Concurrent Infection of Hydatidosis and Fasciolosis in Cattle Slaughtered at Mekelle Municipal Abattoir, Tigray Region

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Abstract

An abattoir survey was carried out in Mekelle municipal abattoir, Ethiopia to determine the prevalence of concurrent infections of hydatidosis and fasciolosis in cattle. A total of 4,481 slaughtered cattle were studied by ante- and post-mortem examinations. From the total 4,481 slaughtered cattle examined at Mekelle municipality abattoir, 357 (8%) were found to harbor mixed infection of hydatidosis and fasciolosis. While the individual prevalence of hydatidosis and fasciolosis was 32.11% and 24.32%, respectively. Multivariate logistic regression analysis indicated that among the factors considered in the current study, origin of animals had statistically significant effect on the prevalence of concurrent infection (OR = 1.418, 95% CI = 1.108 - 1.814, p = 0.005), whereas breed and body condition of animals didn't have significant effect on prevalence of the co-infection. Moreover, month had no statistically significant effect on prevalence of hydatidosis and fasciolosis co-infection (OR= 1.0029, 95% CI = 0.9758 - 1.0306, p = 0.867). Generally this study showed that hydatidosis and fasciolosis are important disease problems in cattle in the study area. The relatively higher prevalence in the occurrence of the concurrent infection of hydatidosis and fasciolosis in this study may suggest that ecological factors that determine the occurrence of the two diseases might be similar. On the other hand, the higher prevalence of the individual or concurrent infection may imply that these diseases have the potential to cause considerable economic and public health problems.

Keywords: Coinfection, Fasciolosis, Hydatidosis, Mekelle, Prevalence.

Introduction

Ethiopia has the largest livestock population and the largest number of indigenous cattle breeds in Africa, with an estimated number of large and small ruminant populations of 40.3 million cattle, 20.7 million sheep and 16.3 million goats (CSA, 2004). The livestock sector in Ethiopia has substantial contribution to the economy; however, parasitic diseases that include hydatidosis and facioliasis cause a significant economic problem by lowering the productivity of cattle and in addition to losses from condemnation of affected organs. Productivity losses attributable to helminth parasites are often substantial. A loss of US$ 81.8 million is reported annually due to helminth parasites. In a country confronted with challenges of an ever-rising human population and food shortage, such enormous losses caused by helminth parasites, 'the silent predators', are intolerable (Demelash Biffa et al., 2007). Moreover, these diseases are also known to cause public health problems as humans can be infected from accidental ingestion of parasite eggs/larvae passed into the environment with faeces from definitive hosts (Ashrafi et al., 2006; Jenkinsa et al., 2005). Therefore, helminth control should receive special attention in poverty reduction strategies through improved productivity of livestock if the present and future challenges of food shortage are to be addressed. Productivity loss due to helminth infections can be substantially reduced through implementation of effective disease control strategies, which require an understanding of the epidemiology and ecology of parasites and parasitic infections under local conditions (Demelash Biffa et al., 2007).

Therefore, the aim of this study was to estimate the prevalence of concurrent infection of hydatidosis and fasciolosis at Mekelle Municipal abattoir of Tigray Region of Ethiopia.

Materials and methods

Study area and animals

The study was conducted in Mekelle municipality abattoir. Mekelle is the capital city of Tigray national regional state and it is located at 39 ° 29′ E and 13 ° 30′ N. Mekelle is located at 778 km north of Addis Ababa at an altitude of 2000 m.a.s.l. The climate of the study area conforms to that of the Ethiopian highlands. The mean annual rainfall of the study area is 628.8 mm and the rain is associated with the north and south oscillation of Inter-tropical Conversion Zone (ITZ). The rainfall is bimodal with short rainy season occurring from March to May and long rainy season from June to August, followed by the dry season from middle of September to February. The annual minimum and maximum temperature is 11.8°C and 29.94 °C, respectively, (Bureau of Planning and Economic Development, 1998). Mekelle municipality abattoir is the oldest and largest abattoir in the region. It was established in 1964 and on an average 8,206 cattle are slaughtered annually for meat consumption. Slaughtered animals originated from Tigray and Afar Regions and North Wollo areas.

