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Study on prevalence and cyst characterization of cystic Echinococcosis (Hydatidosis) in bovine slaughtered at Bishoftu municipal Abattoir, Centeral Ethiopia

Amanuel Ashebo[1] , Mulugeta Sosango[2], * Kefele Yohannes[2]
[1](DVM, Graduate), Kembata Tembaro Zone , Hadero Tunito Zuriya Woreda Livestock and Fisher resource , Hadero, Ethiopia. E-mail: *amnuelashebo@gmail.com*
[2](DVM, Graduate), Kembata Tembaro Zone, Hadero Tunito Zuriya Woreda Livestock and Fisher resource, Hadero, Ethiopia. E-mail: *mulugetasosango@gmail.com*
[3](DVM, Graduate), Jimma University, College of Veterinary Medicine, Jimma, Ethiopia.
*Corresponding author- Kefele Yohannes; Jimma University, Jimma, Ethiopia.
E-mail : *kefeleyohannes@gmail.com*

Abstract

Objective A cross-sectional study was conducted from November, 2015 to March, 2016 at Bishoftu municipal abattoir with the objectives of determining the prevalence of bovine hydatidosis and its associated risk factors, and characterizing the cysts.

Result; A total of 420 animals were randomly sampled, of which 161 were found harboring a single or multiple hydatid cysts based on routine meat inspection. Therefore the prevalence (95% CI) of hydatidosis (or cystic echinococcosis) in cattle was estimated at 38.3% (33.66 – 43.17). Hydatid cyst count and further characterization were conducted. The statistical analysis showed that there was no significant association ($p > 0.05$) between the prevalence of bovine hydatidosis and breed of animals. Infection of hydatidosis has shown statistically significant (OR=1.637, $p = 0.00$) association with age of cattle, being higher in those above five years (41.7%) of age than in five and below five years old group (30.44%). Also the result revealed that highest prevalence of bovine hydatidosis was recorded in cattle with lean body condition (54.5%) followed by medium (34.4%) and then in fat body condition (27.3%), with strong statistically significant difference (OR=1.558 p=0.02). The total number of organs affected by one or more hydatid cyst(s) was found to be 180, out of which lung account for 101 (66.73%), liver 68 (31.52%), kidney 6(0.96%), heart 3 (0.48%) and spleen 2 (0.3%). Lungs and livers accounted for more than98% of the infected organs, with lungs being the highest infected organ. Out of 82 cystsexamined, 33 (40.24 %) calcified, 35 (42.68%) sterile, and 14 (17.07%) were fertile, of which 13.33% were found viable. The rate of cyst calcification was higher in the liver than in the lung while fertility rate was higher among the cysts of the lung.

Conclusion; In conclusion the findings reported here has shown that hydatidosis is widespread in cattle slaught eredat Bishoftu municipal Abattoir. Hence, application of the conventional preventive and control measures like detail meat inspection, proper disposal of infected organs and control of stray dogs are recommended to control the disease.

Keywords: abattior; Bishoftu; cattle; cyst viability; hydatidosis; prevalence

1. Introduction

Hydatid cyst is the larval stage of the tapeworm *Echinococcus granulosus* or *Echinococcus multilocularis*, containing daughter cysts, each of which, if fertile, will have many protoscoleces. It is the cause of the disease hydatidosis, also termed cystic echinococcosis [1]. Infection, with the metacestode hydatid cyst of *Echonococos granulosus*, larval stage of parasite tape worms is recognized as one of the world‟s major zoonosis affecting both humans and domestic animals [2]. The life cycle of *Echinococcus* species is complex, involving two hosts (Definitive hosts and intermediate hosts) and a free-living egg stages. Dogs are the usual definitive hosts whilst a large number of mammalian species can be intermediate hosts, including domestic ungulates and man [1]. Ethiopia have an estimated livestock population of approximately 49.3 million cattle, 25.02 million sheep, 27.88 million goats, 8.41 million equines, 1.06 million camels, 20,000 pigs, and 58 million chickens, which stands first in Africa and tenth in the world [2]. However, the contribution from these huge livestock resources to the national economy is disproportionately small, owing to several factors such as drought or malnutrition, management problems, poor genetic performance and livestock diseases. Among the many prevalent livestock diseases, parasitism represents a major constraint to livestock development in the tropics in general and hydatidosis is among the major parasitic diseases contributing to low productivity of meat production due to carcass or organ condemnation, in particular [1].The definitive hosts of *Echinococcus* species are carnivores which harbor mature tapeworm in the intestine and excrete the parasite eggs along with their feces and play a major role in the epidemiology of the disease, while livestock and humans are intermediate hosts for whom the outcome of infection is the development of hydatid cysts in lung, liver or other organs. The transmission of *Echinococcus* species from intermediate to definitive host is the result of predator-prey relationship existing between hosts; however, it can be modified by human behavioral factor synathropic cycles and man is usually a dead end intermediate host [1]. In Africa *E. granulosus* has long been recognized from most countries including Ethiopia. Previous and recent report has described the endemic occurrence of *E.granulosus* in dogs and hydatid cyst in livestock [2]. *Echinococcus granulosus* remains as a cause of a persistent and reemerging problem in low income countries where resources for an intensive control program are not available. Future control programmes for human echinococcosis are also likely to depend on the reduction of transmission of the parasite from animals to humans [3]. Diagnosis of the disease relies on epidemiologic and clinical findings; on detection of the hydatid cyst by imaging techniques, and serology. There are several major options for treatment of cystic echinococcosis (CE), including surgery, puncture aspiration injection respiration (PAIR), and chemotherapy [4]. Control of *E.granulosus*is based on the regular treatment and exclusion of dogs from their diet of animal material containing hydatid cysts.

