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Prevalence of Gross Pathologies Causing Organs and Carcass Condemnation at Hashim Nur's Ethiopian Livestock and Meat Export Abattoir, Debre Zeit Ethiopia

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Abstract: A cross-sectional study to determine the prevalence of pathologies causing organs and carcass condemnation in slaughtered sheep and goats was conducted from November 2010 to April 2011 in Hashim Nur's Ethiopian livestock and meat export abattoir. During the study, a total of 5,376 organs of 768 animals (384 each of sheep and goats) selected by systematic random sampling, were examined for any pathological conditions causing condemnation. As of the study, 191(24.87%), 8(1.04%), 25(3.26%), 13(1.69%), 57(7.42%) and 32(4.17%) of all Livers, Lungs, Hearts, Kidneys, Brain and Carcass respectively, were affected by gross pathologies. The major causes for Liver condemnation were parasites 158(20.57%), Hepatitis 21(2.73%), Cirrhosis 27 (3.52%) and Calcification 191 (24.87%). Similarly the major causes for Lung condemnation were: Pneumonia 402 (52.34%) and Emphysema 128 (16.67%). Causes for Heart condemnation were: Pericarditis 40(5.21%), Calcification 25(3.26%), *Cysticercusovis*12(1.56%) and Hydropericardium 6(0.78%). Nephritis 78(10.16%), Nephrosis 39(5.08%) and Abscess 13(1.69%) were causes for Kidney condemnation and Coenurosis 26 (3.39%) and *Oestrus ovis* 64(8.33%) on the other hand were causes for Brain condemnation. Fasciolaspecies, *Stelesia hepatica*, *Cysticercus tenuicollis*, Hydatidosis and *Coenurus cerebralis* were found to be the major parasitic conditions responsible for organ condemnation. The result of this study indicated, several parasitic casesas major causes for organs and carcass condemnation and therefore warrants immediate, safe and controlled elimination of all condemned abattoir materials and recommends formulation of Standard regulations on meat inspection policies, as most of the cases have public health significance.

Key words: Abattoir · Condemnation · Goats · Gross Pathology · Organ · Sheep

INTRODUCTION

Ethiopia owns 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 [1].

Small ruminants (sheep and goats) are important domestic animals in the tropical animal production systems [2]. Within African society they comprise a greater proportion of the total wealth of poor families because of low input requirements such as small initial capital, fewer resources and maintenance cost and ability to produce milk and meat using marginal lands and poor

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pasture. Furthermore, they need only short periods to reconstitute flocks after disaster and respond quickly to the demand [3, 4]

The significant economic losses incurred each year in the different abattoirs in Ethiopia are due to mortality, inferior weight gain and condemnation of edible organs at slaughter [5, 6].

Slaughter houses provide an excellent opportunity for detecting these diseases of both economic and public health importance. Numerous abattoir surveys of pathological conditions have been conducted to investigate macroscopic and microscopic abnormalities by a thorough meat inspection procedure [7-9].

These meat inspection procedures require two steps. Ante mortem and postmortem inspections. 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 and should be done within 24 hours of slaughter and repeated if slaughter has been delayed over a day [10, 11]. A proper ante mortem inspection of the animal makes the task of routine post mortem inspection simpler and straightforward procedure [10].

Post mortem inspection is the centre 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 [12, 10]. All gross lesions should be identified at least in a general way. A routine postmortem 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 [10].

Recently, several modern abattoirs like Helimex, Elfora, Metehara, Modjo and Luna have been established in Ethiopia. This increase number of abattoirs shows increase in demand of carcass and organs supply, but the supply is decreasing due to disease and production problems. In view of this, proper examination and detection of major organ pathological lesions resulting from various diseases at abattoirs is needed.

The objective of this study is therefore to: Determine prevalence of the gross pathologies causing condemnation of edible organs and carcass of sheep and goats slaughtered at HashimNur's abattoir, Debrezeit.

MATERIALS AND METHODS

Description of Study Area: The study was conducted at HashimNur's Ethiopian livestock and meat export industrialized abattoir in DebreZeit town, Ethiopia. Debrezeit is located about 45 km south east of Addis Ababa just on the escarpment of the Great Rift Valley and the geography of the area is marked by creator lakes. It is located at 9° N latitude and 40°E longitude with an altitude of 1850 meters above sea level in the central highlands of Ethiopia. It has a human population of about 95,000. It experiences bimodal pattern of rainfall with the main rain season extending from June to September (of which84% of rain is expected) and short rainy season from March to May with an average annual rain fall of 800mm. The mean annual minimum and maximum temperatures is 12.3 and 27.7°C respectively with an overall average of 18.7 °C. The mean humidity is 61.3% [13].

