

Human Taeniosis/*T. saginata*, Treatment Cost and Community Knowledge about Meat Borne Zoonosis in Batu Town of Oromia Regional State, Ethiopia

¹Yacob Hailu Tolossa, ¹Dinka Ayana, ²Tibesso Tona banato and ¹Emebet Etisa

¹Addis Ababa University, College of Veterinary Medicine and Agriculture,
P.O. Box 34, Debre-Zeit, Ethiopia

²Kofale District Livestock Development and Fisheries Resource Office,
Western Arsi Zone, Oromia region, Ethiopia

Abstract: A study was conducted to determine prevalence of taeniosis, the cost of human treatment and assess community knowledge about meat borne zoonosis in Batu town of Oromiya region. Retrospective recorded on coproscopic laboratory result of the past six months in three selected health centers for disease prevalence, questionnaire survey to assess community knowledge and inventory of pharmaceutical shops of selected pharmacies to estimate financial cost of treatment were employed in this study. Out of total 3938 humans, 82 patients were positive for taeniosis with an overall prevalence of 2%. The prevalence was significantly higher in adults (> 20 years) than youngsters (< 20 years) ($P < 0.001$). Of the total 100 interviewed volunteers, 68% of them had experienced *T. saginata* infection, of which 80% and 20% reported using modern drugs and traditional medication for treatment respectively. Meanwhile more than half (54 individuals) had strong habit of raw beef meat consumption. There was statistically significant association ($p < 0.05$) in the prevalence of taeniosis between different age group of patients, habit of meat consumption and knowledge about meat borne parasite. The prevalence was significantly higher in male than females, accordingly, males, (OR=4.030), raw beef consumers (OR=6.0) and people had less knowledge about meat borne zoonosis had higher odds of acquiring human taeniosis (OR=5.727) than those female respondents consuming cooked beef meat and relatively had a knowledge about this parasite and means of transmission. Estimates of annual adult taeniocidal drugs dose is 75,732.84 which may worth 325,594.32 ETB per annum. Finding of this study indicated the importance of human taeniosis in both public health aspects and its financial impacts in Batu town warranting community based control intervention.

Key words: Coproscopy • *Taenia saginata* • Prevalence • Public health • Batu • Ethiopia • Oromia

INTRODUCTION

It is well documented that a number of foods born parasitic zoonosis prevail worldwide. Among these are *Sarcosistis* spp., *Taenia* spp. and *Trichinella* spp, which human beings acquire by eating raw or undercooked meat infected with cyst stages of these parasites. In developing countries a large proportion of carcasses escape meat inspection because it is not practiced or because the animals are not slaughtered in abattoirs [1].

Human taeniosis/*Taenia saginata* is widely distributed parasitic disease found in industrialized countries as well as in developing countries. Taeniosis is

more common in populations/age groups that consume raw or undercooked beef [2]. In Ethiopia up to 70% of the population was reported to have been infected with a tapeworm [3] while in developed western countries much lower prevalence (0.01% to 10%) were recorded [4]. Likewise, bovine cysticercosis, the source of infection for human, is highly prevalent in developing countries including sub-Saharan Africa. The prevalence of bovine cysticercosis in Ethiopia showed considerably variable results ranging from lower prevalence of 3.1% in central Ethiopia [5] to as high as 26.25 in Hawassa [6] whereas in Europe it ranges from 0.007% to 6.8% [2]. The distribution of *T. saginata* is wider in developing countries, where

hygienic conditions are poor and where the inhabitants traditionally consume raw or insufficiently cooked beef meat [7].

Although a number of data have been generated on *T. saginata*/taeniosis in different parts of Ethiopia [6]; [3], [8] these works have not yet conducted in Batu town of Oromia region. Cultural and religious practices with respect to beef consumption are expected to vary in different parts of the country and this was the basis for initiating this study. The objectives of this study were to determine coproscopic prevalence of taeniosis among human in Batu town, to evaluate community knowledge about meat borne zoonosis and to estimate financial cost of treatment.

