

Investigation on Major Cause of Organ Condemnation and its Economic Significance in Cattle Slaughtered in Chiro Municipal Abattoir, Ethiopia

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Research Article

ABSTRACT

A cross sectional study was carried out from November 2021 to April 2022 with aim to identify the major cause of organ condemnation; associated risk factors and to estimate direct financial losses attributed to the condemned organ in cattle slaughtered at Chiro Municipal abattoir, Eastern Ethiopia. Prior to slaughter, animals were subjected to anti and post mortem examination to identify physical abnormalities and gross pathological lesions responsible for organ condemnation. During ante mortem examination, in 75 (19.3) cattle various types of abnormalities were detected include; lacrimation (2.6%), pale mucus membrane (3.09%), nasal discharge (2.9%), hernia (1%), salivation (0.8%), lameness (1.8%), emaciation (0.41%), depression (1%), blindness (0.41%), local swelling (0.27%) and rough hair coat (2%). Out of 384 cattle examined 185 (48.2%) were animals positive from which different organ condemned during postmortem inspection. Among organs examined, 105 (27.3%) livers, 55 (14.3%) lungs, 18 (4.68%) hearts and 7 (1.8%) kidneys were condemned. Major pathological conditions that caused a total condemnation of organs were fasciolosis (14.6%), hydatidosis (9.38%), cirrhosis (6.25%), calcification (2.6%), emphysema (2.34%), percarditis (2.6%), hydronephrosis (1.7%), and pneumonia (4.09%) Cystercercusbovis (0.5%) and abscess (1.56%). Organ condemnation rates show significant difference ($P < 0.05$) among age group, origin of animals and status of body condition. The total financial loss estimated in this study, due to organ condemnation was 138,784.00 ETB per annum. Therefore, the observation of such level of abnormalities and substantial financial loss with condemnation of affected organs warrants the veterinary institution to design appropriate control measures.

Keywords: Abattoir; Cattle; Chiro; Ethiopia; Financial loss; Organs condemnation

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INTRODUCTION

Ethiopia is a developing nation with the most livestock in Africa, with an estimated population of 53.99 million cows, 25.5 million sheep, 24.06 million goats, 1.91 million horses, 6.75 million donkeys, 0.35 million mules, 0.92 million camels, and 50.38 million chickens. Ethiopia's cattle industry formerly made a sizable contribution to the national economy, and it continues to hold out hope for the future of the nation's economy. About 52.13 million cattle heads are present in the nation ^[1].

In the entirety of Sub-Saharan Africa, animal production has traditionally been considered the route to agricultural development. Domesticated animals are fundamental to Ethiopia's economy, like they are in many other developing countries. They provide food in the form of meat and milk as well as non-food products including transportation services, draft power, manure, and other inputs for the cultivation of food crops and fuel for cooking. The selling of the aforementioned goods as well as animal hides and skins is another way that livestock generate money. Ethiopia, which is the first in Africa and tenth in the world, is well recognized for having a large cattle population ^[2]. According to latest animal population estimates, the nation has roughly 1.9 million horses, 6.75 million sheep, 49.56 million goats, and 53.99 million heads of cattle ^[3].

Ethiopia has a significant quantity of cattle, however the industry is known for its low output. Low genetic potential of native breeds, poor management, poor diet, poor reproductive ability, high illness incidence, and parasite burden are all contributing factors to the low output. In addition, each year a sizeable loss is caused by animal deaths, inadequate weight growth, and the rejection of edible parts and carcasses at the time of slaughter during regular meat inspection. The cattle business suffers a productivity loss that is expected to cost more than \$900 million a year ^[4-9].

The monitoring of numerous human and animal illnesses was greatly aided by abattoirs. All animals entering the human food chain can be checked at the slaughterhouse for strange symptoms, lesions, or particular illnesses. Diseases caused by parasites, bacteria, and viruses are the main reason for organ condemnation during post-mortem examination. In 2010, one method of determining the illness state of a herd has been identified as monitoring and other conditions at slaughter; however, this source of data is not widely utilized globally. The incidence and epidemiology of animal illness problems may be determined using data from abattoirs, which can also be used to calculate the financial losses resulting from the condemnation of afflicted organs ^[10-17].

