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Major metacestodes in cattle slaughtered at Holeta municipal abattoir and community knowledge about mode of transmission of zoonotic cestodes in Oromia, Ethiopia

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Abstract

A cross sectional study was conducted to estimate the prevalence of major metacestodes of cattle slaughtered at Holeta municipal abattoir and a questioner survey to assess the knowledge of community residing in Holeta town on ways zoonotic cestodes could transmitted to human. Out of 422 randomly selected and slaughtered cattle, 8 (1.9%) and 139 (32.9%) were found infected with *Cysticercus bovis* and Hydatid cyst respectively. There was no significant difference for the prevalence of *Cysticercus bovis* and hydatid cyst among animals of different origins and management systems ($p>0.05$). In contrast, the difference in the prevalence of the hydatid cyst between adult and young cattle was found to be statistically significant ($p<0.05$). Adult cattle were found to be highly infected. Tongue and masseter muscle were the most frequently infected organs with *Cysticercus bovis* while lungs took the highest proportion among the other organs infected with hydatid cyst. The viability test of the metacestodes of cattle showed that 44 % of *Cysticercus bovis* and 47.5% of the examined hydatid cysts were viable. Out of 100 volunteer respondents, 84% responded that they were aware of the way taeniosis/*Taeniasaginata* is infection in human, transmitted by consuming raw beef meat while 16% of respondents had no information even about the diseases and ways of transmission. On the other hand 3% of the respondents were knew as human can get haydatid disease through ingestion of tapeworm eggs shadedby dogs with feces. But 97% of the respondents do not known even the name of the hydatidosis. The present study showed a visible reduction in the prevalence of *Cysticercus bovis* from the previous years and still a higher prevalence in hydatid cyst. Therefore, due attention should be given to public educationin order to reduce the economic and public health impacts of zoonotic metacestodes.

Keywords: Abattoir, Cattle, Metacestodes, Holeta, Prevalence, Oromia

Introduction

In Ethiopia, among the parasitic diseases metacestodes of *Taenia saginata* and *Echinococcus granulosus* are the most important ones because they have economic as well as public health significance (Regassa *et al.*, 2009). Bovine cysticercosis, refers to the infection of cattle with metacestodes of the human tapeworm *Taenia saginata* (Oladele *et al.*, 2004). It is a major problem for producers in sub Saharan Africa. The clinical effect of cysticercosis on infected animal is generally not significant, however, in addition to the effect on human health, economic losses may be high due to the condemnation of heavily infected carcasses and the necessity to freeze or boil infected meat, restriction of export and herd quarantine (Scandrett *et al.*, 2009). Hydatidosis refers to a zoonotic infection caused by adult or larval stage of cestode belonging to the genus *Echinococcus*. It is characterized by cyst containing numerous tiny protoscolices that most often develop in the liver and lungs and also develop in the kidneys, spleen, nervous tissue, bone and other organs (Magambo *et al.*, 2006).

Both bovine cysticercosis and hydatid cysts are considered as an important public health and economic problem in most developing countries including Ethiopia (Abunna *et al.*, 2007). Hydatidosis is considered as one of the world's most geographically wide spread zoonotic diseases. The pathogenicity of hydatidosis heavily depends on the extent and severity of infection and the organ on which it is situated. The occasional rupture of hydatid cysts often leads to sudden death due to anaphylaxis, hemorrhage and metastasis (Marriott *et al.*, 2010). *Taenia saginata* infestation in human is accompanied with mild symptoms ranging from nausea, abdominal discomfort, epigastric pain, diarrhea, vitamin deficiency, excessive appetite or loss of appetite, weakness and loss of weight to digestive disturbances and intestinal blockage (Neva *et al.*, 1994).

Although there were some works carried out in certain parts of the country, the status of metacestodes in livestock were not studied in

Holeta. Therefore, the objective of this study was to [1] determine major zoonotic metacestodes of cattle slaughtered at Holeta municipal abattoir [2] to assess community knowledge about mode of transmission of zoonotic cestode.

Materials and Methods

Study Area

This study was conducted at Holeta town. Holeta town is located in Oromia National Regional State, in Oromia Special Zone at a Distance of 45 Km west of Addis Ababa at an altitude of 2400m.a.s.l. It has a latitude and longitude of 9°30' N 38°30' E /9.050°N 38.500°E respectively. In this area the rainfall pattern is bimodal, with a short rainy period from February to April and a long rainy season from mid-June to September. The annual temperature ranges between 18°C to 24°C and the rain fall of the area ranges from 1000 to 1100 mm. The predominant soil type is verti soil and semi intensive farming is a common practice (Holeta agricultural research center) (OHWARC, 2004).

