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# A Study on the Prevalence, Distribution and Economic Significance of Echinococcosis/Hydatidosis in Livestock (Cattle, Sheep, Goats and Pigs) Slaughtered at Addis Ababa Abattoir, Ethiopia

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## Abstract

Of the total 2132 animals slaughtered at Addis Ababa abattoir and examined at autopsy for the presence of Hydatid cysts, (21.13%) of 1027 cattle, (14.67 %) of 825 sheep & (7.05%) of 170 goats were found to harbor Hydatid cysts, while none of the 110 pigs examined were infected with the disease, Sheep & goats drawn from Ogaden region of Harargie showed no incidence of the disease. Lungs & Liver constitute the highest percentage of infection for all the three animal species. In cattle & sheep there was more pulmonary involvement (62.0% & 56.6 %) than hepatic involvements (29.0% & 40.1%), whereas in goats hepatic involvements (68.8%) was higher than pulmonary involvements (25.0%). In cattle, (10.12%) of the cysts were fertile with an average viability of (66.83%), 56.92%) were sterile & (32.96%) were calcified. In sheep & goats, (55.9% & 42.3%) of the cysts were fertile with respective viabilities of (80.7% & 72.71%) leaving (11.8% & 30.8%) sterile and (32.3% &26.9%) calcified respectively. Calcification rate was higher among the cysts of the liver, whereas fertility rate was higher among the cysts of the lungs for all the three animal species. The average number of cysts per animal was higher in cattle than in sheep & goats. Out of 34 urban stray dogs of Addis Ababa, examined at autopsy, (23.5%) were found to harbor adult. *Echinococcus granulosus*. Improper disposal of carcass (organ), increased population of stray dogs, lack of proper meat inspection and lack of appropriate legislations for the control of the disease are the most important factors that increase the transmission of the disease.

**Keywords:** Abattoir, Addis Ababa, Hydatidosis, Prevalence, Ethiopia.

## Introduction

Hydatidosis or larval echinococcosis is a cyclzoonotic infection caused by the metacestode stage of *Echinococcus granulosus*, known to occur in various visceral organs of domestic herbivores and humans. The disease is characterized by the presence of cysts containing numerous tiny protoscoleces that most often develop in the liver and lung, but also in spleen, kidney, heart, CNS and skeletal system as well as other rare sites such as thyroid gland, subcutaneous tissue, body cavity and musculature [1].

The disease is a chronic two host zoonosis which, occurs in all kinds of food animals and other herbivorous & omnivorous mammals, characterized by the formation of variably sized cysts in the intermediate host and a tapeworm in the definitive host [2]. Because the distribution has worldwide and generally high incidence, it causes high economic losses in livestock industry, from reduced productivity (wool, meat, milk), from condemnation of infected

organs and occasionally carcasses as well as from the cost of preventive & eradication programmes [2, 3].

The parasite is perpetuated primarily in a domestic cycle involving the dog (*Canis familiaris*) as the definitive host and domestic ungulates like, sheep, cattle, pigs, goats, horses, and camels, etc. as intermediate hosts [4]. However, in some areas wildlife cycle exists involving wolves, jackals, foxes, hyenas, coyotes, lions [4, 5] as definitive hosts and numerous wild herbivore species such as wild beast, deer, hares & nutria as intermediate hosts [4, 5].

Hydatidosis has a socioeconomic significance**,** since man is an incidental or accidental intermediate hose [4]. Echinacoccosis/ Hydatidosis is a zoonotic disease of cosmopolitan in distribution, occurring in a wide variety of hosts at various levels of prevalence [4]. The public significance of Hydatidosis lies on the cost of hospitalization, medical & surgical fees, loss of income & productivity, permanent or temporary incapacity to work, social consequences of disability and mortality [6]. Several hundred articles have been published reporting the occurrence of E.granulosus infection in man and other animals throughout the world [4, 7].

Hydatidosis in animals is of economic importance due to the losses caused by the condemnation of organs of slaughtered animals, and because of the indirect losses from their reduced capacity for work or permanent incapacity; losses due to mortality and social consequences of disability and mortality [8].

