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Magnitude of *Echinococcus granulosus* in Dogs, Through the Infection Rate of Hydatid Cyst in Cattles and Humans

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Absract: A cross sectional study was conducted from November 2007 to April 2008 to determine the magnitude of *Echinococcus granulosus* in dogs, through the infection rate of hydatid cyst in cattles and people in Mekelle Municipal abattoir and hospital, respectively. A total of 1024 Cattles were examined systematically and 222 (21.68%) of them were found infected with hydatid cyst. Furthermore, 12 stray dog were randomly selected from a total of 300 stray dogs euthanized by Mekelle city municipal and 2 (16.67%) were positive for *E. granulosus*. In addition, a retrospective data was collected in order to evaluate the incidence rate of hydatid cyst in humans and revealed that 7 cases were positive to hydatid cyst per 3560 patients submitted to Mekelle hospital. Among the inspected organs, lung was found to have more cysts compared with other organs. There was significant difference ($P<0.05$) between age group and infection to hydatid cyst. Whereas there was found no association between body condition of the animal and hydatid cyst infection. From the total affected organs (n=222) the distribution of cysts were 145 (65.31%) lung, 3 (1.35%) kidney, 33 (14.86%) liver 1 (0.45%) heart, 37 (16.67%) both lung and liver. Proportionally, out of the inspected cysts, 23.13% were fertile, 36.86% sterile, 34.51% calcified and 5.49% rupture. From a total of 222 infected animals, 91.44% of cattle were animals with greater than five years and 8.56% of cattle were below five-year age.

Key words: Echinococcosis · *Echinococcus granulosus* · Hydatid Cyst · Slaughter Animals · Dog · Human · Zoonotic · Prevalence · Mekelle · Tigray

INTRODUCTION

Ethiopia has enormous livestock resource with a total contribution of 15% of Gross Domestic Product and 33% of the agricultural output. Current estimates show that there are 41.5 million heads of cattle, 28.2 million of sheep and goats, 5.8 million equine species; 0.92 million camels and over 42 million poultry. The population of cats and dogs are not known. However, each house hold in the rural area owns one or two dogs and owns a cat. There are also an estimated 4.6 million honey bee colonies contributing to the household of the rural population [1].

Livestock are the main stay of the livelihood of the majority of the human population by giving draft power supply for crop production and transport, as source of meat, milk and egg and source of each in come. However, the performance of livestock of food producer in Ethiopia is poor [1]. The annual growth of meat and milk production is 1.8% and 2.8% respectively, which is below the recommended average of 4% that is needed to feed the growing population reported by Sendros and Tesfay [2] (as cited by Brhane [3]).The main constraints are lack of sufficient and standard nutrition, poor husbandry practices, lack of marketing facilities and opportunities, inadequate animal health service such as treatment practices, disease control activities and uncoordinated development programs between various level of government institutions and non-government organizations [1].

Echinococcus granulosus and its metacestode in herbivores and human have been recognized as the most important helminths with great economic and public health significance in developing countries. Hydatidosis is one of the major infectious zoonotic diseases, where, cattle, sheep and goats are still slaughtered traditionally and carcass wastes are easily accessible to scavenging dogs. Dogs in this region are at risk for *E. granulosus* [4].

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The treatment of *Echinococcus* tapeworms are more difficult to remove the Taenian but several drugs, notably praziquantel, are now available which are highly effective [5]. Final host prevention of infection in dog is essential for control of hydatid disease. This can be accomplished with strict control of slaughtering and strict regulation of dogs ([6]: cited by [7]). The destruction of stray dogs for rabies control has been a great reduction in the incidence of the hydatid infection in human [5].

