Acta Parasitologica Globalis 5 (1): 33-47, 2014
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2014.5.1.82369

Prevalence of Some Parasitic Helminthes and Causation of Organ Condemnation among Small Ruminants Originated from Some Selected Locations of Ethiopia

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Abstract: The study was undertaken from November, 2009 to April, 2010 at HELMEX Export Abattoir to determine and identify the prevalence of some parasitic helminthes and causation of organ condemnation among sheep and goats originated from some selected locations of Ethiopia. Faecal samples from 174 males' sheep and goats (85 sheep and 89 goats) were collected and examined by using floatation, sedimentation and egg counting techniques. The prevalence of Strongyle, Trichuris, Fasciola, Paramphistomum, Moniezia eggs and Dictyocaulus larvae in faeces were 77.01%, 5.17%, 4.02%, 3.45%,3.45% and 2.87%, respectively. A total of 2982 small ruminants (2038 goats and 944 sheep) organs were examined and revealed that 1653 (55.4%) livers, 1600 (53.65%) lungs, 268 (8.98%) kidneys and 188 (6.30%) hearts were rejected due to various types of abnormalities. Pneumonia (46.81%), Stelesia hepatica (18.18%), liver calcification (12.94%), hepatitis (10.87%), Cysticercus tenuicollis (6.33%), nephritis (5.33%), pericarditis (4.26%) and emphysema (3.66%) were found to be the major causes responsible for the rejection of respective organs. From the total organs inspected, only 30.95% organs of sheep and goats were rejected from the market. Finally, pertinent conclusions are drawn and recommendations are forwarded.

Key words: Cestodes · Nematodes · Organ Condemnation · Prevalence · Small Ruminants · Trematodes · Ethiopia

INTRODUCTION

Ethiopia has around 34-40 million TLU (Tropical livestock unit) livestock population in Africa. The share of Ethiopia is 17% cattle and 12% small ruminants in Africa [1, 2]. Ethiopia owns huge number of small ruminants, about 24 million sheep and 18 million goats [3, 4]. Sheep and goats cover more than 30% of all domestic meat consumption and generate cash income from export of meat, edible organs, live animals and skins [5, 6]. Hence, an increase in small ruminants production could contribute to the attainment of food self-sufficiency in the country particularly in response to the protein requirements for the growing human population as well as to enhance the export earning [7, 8]. However, this great livestock potential is not properly exploited due to many prevailing socio-economic, values and attitudes or traditional management methods, limited genetic potential, government policies and rampant diseases and parasitism [9]. Each year a significant loss results from death of animals, poor weight gain, condemnation of edible organs and carcass at slaughter. This production loss to the livestock industry is estimated at more than 900 million USD annually [10- 12].

Inspire of the presence of large number of small ruminant population, Ethiopia fails to optimally utilize this resource as the sector is suffering from lower productivity. Among many factors disease stands in front line in reducing the economic return. In the field while sharing common pasture animals are exposed to avarice of parasites among that cause considerable animal health problem in many parts of the world [13, 14].

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Helminthes infection in small ruminants are among serious problems in developing countries, particularly where nutrition and sanitation standard are generally poor through reduction of productivity infected animals and mortality. Most parasitic helminthes infect their host via the oral route and live either at the mucosal surface of the gastro intestinal tract or across this mucosal barrier on their way to predilection sites. The problem is greatest in tropical countries with good rainfall [15]. Among prevalent disease, gastro-intestinal tract (GIT) helminthes, particularly nematodes have been recognized as one of the major factor that limits production. GIT nematodes reduce productivity by causing production losses which is manifested by reduce weight gain, lowered meat and milk production and mortalities especially in lambs and kids [16].

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 [17].

The importance of antemorterm 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 [18, 19]. A proper ante-mortem inspection of the animal makes the task of routine postmortem inspection simpler and straight forward procedure [18]. 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 [18, 20].

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 [18]. 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 [21]. As meat is the main source of protein to man, it should be cleaned and free from diseases of particular importance to the public such tuberculosis, hydatidosis, Cysticercosis and fasciolosis. Meat and meat products are extremely perishable [22].

Therefore, special care and handling must be exercised during all operations [19]. Although some sources of contamination are obviously removed when the carcass and organs leaves the slaughter floor, contamination by contact with unhygienic surface, personnel's and air borne organisms will remain as a possibility in all operations during the subsequent handling which include chilling, freezing, processing, cutting, packaging, transport, sale and domestic handling [18].