Study population

Animals which presented to Holeta municipal abattoir for slaughter were local zebu cattle originated from Holeta, Ginch, Inchini, Adissalem and Olonkom districts.

Study Type and Sampling Method

A cross-sectional study was carried out from November 2014 to April 2015. The total number of cattle required for the study was calculated based on the formula given by (Thrusfield, 1995) for a simple random sampling method. By rule of thumb where there is no information for an area, it is possible to take 50% of expected prevalence. Using 5% degree of absolute precision, 384 animals were needed to be sampled but, to increase the precision of prevalence estimates, 422 animals were sampled.

Study Methodology

Active abattoir survey

During ante-mortem examination, each study animal was given an identification number and age was determined. Estimation of age was done by the examination of the teeth eruption (De Launta and Habel, 1986). Two age groups were considered: above 5 years (adult) and below 5 years (young). Over that, body condition, sex, breed and their place of origin were determined during ante-mortem inspection. Careful post-mortem examination was carried out on different organs including lungs, liver, spleen; kidney, heart; masseter muscle and tongue were inspected for both of *Cysticercus bovis* and hydatid cyst. For *Cysticercus bovis*, each predilection sites were inspected according to the guide line by Ministry of Agriculture (Ministry of Agriculture, 1972) Samples collected from each positive organ were transported to the veterinary parasitology laboratory of Holeta agricultural research center for confirmation of cyst viability. The cysts were incubated at 37°C for 1-2hrs using 40% ox bile solution diluted in saline solution. Then, the scolex was examined under microscope by pressing between two glass slides. The cysts were regarded as viable if the scolex everted. Individual cysts were grossly examined for any evidence of degeneration and calcification. For the case of hydatid cysts, individual cysts were carefully incised and examined for protoscolices and fertility. Then, fertile cysts were subjected to viability test. A drop of the sediment containing the protoscolices were placed on the microscope glass slide and covered with cover slip and observed for amoeboid like peristaltic movements with (40X) objective. For clear vision, a drop of 0.1% aqueous eosin solution was added on microscope slide with the principle that viable protoscolices should completely or partially exclude the dye while the dead ones take it up (Macpherson *et al.*, 1985).

Questioner surveys

Identification of respondents for questioner survey was based on random selection of volunteers who reside in different kebeles of holeta town. By using the formula given by Arsham [2002] ($0.25/SE^2SE=5\%$), the sample size for the questionnaire survey was expected to be 100 for each kebele. The selection was irrespective of age, sex and working conditions. Accordingly, 100 volunteer respondents were asked from six different kebeles.

Data Management and Analysis

Data obtained from abattoir and questioner survey were collected and stored in to the Microsoft Excel spreadsheet and after coding, data were subjected to descriptive statistics and chi-square in order to assess the magnitude of the difference of comparable variables using SPSS version 20 software. Statistically significant association between variables is considered to exist if the p-value is less than 0.05.

Results

Prevalence and Associated Risk Factors

Of 422 heads of cattle slaughtered and examined at the abattoir, the percentage of animals found with *C. bovis* cyst was found to be 1.4% (6/422) while hydatid cyst infection was 32.4% (137/422) and the infection rate with both parasites (double infection rate) was 0.5% (2/422). Hence, the prevalence of *C. bovis* and hydatid cyst was found to be 1.9% ($2+6 = 8/422$) and 32.9% ($2+137 = 139/422$), respectively indicating relatively higher prevalence of hydatid cyst than *C. bovis*. Thus, the overall prevalence of metacestodes in cattle in this study, considering both the sole and double infection, was found to be 34.3% ($2+137+6 = 145/422$) as indicated in Table 1.

Table 1: Prevalence of *C. bovis* and hydatid cyst in slaughtered cattle (n = 422)

Parasites sps	No. positive	Ifn proportion	No. positive	Prevalence (95%CI)
<i>C. bovis</i>	61.4%	8 (6+2)	10.1 (7.4, 13.6)	
hydatid cyst	137	32.4%	139 (137+2)	50.1 (45.1, 55.1)
Double infection	20.5%		2	8.4 (6.0, 11.7)
Total metacestodes	145	34.3%	145 (6+137+2)	51.9 (46.9, 56.9)

Cystercercus bovis

Association between the prevalence of bovine cysticercosis and the three risk factors considered is presented in Table 2. Accordingly, no

statistically significant difference ($p > 0.05$) was observed in the prevalence of bovine cysticercosis among cattle from different origins and between the management systems.