This is achieved by denying dogs access to abattoirs, and where possible, by proper disposal of carcasses on farms (Oku *et al*., 2004). Several reports had indicated that hydatidosis is widely prevalent in livestock population of various regions of Ethiopia [5]. However there is no current information regarding the prevalence of bovine hydatidosis in Bishoftu and its surroundings, which is found in the central Ethiopia, Oromia region. Hence, it would be essential to have information on the status of hydatidosis with regard to its magnitude of this disease in the region. Therefore, based on the above justification, the current study was undertaken with the objectives of:

- Estimating the prevalence bovine hydatidosis and factors associated with itsoccurrence in cattle slaughtered at Bishoftu municipal Abattoir;
- Assessing the organ distribution, fertility and viability characteristics of cysts identified during routine meat inspection of animal carcasses.

2. Literature Review

2.1. The Hydatid Disease

Hydatid disease is a syndrome characterized by the development of the larva or metacestode stage of a genus of tapeworm *Echinococcos* species found in small intestine of dog; the definitive host. Hydatid disease is characterized by the formation of

large fluid filled cysts in the internal organs of the intermediate host [7]. The disease is also referred to as cystic echinococcosis. In carnivores, the adult worm has very little clinical effect if any. However, in the intermediate host, the effect due to hydatid cyst can be grave, depending on the site of infection and the organ involved [8].

2.2. Etiology

Cystic echinococcosis is a zoonotic infection caused by the larval stage (hydatid) of tapeworms of the genus *Echinococcus* (Family *Taeniidae*) found in the small intestine of carnivores. Although there are different species of *Echinococcus* identified, only five of them, namely*: E. granulosus*, *E. multilocularis*, *E. oligarthrus*, *E. shiquicus* and *E. vogeli*are are recognized as taxonomically relevant and only *E. granulosus* and *E. multilocularis* are the most pathogenic to humans and other domestic animals
[9].

2.3. General Morphology

2.3.1. The Eggs

The eggs (Figure 2.1) of *Echinococcus* are ovoid in shaped, 30-40 micro meter in diameter, consisting of hexacanths embryo (first larval stage) surrounded by several envelops. *Echinococcus* eggs contain an embryo that is called an oncosphere or hexcanth, the latter name of this embryo being stem from the fact that it has six hook lets. The eggs of *Echinococcus* are morphologically indistinguishable to those of other tapeworms of the genus *Taenia* [10].

Figure 2.1: Morphology of egg of *E. granulosu* in feces (Rahman *et al*., 2015)

2.3.2. Hydatid Cysts (The Metacestode)

The metacestode (second larval stage) basically consists of a bladder with an outera cellular laminated layer and an inner nucleated germinal layer, which may give rise to asexual budding to brood capsules. protoscoleces arise from the inner wall of the brood capsules, protoscoleces and brood capsules are frequently described as hydatid sand, occasionally also, daughter cysts complete with tegument and germinal layer are formed endogenously or, if the cyst wall ruptures, exogenously [11]. Cysts containing protoscolices are fertile and can produce daughter cysts, whereas cysts without protoscolices are sterile. Before becoming daughter cysts, these daughter vesicles are attached by a pedicle to the germinal layer of the mother cyst. At gross examination, the vesicles resemble a bunch of grapes. Daughter cysts may grow through the wall of the mother cyst, particularly in bone disease [12].

2.3.3. *Echinococcus granulosus* Adult Worm

Echinococcus granulosus adult worms develop from protoscolices and are typically 6mm or less in length and have a scolex, neck and typically three proglottids, one of Which is immature, another of which is mature and the third of which is gravid (or Containing eggs) [13]. These proglottids increase in size and maturity as you travel down the tapeworm's body from the head (scolex) towards the tail. At the tail end, the proglottid segments are large and sexually mature with hundreds of Fertilized eggs contained inside of them. These tapeworm eggs are released into Environment with feces (ready for the intermediate host to come along and consume).

Still contained within their protective proglottid casing [14]. Basically, the entire proglottid segment (mature, egg bearing proglottid segment located towards the tail end of the tapeworm parasite), eggs and all, exits the definitive host animal's body via the animal's anus. The gravid segment either physically crawls from the anus of the host animal by contracting its muscles and creeping along or it is voided passively in the animal's stools as the pet defecates. The scolex of the adult worm contains four suckers and a rostellum that has about 25-50 hooks (Figure 2.2). Similar to other tapeworms, the hydatid tapeworm is a hermaphrodite organism (bearing both male and female sex structures) [15].