Parasites in the tropics are responsible for greater losses to the meat industry than any other disease. Similarly, like many other tropical African countries, it is well known that parasitic diseases are among the major factors responsible for the low productivity of livestock in Ethiopia [10, 12]. These infestations not only cause clinical disease and mortalities but also cause economic losses through production losses and condemnation of organs and whole carcass at slaughter [23].

Recently several new export abattoirs like HELMEX, ELFORA, Metahara, Mojo and Luna Modern export abattoirs with export purpose have been established in Ethiopia that could enhance the contribution of the sector to the export of red meat and edible offal to the international market this enhances the economic development of the country, through economical exploration of the livestock base of the country [24- 26]. Various investigations have determined the prevalence and economic importance of organs condemnation in Ethiopia through abattoir survey [24, 27, 28]. However, most of the surveys paid attention to parasitic cause: fasciolosis and hydatidosis in cattle. Thus, there is lack of adequate information on the other causes of organ condemnation in small ruminants.

Therefore, objectives of this study were:

- To determine the prevalence of some parasitic helminthes of small ruminant in some selected locations of Ethiopia during ante and post mortem examination,
- To assess the cause of organ condemnation of sheep and goats of different locations slaughtered at HELMEX abattoir.

MATERIALS AND METHODS

Study Area: The study was conducted at Hashim Nurs' Ethiopian Livestock and Meat Export (HELMEX) abattoir from November 2009 to April 2010. The mean annual

minimum and maximum temperatures are 8.5°C and 30.7°C respectively and the mean relative humidity is 61.3% [29]. The abattoir slaughtered up to 1500 animals per day with few number of meat inspectors assigned by the Ministry of Agriculture and rural development.

Arba Minch: Some of small ruminants slaughtered at HELMEX abattoir were brought from Arba Minch Zuria Woreda, southern Ethiopia, which is located at about 500 km from Addis Ababa. The mean annual temperature is 15-31°C. The soil type of area is also classified as sandy and clay-sandy soil [30].

Jinka: The study animals were also come from South Omo Zone (Jinka) which is found in Southern Nation Nationalities and people Regional state (SNNP). The temperature of the area falls between 15.7°C and 38°C. The livestock resource of the zone is 2367712 cattle, 151499 sheep, 1881352 goats, 98545 equine, 1105053 poultry and 85,528 traditional beehives [31].

Afar: The study animals (Shoats) were brought from Afar regional state, north eastern Ethiopia. Afar regional state is characterized by an arid and semiarid climate. According to the current statistical report of the region, there are about 4 million livestock in the region including cattle, sheep, goats and camel. Over 91% of the human population in the region depends on livestock production. When the grazing resources permit, the Afar people lead Semi- Sedentary life style. The house hold may remain sedentary throughout a given year or consecutive years [32].

Borana: The study animals were also brought from Borana Zone which is situated about 600 kms South of Addis Ababa. The area is bordered by Kenya from the south, Somali regional state from east, highlands of Guji from the north and Southern Nation Nationalities and People Regional State from the west [33]. The climate is generally semi-arid with annual average rainfall ranging from 300mm in the south to over 700mm in the north. Annual mean daily temperature varies from 19°C to 24°C with moderate seasonal variation. Season affects herding patterns due to its effect on forage and water resources availability [33].

Study Population: The small ruminants destined for slaughter were all males and adult in age. They were originated from Borana, Jinka, Afar and Arba Minch. A total of 174 small ruminants comprising of 85 sheep and 89 goats were examined for helminthes corpological examination. The animals were selected randomly and identified by place of origin, species and age group. A total of 2982 small ruminants comprising of 944 sheep and 2038 goats destined for slaughter were all male and originated from Borana, Afar and Jinka. The animals were randomly selected and identified based on the place of origin and species during the study period at HELMEX abattoir from November 2009 to April 2010. The study was focused on the edible organs (Liver, kidney, heart and lung) of both sheep and goats during post mortem examination in the abattoir.

Study Design: A cross-sectional study design was undertaken and the desired sample size was calculated by the formula given by Thrusfield [34]. This was to determine the prevalence of live animal's abnormalities, slaughtered animal's organ lesions and helminthic parasites. The study was conducted in sheep and goats of Borana, Jinka, Afar and Arba Minch during ante-mortem (Live animal's abnormality, fecal helminthes examination) and post mortem (Organ lesions and helminthes examination). Most nematodes need 21 days of prepatent period and trematodes and cestodes need months to shed their eggs in feces [35, 36]. Thus, the prevalence of helminthes in Borana, Jinka, Afar and Arba Minch in sheep and goat populations was determined by this study during ante-mortem and post mortem examination as the time taken to travel to Debre Zeit for slaughter is less than 10 days as shown in Table 2.

