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Major Parasitic Causes of Organ Condemnation and Economic Loss in Cattle Slaughtered at Enango Municipal Abattoir, Western Ethiopia

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Abstract: Across sectional study was conducted from April, 2017 to November, 2017 to identify the major parasitic cause of organ and carcass condemnation and estimate financial losses attributed to the condemned organ and carcass in cattle slaughtered at Enango Municipal Abattoir. Liver, lung, heart, tongue, Masseter muscle, Shoulder muscle, Thigh muscle and Kidneys were the organs or muscle examined for the parasites and find that Fasciola 84(21%), hydatid cyst 40(10%) and Cysticercus bovis 21(5.25%) were the main factors for condemnation of those inspected organs. During postmortem, out of 400 cattle examined, 168(42%) animals had at least one organ infested by parasites. Among those affected organs 25.25, 9.25, 6.25, 4.5, 3.25 and 1.5% animal's liver, lung, heart, Tongue, Masseter and Shoulder were infested respectively. In this study, there is no significant association ($p>0.05$) between, age, origin, body condition and the prevalence of major parasitic diseases. Out of the total examined organs 38(9.5%) liver, 10(2.5%) lungs, 3(0.75%) heart and 2(0.5%) tongues were condemned due to various causes. The total direct economic loss incurred due to condemnation of organs in active abattoir survey of the study area was 13,855.00 Ethiopian birr. Therefore, creation of awareness on animal attendants and/or cattle owners and abattoir workers about the effect of parasites and safe disposal of condemned organs must be made.

INTRODUCTION

Ethiopia has the larger livestock population in Africa, estimated at 49 million head of cattle 47 millions of small ruminant, 2.7 million head of donkeys and about 76,000 of camel and 42 million chickens[1]. Even though, the livestock subsector contributes much to the national economy, its development is hampered by different constraints. These include rampant animal diseases, poor nutrition, poor husbandry, infrastructure and shortage of trained man power and lack of government policies.

Parasitic diseases are considered as a major health problem and cause a significant economic loss in countries where livestock production is an important segment of the agricultural practice. Developing countries have about two third of the world's livestock diseases population but their meat and milk production is less in cyst circus bovis[2]. Parasites in the tropics are responsible for greater losses to the meat industry than any other disease[3]. 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[4]. These infestations not only cause clinical disease and mortality but also cause economic losses through production losses and condemnation of whole carcass and organs at slaughter. The latter have a huge effect in countries like Ethiopia as export beginner and its effect were seen significant in different abattoirs[5].

In developing countries, abattoir plays a major role in providing and serving sources of information and reference center for disease prevalence. Meat inspection is conducted in the abattoir for the purpose of screening animal products with abnormal pathological lesions that are unattractive and unsafe for human consumption. Meat inspection assists to detect certain diseases of livestock and prevent the distribution of infected meat that could give rise to disease in animal and human being and to insure competitiveness of products in the local market[6]. Abattoir data can be a source of valuable information on the incidence and epidemiology of animal diseases conditions 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[7].

As meat is the main source of protein for man it should be clean and free from diseases of particular importance to the public such as Tuberculosis (TB), hydatidosis, cysticercosis and fasciolosis[8]. The main cause of organ condemnation during post mortem inspection are disease originated by parasite, bacteria and virus of these diseases liver fluke in the liver and hydatid cyst in the liver, lung and kidney are mainly involved[9].

In Ethiopia many studies have been undertaken to identify the major disease conditions encountered during ante mortem and postmortem inspection and to determine the economic importance of organ and carcass condemnation. Alembrhan and Haylegebriel have reported that Fasciolosis, hydatid cyst, *Cysticercusbovis*, pneumonia, emphysema, hydronephrosis, cirrhosis, hepatitis, calcification and abscessation were the major causes of organs condemnation in cattle slaughter at Adigirat municipal abattoir. The main causes of organ condemnation during post mortem inspection are diseases originated by parasites, bacteria and viruses. Flukes in liver and hydatid cyst in lung, liver and kidney, cystcercus bovis in red meat and tongue are mainly involved[10]. Parasites in the tropics are responsible for far greater loss to meat industry than any other diseases[3]. Similarly like many other tropical countries in Africa, it's well known that parasitic diseases are the major factors responsible for low productivity in livestock in Ethiopia[4].

