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Prevalence, economic importance of cystic Echinococcosis in cattle at Wolita Soddo, municipal abattoir, Southern Ethiopia.

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Abstract

A cross- sectional study was conducted from November 2013 to April 2014 to estimate the prevalence, financial significance and characterizing cyst due to hydatidosis in cattle slaughtered at WolitaSoddo municipal abattoir. Out of the total 412 cattle examined visually and manually (palpation and incision), 71(17.2%) were found harboring hydatid cysts. A significantly higher infection was detected on cattle greater than five years ($p<0.05$) and less than or equal to five years. Regarding body condition score and origin, no significant variation ($p>0.05$) was observed as the prevalence was (22.2%) for poor cattle, (17.3%) for medium cattle and (14.5%) for fat cattle. Of the total 71 infected, 43(60.6%) had hydatid cysts only in the single organ, while the rest 28(39.4%) had multiple organ infections. Of the 112 viscera's harboring hydatid cysts, the higher 51(45.5%) in lung, 39(34.2%) in liver, 12(10.7%) in kidney and 10(9.0%) found in spleen. Of the total 112 hydatid cysts counted,47(41.2%), 35(31.3%) and 30(26.8%) were found to be small, medium and large respectively. In addition, out of the total 112 cysts collected, 30(26.8) were fertile, 73(65.2%) sterile and 9(8.0%) calcified cysts. There was a significant difference in fertility of cyst from different organs ($p<0.05$), those of lung origin being highly fertile. Likewise, out of the 30 fertile cysts subjected for viability test, 13(43.3%) were viable and 17(56.7%) were non-viable. Considering the current result, the total annual financial loss from organ condemnation and carcass weight loss due to bovine hydatidosis at WolitaSoddo municipal abattoir was estimated at 1,368,804.3456 ETB.

Keywords: Abattoir, Hydatidosis, Economic loss, Prevalence and Wolita Soddo

1. Introduction

Cystic echinococcosis (Hydatic cyst) is a zoonotic disease that occurs throughout the world and it causes considerable economic loss and public health problem in many countries [5]The disease has greater public health significance and economic impact in countries where the livestock industry isa significant segment of agriculture sector and when livestock production is basedon extensive grazing system [10]. It causes production loss in cattle; productivity (reduction in carcass weight), offal (liver, lung etc) and fertility lose [8]

The species of genus Echinococcous are recognized and regarded as taxonomically valid; *E.granulous* (cystic hydatidosis), *E. multilocularis* (multivescularhydatidosis), *E. vogeli* (polycystic hydatidosis) and*E. Oligarthus*[19]. This four species are morphologically distinct both the adult and the larval stages. In addition to this, several different strains of *E.granulous* and *E. multilocularis* are recognized[9]. The development of strains may result of the fact that flat worms are hermaphrodites which produce themselves through cross or self-fertilization; A single mutant can produce large genetically

identical populations that differ from the original genus. These populations are referred to as strain[19]. Of four accepted species in the genus, *Echinococcus*, *E. granulosus* and *E. multilocularies* have veterinary and public health significance [17]. However; it is recently indicated that infection in human is also caused by *E. vogeli* and *E. oligarthus* [47].

Morphologically, Echinococci are the smallest of all flat worms (3-4um) long with no gut and metabolic interchange take place across syncytial covering, the tegument anteriorly two hooks and four muscular suckers. The body or stobilia is segment and consist of a number of the reproductive units or proglotids [7and Deplazes, 2004).The life cycle of Echinococcsus is indirect[39]. Unlike taenia the larval stage of (meatcestode) of the Echinococcsus exhibit low degree of host specificity and has much greater reproductive potential. As with all members of family taenidae, Echinococcus requires two mammalian hosts for the completion of its life cycle [40].One with definite host carnivore and the other intermediate host. In the definite host the adult, strobilar stage develops in small intestine and an intermediate host in which the cystic meatcestode usually develops in visceral[49].