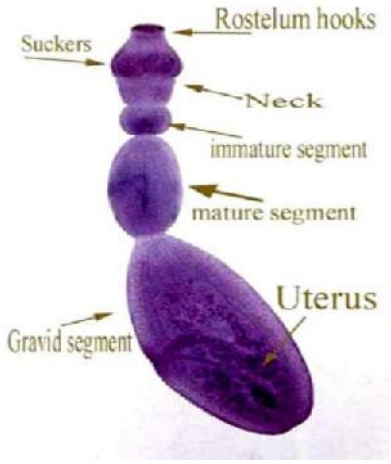

Figure 2.2: Morphology of Adult Worm of *E. granulosus* (Rahman *et al*., 2015).

2.4. The Life Cycle of *Echinococcus granulosus*

The life cycle of *Echinococcus* includes a definitive host (usually dogs or related species) and an intermediate host (herbivores such as sheep, horses, cattle, pigs, goats and camels). Humans are incidental hosts; they do not play a role in the transmission cycle. *E. granulosus* adult tapeworms are usually found in dogs or other canids [17]. The adult stage affects several final hosts such as domestic dogs, wild carnivores such as foxes, coyotes, wolves, and jackals. Gravid proglottids release the eggs that are spread in the feces of carnivores. Intermediate hosts include sheep, cattle, swine, goats, equines, camelids and cervids. These get the infection by ingesting infective eggs during grazing or feeding. Within the intermediate hosts, the eggs hatch in the small intestines and release an oncosphere that penetrates the intestinal wall and migrates through the circulatory system into various organs, especially the liver and lungs [18] . In these organs, the oncosphere develops into a cyst that enlarges gradually, producing protoscolices and daughter cysts that fill the cyst interior. Carnivores get the infection by feeding on the raw materials from the intermediate hosts, mainly the visceral [19]. After ingestion, the protoscolices evaginate and attach themselves to the mucosa and develop into adults in 30 to 80 days and the cycle starts all over again. Accidentally, eggs are also ingested by humans and other "aberrant" hosts that do not play a role in the natural cycle. Whereas the infection of carnivores with immature or mature intestinal stages does not cause morbidity, the invasion of various organs (mainly liver and lungs) of the intermediate or aberrant hosts by metacestodes can cause severe and even fatal echinococcosis [20].

2.5. Epidemiology and Transmission

Echinococcus granulosus lives as a small intestinal tapeworm of dogs and occasionally other carnivores. The shedding of gravid proglottids or eggs in the feces occurs within 4-6 weeks after infection of the definitive host. Ingestion of eggs by intermediate host animals or humans results in the release of an oncosphere into the Gastrointestinal tract, which then migrates to primary target organs such as liver and lungs, and less frequently to other organs. Usually the fully mature metacestode (i.e. hydatid cyst) develops within several months or years [21]. Cystic echinococcosis (CE) has a serious impact on human health and livestock production in endemic areas such as in South and Central America, the Middle East, some sub-Saharan African countries, China, and the former Soviet Union). CE occurs mostly in poor communities raising sheep and other livestock, and involving dogs in guarding as well as herding animals. *E.granulosus*is mainly transmitted in a cycle between dog definitive hosts and livestock; the human behaviour also helps to perpetuate the domestic cycle of *E. granulosus* [22].

2.5.1. Disease Distribution

Echinococcus granulosus has a world wide geographic range and occurs in all continents including circumpolar, temperate, sub tropical and tropical zones (Craig *etal*., 1996). Very few countries are considered to be completely free of *E. granulosus*. Areas of the world where there is a high rate of infection often coincide with rural grazing areas where dogs are able to ingest organs from infected animals[23]. The host, agent and environment interaction determines the distribution of the disease. Provided the pre-condition, occurrence in the same environment of suitable definitive and intermediate host, a predator pray relationship between host and introduction of the parasite are maintained: the following factors determine the epidemiology of*Echinococcus granulosus* in its domestic cycle. These are extrinsic factors(environment, temperature, humidity, and egg spreading agents) socio ecological factors (farming system, feeding behavior of intermediate and definitive host, and level of awareness of human population) and intrinsic factors(biotic potential of tape worm, innate and acquired resistance to infection) [25].

2.5.2. Status of Hydatidosis in Ethiopia

In Ethiopia, hydatidosis has been known and documented as early as 1970ʿs. Hydatidosis is the major cause of organ condemnation in most Ethiopian abattoirs and Slaughter houses causing huge economic losses [26]. In Ethiopia prevalence rate varying between 11.3 to 48.9% in cattle and 9.9 to 35% in sheep was described [26] (Table2.1).

Table 2.1: prevalence of bovine hydatidosis in cattle slaughtered at 14 abattoirs in Different parts of Ethiopia.