Table 2: Factors associated with the occurrence of Bovine cysticercosis

Risk factor	Total inspected	No (%) of positives	X ²	P-value
Origin				
Inchini	126	2 (1.6%)		
Addis alem	61	1 (1.6%)		
Ginch	121	4 (3.3%)	4.13	0.39
Holeta	72	0 (0%)		
Olonkomi	42	1 (2.4%)		
Management				
intensive	57	1 (1.7%)		
extensive	365	7 (1.9%)		13.29
	0.10			

Hydatid Cyst

The prevalence of hydatid cyst showed significant variation between adult and young cattle ($X^2 = 6.472$, $p = 0.011$). Relatively adult cattle were highly affected (table 3).

Table-3: Prevalence in different age group

Age groups (yrs)	No animals		Prevalence	X ²	P-value
	examined	infected			
Young (<5)	90	19	4.7		
Adult (>5)	332	117	28.2	6.472	0.011
Total	422	139	32.9		

Anatomical Distribution of *Cysticercus bovis*

The anatomical distribution showed that of the organs positive for *C. bovis* cyst, 4 (50%) were tongue indicating it is a preferable predilection site for the cyst followed by masseter muscle 3 (37.5%) and heart 1 (12.5%).

Viability of *Cysticercus bovis*

Of 25 cyst, the proportion of viable and non-viable cysts were found to be 44% (n=11) and 56% (n=14) respectively.

Anatomical Distribution of Hydatid Cyst

Of 146 organs positive for hydatid cyst, 82 (56.2%) were lung followed by liver 49 (33.6%), heart 8 (5.5%) and spleen, 7 (4.8%) indicating that lung is a preferable predilection site for haydatid cyst.

3.5. Fertility and Viability of Hydatid Cyst

Of the total 423 recorded hydatid cysts and subjected to laboratory test, 174 (41%) were viable fertile, 47 (11%) were non-viable fertile, 148 (35.2%) were sterile and 54 (12.8%) were calcified (Table 3). Cysts from lungs were relatively fertile (51.6%) and viable (28.7%) than cysts from the liver (Table 5).

Table 4: Distribution of *C. bovis* and hydatid cyst in the organs inspected.

Organs inspected	<i>Cysticercus bovis</i>		Hydatid cyst	
	No positive	Proportion (%)	No positive	Proportion (%)
Tongue	4	50%	0	-
Masseter muscle	3	37.5%	0	-
Heart	1	12.5%	8	5.5%
Liver	0	-	49	47.8%
Lung	0	-	82	56.2%
Kidney	0	-	0	-
spleen	0	-	7	4.8%

Table 5: Viability of *C. bovis* in organs inspected during the study period

Organs inspected	<i>Cysticercus bovis</i>	
	Cyst examined	Viable cyst
Tongue	15	7(28%)
Masseter muscle	9	4(16%)
Heart	1	-
Total	25	11(44%)

Table 6: Fertility and viability status of *hydatid cyst* in different organs (N=405 organs inspected)

Organs Inspected	No(%)of Positive organs	No(%)of cyst	Non-calcified cysts		Sterile cyst	Calcified cyst
			Fertile cyst	Non-viable		
			Viable	Non-viable		
Liver	49(33.6%)	132(31.2%)	53(30.5%)	19(40.4%)	23(15.5%)	37(68.5%)
Lung	82(56.2%)	248(58.6%)	111(63.8%)	17(36%)	112(75.7%)	8(14.8%)
Heart	8(5.5%)	24(5.7%)	4(2.3%)	7(14.9%)	6(4%)	7(13%)
Spleen	7(4.8%)	19(4.5%)	6(3.4%)	4(8.5%)	7(4.7%)	2(3.7%)
Total	146	423	174	47	148	54

Questionnaire Survey result

Of the total 100 interviewed volunteer respondents at Holeta town, 84% of the respondents had awareness on the way human can be affected by *Taenia saginata*. They replied as the main source of infection for humans was consumption of raw and undercooked beef and 16% of the respondent were had no knowledge. On other question related with *Taenia saginata*, 32% consume raw meat in the form of *kurt* and 68 were did not eat raw meat. Regarding hydatidosis,