MATERIALS AND METHODS

Study Area: This study was conducted from October 2013 to May 2014 in Batu town which is located at 7.58° North latitude and 38.43° East longitudes in the southern part of Oromia situated in mid rift valley, about 167 kms South of Addis Ababa. The town is inhabited by about 141,745 people of them more than 85% are living in rural areas. The minimum and maximum mean temperature is 12.7°C, 27.2°C respectively. It has altitude ranges from 1500 to 2000 meter above sea level with an average annual rain fall ranging from 650 to 750 mm. All the farmers are subsistence, whose livelihoods depend mainly on mixed farming of crops and livestock. Natural pasture, the major feed resources of livestock, is composed of predominantly grasses [9].

Study Population: Study population were selected patients that visited Addisu poly clinic, Batu health center and Sher-Ethiopia hospital in 2013/14 those with six months recorded coproscopic laboratory results. Due attention was given to patients' age; sex and level of education were considered among major risk factors. For the questionnaire survey targeted residents from two purposively selected kebeles of Batu town based on population size, age and sex diversity. For drug inventory of pharmaceutical shops to determine taeniocidal drugs sold and in the last two years (2011-2012) there pharmacies were randomly selected in order to estimate the annual cost of treatment spent for human taeniosis/*T. saginata*.

Study Design and Sampling: For retrospective study, three health stations were selected based on numbers of patients visiting each of them per-days. Recorded cases

in these health centers namely, Addisu poly clinic, Batu health center and Sher-Ethiopia hospital in Batu town were analyzed to determine coproscopic prevalence of human *T. saginata*/taeniosis in patients visited these health stations. Patients were selected by systematic random sampling, by dividing total number of patients by total number of required sample size to get equal intervals and the first patient was selected randomly. For each patient due attention was given to patients' age, sex and health center visited by the patients. Patients visited health stations were selected for retrospective coproscopic prevalence of human *T. saginata*/taeniosis based on their recorded complain such as abdominal discomfort/pain, reduced body weight, diarrhea, weakness and increased/decreased appetite by systematic random sampling. A total of 3938 patients' coproscopic laboratory results were recorded and analyzed.

Questionnaire survey was designed to collect data from voluntary respondents to determine the occurrence of human *T. saginata*/ taeniosis, to assess the significance of potential risk factors and community knowledge about meat borne zoonotic parasitic diseases. For this purpose, by using the formula $0.25/SE^2$, $SE=5\%$ [10], the sample size for the questionnaire survey was expected to be 100 for a given study site. For the questionnaire survey in Batu town, two kebeles were selected based on the relatively high residents, raw meat consumption restaurants/butchers and high beef cattle slaughter in the area. Fifty individuals from each kebele were interviewed. The sample kebele were selected proportionally to the number of target population. From each kebele fifty respondents/households/ were selected. The respondents from each sample kebele were selected by systematic random sampling by dividing total households of the kebele by sample size to get equal intervals and the first households were selected randomly. For this individuals who were selected based on convenience and interviewed on topics related to taeniosis and major risk factors. Efforts were made to include respondents of different age, sex, religion and occupation. Age of respondents was categorized as (young: <20 years of age and adults: >20 years of age). Similarly, religion was broadly classified as Christian and Muslim where as occupation was subdivided into farmers, merchants, butchers and abattoir workers, civil servants and students. Data were also classified according to education levels of the respondents as illiterate (without formal education), literate (elementary up to high school) and graduates (colleges and universities).

An inventory of pharmaceutical shops were involved in study area on selected Health center, Hospital and Red Cross society pharmacies to estimate the annual economic loss associated with taeniosis/*T. saginata* treatment in humans.

