

Human taeniasis in health centers and bovine cysticercosis in selected abattoirs in Addis Ababa and Modjo, Ethiopia

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ABSTRACT

Taeniasis and bovine cysticercosis are common parasitic infections in developing countries like Ethiopia. The purpose of this study was to know the prevalence of taeniasis and *Cysticercus bovis* using active and retrospective assessment in Addis Ababa and Modjo from November 2009 to March 2010. For this cross-sectional study stool samples were collected from Saint Paul Hospital, Ethiopian Health and Nutrition Research Institute and clinics at Addis Ababa Abattoir and Luna Export Abattoir. The stool samples were examined for the presence of *Taenia spp* eggs microscopically and cattle slaughtered during the study period were also subjected to postmortem inspection to study bovine cysticercosis. Case book records were also assessed to get information on situation of taeniasis and bovine cysticercosis. Out of 384 stool samples examined, the overall prevalence of *Taenia spp.* egg was 8.1%. The prevalence at different stool sampling sites was not found statistically significant ($P>0.05$). *Taenia saginata* infection was found higher among age group 26-30 years followed by individuals with greater than 40 years of age ($P<0.05$). The sex-wise prevalence was 8.4% and 7.8% in female and male ($P>0.05$), respectively. From a total of 61000 cattle carcass inspected using active abattoir survey of both sites, 3.7% were found positive for *C. bovis*. On the basis of retrospective survey, of 366 total stool samples collected throughout the year and the prevalence of *Taenia spp.* egg was 6.6%. Age and sex-wise *Taenia spp.* egg were observed more in 26-30 years age categories as compared to less than 15 years age categories. Of a total 33289 cattle slaughtered between 2001 and 2008 at Addis Ababa abattoir 1.04% had *C. bovis* cyst. The results of the present study clearly indicated the economic as well as public health significances of the infection. Thus, interdisciplinary collaboration between veterinarians and medical personnel is imperative to help in the control of this infection.

Keywords: Abattoir, *Cysticercus bovis*, Ethiopia, Prevalence, Stool sample, Taeniasis

Introduction

Bovine cysticercosis, an important helminthic zoonosis, refers to the infection of cattle with metacestodes of the human tapeworm (Radositis, 1994, Dorny et al., 2002; Pal, 2007). Mature tapeworm proglottids containing thousands of eggs are commonly passed in the stool of infected individuals and under un-sanitary condition can lead to pasture or water contamination and the infection of cattle (Gracey and Collins, 1992). The prevalence of the disease is high in developing countries and also has a cosmopolitan distribution (Dorny et al., 2002; Pal, 2007).

In developing countries, the incidence of human infection with taeniasis is high, in certain areas being well over 20% and in developed countries where the prevalence of cysticercosis is low, being less than 1% (Urquhart *et al*,

Published data on taeniasis in Ethiopia are scanty. The research work conducted in Gondar by Dawit (2004) revealed 4.2 % infection rates of *T. saginata*. Therefore, the objectives of this study were to know the prevalence of taeniasis using laboratory investigation of human stool samples in selected health centers and abattoirs and also to determine abattoir based prevalence of *C. bovis* using active and retrospective assessment of selected abattoirs.

MATERIALS AND METHODS

Description of the study areas

This study was conducted at two sites, namely Addis Ababa and Modjo from November 2009 to March 2010.

Study subjects

Human patients that visited selected health centers for GIT parasitism and selected abattoir workers that routinely deal with the process of slaughtering and preparation of raw meat were target groups of this study through informal consent.

Study Design

Sample size

Sample size for stool examination was determined using sample size formula described by Thrustfield (2005) as indicated below.

$$N = \frac{1.96^2 P_{exp} (1 - P_{exp})}{d^2}$$

Where: N = required sample size

P_{exp} = expected prevalence (50%)

d = desired absolute precision (5%) at 95% confidence interval

N = 384 stool samples were collected.

Animals presented for slaughter at selected abattoirs were considered for postmortem examination.