Location	Sample size	prevalence	Reference
Gondar elfora	400	28	[27]
Ambo	384	29.69	[28]
Debre markos	400	48.9	[29]
Kombolicha	376	17.6	[30]
Mekele	540	17.6	[31]
Shire	484	25.92	[32]
Addis abeba	384	40.5	[33]
Hosana	153	24.4	[34]
Dire dawa	679	20.5	[35]
Harar	384	11.3	[36]
Hawassa	395	22.9	[37]
Sebeta	384	24.5	[38]
Jimma	384	30.7	[39]

A possible reason for these variations in prevalence of hydatidosis among different Geographical locations could be associated with the strain difference of *Echinococcus granulosus* that exist in different geographical locations, age of the animals and other factors like socio-economic activities and management of dogs in different region [40].

2.5.3. Host Range

It is likely that *echinococcusus granulosus* originally complete its life cycle among wild animals in sylvatic cycle that involved, for example, wolves and cervides or lions and warthogs. It has now adopted in domestic cycle in which dog and sheep are commonly involved animals as final and intermediate hosts [41]. *Echinococcusus granulosus* has less host specificity with regarded to intermediate hosts. Hydatid cysts of this species have been seen in a wide range of mammals including domestic ruminants, camels, giraffes, pigs, equines, elephants, hippopotamus, marsupials and different types of deer as well as human [42]. But sheep is the optimum intermediate host [43].

2.5.4. Transmission

Various factors perpetuate the transmission and endemicity of echinococcosis. They can be biological, demographic and culture risk factors that are facilitated by husbandry Systems. Lack of drinking water and utilities, combined with low levels of education and poor sanitary conditions increases the transmission of diseas[44]. The biotic potential of *E. granulosus* is a major contribution to the transmission dynamics of this parasite. The biotic potential can be defined as „the potential number of viable cysts which can be established in an intermediate host by an individual definitive host per day [45].

The well-known factor in transmission of the disease is the feeding of infected material (hydatid cysts) to dogs by pastoral communities and other rural communities where backyard slaughtering (home slaughtering) is done. In endemic areas, hunting dogs are Often fed the raw viscera of backyard slaughtered animals [46]. Dogs scavenging on the carcasses of intermediate hosts are also important in the transmission of the parasite [47]. Predator- prey associations play an important role in the transmission of the disease as well as human behavior and traditional animal husbandry practices. As dogs can get infected with the wild species, they constitute a grater reservoir for echinococcosis [48].

2.5.5. Risk Factors

The following factors were responsible for the perpetuation of the disease: cultural and social taboos that favor close association of dogs with human beings. Almost all cattle owners had one dog and no deworming was reported. Backyard slaughtering of animals and slaughtering animals along the roads was common. There was a wide spread tradition of giving dogs uncooked offals, poor public awareness of the disease and improper disposal from the slaughter houses which allows easy access to carnivores. There was also a habit of disposing dead domestic or wild animals leaving them open hence allowing the maintenance cycle. Sheep, which were found to have a high infection rate, are never brought to the abattoir, they show the highest number of backyard slaughtered animals [49]. Proper disposal of carcasses and offal after home slaughter is difficult in poor and remote communities and therefore dogs readily have access to offal from livestock, thus completing the parasite cycle of *Echinococcus granulosus* and putting communities at risk of cysticechinococcosis [50].

2.6. Pathogenesis in Animals

The adult tape worm is comparatively harmless to the dog although in large numbers Enteritis may be seen. The pathogenesis of hydatidosis heavily depends on the extent and severity of infection and the organ on which it is situated. In domestic animals Clinical sign are not commonly seen despite heavy infection [51]. Depending on mode of development of cystic echinococcosis (CE) are two types, Primary CE and secondary CE. In primary echinococcosis, hydatid cysts develop in Various sites from oncospheres after ingestion of *E. granulosus* eggs. In secondary echinococcosis, larval tissue spreads from the primary site and proliferates after spontaneous or trauma induced cyst rupture or after release of viable parasite material during invasive treatment procedures [52].

2.7. Clinical Effects

The initial phase of primary infection is always asymptomatic. The infection may then Remain asymptomatic for years or even decades depending upon the size and site of The developing cyst or metacestode mass. After a highly variable incubation period, The infection may become symptomatic due to a range of different events. Infections With *E. granulosus* cysts in intermediate hosts (sheep, goat, cattle, horses, etc.) are typically asymptomatic, except a few cases of long-standing and heavy infections, for example in horses. There are no reliable methods for the routine diagnosis of the infection in living animals, but in rare cases cysts have been identified by ultrasonography alone or in conjunction with serum antibody detection (Eckert and
[53].

2.8. Diagnosis

2.8.1. Diagnosis in live Animals

Safety precautions: Handling of material containing viable eggs of *E. granulosus* Represents an infection risk for humans. Detection of eggs and proglottids: The *E. granulosus* infection in canids cannot be diagnosed by microscopic egg detection in faecal samples, because these eggs are morphologically indistinguishable from those of *E. multilocularis* and the *Taenia* species. Furthermore, egg excretion is often irregular. Eggs can be detected in faecal samples using routine flotation techniques or on the perianal skin using clear adhesive tape, which is pressed to the skin, transferred to a microscopic slide and examined. Proglottids of *E. granulosus* spontaneously discharged by dogs and detected mostly on the surface of faecal samples may allow a correct morphological diagnosis, if they are in good condition[54].