Abnormalities in Live Sheep and Goat During Ante Mortem Examination: Ante mortem inspection was conducted on 2038 goats and 944 sheep independently of the post mortem examination, while the animals enter into the lairage within 24 hours of arrival at the slaughter house. Animals were grouped into different categories of species and place of origin. Animals were then clinically examined for any sign of illness both at static and in motion according to Campos [37] and following the judgments passed by FAO [1]. Animal fit for human consumption was allowed for slaughter.

Helminthes in Live Sheep and Goats: Animals considered in this study were a total of 174 small ruminants comprising of 85 sheep and 89 goats originated from Borana, ArbaMinch and Jinka. Faecal samples were taken directly from the rectum from randomly selected small ruminants. The faecal samples were processed and examined microscopically to detect qualitatively the

Table 1: Number of sheep and goats studied by geographical origin for body abnormalities during ante-mortem and for helminthes and organ lesions during post mortem examination at HELMEX

Origin	Caprine	Ovine	Total
Afar	501	349	850
Borona	636	400	1036
Jinka	901	195	1096
Total	2038	944	2982

Table 2: Number of sheep and goats studied by geographical origin for some parasite helminthes during ante-mortem from fecal samples at Debre Zeit HELMEX abattoir

Origin	Caprine	Ovine	Total	Time taken to travel to Debre Zeit
Arba Minch	29	28	57	7 days
Borona	31	29	60	10 days
Jinka	29	28	57	10 days
Total	89	85	174	

helminthes parasites eggs and their parasite load or burden quantitatively measured by McMaster and Stoll's egg counting technique.

Coprological Examination

Qualitative Fecal Examination: Fecal samples were taken directly from the rectum of the selected animals randomly. Faecal samples were processed by faecal floatation technique for nematodes and cestodes and sedimentation technique for trematode parasites. Finally the processed samples were examined using microscope as described by Urguhart [36].

Quantitative Faecal Examination: From each of randomly selected small ruminants comprising of 174 animals (85 sheep and 89 goats) faecal samples were taken directly from the rectum and the faecal samples were processed and examined. And the level of egg per gram of faeces (EPG) was determined by the standard Mac Master egg counting technique using saturated salt solution as flotation fluid for cestodes and nematodes, while Stoll's egg counting technique was used to determine the level of egg per gram faeces for trematode parasites [36].

Helminthes in Organs of Slaughtered Sheep and Goats: A total 2038 goats and 944 sheep were randomly selected from Borana, Jinka and Afar. The animals were slaughtered and examined during post mortem inspection in the HELMEX abattoir from November 2009 to April 2010. The edible organs, namely livers, lungs, kidneys and hearts were inspected in routine meat inspection procedures for the presence of helminthes and the results were recorded.

Postmortem Lesion/Abnormalities in Organs of Slaughtered Sheep and Goats: During post mortem inspection the edible organs, namely livers, lungs hearts and kidneys were thoroughly inspected by visualization, palpation and making system incisions where necessary for the presence of cysts, parasites and other pathological abnormalities. Pathological lesion were differentiated and judged according to FAO [1] and WHO [38] guidelines on meat inspection for developing countries. The decisions at post mortem inspections were classified into the following four categories of judgments. These were 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.

Data Management and Statistical Analysis: Data generated from coprological examination, ante mortem and post mortem inspections were recorded in the Microsoft Excel 2003 program. Descriptive statistics such as percentage was used to determine the prevalence of some parasitic helminthes and percentage was also used to determine the level of organs condemnation rate which was defined as proportion of condemned organ to the total number of organs examined. The variation of parasite species and organ lesions prevalence among locations and host species were compared using Pearson's chi-square (X^2) and differences were regarded statistically significant if α– value is less than 0.05.

RESULTS

Ante Mortem Findings

The Prevalence and Mean Burden of Parasitic Helminthes During Ante-Mortem: The prevalence and mean burden of parasitic helminthes in different geographical locations was assessed during antemortem fecal samples of sheep and goats before slaughtered at HELMEX abattoir, Debre Zeit are presented in Table 3.

The Prevalence of Abnormal Clinical Signs in Live Animals: The prevalence of abnormalities in 2982 small ruminants (944 sheep and 2038 goats) was assessed using clinical signs in different geographical locations during antemortem examination as presented in Table 4.