3% of the respondents were had knowledge on the way human can be affected by hydatidosis and

97% of the respondent had no any information on hydatidosis. On question related with hydatidosis, 94%, feed their dog uncooked organ and viscera and 6% feed cooked viscera. 91% of the respondent didn't know that uncooked viscera can cause disease to dogs and the rest 9% had knowledge. 78% dispose feces of their dog together with other garbage on the field. The rest, 22% disposes in to hole made for garbage. 97% of the respondent had no knowledge on vegetables contaminated with cestode eggs could be a source of hadatid disease in human and the rest 3% had the knowledge.



Fig-1: Picture of hydatid cyst on liver of slaughtered cattle in Holeta municipal abattoir

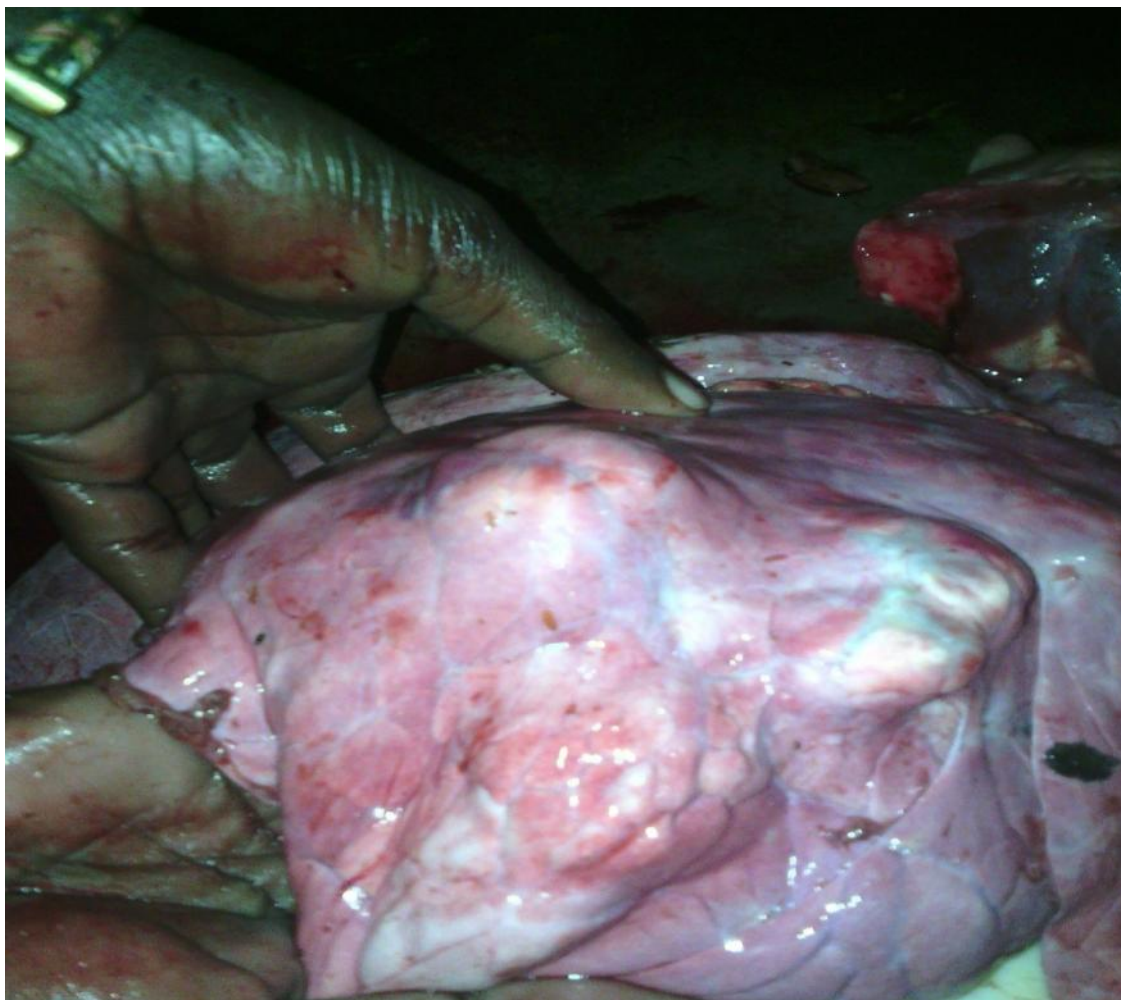


Fig-2: Picture of hydatid cyst on slung of slaughtered cattle captured in Holeta municipal abattoir

