Global Veterinaria 7 (2): 164-168, 2011
ISSN 1992-6197

Cyst Viability, Body Site Distribution and Public Health Significance of Bovine Cysticercosis at Jimma, South West Ethiopia

[1]*Gomol Taresa,* [1]*Achenef Melaku,* [2]*Basazenuw Bogale and* [2]*Mersha Chanie*

[1]Basic Veterinary Science Unit, Faculty of Veterinary Medicine,
University of Gondar, P.O. Box: 196, Gondar, Ethiopia
[2]Veterinary Paraclinical Studies Unit, Faculty of Veterinary Medicine,
University of Gondar, P.O. Box: 196, Gondar, Ethiopia

Abstract: A cross sectional study was conducted from October 2010 to March 2011 on bovine cysticercosis at Jimma town with the objectives of determining the prevalence, cyst viability, body site distribution and its public health implications. Interview was conducted on 180 residents using pre-structured questionnaire to know the public health significance. A total of 520 carcasses were inspected and 19 (3.65%) were infected with cysticerci. A total of 57 cysts were collected in which 15 (26.32%) were viable while others 42 (73.68%) were degenerated. The anatomical distribution of cysticerci were; 17 (29.82%) in shoulder muscle, 11 (19.30%) in neck muscle, 8 (14.04%) in tongue, 8 (14.04%) in heart, 4 (7.02%) in masseter, 4 (7.02%) in liver, 3 (5.26%) in kidney and 2 (3.51%) in diaphragm. The prevalence of cysticercosis was not significantly ($P>0.05$) different between age groups of animals. One hundred and sixteen (64.44%) respondents had contracted the disease at least once in last two years and maximum infestation frequency was three times per year. The infestation was varied significantly ($P<0.05$) with age, habit of eating raw meat and religion of respondents. However, there was no significance ($P>0.05$) difference between sexes, marital and educational statuses of the respondents. This study indicated the presence of bovine cysticercosis and its public health hazards in the area. Therefore, the disease deserves due attention to safeguard the public and promote beef industry in the country.

Key words: Bovine · Cysticercosis · Cyst Viability · Jimma · Public Health

INTRODUCTION

Bovine cysticercosis is caused by larval stages of the beef tape worm, *Taenia saginata*. Human beings are the obligate final host and become infected by ingesting beef having the parasite that has been inadequately cooked or frozen, while cattle become infected by ingesting tape worm eggs passed with human faeces which contaminate the pasture [1, 10]. The life cycle and transmission of *T. saginata* occurs most commonly in environments characterized by poor hygiene, poor sanitation, poor livestock husbandry practices and inadequate meat inspection and control and also where inhabitants traditionally eat raw or insufficiently suncured or cooked meat [1, 2].

Cysticercus bovis is found almost all over the world; with very low prevalence in developed countries, where under cooked beef steak is consumed rarely. Moderate prevalence levels are seen in Southern Asia. High prevalence rates occur in Sub- Saharan Africa, where it causes an important economic loss due to condemnation of meat. In Ethiopia, the prevalence of 89.41% [3] and 64.2% [4] Taeniasis was reported in humans. In cattle, 3.1% [3], 26.25% [4], 18.49% [5] prevalence rates of *C. bovis* were reported. This study was designed with the objectives of determining the prevalence, cyst viability, organ distribution of bovine cysticercosis and showing its public health significance in and around Jimma town, South West Ethiopia.

Corresponding Author: Achenef Melaku, Veterinary Paraclinical Studies Unit, Faculty of Veterinary Medicine, University of Gondar, P.O. Box: 196, Gondar, Ethiopia.
Tel: +251-918065724.

MATERIALS AND METHODS

Study Area: The study was conducted from October 2010 to March 2011 at Jimma town; located in Oromia National Regional State, South West Ethiopia. The town is located 352 km away from the capital (Addis Ababa) at 7°13'-8°56'North latitude and 35°52'-37° 37'East longitude and the elevation is ranged from 880 to 3360 meters above sea level. The area receives a mean annual rainfall of about 1530 mm that comes from the long and short rainy seasons. The mean annual minimum and maximum temperatures are 7 and 30°C, respectively with dominant warm and humid weather condition [6].

Study Population: The study animals were collected from different districts around the town. Most of them were kept in extensive husbandry system with free grazing. The breed of animals used in this particular study was local Zebu (*Bos indicus*) and all slaughtered animals were males.