The most commonly encountered abnormalities during antemortem inspection were nasal discharge (17.37%), local swelling (1.07%), lameness (1.07%) and poor body condition (1.04%). Nasal discharge was the

Table 3: Prevalence and mean load of helminthes in sheep and goats in different locations as assessed during ante mortem examination

Small ruminants geographical origin	Dictyocaulus	Fasciola	Moniezia	Strongyle	Trichuris	Paramphistomum
Arba Minch						
Caprine (Total examined)	29	29	29	29	29	29
Caprine (+ ve & prevalence)	0(0)	0(0)	1(3.33)	25(83.33)	1(3.33)	0(0)
Caprine (Mean burden + SD)			150	1092±504	100	
Ovine (Total examined)	28	28	28	28	28	28
Ovine (+ve & prevalence)	2(6.25)	1(3.13)	2(6.25)	16(50)	1(3.13)	2(6.25)
Ovine (Mean burden + SD)	175±35	400	150±0	1131±422	250	300±141
Borana						
Caprine (Total examined)	31	31	31	31	31	31
Caprine (+ ve & prevalence)	1(2.94)	1(2.94)	0(0)	27(79.41)	1(2.94)	2(5.88)
Caprine (Mean burden + SD)	200	200		1669+ 636	150	250+ 71
Ovine (Total examined)	29	29	29	29	29	29
Ovine (+ve & prevalence)	0(0)	2(6.45)	1(3.23)	21(67.74)	2(6.45)	1(3.23)
Ovine (Mean burden + SD)		(300±141)	150	1648±639	175±106	300
Jinka						
Caprine (Total examined)	29	29	29	29	29	29
Caprine (+ ve & prevalence)	0(0)	1(3.13)	2(6.25)	23(71.86)	2(6.25)	1(3.13)
Caprine (Mean burden + SD)		400	225±35	1615±674	225±106	100
Ovine (Total examined)	28	28	28	28	28	28
Ovine (+ve & prevalence)	2(6.45)	2(6.45)	0(0)	22(70.97)	2(6.25)	0(0)
Ovine (Mean burden + SD)	125±35	250±71		1075±337	250±0	

Table 4: Prevalence of abnormalities in live sheep and goats that originated from different locations as assessed during ante mortem using clinical signs

Ante-mortem abnormality types	Afar (%)	Borana (%)	Jinka (%)	Grand Total (%)	Sign. b/n sites	Sign. b/n species
Lameness (Overall in sheep & goat)	15/850(1.76)	6/1036(0.58)	11/1096(1.00)	32(1.07)	Sign	0.044
Caprine (negative)	489	633	891		0.232	Non-Sign
Caprine (positive & prevalence)	12 (2.40)	3 (0.47)	10 (1.11)	25(1.23)		
ovine(negative)	346	397	194			
ovine (positive & prevalence)	3 (0.86)	3 (0.75)	1 (0.51)	7(0.74)		
Poor body condition (Overall)	8(0.94)	6(0.58)	17(1.55)	31(1.04)	Non-Sign	0.082
Caprine (negative)	497	632	890		0.396	Non-Sign
Caprine (positive & prevalence)	4(0.80)	4(0.63)	11(1.22)	19(0.93)		
ovine(negative)	345	398	189			
ovine (positive & prevalence)	4(1.15)	2(0.5)	6(3.08)	12(1.27)		
Local swelling (Overall)	10(1.18)	15(1.45)	7(0.64)	32(1.07)	Non-Sign	0.182
Caprine (negative)	494	626	896		0.960	Non-Sign
Caprine (positive & prevalence)	7(1.40)	10(1.57)	5(0.55)	22(1.08)		
ovine(negative)	346	395	193			
ovine (positive & prevalence)	3(0.86)	5(1.25)	2(1.03)	10(1.06)		
Nasal discharge (Overall)	191(22.47)	177(17.08)	150(13.69)	518(17.37)	Sign	0.000
Caprine (negative)	361	509	776		0.000	Sign
Caprine (positive & prevalence)	140(27.94)	127(19.97)	125(13.87)	392(19.23)		
ovine(negative)	298	350	170			
ovine (positive & prevalence)	51(14.60)	50(12.50)	25(12.82)	126(13.35)		

major cause of abnormalities during antemortem inspection and statistical analysis has shown that there was significant difference between the species and sites ($P<0.05$).

Post Mortem Examination: Out of 2982 small ruminants slaughtered in the HELMEX abattoirs, 1653, 1600, 268 and 188 of livers, lungs, kidneys and hearts were condemned from gross abnormalities as unfit for international and domestic consumption.

The Prevalence of Helminthes During Post Mortem Examination: The most commonly encountered helminthes during postmortem inspection for the major causes of organs condemnation were *Stelesia hepatica* (18.18%), *Cysticercus tenuicollis* (6.33%), Fasciolosis (1.61%) and hydatidosis (0.50%). *Stelesia hepatica* was the major cause of organ condemnation as result of helminthes and there was a significant difference between the species and sites ($P<0.05$) as shown in Table 5.