The disease is known to inflict considerable direct and indirect economic losses in the livestock industry. The direct loss is related to the death, premature slaughter and organs condemnation, while the indirect is result of decreased meat, milk and wool production due to infection [9, 10, 11]. It was indicated that hydatid cyst in the liver, lung, kidney and heart is the major causes of organ condemnation in slaughterhouses [7]. Previous studies showed a reduction of up to 5% in meat and 10% in milk production [10], and a 20% decrease in hide value and 11% decrease in fecundity [11], due to hydatidosis. The infection occurs throughout North, Central and Southern America with highest prevalence in Southern Latin America, Europe, the Mediterranean countries, Africa, Australia & Asian countries [4, 7, 12]. In Africa the prevalence of Hydatid disease has been reported in Northern Africa, many countries South of the Sahara [4], in Nigeria [13], in Libya [14]**,** in Tanzania [15**]**, in the Republic of Sudan [16]**,** and Kenya.(2,6 fit),19$_5$21). The prevalence of Hydatid disease has been reported in Ethiopia in Livestock (sheep, goats, cattle, camels & pigs [17, 18, 19, 20, 21, 22, 22] and in Man [23, 24]**.**

Knowledge about the prevalence of the diseases together with epidemiology of the disease is crucial for any attempt of prevention and control of the disease in question. Moreover, determination of the economic significance of the disease is important for decision making, planning, and implementation of local control strategies. The present study were, therefore, conducted in the area with objective of determining the prevalence of Echinacoccosis/ Hydatidosis in livestock slaughtered **at** Addis Ababa abattoir and to estimate the economic significance of the disease in cattle. The incidence of adult *Echinococcus granulosus* in the final host (dogs) in Addis Ababa and the public health significance of the disease were assessed and control measures to be applicable are recommended.

## Materials and Methods

### Study area

The study was conducted from December 1987 to April 1988 to Addis Ababa Abattoir, which slaughters animals drawn from all over the country. Addis Ababa, the capital of Ethiopia, is located at $9.03^0$ North latitude and $38.8^0$ East longitudes with an average altitude of 2400 meters above sea level. The mean annual rainfall is 1800 with a bimodal pattern while the days mean annual minimum and maximum temperature are 14 and 21°C respectively [25].

### Study animals

The study population constitutes of cattle, sheep, goats and pigs originating from different localities and markets of the country. A total of 2132(1027 cattle, 825 sheep, 170 goats & 110 pigs) were examined at Addis Ababa abattoir at post mortem examination for the presence of Hydatid cysts. The origin of animals was-doubtful**,** however; based on a few animals of known origins the disease was detected in almost all animals drawn from different regions of the country, i.e. Shoa, Arsi, Bale, Harargie, Sidamo, Wollo, Gojjam & wollega. Because of this, it was difficult to give the exact picture of the geographical distribution Majority of breed slaughtered were local breeds however relatively few cross and exotic breeds were also

slaughtered. According to the information obtained from abattoir, averagely 700 cattle, 250 sheep, 70 goats and 30 pigs were slaughtered per day.

## Study methodology

### Estimation of annual prevalence rate

The mean annual prevalence of hydatidosis in Ethiopia, and levels of organ involvement were calculated based on previous slaughterhouse surveys carried out in Dire Dawa by Woubet Mulugeta, 1987 [22], Gondar by Roman Tiruneh, 1987 [26] and by Tamene Melkamu, 1986 [32], Wondo by Getahun Demeke, 1987 [27], Nekemte by Feyessa Regassa, 1987 [8] and Wollaita Soddo by Abel Mersie, 1985 [17]. Estimation of economic losses Direct annual economic loss The estimated direct annual economic loss due to hydatidosis is computed based on the measurement of the following parameters: • level of organs (lungs, liver, spleen, kidney and heart) condemnation

### Abattoir Survey

Frequent visits were made from December 1987 to April 1988 to Addis Ababa Abattoir, which slaughters animals drawn from all over the country. A total of 2132(1027 cattle, 825 sheep, 170 goats & 110 pigs) were examined at Addis Ababa abattoir at post mortem examination for the presence of Hydatid cysts.

