Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.125, 2025

The prevalence of abattoir diseases, Major causes of organ condemnation and associated financial loss in cattle slaughtered at Hawassa Municipality Abattoir, South Ethiopia.

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Abstract
A cross-sectional abattoir study was undertaken from November 2016 to April 2017 on cattle slaughtered at Hawassa municipal abattoir with the aim to identify major abattoir diseases of cattle and associated financial losses due to organ condemnation. Of the total 384 examined animals abnormalities were recorded in 58 (15.10%) during anti-mortem examination and 161 (41.92%) were animals from which organs condemned during post mortem examination. From the total cattle organs condmned during postmortem inspection 112 (29.16%) liver, 49 (12.76%) lungs, 10(2.6%) hearts, 4(1.04%) spleen and 3 (0.56%) tongues were condemned due to various cases. From the total affected organs, parasitic diseases take higher proportion 151/177 (85.31%) (fasciola, hydatid cyst, c.bovis and only 25/177 (14.12%) cases by bacterial disease, yellowish fluid accumulation in pericardial sac and inferfect bleeding during slaughtering. From Various disease conditions identified during the study hyadatidosis 77 (20%), fasciolosis 71 (18.5 %), cysticercosis 5 (1.3%), CBPP 6 (1.56 %), caudrosis (0.78%) and emphysematous lung 8(2.08%) were the major causes of organ condemnation. fasciolosis and hydatidosis were the most common causes of organ condemnation. In this study period the total annual financial loss due to organ condemnation was 1,639,401.56 ETB. In conclusions results of the present study justify immediate need for control and prevention of various animal diseases through development of animal health delivery method, enforcement of modern slaughter policy, strong deworming strategy of domestic animals including dogs, destruction of stray dogs which play great role in distribution of hydatid disease, training of farmers, pastoralists, meat inspectors on control and prevention of animal diseases.
Key words; *Abattoir, Condemnation, Disease and Financial Loss*
DOI: 10.7176/FSQM/125-01
Publication date: May 30th 2025

INTRODUCTION

Ethiopia has a large livestock population in Africa, which is estimated to be around 34-40 million Total Livestock Unit out of which 17% and 12% of cattle and small ruminants, respectively, are found in Ethiopia. Ethiopia is with the largest livestock in Africa including more than 55.06 million cattle, 27.8 million sheep, 28.5 million goats, 1.07 million camels, 8.5 million Equines and 65 million chickens with live stock ownership currently contributing to the livelihoods of an estimated 80% of rural population (CSA, 2009). Contradiction to having country huge number of ruminants having high contribution for meat consumption and generates cash income from export of live animals, meat, edible organs and skin. In spite of the presence of huge ruminant population, Ethiopia fails to optimally exploit these resources due to a number of factors such as recurrent drought, infrastructures problem, rampant animal diseases, poor nutrition, poor husbandry practices, shortage of trained man power and lack of government policies for disease prevention and control (ILRI, 2009).

Abattoirs provide information on the epidemiology of diseases on livestock to know to what extent the public is exposed to certain zoonotic diseases and estimate the financial losses incurred through condemnation of affected organs and carcasses (Van Longtestijn, 1993). It is necessary to have clear information on major causes of organs and carcass condemnation at the abattoir. This is important in providing information on where and how to reduce the losses that may be caused by the various abnormalities (lesions/pathology). Each year a significant economic loss results from mortality, poor weight gain, condemnation of edible organs and carcasses at

slaughter. This production loss in the livestock industry is estimated at more than 900 million USD annually (Jobre *et al.*, 1996).

At abattoir, organs and carcasses were condemned due to various pathogen/or pathological conditions. Some of the pathogens are zoonotic and has public health importance; and all causes of condemnation incur serious economic losses to the livestock industry (Desie Sheferaw and Kedir Abdu, 2017. The direct and indirect losses from livestock diseases have significance economic, food security and livelihood impacts on livestock keepers and the national economy. The widely prevalence of these diseases coupled with poor capacity of the veterinary services for early detection and response has denied the country its fair share in the international livestock and livestock products market. Moreover, some of these diseases could reach 30-50 percent (Ethiopian Veterinary Association, 2014).

The purpose of meat inspection comprising of ante mortem and post mortem examination are to remove gross abnormalities from meat and its products, prevention of distribution of contaminated meat that could result to disease risk in man and animals and assisting in detecting and eradication of certain disease of livestock (Van Longtestijn, 1993). The importance of ante mortem inspection in the abattoir has long been recognized in an attempt to avoid the introduction of clinically diseased animals into the slaughter hall. Ante mortem inspection should be done within 24 hours of slaughter and repeated if slaughter has been delayed over a day (Teka, 1997).

A proper ante mortem inspection of the animal makes the task of routine post mortem inspection simpler and straight forward procedure. Post mortem inspection is the center around which meat hygiene revolves since it provides information indispensable for the scientific evolution of clinical signs and pathological processes that affect the wholesomeness of meat (Gracey and Huey, 1999).

All gross lesions should be identified at least in a general way. A routine post mortem inspection of a carcass or an organ should be carried out as soon as possible after completion of dressing. The main purpose of post mortem examination is to detect and eliminate abnormalities, including contamination, thus ensuring that only meat fit for human consumption is passed for food. It is necessary to be aware of the extent to which the public is exposed to certain zoonotic diseases detected in abattoirs and financial losses through condemnation of organs. Meat and meat products are extremely perishable (Sirak, 1991).

Among helminthes, fasciolosis is an economically important parasitic disease, which is caused by trematodes of the genus *Fasciola* that migrate in hepatic parenchyma and establish in the bile ducts. (Aliyu *et al.,* 2014). *Fasciola* is commonly recognized as liver flukes responsible for wide spread morbidity and mortality ruminants characterized by weight loss, anemia and hypoproteinemia (Nayeb and Merab, 2010; Swamaker and Janger 2014). It causes a substantial economic loss which includes death, loss in carcass weight, reduction in milk yield, condemnation of affected liver, decline production and productive performances, exposure of animals to other diseases due to secondary complications and cost of treatment expenses (Abuna *et al*., 2010).