Ethical consideration

For reasons of medical ethics, the stool sampling was restricted to volunteer participants of the project and patients who were visiting the health facilities for any other GIT parasites.

Sampling strategy

Stool samples were randomly collected from human patients visiting Saint Paul Hospital and Ethiopian Health and Nutrition Research Institute Referral laboratory (EHNRI) for GIT disturbance; whereas volunteer abattoir workers were asked to provide stool samples. All cattle slaughtered during the study period were subjected to postmortem inspection to detect bovine cysticercosis.

Study protocol

Cross-sectional study

Stool samples and processing

Stool samples were collected from all consenting individuals in disposable plastic boxes and examined using routine stool examination technique. Sampled individuals were carefully instructed about adequate hygiene to avoid contamination.

A portion of preserved stool samples were processed by formalin-ether concentration method at EHNRI laboratory as described by Ritchie (1948) with some modification. The preserved stool sample was sieved with cotton gauze and transferred to 15 ml centrifuge tube. Then 8 ml of 10% formalin and 3ml of diethyl ether was added and centrifuged for 2 minutes at 2000 rpm. The supernatant was decanted and the sediment was transferred to glass slides and observed under light microscope at 100X and 400 X magnifications for the presence of cysts and ova of the parasites.

Active abattoir survey

The presence or absence of *Cysticercus bovis* was investigated using cattle passed through routine meat inspection procedure at selected abattoirs. Carcasses of these

animals were thoroughly inspected; incisions and inspection were done following the methods earlier described by (Gracey and Colloins, 1992). In both the abattoirs, emphasis was made on the heart, tongue, liver and carcasses to look for *C.bovis* cyst

Retrospective study

Official case book records of the selected health centers and Addis Ababa abattoir record book were assessed to get information on past status of taeniasis and bovine cysticercosis, respectively.

Data analysis

The data collected was entered and stored in MS-Excel computer program and descriptive statistics was used to analyze the distribution of taeniasis and bovine cysticercosis using SPSS version 16.0. The association between taeniasis and different factors were analyzed using the chi-square test and level of significance was set to $P < 0.05$.

Results

Cross-sectional study

Prevalence of taeniasis

Out of 384 human stools examined 31 were found to be positive for *Taenia spp.* egg (Table 1).The overall prevalence of *Taenia spp.* egg was 8.1%. The prevalence at different stool sampling sites was not found statistically significant ($P>0.05$).

In the present study, a relatively higher prevalence of *Taenia spp.* egg was recorded among age group 26-30 years followed by individuals with greater than 40 years of age (Table 2). This age wise prevalence was found statistically significant ($P<0.05$).

The prevalence of *Taenia spp.* egg in human stool collected was 8.4% and 7.8% in female and male, respectively (Table 3). There was no statistically significant difference between male and female ($P>0.05$).

Prevalence of bovine cysticercosis

The results of abattoir survey of organs and carcasses of cattle at Addis Ababa abattoir and Luna export abattoir from February to April 2010 indicated that out of 61000 cattle carcass inspected, 3.7% were found positive for *C. bovis* (Table 4).

Out of 44000 carcasses inspected at Addis Ababa abattoir, there was an overall condemnation of 326 carcasses (Table 5), 10445 liver, 5738 lung, 691 heart and 551 tongue due to different abnormalities including *C. bovis*.

Retrospective study

Stool examination

Case book record of human stool laboratory examination at St. Paul hospital and EHNRI referral laboratory showed remarkable differences in Gastro intestinal parasites assessment for the year 2008. The retrospective stool result indicated that out of total stool samples examined 169 (45.9%) were negative for GIT parasites. Accordingly, of 366 total stool samples collected throughout the year the frequency of *Taenia spp* egg was 24 (6.6%) as compared to hook worm with 8 (2.2%) (Table 6). Age and sexwise *Taenia spp.* egg were observed more in 26-30 years age categories as compared to less than 15 years age categories (Table 7).