Table 5: Prevalence of helminthes in different geographical locations as assessed in slaughtered sheep and goats during post mortem examination.

Helminthes in sheep & goats	Afar (%)	Borana (%)	Jinka (%)	Grand Total (%)	Sign. b/n sites	Sign. b/n species
Fasciolosis (Overall in sheep & goat)	17/850(2)	16/1036(1.54)	15/1096(1.37)	48/2982(1.61)	Non-Sign	0.536
Caprine (negative)	501	636	896		0.000	sign
Caprine (positive & prevalence)	0(0)	0(0)	5 (0.55)	5(0.25)		
ovine(negative)	332	384	185			
ovine (positive & prevalence)	17 (4.87)	16 (4.0)	10 (5.13)	43(4.56)		
Cysticercus tenuicollis (Overall)	48(5.65)	98(9.46)	43(3.92)	189(6.33)	Sign	0.000
Caprine (negative)	478	566	871		0.319	Non-Sign
Caprine (positive & prevalence)	23(4.59)	70(11.00)	30(3.33)	123(6.04)		
ovine(negative)	324	372	182			
ovine (positive & prevalence)	25(7.16)	28(7.00)	13(6.67)	66(6.99)		
Cysticercus ovis (Overall)	0(0)	0(0)	0(0)	0(0)	Non-value	
Caprine (negative)	501	636	901			Non-value
Caprine (positive & prevalence)	0(0)	0(0)	0(0)	0(0)		
ovine(negative)	349	400	195			
ovine (positive & prevalence)	0(0)	0(0)	0(0)	0(0)		
Hydatidosis in lung (Overall)	6(0.71)	4(0.39)	5(0.46)	15(0.50)	Non-Sign	0.598
Caprine (negative)	497	634	897		0.889	Non-Sign
Caprine (positive & prevalence)	4(0.80)	2(0.31)	4(0.44)	10(0.49)		
ovine(negative)	347	398	194			
ovine (positive & prevalence)	2(0.57)	2(0.5)	1(0.51)	5(0.53)		
Stelesia hepatica (Overall)	106(12.47)	217(20.95)	219(19.98)	542(18.18)	sign	0.000
Caprine (negative)	424	481	701		0.000	sign
Caprine (positive & prevalence)	77(15.37)	155(24.37)	200(22.20)	432(21.20)		
ovine(negative)	320	338	176			
ovine (positive & prevalence)	29(8.31)	62(15.5)	19(9.74)	110(11.65)		

Table 6: Prevalence of different gross lesions in different geographical locations as assessed in slaughtered sheep and goats during postmortem examination in lungs

Gross lesions in lungs	Afar (%)	Borana (%)	Jinka (%)	Grand Total (%)	Sign. b/n sites	Sign. b/n species
Lung emphysema	36(4.24)	23(2.22)	50(4.56)	109(3.66)	sign	0.009
caprine(negative)	486	623	863		0.075	Non-Sign
caprine(positive and prevalence)	15(2.99)	13(2.04)	38(4.22)	66(3.24)		
Ovine (negative)	328	390	183			
Ovine(positive and prevalence)	21(6.02)	10(2.50)	12(6.15)	43(4.56)		
Pneumonia of lung	419(49.29)	641(61.87)	336(30.66)	1396(46.81)	sign	0.000
caprine(negative)	247	217	635		0.234	Non-Sign
caprine(positive and prevalence)	254(50.70)	419(65.88)	266(29.52)	939(46.07)		
Ovine (negative)	184	178	125			
Ovine(positive and prevalence)	165(47.28)	222(55.5)	70(35.90)	457(48.41)		
Lung calcification	6(0.71)	19(1.83)	7(0.64)	32(1.07)	sign	0.013
caprine(negative)	499	626	896		0.063	Non-Sign
caprine(positive and prevalence)	2(0.40)	10(1.57)	5(0.55)	17(0.83)		
Ovine (negative)	345	391	193			
Ovine(positive and prevalence)	4(1.15)	9(2.25)	2(1.03)	15(1.59)		
Lung abscessation	4(0.47)	6(0.58)	10(0.91)	20(0.67)	Non-Sign	0.449
caprine(negative)	499	632	892		0.521	Non-Sign
caprine(positive and prevalence)	2(0.40)	4(0.63)	9(1.0)	15(0.74)		
Ovine (negative)	347	398	194			
Ovine(positive and prevalence)	2(0.57)	2(0.5)	1(0.51)	5(0.53)		
Other lesions of lung	8(0.94)	7(0.68)	13(1.19)	28(0.94)	Non-Sign	0.474
caprine(negative)	498	633	891		0.200	Non-Sign
caprine(positive and prevalence)	3(0.60)	3(0.47)	10(1.11)	16(0.79)		
Ovine (negative)	344	396	192			
Ovine(positive and prevalence)	5(1.43)	4(1.0)	3(1.54)	12(1.27)		

