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Prevalence and Monetary Loss of Hydatidosisamong Apparently Healthy Slaughtered Cattle in Shirka District, Oromia Regional State, Ethiopia

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Abstract: The study was conducted to assess the prevalence ofhydatidosis in cattle that were slaughtered at Shirka district, South Eastern Ethiopia, between the periods of June 2021 and August 2021. Out of 384 cattle slaughtered and examined 230(57.6%) were found to be positive for hydatidosis. In this study body condition and animal origin has significant variation whereas sex and age has no significant relationship. The percentage of organs affected during the study period was (43.59%) lung, (27.3%) liver, (2%) heart, (1.5%) spleen and (1%) kidney. The total annual monetary loss due to hydatidosis was calculated to be 3, 785, 179.93 Ethiopian birr. Thus, hydatidosis were considerably prevalent disease with serious public health concern reflection and caused visible and invisible losses in cattle in the study area therefore, it is necessary to establish appropriate strategy for prevention and controls of the disease.

Key words: Cattle · Haydatidosis · Prevalence · Monetary Loss · Shirka

INTRODUCTION

Ethiopia has large livestock population in Africa with an estimated of 44, 318, 877 cattle, 23, 619, 720 sheep and 23, 325, 113 of goats [1]. However, there are constraints that hindered the potential of livestock production include; traditional management system, limited genetic potential, lack of appropriate disease control policy and veterinary services. Due to these and related factors, each year significant monetary losses result from condemnation of edible organs and carcass were estimated from different abattoirs of the country. The significant monetary losses incurred each year in the different abattoirs in Ethiopia are due to mortality, inferior weight gain and condemnation of edible organs at slaughter [2].

Parasitic diseases are considered as a major health problem and cause a significant monetary loss in countries where livestock production is a segment of the agricultural practice. Developing countries have about two third of the world's livestock population but their meat and milk production are less than a third of the world. Among many parasitic problems of farm animals, hydatidosis are major diseases which impose direct and indirect monetary impact on livestock production, particularly of sheep and cattle [3].

Hydatidosis is a term used to describe infection of different animal's species and humans with larval or different animal's species and humans with larval or including sheep, cattle, goats, pigs and horses are intermediate hosts in which Hydatid cysts occur. Adult of the genus *Echinococcus* are found in the small intestines of dogs and other carnivores. Four species are currently recognized within the genus *Echinococcus; E. granulosus, E. multilocularis, E. oligarthus* and *E. vogeli.* The parasites are perpetuated in life-cycles with carnivores as definitive hosts, which harbor the adult carnivores as definitive hosts, which harbor the adult egg-producing stage in the intestine and intermediate host animals, in which the infective metacestode stage develops after infection with eggs. Hydatid cyst in livestock leads to considerable monetary losses due to condemnation of edible offal's primarily liver and lung. The loss due to condemnation of organs by Hydatid cyst, particularly liver and lung in some countries is veryconsiderable. Though Hydatidosis, constitutes a public health problem worldwide, yet causes a particularly heavy burden in developing countries. The distribution *E. granulosus* is higher in rural communities of developing countries where there is close contact between definitive host, the dog and variousdomestic animals, acting as intermediate hosts [4]. Even though,

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the Hydatidosis is common developing country, there is no any study conducted in ShirkaWored Arsi Zone. Therefore, the objectives of this study were todetermine the prevalence of Hydatidosis andits associated risk factors in the study area.

MATERIALS AND METHODS

Study Area: The study area is found in south Eastern Oromia regional state in Arsi zone which is located 265 km south East of Addis Ababa. Its altitude is between 1500-3400 m with an average altitude of 2450 m above mean sea level. The average temperature is 18°C which varies between 10°C to 25°C, with an annual average rain fall of around 1000 mm. The livestock population of the district is estimated at 236, 523 cattle, 70, 200 sheep, 62, 545 goats, 16, 212 horse, 22, 528 donkeys, 7, 423 mules, 14, 2594 chickens and 16, 351 beehive colonies [5].

Study Population: The study was conducted on cattle slaughtered at Shirka district. In active abattoir survey, on female and male animals of local breed were included in the study. The origins of animals were from Sole, Gado and Tareta. Slaughtered animalreached either by transporting using vehicles or on foot.