Study Methodology and Design

Abattoir Survey: A total of 520 cattle organs and their carcasses were examined. Random sampling method was used for sampling and using the 95% confidence interval. Sample size determination was based on the formula given by Thrusfield [7] with expected prevalence of 50%. Prior to sampling, each selected animal was given an identification number. Age categories (young less than four and adult greater or equal to four years) were given by using the dental eruption and wear as described by De-Lahunta and Habel [8]. During meat inspection, identified animals and their respective organs were strictly examined separately. The meat was inspected visually, followed by multi-incisions of the heart, diaphragm, tongue, liver, kidney, shoulder and masseter muscles.

Cyst Evaluation: Lesions consisting of cysticerci were carefully removed and incubated at 37°C in 40% ox bile solution dissolved in normal saline (0.9%) for 2 hours. The cyst was regarded as viable if the scolex is evaginated during the incubation period. Examination was performed under microscope after pressing between two glass slides for scolex whether it was *T. saginata* or other metacestodes based on the size of cysticerci and presence of hooks on the rostellum of the evaginated cyst [9].

Public Health Significance: In order to assess the extent of human taeniosis at Jimma town, 180 randomly selected voluntary respondents were interviewed individually using semi-structured questionnaire. The potential risk factors like age, habit of raw meat consumption, religion, sex, marital status and education were recorded.

Data Analysis: Data were collected and recorded on Microsoft Excel spread sheet. The point prevalence was calculated for all data as the number of infected individuals divided by the number of individual sampled and multiplied by 100. The influence of risk factors on the infestation rates were compared by chi-square (χ^2_{cal}). Statistical analysis was done using SPSS statistical software version 17.0 and $P< 0.05$ was considered as significant.

RESULTS

Prevalence of Bovine Cysticercosis:. The prevalence of bovine cysticercosis in cattle slaughtered at Jimma municipal abattoir was 3.65%. The prevalence was 4.42% in adult and 2.65% in young cattle. Despite these, there was no statistically significant ($P>0.05$) difference between age groups (Table 1).

Cyst Viability: A total of 57 cysts were collected, 15 (26.32%) were alive while others 42 (73.68%) were degenerated (Table 2).

Anatomical Distribution: The highest proportions of cysts were observed in the shoulder (29.82%) followed by neck (19.30%), tongue (14.04%) and heart muscles (14.04) (Table 2).

Taeniosis in Jimma Town: From the interview made with residents of Jimma town, 116 (64.44%) had already contract the disease at least once in the last two years and maximum infestation frequencies of 3 times per year. Considerable proportion of the respondents (81.89%) had habit of eating raw meat. The occurrence of taeniosis varied significantly ($P<0.05$) with habit of raw meat consumption, religion and age of the respondents. Conversely, statistically significant ($P>0.05$) difference were not observed between sexes, marital and educational status of the respondents (Table 3).

Table 1: Prevalence of bovine cysticercosis in age groups of the animals

Age	Number Examined	Positive	Prevalence (%) (95%, CI)	OR (95% CI)
Young	226	6	2.65 (0.56-4.74)	0.57 (0.21-1.53)
Adult	294	13	4.42(2.07-6.77)	
Total	520	19	3.65 (2.04-5.26	

Chi square (χ^2_{cal}) = 1.13, CI= Confidence interval, OR= odds ratio

Table 2: Bovine cysticercosis in different organs of the animal

					Degenerated Cyst	
Organs	No of cyst recorded	% by organ	No of Viable Cyst	% of viable cyst	Non-viable	Calcified
Shoulder muscles	17	29.82	3	20.00	8	6
Neck muscles	11	19.30	2	13.33	4	5
Tongue	8	14.04	3	20.00	3	2
Heart	8	14.04	5	33.33	3	0
Masseter muscle	4	7.02	1	6.67	2	1
Liver	4	7.02	1	6.67	1	2
Kidney	3	5.26	0	0.00	2	1
Diaphragm	2	3.51	0	0.00	1	1
Total	57		15	26.32	24	18