In order to identify animal products with aberrant pathological lesions that are unsightly and unfit for human consumption, meat inspection is done in the slaughterhouse. Meat inspection helps identify specific livestock illnesses, stops the spread of contaminated meat that might cause disease in humans and animals, and ensures product competitiveness in the local market. The infections caused by parasites, bacteria, and viruses are the major reasons for organ condemnation during post-mortem examination. The primary issues are liver flukes and hydatid cysts in the lung, liver, and kidney ^[18].

Tropical parasites cost the meat industry more than any other ailment by a wide margin. Ethiopia has conducted several researches to identify the main illness conditions seen during ante mortem and post mortem inspection and to estimate the economic significance of organ condemnation, just like many other tropical nations. Therefore, in order to build an effective plan for preventive and controls, it would be important to have thorough information on the occurrence of various causes and their economic loss. The research area currently lacks slaughterhouse surveillance data on the prevalence of different diseases and economic loss from organ condemnation ^[19]. Therefore, the objective of present study was:

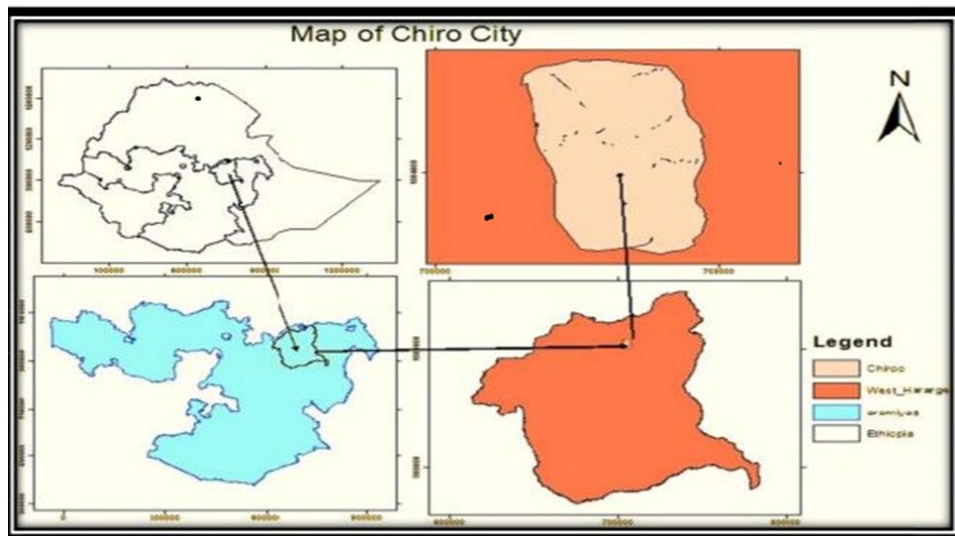
- To determine the main factors that lead to organ condemnation in cattle slaughtered at the Chiro Municipal Abattoir.
- To determine the potential risk factors in the study area that could be related to organ condemnation.
- To calculate the financial damage directly attributable to the organs of condemned animals that was slaughtered at Chiro Municipal Abattoir.

MATERIALS AND METHODS

Study area description

The study was conducted in Chiro municipal abattoir from November, 2021 to April; 2022. Chiro is a capital town of West Hararghe zone, which is located 326 km far away from capital city of Ethiopia, Finfinnee. The district has 40 rural peasant associations and one urban administration. The weather climate of the woreda is characterized by four main seasons in a year. The dry April and long rainy season that extend from July to the end of November. The district has daily mean a temperature ranging from 27.5°C-38.5°C and rain fall ranging from 900 mm-1800 mm. The agro ecological zone of the district can be categorized into, high land which portion 8%, midland 38% and lowland 54%. Its altitude ranges between 2500 m 3748 m above sea level ^[20]. The livestock populations of the district are cattle 92656, goat 67962, sheep 37594, horse 403, mule 234, donkey 15404, camel 626 and poultry 105,253 (Figure 1).