Hydatidosis/Echinococcosis: is one of the major parasitic causes of intensification not only its effect on animal production but also due to its public health importance. It is one of the world's most geographically widespread zoonotic diseases *(*OIE, 2002*)*. Hydatidosis in cattle is caused by the larval stage of the 2 - 7 mm long tape worm *Echinococcus granulosus,* lives in the intestine of dogs and other carnivores *(*FAO, 2007*)*. Hydatidosis is one of the major causes of organ condemnation and causes huge economic losses (Yimer *et al.*, 2005*)*.

Bovine Cysticercosis: infection with *Taenia saginata* is among the zoonotic in that it is maintained in nature with human as sole definitive host. Its life cycle is entirely dependent on the link between human and cattle so that any break in this link can result in the total elimination of the parasite *(*FAO, 2007*)*.

Emphysema refers to an excessive abnormal permanent accumulation of air in the lungs. Bovine emphysema can be excessive amounts of air pressure or secondary to either chronic bronchitis or bronchiolitis that causes obstruction of airways on expiration due to exudates plugging airway passages (McGavin *et al*., 2001). Congestion is an excess of blood contained within blood vessels in a part of the body due to a passive process. A dark blue red tinge, swollen and cooler than normal of lung was inspected and the cut surface of such tissues oozes blood freely. (Belkhiri *et al*., 2009): Cirrhosis of liver is a condition in which the liver slowly deteriorates and is unable to function normally due to chronic, or long lasting, injury. Scar tissue replaces healthy liver tissue and partially blocks the flow of blood through the liver (Makol *et al*., 2011).

In Ethiopia, there were studies conducted by (Ejeta *et al.,* 2008; Ephrem *et al*., 2012) that indicated a higher economic loss resulting from condemnation of edible organs and carcass due to parasitic causes. Nevertheless, they failed to show extent and impact of these parasitic and infectious diseases in combination as causes of organs and carcass condemnation at abattoirs. Various investigations have been conducted through abattoir surveys to determine the economic importance of organs and carcass condemnation in Ethiopia (Jembere, 2002; Assefa, 2005). Study result of some abattoirs revealed that parasitic infection of livers; pneumonia, pericarditis and nephritis are found to be the major causes of organs condemnation, with an approximate annual loss of 1,011, 020.22 ETB by Lati *et al*. (2015) Nekemte municipal abattoir and 106, 788. 18 ETB in Gondar Municipal abattoir (Yimam, 2003).

A number of abattoir based prevalence studies have been conducted on hydatidosis and fasciolosis with in different parts of Ethiopia, including SNNPR (Abunna *et al*., 2012; Demissie *et al*., 2018; Fatuma Kidane Hersi, 2017). However, there is a still scarcity of well documented and updated data about the status of major diseases and the financial loss they cause in the region.

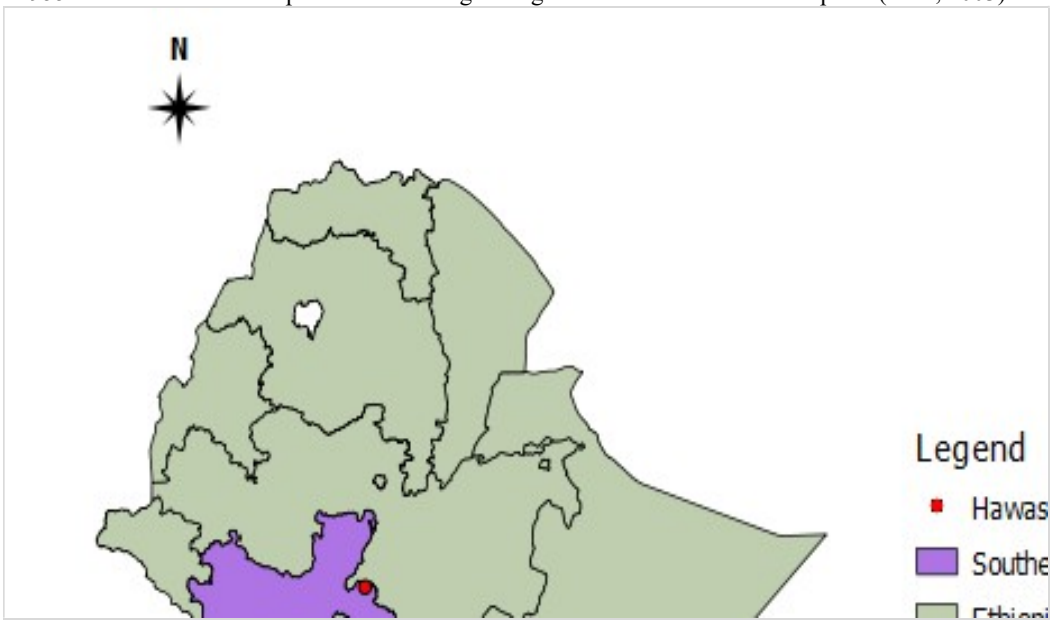
Therefore, the objectives of this study are:

- ✓ To determine the prevalence of major abattoir diseases and pathological conditions during post mortem examination.
- ✓ To asses economic losses encountered by organ condemnation.

2. MATERIALS AND METHODS

2.1. Study Area Description

The study was conducted in Hawassa abattoir which is located in Hawassa Town, at about 275 kms from Addis Ababa**.** The town is located at 07^0 63᾽ 66᾽᾽ North latitude and 038^0 484᾽ 84᾽᾽ East longitude. The agro-ecology of the area is “woinadega” (semi-arid) having an altitude ranging from 1650 to 1700 m above sea level (masl). The average minimum and maximum temperature is 20.1 and 34°C, respectively with mean annual an annual rainfall of 955 mm. The abattoir is specialized in slaughtering cattle for domestic consumption (CSA, 2003).



2.2. Study Animals

The study animals were local (zebu) breed cattle originated from different localities such as Shashmane, Kibremengist, Arsi Negelle, Tula, Negelle Borena, Yabello and Dodola were included in the study. Animals were considered in the study irrespective of their origin, age, and sex and body condition.