There are no reliable methods for the routine diagnosis of the infection in living Animals, but in rare cases cysts have been identified by ultrasonography alone or in Conjunction with serum antibody detection [55]. A new ELISA with a high specificity and a sensitivity of 50 to 60% might be useful for detecting *E. granulosus* cysts in sheep on a flock basis but cannot be used for reliable diagnosis of infected individual animals [56].

2.8.2. Post Mortem Diagnosis

In cattle, diagnosis of cystic echinococcosis is mainly through post-mortem findings during meat inspection. The presence of hydatid cysts in internal organs is a very important tool of diagnosis in that it actually confirms the disease [57].

2.9. Economic Importance of the Disease

Hydatidosis (cystic echinococcosis) caused by the larval stage (metacestode) of *Echinococcus granulosus*, the most important worldwide parasitic disease of livestock that has both economic and public health significance [58]. The major economic impacts caused by cystic echinococcosis in food-producing animals are losses in productivity such as reductions in carcass weight, milk production, fleece and wool value, fertility, hide value, birth rate and fecundity, delayed performance and growth, condemnation of organs especially liver and lungs, costs for destruction of infected viscera, and dead animal[59].

2.10. Public Health Importance

Humans acquire primary CE by oral uptake of *E. granulosus* eggs excreted by infected carnivores. The infection may be acquired by handling infected definitive hosts, egg containing feces, or egg-contaminated plants or soil followed by direct hand-to-mouth transfer. It has been shown that *Echinococcus* eggs adhere to the coat of dogs, particularly to the hairs around the anus and on the thighs, muzzles, and paws. The same applies to dogs infected with *Taenia* species and to foxes infected with *E. multilocularis* [60].

2.11. Treatment

Treatment in definitive hosts can be accomplished by giving candids praziquantel or Arecoline. Arecoline is a parasympathetic agent and increase the tonus and the Motility of smooth muscle resulting in the intestinal tract to the outside through fecal Material. The drug works by paralyzing the tapeworms, resulting in relaxation of its hold on the intestinal wall [61]. After treatment it is advisable to confine dogs‟ for48 hours to facilitate the collection and disposal of infected faeces. In man, hydatid cysts may be excised surgically although Mebendazole, Albendazole and praziquantel therapies have been reported to be effective [62]. Treatment of the disease in human host involves surgical removal of either the entire cyst (Laparotomy) or its contents by Puncture, Aspiration, Injection and Re-aspiration (PAIR) [63] or the use of benzimidazole chemotherapy. Albendazole is the drug of choice; beneficial results have been obtained in 75% of cases treated with it [64].

2.12. Control Options and Prevention of Cystic Echinococcosis

Several options for the control of *E. granulosus* have been thoroughly evaluated and Two basic options are formulated as guide lines. Option type- I emphasizes long-term Measures of public health education with primary health care [65] and veterinary public health activities, such as the improvement of slaughter hygiene and meat inspection, dog registration and sanitation measures [66]. Another option (type II) is based on legislation and includes specific measures targeted to interruption of parasite transmission. Prior to the “attack phase” of the program, base-line data are collected to serve as references for measuring control progress. Important base-line data are the prevalence of *E. granulosus* in dog populations, the age-dependent prevalences of cysts in cattle, sheep and other domestic ungulates, and human cases of CE. Modern techniques can now be used for surveys; for example, the coproantigen ELISA can be used to detect *E. granulosus* in dog populations (instead of arecoline testing) and ultrasonography alone or in combination with serology can be used for mass diagnosis of CE in humans [67].

In addition to targeting risk factors and transmission, control and prevention strategies of cystic echinococcosis also aim at intervening at certain points of the parasite‟s life cycle, in particular, the infection of hosts (i.e. especially dogs) that reside with or near humans. For example, many countries endemic to echinococcosis have implemented programs geared at de-worming dogs and vaccinating dogs and other livestock, such as sheep, that also act as hosts for *E. granulosus*. Careful washing of vegetables and contaminated fresh produce can also reduce infection. Prohibition of home-slaughter of sheep will prevent dogs from consuming infected viscera, thus disrupting the life cycle of the parasite [68].

3. Materials and Methods

3.1 Study Area and Animals

The study was conducted from November, 2015 to March, 2016 in Bishoftu municipal Abattoir, which is found in Bishoftu town, located in Central Oromia regional state, at a Distance of 47 km of the South Eastern part of Addis Ababa. It is the main city of Ada‟a Liban district, which is located at 9^0Nlatitude

and 39° E longitude with an altitude of 1860 meter above sea level [62]. The study animals were cattle presented to Bishoftu municipal abattoir from November, 2015 to May, 2016 for slaughtering and the study animals was taken randomly and routinely inspected for cystic echinococcosis.

3.2. Study Design

A cross-sectional study designs was employed to generate the desired data. It was of Active abattoir survey carried out from November, 2015 to May, 2016 at Bishoftu Municipal abattoir on three days per week and according to the standard procedures Recommended for ante mortem and post mortem inspection by [47].