Sample Size Determination: Simple random sampling method was employed for determining the prevalence of hydatidosis among cattle and the magnitude of direct monetary loss due to organcondemnation and indirect carcass loss at Shirka District. To calculate the total sample size, the following parameters were used: 95% level of confidence (CL), 5% desired level of precision and 50% prevalence of cattle haydatidosis in Shirka District, the sample size was determined using the formula given in [6]. Therefore, the sample size in this study was calculated using the following formula.

$$n = \frac{(1.96^2) - p(1-p)}{d^2}$$

where; n= Sample size, p = Expected prevalence (50%), 1.96 = the value of Z at 95% confidence level, d = desired absolute precision = 5%

Hence, the sample size required as per the above formula 384 heads of cattle was taken for the study.

Sampling Method: Simple random sampling technique was used to select animals and to determine the prevalence of hydatidosis among cattle slaughtered in Shirka District during study period.

Study Design: The study was carried out from June 2021 to September 2021 in Shirka District. The study was a cross sectional type with actively abattoir survey with routine meat inspection of the carcass slaughtered in the abattoir. From all animals those came to Shirka District abattoir, study animals were randomly selected and their carcasses were routinely inspected for prevalence of hydatidosis.

Ante-Mortem Inspection: Pre- Slaughter examination of cattle was conducted in the lairage by grouping the animals based on species, age and place of origin. Age grouping was done based on dentition those which erupted only one pair of incisor teeth classified as young, while those with erupted more than one pair of incisor teeth was classified as old [7]. Ante-Mortem inspection was conducted on individualanimals, while the animal entering into the lairage and after they entered into the lairage in mass. Both side of the animal were in inspected at rest and in motion. Moreover the general behavior of the animals, body condition, cleanness and sign of diseases and abnormality of any type was registered according to the standard ante-mortem procedures [8].

Postmortem Inspection: According to Meat Inspection Regulation Notice Number 428, 1972 by Government of Ethiopia [9], the routine inspection of carcass is to be done as per the procedure stated below.

All animals that undergo post-mortem examination were those which passed ante-mortem inspection During postmortem inspection liver, lungs, heart, kidney brain and carcasses were thoroughly inspected by visualization, palpation and making systemic incisions where necessary for the presence of cysts and the results were recorded on the predesigned data collection format [10].

Data Analysis: Microsoft Excel was used for data management and computation of descriptive statistics. Computation of descriptive statistics was conducted using SPSSversion 20.0. Descriptive statistics such as percentage, proportions and frequency distributions were applied to compute some of the data. The prevalence of Hydatidosis was calculated by dividing the number of cattle harboring the parasites by number of cattle examined. Pearson's chi-square (χ^2) to measure associationbetween prevalence of the parasite with the potential risk factors was used as a statistical tool. The difference among risk factors was statistically significant if the p-value was less than 0.05 ($p<0.05$).

Monetary Loss Assessment: The monetary significance of bovine hydatidosis was estimated from the amount of organs condemned and also from loss of carcass weight. The following points have been considered in calculating the monetary loss: - market price of liver, lung, heart, kidney, spleen and a kg of beef at shirka district is price 120, 40, 80, 60, 10 ETB and 340 ETB respectively. Average slaughter rate of cattle in the abattoir is 3200 (record of the slaughter house). Carcass weight loss was estimated to be 5% due to hydatidosis[11] and the average carcass weight (126kg) of Ethiopian zebu cattle breeds was taken from estimated by ILRI [12].

In order to evaluate the monetary loss from offal condemnation, the following parameters were taken into consideration.

- The mean retail market price of liver, lung, heart, kidney and spleen at Shirka was collected from butchers.
- Average annual slaughter rate of cattle in Shirka district was estimated based on retrospective analysis of data recorded from three years. Accordingly, the loss from liver, lung, heart, kidney and spleen condemnation was calculated as follows [13].