Data Analysis: All collected data was entered in to Microsoft excel and processed using SPSS (2002) versions. Analyses were made at 95 % confidence interval and 5 % precision. Prevalence of *T. saginata taeniosis* per visited public/private health stations for six months recorded coproscopic results cases were all summarized using descriptive statistics. Questionnaire survey was also summarized using descriptive analysis and important potential risk factors were tested using logistic regression for their contribution for the occurrence of *T. saginata* /taeniosis in human. Pharmaceutical shops inventory data was also summarized and analyzed using descriptive statistics.

RESULTS

Retrospective Coproscopic Prevalence of Human Taeniosis: All the humans/patients their stool examined in Batu town at Addisu poly clinic, Batu health center and Sher-Ethiopia hospital for six months recorded cases and their retrospective coproscopic laboratory result case book observed were males, females and different age groups. Of total 4020 humans/patients those, their retrospective recorded coproscopic laboratory result case book observed, 82 humans/patients were positive for human taeniosis. Over all retrospective recorded coproscopic prevalence of human *T.saginata* taeniosis in study area was 2%. The sex distribution of *T.saginata* taeniosis of human was described in (Table: 1). Out of the total 3938 humans/patients those, their retrospective recorded coproscopic laboratory result case book observed 56.2%, 43.8% were females and males respectively. Although more females than males whose retrospective coproscopic laboratory result case book were seen, the prevalence of human taeniosis/ *T.saginata* did not show any significant difference between two sexes (Table: 1) ($P>0.05$), however, the retrospective coproscopic prevalence of human *T.saginata* taeniosis were showed statistically significant difference between different age groups of patients ($p=0.000$) (Table: 2). Even though, three health stations were investigated for recorded coproscopic prevalence of human *T.saginata* taeniosis, there was no statistically significant difference seen between them ($p>0.05$) (Table: 3).

Table 1: Sex distribution of retrospective coproscopic prevalence of human *T.saginata* taeniosis

Risk factors	No. examined	No. of positive%	χ^2	p-value
Sex male	1729	33(1.9%)	0.437	0.508
Female	2209	49(2.2%)		
Total	3938	82(2%)		

Table 2: Age groups distribution of retrospective coproscopic prevalence of human *T.saginata* taeniosis

Risk factor	No. examined	No. positive%	χ^2	p-value
Age 0-15	917	14(1.5%)	30.890	0.000*
16-30	2170	38(1.7%)		
31-45	610	13(2.1%)		
46-60	176	11(5.9%)		
>60	65	6(8.5%)		
Total	3938	82(2%)		

Table 3: Three health stations investigated for retrospective coproscopic prevalence of human *T.saginata* taeniosis in Batu town

Risk factor	No. Examined	No. positive%	χ^2	p-value
Site Addisu poly clinic	1408	28(1.9%)	0.244	0.885
Batu health center	523	10(1.9%)		
Sher-Ethiopia hospital	2007	44(2.1%)		
Total	3938	82(2%)		

Questionnaire Survey: Questionnaire survey data collected from 100 interviewed volunteer respondents was translated into categorical variables which were assessed for association with human *T.saginata* taeniosis. Out of the total 100 volunteer respondents interviewed, 68% (68) of them said, they were infected with human *T.saginata* taeniosis at least once in their life time and 54 of them had strong habit of raw meat and lebleb kitfo consumption. There was statistically significant association in the prevalence of human *T.saginata* taeniosis between two sexes ($p<0.05$), habit of meat consumption and knowledge about meat borne parasite ($p<0.05$). Accordingly, males, ($p=0.004$, $OR=4.030$, $95\%CI=1.557-10.432$), raw beef, raw and lebleb kitfo consumers ($p=0.000$, $OR=6.0$, $95\%CI=2.321-15.511$) and people/respondents had less knowledge about meat borne parasite ($p=0.001$, $OR=5.727$, $95\%CI=1.972-16.633$) had higher odds of acquiring human *T.saginata* taeniosis than females, cooked meat consumers and people/respondents those had knowledge about meat borne parasite. There was no statistically significant difference ($p>0.05$) in the prevalence of human *T.saginata* taeniosis observed between different age categories, Occupations, Religions, different level of education and presence/absence of latrine facility at home.