2.3. Sample Size and Sampling Method

Simple random sampling method was employed to select study animals for the study. The total number of cattle for the study was calculated based on the formula given by Thrusfield (2005) with 95% confidence interval and at 5% absolute precision.

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

Where N= sample size required, 1.96 = the value of z at 95% confidence level, Pexp = expected prevalence, d = desired absolute precision. Hence, the required sample size was 384 cattle examined during the study period.

2.4. Assessment of Direct Economic Loss

All affected organs and a carcass was rejected from international market. To evaluate the economic losses, only the direct monetary losses due to rejection of liver, heart, kidneys and carcass were considered. The analysis was based on annual slaughter capacity of the abattoir considering market demand, average market prices on international and the rejection rates of specific organs and carcasses. The annual slaughter rates were estimated from retrospective data recorded in the past years. The economic loss due to condemnation was estimated by the formula set by (Ogunrinade and Ogunrinade1980) as follows:

EL =Σsrx X Coy X Roz

Where:

EL = Annual economic loss estimated due to organ and carcass condemnation from International market.
Σsrk = Annual sheep/ goats slaughter rate of the abattoir
Coy = Average cost of each sheep or goats liver/ lung/ heart/ kidney/ brain and carcass
Roz = Condemnation rates of sheep/goats/liver/lung/heart/kidney/brain and carcass

2.5. Study Design and Methodology

A cross-sectional study design was conducted from November 2016 to April 2017 on cattle slaughtered at Hawassa municipal abattoir. Data were collected by Ante-mortem inspection and Post-mortem examination all animals entering into the abattoir.

Ante-mortem inspection of slaughtered cattle was made by visualization in a collection barn and the cattle were kept in the barn for 24 hours to assess any clinical signs of illness. Pre-slaughter examinations of bovine cattle were conducted in the lairage by grouping the animals based on age, sex, breed and body condition Ante mortem inspections were conducted on individual animals, while the animals were entering into the lairage and after they entered in to the lairage in mass. Both sides of the animals were inspected at rest and in motion. Moreover, the general behavior of the animals sign of diseases and abnormality of any type were registered according to the standard ante-mortem inspection procedures following the judgments passed by (FAO, 1994), animal fit for human consumption was allowed for slaughter.

Post-mortem examination was made by visualization, palpation and incision on the respective organs for the presence of cysts, parasites and any abnormalities Representative samples of the parasites, cysts and other pathological lesions associated with the parasites and other types of lesions were collected using sterile universal bottles and examined. Liver, lungs, heart, kidney and carcasses were thoroughly examined by visualization, palpation and making incisions where necessary for the presence of cysts, parasites and other abnormalities. Pathological lesions were differentiated and judged according to guidelines on meat inspection for developing countries and the results were recorded and the decisions at postmortem inspection was classified in to the following categories of judgment such as approved as fit for human consumption, conditionally approved as fit for human consumption, totally condemned as unfit for human consumption and partially condemned as fit for human consumption (FAO, 1994).

2.5. Data Management and Statistical Analysis

Data generated from ante mortem and post mortem meat inspection was recorded in Microsoft EXCEL program. The collected data are analyzed using Stata14. Descriptive statistics were used to determine the level of organs and carcass condemnation rates defined as proportion of condemned organs and carcass to the total number of organs and carcasses examined. Possible variation between rejection rates of specific organs, age groups, origin and species of animals were taken into consideration. Logistic regression was used to identify association between the outcome variable (post mortem findings) and various potential risk factors possible variation

between rejection rates of specific organs, age groups and differences was regarded statistically significant if the 95% confidence interval drawn do not overlap to each other and p-value less than 5%.

3. RESULTS

Over all prevalence

Out of the total 384 cattle examined at ante mortem inspection in Hawassa municipal abattoir 58 (15.10%) cattle were found to have abnormalities such as tick infestation (35.18%), poor skin (18.5%), poor hair coat (13.0%) and nasal discharge (Table 1).

Postmortem examination

The findings of the current study also indicated that out of 384 cattle slaughtered 161 (41.92%) have different pathological conditions during postmortem inspection from which 112 (29.16%) liver, 49 (12.76%) lungs, 10(2.6%) hearts, 4(1.04%) spleen and 3 (0.56%) tongues. From observed pathological conditions during postmortem inspection 76/384 (19.79%) harbored hydatid cysts in their different visceral organs (mainly in lung and liver 35 (46%) and lung 38 (50%) spleen 4(5.26%), But no hydatid cysts were observed in the kidney, peritoneum and heart), 71/384 (8.79%) harboring fasciola in the bile duct of the liver, 8/384 (2.08%) were bleeding problems/ imperfect bleeding, 6/384 (1.56%) marbling of lung tissue, (5/384 (1.3%) have c.bovis observed out of 3(60%) in tongue muscle and 2 (40%) in heart muscle and 3/384 (0.78%) were due to yellowish fluid accumulation in pericardial sac. From the total affected organs, parasitic diseases take higher proportion 151/176 (85.79%) (fasciola, hydatid cyst, c.bovis and only 25 (14.2%) cases by bacterial disease, yellowish fluid accumulation in pericardial sac, calcification due to various disease conditions in the liver and bleeding problems during slaughtering table (Table2) .

Information collected from Butchers, Residents or Households and Meat Inspectors on the mean current price of visceral organs at Hawassa town for liver, lung, heart, spleen and tongue 100, 55, 40, 50 and 35 Ethiopian Birr, respectively. The abattoir record from 2016 to 2017 revealed that the mean annual slaughter was 22,531 cattle but the 4 years mean annual slaughter was 18,031. Accordingly total annual direct financial loss incurred due to rejection of visceral organs was 1,639,401.56 ETB (Table3)**.**