The infective eggs containing onchosphere which are capable of prolonged survival outside the most being viable on the ground for two years are accidentally ingested by intermediate host; they penetrate the gut wall and travelled in the blood to the liver or in the lymph to the lungs. These are the most common sites for the larval development, but occasionally onchospheres escape in the general systemic circulation and develop in other organs and tissue. In the liver and lung the cyst may have develop up to diameter 20cm, but in rare sites as the abdominal cavity where unstricted growth is possible, it may be very large and contain several liters of fluid[18]. The life cycle is completed when fertile hydatid cyst is eaten by a definite host, the dog or the appropriate carnivores and its prepetent period in the final host is around 40-50 days, after which only one gravid segment shed per week [5]. Even though the onchospheres are capable to out stand the environmental condition, the survival of the eggs influenced by environmental factors such as low humidity and high temperature, the desiccation is detrimental and they will only a short time when expose to direct sunlight and dry conditions [27].

The pathogencity heavily depends on the extent and severity of the infection and the organ on which it situated [28]. In domestic animal the hydatid cyst in the liver or lung is usually tolerated without any clinical sign and the majority of the infections are only revealed at the abattoir [30].In contrast, when man involved man involved asintermediate host, it is particularly serious because the cyst may rich any part of the body especially lung and lung and if both lungs affected it cause respiratory symptom and if several hydatid is present in the liver, it causes gross abdominal distention [38].

Control and preventive measures are break the life cycle between the definite and the intermediate host. These measures include regular periodic de-worming of dogs, inspecting meat, educating the public on the risk to humans, avoiding feeding offal'sto dogs, prevention of enter to slaughter house, destroying all offal's containing cysts and washing vegetables before eaten. Application of these and other strict measures have greatly reduced or eliminated the disease from countries, notably in Iceland, disease can be controlled successfully through health education, appropriate legislation and announcing the people to understand the life of cycle of the disease [1].

Varies investigation have been conducted through abattoir survey to determine the status and financial significance of organs condemnation due to hydatidosis [37, 20; 38]. However, there is no recent information regarding to prevalence and financial significance of hydatidosisin Wolita Soddo. Hence, it is essential to have information on the status of hydatidosis with regard to its magnitude occurrence and financial significance.

The objectives of this research study were:

- To estimate the prevalence and the status of hydatidosis in bovine; and estimate direct and indirect economic losses associated with the disease at Woita Soddo, municipal abattoir.

2. Materials and Methods

2.1. Study area

The study was conducted at Wolita Soddo municipal abattoir from November 2013 to April 2014. Wolita town is located South of Addis Ababa,West and North of Hawassa, and East of. The Wolita located on the highland, with an altitude ranging from 1900-2800meters. The area receives average annual rainfall ranging from 1800mm and characterized by bimodal rainfall with long rain period (June to mid-October) and short rainy period (March to April). The mean annual temperature and humidity on average from 12 to 14 and 50% to 60% respectively. Main occupational of rural population is mixed farming system. The livestock population of Wolita is cattle (692,222), sheep (112,939), goats (81,939), horse (3,303), donkey (30, 621) and poultry (378, 422) (CSA, 2003).

2.2. Study animals

Cattle presented Wolita Soddo abattoir for slaughter were used for the cross-sectional survey. The study animals were all cattle brought for slaughter from different parts of Wolita districts. They are transported to abattoir by vehicles from far area and on foot from surrounding districts. According to the information obtained from the abattoir the average cattle slaughtered annually were 8600. It was difficult to exactly trace back the origin of the animals slaughtered at the study area because the merchants do not know the origin of the animals. However, it is generally know that the majority of slaughtered animals came from places such as Mirab Abaya, Dawro, Halaba, Gamogofa, Hossana and most of them were brought from surrounding districts.

2.3. Study design

A cross-sectional study was conducted to determine prevalence, financial, public health significance and cyst characteristics of cystic Echinococcosus at Doyogena municipal abattoir. Systematic (three slaughtering days per week) visit made to Wolita Soddo abattoir November 2013 to April. In this study, randomly selected visceral organs of male animals were inspected for the presence of cysts Echinococcosus in different organs.

2.4. Sample size determination

The sample size was determined by 95% confidence interval at desired accuracy level of 5%. The sample size was calculated according to [11]. N =1.96 Pexp (1-Pexp)/d, were: n = required sample size, Pexp = expected prevalence, d = desired absolute precision. The determined sample size was 206. However, to increase precision of the study, a total 412 cattle were randomly sampled and examined for the presence of hydatid cysts.