Postmortem inspection

Among 33,289 cattle slaughtered between 2001 and 2008 at Addis Ababa abattoir, a total of 348 (1.04%) had *C. bovis* cyst. The maximum cases (1.89%) were observed in 2001 and minimum (0.84 %) in 2007 (Table 8).

The results obtained from retrospective study of Addis Ababa abattoir slaughter record of 12 months in 2009 have shown that out of 71216 carcasses of cattle inspected, 17756 of liver, 12682 of lung, 6488 of heart and 2462 carcasses were condemned due to other abnormalities, whereas 5626 tongues and masseter muscles were solely due to *C.bovis* (Table 9).

Discussion

In developing countries, cattle are reared on extensive scale, human sanitation is of comparatively lower standards and the inhabitants traditionally eat raw or inadequately cooked beef. The prevalence of taeniasis has been reported to be over 20% in certain areas of these countries. Based on routine carcass inspection, the infection rate of bovine cysticercosis is often around 30-60% although, the real prevalence is assumed to be considerably high (Tembo, 2001).

In Ethiopia, there are few studies on prevalence of *Taenia saginata* taeniasis as compared to bovine cysticercosis. Mengistu *et al.* (2007) undertook community-based, cross-sectional study in Jimma town and reported 2.3% prevalence rate of *Taenia saginata* infection. Hailu (2005) documented prevalence of 86.11%, 81.05% and 75% in Dukem, Modjo and Debre Zeit, respectively using questionnaire survey. In northern Iran, Kia *et al.* (2005) reported prevalence of 0.5% in their study performed by administering anti-taenia drug.

According to the active and retrospective data obtained in this particular study, both human taeniasis and bovine cysticercosis are common in Addis Ababa and Modjo. Prevalence of 8.1% found in the present study was lower compared to the results of other researchers (Hailu, 2005; Mangistu *et al.*, 2007). This may be attributed to lower egg recovery rate of *Taenia spp.* in human stool examination technique. There was no statistically significant difference in the prevalence of taeniasis between abattoir workers and other individuals in the community. The prevalence of taeniasis was found to be high among age group of 26-30 years. This finding is in accordance with the work of Hailu (2005) in this country. Similar report has been documented in Taiwan (Fan, 1988).

On the other hand, retrospective assessment of taeniasis in this study revealed 6.6% which is higher as compared to other gastrointestinal parasites such as hook worm and ascaris recorded in case books. Nevertheless, taeniasis is still a problem in Ethiopia. In most parts of Ethiopia, the infection may continue, due to the habit of eating raw beef dishes such as *kourt* and *kitffo* that are served in raw or undercooked are the source of *T. saginata* infection in human (Teka, 1997).

In the present active abattoir survey, the prevalence of *Taenia saginata* cysticercosis was 3.7% with high frequency of infection in tongue and liver. Teka (1997) reported 2.2-3.2% in Addis Ababa Abattoir. In another study, Kebede *et al.* (2009) examined various organs of 11227 cattle in Addis Ababa Abattoir and the results showed that 842 (7.5%) were infected with *T. saginata* cysticercosis. In northwestern Ethiopia, out of 4456 various organs of cattle inspected 824 (18.49%) were infected with *C. bovis*. The tongue, masseter muscle, heart muscle, triceps muscles and thigh muscle were the main predilection sites of the cysts reported (Kebede, 2008).

The results of retrospective data analysis for the years 2001- 2008 at Addis Abeba abattoir have indicated an overall prevalence of 1.04% for *C. bovis*. This finding is close to the report of Tembo (2004) who also recorded 1% prevalence. However,

similar study done in Brazil (Morera et al., 2002) reported prevalence of 7, which is higher than our findings. The analysis of the 2009 record book of Addis Ababa abattoir showed that most frequently rejected organs were liver, lung, heart and tongue with masseter muscles.