A thorough inspection was carried out on each slaughtered animal species and all organs infected with Hydatid cysts were collected from each animal & brought to the laboratory. Each organ was assessed macroscopically by visual inspection, palpation & incisions where necessary. The material from each infected animal was examined separately and a record was made for the location, number & size of the cysts. The cysts were then opened & examined for protoscoleces. If procoscoleces were present the cyst was classified as fertile and then examined for viability. For this purpose, a drop of the sediment (protoscoleces) was added on/the microscopic slide and a cover slip was put on. Then, the protcscoleces were observed for flame cell activity and for those which did not exhibit amoeboid like peristaltic movement; a drop of (0.1% aqueous eosin) was added and examined under the microscope. Viable protoscoleces will not take-up the stain while dead protoscoleces stain readily with eosin.The average viability percentage of protoscoleces was determined by counting number of protoscoleces assumed to be viable from each 100 protoscoleces of a fertile cyst. Non fertile cysts were classified as sterile (fluid filled but containing no protoscoleces) or (calcified, calcifying**,** or abscessed cyst) [7].

### Survey on Urban Stray Dogs

A survey was carried out on 34 stray dogs of Addis Ababa to determine the prevalence of adult *Echinococcus granulosus* infections. For this purpose, stray dogs were killed by giving strychnine baits. Immediately after deaths, the dogs were collected & brought to areas of disposal. The abdomen was opened and the small intestine was removed, tied at both ends and preserved in a bucket containing 5% formalin for later laboratory examination. The intestines were then opened along its length and the intestinal contents were washed into a bucket after which the intestinal wall was scrapped with a spatula. The washed intestinal contents and scrapings were then suspended in water for 30 minutes.

Then the supernatant was decanted by sieving through a wire mesh. The material retained on the sieve was washed off in to a bucket & re-suspended together with the sediment. The procedure was repeated for several times until the content becomes clear. The sediment was transferred into a black tray containing 0.85% saline and examined under stereoscopic microscope. The worms were then counted & recorded. Sampling technique was used for those dogs infected with large numbers of *E.granulosus*. This consists of mixing all the sediment material in 1 liter (1000 ml) of saline and to count the number of *E.granulosus* recovered from 10 ml of the mixed material. Then after, the counted number was multiplied by 100 & this gives the total number of the parasite recovered from the animal. All the recovered parasites were put in 5% formal-saline & preserved. They were then sent to the Faculty of Veterinary Medicine for identification. Human cases of Hydatid disease was also assessed on the bases of subjective information (interviews) and analysis of case recording book of some hospitals in Addis Ababa examined.

### Monetary loss estimation

An attempt was made to estimate the economic significance of hydatidosis on cattle from the cost of the offal's condemned (liver and lung) (direct loss),

and carcass weight losses from it (indirect loss). As far as the location of hydatid cysts are concerned, the economic losses which arises from condemnation of infected organs calls our attention how far the disease is very important.

By considering only the lungs and the liver of infected animals (cattle, sheep & goats) slaughtered at Addis Ababa abattoir, One hundred twenty five kg was taken as a dressing weight for local zebu cattle [28], to calculate the direct loss on the formula described below as described by Ogunrinade and Ogunrinade (1980) [29]. A 5% estimated carcass weight loss due to bovine hydatidosis as described by [10] Polydorous (1981) was used for the indirect loss from carcass weight loss. the mean annual loss from condemnation of these organs can be calculated as follows;

Economic Loss Assessment: The economic loss due to hydatidosis in cattle, sheep and goats slaughtered at Elfora export abattoir in Debre zeit town local market was estimated by considering of condemned visceral organs due to hydatid cyst. By taking into account the average number of ruminants slaughtered and the degree of organ condemnation per annum at Addis Ababa, the direct economic loss attributed to hydatidosis was made using the formula indicated by Ogunrinade and Ogunrinade [29].

Mean annual loss = **(P** x $R_1$**)** x AK **+ (**H x $R_2$**)** x AK

.

P- Mean local price of lungs at Addis Ababa

**H-** Mean local price of liver at Addis Ababa

$R._1$ - Percentage infection of fangs out of total examined lungs

$R_2$- Percentage infection of liver out of total examined livers

AK - Mean annual Kill o**f** Addis Ababa abattoir for the last 5 years.

Sources for the mean annual kill of Addis Ababa abattoir for sheep, goats & cattle were obtained from recording books of Addis Ababa abattoir for the last 5 years (1983 - 1987).