Discussion

During the study period, the occurrence of Bovine cysticercosis in cattle at Holeta municipal abattoir was found to be 1.9%. The current study agreed with the findings of (Tembo *et al.*, 2001). (Taresa *et al.*, 2011) and (Ibrahim and Zerihun, 2012) who reported 3.2%, 3.65% and 3.6% prevalence at central part of Ethiopia, Jimma and Addis Ababa localized abattoirs, respectively. However, the current finding showed marked variation when compared with the findings of (Abunna *et al.*, 2008), (Ahmed *et al.*, 1990) and (Kebede *et al.*, 2009) who reported prevalence of 26.25%, 21.17% and 7.5% from Hawassa, Nekemit and Addis Ababa abattoirs, respectively. The observed different among these studies could be explained with the agro-climatic conditions of the study areas, the number of incision made during inspection, the ability of the meat inspector to

identify the cases, habit or culture of raw meat consumption, sample size and sampling method, level of environmental contamination with the eggs of *T. saginata*, dose and viability of egg consumed (Scandrett *et al.*, 2009).

From personal observation, areas known for high trend of eating raw meat and backyard slaughter, like the case in Hawassa and Nekemit, are more exposed for *C. bovis* and hence more cases of Bovine cysticercosis in cattle. Bovine cysticercosis was not statistically variable among the different origins of the slaughtered animals. Similar result was reported previously by (Regassa *et al.*, 2009) in Wolaita Soddo municipality abattoir. This finding can partly be explained by a more or less similar habit of raw meat consumption of these geographically and socio-economically related areas.

Although higher numbers of cattle brought from extensive management system were infected, the prevalence of bovine cysticercosis infection between the two management systems also showed no significant difference. This could be related to the small number of positive cases encountered, which is not sufficient to bring marked difference during the analysis. However, cattle came from intensive management system had less exposure to the infection because they are kept in good feeding and housing management. Moreover, preventive measures like restricted access to contaminated areas, zero grazing and environmental sanitation are more practiced in intensive management system. In the current study, like other previous studies Kebede *et al* (2009) the tongue, masseter muscle, heart and were the predilection site for the cysts of the *C. bovis*. In addition to the above organs, shoulder muscles and diaphragm are also the common predilection site for the cysts of *C. bovis*. In this study, examination of the shoulder muscle and the diaphragm couldn't be done because the inspector, slaughter house personnel and the owner or his/her representative were not voluntary to let inside and inspect those muscle.

The prevalence of hydatidosis in cattle recorded in this study (32.9%) agree with the findings of (Getachew, 2008) 31.44% in Jimma. However, it showed slight variation with the finding of (Tigist., 2009) 36.58 % in the same study area. In contrast, the present study disagree with the report

of (Kebede *et al.*, 2009)16% in Wolitasodo, (Alemayehu., 1990)54.8% in Assela and (Kebede *et al.*, 2009) 48.9% in Debre Markos and (Wubet, 1988) 62.96% in Bale Robe. The variation in prevalence of hydatidosis from different areas of a country might be attributed mainly to the strain difference of *Echinococcus granulosus* that exist in different geographical location (McManus, 2006) On top of that, differences in animal husbandry system, backyard slaughtering of animals,slaughtering of aged cattle which may have had considerable chance of exposure to the parasitic ova, provision of infected offal to pet animals around homesteads, poor public awareness about the disease and

presence of few slaughter houses, lack of proper disposal of infected carcass and presence of stray dog could attribute for the variation in prevalence of hydatidosis (Garippa, 2004). Furthermore difference in culture, social activities and attitudes to dogs in different region may contribute for the variation (Macpherson, 1985).

With regards to rate of infection of hydatidosis in different age groups of cattle, significant difference ($P < 0.005$) was observed. Adult animals were highly affected. The difference in infection rate could be mainly due to longer exposure time to *E. granulosus* eggs. This finding is similar to the finding of (Lobago, 1994; Yihdego, 1997; Umur, 2003; Azlaf and Dakkak, 2006; Esatgil and Tuzer, 2007).