Direct Monetary Loss: Annual monetary loss of organs condemned due to hydatidosis

LOC= (NAS x ph x plu x cplu) + (NAS x ph x phr x cphr) + (NAS x ph x pli x cpli) + (NAS x ph x psp x cpsp) + (NAS x ph x pkid x cpkid);

where NAS–Average number of cattle slaughtered annually

Ph-prevalence rate of hydatidosis
Plu-percent involvement of lung
Phr-percent involvement of heart
Cph-current mean retail price of heart
Pli-percent involvement of liver
Cpl -current mean retail price of liver
Psp-percent involvement of spleen
Cpsp-current mean retail price of spleen
Pkid-percent involvement of kidney
Cpkid-current mean retail price of kidney
N: B-All prices are determined from the price at Shirka district.

Indirect Monetary Loss: Thus the loss from carcass weight loss was computed as follows;

LCWL= NAS x ph x CPB x 5% x 126kg for fasciolosis and hydatidosis respectively

where LCWL-loss from carcass weight loss
5%-estimatedcarcass weight loss due to hydatidosis.
NAS-Average number of cattle slaughtered annually
Ph-prevalence of hydatidosis
CPB –current average price of 1 kg of beef at Shirka district
126 kg- Average carcass weight (dressing percentage) of adult zebu cattle, ILRI [12].

Total Monetary Loss Estimation: Total monetary loss was evaluated by considering both loss from organ condemnation and loss from carcass weight loss. Total loss = direct loss (loss from organ condemnation) + indirect loss (loss from carcass weight loss).

RESULT

In this study the overall prevalence of hydatidosis among cattle slaughtered in Shirka district was found to be 53.9% (207/384). The number of affected organs during the study period was (43.59%) lung, (27.3%) liver, (1%) kidney, (2%) heart and (1.5%) spleen. The prevalence of hydatidosis was found to be higher among male (57.9%) animals than females (37.7%). The difference was not statistically significant ($p>0.05$) (Table 1).

The prevalence of hydatidosis was found to be higher among old (57.02%) animals followed by adult (54.4%) and young (41.8%) animals. The difference was not statistically significant ($p>0.05$) (Table 2).

Statically analysis of the data showed that there was statically significant difference ($p<0.05$) in the prevalence of Hydatidosis among body condition groups of cattle. Animals with poor body condition were more likely to be infected by Hydatid cyst than animals with medium body condition. Similarly, Animals with medium body condition more likely to be at risk of acquired Hydatidosis than animals with good body condition (Table 3).

Origin dependent study revealed that there was statistically significant difference in prevalence of hydatidosis between origin ($p<0.05$) with higher prevalence of 58.4%, 56.4%, 42.2% were recorded in animal originated from Gado, Gobessa and Tareta respectively (Table 4).

Table 1: Prevalence of hydatidosisamong sex

Sex	Examined animal	Positive animal	Prevalence (%)	χ^2(p-value
Male	309	179	57.9	0.058(0.632)
Female	75	28	37.3	
Total	84	207	53.9	

Table 2: Prevalence of Hydatidosis among age

Age	Examined animals	Positive animals	Prevalence (%)	χ^2(P-value)
Old	121	69	57.02	
Adult	220	120	54.5	0.876(0.713)
Young	43	18	41.8	
Total	384	207	53.9	

Table 3: Prevalence of Hydatidosis among body condition

Body Condition	Examined animal	Positive animal	Prevalence (%)	χ^2(p-value
Good	130	48	36.9	
Medium	215	140	65.1	21.0 (<0.001)
Poor	23	20	86.9	
Total	384	207	53.9	

Table 4: Prevalence of Hydatidosis among origin

Origin/area	Examined animals	Positive animals	Prevalence (%)	χ^2(P-value
Gobessa	140	79	56.4	
Gado	154	90	58.4	17.611(0.007)
Tareta	90	38	42.2	
Total	384	207	53.9	

DISCUSSION

The overall prevalence of hydatidosis in cattle slaughtered in Shirka district during the study period was 53.9%. The current finding is in close agreement with that reported 52.69% in Hawassa byRegassa *et al.* [14], 53.5% in Asselaby Ararso [15] and 54.8% in Arsi region by Alemayehu [16]. The present finding was higher than the previous works reported from in different part of the country 32.1% in Mekelle Municipal abattoir by Berhe [17], 22.1% in Tigray region by Kebede *et al.* [18], 48.9% in Debre Markos by Kebede *et al.* [19] and 40.5% in Addis Ababa Abattoir by Terefe *et al.* [20]. However, the current finding is lower than prevalence study in other areas like 57.6% in Asselaby Gadisa and Addis [21], 59.9% in Bahir Dar by Nebiyou [22] and 62.96% around Bale by Polydorou [11]. These discrepancies in disease prevalence among the various studies in different areas might be due to the difference in availability and frequency of exposure of the final hosts among the infected intermediate hosts and vice-versa.