## Results

### Prevalence of Hydatidosis in Slaughtered Ruminants

In current study a total of 2132 ruminants consisting of 1027 cattle, 825 sheep, 170 goats and 110 pigs were examined for the prevalence of hydatid cyst. Out of these total examined animals 217(21.13%), 121(14.67%) and 12(7.05%) cattle, sheep and goats, respectively were found infected with hydatid cyst (while of the total 110 pigs slaughtered & examined, none of them were infected with Hydatid cysts (Table 1).

**Table 1:** The overall prevalence of hydatidosis in cattle, sheep, goats and pigs slaughtered at Addis Ababa Abattoir

| Animal species | Number of animals | Number of positive | Prevalence % |
|---|---|---|---|
| Cattle | 1027 | 217 | 21.13 |
| Sheep | 825 | 121 | 14.67 |
| Goats | 170 | 12 | 7.05 |
| Pigs | 110 | 0 | 0 |
| Total | 2132 | 350 | 42.85 |

**Table 2:** Organ level distribution of hydatid cysts among infected cattle, sheep and goats at Addis Ababa abattoir.

| Organ (S) | Cattle | | Sheep | | Goats | |
|---|---|---|---|---|---|---|
| | No of cattle infected | %0ut of total infected cattle | No of sheep infected | % 0ut of total infected sheep | No of goat infected | %0ut of total infected goats |
| Lung only | 107 | 49.31 | 48 | 39.7 | 1 | 8.3 |
| Liver only | 10 | 4.61 | 18 | 14.9 | 8 | 66.7 |
| Heart only | 6 | 2.76 | - | - | - | - |
| Liver & Lungs | 72 | 33.18 | 49 | 14.9 | 2 | 16.7 |
| Lungs &Kidneys | 8 | 3.69 | - | - | - | - |
| Liver, Lungs& Spleen | 3 | 3.69 | 6 | 4.9 | - | - |
| Liver, Lungs& Omentum | - | - | - | - | 1 | 8.3 |
| Liver, Lungs, Spleen & Omentum | - | 0.46 | - | - | - | - |
| Liver, Lungs& Kidneys | - | 4.61 | - | - | - | - |

Out of the total 1611 cattle cysts, 78l (48.5%) were small sized, 478(29.7%) were medium sized and 352(21.8%) were large sized. In sheep & goats, out of the total 663 & 26 cysts respectively; 435(65.6%) &14(53.8%) were small sized, 179(27.0%) & 10(38.5%) medium sized and 49(7.4**%)** and 2(7. 7%) were large sized respectively. (Table 3)

**Table 3:** Distribution of hydatid cysts in different organs based on their size among infected ruminants slaughtered at Addis Ababa Abattoir

| **Animal species** | **0rgans** | **Total Number of cysts examined** | **% 0f all organs infected** | **Small cyst No-%** | **Medium cyst No-%** | **Large cyst No-%** | **Total cysts** |
|---|---|---|---|---|---|---|---|
| Cattle | Lungs | 103 | 56.6 | 525 -43.4 | 398-32.9 | 286-23.7 | 1209 |
| | Liver | 73 | 4 0.1 | 244 -72.2 | 57-20.8 | | 338 |
| | Spleen | 4 | 1.2 | - | --- | - | 8 |
| | Heart | 6 | 3,3 | 6- 100.0 | 2-25.0 | -- | 8 |
| | Kidneys | 18 | 5.6 | | --- | -- | -- |
| | Omentum | 1 | 0.3 | --- | -- | 30-100.0 | 30 |
| **Total** | | | | | | | |
| Sheep | Lungs | 103 | 56.6 | 229 -60.1 | 120-31.5 | 120-31.5 | 381 |
| | Liver | 73 | 4 0.1 | 200 -73.0 | 57-20.8 | 57- 20.8 | 274 |
| | Spleen | 6 | 3.3 | 6-75.0 | 2-25.0 | - | 8 |
| **Total** | | 182 | 100.00 | 435-65.6 | 179-27.0 | 49-7.4 | 663 |
| Goats | Lungs | 4 | 25.0 | 2-22.2 | 5-55.6 | 2- 22.2 | 9 |
| | Liver | 11 | 68.8 | 12 – 75.0 | 4-25.0 | ---- | 16 |
| | Spleen | 1 | 6.2 | - | - | 1-100.0 | 1 |
| **Total** | | 16 | 100.00 | 14-53.8 | 10-38.5 | 2- 7.7 | 26 |