Figure 1. Map of Chiro city.



Study population

The research animals were cattle from several woreda in and around Chiro, such OdaBultum, Gemachis, Tulo, Mieso, and others, which were transported to the town abattoir for slaughter. These animals were kept in an extensive production system, and both cars and people were used to convey them to the slaughterhouse. Animals were chosen using a simple random sample procedure, regardless of their body condition scores, sex, or age.

Study design

From November 2020 to April 2021, a cross-sectional study was conducted in order to identify the primary reason for organ condemnation and to estimate the direct economic loss incurred as a result of organ condemnation in cattle slaughtered at the Chiro Municipal abattoir.

Sample size and sampling method

Since no previous research had been done in the area, the following parameters were used to calculate the necessary sample size: 95% Level of Confidence (CL), 5% desirable level of accuracy, and 50% prevalence. The formula provided by () was used to calculate the sample size. Thrusfield

$$n = \frac{1.96^2 \times Pexp(1 - Pexp)}{d^2}$$

Where:

- n=the total sample size;
- Pexp=expected prevalence;
- d=absolute precision

Accordingly, the calculated sample size was 384. Thus 384 Cattle where considered for ante and post mortem examination.

Study methodology

Ante-mortem inspection: Cattle were examined at the lair age before to slaughter to determine their age, sex, physical condition score, provenance, and any anomalies they may have had. Based on tooth eruption trends, two traditional age groups—young 2 to 6 years and adult >6 years were created. According to the approach described by Nicholson and Butterworth, the body condition of the cattle was scored and divided into three categories: poor, medium, and good.

Post mortem inspection

Each visceral organ, particularly the liver, lung, heart, and kidney, was thoroughly examined postmortem by vision, inspection, palpation, and systematic incision for the presence of cysts, different adult parasites, and other abnormalities. The guidelines for meat inspection were used to differentiate and evaluate the pathological lesions.

Financial assessment

Based on the average number of animals slaughtered in the slaughterhouse annually from retrospective data of the abattoir, the condemnation rate of each kind of studied organ, and the condemnation rate of each organ, the total financial loss due to organ condemnation was calculated. From the butcheries in Chiro town, the average local market price of each organ was obtained through a questionnaire. The following formula, developed by Ogunrinade and Ogunrinade in 1980, was used to determine the total direct financial loss:

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

Where

EL=Annual economic loss estimated due to organ condemnation

$\sum srx$ =Annual number of cattle slaughtered at the abattoir.

Coy=Average cost of each liver/lung/heart/kidney

Roz=Condemnation rate of each liver/lung/heart/kidney

Data analysis

For data analysis, SPSS software version 16.0 was utilized. Collected data were put on a specifically designed form, coded, and entered. The level of condemnation, expressed as the ratio of condemned organs to all investigated organs, was calculated using descriptive statistics. Pearson's *Chi-square* was used to analyze the differences between condemnation rates, age, sex, and bodily condition ratings (X^2). When the p-value for this study's outcome is less than 0.05, it was deemed statistically significant.

RESULTS

Out of 384 cattle examined upon ante mortem examination, various types of abnormalities were detected on 75 (19.3) of cattle. The abnormalities detected include: localized lesion, hernia, lacrimation, nasal discharge, rough hair coat, lameness, depression, blindness (Table 1).

Table 1. Rate of abnormalities encountered during ante mortem inspection in cattle slaughtered at Chiro municipal abattoir.