Table 7: Prevalence of gross pathological abnormalities or lesions in different geographical location as assessed in slaughtered sheep and goats during post examination of livers

Liver lesion types in small ruminants	Afar	Borana	Jinka	Grand Total	Sign. b/n sites	Sign. b/n species
Liver abscessation	3(0.35)	3(0.29)	8(0.73)	14(0.47)	Non-Sign	0.279
Caprine (negative)	500	635	895		0.366	Non-Sign
Caprine(positive and prevalence)	1(0.20)	1(0.16)	6(0.67)	8(0.39)		
Ovine (negative)	347	398	193			
Ovine(positive and prevalence)	2(0.57)	2(0.50)	2(1.03)	6(0.64)		
Liver calcification	93(10.94)	144(13.90)	149(13.59)	386(12.94)	Non-Sign	0.118
Caprine (negative)	464	574	801		0.000	sign
Caprine(positive and prevalence)	37(7.39)	62(9.75)	100(11.10)	199(9.76)		
Ovine (negative)	293	318	146			
Ovine(positive and prevalence)	56(16.05)	82(20.50)	49(25.13)	187(19.81)		
Liver cirrhosis	24(2.82)	18(1.74)	23(2.10)	65(2.18)	Non-Sign	0.268
caprine(negative)	498	633	889		0.000	sign
caprine(positive and prevalence)	3(0.60)	3(0.47)	12(1.33)	18(0.88)		
Ovine (negative)	328	385	184			
Ovine(positive and prevalence)`	21(6.02)	15(3.75)	11(5.64)	47(4.98)		
Hepatitis of liver	99(11.65)	122(11.78)	103(9.40)	324(10.87)	Non-Sign	0.146
caprine(negative)	448	546	817		0.481	Non-Sign
caprine(positive and prevalence)	53(10.58)	90(14.15)	84(9.32)	227(11.15)		
Ovine (negative)	303	368	176			
Ovine(positive and prevalence)	46(13.18)	32(8.00)	19(9.74)	97(10.28)		
Liver mechanical damage	23(2.70)	11(1.06)	12(1.09)	46(1.54)	sign	0.005
caprine(negative)	498	631	894		0.000	sign
caprine(positive and prevalence)	3(0.60)	5(0.79)	7(0.78)	15(0.74)		
Ovine (negative)	329	394	190			
Ovine(positive and prevalence)	20(5.73)	6(1.50)	5(2.56)	31(3.28)		
Other lesions of liver***	10(1.18)	20(1.93)	9(0.82)	39(1.31)	Non-Sign	0.073
caprine(negative)	498	629	895		0.000	sign
caprine(positive and prevalence)	3(0.60)	7(1.10)	6(0.67)	16(0.79)		
Ovine (negative)	342	387	192			
Ovine (positive and prevalence)	7(2.01)	13(3.25)	3(1.54)	23(2.44)		

Table 8: Prevalence of gross pathological abnormalities or lesions in different geographical location as assessed in slaughtered sheep and goats during post examination of heart

Heart lesion types in small ruminants	Afar	Borana	Jinka	Grand Total	Sign. b/n sites	Sign. b/n species
Heart abscessation	1(0.18)	1(0.10)	2(0.18)	4(0.13)	Non-Sign	0.853
caprine(negative)	501	636	900		0.062	Non-Sign
caprine(positive and prevalence)	0(0)	0(0)	1(0.11)	1(0.05)		
Ovine (negative)	348	399	194			
Ovine(positive and prevalence)	1(0.29)	1(0.25)	1(0.51)	3(0.32)		
Heart calcification	5(0.59)	8(0.77)	8(0.73)	21(0.70)	Non-Sign	0.886
caprine(negative)	499	632	894		0.524	Non-Sign
caprine(positive and prevalence)	2(0.40)	4(0.63)	7(0.78)	13(0.64)		
Ovine (negative)	346	396	194			
Ovine(positive and prevalence)	3(0.86)	4(1.0)	1(0.51)	8(0.85)		
Pericarditis of heart	42(4.94)	38(3.67)	47(4.29)	127(4.26)	Non-Sign	0.396
caprine(negative)	467	615	859		0.047	sign
caprine(positive and prevalence)	34(6.79)	21(3.30)	42(4.66)	97(4.76)		
Ovine (negative)	341	383	190			
Ovine(positive and prevalence)	8(2.29)	17(4.25)	5(2.56)	30(3.18)		
Other lesions of heart	13(1.53)	11(1.06)	12(1.09)	36(1.21)	0.596	Non-Sign
caprine(negative)	497	631	892		0.017	sign
caprine(positive and prevalence)	4(0.80)	5(0.79)	9(1.0)	18(0.88)		
Ovine (negative)	340	394	192			
Ovine(positive and prevalence)	9(2.58)	6(1.5)	3(1.54)	18(1.91)		