Analysis of organ condemnation rate with potential risk factors revealed that there is statistically significant difference in organ condemnation rate among body condition (P = 0.004. However, there was no statistically significant difference between age (P = 0.091). From the total 384 cattle slaughtered, 112 (29.16%) livers were condemned because of various abnormalities or causes of condemnation. Out of these condemned livers, fasciolosis was responsible for 55 (14.32%) liver condemnation followed by hydatidosis 35 (9.11%), and calcification 6 (1.56) due to different parasitological and pathological conditions 34 (4.43%), the rest rejection rate was due to Fasciolosis + Hydatidosis 16 (4.16%) in condemnation rate of liver. There was no statistically significant difference between the two age groups (p = 0.901) and but it was statistically significance between body condition scores. (p = 0.04) (Table 3) and from the total cattle slaughtered, *cysticercus bovis* found in 5 (1.3%) from which 2 (40%) were from heart and 3(60%) in tongue muscle. Out of the total cattle slaughtered, 49 (12.76%) lungs were totally condemned because of various abnormalities or causes of condemnation. Out of these condemned lungs, hydatidosis was the cause for 38 (9.89%) of the condemnation followed by CBPP 6 (1.56%) and Emphysema 5(1.3%). From the total cattle slaughtered, 10 (1.3%) hearts were totally condemned because of various abnormalities or cause of condemnation. Out of these condemned hydropericardium caused by heart water was 5(1.3%) coagulation of blood in periacardial sac was 3(0.78) and c.bovis 2(0.52%) (Table4).

Table1; Major Abnormalities Encountered during anti-mortem examination

Abnormalities/disease conditions	Number of cases	Prevalence rate (%)	Anti-mortem judgment
Lameness	5	1.3 %	Judgment was passed for slaughter but they need special attentions during PME
Depression	5	1.3 %	
Tick infestations	20	5.2 %	
Skin problems	10	2.6 %	
Nasal discharge	6	1.56 %	
Poor hair coats	7	1.82 %	
Lacrimation	5	1.3 %	
All cases	58	**15.10%**	

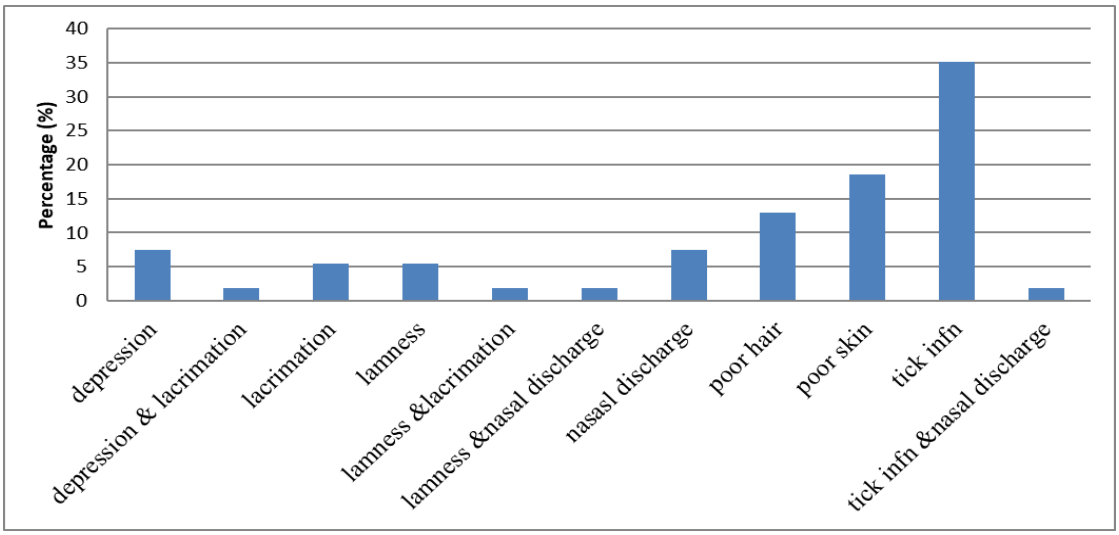


Fig1; Frequency of anti-mortem findings

Table2; Association of animal age and body condition with abattoir diseases

Variables	No. of examined animals	No of positive animals (%)	95% CI	X2	p-value
Age					
Young	156	66 (42.30)	54.44-64.30	0.015	0.901
Adult	228	95 (41.66)			
Body condition					
Poor	51	32 (62.74)			
Medium	158	65 (41.13)	125-139	11.179	0.004
Good	175	64 (36.57)			
Overall	**384**	**161 (41.9)**	**36.9-46.9**		

Table3; The rejection rate of individual organs and average price of organs condemned from Hawassa town Municipality abattoir

Condemned organs	Condemnation rate (%)	Average annual slaughtered animals from retrospective Data	Average price of the organ (ETB)	Annual loss estimation (ETB)
Liver	69.56		100	1,254,232.36
Lung	30.43		55	301,775.8315
Heart	6.31	18,031	40	45,510.244
Spleen	2.9		50	26,144.95
Tongue	1.86		35	11,738.181
Total				**1,639,401.56 birr**

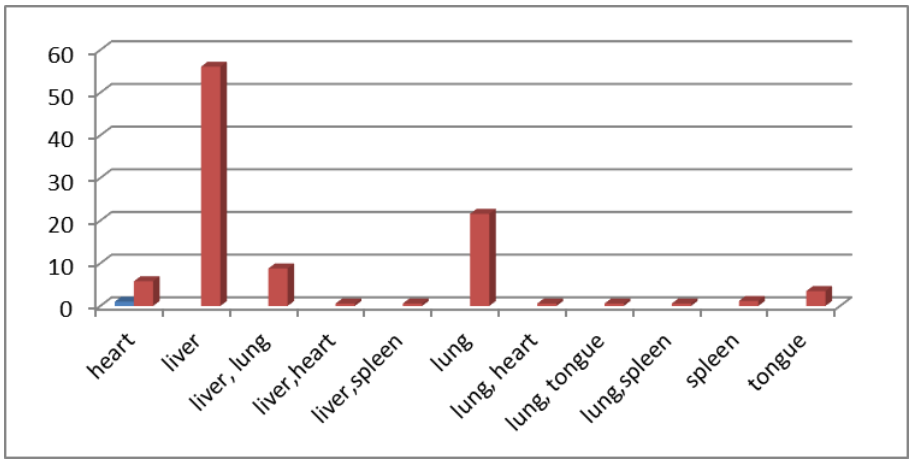


Fig2; Frequency of organ condemnation rate

Table4; proportion of postmortem findings in organs with their rejection rate

Condemned organ	Number of Organs	Disease Condition	Condemnation rate (%)	Proportion (%)
Liver	71	Fasciolosis	18.49	44.1
	35	Hydatidosis	9.11	21.74
	6	Calcification	1.56	3.72
Lung	38	Hydatidosis	9.9	23.6
	6	Marbling lesions	1.56	3.72
	5	Imperfect bleeding/Emphysema	1.3	3.1
Heart	5	Hydropericardium	1.3	3.1
	3	Coagulation of blood	0.78	1.86
	2	C.bovis	0.52	1.24
Spleen	4	Hydatidosis	1.04	2.49
Tongue	3	C.bovis	0.78	1.86
Total	178		100	100