3.3. Sampling Method and Sample Size

A systematic random sampling technique was employed to choose the study animals. The total number of cattle required for the study was calculated based on the formula given by [69]. The sample size was determined based on expected prevalence of 46.5% (Yilma Jobre *et al*., 1996) reported around Bishoftu, 5% accepted level of precision and 95% confidence interval using the following formula:

$$N = \frac{(1.96)^2 (P_{exp})(1-P_{exp})}{d^2}$$

Where,
N = Total number of sample size
P_{exp} = Expected prevalence
d=Absoluteprecision

Accordingly, a minimum sample size required for the study was calculated to be 382 cattle. But to increase the level of accuracy of determining the prevalence, the sample size was increased to 420.

3.4. Study Methodology

3.4.1. Ante Mortem Examination

During ante mortem examination each of the study animals was given identification number by using ink. Age, breed and body condition of animal‟s were also recorded. Estimation of age was carried out by examination of the teeth eruption and wear, following the approach forwarded by [30] (Annex 4). For simplicity, animals were grouped in to two age categories: those less than or equal to 5 years as young, and those above 5 years old as adult. The body condition scoring was performed on a 1 – 9 scale according [27]. During data analysis, ages were classified in to three groups as lean (Score 1, 2 and 3), medium (Score 4-6) and fat (7-9).

3.4.2. Postmortem Examination

At postmortem examination, organs of the abdominal and thoracic cavities namely; Liver, lungs, heart, spleen and kidney were inspected for the presence of hydatid cyst And organ distribution by applying the routine meat inspection procedures [42]. If evidence of hydatid cyst is found, the primary examination involved was visualization and palpation of organs and muscles. Secondary examination involved further incision of each organs; particularly lungs, liver, spleen, kidney and heart. In the case, when and where a single or more hydatid cysts are found, each organ hydatid cysts are carefully removed and separately collected (In organ basis) in clean containers for further cyst characterization to assess the status of the cysts. The number of cysts was recorded, as well as calcified cysts was registered.

3.4.3 Cyst characterization

All collected hydatid cysts were subjected to cyst fertility and viability studies. The pressure of the cyst fluid was reduced by using a sterile hypodermic needle. Then, cyst was incised with a sterile scalpel blade and the content was poured into a glass petri dish and examined under stereo microscope for the presence of protosclices. If protosclices were present, seen as white dotes on germinal epithelium or brood capsule or hydatid sands within the suspension, the cyst was categorized as fertile. Fertile cysts were subjected to viability test. A drop of fluid from cyst containing the protoscolices was placed on the microscope glass slide and with a cover slip and observed for amoeboid like peristaltic movements, with X40 objective. For clearer vision, a drop of 0.1% aqueous eosin solution was added equal volume of protoscolices in hydatid fluid on microscope slide with the principle that viable protoscolices should completely or partially exclude the dye, while the non-viable protoscolices absorb the stain [43] Furthermore, infertile cysts were further classified as sterile or calcified. Sterile hydatid cysts were characterized by their smooth

inner lining usually with slightly turbid fluid in its content. Typical calcified cysts produce a gritty sound feeling up on incision [44] (Annex5).

3.5. Statistical Analysis

All data analyses were performed by IBM© SPSS® Statistical package version 20 [39]. The animal prevalence level was defined as the number of positive per 100 animals examined. Estimates of prevalence were given in ±95% confidence interval (CI). Chi-square ($\chi 2$) and multivariable logistic regression analyses were used to examine the effect of risk factors on animal prevalence (P). A $\chi 2$ value and associated odds ratios (OR ±95% confidence interval) were estimated. A p value < 0.05 was considered to be statistically significant.

4. Results

4.1. Prevalence of Bovine Hydatidosis in Cattle Slaughtered at Bishoftu Municipal Abattoir

The present study showed that from a total of 420 cattle slaughtered and examined at Bishoftu municipal abattoir, 161 were found positive of hydatidosis with an overall Prevalence of 38.3 %. The 95% CI of hydatidosis (or cystic echinococcosis) Prevalence in cattle was estimated at 33.66 —43.17. The prevalence of bovine hydatidosis across different breeds was found to be 38.3% and 38.5% in local and cross breeds, respectively. Hence, breed types were shown to be not differing in their prevalence of hydatidosis (OR=1.006, $p > 0.05$). Rate of infection of hydatidosis with Respect to age group has statistically significant (OR=1.637, $p = 0.00$) association, Being higher in cattle above five years (41.7%) than in five and below five years old group (30.44%). Also the result revealed that highest prevalence of bovine hydatidosis was recorded in cattle with lean body condition (54.5%) followed by medium (34.4%) and the lower prevalence was observed in fat body condition (27.3%), with strong statistical significance difference between body condition score of the animal and occurrence of the disease(OR=1.558 p=0.02) as depicted in Table 4.1.