In the present study the variables such as body condition and origin showed statistical significant ($p< 0.05$) association whereas sex and age of the animals was statistically insignificant ($p>0.05$) with the prevalence of hydatidosis during the study period. In the present study male animals were highly affected (57.9%) than females (37.7%). This difference in the infection rate could be due to the fact that most females came from the farm (intensive) which decreases the contact rate with the definitive host and contaminated pasture. However, the current finding disagrees with what was reported from Harar [23] where infection rate was high in female (14.5%) than male (9.1%). With regard to age the infection rate was higher in cattle having older agethanadult and young cattle. This finding was in agreement with the study in Gonder ELFORA abattoir carried out by Adane and Guadu [24]. This might be due to longer exposure time to *E. grannulosus* eggs in addition to weaker immunity against the infection in older animals. In addition, most of the older animals slaughtered were culled animals due to less productivity and hence were exposed to the disease over long period with an increased possibility of acquiring the infections.

In the present study, the infection rate of bovine hydatidosis was higher in animals having poor body condition than medium and in medium than in good body conditioned animals. This finding supported the study in GonderbyAdane and Guadu [24] With respect to the origin of the slaughtered animals, though the result indicates that prevalence of the disease was 58.4%, 56.4% and 42.2% in Gado, Gobessa and Tareta respectively,

it was statistically insignificant. This can be due to difference in culture. Social activity, attitude to dogs and climate in different regions.

CONCLUSION AND RECOMMENDATION

The present investigation showed that hydatidosis is prevalent in cattle population of Shirka district. The study also confirmed that hydatidosis to be important disease entities in causing considerable economic losses at Shirka district due to condemnation of the organs and carcass weight loss. In addition to this, there was no construction of well-equipped abattoirs and no awareness of people about economic and public importance of the disease. Therefore, it is necessary to establish appropriate strategy for prevention and controls of the disease.Based on the above conclusion, the following recommendations are forwarded:

- Awareness should be given to the community about the economic importance of the hydatidosis and be ready to take measures in order to reduce the monetary losses.
- Regular deworming of pet dogs and control of stray dogs
- The abattoir should be fenced properly to stop access of some wild candies (particularly hyenas) and stray dogs.
- Collaboration between veterinarians and public health workers in the prevention and control of the disease is mandatory.

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ANNEXES

Annex1: Bovine age determination based on dental formula (DeLaunta and Habel, 1986)

Age (years) Characteristics Change

$1^{1/2}$ I1 erupts

2-$2^{1/2}$ I2 erupts

3I3 erupts

$3^{1/2}$I4 erupts

5 All incisors are wearing

6 I1 is level and the neck has merged from the gum

7 I2 is level and the neck is visible

9I3 is level and the neck is visible and I4 may be level

10the dental stare is square inI1 and all teeth I2 wear

15The neck that has not fallen out is reduced to small round pages

In this study the age of animals classified as young, adult and old.

Young (<5 years) Adult (5-9years) Old (> 9 years)

Annex 2:Body Condition Score of the Cattle

During the study period, the body conditions are classified in to poor, medium and good using the body condition scoring method according to Nicholson and Butter (1986).

Score 1 The individual Spinous process is sharp when to touch and easily distinguished.

Score 2 The spinous process can be identified individually when touched but feel round rather than sharp.

Score 3 The spinous process can only felt with very firm pressure and area of either side of the tail head has some fat cover.

Score 4 Fat cover around tail head is easily seen as slight moulds, soft to touch, the spinous process cannot be felt.

Score 5 The bone structure of the animal is no longer noticeable and the tail head is almost completely buried in fatty tissue

Annex 3: Abattoir data collection format

Region _____ city_____ name of abattoir_____

Date_____ No of slaughtered cattle in the day_____

No of inspected animals_____

Date ID No Antemortem Examination Postmortem result

Spp Breed Origin Sex Age Body temp.in °C BCS Abnormalities observed Positive/negative Organ positive