Data Collection

Ante- mortem and post-mortem inspection

Each week three days visit was made for ante-mortem inspection and post-mortem examination of slaughtered animals. All cattle slaughtered on each visit day were included. A total of 4,481 cattle were slaughtered in the abattoir during the survey period. During the ante mortem inspection, the age, sex, breed, origin, and body condition of each individual animal was assessed and recorded. Age determination was done by teeth (Kelly, 1975) and the method described by Nicholson and Butterworth (1986) for *condition scoring of zebu cattle* was used after some modification. In the method described here for *Bos indicus* (zebu) cattle, three main conditions- fat (combining score 1-3), medium (6-9) and lean (7-9) were used instead of the nine scores. Animal origin was also recorded as highland (> 1500 m.a.s.l.) and lowland (< 1500 m.a.s.l.) by requesting information on origin of animals from the farmers or traders. Animals were identified based on enumerated marks on its body surface before slaughter using ink. Before conducting the postmortem examination, the identification markings done in the ante-mortem examination were transferred to all organs that are going to be examined by postmortem examination. Following a thorough visual inspection, palpation and systematic incision of each liver, lung, kidney, heart and spleen (FAO, 1994), all hydatid cysts found in these organs were collected to conduct cyst fertility test. Based on the presence or absence of broad capsule containing protoscoleces in hydatid fluid, cysts were identified and classified as fertile and infertile according to the method described by Macpherson (1985). On the other hand infertile cysts were also further classified as sterile (fluid filled cyst without protoscoleces) or calcified (cyst already calcified).

Examination of cysts and viability of protoscoleces

After fertility test was carried out on each hydatid cyst collected from the different internal organs, the cyst wall was penetrated by a needle and opened with scalpel blade. The contents were then transferred to a sterile test tube and examined microscopically (40 x) for the assessment of viability according to standard procedure (Smyth and Barrett, 1980). A drop of the sediment consisting of the protoscolices was placed on a microscopic glass slide and 22x22 mm cover slip was applied and observed for the amoeboid-like peristaltic movement (flame-cell activity) under 40 x magnification. When it became doubtful or confusing to observe such movements, a drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices in hydatid fluid on a microscopic slide with the principle that viable protoscolices should completely or partially exclude the dye while the dead ones take it up (Smyth and Barrett, 1980; Macpherson, 1985).

Fasciola species identification

After making systematic incisions on the bile ducts and liver parenchyma flukes if present were collected in universal bottles and then examined for morphological identification of the species involved under stereomicroscope using standard methods described by Soulsby (1982) and Urquhart et al. (1996).

Data analysis

The study was conducted from November 2006 to October 2007. Data was entered and stored in Microsoft Excel program and analysis was done using Intercooled STATA 9.2 for windows (Stata Corporation, Texas, USA, 2006) program. The total prevalence was calculated by dividing the number of hydatidosis, fasciolosis positive and co-infected animals by the total number of animals examined. Multivariate logistic regression analysis was also conducted to see the effect of different risk factors (age, sex, breed, origin of animals, and body condition) on the outcome variable of co-infection status. To examine variation among different months of the year, bivariate logistic regression analysis was also performed. $P < 0.05$ was considered as statistically significant in all cases.

Results

Of the total 4,481 slaughtered and examined cattle at Mekelle municipality abattoir, 357 (8%) were found to harbor mixed infection of hydatidosis and fasciolosis (Figure 1). Proportion of animals infected with hydatid cyst alone was higher than those infected with Fasciola and concurrent infection of fasciolosis and hydatidosis (Figure 1).