Table 9: Prevalence of gross pathological abnormalities or lesions in different geographical location as assessed in slaughtered sheep and goats during post examination of kidney

Kidney calcification	6(0.71)	4(0.39)	5(0.46)	15(0.50)	Non-Sign	0.598
Caprine(negative)	498	633	896		0.677	Non-Sign
Caprine(positive and prevalence)	3(0.60)	3(0.47)	5(0.55)	11(0.54)		
Ovine (negative)	346	399	195			
Ovine(positive and prevalence)	3(0.86)	1(0.25)	0(0)	4(0.42)		
Nephritis	57(6.71)	50(4.83)	52(4.74)	159(5.33)	Non-Sign	0.108
caprine(negative)	469	606	863		0.129	Non-Sign
caprine(positive and prevalence)	32(6.39)	30(4.72)	38(4.22)	100(4.91)		
Ovine (negative)	324	380	181			
Ovine(positive and prevalence)	25(7.16)	20(5.0)	14(7.18)	59(6.25)		
Nephrosis	8(0.94)	10(0.97)	7(0.64)	25(0.84)	Non-Sign	0.659
caprine(negative)	497	628	895		0.693	Non-Sign
caprine(positive and prevalence)	4(0.80)	8(1.26)	6(0.67)	18(0.84)		
Ovine (negative)	345	398	194			
Ovine(positive and prevalence)	4(1.15)	2(0.5)	1(0.51)	7(0.74)		
Kidney abscessation	3(0.35)	3(0.29)	5(0.46)	11(0.37)	Non-Sign	0.814
caprine(negative)	500	634	897		0.737	Non-Sign
caprine(positive and prevalence)	1(0.2)	2(0.31)	4(0.44)	7(0.34)		
Ovine (negative)	347	399	194			
Ovine(positive and prevalence)	2(0.57)	1(0.25)	1(0.51)	4(0.42)		
Others lesions of kidney	15(1.76)	25(2.41)	18(1.64)	58(1.95)	Non-Sign	0.394
caprine(negative)	496	616	886		0.918	Non-Sign
caprine(positive and prevalence)	5(1.00)	20(3.14)	15(1.66)	40(1.96)		
Ovine (negative)	339	395	192			
Ovine(positive and prevalence)	10(2.87)	5(1.25)	3(1.54)	18(1.91)		

The Prevalence of Gross Pathological Abnormalities or Lesions During Post Mortem

The Prevalence of Gross Pathological Abnormalities or Lesions in the Lungs: The most commonly encountered gross pathological abnormalities during postmortem inspection of lungs were pneumonia (46.81%), emphysema (3.66%), calcification (1.07), other lesions (0.94%) and abscessation (0.67%). Pneumonia was the major gross pathological lesion encountered and statistical analysis has indicated that there was a significant difference between the species ($p<0.05$), while no significant difference was observed between the sites ($P>0.05$).

The Prevalence of Gross Pathological Abnormalities or Lesions in the Livers: The most commonly encountered gross pathological abnormalities or lesions during postmortem inspection in liver were calcification (12.94%), hepatitis (10.87%), cirrhosis (2.18%), mechanical damage (1.54%), other lesions (1.31%) and abscessation (0.47). Calcification was the major pathological gross lesion was detected during postmortem inspection of the liver and statistical analysis has shown that there was a significant difference between the sites ($P<0.05$), but no significant difference was observed between species ($P>0.05$).

The Prevalence of Gross Pathological Abnormalities or Lesions in the Heart: The most commonly encountered gross pathological abnormalities or lesions during postmortem inspection of hearts were pericarditis (4.26%), other lesions (1.21%) calcification (0.70%) and abscessation (0.13%). Pericarditis was the major pathological gross lesion was detected during post mortem inspection of the hearts and statistical analysis has shown that there was a significant difference between the sites ($P<0.05$), but no significant difference ($P>0.05$) was observed between the species.