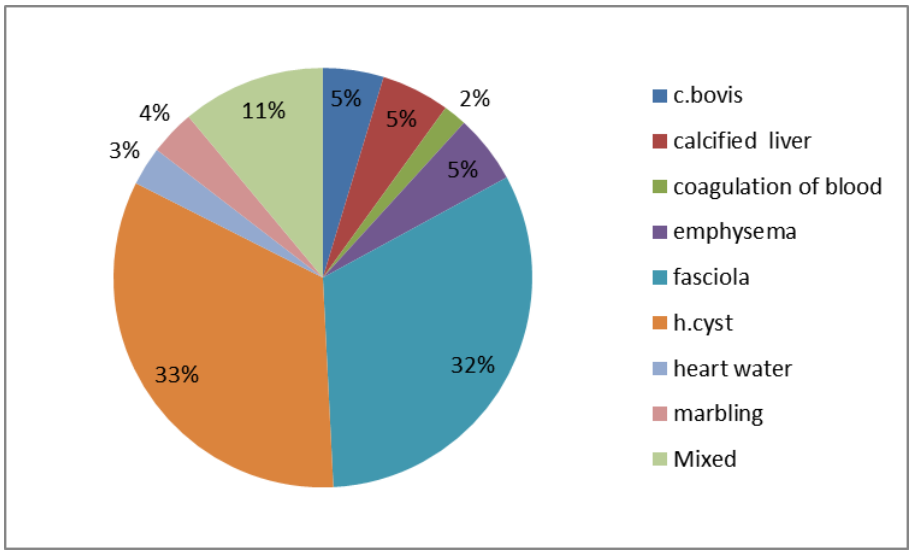


Fig2; frequency distribution of abattoir diseases and prevalence rate

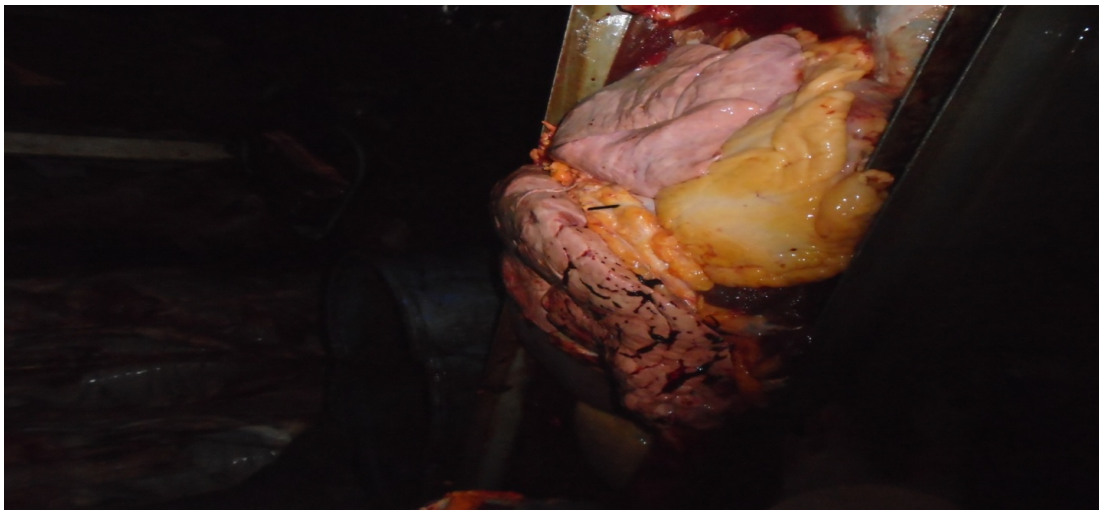


Fig3; marbling of lung tissue

Fig4; yellowish fluid accumulation in pericardial sac

Fig5; Lung emphysema, poor/imperfect bleeding

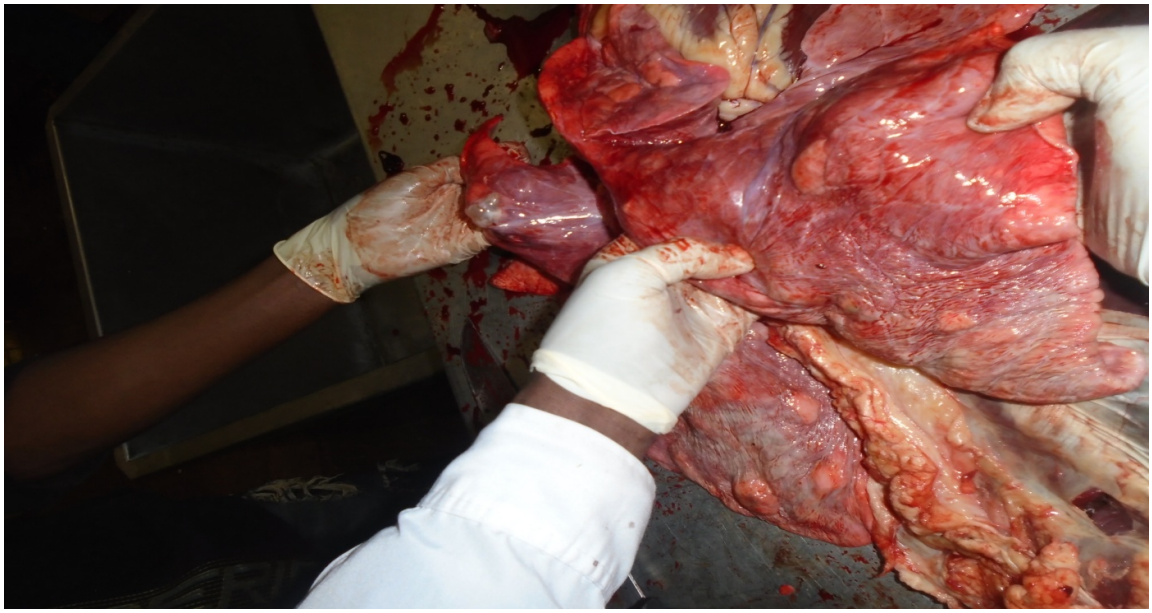


Fig6; Lung, multiple hydatid cysts

Assessment of direct economic (finantial) loss due to condmnation of liver, kidney, heart, spleen, lung, tongue and whole carcass

Present study showed significance economic losses associated with the prevalence of hydatidosis, fasciolosis, cysticercosis, caudrosis, calcification, and bleeding problems in Hawassa .To evaluate the economic losses, only the direct monetary losses due to rejection of liver, lung, heart, spleen and tongues were considered. The analysis was based on annual slaughter capacity of the abattoir considering market demand, average market prices on international and the rejection rates of specific organs and carcasses. The annual slaughter rates were estimated from retrospective data recorded in the past years. The economic loss due to condemnation was estimated by the formula set by (Ogunrinade, A, and Ogunrinade, B, 1980) as follows:
(Loss by lung)+ (loss by liver) + (loss by spleen) + (Loss by heart) + (loss by kidney) + (loss by tongue)

(Nps×Ilu×CLU)+(Nps×Ili×Cli)+(Ns×Isp×Csp)+(Nps×Ih×eChe)+(Nps×Ili×Cki)+(Nps×IToC×To)

(Nps×Ili×Cli)+(Nps×Ilu×CLU)+(Nps×Isp×Csp)+(Nps×Ihe×Che+(NPs×ITo×Cto) =(18,031×0.6956×100)+(18,031×0.3043×55)+ (18,031×0.029×50)+(18,031×0.0631×40)+(18,031×0.0186×35)

= (1,254,232.36 birr by liver) (301,775.8315 birr by lung) + (26,144.95 birr by spleen) +

(45,510.244 birr by heart)+ (11,738.181 birr by tongue)

Total cost = 1,639,401.56 birr

Total estimated annual loss due t condemnation of offal's (lung, liver, spleen, heart,kidney and tongue) at the abattoirs of Hawassa, due to Fascilosis, Hydatidosis, Cyticercosis, CBPP, Caudrosis, calcificationa and bleeding problems was ; =1,639,401.56 birr from Hawassa Municipality Abattoir

DISCUSSION

During the study, examinations before slaughtering (ante-mortem examination) and after slaughtering (post-mortem examination) were carried out. Out of 384 cattle physically examined during ante-mortem inspection in municipal abattoir of Hawassa, different abnormalities were found during anti-mortem examinations in 58 (15.10%) head of cattle. These abnormalities include lameness 5(1.3%), depression 5(1.3%), tick infestation

20(5.2%), skin problems 10(2.6%), lacrimation 5(1.3%), nasal discharge 6(1.56) and poor hair coat 7(1.82%). However, these animals were passed for slaughter with great caution with thorough postmortem examination.