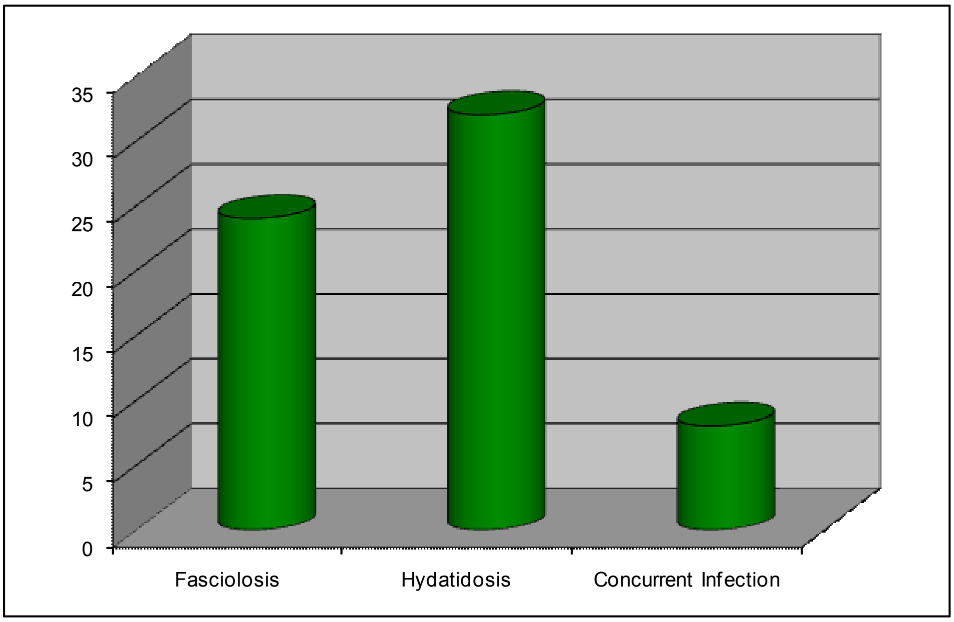

Figure 1. Prevalence of fasciolosis, hydatidosis and concurrent infection of fasciolosis and hydatidosis in cattle slaughtered at Mekelle municipal abattoir

Prevalence of concurrent infection of hydatidosis and fasciolosis in cattle depending upon age, sex, breed, origin, and body condition status of animals is presented in Table 1.The effect of different months of the study period (November 2006 to October 2007) on prevalence of concurrent infection was examined using bivariate logistic regression analysis, the result indicated that sampling during different months had no statistically significant effect on prevalence of the concurrent infection of hydatidosis and fasciolosis (OR= 1.0029, 95% CI = 0.9758 - 1.0306, p = 0.867). Multivariate logistic regression analysis showed that breed and body condition of animals also didn't cause significant effect on prevalence of the co-infection; however, origin of animals had statistically significant effect on the prevalence of concurrent infection (OR = 1.418, 95% CI = 1.108 - 1.814, p = 0.005) (Table 1). Age and sex were not subjected to multivariate logistic regression as the numbers of observations in the different categories of the variables were too small to compare.

Table 1. The effect of risk factors on the occurrence of concurrent infection of hydatidosis and fasciolosis in cattle slaughtered at Mekelle municipal abattoir

Category	No. examined	No positive for co-infection	Prevalence of co-infection	OR	95% CI	p value
Age						
< 2 yrs	2	0	0.00			
2 - 4 yrs	16	0	0.00			
> 4 yrs	4,463	357	7.99	-	-	-
Sex						
Female	19	1	5.26			
Male	4,462	356	7.97	-	-	-
Breed						
Local	4394	349	7.94			
Cross	87	8	9.19	1.481	0.666 - 3.290	0.335
Origin						
Lowland	1,466	465	31.72			
Highland	3,015	974	32.31	1.418	1.108 - 1.814	0.005
Body condition						
Poor	376	28	7.45			
Medium	3,387	284	8.39			
Good	718	45	6.28	0.866	0.689 - 1.089	0.218
Total	4,481	357				

The cyst fertility assessment indicated that among the 7,315 examined cysts, 2349 (32.11%) were sterile, 3979 (54.39%) calcified, 782 (10.66%) fertile and viable while 205 (2.80%) were fertile but nonviable. According to their fertility status in different organs, it was observed that liver had 313 fertile, 958 sterile and 1391 calcified cysts, whereas, lung had 638 fertile, 1385 sterile and 2584 calcified (Table 2). Hepatic and pulmonary cysts study had fertility rate of 11.75% and 13.83%, respectively. Out of the total cysts examined, the proportion of viable protoscoleces was 10.69% (Table 2).