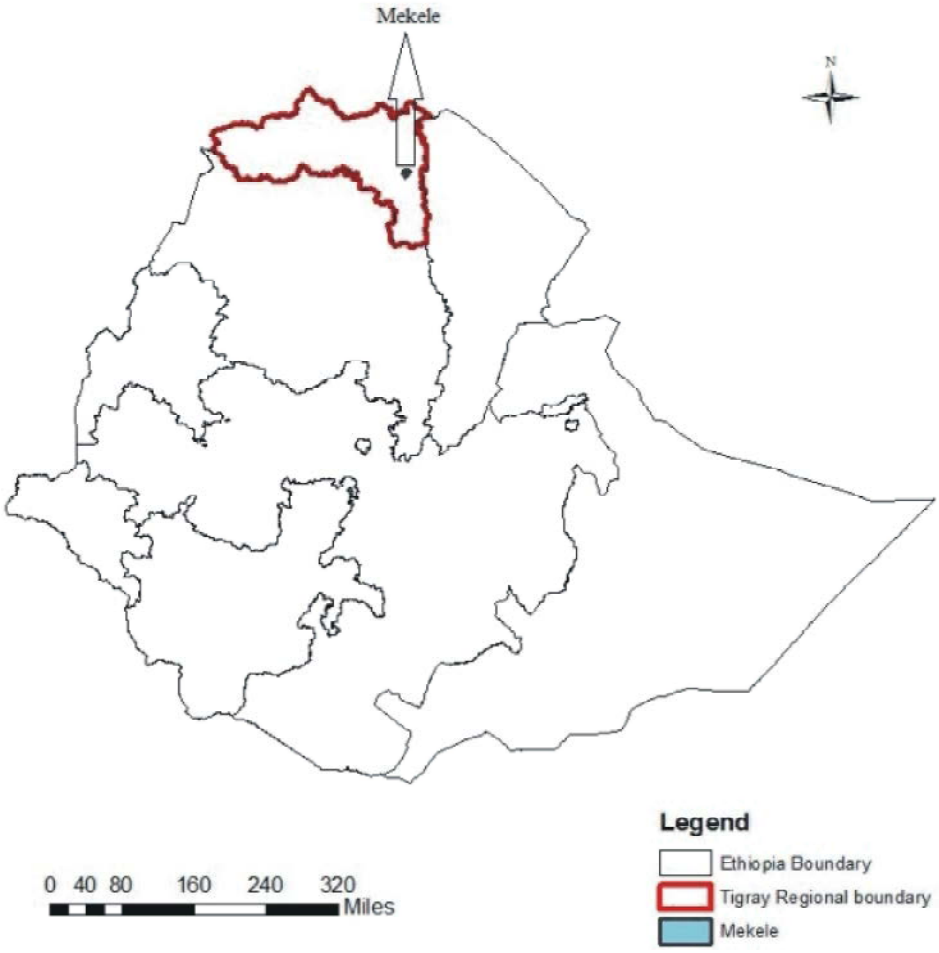
Studies on the prevalence and economic importance of hydatidosis were conducted in Mekelle [7]. Even though hydatidosis in animals has been studied in several regions of Ethiopia, it has not been studied comparing all the parties (Cattles, Humans and Dogs) in the transmission of disease in Mekelle town. Therefore, the objective of this study is to determine the prevalence of the hydatid cyst in cattle slaughtered in Mekelle abattoir and to determine the level of infection by *E. granuloses* in stray Dogs and finally assess the status of human infection retrospectively.

MATERIALS AND METHODS

Study Area: The study was conducted in Tigray region from November 2007-April 2008 at Mekelle municipal abattoir, where different species of animals are brought from neighboring districts of Mekelle city to be slaughter for the consumption of the inhabitants of the city, at Mekelle Regional laboratory for laboratory analysis, at Woreda clinic and Mekelle hospital.

Tigray is located at Northern extreme of Ethiopia. The region extends from 12° 13' to 14° 54' North latitude and from 36° 27' to 40 ° 13' East longitude with a total area of approximately 102,000 square kilometers [7].

Mekelle is the capital city of Tigray regional state and located 783 km North of Addis Ababa. The exact location of Mekelle is 39 ° 29' E and 13° 30' N of equator. The altitude of the area ranges from 2000-2200 meters above sea level. The mean annual rainfall of the study area is 579-650 mm. The annual minimum and maximum temperature is 11.8°C and 24.9°C respectively [7].



Study Animals and Humans

Cattles: A total of 1024 cattle were examined for hydatid cyst infection at Mekelle municipal abattoir. Approximately more than 99.5% of cattle presented for slaughters were indigenous Zebu but the remaining were Begait (Barka) and cross breed. All animals were adult and male except there was one female cow certified for slaughter. The majority of the animals were originated from the central high land (Mekelle periphery area) but a few were from the south part of the region. Anti-mortem and post mortem inspection was carried out with in the same day but vary in time.