Regarding organ distribution, the current study showed that lungs (17.8%) were the most preferred predilection site for hydatid cysts followed by liver (10.2%). This might be due to the fact that cattle are slaughtered at older age, during which period the liver capillaries are dilated

and most oncospheres pass directly to the lung. It is also possible for the hexacanth embryo to enter the lymphatic circulation and be carried via the thoracic duct to the heart and then trapped in the lungs (Arene, 1985).Furthermore, the lungs and liver possess the first great capillaries encountered by the migrating oncosphere (hexacanth embryo) which adopt the portal vein route and primarily negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved (Eckert and Deplazes, 2004)

The result of fertility test (47.8%) conducted on hydatid cysts was relatively higher than other reports made so far; in Wolayita Sodo 1.76% (Kebede *et al.*, 2009a) and in Debre Markos 10.1% (Kebede *et al.*, 2009b). The variation in fertility rate among these studies, in different species and in different geographical zone could be due to the differences in strain of *E. granulosus* (McManus, 2006). Though not proven, the fertility rate of hydatid cysts may show a tendency to increase with advancing age of the host. The fertility rate among different

organs also showed varied proportion. Accordingly, cysts in the lungs took the higher proportion of fertility rate. It has been stated that the relatively softer consistency of the lung tissue allows the easier development of the cyst and this may be aggravated due to reduced immunological compatibility of animals at their older age of infection. The variation between tissue resistances of the infected organs may also influence the fertility rate of the hydatid cysts (Kebede *et al.*, 2009b). Unlike the case in lungs, relatively higher number of calcified cyst encountered in the liver (24%). The liver is firm in consistency and lack suitable matrix for long term cyst survival and hence the cyst degenerate earlier than the once found in lungs. The higher number of calcified cysts in the liver could also be attributed to relatively higher reticulo endothelial cells and abundant connective tissue reaction of the organ (Regassa *et al.*, 2009).

The quality of questionnaire is an important tool in the assessing knowledge of community (Garippa, 1950) In the present study the knowledge of the community was estimated based on the questionnaire. Most of the respondents (84%) were aware of taeniasis and about source the infection to human. This finding agree with the report of (Tesfaye *et al.*, 2013) from jimma south western Ethiopia (82.3%) and (Tariku, 2014) who reported 80%. They replied as the main source of infection for humans was consumption of raw and undercooked beef; and possible measure of prevention could be properly cooking of meat, slaughtering animals in abattoir to be inspected carefully, environmental hygiene by constricting toilets and using drugs after infection. Even though they were aware of, they were still consume raw beef due to deep rooted cultural habit and by considering the disease as non-fatal and could be cured by using drugs after consumption of the beef.

In case of haydatidosis, only 3% of the respondent had knowledge on the way human can be affected with haydatidosis. In this study, only a small proportion (3%) of the participants had an awareness of echinococcosis. This finding disagrees with the work of Tigre (2012) who reported that 32.2% of the study participants had

an awareness of echinococcosis. The variation in the level of awareness could be due to the difference in the study groups, where the previous study was conducted only on butchers and abattoir workers who might be familiar with the problem unlike our study groups which incorporated a variety of respondents. On the other hand, the awareness level of participants in this study was consistent with report of (Kebede *et al.* 2010) and (Zelalem, 2012) who reported an awareness level of 0 and 8% respectively. The lower level of awareness about echinococcosis could be due to the longer incubation period of the disease in humans, in which it can takes up to 30 years to manifest clinical signs (CFSPH, 2011).

Conclusion and Recommendations

The recorded prevalence of cysticercosis was found to be lower as compared to previous findings from different part of the country. In the study area, the introduction of urban and rural health extension programs that taught the people intensively to use latrine might have played a significant role for reduced prevalence of *Cysticercus bovis* among slaughtered cattle and *Taenia saginata* among public. However, the present study and some other past studies showed higher prevalence of hydatid cyst. Backyard slaughtering with a tendency to give condemned visceral organs to dogs and keeping untreated dogs in close association with animals and humans are the major factors which favor the life cycle of the parasites to continue and hence a higher infection rate in cattle. In the study areas a good public awareness has been created regarding taeniosis. However, community knowledge on haydatidosis and their mode of transmission is still very low. Based on the above conclusion, the following recommendations were forwarded:

-) Public education and awareness should be created particularly on the risk of backyard slaughtering of food animals and proper disposal of offal.
-) Public education is highly required on way of transmission and zoonotic importance of haydatidosis

- J) The community need to be educated on the importance of regular anthelmintic treatment of their dogs

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