2.5. Study methodology

2.5.1. *Ante mortem* examination

Regular visit were made to conduct *ante mortem* examination of animals brought for slaughter. During *ante mortem* examination, each of the study animals was given an identification number (with a paint mark on their body). Body condition score of the study animals recorded [31].Estimation of the age was carried out by examination of each the teeth eruption using approach forwarded by[41]. Two age groups were considered; less than or equal to five years and above five years old and origin was also recorded as highland >1500 m.a.s.l and lowland <1500 m.a.s.l, Since almost all the cattle presented to slaughtering in the study area were male, the body condition scoring was classified into three categories as poor, medium and fat according to [2].

2.5.2. Post mortem examination

During the *post mortem* inspection those animals were identified systemically according to their identification number were thoroughly inspected by visualization and palpation of each visceral organs particularly lung, liver, spleen, kidney and the presence of hydatid cystsand organ distribution were recorded. Hydatid cysts were carefully removed and separately collected in clean containers for further cyst characterization. Hydatid cysts characterization was made to assess to the status of cysts. The size (diameter in centimeter) of each and individual cyst randomly selected were measured and the number of the cyst per organs (Annex 2). During *postmortem* inspection, all organs harbornighydatid cyst were condemned and judged according to the guidelines on meat inspection for developing countries and cysts were classified as small (<4cm), medium (4-8cm) and large (>8cm) according to [22].

2.5.3. Hydatid cyst status characterization

After each hydatid cyst was randomly collected from different organs it was taken to laboratory and examine for fertility and viability. The pressure of cysts fluid were reduced by a sterile hypodermic needle, then cyst was incised with a sterile scalpel blade and the content was poured into glass petridish and examine for the presence of protoscolices either attached to germinal layer in the form of broad capsule or its presence in the fluid. If protoscolices are present they are as white dots on the germinal epithelium or broad capsules or hydatid sand within suspension, they cysts are characterized as fertile, if not they are considered as sterile cysts [32].

Fertile cysts were further subjected to viability test. A drop of sediment containing protoscolices was placed on microscopic glass slide, cover with cover slip and observed at 40x objectives of compound microscope, viable cysts shows amoeboid like peristaltic movements. For clear vision, a drop of 0.1% of aqueous Eosin solution was added to equal volume of the protoscolices containing hydatid fluid on microscopic slide with the principle that viable prooscoloses should partially or completely exclude the dye and while non – viable or dead ones take it up, thus the technique differentiate between dead (red stained) and live one (unstained) protoscolices [42].Sterile hydatid cysts are characterized by their smooth inner lining, usually with a slight turbidity of the contained fluid and typically calcified cysts that produced a gritty sound feeling upon incision [3].

2.6. Economic loss estimation

Annual financial loss due to hydatidosis in cattle was estimated from the cost of organs condemned (lung, liver, spleen and kidney) and the carcass weight loss due to the disease. The average price of different organs was obtained from butchers. The parameters considered to estimate the financial loss from carcass weight loss include information on the mean retail market cost of 1kg beef at Wolita town obtained from butchers during study period (Table 6). The average annual slaughter rate of cattle at Wolita Soddo municipal abattoir was estimated from retrospective data of the last five years. Then, the average carcass weight loss was estimated according to [13] considering a 5% carcass weight loss as a result of hydatidosis and the loss from organs condemned was calculate by using the formula [23].

2.6.1. Direct loss from organ condemnation

LOC = (NAS phpluCplu) + (NAS phpliCpli) + (NAS phpsp C psp) + (NAS phpikdCkid) where: LOC = loss due to organ condemnation ; NAS = average number of cattle slaughter annually; ph = prevalence of hydatidosis; plu = percent involvement of lung; Cplu = current mean retail price of lung; pli = percent involvement of liver; Cpli = current mean retail price of lung; psp = percent involvement of spleen; Cpsp = current mean retail price of spleen; pkid = percent involvement of kidney; Ckid = current mean retail price of kidney.

2.6.2. Indirect loss from carcass weight loss

The economic loss due to caracass weight loss was determined as described by [11].

LCWL = NAS phCpB 5% 126kg where: LCWL = loss from carcass weight loss; NAS = average number of cattle slaughtered annually; ph = prevalence of hydatidosis; CpB = current average price of 1kg beef Doogenatwon; 5% = estimated carcass weight loss due to hydatidosis (polydorous, 1981); 126kg = average carcass weight (dressing percentage) of adult zebu (ILCA, 1979). The total financial loss is calculated by considering the loss from both organ comdemnation (LOC) and carcass weight losses (LCWL) that is:

Total loss = LOC + LCWL

2.7. Data analysis

Data obtained from ante mortem and post mortem findings and characterization of cysts were stored in Microsoft excel 2007 spread sheet computer program. The data was analyzed by using SPSS – 20 versions and the chi – square test was applied to compare the infection status with regard to the hypothesized risk factors like origin, body condition and age.