Dogs: Among the total of 300 stray dogs euthanized by the city municipal, only 12 dogs were randomly collected and post mortem was performed after permission had been taken from Mekelle municipality.

Hospitalized Human Patients: A retrospective study was conducted to determine the infection of hydatid cyst among patients hospitalized in Mekelle hospital. All medical documents (case book) of patient with hydatid cyst were collected from the room of radiography in Mekelle hospital.

Study Design and Sampling Technique: Cross sectional study was conducted to determine the prevalence of Hydatidosis in cattle and Dogs. Retrospective data analysis was used to determine the incidence of hydatid cyst infection in humans submitted to Mekelle hospital. Mixed sampling techniques were used in the study. That is systematic sampling was conducted in animals slaughtered in Mekelle abattoir. That is every 5^{th} animal submitted to the slaughter room were investigated for the presence and quantification of hydatid cyst in main offal. While random sampling technique was conducted to sample the dogs among euthanized ones.

Sample Collection and Laboratory Procedure: The sample that contains a fluid filled cyst was taken from the slaughter house every three days per a week. Cysts that rupture during making an incision at the time of post mortem inspection were exempted from being collected and the number of cysts per organ were not also counted rather a cyst was taken randomly.

The contents of a cyst were aspirated with a syringe and collected in a graduate beaker. Then it was allowed to stay on incubator for 30 min at 36°C to settle the content. Ten ml of fluid from the sediment was poured to the test tube and centrifuged at 11000 for 5 min to separate the contents from liquid part and the supernatant was discarded but the sediment with some fluid was left in the test tube. Finally, the contents were taken from the sediment and examination was done under objective of 40X magnification for the presence or absence of protoscoleces. Based on the presence or absence of broad capsule containing a protoscoleces in hydatid fluid, cysts were identified and classified as fertile and sterile according to the description provided by FAO [8].

The abdominal cavity of the dogs was opened and the small intestine was tightly legated with a double ligature close to the pyloric region, ileocecal site and the terminal portion of the rectum. The intestines were then opened longitudinally under a slow flow of tap water. The mucosa was scraped between the blades of a forceps and the contents with epithelial scrapings. Passed through 40 and 60 mesh per inch brass sieves. The filtrate retained in the sieve was washed in to a glass container and examined carefully for helminthic parasites by using hand lens. Recovered parasites were fixed in 70% of ethanol. Echinococcosis species were identified according to the guide lines given by kumaratilake and Thompson [9].

Data Management and Statistical Analysis: Data obtained in the study were stored in Micro Soft Excel spread sheet and Chi-square and percentage were applied for analysis of the data.

RESULTS

Hydatidosis in Bovine: The study was conducted in Mekelle abattoir to estimate the prevalence of bovine hydatidosis and a fluid filled cyst with organ was taken to the laboratory to check the cyst whether fertile or sterile by observing the presence or absence of protoscoleces. From the total of 1024 examined cattle, 222 were infected with *Echinococcus granulosus* and 21.68% prevalence was obtained and it is shown in Table 1.

Infection rate of the disease was correlated with the age of animals. Animals which are less than five years were grouped into group I whereas animals greater than five years were classified into group II. Chi-square test showed that there is a significant difference between age group and infection rate ($P<0.05$). Prevalence in different age group is shown in Table 2.

In the present study 1024 Cattle were examined and hydatid cysts were found in different organ of the animal. A lung was observed to have more than 15 cysts when compared with other offal. The distributions of cysts

Table 1: Overall Prevalence of bovine hydatidosis

No. of examined animals	No. of infected animals	Infected animals%
1024	222	21.68

Table 2: Prevalence of hydatid cyst in different age groups

Age group in year	Infected animals	Non-infected	Infected (%)
Group I (<5)	19	136	12.26
Group II (>5)	203	666	23.36
Total	222	802	21.*68*