Of the total 1611 examined cattle cysts, (10.12%) were fertile**,** (56.92%) sterile & (32.96%) calcified. (Table 4). In sheep and goats out of 663 & 26 examined cysts, (55.9% & 42.3%) were fertile, (11.8% & 30.8%) sterile, and (32,3% 6 & 26.9%) calcified respectively (4). The average percent viability of protoscoleces (fertile cysts) was higher in sheep & goats with (80.7%&72.71%) respectively than for that of cattle which is (66.83%)

**Table 4:** Total Number & condition of Hydatid cysts seen in cattle

| Animal species | Organs Involved | Total Number Cysts | % infection | Fertile Number-% | Average % Viability | Sterile Number- % | Calcified Number -% |
|---|---|---|---|---|---|---|---|
| Cattle | Lungs | 1209 | 75.0 | 117- 9.66 | 66.83% | 777-64.27 | 315-26.05 |
| | Liver | 338 | 21.0 | 12 – 3.55 | 54.79% | 110-32.55 | 216-63.90 |
| | Spleen | 8 | 0.5 | 4-50.00 | 74.3% | 4-50.0 | ------- |
| | Omentum | 30 | 1.9 | 30- 100.00 | 71.4% | ---- | ------ |
| | Kidneys | 20 | 1.2 | ---- | --- | 20-100.00 | ------- |
| | Heart | 6 | 0.4 | ---- | --- | 6-100.0 | --- |
| **Total** | | 1611 | 100% | 163-10.12 | 66.83% | 917-56.92% | 531-32.96% |

**Table 5:** Total Number & condition of Hydatid cysts seen in Sheep

| Animal species | Organs Involved | Total Number Cysts | Fertile Number-% | Average % Viability | Sterile Number- % | Calcified Number -% |
|---|---|---|---|---|---|---|
| Sheep | Lungs | 381-57.5 | 251- 65.9 | 83.2 | 58-15.2 | 72- 18.9 |
| | Liver | 274- 41.3 | 112- 40.9 | 83.0 | 20-7.3 | 142- 51.8 |
| | Spleen | 8-1.2 | 8- 100.0 | 75.0 | - | --- |
| **Total** | | 663-100% | 371-55.9 | 80.7% | 78-11.8 | 214- 32.3 |

**Table 6:** Total Number & condition of Hydatid cysts seen in Goats

| Animal species | Organs Involved | Total Number Cysts | Fertile Number-% | Average % Viability | Sterile Number- % | Calcified Number -% |
|---|---|---|---|---|---|---|
| Goats | Lungs | 9-34.6 | 4- 44.4 | 84.25% | 5- 55.6 | ---- |
| | Liver | 16- 61.5 | 7- 43.8 | 68.2% | 2- 12.5 | 7- 43.7 |
| | Spleen | 1-3.9 | ----- | ---- | 1-100.0 | --- |
| **Total** | | 26-100.00 | 11-42.3 | 72.7 | 8- 30.8 | 7- 26.9 |

**Table 7:** Classification of the animals according to the kinds of Hydatid Cysts

| Animals Species | Total No. infected | fertile cyst only | Sterile cyst only | Calcified cyst only | Calcified With fertile & Sterile cyst only | fertile & Calcified cyst only | Sterile & Calcified cyst only | fertile & Calcified cyst only |
|---|---|---|---|---|---|---|---|---|
| | | No-% | No-% | No-% | No-% | No-% | No-% | No-% |
| Sheep | 121 | 32-26.4 | ----- | 22-18.2 | 11- 9.1 | 18-14.9 | ----- | 38- 31.4 |
| Goat | 12 | 5-41.6 | 2- 16.7 | 2-16.7 | 1-8.3 | ----- | 2- 16.7 | ---- |
| Cattle | 217 | 4-1.8 | 62- 28.6 | 28-12.9 | 8-3.7 | 2- 0.9 | 88- 40.6% | 25- 11.5 |