Study population: A total of 768 animals (384 sheep and 384 goats) wererandomly selected and identified by origin, species and ageduring ante mortem inspection. All animals were males broughtfrom different areas of the country. Goats from: Borena, Arbaminch, Jinka, Afar, Jijiga and Awash and sheep from: Awash, Borena and Arbaminch. Theywere transported to the abattoir using vehicles and on foot. 128 sheep from each of the three areas and 64 goats from each of the six areas were selected, to have a uniform representative sampling. Animals were classified into two groups: young and adult, based on eruption of one or more incisor teeth to see the effect of age. From 384 slaughtered sheep, 192 were young and 192 were adults and the same categorization technique was used for goats' as well.

Sampling and Study design: A Cross-sectional study was employed to determine gross pathologies on internal edible organs and carcass. Animals' belonging to a group of young and adult were randomly sampled using systematic sampling method and examined pre slaughter and then post slaughter with their identification numbers and any abnormal condition encountered was recorded on a prepared format.

Abattoir Survey

Ante Mortem Examination: Animals were closely examined in lairageby grouping them based on species, age and place of origin. Arbitrary classification, according to [4, 3] was made to perform the age grouping

on the animals which was based on dentition. Those which have not erupted permanent incisor teeth, were classified as young, while those with one pair or more permanent incisor teeth were classified as adults [3, 4].

Post Mortem Examination: Liver, Lungs, Heart, Kidney, Brain and Carcasses were thoroughly inspected by visualization, palpation and systemic 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 were 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 [14].

Data Management and Statistical Analysis: Data generated from ante mortem and postmortem meat inspection were recorded in Microsoft EXCEL 2003 program. Descriptive statistics was used to determine the prevalence of organs affected by the gross pathology. The data obtained during the study was subjected to 95% confidence interval statistical analysis for possible variation between rejection rates of specific organs, age groups and species of animals and differences were regarded statistically significant if the 95% confidence interval drawn do not overlap to each other. The lower and upper limits of the 95% confidence interval for a proportion were calculated according to two methods described by [15, 16].

RESULTS

Ante Mortem Findings: The ante mortem examination was carried out on all 768 small ruminants (384 ovine and 384 Caprine) for the detection of any pathology encountered pre slaughter and found to have abnormalities listed on Table 1.

Post Mortem Findings: From a total of 5,376 organs of 768 animals (384 each of sheep and goats) studied, 191(24.87), 8(1.04), 25(3.26), 13(1.69), *57(7.42) and 32(4.17)* of all livers, lungs, hearts, kidneys, brain and carcass respectively, were affected by gross pathologies. The most frequently condemned organ was liver followed by the heart, kidney, lung, brain and carcass.

The frequency of liver condemnation was significantly higher in sheep than goats with the respective value 235(61.20%) & 105(27.34%). Similarly the frequency of lung and heart condemnation was higher in sheep than goats with the values 299(77.86%) & 89(23.18%) and 38(9.90%) & 33(8.59%) respectively Table 2 and 3.

Table 1: Ante mortem findings

	Species affected		
Ante Mortem Abnormalities	Caprine 384(%)	Ovine 384(%)	Total 768(%)
Nasal discharge	42(10.93%)	50 (13.02)	92(11.98)
Lameness	8(2.08%)	20(5.2)	28(3.65)
Emaciation	35(9.11%)	31(8.07)	66(8.59)
Diarrhea	19(4.95%)	23(5.99)	42(5.47)
Tick infestation	11(2.86%)	15(3.95)	26(3.39)
Total	115(29.95%)	139(36.21)	254(33.07)

Table 2: The overall prevalence of organs and carcass condemned

	Total Animals Slaughtered		Frequency of Organ And Carcass Condemnation				
Species	Age	Liver	Lung	Heart	Kidney	Brain	Carcass
Sheep	Young (192)	106(27.60)	143(37.24)	18(4.69)	19(4.95)	13(3.39)	8(2.08)
	Adult (192)	129(33.59	156(40.63)	20(5.21)	36(9.38)	17(4.43)	8(2.08)
	Total (384)	235(61.23)	299(77.86)	38(9.92	55(14.32)	30(7.81)	16(4.17)
Goats	Young (192)	78(20.31)	140(36.46)	14(3.65)	40(10.42)	12(3.13)	6(1.56)
	Adult(192)	84(21.88)	161(41.93)	19(4.95)	35(9.11)	15(3.90)	10(2.60)
	Total (384)	162(42.19)	301(78.39)	33(8.59)	55(14.32)	27(7.03)	16(4.17)
Total	768	397(51.69)	600(78.13)	71(9.24)	130(16.93)	57(7.42%)	32(4.17)