Amene *et al*.[11] reported that an estimated average amount of 172,664.09 ETB was lost annually due to organ condemnation of cattle at the abattoir. Liver condemnation takes the higher proportion of all the losses accounting for 92.7% of all the losses at Jimma Municipal abattoir. Similar economic loss analysis by Fasil[12] showed annual economic loss of 150,048.98 ETB at Gondar Municipal abattoir. Another report in cattle slaughtered at Mekele municipal abattoir revealed an estimated annual economic loss of 222,884.58 ETB. Differences in the amount of money lost in various abattoirs could be attributed to differences in the prevalence of diseases, differences in the rejection rate of organs, difference in the slaughtering capacity of abattoirs, difference in ant mortem inspection and also variations in the management of animals in different parts of the country[11].

Most of the studies in Enango municipal abattoir were focusing only on specific diseases such as fasciolosis, hydatidosis, pneumonia and *cysticercusbovis*. Hence, it would be essential to have comprehensive information on occurrence of various diseases/causes and their economic loss to establish appropriate strategy for prevention and controls. Therefore, the objectives of this study are:

- To identify the major causes of organs and carcass condemnation and
- To estimate the direct financial loss attributed to the condemned organs and carcasses in cattle slaughtered at Enango municipal abattoir

MATERIALS AND METHODS

Study area: The study was conducted in Lalo Assabi district in West Wollega zone of Oromia regional state from April, 2017 to November, 2017. The district capital town, Enango is located at 461 km to the East of Addis Abeba, the capital city of Ethiopia. Geographically the district lies between 9-20°N Latitude and 35-45°East Longitudes. The total area coverage of the district is estimated as 76-261 hectares of land. The altitude of the district ranges from 1500-1900 m above sea level with the annual rainfall of 1750 mm and the mean annual minimum and maximum. Temperature of 20° and 30°,

respectively. Lalo Assabi is bordered in the East by Gimbie in the West by Gulliso, in the North by Boji Dirmaji and in the South West by Ganji and South East by Homa districts.

Study population: The study population was the total number of local zebu cattle and some cross cattle presented to the abattoir for slaughter from different districts around the town (Tosiyo Mole, Barko, Batiro, Horda, Dini, Jarso, Atosi, Wanjo, Warago, Alle, Dunmore, Haroji and around the Enango town). Almost all slaughtered animals were male except, some females. Study animals were randomly selected from the study population based on paints (numbers) on their body for identification.

Study design: A cross-sectional and retrospective study designs will be employed to generate the desired data. The cross-sectional study of active abattoir survey will be made according to the standard procedures recommended for ante mortem and post mortem inspection by FAO[13].

Sampling and sample size determination: Study was conducted on randomly selected cattle slaughtered at the abattoir. For this study systematic random sampling method was employed to include the representative cattle from those slaughtered from April, 2017 to November, 2017. The total numbers of cattle required for the study was calculated based on the formula given by Thusfield[14] using random sampling method. The expected prevalence 50% has been taken into consideration, since no study was conducted in area. Accordingly for the sample size determination 95% confidence interval and at 5% absolute precision was considered.

Active abattoir survey/ante mortem and post mortem: A cross sectional study was conducted from April, 2017 to November, 2018 to identify the major causes of organ and carcass condemnation and to estimate the direct economic loss in cattle slaughter at Enango municipal abattoir.

During ante mortem examination each of study animal was identified based on the number marked on their body before slaughter and their general behavior, signs of disease, nutritional status, cleanliness and any type of abnormality can affect the fitness of the animal for slaughter were recorded[15]. The judgment was also passed based on the procedure given by FAO[13]. Postmortem examination was conducted by visualization, inspection, palpation and systematic incision of each visceral organ particularly the liver, lung, heart and kidney for the presence of cysts, various adult parasites and other abnormalities[15].

Assessment of direct financial loss: The total financial loss due to organ and carcass condemnation was computed or determined by taking into consideration the condemnation rate or percentage of each edible organs and carcass which was determined by this study, average number of animals slaughtered in the abattoir per year from retrospective data of the abattoir, average weight of each organs and carcasses in kg, average current local market price of major organs and carcass and number of each condemned organ was used to estimate the economic loss. Average current local market price of each organ and carcass was collected by questionnaire from the butcheries in Enango town for ease of computing the loss. Consequently the financial loss due to condemnation of organs and carcass was estimated by the formula set by Ogunrinade(1980) as follows:

$$EL = \sum srx * Coy * Roz$$

Where:

EL = Annual economic loss estimated due to organ or carcass condemnation
Σsrx = Annual cattle slaughter of the abattoir
Coy = Average cost of each cattle liver/lung/heart/ kidney
Roz = Condemnation rate of each cattle organ/carcass

Data management and statistical analysis: Collected Data generated from longitudinal ante mortem and post mortem inspections were entered in to Microsoft excel, coded and analyzed using SPSS Software (Version 20). Descriptive statistics was used to determine the level of organ condemnation, defined as the proportion of condemned organs to the total number of organs examined. Association between the considered risk factors and the proportion of organ(s) condemnation was analyzed using chi-square test. In all the analysis, the study considered 95% level of significance and 5% desired level of precision.