### Monetary loss estimation

Sources for the mean annual kill of Addis Ababa abattoir for sheep, goats & cattle were obtained from recording books of Addis Ababa abattoir for the last 5 years (1983 - 1987)

A = the annual loss for cattle = (2 x0.62) x 150,230 + (5x0.29) xl50, 230

=404,118.70 **Eth.Birr** or 2.69 Eth.Birr/animal

B = the annual loss for Sheep = 0.5 x0.566) x48729.6+ (0.5x0.401) x48729.6

=23,560.79 Eth.Birr or 0.48EthBirr/animal

*C*=**the annual loss for** goats= 0.5x0.25) x 90l4.8+ (0.5x0.688) x90l4.8

=4227.**95Eth.Birr or** 0.46Eth.Birr/animal

Therefore, the total mean annual loss from the **three** species **of** animals

**Will be (A+B+C) = 404,118.70 +23,560.79+ 4227.95** = **431**,907.**44** Eth.Birr.

## Discussion

The incidence of hydatid disease in livestock slaughtered at Addis Ababa abattoir was very significant with the infection rate of (21.13%) in cattle in (14.67%) in sheep, (7.05%) in goats and no infection in pigs. Prevalence rate was variable among the three animal species. It has been reported that variable prevalence rate occurs among different species of animals even from the same locality. El-Badaw, E.S., et al. [16] from the Republic of the Sudan reported the incidence rate of (4.28%) in cattle, (8.11%) in sheep, (3.17%) in goats and (35. 3%) in camels. Shamsul Islam [30] reported the incidence of (8.29%) in goats, (55%) in sheep in (1981) & (41.44%) in cattle in (1982) in Bangladesh. Himonas, C., et al. (1987) [31] from Greece has reported the prevalence rate of (51.16%), (13.5%), (33.31%) & (4.65%) in Sheep, goats, cattle & pigs respectively.

In Ethiopia, Tamene M. (1986) [20], reported the incidence of hydatid disease to be (33.72%), (8.67%) & (4.64 %) in cattle, sheep & goats respectively. This variation in prevalence rate among different 8animal species is probably because of the difference in strains of *Echinococcus granulosus* [7]; while in these findings the difference is most likely due to age factor, i.e.; Cattle were generally older when slaughtered than sheep & goats and consequently exposed to infection over a longer period of time.

The no findings of hydatid disease in pigs slaughtered at this abattoir is probably because of good control measures practiced in the farm, since they were drawn from governmental farms which were well fenced and consequently not exposed to infection from dogs. Also their feeding system may contribute to the absence of infection, i.e. their feed is restricted to concentrate and other byproducts but not grazing.

Generally, the density**,** infectivity and availability of the eggs in the environment, the feeding behavior of the intermediate host together with the external environment have a vital role in determining the dynamics of transmission of the parasite [4]. The significant findings of Hydatidosis in livestock slaughtered at Addis Ababa abattoir is probably because of considerable socio-economic & cultural problems existing in the country.

Hydatid cysts were found occurring predominately in lungs & liver for all the three species of animals representing (91.0%), (96.7%), & (93.8%) for cattle, sheep & goat respectively. It has been stated that hydatid cysts are most commonly found in the liver & lungs of ungulates [32]. This is true, because, these organs are the first greater capillary fields, which acts as partial barriers, for the ingested exacauth embryos which adopt the partial vein routes & primarily negotiate the hepatic and pulmonary filtering system sequentially before any other peripheral organ invasion, but oncospheres which traverse them will reach the systemic circulation and hydatids have been found in many organs and tissues [32, 33].

The lungs/liver infection ratio was variable among the three animal species 62.0:29, 56.6:40.1, 25.0: 68.8, for cattle, sheep & goats respectively. Hydatid cysts are found primarily in the lungs of sheep where they are frequently multilocular [7]. This is in agreement with the present study, where there was more pulmonary involvement in goats. This finding can be justified by the fact that the localization of the onchospheres may be influenced by age of the host [32]. In the actual study, cattle were generally older enough (greater than 7 years) & most of the sheep were greater than 3 years. Therefore, the advancing age of animals at slaughtering is one of the probable cause of high

pulmonary incidence than hepatic infection, as they were exposed to infection at their older age. The higher degree to which more pulmonary involvement occurs in older animals is attributed to the greater diameter of the capillaries of the portal system acquired with advancing age of the host.