In this study, investigation was made on all abattoir diseases based on Post-mortem findings. It is therefore noted that the prevalence estimates provided here may have some bias as abattoir sample Populations is not always representative of the reference populations where animals are drawn. This is often so because animals brought for slaughters are those that are old or out of production. Considering the reduced sensitivity of post mortem inspection-based diagnosis, there is always a possibility that some positive cases were missed resulting in under reporting the actual disease burden. Despite these short-comings, abattoir survey data is routinely used to estimate disease burden because of easy feasibility of conducting abattoir surveys compared to field surveys based on random study designs. Besides, abattoir data provides opportunity for developing intervention strategies by timely diagnosis and condemning carcasses infected with zoonoses likely to enter the food chain.

Major parasitic disease such as fasciolosis, hydatid cyst, cysticercosis and other causes like abscessation and cirrhosis are of great public health concern and cause significant economic losses by lowering productivity of cattle and condemnation of edible organs (Biu and Adindu, 2004; Chhabra and Singla, 2009). Among the major causes of organ condemnation in the Ethiopia are hydatidosis as discussed by Yifat *et al.* 2011), (Alemu *et al.* 2012), Alembrhan and Haylegebriel (2013), fasciolosis (Mulat *et al.,* 2012; Bekele *et al.,* 2014), cysticercosis (Mesfin and Nuradddis, 2012) and other causes of organ condemnation (Alemayehu *et al.,* 2012; Alembrhan and HaylegebrieL, 2013). Studies conducted in different abattoirs of Ethiopia revealed that parasitic infection of livers, lungs (pneumonia), pericarditis and pyelonephritis are the major cause of organs condemnation (Asmare *et al.,* 2012). The activity also provides vital data and valuable information on the incidences and prevalence of animal diseases and conditions within the country (Ansari-Lari and Moazzeni, 2006; Phiri, 2006). Parasites in the tropics are responsible for far greater losses to meat industry than other diseases. Similarly like many other tropical countries of Africa, it is well known that parasitic diseases are among the major factors responsible for the low productivity of livestock in Ethiopia (Kidanu, 2011).

The overall cause of organ condemnation, its public health and financial significance obtained from abattoir in the present study (41.92 %) was relatively almost higher than the previous reports or findings from Gondar Elfora Abattoir (24.7%) by (Yifat *et al*., 2011) but is lower than The work of Nekemte municipal abattoir (Lati *et al*., 2015) where the total prevalence was (47.94%). However, the prevalence of hydatidosis was 19.79 % which is relatively higher when compared with several reports from different abattoirs of the country like at Adigrat Municipal Abattoir (18.61%) (Alembrhan and Haylegebriel, 2013) and at Southern Wollo abattoir (17.4%) (Alemu *et al*.,2012). These differences within the country are attributed mainly to variations in the ecological and climatic conditions such as altitude, rainfall, and temperature, although differences in livestock management system and the ability of the inspector to detect the infection may play a part and for the reason the present work was conducted in three different abattoirs that increased getting the chance of more positive cases from different ecological zones.

