance to easily be infected with *Taenia saginata*. Those, who have low level of education, do not consider taeniosis as a disease, so that the prevalence of taeniosis was higher in this group than those in higher level of education.

Analysis of the results of the present study demonstrate that there was very strong association between raw meat eaters and infection of taeniosis (P=0.000) that is coincide with the findings of Hailu (2005), Dawit (2004), Tembo (2001) and Abunna et al., (2008).

Annual drug inventory at three district of Oromia has showed that iclosamide, mebendazole, praziquantel and Albendazole were the most frequently used drugs at three district of West central Oromia. The worth of taenicidal drugs used in the one year period was 68.181doses that worth 380.032 Eth. Birr. Other investigators as Bedu et al., (2011) indicated that the utilization of 74,614 adult

taeniacidal drug doses with an estimated cost of 110,560 Eth. Birr in two years' time in Zeway town and Tesfaye et al., (2012) also revealed the consumption of 29,952 adult doses which worth 40,201.8 Eth. Birr (2407.2 USD) per annum in Wolaita Soddo. All the existing reports in Ethiopia revealed that a huge sum of family and country money is spent for the purchase of taenicidal drugs that would have been spent on other important items. Of these traditional herbal medicines, Kosso (70%), Enkokko (62%) and Meterie (58%) were commonly used at a higher percentage followed by Duba-fre (pumpkin seed) (42%) and Tosigne leaf (20%).

Conclusion and Recommendations

Although the prevalence was lower compared to other studies, the current study showed that *Taenia saginata/Cysticercus bovis* is an important zoonotic parasitic disease in the study areas. Consumption of raw meat, open air defecation, poor waste disposal, low level of public awareness and presence of backyard slaughtering practices were the factors associated with the disease. Apart from its zoonotic significance taeniosis/cysticercosis causes an economic loss through condemnation of edible offal and whole carcasses as well as incurring cost for therapeutic use for infected humans. Conventional meat inspection technique, which is less sensitive, was practiced in the study area and the detection of bovine cysticecosis was influenced by minimized number of cuts in inspected predilection sites, lack of transportation facilities and lack of equipments and level of qualification offered to the meat inspectors. By conventional meat inspection techniques infected carcasses can be easily missed and passed for human consumption thus favoring the infection transmission. Based up on the findings of the present study we recommend that infected meat must undergo the proper process of freezing, boiling or destruction based on the intensity of infection with cyticerci. As well as offals found infected with the cyst must be properly disposed via through burying or incineration. Furthermore, public awareness about the health and economic significance of the disease with special reference to the risk of consumption of either raw or undercooked meat should be made.

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