Table 4: Inventory of annual prescribed adult taeniacidal drugs dose and their worth in Ethiopian currency Birr (2011-2012) in Batu town pharmaceutical shops

Name of taeniacidal Drugs	Year					
	2011		2012		Total	
	Dose	worth	Dose	worth	Dose	Worth
Niclosamide (bolus)	3240	6630.45	3 286.25	6674.90	6526.25	13305.35
Praziquantel (bolus)	3750	7350.00	3687	7058.40	7437	14408.40
Albendazole (bolus)	10280	11665.40	19253.5	76251.25	29533.50	87916.65
Albendazole (syrup)	1566	53089.88	1742.67	59712.95	3308.67	112802.83
Menbendazole (bolus)	16240	28451.90	10443.92	27745.60	26683.92	56197.50
Menbendazole (syrup)	1092	19200	1151.50	21763.59	2243.50	40963.59
Total	36168	126387.63	39564.84	199206.69	75732.84	325594.32

Retrospective Inventory Pharmaceutical Shops: An inventory of pharmaceutical shops (Batu health centre pharmacy, Sher-Ethiopia hospital pharmacy, Batu Red Cross society pharmacy and rural drug vender) was conducted in Batu town (Table: 5). During the inventory pharmaceutical shops, it was noted that the modern taeniacidal drugs sold in Batu pharmacies/drug shops were produced in the country/imported from abroad (United State of America, Europe, Far East and some African countries). Estimates of annual adult taeniacidal drugs dose and its worth was collected via personal interviews with pharmacist and their assistants and from recorded data. Descriptive statistics employed revealed that a total of 75,732.84 adult doses which may worth 325,594.32 ETB per annum on average were spent for treatment of human taeniosis in the Batu town. Relatively high dose bolus form of Albendazole (39%) was used followed by bolus form of Membendazole (35.23%), Praziquantel (9.82%), Niclosamide (8.62%), suspension form of Albendazole (4.37%) and suspension form of Membendazole (2.96%).

DISCUSSIONS

Retrospective coproscopic laboratory result case books of private clinic, public health center and hospital were observed for six months recorded cases to record human T.saginata taeniosis positive patients in Batu town. Out of total 4020 humans/patients those, their retrospective recorded coproscopic laboratory result case book observed, 82 humans/patients were positive for human T.saginata taeniosis. Over all retrospective recorded coproscopic prevalence of human T.saginata taeniosis in study area was 2%. The result of present study agrees with findings of [11] reported 4.2% prevalence of human T.saginata taeniosis in Nigeria. There was no statistically significant difference in the retrospective coproscopic prevalence of human T.

saginata taeniosis/infection between two sexes, even though prevalence was higher in females than males in study area which disagree with finding of [11]. Both study conducted by [11] and [12] showed higher prevalence of human T. saginata taeniosis in males than females in Nigeria and Ethiopia respectively. There was statistically significant association observed in the prevalence of human T. saginata taeniosis/infection between different age groups of patients which disagree with the finding of [11-14] who reported higher prevalence/infection in elder patients than youngster. As observed in Table: 2 as ages of patients increases prevalence of human T.saginata taeniosis also increased while number of recorded patients decreased. This could be due to elder patients/humans might have financial access to consume raw beef, raw and kitfo lebleb in butcheries and restaurants and higher social interaction to participate in kircha, tradional and cultural social events those increase access to raw meat consumption which. There was no statistically significant difference seen in the prevalence of human T.saginata taeniosis/infection between three different health stations included in study in the area. This is based on the [15] and [16] guidelines, which stated that T.saginata is known by its more frequent expulsion through anus than T. solium. The supporting evidence for the occurrence of T. saginata rather than T. solium among the patients those their retrospective coproscopic laboratory result case book seen were that almost all of the residents of the Batu town do not eat pork due to religious cult which confirms the current finding to be T. saginata, by eliminating possible differential diagnosis of T. solium.