X^2= 10.65 P<0.05

Table 3: Distribution of hydatid cyst in different organ

	Positive		Negative		Total	
Organ	No.	%	No	%	No.	%
Lung	145	14.16	879	85.84	1024	100
Liver	33	3.22	991	96.78	1024	100
Kidney	3	0.3	1021	99.70	1024	100
Heart	1	0.01	1023	99.90	1024	100
Spleen	1	0.01	1023	99.90	1024	100
Lung + Liver	37	3.61	987	96.39	1024	100
Liver + Heart	1	0.01	1023	99.90	1024	100
Lung + Liver + Kidney	1	0.01	1023	99.90	1024	100

X^2=512.48 P<0.05

Table 4: Description of cysts fertile, calcified and rupture in different organs

	Fertile		Sterile		Calcified		Rupture		Grand total	
Organ	No	%	No	%	No	%	No	%	No	%
Lung	51	27.86	68	37.16	55	30.05	9	4.92	183	100
Liver	8	11.11	26	36.11	33	45.83	5	6.94	72	100
Total	59	23.13	94	36.86	88	34.51	14	5.49	255	100

X^2= 10.40 P<0.05

Table 5: Body condition in relation to cyst burden

	Body condition of animals		
Infected organs	Poor	Medium	Good
Lung	55	96	32
Liver	22	42	8
kidney	2	2	0
Total	79	140	40

X^2=2.84 P>0.05

were; lung 65.31%, liver 14.86%, both liver and lung 16.67% and the remaining were 3.15%. Among the offal, lung was ranked first to be affected with hydatid cyst in this study, so rate of infection in lung was higher when compared with other organs (Table 3).

Of the total of 1024 cattle examined, 59 (23.13%) cattle had fertile cyst both in lung and liver out of which 51 (86.44%) were in lungs and the remaining 8 (13.56%) in liver and 88 (34.51%) was found to be calcified in lung and liver out of these 55 (62.5%) were calcified in lung and 33 (37.5%) were in the liver and then 14 (1.37%) cysts were ruptured during inspection. Out of the positive cysts 94 (36.86%) were sterile in lung and liver.

There was no significant difference between body conditions in relation to cyst burden (Table 5).

Echinococcosis in Dogs: Out of the total 300 stray dogs, 12 were examined in post mortem examined stray dogs, 2 (16.67%) were found positive for *E. granulosus*.

Echinococcosis in Human: A retrospective data was studied in Mekelle hospital and the data was collected from the room of radiography. From a total of 3560 patients only 7 people were positive for hydatid cyst. The entire positives for hydatid cysts were female and their ages were greater than 40 years. Rate of infection,

age associated with sex, was not recorded because of the data that found in Mekelle hospital was not arranged in appropriate form.

DISCUSSION

Echinococcosis is a well-known disease of livestock and humans, so it has a significant effect on animal production and public health, hence several studies has been conducted in different areas of the world. Although the disease caused by parasite of *E. granulosus* and *E. multilocularis,* it needs complete life cycle to affect both definitive host and intermediate host. Hydatid cysts occur predominantly in cattle and sheep in developing countries because of the insufficient hygienic conditions and due to poor water sanitation.

The present study revealed that the prevalence of bovine hydatidosis was calculated to be 21.68%. This prevalence is lower from Hagos [7] and Hagos [10] who reported the prevalence of hydatidosis to be 32.12% and 31.2%, in the study area respectively. The decrease of prevalence in the present study might be due to the development of awareness among people with regard to methods of its transmission. Besides, the lower prevalence might be contributed by the commitment of the city municipal to control and manage stray dogs in return could minimize the risk of contact between humans and livestock. Similar finding was recorded in Ambo municipal abattoir (26.7%), western part of Oromia Regional State of Ethiopia, by Endrias *et al*. [11]. Different prevalence rates were reported in different area of Ethiopia. The presence of this gap might be geographical areas [12].

Lower prevalence rate was reported by Desta *et al*, (11.6%) in Abergelle export abattoir [13]. Similar findings were recorded by different authors in different areas; like in Ambo municipal abattoir (26.7%), by Endrias *et al*. [11], a prevalence of 24.3% of hydatidosis was reported by Roman [14] in Gonder, 25.7% was recorded by Fikre [15] in Konso, 25.88% by Mohammed [16] in Gamogoffa, 36.07% by Bersissa [17] in Nekemt and 34.3% recorded by Getachew [18] in Awassa. The higher prevalence rate was reported in different studies such as 46.5% reported in Debre-Zeit by Feseha and Yilma [19], 54.8% reported in Arsi region by Alemayehu [20], Bahir Dar 54.9% by Nebiyou [21] and 89% reported in Ticho by Gedlu [22] as cited by Hagos [7].