3. Results

3.1. Overall prevalence of hydatidosis

Out of 412 cattle slaughtered and examined, 71 (17.2%) were infected with hydatid cyst, harboring one or more cyst in different visceral organs (liver, lung, kidney and spleen).

3.2. Prevalence of hydatidosis and risk factors

Data on the occurrence of the infection and assumed risk factors such as origin, body condition and age has made by using proportion and chi – square test (Table 1). The factors like origin and body condition did not show significant difference with regard to cyst detection (p> 0.05), but there were significant difference between age groups (p < 0.05)

Table 1: Prevalence of hydatidosis and risk factors

Variables	No of animal examined	No of positive cases	Prevalence (%)	X2	Df	P value
Origin						
Highland	245	47	19.2	1.612	1	.204
Lowland	167	24	14.4			
BCS						
Poor	81	18	22.2			
Medium	179	31	17.3	.496	2	.780
Fat	152	22	14.5			
Age						
Group 1(<5)	62	5	8.1	4.301	1	.038
Group2 (>5)	350	66	18.9			
Overall	412	71	17.2			

BCS = Body condition score

3.3. Distribution of hydatid cyst in different organs of positive cattle

Distribution of hydatid of the cyst in different organs of cattle slaughtered at Wolita Sodo municipal abattoir was described in Table (2). Of the 71 cattle in positive for cyst, 43(60.6%) of cases were bearing cysts in single organ while remaining 28(39.4%) cases with multiple organ involvement.

Table 2: Distribution of the hydatid cysts in different organs of positive cattle

Organs infected	No of cattle examined	No of cattle infected	Prevalence from totally examined	Prevalence infected animals
Lung	412	18	4.37	25.4
Liver	412	16	3.88	22.5
Kidney	412	5	1.21	7.0
Spleen	412	4	0.97	5.6
Lung & liver	412	19	4.62	26.8
Lung & kidney	412	2	0.49	2.8
Lung & spleen	412	1	0.24	1.4
Liver & kidney	412	2	0.49	2.8
Liver & spleen	412	3	0.73	4.2
Kidney & spleen	412	1	0.24	1.4
Totally	412		71	100%

3.4. Distribution of cysts in different organs based on their size in cattle

Out of 112 cysts detected from different organs, 51 (45.5%) were in lung, 39 (34.8%) in liver, 12 (10.7%) in kidney and 10 (9.0%) in spleen. On the other hand, size category of the cysts indicated that 47(41.9%), 35(31.3%), 30(26.8%) were small, medium and large respectively. The observed distribution of cysts in different organ based on their size shown in (Table 3).

Table 3: Distribution of cysts in different organs based on their size in cattle

Cyst type	Organs inspected/examined n %				
	Lung	Liver	Kidney	Spleen	Total
Small	9(17.6)	19(48.7)	10(83.3)	9(90)	47(41.7)
Medium	18(35.3)	14(35.9)	2(16.7)	19(10)	35(31.3)
Large	24(41.7)	6(15.4)	0(0.00	0(0.0)	30(26.8)
Total	51(45.5)	39(34.5)	12(10.7)	10(9.0)	112(100)

3.5. Cyst status characterization

Out of the 112 hydatid cysts collected and examined for the status of the fertility and viability 30(26.8%) fertile and 73(65.2%) sterile and 9(8.0%) calcified (Table 4). Those cysts that are fertile are tested for viability, 13(43.3%) are viable and 17(56.7%) (Table 5).

Table 4: Fertility/Sterility of cysts collected from different organs of cattle slaughtered at Wolita Soddo municipal abattoir.

Organ	Fertile cyst	Sterile cyst	Calcified	Total
Liver	5(16.7)	27(36.9)	7(77.8)	39(34.8)
Lung	25(83.3)	24(32.9)	2(22.2)	51(45.5)
Kidney	0(0.0)	12(26.4)	0(0.0)	12(10.7)
Spleen	0(0.0)	10(13.7)	0(0.0)	10(9.0)
Total	30(26.8)	73(65.2)	9(8.0)	112(100)

Table 5: Viability statuses of fertile cysts collected from organs of cattle slaughtered at Wolita Soddo municipal abattoir.