Table 3: Occurrence of taeniosis based on the age of respondents

S/n	Risk Factors	Interviewed No	Infested No	Prevalence (%) (95%, CI)	OR (95% CI)	Chi square (χ^2_{cal})
	Age					
1	15-30	43	16	37.21 (22.78-51.66)		
2	31-45	56	39	69.64 (57.60-81.68)	3.21(2.96-3.40)	18.78
3	46-60	58	44	75.86 (64.85-86.87)	5.32(5.11-5.52)	
4	>60	23	17	73.91 (55.96-91.86)	4.45(4.22-4.65)	
	Habit of Raw Meat consumption					
1	Raw meat consumers	116	95	81.90 (74.89-88.91)		
2	Non raw meat consumers	64	21	32.81 (21.31-44.31)	9.26 (4.58-17.72)	43.37
	Religion					
1	Christian	108	77	71.30 (62.77-79.83)		
2	Muslim	72	39	54.17 (42.66-65.68)	2.10 (1.13-3.92)	5.53
	Sex					
1	Male	91	62	68.13 (58.56-77.70)		
2	Female	89	54	60.67 (50.52-70.82)	1.38 (0.75-2.55)	1.09
	Marital status					
1	Married	95	61	64.21		
2	Unmarried /Single/	85	55	64.71	0.97 (0.53-1.80)	1.35
	Education					
1	Educated	89	53	59.55		1.84
2	Uneducated	91	63	69.23	0.65 (0.35-1.21)	1.84

DISCUSSION

The prevalence of bovine cysticercosis obtained in this study was relatively comparable to the report of Tembo [3] in the central Ethiopia. However, it was lower than reports of Kebede [5] in Northwest Ethiopia, Hailu [11] in East Shoa, Abunna *et al.* [4] in Hawassa, Ethiopia. Prevalence of *C. bovis* obtained in this study was in contrast to the prevalence rate reported in some parts of Africa, 20% in Senegal, 27% in Tanzania and 38-62% in Kenya [12] and 26.2% in Nigeria [13]. Conversely, lower prevalence was reported from developed countries such as 0.26% in Crotia [14], 0.48-1.08% in Germany [15] and 0.9% in Cuba [16]. Factors like the method of meat inspection, difference in the management and the number of cuts made on each organ during inspection can

contribute for the variation of prevalence. The variation may also be associated with poor sanitary infrastructures, low awareness and improper disposal of sewage particularly in developing countries.

Cysticerci have distributed in all inspected organs with shoulder, cardiac and neck muscle being the most frequently affected organs with the highest number and viable cysts. Accordingly, the heart, tongue, shoulder and neck muscle harboured higher number of viable cysts compared with other organs. The finding in this study is in agreement with the reports of Dawit [17] and Opara *et al.* [13]. Minozzo *et al.* [2] has recovered higher proportion of cysts from anterior muscles (46%) and posterior muscles (53.3%) from experimentally infested animals. In a study conducted by Wanzala *et al.* [18], most organs had cysticerci with skeletal muscles carrying the highest percentage (24-74%). The variations in anatomical distribution depend on a number of factors as, blood kinetics and animals' daily activities play a great role [19]. These differences in the infestation rate of organs by cysticerci suggest existence of preference to certain sites which need more attention during meat inspection.

Absence of significance difference between two age groups may be due to the close age of animals slaughtered as extremely young and old animals are not usually slaughtered in the country. Kebede [5] also stated the difficulty of comparing age groups since the animals slaughtered are usually almost adults.

Occurrence of human taeniosis obtained in this study was relatively equivalent with the finding of Abunna *et al.* [4] in Hawassa but far from the findings of Hailu [11] in East Shoa and Tembo [3] in Addis Ababa, Ethiopia. The occurrence of the disease had significant association with habit of raw meat consumption, with the religion of the respondents. In this study, raw meat eaters are highly infested with the disease than those who did not eat raw meat. Thus, infestation of human being by *T. saginata* is mainly due to the habit of eating raw meat particularly in Ethiopia and in other countries where undercooked and raw meat eating has practiced [2]. Similar to the reports of Tembo [3] and Abunna *et al.* [4], taeniosis occurrence was higher among the Christian community than Muslims. The occurrence was also varied significantly with age of the respondents; in which older aged people were highly infested by *T. saginata* than younger people. This might be due to old aged people accustomed to eat raw meat most of the time with the interest of drinking with their friends than young people and most of the time young people do not have interest of consuming raw meat [4].

In summary, this study indicated that *T. saginata* is medically and economically important parasite in the area. Therefore, attention must be given to the personal and environmental hygiene. People in the area should avoid eating raw or undercooked meat.