Abnormality	No of affected animals	Percentage (%)
Localized lesion	21	5.5
Hernia	4	1
Lacrimation	10	2.6
Nasal discharge	11	2.9
Rough hair coat	8	2
Lameness	7	1.8
Depression	4	1
Salivation	3	0.8
Total	75	19.3

In the Chiro municipal abattoir, 384 cattle were examined during the study period. Of the inspected organs, 185 (48.2%) were positive for various lesions detected on various organs, among which 72 (18.8%) and 113 (29.4%) were condemned for various reasons. Young cattle 61 (32.9%) were more likely to be condemned than mature cattle 124 (67.1%), and male cattle 159 (85.9%) were more likely to be condemned than female cattle 26 (14.1%). Medium body condition cattle had the highest condemnation rates, followed by good and poor cattle with scores of 101 (54.6%), 56 (30.3%), and 28 (15.5%), respectively. Cattle from OdaBultum share the largest percentage, 80 (43.2%), of the 185 (48.2%) condemned rates, followed by Tulo (49 (26.5%), Gemachis (27 (14.6%), and Miesoworeda (29 (15.7%), in that order. Age, bodily condition ratings, and origin all varied statistically significantly (P 0.05) when possible risk variables were examined in animal models (Table 2).

Table 2. Prevalence of affected organ with regard to sex, age, BCS and origins.

Variables		No. of examined cattle	Positive (%)	X ²	P-value
Sex	Male	333	159 (85.9%)	0.478	0.49
	Female	51	26 (14.1%)		
Age	Young	151	61 (32.9%)	6.441	0.011
	Adult	233	124 (67.1%)		
BCS	Poor	32	28 (15.5%)	25.203	0
	Medium	207	101 (54.6%)		
	Good	145	56 (30.3%)		
Origin	Odabultum	145	80 (43.2%)	10.506	0.014
	Tuloworeda	132	49 (26.5%)		
	Gemachis	51	27 (14.6%)		
	Mieso	56	29 (15.7%)		
Total		384	185 (48.5%)		

In the current investigation, 185 (48.2%) of the total inspected organs were rejected for a variety of reasons. The liver was the organ that was condemned the most (27.3%), followed by the lung (14.3%), heart (4.68%), heart, and kidney (1.8%). The most frequent macroscopic lesions on the liver were fasciolosis (14.6%), cirrhosis (6.25%), hydrated cyst (3.13%), calcification (2.6%), and abscess (0.78%). With rates of 6.5%, 4.69%, 2.34%, and 0.78%, respectively, pneumonia, emphysema, abscess, and hydrated cyst all contributed to the rejection of the lung. 1.5% of hearts and 2.6% of hearts, respectively, were condemned due to hydrated cyst and pericarditis. 1.8% of renal cases resulted in death from hydronephrosis (Table 3).

Table 3. Distribution of condemned organ with respect to lesion found.

Organ condemned	No. of inspected	Lesion found	Condemnation (%)	Proportion (%)
Liver	105	Fasciolosis	56 (14.6)	53.3
		Hydatid cyst	12 (3.13)	11.4
		Cirrhosis	24 (6.25)	22.9
		Abscess	3 (0.78)	2.9
		Calcification	10 (2.6)	9.5
		Total	105 (27.3)	
Lung	55	Hydatid cyst	25 (6.25)	45.5
		Pneumonia	18 (4.09)	32.7
		Abscess	3 (0.78)	5.5
		Emphysema	9 (2.34)	16.4
		Total	55 (14.3)	
Heart	18	Pericarditis	10 (2.6)	55.6
		Cysticercusbovis	2 (0.5)	11.1
		Hydatid cyst	6 (1.5)	33.3
		Total	18 (4.68)	
Kidney	7	Hydronephrosis	7 (1.8)	100
			7 (1.8)	
Grand total	185	Total	185(48.2)	100

Liver condemnation was more common in cattle with medium body condition (4.69%), good body condition (8.07%), and poor body condition (4.69%), in that order. In a similarly, medium conditioned cattle had greater rates of lung,

heart, and kidney rejections than good and poor conditioned animals. Adult cattle have greater liver, lung, heart, and kidney rejection rates than young cattle, and male cattle shows greater rejection rates than female calves for all examined organs (Table 4).

Table 4. Distribution of condemned organ with regard to age, sex, body condition score.