Table 2. Classification of cysts according to their fertility status in cattle slaughtered at Mekelle municipal abattoir

		Fertile cysts			
Organ	No. of cysts	Viable	Non-viable	Sterile cyst	Calcified cyst
Liver	2662	241	72	958	1391
Lung	4607	513	125	1385	2584
Heart	24	18	3	3	0
Kidney	7	5	2	0	0
Spleen	15	5	3	3	4
Total	7315	782	205	2349	3979

From the 1090 liver fluke infected animals (1090/4481 = 24.32%), F. hepatica had the highest prevalence (56.42%) and mixed infection of F. hepatica and F. gigantica had lower prevalence (5.87%) (Table 3)

Table 3. Prevalence of fasciolosis in slaughtered cattle at Mekelle municipality abattoir by fluke species

Species of Fasciola	Number of positive livers	Prevalence (%)
Immature fasciolosis	311	28.53
F. hepatica	615	56.42
F. gigantica	100	9.17
F. hepatica + F. gigantica	64	5.87
Total	1090	100

Discussion

Reports on concurrent infection of hydatidosis and fasciolosis in Ethiopia published in peer reviewed journals are scant. However, several separate studies have been conducted on prevalence of hydatidosis or fasciolosis. The individual prevalence reports on hydatidosis or fasciolosis conducted in different parts of the country and in the same study area were higher than the prevalence of concurrent infection of hydatidosis and fasciolosis. A study conducted in Tigray region reported that echinococcosis/hydatidosis is considerably prevalent disease in cattle and it is a serious public health concern in the region. From 5,194 cattle examined at slaughter houses, 1146 (22.1%) of them were found harboring hydatid cyst (Kebede Weldegiorgis et al., 2009). A study on 4,481 cattle slaughtered at Mekelle municipal abattoir observed a prevalence of 32.1% for hydatidosis (Gebretsadik Berhe, 2009). Nigatu Kebede et al. (2009a, 2009b) found a prevalence of 34.5% (143/420) and 16% (64/400) hydatid cysts in cattle slaughtered at Bahir Dar and in Wolaita Sodo abattoir, respectively. Study conducted at Adama municipal abattoir revealed that hydatidosis was prevalent in 46.8% cattle, 29.3% sheep, and 6.7% goats (Aseffa Getaw et al., 2009). These variations in prevalence of the diseases in different areas might be due to variation in the ecological factors that determine the occurrence of the diseases. Different prevalence results may be reported from the same area due to variations in the number of animals examined, the duration and months of the study period.

Varying prevalence figures of hydatidosis have been reported in cattle in Africa by several workers. In Kenya, 19.4% of cattle, 3.6% of sheep, 4.5% of goats and 61.4% of camels were found infected with hydatidosis (Njoroge et al., 2002). In the Sudan, hydatidosis has been reported to have a prevalence of 45% in camels, 3% in cattle and 7% in sheep (Elmahdi et al., 2004). In Ngorongoro district of Tanzania, a study showed that 48% of cattle, 34.7% of goat, 63.8% of sheep and 10% of dogs were infected with E. granulosus (Ernest et al., 2004).

On the other hand, study carried out on fasciolosis reported prevalence of (21.6%) in Tigray region (Takele Abayneh, 1995). Recently prevalence of 24.32% (1,090/4,481) was recorded in cattle slaughtered in Mekelle municipal abattoir (Gebretsadik Berhe et al., 2009). A study conducted in Wondogenet and Kemissie areas revealed the prevalence of 39.7% and 41%, respectively (Getachew Tilahun et al., 2006). Elsewhere fasciolosis prevalence of 8% and 26% were found from abattoir survey in Kenya (Kithuka et al., 2002; Mungube et al., 2006). Another study in Zimbabwe reported a prevalence of 31.7% (Pfukenyi and Mukaratirwa, 2004). It was reported that the infection rates of fasciolosis in the highlands are influenced by environmental conditions including rainfall, temperature and biotopes that influence the parasite, intermediate and final host (Jacinta, 1983).

With regard to the proportion of Fasciola species identified, the present study demonstrated 56.42% F. hepatica, 9.17% F. gigantica and 5.87% mixed infection, which is contradictory to the report of Takele Abayneh (1995) who recorded 15.9% F. hepatica, 57.2% F. gigantica and 26.9% mixed infection. The reasons for this difference may be due to variation in source of animals.

Generally this study showed that hydatidosis and fasciolosis are important disease problems in cattle in the study area. The findings of the present investigation corroborate with several earlier studies that hydatidosis and fasciolosis are endemic and widespread diseases in Ethiopia. The relatively higher prevalence in the occurrence of the concurrent infection of hydatidosis and fasciolosis in this study may suggest that ecological factors that determine the occurrence of the two diseases might be similar. On the other hand, the higher prevalence of the individual or concurrent infection may imply that these diseases have the potential to cause considerable economic and public health problem.

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