Table 3: Prevalence of various pathological conditions of liver and lung among species

Organs Examined	Pathologies	Species affected: Caprine (384) (%)	Ovine (384) (%)	Total (768) (%)	Chi-Square ($\times^2$)	P- Value
Liver	*Hepatitis*	12(3.13)	9(2.34)	21(2.73)	0.44	0.5
	Cirrhosis	9(2.34)	18(4.69)	27(3.52)	3.10	0.078
	Fasciolosis	4(1.04)	22(5.73)	26(3.39)	12.89	0.00
	C.Teniculosis	49(12.76)	44(11.46)	93(12.11)	0.30	0.58
	S. Hepatica	13(3.39)	18(4.69)	31(4.04)	0.84	0.35
	Hydatidcyst	1(0.26)	7(1.82)	8(1.04)	4.54	0.03
	Calcification	74(19.27)	117(30.47)	191(24.87)	12.88	0.00
Lung	*Emphysema*	55(14.32)	73(14.32)	128(16.67)	3.03	0.081
	Pneumonia	216(56.25)	186(49.44)	402(52.34)	4.69	0.03
	Abscess	5(1.30)	18(4.69)	23(2.99)	7.57	0.006
	Hydatid Cyst	2(0.52)	13(3.39)	15(1.95)	8.22	0.004
	Marbling	18(4.69)	6(1.56)	24(3.13)	6.19	0.013
	Calcification	5(1.30)	3(0.78)	8(1.04)	0.50	0.47

Table 4: Prevalence of various pathological conditions of heart and kidney among species

Organs Examined	Pathologies	Species affected: Caprine (384) (%)	Ovine (384) (%)	Total (768) (%)	Chi-Square($\times^2$)	P- Value
Heart	*Pericarditis*	16(4.17)	24(6.25)	40(5.21)	1.68	0.19
	Hydropericardium	3(0.78)	3(0.78)	6(0.78)	0.000	1.00
	Calcification	14(3.65)	11(2.86)	25(3.26)	0.37	0.54
Kidney	*Nephritis*	40(10.42)	38(9.90)	78(10.16)	0.057	0.81
	Nephrosis	31(8.07)	8(2.08)	39(5.08)	14.28	0.000
	Abscess	4(1.04)	9(2.34)	13(1.69)	1.95	0.16

As of the study the higher condemnation of liver was due to calcification followed by Cysticercus tennuicollis and fasciollosis. The study also indicated higher prevalence of fasciolosis in adult sheep and goats than young's and the lower rate of infection in young could be best explained by the fact that young animals are usually kept in door or around the home and not allowed to go far with adult animals for grazing so that they have reduced chance of exposure to infective parasitic stages when compared to adults Table 4.

Major cause of condemnation of liver is diffuse Calcification followed by Hepatitis and Cirrhosis with the rate of 191(24.87), 27(3.52) and 21(2.73) respectively. Among gastrointestinal parasites: *Cysticercus tenuicollis*, *Stelesia hepatica*, *Fasciola*and hydatid cysts were major causes of livers condemnation with rates of 93(12.11), 31(4.04), 26(3.39) and 8(1.04) respectively. Mechanical damage caused during evisceration was also found to be a significant cause of liver condemnation Table 5.

Fasciolosis caused a statistically higher liver condemnations in sheep 22(5.73%) than in goats 4(1.04) (p=0.000) and calcification was found to be a major cause of liver condemnation in sheep 117(30.47%) than in goats 105(27.34%) (p=0.000). However, *C. tennuicollis* causedhigher rate of liver condemnation in goats 49(12.76%) than in sheep 44(11.46%). Similarly, Hepatitis caused significant losses in goats 12(3.13%) than in sheep 9(2.34%).

In sheep, there was no statistically significant difference (p>0.05) between young and adult age categories regarding the causes of liver lung heart and kidney condemnations except that nephrosis causes significantly higher kidney condemnation in adults than in young. In goats the causes for liver, lung, heart and kidneys brought less significant change (p>0.05) between the age groups except that hepatitis for liver and abscess for lung that caused higher condemnation in young's and emphysema for lung that is higher in adults.

Pneumonia was the major cause of lung rejection with a rate of 402(52.34%) followed by emphysema 128(16.67%).