RESULTS AND DISCUSSION

Abattoir survey result: This study showed that from 400 cattle inspected 168(42%) Animals were positive for major parasites of organs detected, out of these, 84 (21.5%) were positive for fasciolla, 40(10%) for hydatid cyst, 21(5.25%) for Cysticercus bovis, 13(3.25%) for Hydatid cyst and Cysticercus bovis, 10(2.5%) Hydatid cyst and Fasciolla. Out of 168, 13(73.25%) of young, animal and 153(38.25%) of animals were adult and 2(0.5%) of old cattle were positive for major the parasite detected. The prevalence of the disease in relation to body condition was 42.86% (72/168) and 57.14% (96/168) for medium and good, respectively. The highest prevalence was observed from cattle of Horda Daleti 21(12.5%)

Table 1: Number of positive animals in relation to major parasite with over all prevalence

Major parasite encountered	No. of positive animals (%)	Over all prevalence of each parasite (%)
Fasciolla	84(21%)	94 (23.5%)
Hydatic Cyst	40(10%)	50(12.5%)
Cysticercusbovis	21(5.25%)	34(8.5%)
Hydatic cyst and Cysticercusbovis	9(2.25)	-
Hydatic cyst and Fasciolla	10(2.5)	-
Total	168(42%)	178(44.5%)

Table 2: Intensity of prevalence of parasite in relation to organs

Types of organ	Infestation (%)
Liver	101(25.25)
Lung	37(9.25)
Heart	25(6.25)
Tongue	18(4.5)
Masseter	13(3.25)
Shoulder	6(1.5)

Table 3: Occurrences of major parasites in relation to different risk factors

Risk factors	No. of animals examined	No. of positive animals (%)	X^2	p-values
Age				
Young	29	13(3.25)		
Adult	362	153(38.25)		
Old	9	2(0.5)	2.950	0.086
Total	400	168(42)		
Body condition				
Good	228	96(42.11)	0.454	0.839
Medium	172	72(41.86)		
Total	400	168(42)		
Origin				
Horda	53	27(16)		
Batiro	40	26(15.5)		
Jarso	43	15(8.93)		
Tosiyo	48	12(7.14)		
Atosi	22	12(7.14)		
Barko	37	15(8.93)		
Wenjo	28	11(6.55)	13.740	0.318
Dini	34	13(7.56)		
Ale	10	4(2.38)		
Enango	19	6(3.5)		
Dongoro	25	14(7.56)		
Warago	19	7(4)		
Haroji	22	6(3.5)		
Total	400	168 (42)		

followed by Batiro 19 (11.3%), Jarso Damota and Barko 15(8.93%), Dongoro 14(8.33%), Dini Uwa 13(7.74%), Tosio and Atosi 12(7.14%), Wanjo 11(6.55%), Warago 7(4.17%), Haroji and Inango 6(3.57%) and Ale 3(1.78%) (Table 1-3). There was no statistically significant difference ($p>0.05$) in prevalence of major parasites involved between age, origin and body condition of animals.

Number of positive Animals in relation to major parasite encountered: Out of 168 major parasitic infested Animals, 94(23.5%) were Fasciolla, 50(12.5%) Hydatic cyst and 34(8.5) Cyst cercusbovis.

Prevalence of major parasites in relation to risk factors

Judgment of infested Organs: As indicated in Table 4 below, 9.5 and 17% of Liver were totally condemned and partial trimmed, respectively. Whereas 2.5, 0.75 and 0.5% of Lung, Heart and Tongue were totally condemned and 7, 4.75, 2.75, 1.5 and 0.5% of Lung, Heart, Tongue, Masseter and Shoulder were partially trimmed, respectively (Table 4).

Total costs of condemned organ: The total cost of lost Organ were higher in Liver followed by lung, heart, tongue, Masseter and shoulder as showed in Table 5.

Parasitic diseases are considered as a major health problem and cause a significant economic loss in countries where livestock production is an important segment of the agricultural practice. Developing countries have about two third of the world's livestock diseases population but their meat and milk production is less cysticercus bovis and then a third of the world FAO[2].