Fertility rate of the cysts was higher among the cysts of the lungs for all the three animal species representing (9.68%, 65.9% and 44.4%) for cattle, sheep and goats respectively than the cysts of the liver, with the exception of cattle cysts found on the omentum & spleen which represented (100% & 50%) fertile respectively; whereas , calcification rate was higher among the cysts of the liver for all the three animal species representing (66.9 %, & 51.8% and 43.7%) for cattle, sheep & goats respectively.

In cattle of the total 531 calcified cysts 216 (40.68%) were found, on the liver, whereas in sheep & goats out of the total 214 & *7* calcified cysts, (66,35% & 100%) respectively were found to occur on the liver. The number of hydatid cysts per organ ranged between 1 to 34, 1 to 16, and 1 to 3 on lungs; 1 to 12, 1 to 25, & 1 to 3 **on** liver of cattle, sheep & goats respectively. The mean number of cysts per organ was higher for the lungs in cattle & goats and for the liver in sheep. The ratios of the mean numbers of cysts on Lungs, and liver for cattle, sheep & goats were (601: 3.59); ( 3.7: 3.8) & (2.45: 1.46) respectively.

The number of cysts per animal ranged between 1 - 48 with a mean of 7.42 for cattle, 1 to 39 with a mean of 5.5 for sheep and 1 to 5with a mean of 2.2 for goats. Out of 217 cattle infected with hydatid cysts, 39(17.97%) were carrying fertile cysts, 183(84.35%) were carrying sterile cysts and 143(65.9%) were carrying calcified cysts. In sheep out of 121 infected with hydatid cysts; they were carrying 99(81.81%) fertile cysts, 49(40.5%) sterile and 78(64.46%) calcified cysts. Of 12 goats infected with hydatid cysts, 6(50%) were carrying fertile cysts, 5(41.7%) sterile & 4(33.33%) calcified cysts.

It is also possible for embryos to enter the lymphatic circulation & be carried via the thoracic duct; to the heart & the lungs. In this way the lungs may be infected before or instead of the liver [34]. This is probably true for the high pulmonary incidence than hepatic involvement particularly for sheep.

The fertility & viability rates of hydatid cysts were variable among the three animal species. The fertility rate was higher for sheep& goats (55.9% &42.3%) respectively than for cattle (10.12%). This result corroborates with the findings of Shamsul Islam 1980, 1981&1982 [30, 35, 36] and Himonas, C.et.al (1987) [31] and the general view of Hydatidosis in animals in other countries with high fertility rate of cysts in sheep & goats than in cattle in different countries (31). This variation in fertility rate of hydatid cysts among different animal species is probably due to the differences in strains of Echinococcous granulosus [19, 37]. Gemel M.A. (1978) [38] stated that the strains of parasites and hosts can modify the infective pattern of the parasite.

The fertility rate was higher among the- cysts of lungs than those of the liver. This result is in agreement with the findings of Himonas,C. et.al (1987) [31] . It has been stated that the fertility rate of hydatid cysts may show a tendency to increase with advancing age of the hosts [32]. This may be attributed probably to the reduced immunological compatibility of animals at their older age of infection.

The variation between the tissue resistances of the affected organs may also influence the fertility rate of the cysts. In the liver, host reaction may limit the fertility rate of hydatid cysts. The viability rate of protoscoleces were also varied with an average % viability of (80.7% to 72.7%) for sheep & goats respectively and (66.83**%)** for cattle**.** This result is in agreement with the findings of Macpherson**,** C.N.L. 1985 [39], the higher % viability of protoscoleces in sheep & goats than in cattle.