Table 4.1: Prevalence of bovine hydatidosis in cattle slaughtered at Bishoftu municipal abattoir and effect of various risk factors on the prevalence

factor	Category	Number of examined	Prevalence (%)	±95%CI	OR	P value
breeed	Local	407	38.3	33.6_43.2	1	1.00
	Exotic	13	38.5	13.8_68.4	1.006	
Age group	≤	125	30.4	22.4_39.2	1	0.00
	>	295	41.7	36.00_47.5	1.637	
Body condition	Lean	142	54.5	40.8_57	1	0.002
	Medium	212	34.4	28.06_41.2	1.558	
	Fat	66	27.3	17.03_39.6		
Total	420	420	38.3	33.66_43		

4.2. Distribution of Hydatid Cyst between the Internal Organs

The postmortem inspection revealed that different organs were affected with hydatid Cyst. Out of 420 animals examined, 101 (62.7%) cattle had affection of a single organ (lung, liver, kidney or heart), whereas 60 (37.26%) had affection of two or three organ systems. In this study there was no cattle found affected with hydatidosis at more than three organs at the same time. In majority of the animals harboring hydatidosis, the cysts had the tendency to be located more in lungs and liver than in other organs such as heart, spleen and kidneys. The total number of organs with one hydatid and their relative proportion of each organ is as follows: lung only 86 (53.41%), liver only 10 (6.21%), kidney only 4 (2.48%), heart only 1 (0.6%), spleen only 0 (0%).

54 cattle (33.54%) were found harboring both lung and liver infections, 2(1.24%) were found harboring both lung and kidney infections. 2 (1.24%) and 2 (1.24%) hydatid infections in their lungs, liver and spleen and lungs, liver and heart, respectively were also observed in the study period as it could seen on table 4.2.

Table 4.2: Distribution of hydatid cysts in different visceral organs of cattle Slaughtered at Bishoftu Municipal Abattoir.

Affected organ	No. of infected animal	Proportion from infected (%)
Lungs only	86	53.41
Liver only	10	6.21
Kidney only	4	2.48
Spleen only	1	0.6
Lung and liver only	54	33.54
Lung and kidney only	2	1.24
Lung, liver and spleen only	2	1.24
Lung, liver and heart only	2	1.24
Total	161	100

Single and multiple hydatid cyst distributions were recorded in different organs of Infected cattle. The total number of organs affected by one or more hydatid cyst(s) Was found to be 180 out of which lung account for 101 (66.73%), liver 68 (31.52%), Kidney 6 (0.96%), spleen 2 (0.3%) and heart 3 (0.48%). Among the different organs Affected, lung and liver constituted almost 98% of the overall infection of the organs. The number of cysts found range from 1-25 in the different organs, the highest Number of cysts (n=25) was observed in lung and liver (Table 4.3).

Table 4.3: The total number, relative prevalence and number of cysts harbored in Affected organ of infected cattle.

Affected organ	No. of infected organ	Relative prevalence	Cyst count		Total
			mean	range	
Lung	101	66.73	6.81	1-25	688
liver	68	31.52	4.78	1-20	325
kidney	6	0.96	1.6	1-5	10
Spleen	2	0.3	1.6	2-3	3
Heart	3	0.48	1.5	1	5
	180	100	3.25	-	1031

4.3. Cyst Fertility, Viability and Sterility

During the study period, out of the total 82 cysts examined, 33 (40.24 %) were calcified, 35 (42.68%) were sterile, and 14 (17.07%) were fertile of which (13.33 %) Viable. The cyst condition by organ involvement was found to be 23 (51.11%) sterile, 12 (26.67%) fertile, of which 6(50%) were viable and 10 (22.22%) were calcified in the lung. 8 (25%) sterile, 2 (6.24%) fertile of which 1 (50%) were viable, and 2 (68.75%) were calcified in the liver, but cysts in spleen, heart and kidney were sterile.