There was no statistically significant difference between species (sheep and goats) in the frequency of lung condemnation due to pneumonia and calcification with the respective values 186(49.44%) & 216(56.25%) and 3(0.78%) & 5(1.30%) (P>0.05); however, statistically significant difference was observed (p<0.05) due to all other causes (Emphysema, Abscess and Hydatid cyst). Within the species as well, statistically significant difference was observed (p<0.05), between young and

Table 5: Pathologies encountered on liver and lung

		Species of animals					
		Sheep (384)			Goats(384)		
Organs Examined	Pathologies	Adult (192)	Young (192)	Total (384)	Adult (192)	Young (192)(%)	Total (384)(%)
Liver	Hepatitis	5(2.60)	4(2.08)	9(2.34)	2(1.04)	10(5.21)	12(3.13)
	Cirrhosis	10(5.21)	8(4.17)	18(4.69)	6(3.13)	3(1.56)	9(2.34)
	Fascilosis	13(6.77)	9(4.69)	22(5.73)	2(1.04)	2(1.04)	4(1.04)
	C.Teniculosis	23(11.98)	21(10.94)	44(11.46)	28(14.58)	21(10.94)	49(12.76)
	S.Hepatica	9(4.69)	9(4.69)	18(4.69)	5(2.60)	8(4.17)	13(3.39)
	Hydatidcyst	4(2.08)	3(1.56)	7(1.82)	0(0.00)	1(0.52)	1(0.26)
	Calcification	65(33.85)	52(27.08)	117(30.47)	41(21.35)	33(17.19)	74(19.27)
	Total						
		129(33.59)	106(27.60)	235(61.23)	84(21.88)	78(20.31)	162(42.19)
Lung	Emphysema	37(19.27)	36(18.75)	73(19.01)	38(19.79)	17(8.85)	55(14.32)
	Pneumonia	99(51.56)	87(45.31)	186(48.44)	115(59.90)	101(52.60)	216(56.25)
	Abscess	9(4.69)	9(4.69)	18(4.69)	0(0.00)	5(2.60)	5(1.30)
	Hydatid Cyst	7(3.65)	6(3.13)	13(3.39)	0(0.00)	2(1.04)	2(0.52)
	Marbling	3(1.56)	3(1.56)	6(1.56)	5(2.60)	13(6.77)	18(4.69)
	Calcification	1(0.52)	2(1.04)	3(0.78)	3(1.56)	2(1.04)	5(1.30)
	Total	156(40.63)	143(37.24)	299(77.86)	161(41.93)	140(36.46)	301(78.39)

Table 6: Pathologies encountered on heart and kidney

		Species of animals					
		Sheep (384)			Goats (384)		
Organs Examined	Pathologies	Adult (192)	Young (%)	Total (%)	Adult (%)	Young (%)	Total (%)
Heart	Pericarditis	13(6.77)	11(5.73)	24(6.25)	9(4.69)	7(3.65)	16(4.17)
	Hydro pericardium	2(1.04)	1(0.52)	3(0.78)	1(0.52)	2(1.04)	3(0.78)
	Calcification	5(2.60)	6(3.13)	11(2.86)	9(4.69)	5(2.60)	14(3.65)
	Total	20(5.21)	18(4.69)	38(9.92)	19(4.95)	14(3.65)	33(8.59)
Kidney	Nephritis	23(11.98)	15(7.81)	38(9.90)	15(7.81)	25(13.02)	40(10.42)
	Nephrosis	8(4.17)	0(0.00)	8(2.08)	19(9.90)	12(6.25)	31(8.07)
	Abscess	5(2.60)	4(2.08)	9(2.34)	1(0.52)	3(1.56)	4(1.04)
	Total	36(9.38)	19(4.95)	55(14.32)	35(9.11)	40(10.42)	75(19.53)

adult age groups of both species in the frequency of lung condemnation from any cause. In goats, Pneumonia, Hydatidosis and lung calcification were more frequently observed in adults than in young animals ($p<0.05$).

Statistical analysis of the present study showed no significant difference on the condemnation of heart between species. ($p>0.05$) However, frequency of kidney condemnation was significantly lower in sheep than goats with the value 55(14.32%) & 75(19.53%) respectively. Nephrosis caused significantly more kidney to be condemned from goats 31(8.07%) than sheep 8(2.08%) but condemnation due to nephritis and abscess is less significant ($p>0.05$).