The liver rejection rate recorded in this study (29.16%) is higher than the reports 17.58% made by (Alembrhan and Haylegebriel., 2013) from Adigrat municipal abattoir however it is almost similar with the study findings of (Yifat *et al*., 2011) who reported 31.1% from and Gondar Elfora Abattoir and (Lati *et al*., 2015,) who again reported 33. 7% from Nekemte municipality abattoir but it is lower than that of (Teha Meda Nure, 2017), (Abunna *et al*., 2012) and (Yalew *et al*.,2016) who reported 38.8%, 39.68% and 40.49% rejection rate liver from abattoirs of Assella, Wolaita sodo, Dessie and municiplity abattoirs respectively. The present findings indicated that a high number of livers were condemned due to various abnormalities. Of these, Fasciolosis (44.1%), hydatidosis (21.74%) and calcification (3.72%) were found to be the major causes for liver rejection.

The total lung condemnation (12.76%) rate was much lower than (46.22%) the report by (Amene *et al*. 2012) from Jimma municipal abattoir. The prevalence of hydatid cyst on the Lung (23.6%) was lower than the reports made by (Abebe and Yilma, 2012) who reported prevalence of 27.98% from different part of the country and Jimma Municipal Abattoir respectively. However, the Current finding is higher than the report of (Lati *et al*., 2015) from Nekemte Municipal Abattoir who reported 12.17% prevalence. The lung is the most frequently affected organ by hydatidosis (23.6%) due to its size, blood supply and availability of oxygen supply (Urquhart *et al*., 1996). Emphysema was also the cause for lung condemnation with rejection rate of 3.1%, which is higher than the rate 1.62% reported by (Nebyou *et al*. 2014), and 1.2% reported by (Fasil, 2009) from Nekemte Municipal and Gondar Elfora Abattoirs, respectively.

In this study, 2.6 % of heart was totally condemned due to cysticercus bovis (1.24), coagulation of blood (1.86%) and yellowish fluid accumulation in the pericardial sac (3.1%) was higher than that of 1.2% by (Teha Meda Nure, 2017) From Assella municipalty abattoir but this finding was lower than, 3.71% reported by (Shegaw *et al*., 2009) in Mekelle and 4.09% by (Fufa and Abunna, 2012) in Wolaita sodo municipal abattoir but it is much higher that the findings of (Lati *et al*., 2105) 0.76% from Nekemte municipality abattoir and (Alembrhan and Haylegebriel, 2013) 0.27% from Adigrat municipality abattoir. In the present study, 0.52 % for the condemnation of heart is by c.bovis and from the slaughtered cattles 0.78% of tongue muscle was condemned by c.bovis. The result of this finding coincides with that of 0.78% (Dawit *et al*., 2012) from wolaita sodo municipal abattoir and 0.9% (Shegaw *et al*., 2009).

In the present study 1.04 % of the spleen was totally condemned from the total abnormalities mainly by hydatid cyst and The frequency in which spleen was condemned due to hydatidosis (1.04%) of this study is related to (Abunna and Debele,2013), 0.94% hydatidosis was reported in 2013 in wolaita soddo abattoir. Overall tongues condemned during the study period were 1.3 %. The result of this finding higher than that of 0.9% (Shegaw *et al*.,2009) and 0.78% (Yalew *et al*.,2016) from Mekelle and Dessie municipality abattoirs respectively..

The current study revealed that the prevalence of bovine hydatidosis in cattle slaughtered at municipal abattoir of Hawassa was found to be 20 % this finding is higher than the 17.4 % prevalence report in southern Wollo abattoir (Alemu *et al*., 2012)) but the finding is relatively higher than 22.4% in Jimma (Moges, 2003). Comparable findings of bovine hydatidosis were also reported from from Morocco and Kenya in which the prevalence of 23.0 % (Azlaf and Dakkak, 2006) and 19.4% (Njoroge, 2002) were recorded, respectively.The variation of the prevalence of hydatidosis among different geographical locations could be associated withn 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. In the study period hydatidosis was more prevalent at (20%) and the overall lung was found to be the most affected organ by Hydatidosis and it had a higher prevalence organ compared to the liver and the least affected prevalence was observed in spleen. The reason why the lung and liver are mostly affected could be due to the fact that the lungs and liver are first capillary beds encountered by migrating echinococcus oncospheres via the portal vein route before any other peripheral organs. The lungs, however, have a larger capillary bed than any other organs and this could account for the observed higher prevalence than seen in the other organs.

The reason for the high prevalence of hyadtidosis could be attributed to a high numbers of infected cattle and dog populations in the origin (areas) where cattle are coming to slaughtered. This may be due to a high number of home slaughters during ceremonies, which in some cases are not inspected by the veterinary department or due to increased interaction of dog and cattle in free range rearing of cattle which increase contact of cattle with dog feces. Furthermore, dog and hyena access to back yard slaughter and municipal slaughter house wastes.

Especially there was a greater contact of hyenas and contaminated offal's with hydatidosis, because, observation in the study period reveal that some hyenas found in the surrounding areas are fully dependant on condemned and discarded offal's by abattoir workers out of the abattoir compound this is likely to increase exposure of hyenas for infection by the larval stage of Echinococcus granulosus, and the problem would be more hazardous for the local human population living around the abattoir due to attack by these hyenas. If the case will be minimized in the origin where cattle are coming for slaughter to the abattoir due to effective prevention and control measures and the ultimate reduction of infected offal's and the associated reduction of condemned and discarded offal's.