REFERENCES

1. Cabaret, J., S. Geerts, M. Madeline, C. Ballandonne and D. Barbier, 2002. The use of urban sewage sludge on pastures: the cysticercosis threat. Veterinary Res., 33: 570-598.
2. Minozzo, J.C., R.L. Gusso E.A. De Castro, O. Lago and V.T. Soccoi, 2002. Experimental Bovine Infestation with *Taenia Saginata* eggs: Recovery rate and cysticerci location. Brazilian Archive of Biology and Technol., 45: 452-455.
3. Tembo, A., 2001. Epidemiology of *Taenia saginata*, Taeniasis/Cysticercosis in Three Selected Agro-Climatic Zones in central Ethiopia. MSc Thesis, Addis Ababa University. Faculty of Veterinary Medicine. Free University of Berlin.
4. Abunna, F., G. Tilahun, B. Megersa, A. Regassa and B. Kumsa, 2008. Bovine Cysticercosis in Cattle Slaughtered at Awassa Municipal Abattoir, Ethiopia: Prevalence, Cyst Viability, Distribution and its Public Health Implication. Zoonoses and Public Health, 55: 82-88.
5. Kebede, N., 2008. Cysticercosis of slaughtered cattle in northwestern Ethiopia. Research in Veterinary Sci., 85: 522-526.
6. MoA, 2008. MOA (Ministry of Agriculture) Annual Report, Jimma, Oromia Regional state, Ethiopia.
7. Thrusfield, M., 2005. Veterinary Epidemiology. 3rd ed. Blackwell, Edinburgh, pp: 232-233.
8. De-Lahunta, A. and R.E. Habel, 1986. Teeth. Applied Veterinary Anatomy. USA. W.B. Sounders Company, pp: 4-8.
9. Gracey, J.F., D.S. Collins and R.J. Huey, 1999. Meat Hygiene. 10th ed. W. B Philadelphia Sounders Company, p: 352-354.
10. Pawlowski, Z.S. and K.D. Murell, 2001. Taeniasis and cysticercosis. In: Y.H. Hui, S.A. Sattar, K.D. Murell, W.K. Nip and P.S. Stanfield, (Eds), Food borne Disease Handbook. 2nd ed. Marcel Dekker, NY, USA, pp: 217-221.
11. Hailu, D., 2005. Prevalence and risk factors for T. saginata cysticercosis in three selected areas of Eastern Shoa. MSc Thesis, Addis Ababa University, Faculty of Veterinary Medicine. Debre Zeit, Ethiopia.

12. Over, H.J., J. Jansen and P.W. Van Olm, 1992. Distribution and Impact of Helminthic Disease of Livestock in Developing Countries. In: FAO animal production and Health paper 96. Food and Agriculture organization of the United Nations, Rome
13. Opara, M.N., U.M. Ukpong, I.C. Okoli and J.C. Anosike, 2006. Cysticercosis of slaughtered cattle in Southern Nigeria. NY Academic Sc., 1081: 334-340.
14. Zivkovic, J., D. Velimirovic, P. Dzaja and Z. Grabarevic, 1996. Prevalence of Cysticercus bovis. Measles with Particular References to Histopathological changes in Meat. Archiv Furlebensmittel Hygiene, 47: 66-68.
15. Abusier, S., C. Epe, T. Schnieder, G. Kelein and M. Kuhene, 2006. Visual Diagnosis of *T. saginata* Cysticercosis during Meat Inspection. Parasitol. Res., 99: 405-416.
16. Sau'rez, H.M. and R.M. Santizo, 2005. Epidemiology of the *Taenia saginata* complex and *C. bovis* in Ciego De Avila province of Cuba. Rev. Pathol. Tropic, 34: 43-52.
17. Dawit, S., 2004. Epidemiology of T. saginata taeniosis and Cysticercosis in North Gondar Zone. North West Ethiopia. DVM Thesis, Addis Ababa University. Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
18. Wanzala, W., J.A. Onyango-Abuge, E.K. Kang'ethe, K.H. Zessin, N.M. Kyule, M.P. Baumann, H. Ochanda and L.J. Harrison, 2003. Control of *Taenia Saginata* by Post-mortem Examination of Carcasses. Africa Health Sci., 3: 68-76.
19. Gracey, J.F. and D.S. Collins, 1992: Meat Hygiene, 9th ed. Balliere Tindal, London.