Variables		No. of examined	Condemned organ				
			Liver	Lung	Heart	Kidney	Total
Age	Young	151	40	15	4	1	60(39.7%)
	Adult	233	65	40	14	6	125(53.6)
BCS	Poor	32	18	7	3	0	28(87.%)
	Medium	207	56	32	10	4	112(49.3%)
	Good	145	31	16	5	3	55(37.9%)
Sex	Female	51	15	7	4	1	27(52.9%)
	Male	333	90	48	14	6	158(47.4%)

In the current study, the estimated annual direct financial loss as a result of organ condemnation was 138784.00 ETB. Liver condemnation accounts for the highest percentage of economic losses, or 27.3% of the overall losses of \$11998.00 ETB, followed by the lungs, heart, and kidney, which account for all of the direct economic losses (Table 5).

Table 5. The rejection rate and average price of organ condemned in the study area.

Condemned Organ	Rate of condemned Organ (%)	Average price in ETB	Total loss in ETB
Liver	27.30%	75	111998
Lung	14.30%	20	15644
Heart	4.68%	30	7696
Kidney	1.80%	35	3446
Total price (ETB)			138784

DISCUSSION

The present study examined the factors for organ condemnation and the financial harm they generated in 384 cattle assessed at the Chiro municipal abattoir during the study period. According to this study, the most common reasons for organ condemnation in cattle slaughtered at the Chiro municipal abattoir were fasciolosis, hydatid cyst, pneumonia, *Cysticercus bovis*, cirrhosis, hydronephrosis, calcification, emphysema, pericarditis, and abscess. Out of 185 tested organs, the liver, the lung, the heart, and the kidney were all found to be defective in 27.3%, 14.3%, 4.68%, and 1.8% of cases, respectively. This result is consistent with earlier research from the Jimma Municipal slaughterhouse and Nekemte Municipal abattoir, which was published by Nebyou and Wale.

In the current study, 27.3% of the liver was deemed defective due to different abnormalities discovered during the postmortem examination. Fasciolosis was found to be one of the major reasons for liver rejection in this study with a prevalence of 14.6%, which is lower than the prevalence's of 21.1 and 20.18% reported by Shitaye, et al., from the Hawasa Municipal abattoir and Yelew, et al., from the Dessie Municipal abattoirs, respectively. The findings of the current study outperform those of Hassen, et al., study from Iran (7.9%) and Alembrihan and Hylagebriel study from the municipal slaughterhouse in Adgrat (9.26%). The discrepancy in climatic and ecological variables, such as height, rainfall, and temperature, between this research and the aforementioned findings may be primarily blamed for the difference in the rejection rate of liver owing to fasciolosis.

Findings of 6.25 percent liver condemnation owing to cirrhosis are close to Raji, et al., 8.4 percent findings at Zara slaughterhouse. However, this figure is greater than the 1.1% reported by Yefat, et al., in Gonder, while the present study's liver condemnation rate owing to cirrhosis was lower than the 16.5% reported by Nurit, et al., in Kombolcha. Compared to the report of 1.9% in Tanzania by Nongoad, calcification was shown to be the cause of 2.6% of liver condemnation from the entire studied organ. The rejection rate of the liver owing to hydatidosis in the current study is 3.13%, which is close to studies done by Dawit, et al., from the municipal slaughterhouse in Adigrat. Buzuayehu, et al., reported migration rates from Harar of 3.6% and 3.62%, respectively. however much lower than the reports of Zelalem, et al., 31.7% from Addis Abeba and Mihret, et al., 33.33% from Dire Dawa. In contrast to Ahmedullah, et al., who reported a 3.8% liver condemnation rate in Bangladesh, the current study found a 0.78% liver condemnation

owing to abscess.