The overall prevalence of bovine fasciolosis (18.5%) observed in this study is lower than the reports of (Gebretsadik *et al*., 2009), (Nuraddis *et al*., 2010), and (Yusuf *et al*., 2016) who reported prevalence of 24.3, 28% and%, 24.4% at Mekelle , Kombolcha Industrial Abattoir and Jimma municipality abattoirs of Ethiopia respectively. However, it is much lower than that of many other studies from different abattoirs in the country and elsewhere in Africa. (Tolosa and Tigre, 2007) recorded prevalence of 46.2% at Jimma abattoir, (Phiri *et al*., 2005) from Zambia and (Pfukenyi and Mukaratirwa, 2004) from Zimbabwe reported prevalence of 53.9% and 31.7%, respectively. On the other hand, a lower prevalence of fasciolosis has been observed in slaughtered cattle Difference in prevalence among geographical locations is attributed mainly to the variation in the climatic and ecological conditions such as altitude, rainfall and temperature. *Fasciola* spp. prevalence has been reported to vary over the years mainly due to variation in amount and pattern of rainfall (Manyazewal *et al.,* 2014).

In line with the current finding (18.5%), different researchers also indicated that fasciolosis was the leading cause of liver condemnation (Yifat *et al*.; 2011) and (Shimelis *et al*., 2017) Comparable fasciola prevalence

(24.24%) was reported by (Fufa and Debele, 2013) from Wolaita Sodo Municipal Abattoir. However, (Atawalna *et al*. 2016) reported a lower prevalence (2.39%) from the Bolgatanga Municipal Abattoir of Ghana. The report from Hashim Nur's Export Abattoir (located in DebreZeit town) by (Abdulhakim and Addis, 2012) showed the prevalence of 39.8% which is higher than the present finding. Such variation among the different reports could be derived from the difference in ecology, management and husbandry system and veterinary health service in the origin of the animals included in the studies.

Moreover calcification of liver (1.56%) recorded in the present study was lower than (Adem Kembo, 2017) who reported 4.6% from Assella but is higher than (Samuel *et al*., 2017) from Wolaita Sodo abattoirs. Emphysema of lung caused 1.3% of condemnation which is lower than (Asmare *et al*., 2012) 4.4% and higher than (Jatanie *et al*., 2018) from Adama and Marbling of lung tissue (1.56%) due to CBPP was much lower compared to 17.2% by (Demissie *et al*., 2018) from Arbaminch municipal abattoir and 28.5% from Ghana by (Mohammed, 2018). 1.3% of hydro-pericardium (accumulation of yellowish fluid in the pericardial sac is unusual pathological condition observed in this study but it could be because of Ambyloma type of tick infestation. Variations in the rejection rate of organs may be probably due to differences in agro-ecological conditions of animal origin that could be favorable to the parasites, livestock management system and improper disposal of condemned organs that was eaten by stray dogs (final host of hydatid cyst). Differences in the rejection rate of organs with different causes may also be due to differences in the prevalence of the diseases and variations in animal management systems. Total annual financial loss as a result of condemnation of different organs of cattle was estimated about 1,639,401.56 ETB per annual. Therefore, the total annual financial loss due to major abattoir diseases and related conditions in the study abattoir is the summation of losses from organ condemnation only and the carcass condmanation and it is annual finantial loss not included in this study. This finding is by lower than the result reported by (Jibat, 2006), **2.7** million ETB loss from Debre-Zeit Helmix abattoir and (Shimelis *et al*., 2017), 2,535,022.42 ETB loss in the same study area and it is higher than (Lati *et al*., 2015), 1,011,020.20 ETB from Nekemte municipality abattoir but it is much higher than study of (Alemayehu *et al*., 2012), (Shegaw *et al.,* 2009), and (Teha Meda Nure, 2017), a total financial loss of about 110,584.046, 233,501.94 and, 200,880 ETB Ethiopian birr per annum in cattle due to major cause of organ condemnation at Luna Export Abattoir, Adigrat, and Assela municipality abattoir municipal slaughterhouses, respectively. This is probably due to the ecological and climatic difference between those localities and the annual slaughter capacity, the prevalence of animal diseases in abattoir and the cost of organs vary from one area to another and raw meat consumption and the total annual slaughter capacity of the present study area higher than other parts of Ethiopia.

CONCLUSION

The main objective of this study was to describe the situation of major abattoir diseases encountered during post mortem examination and associated economic impact caused by organ condemnation thereby recommending possible intervention measures to the abattoir. The determination of prevalence of each of the disease has some practical implications for further measures which will undertake for control or prevention measures. It should be noted however, that hydatidosis and fasciolosis are diseases of multiple hosts and the objectives of this study could be addressed by the application of conventional observational studies. This study has demonstrated that hydatidosis and fasciolosis are important diseases and endemic in the study area and at the areas where cattle are originated to be slaughtered in the respective abattoirs. The disease also causes considerable economic losses as a result of offal condemnations besides we conclude that there are certain socioeconomic and epidemiological conditions that are favorable for the existence of hydatidosis and fasciolosis. Region wise prevalence studies and surveillance would be desirable in order to effectively map out epidemiology and the spread of these diseases. With regard to hydatidosis a specific study of the disease in dogs could help in knowing the prevalence in the definitive host. Furthermore, studies on small ruminants such as sheep and goats may improve epidemiological understanding of the disease in the study areas.

RECOMMENDATIONS;

- ✓ Further abattoir disease studies, surveillance, and investigation of parasitic diseases and other pathological conditions must required to know the actual economic impact and for implementing systematic disease prevention and control methods at the study area.
- ✓ The origin of cattle slaughtered in the abattoirs must be known through information flow at each chain of sale and purchasing activities to undertake effective control and prevention measure at grass root level or to rule out slaughtering of cattle form these areas.

- ✓ Affected offal's and carcass should be condemned properly as it helps to control the distribution of disease causing agent/parasite and prevents new introduction of disease to unaffected areas.
- ✓ There should be continuous capacity building for meat inspectors by provision of trainings.
- ✓ Municipal abattoir should be modernized to enhance the management, to facilitate post mortem inspection and eventually to provide wholesome meat to consumers, thereby to protect the public from the fear of zoonosis.
- ✓ Finally, farmers, pastoralists, abattoir workers, butcher man and meat inspectors should be awarded, educated and informed about the importance of the disease control and prevention programs and regular deworming of animals before and just after rainy season.

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