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Abstract

Background: Bovine cysticercosis and human taeniasis is an important parasitic disease and more common in developing countries including Ethiopia where meat is an important component of human diet and traditionally consumed raw on several occasions.Methodology: Cross-sectional study was conducted from November 2014 to April 2015 at Asella municipal abattoir in Arsi zone of Oromia to determine prevalence of bovine cysticercosis and status of human taeniasis with its associated risk factors around Asella town. Routine meat inspection method and questionnaire survey were performed for this study.Result: From the total of 430 carcass inspected, 5(1.2

Index terms— bovine, cysticercosis, taenia saginata, prevalence, risk factors, taeniasis.

1 Introduction

ivestock in developing countries play a crucial role in improving food security, generating cash income and are an asset. The total livestock population in Ethiopia according to 2014 estimation was 56.71 million cattle, 29.33 million sheep and 29.11 million goats ??CSA, 2015), which places Ethiopia first in Africa and ninth in the world in terms of total stock population. From the total cattle population 98.95% are local breeds and the remaining are hybrid and exotic breeds. Cattle constitute large portion of livestock population and are managed by small holder farmers under extensive low input traditional system (CSA, 2015). However, its productivity remains marginal due to prevalent diseases, malnutrition and management constraints. Among that T. saginata/ bovine cysticercosis is the one which remaina major public and animal health problem ??EARO, 2000).

Bovine cysticercosis is an infection of cattle caused by the larval stage T. saginata whichlive in human intestinal. This parasite is universally distributed in developing as well as in developed countries (Gracey and Collins, 1992; Cabaret et al., 2002;Dorny et al., 2009). In humans, the disease is called 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. Sometimes, the mobile gravid segments may make their way to unusual sites such as the appendix and biliarytract and may cause serious disorders ??WHO, 2013). Live cattle having C. bovis shows no symptoms, however, heavy infestation by the larvae may cause myocarditis or heart failure ??Gracey and Collins, 1992). Cysticerci can remain alive in cattle anywhere from weeks to years and such infection in cattle is a public health problem as the infected raw or undercooked beef causes taeniasis in human (Garcia, 2003;Garcia et al., 2007). It has economic significance as well as the economic losses accruing from the condemned and downgraded carcasses and due to treatment of carcasses before human consumption is substantial ??Yoder et al., 1994;Onyango-Abuje, 1996;Giesecke, 1997).

Bovine cysticercosis and taeniasis are common where hygienic conditions are poor and the inhabitants traditionally eat raw or insufficiently cooked or sun-cured meat ??Minozzo et al., 2002). Inadequate health education and low availability of taenicides are the major obstacles for the control of such infections (Pawlowski, 1996). Due to these reasons, taeniasis is more common in developing countries including Ethiopia where meat is an important component of human diet and traditionally consumed raw on several occasions. Lack of awareness about raw meat consumption, existence of highest population density, poor hygiene and sanitary facilities some of the factors that facilitate transmission (Jones et al., 1997).

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3 Global Journal of

The epidemiology of bovine cysticercosis/ human taeniasis various from one area to another so control measures appropriate in one area is not necessarily of value in another. Hence, it is essential to have adequate knowledge of the epidemiology of the disease before contemplating control programmes. In Ethiopia some studies have been conducted on bovine cysticercus at different times. But the studies performed were limited to few parts of the country and there was no information on prevalence of bovine cysticercosis and human taeniasisin and around Asella district. Therefore, the objectives of this study were: ? To determine the prevalence of bovine cysticercosis at Asella municipal abattoir, ? To estimate status of taeniasis and associated risk factors in and around the study area II.

4 Material and Methodology a) Description of the Study Area

The present study was conducted at Asella municipal abattoir, and Asella town and its surrounding, Tiyoworeda. Asella town is a capital of Arsi Zone, Oromia regional state, Ethiopia.