Organ	Viable cyst (%)	Non viable cyst (%)	Total
Lung	12(92.3)	13(76.5)	25(83.3)
Liver	1(7.7)	4(23.5)	5(16.7)
Total	13(43.3)	17(56.7)	30(26.8)

The assessment of the mean retail market price of each organs and the number of organs condemned during the study period (Table 6).

Table 6: Number of organs condemned, their current average market price of each organ (2014) the percent involvement and price of 1kg beef in Wolita Soddo.

Organs condemned	No of organs condemned	Percent involvement (%)	Average price per organ	Total price of organs
Lung	51	45.5	16	816
Liver	39	34.8	96	3744
Kidney	12	10.7	20	240
Spleen	10	9.0	6	60
1kg beef			140	
Total	112	100%		4860

3.6. Economic loss estimation

Loss due to organ condemned was estimated at 64, 179.9456 ETB annually and due to carcass weight loss was 1, 304, 654.40 ETB. The total annual loss encountered due to hydatidosis in cattle slaughtered at Wolita Soddo municipal abattoir is estimated at 1,368, 804.3456 ETB.

4. Discussion

Hydatidosis is known to be important in livestock and public health in different parts of the world and its prevalence and financial significance. The prevalence may however vary from country to country or even within a country. The study revealed that the prevalence of hydatidosis in cattle slaughtered at WolitaSoddo municipal abattoir was 17.2%. This finding is higher than 16% in WolitaSoddo [33] and 15.4% in Wolita Soddo[43]. It is much closer to reports as17.5% in [4], 17.3% in Gondar [14], 17.5% in [24], 19.7% in Addis Ababa[34]. However, it is lower than findings from different places of Ethiopia like 61.1% in A, 52.69%in [34], 48.9% in Debremarkos [32] 32.1% in [21], 34.05% in [10]. This variation in prevalence in different area mainly due to the different in the strains of the Echinococcus that exist in different geographical situations [44] and the factors like difference in culture, social activity and the attitude to the dog in different regions.

The prevalence of present study in the study area is much lower than reported in other areas of the country. The lower hydatidosis were found compared to others areas of the country was might be due to the origin of the slaughtered animal, in which the majority of the cases came from the lowland and surrounding districts; where the environment conditions such as high temperature and low humidity (adverse conditions for the survival of the eggs of the echinococcus) exist. This is agreed with [5] suggestion. In contrast this report in some exent higher than the report that mentioned above this due to this due to strains of *E.granulosus* distribution[3]. On another way this variation could be resulted from different livestock management system, backyard slaughtering of cattle, inappropriate removal of infected offal's and keeping of animals in close relation with dogs [15]. In addition most rural communities use dogs as guards, which is the primary factor for the disease transmission. Moreover, poor public awareness about the disease and presence of few slaughter houses could have contributed to such a higher prevalence rate. In the study period higher prevalence of hydatidosis were recorded in cattle from highland areas (19.2%) followed by lowland areas (14.4%) this might due to abundance and frequent contact between the infected intermediate and final hosts. It could also be associated to slaughtering of aged cattle which have had considered chance of expose to the parasitic ova, backyard slaughtering of small ruminants and provision of infected offal's to pet animals around homesteads. And most people in town Owen dogs, this in case maximize or perpetuate the life cycle of the hydatidosis. This high prevalence in the study area was also due to the survival of Echinococcsus eggs for several months under moist condition and moderate temperature [25].

During the study period there was no significant difference ($p>0.05$) observed with regard to body condition of the animals. This might be due to animals indiscriminately exposed to hydatidosis irrespective of their body condition. In that most animals presented to the abattoir have a medium (34.4%) and fat (36.9%) body condition, because people in study area prefers good quality meat especially for raw meat consumption (''kurt'').

With regard 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 were highly affected. The difference in infection rate could be mainly due to longer exposure time to *E.granulosus* and to lower immunity against the infection. In addition, the reason for lower prevalence in below five years cattle could be to early culling of the infected young cattle through slaughtering before they reach old age. This finding was similar with finding of [33, 45, 2 and 45].