In conclusion, the prevalence of bovine cysticercosis both in active and retrospective record survey of the present study clearly indicated the economic as well as public health significances of the infection. Even if cysticercosis has little effect on the animal's health, it is important socially and economically because meat has to be condemned very often. According to the observations of this study, the most realistic sign to lower the overall incidence of human taeniasis and /or cysticercosis is to enhance awareness of the public about economic as well as public health significance of this infection. It is emphasized that interdisciplinary collaboration between veterinarians and medical personnel should be encouraged in order to conduct epidemiological surveillance of human cases and thus, help in the control this infection.

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Table 1. Prevalence of *Taenia spp* egg in human stool from different sites

Sampling site	Stool sample collected	No. positive
St. Paul hospital	99	8 (8.1)*
EHNRI Lab	99	5 (5.1)
Addis Ababa abattoir workers	96	11 (11.5)
Luna export abattoir workers	90	7 (7.8)
Total	384	31 (8.1)

$\chi^2 = 2.70, P = 0.44$ *= Percentage

Table 2. Age wise prevalence of taeniasis

Age in years	Total sample collected	No. positive
<15	87	1(1.1)*

16-20	25	0 (0.0)
21-25	35	2 (5.7)
26-30	96	15 (15.6)
31-40	83	6 (7.2)
>40	58	7 (12.1)
Total	384	31(8.1)

$\chi^2 = 16.7, P = 0.005$ *= Percentage

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Table 3. Sex wise prevalence of *Taenia spp.* egg in stool

Sex	Total sample collected	No. positive
Female	167	14 (8.4)*
Male	217	17 (7.8)
Total	384	31 (8.1)

$\chi^2 = 0.04, P = 0.51$ *= Percentage

Table 4. Prevalence of bovine cysticercosis at different sites

Study site	No. inspected	No. positive
Addis Ababa abattoir	44000	815 (1.9)*
Luna export abattoir	17000	1450 (8.5)
Total	61000	2265 (3.7)

*= Percentage

Table 5. Organ-wise distribution of cysticercosis at Addis Ababa abattoir in 3 months

Predilection site	No. infected	Per cent positive
Tongue	551	1.3
Heart	691	1.6
Carcass	326	0.7
Liver	95	0.2

Table 6. Frequency of retrospective stool results from St. Paul Hospitals and EHNRI

Stool result	Frequency	Per cent
Negative	169	45.9
Pus cell	157	42.8
<i>Taenia spp.egg</i>	24	6.6
Hook worm	8	2.2
<i>Entamoeba hystolytica</i>	4	1.1
Ascaris	4	1.1
Total	366	

Table 7. Frequency of retrospective stool results with respect to age and sex

Age in years	Female	Male	Total
<15	0	1	1
16-20	1	1	2
21-25	3	3	6
26-30	6	7	13
>40	2	0	2
Total	12	12	24

Table 8. Record of bovine cysticercosis at Addis Ababa abattoir (2001-2008)

Year	Slaughtered	Infected
2001	3115	59 (1.89)*
2002	3275	38 (1.16)
2003	3885	35 (0.90)
2004	4115	42 (1.02)
2005	4325	45 (1.04)
2006	4414	37 (0.84)
2007	4885	43 (0.88)
2008	5275	49 (0.93)
Total	33289	348 (1.04%)

*= Percentage

Table 9. Assessment of organ and carcass rejection at Addis Ababa abattoir in 2009

Month	Organ and carcass condemned					
	Number examined	Liver	Lung	Heart	Tongue with masseter muscle	Carcass
January	3650	250	302	119	153	105
February	22000	4236	2896	239	343	138
March	2650	72	53	28	63	81
April	23564	5456	3129	435	173	138
May	4652	1044	573	691	551	326
June	3258	1020	1053	856	478	625
July	2114	826	689	536	478	356
August	1285	69	74	53	49	68
September	2156	1029	82	73	61	91
October	2856	1012	1156	1018	1124	121
November	3529	1560	1652	1320	1635	216
December	3152	1432	1325	1239	1149	302
Over all	71216	17756	12682	6488	5626	2462

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