5 b) Study Population

The study animals comprise indigenous cattle brought to Asella Municipal abattoir for slaughter from different districts in and around Assela town and it includes cattle of different age, sex, breed and body condition categories. For the survey data, the target populations were residents of Asella town and surrounding kebeles (Burqa cilalo, Dosha, Harobilallo, Café Misoma and Gora silingo) and includes all age group >18 and both female and males

6 c) Study Design

A cross-sectional study was used to study the prevalence of bovine cysticercosis at Asella municipal abattoir by using routine meat inspection technique in municipality slaughter house for the presence of C. bovis. Moreover, a cross-sectional study was conducted by a semi-structured questionnaire survey to assess the status of T. saginata/taeniosis and associated risk factors.

7 III.

8 Sample Collection Method a) Active Abattoir Survey

Animal samples were collected by active abattoir survey. The study animals were selected using simple random sampling method and age, breed, sex and body condition of each study animals was recorded on prepared format paper at ante-mortem. Body condition scoring of the cattle was made based on the guideline provide by **??**Nicholson and Butter, 1986) and all animals included in the study were animals with, medium and good body condition. Age determination was carried out by means of their dentition as described by (De-lahunta and Habel, 1989) and all the inspected animals were at the age of adult and old age group. Prior to sampling, each selected animal were given an identification number by writing a code on its head by using unwashable ink.

Meat inspection was made in accordance with the procedures of Ethiopian Ministry of Agriculture Meat Inspection Regulation (MOA, 1972) for the detection of T. saginata's cysts. Because of owners' discomfort on multiple incisions for the thorough examination of major muscles, only the masseters muscle and internal organs such as tongue, heart, liver, kidney, lung and diaphragm were used as indicators of the presence of cysts in the carcass. Careful examination on the carcass of study unit was made through palpation of the organs followed by incision as follows: the surface and substance of tongue was examined visually, followed by longitudinal ventral incision from the tip of the root. Extensive deep incision was made into external and internal muscles of masseters parallel to the plane of the jaw (parallel to the jaw bone from the lower jaw). Visual inspection and longitudinal incision of the myocardium from base to apex was made. The muscles of diaphragm were examined visually and by making incision. Examination of kidney, liver, and the lung was also conducted accordingly by visualization, palpation and incision. Cysts observed in theses organs were carefully dissected and numbers and nature of cysts in each organ was recorded for each animal. The nature of the cyst was recorded as calcified and viable by visual observation of its appearance, as (Ashwani and Gebrehiwot, 2011) dead degenerated or calcified cystcerci clearly form identifiable spots of white and have fibrotic lesions, while the viable cysticerci are pinkish-red in colour.

9 b) Questionnaire survey

Semi-structured questionnaire survey used to asses, potential risk factors and its public health importance. Questionnaire survey on the disease occurrence and risk factor assessment was administered to 415 volunteer respondents who were selected based on convenience sampling method and the interview was conducted phase to phase. The potential risk factors of taeniasis considered in this study were :age, sex, religion, occupation, educational status, and habit of raw meat consumption. The awareness of the diseases, presence/absence of sanitation facilities like toilet and the drug used for treatment were also included in the questionnaire survey and at the end of interview some advices were provided to the respondents on how to control and prevents T. Saginata infection/cysticercosis.

10 c) Sample Size Determination

The desired sample size was calculated using the standard formula described by Thrus field (Thrus field, 2005) for simple random sampling method. Since there was no similar previous study at this area, expected prevalence was considered 50%, 5%desired absolute precision and 95% confidence level were used to calculate the minimal sample size. Hence, the sample size required was 384 heads of cattle. But to increase the precision of the study the sample size were increased and a total of 430 heads of cattle were included in the current study. For questionnaire survey sample size was calculated by using the formula given by Arsham (2002) which is: N= 0.25/SE 2 , When: N= sample size, SE (standard error) =5%),

The sample size required for the questionnaire survey as per the above formula is 100 for each site (urban and rural). However, to include different risk factors and increase the precision of the result the total number was increased to 415individuals.