Out of the total hearts condemned, Pericarditis contributed 40(5.21%) followed by Calcification 25(3.26%) and *Hydropericardium* 6(0.78%). No statistically significant difference was observed between the two species ($p> 0.05$) in heart condemnation rate but significantly higher number of hearts were condemned in the adults than in the young ($p= 0.000$). In goats, significantly higher pericarditis was observed in adults than in the young ($p=0.006$). From the total condemned kidneys, nephritis contributed 78(10.16%) followed by nephrosis 39(5.08%) and abscess 13(1.69%). No statistically significant difference was observed between species in kidney condemnation due to Nephritis and Abscess. However, statistically significant difference was observed due to Nephrosis.

Out of 768 brains examined 57 (7.42%) were condemned, from which *Coenurus cerebralis* and Oestrusovisaccounted for 19 (2.47%) and 38(4.95%) in ovine and caprine species respectively (Table 6). The principal pathological lesion that cause carcasses to be rejected from international market were bonny carcass 20(2.60%) followed by abscess 8(1.04%) and joundice4 (0.52%) of the total carcass rejected during the study (Table 7).

Table 7: pathologies encountered on brain and carcass

		Frequency And Percentage Of Condemnation					
		Sheep (384)			Goats (384)		
Organs Examined	Pathologies	Adult (192) (%)	Young (192)(%)	Total (384) (%)	Adult (192) (%)	Young (192)(%)	Total (384)(%)
Brain	C. Cerebralis	*7(1.82)*	*5(1.30)*	*12(3.13)*	*5(1.30)*	*2(0.52)*	*7(1.82)*
	O. Ovis	*10(2.60)*	*8(2.08)*	*18(4.69)*	*10(2.60)*	*10(2.60)*	*20(5.21)*
	Total	*17(4.43)*	*13(3.39)*	*30(7.81)*	*15(3.90)*	*12(3.13)*	*27(7.03)*
Carcass	Jaundice	*0(0.00)*	*4(1.04)*	*4(1.04)*	*0(0.00)*	*0(0.00)*	*0(0.00)*
	Abscess	*0(0.00)*	*2(0.52)*	*2(0.52)*	*4(1.04)*	*2(0.52)*	*6(1.56)*
	Bony Carcass	*8(2.08)*	*2(0.52)*	*10(2.60)*	*6(1.56)*	*4(1.04)*	*10(2.60)*
	Total	*8(2.08)*	*8(2.08)*	*16(4.17)*	*10(2.60)*	*6(1.56)*	*16(4.17)*

DISCUSSION

The result of the present study whic based on postmortem examination, proved: 397 (51.69%) Liver, 600(78.13%) Lung, 71(9.24%) Heart, *130(16.93%)* Kidneys, 57(7.42%) Brain and 32 (4.17%)Carcass, condemnation. The condemned organs having poor aesthetic value and pathologically unfit for human consumption are incinerated in the abattoir so as to break the transmission cycle of the various diseases.

A high number of livers were condemned from sheep 235(61.19%) and goats 162(42.19%) due to parasitic infection like (*Cysticercus tenuicollis, Stilesia hepatica*, Fasciolosis and Hydatidosis) and mechanical damage during evisceration [17-22].

It has also been shown that significant number of livers could be rejected due to supporting the present study.

On the other hand, from the total lungs inspected in ovine and caprine species, 299(77.86%) and 301(78.38%) respectively were condemned from being used as pet food because of reasons like pneumonia, emphysema, lung worm, Hydatid cysts and marbling appearance. From that, pneumonia accounts for 402(52.34%) prevalence, as a principal cause of lung condemnation. This condition is indicative of violation of animal welfare starting from farm to slaughter. The main causes of brain rejection were found to be *Oestrusovis38 (4.95* %) followed by *Coenurescerebralis19* (2.47%) with a higher prevalence in adults. The reason for higher prevalence of infections in the adult may be due to a longer time of exposure to infection.

Though the abattoir does not export partially approved organ and carcass, loss due to bruising is more apparent in partially and totally condemned carcasses [10]. Apart from affecting carcass value, bruising has also an implication for animal welfare [23].Furthermore, different lesions of infectious and non-infectious causes like abscess, pericarditis, nephritis and jaundice were found to be important causes for the condemnation of edible organs like liver, heart, kidney and brain. Similarly the same causes were found at Gondar [24]. In addition, isolated bacteria with public health significance from these condemned organs with possibility of contaminating the carcass [25].

CONCLUSION

Disease is the major concern to the livestock industry as it causes extensive financial waste as a result of direct and indirect economic losses and adverse effect on public health through zoonosis. The result of this study indicated, Several Parasitic Cases as major causes for organs and carcass condemnation and therefore warrants immediate, safe and controlled elimination of all condemned abattoir materials and recommends formulation of Standard regulations on meat inspection policies, as most of the cases have public health significance.

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