14.3% of the lungs that were examined were condemned for different reasons. Hydatidosis and pneumonia were the main contributors to lung rejection among these causes. The lung condemnation rate (6.25%) in the current research is lower than the 19.37% reported by Gebremeskel and Kalayou from Mekelle. However, this rate is better than the 1.42% reported by Ragassa, et al., for Ghana. This variance in hydatidosis prevalence may result from various animal husbandry practices, backyard killing of animals, improper disposal of diseased carcasses, the existence of stray dogs and their interactions with animals, as well as other factors. Mesele and others pneumonia-related lung death in the current research was 4.09%. It was higher than the amount (0.14%) that Clement, et al., reported in cattle slain at the Zango slaughterhouse. Some many factors, such as stress factors like exposure to environmental dust or exhaustion from long journeys made by pastoral livestock in search of pasture and water or when animals are taken to livestock markets or abattoirs, as well as parasitism, may explain the different prevalence of pneumonic lungs.

Based on the most recent study, the heart's overall condemnation rate is 4.69%. Pericarditis, hydatid cysts, and *Cysticercus bovis* accounted for 2.6%, 1.5%, and 0.5% of all heart rejections in this research, respectively. This compares to studies by Genet, et al., from the Gonder slaughterhouse with 7.8% and 9.4%, respectively, which is incredibly lower. However, it was greater than the findings of Lati, et al., and the Nekemte Municipal Abattoir's 0.18% prevalence, respectively. *Cysticercus bovis* account for two cases (0.5%) of heart condemnation, which is somewhat equivalent to the prevalence of 0.23% reported by Basem from Egypt. This acquired value, however, is less than that published by Garedaghi, et al., who indicated an Iranian prevalence of 3%. This difference in the reported prevalence rate may be caused by a number of variables, including variations in meat consumption habits, patient knowledge of the disease's clinical picture, personnel and environmental hygiene, control measures, and eradication campaigns. Additionally, according to the current study, fewer kidneys were condemned owing to hydronephrosis than was reported by Fufa and Debele in their report from the municipal slaughterhouse at Walaita Sodo. The variance in disease prevalence and animal care practices at various research sites may be the reason of the variability in the rejection rate of organs with connected to various causes.

In this study, the annual direct financial loss attributable to the condemnation of organs at the Chiro Municipal abattoir was estimated to be 138,784.00 Ethiopian Birr, which is higher than the direct financial loss analysis estimated by Bekele, et al., from the Hossana Municipal abattoir and Alemayehu, et al., from the Luna export abattoir, which estimated a total financial loss of about 88,806. The current finding, however, is significantly lower than the estimate made by Haimanot, et al., who estimated yearly losses of 109, 492,725.5 ETB as a result of organ condemnation from calves at the Dire Dawa Municipal abattoir. The difference in the financial loss estimated in various abattoir and/or parts of Ethiopia would be due to the variations in the prevalence of disease, mean annual number of cattle slaughtered in the different abattoirs and also the variation in the retail market price of organs Arbabi and Hooshyar.

CONCLUSION

The purpose of the current study, which was carried out in the municipal abattoir in Chiro, was to determine the main causes that organs are rejected and to estimate the direct financial loss connected with condemned organs. Based on the findings of the current study, the condemnations of organs at the Chiro Municipal Abattoir in Eastern Ethiopia were linked to a number of disease issues. 185 (48.2%) of the 384 animals that were investigated overall had postmortem abnormalities of various kinds. Organ condemnation rates were greater for the liver and lower for the lungs, hearts, and kidneys, correspondingly. Fasciolosis was the major pathological disease that led to the entire condemnation of the organs, followed by cirrhosis, calcification, emphysema, pericarditis, and hydronephrosis. Age group, provenance, and animal body condition all significantly affect organ condemnation rates (P 0.05). According to estimates, edible organ condemnation results in annual financial losses of 138784.00 ETB.

RECOMMENDATIONS

Based on the above conclusion the following recommendations are forwarded:

- It is important to study the epidemiology of the disorders that lead to organ condemnation and implement control measures.
- It is important to encourage the building of abattoirs with the requisite disposal pits and to dispose of rejected organs promptly and correctly.
- The management of condemned carcasses and organs should be taught to meat inspectors and slaughterhouse staff.
- In cooperation with the government, the veterinary extension service should be strengthened to raise community understanding of the disease's prevention and control.

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