11 IV.

12 Data Management and Analysis

The data collected were entered, recorded and stored in Microsoft excel spread sheets program version 2010. Descriptive and inferential analyzed was made by using SPSS version 20 software. Fisher's and Chisquare (X 2) tests were used to determine the variation in prevalence of infection between different groups for abattoir and questionnaire survey respectively. Statistical significance level was set at P < 0.05 at 95% confidence level to determine whether there are statistical significant differences between the parameters measured.

V.

13 Result

Prevalence of C. bovis: the study showed that 5(1.2%) were positive for bovine cysticercosis. The statistical analysis of the data revealed that no significant difference (p> 0.05) was observed in the prevalence of cysticercosis in relation to the risk factors like: sex, breed, body condition and ages. But high prevalence of C. bovis was observed in local breed, old age and female animals relative to cross breed, adult age and male animals respectively, while almost no difference was indicated between animals of good and medium body condition as shown in Table 1. Anatomical distribution of cysts: frequency analysis of active abattoir survey revealed that nearly the there was the same distribution ofC. bovisin the examined organs as follows: liver (0.9%), heart (0.7%), tongue (0.5%) and masseters muscle (0.5%). From the total number of 16 C. bovis observed on different organs, 7(43.8%), 5(31.3%), 2(12.5%) and 2(12.5%) were localized on the liver, heart, tongue and masseters muscle (table 2)and out of the total cyst observed 6 (37.5%) of them were viable with organ distribution of 50%, 33.3% and 16.7% on liver, heart and masseters muscle respectively as indicated in table 2. Questionnaire survey: Of the total 415 interviewed respondents 44.3% (184/415) had contracted T. saginata infection at least once in their life time and the respondents confirmed that they were positive by witnessing they observed proglotttids in their feces and/or under wear. Since due to religious purpose pork meat is not consumed in the study area, the proglottids observed were surely to be of T. saginata. From positive respondents 32% got taeniasis only before 2000E.C (2008G.C), while 6.7% got taeniasis after 2000 E.C (2008 G.C) and 5.5% were those remain positive both before and after 2000E.C. Out of those witnessed their positivity, 88.6% and 10.9% respondents used modern and traditional drugs for treatment respectively, while the remaining percent uses nothing for treatment as indicated by tables 4 respectively. Out of total respondents 90.6% (376/415) uses toilet, 73.5% (305/415) have awareness about human taeniasis.

14 Association of risk factors with prevalence of taeniasis:

A statistical analysis showed that there was a highly significant variation between urban and rural, higher and lower age group, raw meat and cooked meat consumers, female and male, occupation group, and educational levels (p<0.05).High prevalence of humantaeniasiswas reported in rural area, male, higher age group, farmer, raw meat consumer and illiterate. But no statistical significance variation was seen among religion (p>0.05) as shown below by tables 5.

15 VI.

16 Discussion

The prevalence of C. bovis among the carcasses inspected at Asella municipal abattoir was 1.2% which is comparable with the findings of (Birhanu, et al., 2013) **?**nd kidney) and masseters muscle while other predilection sites are rarely inspected due to multiple mutilation of carcass causes reduction in marketability of the meat and the owners not permit multiple incision of heavy muscles. This may in turn lead to omitting of infected animals as the sensitivity of detecting the parasite will decline with limited number of incisions (Wanzala, 2003) and experimental studies showed a 5-50 times higher prevalence will be achieved by complete slicing of the predilection sites **?**Minozzo, 2002).

But the current study's result was higher relative to the finding of **??**Zdolec et al., 2012) and (Blessing et al., 2011) who reported 0.11% and 0.2% from Croatia and South Africa. This could be due to strict application of meat inspection and public health extension rules and difference in hygiene measures in the study countries. It's known that sanitation facilities are better in the developed countries than in the developing countries in which poor environmental hygiene increase the prevalence of the diseases in the environment. More number of C. bovis was observed in the liver than other organs inspected. The reason is that absence of specific predilection site for C. bovis as stated by (Scandrett, 2009) so more number of larvae collected through mesenteric and portal veins residing in the liver.