According to the present study the variation in prevalence rates of hydatidosis may be attributed mainly due to strain difference of *E. granulosus* that based on different agro ecological situations and different regions may contribute variations in the prevalence rate of the disease [7] and hence meat consumption culture has a great factor on the distribution of the disease. A place where there is a practice of eating raw meat and a habit of giving raw viscera to dogs has the impact to raise the prevalence of the disease.

The present study has showed that there is a significant difference ($p<0.05$) between rate of infection of hydatidosis and age group of cattle. From a total of 222 infected animals, 203 (91.44%) of cattle were greater than five years of age but 19 (8.56%) cattle were below five years. The difference in infection rate between age group could be due to longer exposure. The result of this study agrees with Hagos [7] that reported 59.71% affected were greater than 5 years and 40.29% affected animals were less than five years. Obviously, as animals get aged the risk of infection increases due to prolonged period of exposure. In addition, most old animals have higher odds of acquiring infection due to their low immunity to combat infection.

In the present study, the infection rate in lung (76.31%) was higher than in liver (14.86%) and other organs (19.83%), respectively. This result is somewhat in agreement with the result of Hagos [10] who indicated that 74.5% and 25.5% lung and liver were infected respectively. The reason for this phenomenon probably could be because cattle are slaughtered when they become old. Noble, E.R and C.A. Noble, [9] showed in one study that the lung to liver ratio in animals under two years of age was 12.8:82 and for those older animals 39.3:46 and lungs were the one mostly affected, this most probably due to the reason that ruminants are slaughtered at older ages. During this period the liver capillaries are dilated and most cysts directly pass to the lungs, additionally it is possible for the ingested hexacanth embryo to enter the lymphatic circulation and be carried via the thoracic to the heart and the lung, in such a way that the lungs may be infected instead of the liver described by Arene [12] as cited by Hagos [10].

In the study a single cyst was collected randomly because it was difficult to observe all the cysts that had been revealed in the organs in the laboratory within a short time. In the present study, the characteristics of cyst was tried to compare with lung and liver and has significance difference ($P<0.05$) between them. Out of the total cyst examined 23.13% was fertile, 36.8% and 34.51% were sterile and calcified, respectively and the rest 6.23% was ruptured during inspection. From the positive examined cyst 30.05% were calcified in the lung and 45.83% found in the liver. Higher proportion of calcified

cysts were occurred in the liver compared with the lung which probably could be attributed to higher reticulo endothelial and connective tissue reaction of the liver [10]. In this study relationship between body condition and cyst burden was also tried to estimate. However, there is no significance difference (P>0.05) (Table 4).

From total of 300 stray dogs, 12 dogs were randomly collected and out of 12 only two dogs were positive for *E. granulosus*, so the prevalence of Echinococcosis in dogs in Mekelle was 16.67%. Higher and lower rates were recorded in different part of Ethiopia. The higher rate (33.33%) was conducted by Hagos [7] in Tigray. Higher rate of echinococcosis in dog may be due to the high rate of house hold or occupational contact with dogs and the habit of feeding dogs with raw viscera of home slaughtered sheep and goat had created favorable condition for the maintenance of the parasite. Moreover, an increase in echinococcosis prevalence may result after premature cessation of control programs [4].

The presence of hydatidosis in human was tried to asses in Mekelle hospital and the result revealed that the incident rate was seven cases per 3560 population was found within the specific time from September 2006 - April 2008. The people who were positive for hydatid cyst were all female and their ages were above 40 years. The infection in females was higher than males. This may be due to the females are spending their time in home which in turn increases the chance of contact with their pets. This is true in all developing countries. Age has a factor in the disease of echinococcosis. Generally, in case of humans children and old age are infected by hydatid cyst this is may be due to close contact between children and dogs with poor sanitation.

CONCLUSION

Our finding suggests that hydatidosis has a great impact not only in production of animals but also public health importance. Therefore, it is mandatory to control and manage stray dogs who play a significance role in the spread of the disease in the study area.

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