The greater fertility & viability rates of hydatid cysts in **s**heep & goats and the lower in cattle can suggest that, at present, sheep & goats are the most important intermediate hosts for the perpetuation of the domestic life-cycle of *Echinococcus granulosus* and possibly of human Hydatidosis in Ethiopia. This can be justified by the fact that:- Most livestock owners sell their cattle for cash income rather than slaughtering for home consumption as compared to sheep & goats, Sheep & goats are mostly slaughtered at home without any veterinary meat inspection and their total numbers slaughtered are relatively greater than cattle, Finally the country side are regularly sprinkled with carcasses of animals( cattle ,sheep& goats ) dying from diseases, and these are largely left unburied; providing a natural food supply for a thriving population of stray dogs . This is particularly true for sheep & goats where most of the cysts are fertile as compared to that of cattle cysts, so that, if such animals were infected with

hydatid disease, contributes greatly to the perpetuation of the parasite. In addition to these, there is also an evidence which indicates that, it is the ovine strain of *Echinococcus granulosus* which presents the greatest danger to the human population and the presence of fertile cyst in cattle of an apparent ovine strain may constitute an additional public health problem [40].
Calcification rate was higher among the cysts of the liver for all the three animal species than the cysts of the lungs representing (63.9%, 51.8%& 43.7%) for cattle, sheep & goats respectively. Calcification is the signal for the death of the parasite [41]. The high incidence of calcified cysts of the liver is attributed to the difference in the tissue resistance of the organs & the host reaction to the parasite.

The distribution of hydatid cysts in these examined intermediate hosts were over-dispersed with a wide range of the number of cysts per organ. This means, cysts were not dispersed at random, but only a few animals & organs of each host species harbored most of the cysts found.

The size of hydatid cysts in all the three animal species was variable. This may be attributed to the fact that hydatid cysts develop slowly but animals are usually slaughtered before sufficient time has elapsed for the full development of the cyst. An average size of fertile hydatid cyst (15 - 20mm) is achieved at 6 months after ingestion [34].

As far as human hydatidosis is concerned, the results obtained from central Laboratory& Research Institute and some hospitals in Addis Ababa are indicative for the presence & wide spread of the disease in Ethiopia. Meanwhile, the diagnosis is becoming difficult because of the facts that mimic a great variety of diseases, the clinical symptoms are not well manifested on the patient, diagnostic facilities are not available and people themselves are not aware of the disease. Therefore, these facts & others, calls for our attention and emphasis are given to conduct a large scale survey in man & animal throughout the country.

The prevalence of Echinococcosis in urban stray dogs of Addis Ababa was significant (23.5%). This is probably attributed to the following factors:- Most of sheep & goats are slaughtered at home without any veterinary meat inspectors & owners often give visceral organs infected with hydatid cysts to their dogs. This is true particularly during Christmas & Easter holidays for Christians, Some butchers found at the corner of Addis Ababa city are slaughtering secretly certain animals without any veterinary supervision, so that dogs may have an easy access to infected offal with hydatid cysts, Some abattoir workers are not aware of the danger of the disease and often steal some infected organs to feed their dogs at home or to sell it to dog owners for the need of cash income and the presence of wild carnivores such as hyena, foxes and others, in the country side and their occasional visit to Addis Ababa city and their relationship with animal may also contribute to the epidemiology of *Echinococcus granulosus.* Besides *Echinococcus granulosus* , other canine parasites of public health importance such as *Ancylostoma canninum,* have been recovered and warrants for further study to be conducted.

## Conclusion and Recommendations

Hydatidosis is the highly prevalent parasitic disease found in ruminant intermediate host including cattle, sheep and goats slaughtered at Addis Ababa abattoir and found to be the major causes of organ condemnation which leads to huge financial loss. Comparatively high fertility & viability rates of hydatid cysts in sheep & goats than that of cattle, the common practice of slaughtering sheep & goats at home, and the high incidence of echinococosis in urban stray dogs of Addis Ababa, suggests that at present sheep & goats seem to be the most suitable domestic intermediate hosts for the perpetuation of the domestic life cycle of *E. granulosus* in Ethiopia. Generally the biological, cultural, socio-economical, agricultural, educational, and environmental factors are closely related with the epidemiology of the disease in the country. The high incidence of the disease in livestock (cattle, sheep & goats) and urban stray dogs & its public health significance, still calls attention for further study, so that with more accurate knowledge of the incidence in humans, dogs, livestock & wild life together with the improved livestock production; the greater supervision of meat inspection by veterinary authorities throughout the country and the better elucidation of the epidemiology of the disease, control measures can be formulated & implemented where it is practicable to carry them out successfully.

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