Questionnaire survey indicated that human taeniasis was common in the study area with prevalence of 44.3%. This agree with the finding of (Mesfin and Nuraddis, 2012) 44% in Hawassa town and (Dawit and Temesgen, 2013) 44.44% in Shire Indasilassie district. But this result is lower relative to the finding of (Lielt et al., 2015) 64% in Bishoftu, (Dawit, 2012) 62.5% in Wolaittasoddo, (Fetene and Nibret, 2014) 58%, (Abunna, 2013) 70% in Yirgalem, (Bedu et al., 2011) 56.7% at Zeway, (Abunna et al., 2008) 64.2% in Awassa town and (Megersa et al., 2010) 56.7% Jimma town. The reason for reporting lower prevalence of human taeniasis in the current study area could be due to the difference in the religious composition of the respondents, and sample size taken. Out of total respondents of the current study, 45.1% were Muslims that they have traditionally low habit of consuming raw meat than Christians and from the total respondents only 50.8% were raw meat consumers. Raw meat consumption is the only way of getting T.saginata infection, so as raw meat consumption decrease in the area the infection also decrease. The other is sample size difference and as sample size increase the precision will also increases. In the present study the sample size is very large (415) while in the above finding very small (not greater than 170). The other point is that some respondents shy to openly tell about taeniasis and this could also end up with low recovery of positive people in the study area.

It was revealed that T.saginata infection was more prevalent in the rural area than urban. This could be due to low level of personal and environmental sanitation facilities and absence of meat inspection in the rural area than urban area. This finding agrees with the statement of **??**Minozzo et al.,2002) who stated that taeniasis are common where hygienic conditions are poor and the inhabitants traditionally eat raw or insufficiently cooked or sun-cured meat.

The current study indicates that the ages of respondents have strong association with the prevalence of T.saginata infection and high in higher age group (>35 years) than other age group (<18 and 18-35 years) (table 5) which is in agreement with the previous study of (Abunna et al., 2008; **??**dugna et al., 2013;Lielt et al., 2015). This might be due to that the habit of raw meat consumption increase with age and the higher age group have better income to consume raw meat and more prone to C.bovis. But lower age groups are student that they have no sufficient access to raw meat from butcher's houses as commonly raw meat was eaten at this site and they are less invited than elder on different ceremony where raw meat consumption culturally practiced.

In this study T. saginata was more prevalent in men than in women which is a similar report with findings of (Hailu, 2005;Abunna, 2013;Lielt et al., 2015) in other parts of Ethiopia. This may be due to cultural practice in Ethiopia that men not commonly prepare their dishes at home rather they frequently visiting but cheries and restaurants than women for beef consumption. In this study no statistically significant difference were observed between the proportion of taeniasis in Muslim and Christian community which is in consent with the previous reports of (Tembo, 2001;Abunna, 2007;Dawit et al., 2012). The reason behind may be they share same culture and habit of raw meat The current study revealed that raw beef consumers had contracted taeniasis infection more frequently than the non raw beef consumers which is inlined with the report of (Megersa, 2010;Fetene and Nibret, 2014). The reason is well known that in the consumption of raw meat the degree of ingesting C.bovis with meat is higher (Gajadhar et al., 2006;Garcia et al., 2007). T. saginata infection is highly prevalent in the illiterate than literate respondents and this report agrees with the finding of (Abunna et al., 2008;Kebede et al., 2009; **??**dugna et al., 2013) and also the current study revealed that the farmers had contracted taeniasis than individuals with other occupational status. This difference might be from low level of awareness in the illiterate and farmers than literate individuals and other occupational status. The other reason for reporting high prevalence of taeniasis in the farmer community is that most of Ethiopian farmers are illiterate and from rural area where environmental hygiene is low and backyard slaughter was practiced with very low awareness about the diseases.