The prevalence and public health importance of human T.saginata taeniosis was recorded based on the questionnaire survey and showed overall infection rate of 68% which demonstrates the public health importance of human taeniosis in Batu town. The result of present study agrees with findings of [8] who reported an overall

infection rate/prevalence of 62.5% in Wolaita Soddo town, [17] (64.2%) in Hawassa town, [18] (69.2%) in Gondar and [19] (79.5%) in East Shoa respectively. On the other hand, the prevalence of present study is relatively higher than findings of [20], 50.6% in Wolaita Soddo town, [13], who reported prevalence of (56.7%) in Jimma town and [21] who reported relatively lower prevalence (22.5%) in China. The reason for this difference might be related to the degree of knowledge/awareness of different societies about human *T.saginata* source, transmission, prevention and level of environmental and personal hygiene/presence/absence of latrine facility at home. In addition, some individuals in a society particularly females may become shy to tell openly about human *T.saginata* taeniosis infection which may undermine the true infection rate of the disease.

In present study there was statistically significant difference in the prevalence of human *T.saginata* taeniosis between the two sexes that was higher in males than females which agree with the works of [12, 14, 18, 19, 22] in Ethiopia those reported higher prevalence of human taeniosis in males than females but disagree with the findings of [17, 19, 23] in and around Hawassa and [24] who reported that females were found to be more frequently affected than males in a ratio of 2:1. Possible suggestion might be in the study area there was discrimination between males and females in the habit of raw meat consumption in restaurants, butcheries and even at home. In this study there was no statistically significant association in the prevalence of human *T. saginata* taeniosis between different age categories of respondents which disagree with works of [8, 13, 19, 23]. Possible reason for this could be that older and younger people may be had similar habit of raw meat consumption in the study area. In present study there was also no statistically significant association in the prevalence of human *T. saginata* taeniosis/infection between different occupations in the study area, although higher prevalence found in butcher men followed by employee. Higher human *T.saginata* taeniosis prevalence recorded among the butcher men than the other occupations might be due to more access they have to come in contact with meat and meat products as a result of which there could be a higher possibility of getting infection of human *T. saginata* taeniosis which is in line with findings of [13, 17, 19, 18] and Tembo [4] in Ethiopia.

There was no statistically significant difference in the prevalence/infection of human *T.saginata* taeniosis between religions of respondents which is in agreement with the findings of [8, 13, 14, 17, 19] in

Ethiopia. The reason behind the similarity of different religion groups may be the similar culture and habit of meat consumption in the study area. However, [19] reported that Christians had more human *T.saginata* taeniosis than Muslims. The disagreement between the two studies might be due to differences of study methodologies; for instance, in the present study 100 volunteer respondents were included where as in case of [19] only 40 respondents were included which might affect the precision of prevalence estimates.

There was no statistically significant difference in the prevalence /infection of human *T.saginata* taeniosis between different educational levels which agree with finding of [8, 13, 23] but disagree with the finding of [19].

Even though the prevalence of human *T.saginata* taeniosis was higher in absence of latrine facility at home there was no statistically significant difference between presence/absence of latrine facility at home. This might be due to 91 volunteer respondents of Batu town residents replied; they have been used latrine facility at their home but prevalence of human *T.saginata* taeniosis was higher in absence of latrine facility at home because of the habit of raw meat consumption was higher in the population of study area.

In this study there was statistically significant association in the prevalence of human *T.saginata* taeniosis and habit meat consumption of society in the study area.