Abattoir data can be a source of valuable information on the incidence and epidemiology of animal diseases

Table 4: Judgments of organs infested

Organs	Fit/Passed (%)	Partial trimmed (%)	Total condemned (%)
Liver	294(73.5)	68(17)	38(9.5)
Lung	362(90.5)	28(7)	10(2.5)
Heart	378(94.5)	19(4.75)	3(0.75)
Tongue	387(96.75)	11(2.75)	2(0.5)
Masseter	394(98.5)	6(1.5)	0
Shoulder	398(99.5)	2(0.5)	0

Table 5: Financial estimation of condemned organ

	Partially condemned organ(birr)			
Organs infested	Low infested(birr)	Medium infested(birr)	Totally condemned(birr)	Total cost(birr)
Liver	45(2,350)	21(2100)	38(7,600)	12,050
Lung	26(300)	4(100)	10(500)	875
Heart	22(380)	-	3(240)	620
Tongue	15(100)	3(45)	2(60)	145
Masseter	12(180)	-	-	180
Shoulder	6(60)	-	-	60
Grand Total(birr)	3, 210	2, 245	8, 400	13, 855

conditions 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[7].

Over the study period, the prevalence of *Fasciola* spp. in slaughtered bovine livers was estimated at 27%. This is higher than that reported from a similar 3-year study in Arusha Municipality, Tanzania by Mwabonimana *et al*.[16] where the average for the 3 years was 6.7%. In the Arusha study, it was found that the rate of liver condemnation due to fasciolosis was higher (at a range of 50.2-60.9%) compared to Kisumu (where the range was 39.2-52.4%) but in this study it was 9.5% that was significantly lower. The latter figures agree closely to those reported from Zimbabwe by Ptukenyi and Mukaratirwa[17] who recorded a prevalence rate of 37.1% for *F. gigantica*.

In this study, there is no significant association ($p>0.05$) between, age, origin, body condition and the prevalence of major parasitic diseases detected and this agrees with the reports by Tembo[18] and Hailu[19] and in the case of origin this was also agrees with Fufa[20] regarding cysticercus bovis. One possible explanation for insignificance of variation might be due to the fact that the two age group of animals has close susceptibility to Taenia saginata egg and the animals slaughtered in this abattoir were adult and old and have similar husbandry systems[21].

Out of the total examined organs 38 (9.5%) liver, 10 (2.5%) lungs, 3 (0.75%) Heart and 2 (0.5%) Tongues were condemned due to various causes. The rejection rates of liver in this study was lower than the reports of Denbarga *et al*.[22] from Mohammed *et al*.[23] from Kombolcha and Amene etc. from Jimma municipal abattoirs who reported 31.1, 66.55 and 64.4%, respectively. But it was observed higher as compared with studies conducted by Oryan etc., 4.2% and Hassan etc. 7.9% from Iran. This finding was relatively in agreement with the previous studies conducted by Mihreteab *et al*.[25] and Dechassa *et al*.[26] at Adwa and Jimma municipal abattoirs, respectively. Rejection rate of lung in this study was lower than reports by Mesele *et al*.[27] of 19.68% at Gondar, Amuamuta *et al*.[28] of 25.8% at Bahir Dar and Amene *et al*.[11] of 46.2% at Jimma municipal abattoirs. The rejection rate of Tongue, Masseter and Shoulder was not as significance as those of liver and lung and such unlike to produce the pronounced economic effect associated with the first two.

The total direct economic loss incurred due to condemnation of organs in active abattoir survey was 13,800.00 Ethiopian birr which is lower than the reports from Gondar and Jimma municipal abattoirs, 39,490.0 and 172, 664.09, respectively Mesele *et al*.[27]. Economical loss due to hydatid cyst in this study was 1685 Ethiopian birr. This economic loss due to hydatid cyst was lower than the report by Amene *et al*.[11] from Jimma municipal abattoir who reported 125,842.0 and 27,207.3 Ethiopian birr, respectively.

CONCLUSION

Meat inspection protocols in this study were able to detect the prevalence 42% (168/400) of bovine major parasites. These parasites induce considerable public health hazard and economic loss due to total condemnation and trimming of infested organs and carcass. Poor hygienic conditions to waste disposal, poor sludge and sewage treatment and food associated with undercooked beef consumption were the major risk factors for the occurrence of the disease. The role of societies, public health professionals and Veterinary professionals play great role to control and prevention and eradication of the disease. Based on this concluding remark the following recommendations are forwarded: Standard regulations and functional meat inspection procedure should be properly conducted in the abattoir to

provide safe and wholesome meat to the consumer. Enhance awareness of animal attendants, customers and abattoir workers about the public health significance of the continuous life cycle of the involved parasites. All condemned organs should be safely disposed, stray dogs and cats must be prohibited from abattoirs and their numbers should be systematically reduced. Strict routine meat inspection of slaughtered animals should be carried out. There should be strong and close collaboration between medical and veterinary professionals to reduce impact of the disease both in humans and animals.

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