5. Discussion

Hydatidosis is known to be livestock and public health important disease and forestablishment of a control strategy, detailed information on local epidemiology andsignificance of the disease must be known. The overall prevalence of bovinehydatidosis in Bishoftu municipal abattoir in the present study was 38.3%. The present finding is lower than the 46.5% figure reported by [65] at the same study area but different times. The difference may be due to a decrease in illegal slaughtering of animals over the length of study period, which subsequently lade to a reduced in infection rate in dogs. When compared with other reports this study is higher than 16% prevalence of bovine hydatidosis reported at Wolaita Sodo municipality abattoir [65], 28.6% at Gonder ELFORA® abattoir , 25.92% at Shire municipal abattoir [34]. However, it is lower than the findings from different places in Ethiopia like 61% in Assela[69], 52.69% in Hawassa [52], 48.9% in Debre[21], and 40.5% at Addis Abeba abattoir enterprise [22]. A possible reason for the variation in prevalence of hydatidosis among different geographical locations could be associated with the straindifference of *Echinococcus granulosus* that exist in different geographical locations, age of the animals and other factors like socio-economic activities and management of dogs in different region [25]. Estimating the rate of infection of hydatidosis between breeds of cattle was one of the objects of this study. Accordingly there is no statistical significant association (p >0.05, OR = 1.006) between the breeds. However, this may not reflect the true pictureBecause only 13 (3.1%) cross breeds were included in the study. This is due to Slaughtering of higher number of local breeds in the municipal abattoir than cross and Exotic breeds. But according to [61] there is Significant variation (p < 0.05) between the breeds which shows higher prevalence in Local breeds than cross breed cattle, this is mainly due to production system, local Breeds are used for extensive production system, so the animals are expose to the Parasite, while the cross breed were intensive farming system so less exposed to the Parasite and regularly treated with anthehelmentic. With regards to rate of infection of hydatidosis in different age groups of cattle, Significant difference (P < 0.05) was observed. Animals with more than 5 years of age (41.7%) were highly affected than five or bellow five years old (30.4%). This finding is in agreement with report of [66] at Nekemte Abattoir, [48] at Ambo abattoir. The difference in infection rate could mainly be attributed to the fact that aged animals are exposed over a long period of time to *E. granulosus* eggs. Moreover, the growth of the hydatid is slow, maturity being reached in 6 to 12 months [59]. Thus the reason for the lower prevalence rate of hydatidosis in young cattle may be due to early culling of the infected young cattle through selling or slaughtering before they reach old age[60]. In this study, an assessment was made to establish relationship between body condition scores and the occurrence of the disease. Animals with lean body condition were found to have highest infection rate (49.3%) followed by medium (34.4%) and fat body condition score (27.3%). These results are fully consistent with those obtained by [61],explained that in moderate to severe infection, the parasite may cause retarded performance and growth, reduced quality of meat and milk, as well as live weight loss. In the current study the lungs and liver are the most commonly infected organs, with prevalence of 66.73% and 31.52% respectively, whereas the kidney, heart and spleen are the least affected organs. Similar findings were also obtained by [33]. It has been indicated that the lungs and liver are the most commonly affected organs with hydatid cyst. This is due to the fact that lungs and liver possess the first great capillaries‟ sites encountered by the migrating echinococcus 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. Likewise, due to older age of slaughtered cattle, during which time the liver capillaries are dilated and most oncosphere pass directly; additionally, it is possible for the hexacanth embryo to enter the lymphatic circulation and be carried through the thoracic duct to the lungs in such a way the lung may be infected before or instead of the liver [45].

However, development of hydatid cyst occurs occasionally in other organs and tissue when onchosphere escape in to the general systemic circulation [48]. The proportion of animals with fertile, viable cysts is an important indicator of the significance of a species as an intermediate host. Viable cysts may play an active role in disease transmission. The finding of 42.68% sterile, 26.67% fertile and 40.24% calcified cyst may generally imply that most of the cysts in cattle are infertile. The variation in fertility rate among different species in different geographical zone could be due to the

difference strain of *Echinococcus granulosus* [56]. The fertility rate of cysts among the organ was found higher in lungs (26.67%) as compared to liver which was (6.24%) while the liver harbored higher number of calcified cysts. This finding was in agreement with the reports of [70]; This could be due to the relatively softer consistency of the lung allows easer development of the pressure cyst and fertility of hydatid cyst may show tendency to increase in advanced age of the hosts, while the higher yield of calcified cysts in liver could be attributed to relatively higher reticuloendothetial cells and abundant connective tissue reaction of the organ [71]. The variation between tissue resistances might also influence the fertility rate of cysts with respect to organ type; for example, host reaction that limit fertility rate of hydatid cysts in liver is more than in that of the lungs.

6. Conclusion

From the present study, it can be concluded that hydatidosis was one of a very Common parasitic disease in cattle slaughtered at Bishoftu Municipal Abattoir. The Overall prevalence of the disease in the study area was 38.3%. This is due to a habit of Feeding dogs with raw visceral, lack of adequate meat inspection and the absence of Proper fencing, disposal pits for slaughterhouses (where dogs and other carnivores get an easy access) and presence of more stray dogs that visits the abattoir ground and fed on condemned organs, favors the disease transmission in this area. The lungs and liver are the most commonly infected organs, whereas the kidney, heart and spleen are the least affected organs. Though large number of cysts in cattle were sterile, the presence of higher proportion of viable cysts among the fertile cysts indicate that cattle may play important role in the life cycle of this serious zoonosis and the presence of potential risks of transmission to other intermediate hosts and human population of the study area. In line with above conclusion and in view of the results obtained from this study, it is important to forward some general and specific recommendations to the realities of the study area as follows:

- To break the life cycle, feeding of infected or undercooked offal to dogs and canine species should be avoided and prevent their access to condemned organs from abattoirs. All infected visceral organs should be buried.

- Awareness creating programs should be given for butchers, abattoir workers and dog owners as to the dangers of hydatidosis to human and animal health.

- Dog proof garbage collection and waste disposal system should be applied, Particularly around slaughter places and abattoirs.

- Reduction of stray dog‟s population to reduce the risk of hydatidosis to animals and humans should be incorporated with ant rabies campaign for successful Outcome. Detailed studies should be conducted on epidemiology of the disease in order to Expand and implement disease investigation

Conflict of Interest.

There is no any conflict of interest in the publication of this manuscript and control strategy.

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