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

Asella and
its surrounding is characterized by mid sub-tropical
weather, with minimum and maxim temperature ranging
from 8.4 to 22.6°C, and the relative humidity ranging
from 43 to 60%. The average rainfall is 2000mm. The
area has a bimodal rainfall occurring from March to April
(short rainy season) and July to October (long rainy
season). According to Arsi Planning Economic and
Development Office (APEDO, (2007)), the area is
densely populated, with livestock population of 85,893
cattle, 57,118 sheep, 10,725 goats, 7841 horses, 15,642
donkeys, 517 mules and 35,489 poultry. The farmers in
the area practice mixed crop-livestock farming system.

Figure 1:

214 to Ato Haji Geleto the meat inspector of Asella municipal abattoir, for his valuable suggestions, experience share
215 during the abattoir visits.   [1]

South East Ethiopia
Ababa abattoir (Nuraddis and Frew, 2012), 3.65% from
Jimma municipal abattoir (Taresa, et al., 2011), 3.11%
indifferent agro climatic zones of Ethiopia (Tembo,
2001). But lower than the finding of (Dawit, 2004) 4.9%
at Gondar, (Alula, 2010) 5.4% at Konbolcha, (Kebede,
2008) 18.49% in North West Ethiopia, (Abunna, 2008)
26.3% at Hawassa, (Hailu, 2005) 17.5% in East Shoa,
(Fetene and Nibret,2014) 5.1%, at Jimma municipal
abattoir, (Belay, 2014) 5.2% at Municipal Abbatoir of
Shire, (Abunna, 2013) 12% at Yirgalem and (Lielt, 2015)
5.6 at BishoftuElfora abattoir. This difference might be
resulted from difference in the level of personal and
environmental hygiene, habit of raw meat consumption, number of incision
made at inspection site in the abattoir, and management type of the animals
practiced. The main reason with low prevalence of
bovine cysticercosis in the current study could be due to
low number of organs inspected and low incision made
at inspection site at the abattoir. In Asella municipal abattoir the commonly
inspected organs for presence of C. bovis were internal organs (liver, heart,
lung, tongue,

from a total number of 430 carcasses inspected,
who reported prevalence of 2.58% from
Bahir Dar Municipal Abattoir, 2.59% from Wolaita soddo
municipal abattoir (Dawit, et al., 2012), 3% from Zeway
Municipal Abattoir (Bedu, 2011), 3.6% from Addis

Figure 2:

1

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Figure 3: Table 1 :

2

Organs	No. of organs	No. of positive	Prevalence	Total No of cyst	cyst viability (%)
inspected	inspected	organs	(%)	on organ	per organs
Tongue	430	2	0.5	2	0(0/6)
Masseters muscle	430	2	0.5	2	16.7(1/6)
Heart	430	3	0.7	5	33.3(2/6)
Liver	430	4	0.9	7	50(3/6)
Lung	430	0	0	0	0
Kidney	430	0	0	0	0
Total	1720	11	0.64	16	100

Figure 4: Table 2 :

3

Frequency	Percent

Figure 5: Table 3 :

4

Drug used	Taeniasis positive individuals	
	Frequency	Percent
Modern drug	163	88.6
Traditional drug	19	10.3
Non drug users	2	1.1

Figure 6: Table 4 :

5

Variables	Categories	No of interviewees	No infected	Prevalence%	X 2	P -value
Residential area	Rural	307	151	49.2	11.2	0.001
	Urban	108	33	30.6		
Age	<18	92	19	20.7	67.1	0.000
	18-35	199	74	37.2		
	>35	124	91	73.4		
Sex	Male	216	113	52.3	11.6	0.000
	Female	199	71	35.7		
Religion	Christian	228	109	47.8	2.4	0.07
	Muslim	187	75	40.1		
Educational status	Illiterate	173	103	59.5	28.9	0.000
	Elementary	153	52	34		
	High school	54	20	37		
	College/above	35	9	25		
Occupational status	Student	128	25	19.5	55.2	0.000
	Farmer	205	125	61		
	Civil workers	25	10	40		
	Other private workers	57	24	42		
Raw meat	Consumers	211	131	62.1	54.8	0.000
	Non-consumer	204	53	26		
	Total	415	184	44.3		

Figure 7: Table 5 :

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