In this study prevalence of human *T.saginata* taeniosis was higher in raw beef, raw and kitfo lebleb consumers than cooked meat consumers which agree with findings of [13, 14, 17, 18, 19, 23, 25] in Ethiopia. This could be explained by the fact that people have higher chance to consume *C. bovis* infected raw meat in different occasions including traditional and cultural ceremonies where raw meat is served as one of major food items. The transmission of human *T.saginata* taeniosis/infection from animals to humans depends on the habit of consuming raw beef/semi-raw meat dishes, like kitfo and kitfo lebleb in Ethiopia.

There was also statistically significant difference in the prevalence/infection of human *T.saginata* taeniosis and knowledge about this disease that coincide with finding of [26]. In study area people those have less knowledge about meat borne parasite were suffered more than those have knowledge about it. Possible reason for it might be people those have less knowledge about this parasite highly consume raw meat due to deep rooted traditions and cultures in restaurants, butcheries, at home and even when they participate in kircha more than those

have knowledge about it. Community knowledge about *T.saginata* taeniosis in study area was assessed by considering source of the parasite infection and prevention method. 51 volunteer respondents interviewed suggested that source of *T.saginata* infection is raw/under cooked meat consumption. 89 volunteer respondents thought that infection of *T.saginata* is preventable by consuming thoroughly cooked meat. 47 respondents replied that the routine method of *T.saginata* taeniosis prevention is by consuming thoroughly cooked meat.

The volunteer respondents those were participated /interviewed in this study disclosed finding of eggs/proglottids in their faeces and underwear, which indicated the presence of human *T. saginata* taeniosis. This is based on the [15] and [16] guidelines, which stated that *T.saginata* is known by its more frequent expulsion through anus than *T. solium*. The supporting evidence for the occurrence of *T. saginata* rather than *T. solium* among the respondents was that almost all of the residents of the Batu town do not eat pork due to religious cult which confirms the current finding to be *T. saginata*, by eliminating possible differential diagnosis of *T. solium*. Human *T.saginata* taeniosis has public health and socio-economic importance [27].

Inventory of pharmaceutical shops employed revealed that human *T.saginata* taeniosis has importance both in public health aspects and socio-economic, despite the fact that the pathogenic significance of *C. bovis* is considered to be very low [27]. Inventory of pharmaceutical shops (Batu health centre pharmacy, Sher-Ethiopia hospital pharmacy, Batu Red Cross society pharmacy and rural drug vendor) which comprises the two years recorded data (2011-2012) in Batu town during study period revealed that a total of 75,732.84 adult taeniacidal drug doses which worth (325,594.32 EBR)/(16,740.07 USD) per annum that resulted from *T.saginata* taeniosis treatment in humans. In present study the estimates of adult taeniacidal drug doses and their worth relatively higher than that reported by [8] and [23], but lower than that of reported by me [13] and [19]. The reason for the differences might be attributed to variation in size of population reside in the two study areas, differences in prevalence of human *T.saginata* taeniosis/infection from area to area in the country, degree of raw beef, raw and kitfo lebleb consumption habit of society in the two study areas, variation in cost of individual drugs sold in different public and private pharmacies, variations in the level of traditional herbal

medicine usage and awareness/knowledge of patients about the clinical pictures, source, transmission and prevention of the disease, variation in personal and environmental hygiene/presence/absence of latrine facility at home. This indicated that human *T. saginata* taeniosis diminishes the household and country financial resources, which could be easily avoided by consuming thoroughly cooked meat and using latrine facility at home.

In conclusion, finding of this study including retrospective coproscopic prevalence, questionnaire survey and inventory of pharmaceutical shops indicated the both public health and socio-economic importance of human taeniosis/*T.saginata* Batu town. On the other hand, the questionnaire survey revealed that human taeniosis is more prevalent in butchers and abattoir workers and illiterate people. Consumption of raw meat and occupation are the major predisposing risk factors. Intensive meat inspection, appropriate treatment of infected people and the use of latrine has to be encouraged to tackle and reduce the problem in the areas. Further well organized public education in each sector and designing community based control strategies is recommended.

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