The highest number of cyst is small in size (41.9%), this might due to the fact the infected cattle are slaughtered before the cyst become large in size. The high proportion of the small size cyst may also indicate continuous grazing in the past rainy seasons where moisture and the rainfall favour the survival of the eggs of *E.granulous* species and at the same time eggs may get chance to be disseminated by flood. This might be due to immunological response of the host which might have reduced the expansion of the cyst[6]. The greater number of large sized (47.1%) cysts were found in lung than liver (15.4%), while liver harbored many number of the small sized cysts (48.7%), the reason for the higher percentage of the large size cysts in lung was due to their softer

consistency which allows the easier development of the cysts while the higher number of the small cysts in liver may due to immunological response of the host which might preclude the growth and expansion of the cysts [23, 2].

In study period it has been also showed that hydatid cysts occurred most commonly in lung (45.5%) followed by liver (34.8%), kidney (10.7%) and spleen (9.0%). This finding is in the line with findings of [33],[16]and [1]. This is due to the fact that lung and liver poses first capillaries encountered by the migrating Echinococcsusonchospores (hexacanth embryo) filtrating system sequentially before any other peripheral organ is involved [10]. And also it might be due to the fact that cattle are slaughtered at old age. During this period liver capillaries are dilated and most cysts directly pass to the lungs. Additionally, it is possible for the hexacanth embryo to enter the lymphatic circulation and carried through the thoracic duct to the heart and lunds in such way the lungs may be infected before or instead of the liver [26].

The result of the present study revealed that lung is the most common organ which harbored fertile cysts followed by liver. This result is similar to other researchers such as Himones, (1987) and [36] It has been stated that relatively softer consistency of lung allow earlier development of cysts; and fertility of hydatid cysts may show a tendency to increase in advanced age of the host. Low fertility in liver may be related to reduction in immunological compatibility of the host at their older ages of infection [22]. The variations between tissues resistances of the infected organs may also influences the fertility rate of the hydatid cysts. In study period the percentage of fertile cysts recovered was 26.8%. This is lower compared to 70% in the Great Britain, 96.9% in South Africa and 94% in Belgium [9] and higher than [46] and [2] who reported 22% and 21.3% fertile hydatid cysts from central Sudan and Ngorongoro districts of Arusha region, and Tanzania, respectively.

This study also revealed that the higher proportion of the cysts were sterile (65.2%), this finding is consistency to [42] and [22] and [3]. In Britain up to 90% of the total cyst from the cattle are reported sterile. In some countries like South Africa, Belgium and Zimbabwe, 96.2%, 94.2%, and 82.2% respectively of the examined hydatid cysts of cattle were sterile. This variation in sterility was described as strain difference in different geographical zones of the globe [21] stated that strain of the parasites and the host can modify the infectivity of the parasites.

In present study, the annual financial loss due to bovine hydatidosis at WolitaSoddo municipal abattoir from direct and indirect losses were estimated to be about 1,368, 804.3456 ETB was greater than previous report by[8]410,755.90 ETB) and[15]) 244, 287.61 ETB in the same study area. However, it is lower than estimate of 1,791, 625.89 ETB loss estimates in various abattoirs and regions may be due to the variation in the prevalence of the diseases, mean annual cattle slaughtered in the area and the variation in mean retail market price of each organ.

5. Conclusion and Recommendation

Hydatidosis is the diseases of considerable financial significance in Wolita Soddo. It causes substantial direct and indirect loss in the cattle and considerable financial loss in the livestock due to condemnation of organs and carcass weight loss of the affected cattle. On the study period 17.2% prevalence were recorded with most probably affected cattle came from highland area. Regarding the cyst size, small sized cysts were frequent in liver while large sized cysts in lung. Upon characterization of the cysts, majority of them were sterile and non-viable and from those cysts majority of them were located on liver and lung. Based on the financial assessment of condemned organs there was high financial loss during the course of the study period. Therefore, based on the above conclusion the following recommendations were suggested:

- Modern slaughter houses, dog proofed fences and disposal pits should be constructed.
- Required facilities for the existing slaughter house as well as educating meat inspectors should be fulfilled.
- Immediate attention should be given to safe elimination of all condemned organs.
- Regular de-worming of housed and stray dogs must be practiced.
- Backyard slaughtering should be prohibited.
- Awareness creation program should be lunched for the butchers, abattoirs workers and meat inspectors about hydatidosis.

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