The Prevalence of Gross Pathological Abnormalities or Lesions in the Kidney: The most commonly encountered gross pathological lesions or abnormalities during postmortem inspection of the kidneys were nephritis (5.33%), other lesion (1.95%), nephrosis (0.84%), calcification (0.50%) and abscessation (0.37%). Nephritis was the major pathological gross lesion was detected

during postmortem inspection of the kidneys. Statistical analysis has indicated that there was no a significant differences (P>0.05) both between the species and sites.

DISCUSSION

During present study period, the prevalence of some gastrointestinal parasite helminthes in different geographical locations (Arba Minch, Borana and Jinka) were assessed during ante mortem fecal samples of sheep and goats at HELMEX abattoir, Debre Zeit. The following prevalence of parasite helminthes was obtained in Arba Minch *Strongyle* (71.93%), *Moniezia* (5.26%), *Trichuris* (3.51%), *Dictyocaulus* (3.51%), *Paramphistomum* (3.51%) and *Fasciola* (1.75%). And the following prevalence of parasite helminthes was also found in Borana: *Strongyle* (46.67%), *Trichuris* (5%), *Fasciola* (5%), *Paramphistomum* (5%), *Dictyocaulus* (1.67%) and *Moniezia* (1.67%). In Jinka, the following prevalence of some helminthes parasite was obtained: *Strongyle* (78.95%), *Trichuris* (7.02%), *Fasciola* (5.26%), *Dictyocaulus* (3.51%) and *Paramphistomum* (1.75%). Among the helminthes, *Strongyle* nematodes were dominating parasites in both sheep and goats this finding in agreement with other survey reported from Tesfaye [14], Aseffa [24], Jembere [25], Melkamu [39], Bekele [40], Thesfalem [41], Gebreyesus [42], Bayou [43] and Genene [44].

During study period, the overall prevalence of *Strongyle* eggs in the three different geographical locations, namely Arba Minch, Borana and Jinka were much higher as compared to other parasite helminthes prevalence. The distribution of endoparasites depends on the ecology (Rainfall, temperature and soil type) [45]. The wide spread existence of parasites as well as their overall prevalence in the study areas indicated their role in reducing productivity and health of small ruminants of the study areas [46].

During present study period, the overall prevalence of *Strongyle* nematodes in the three different geographical locations, namely Arba Minch, Borana and Jinka were high compared to that of *Fasciola* species. Similar results were reported by Melkamu [39] and Bekele [40] where the prevalence of *Strongyle* species was higher than that of *Fasciola* species. This is may be due to the unfavorable environment and ecology of the rift valley area for snail development and survival of infective metacercaria. The intermediate host for *Fasciola hepatica*, *Lyminea truncatula* and for *Fasciola gingantica*, *Lyminea natalensis* is most adapted to marshy areas, irrigated land and around water bodies [47], which is not the case for Borana and Jinka areas. This is agreement with [24] who indicated that in Ethiopia, Fasciolosis is widespread disease in areas with an altitude above 1800 to 2000 meters above sea level. It might also be due to the fact that *Strongyles* have a direct life cycle and thus the chance of successful infection in much higher than trematodes which need intermediate hosts to complete their life cycle [24].

The present study was not only conducted qualitative helminthes study but also the quantitative fecal egg count was made to indicate the parasite burden of the animal. It is known that fecal egg count are fairly reliable in situations where parasite burdens are high and worms are mature enough to release eggs in feces [48]. The study has also indicated that high mean burden parasite of *Strongyle* nematodes compared to the other helminthes parasite in the three different geographical locations, namely Arba Minch, Borana and Jinka [49].

Meat inspection is conducted in the abattoir for the purpose of screening and removing animal products with abnormal pathological lesions that unattractive and unsafe for human consumption. Meat inspection assists to detect and eradicate certain disease of livestock and prevent the distribution of infected meat that could give disease in animals and humans and to ensure competitiveness of the product in the local and global market [17, 25, 50, 51].

In developing countries abattoirs play a major role in providing and serving as a source of information and a reference center for disease prevalence studies. The governments or other programs aimed at controlling or eradicating diseases across Africa can use abattoirs survey result in the planning and controlling of livestock diseases [52].

In the present study postmortem examination was conducted in the abattoir after all the animals in the lairage have passed the antemortem inspection. The most common clinical signs encountered during antemortem inspection were nasal discharge (17.37%), local swelling (1.07%), lameness (1.07%) and poor body condition (1.04%). Nasal discharge was probably due to immune suppression, stress and consequent respiratory diseases during transportation and overcrowding in the lairage. Diseased or animals that show signs of abnormality during ante mortem inspection were not be allowed to

enter the abattoir for slaughter as recommended [19]. Localized swelling and lameness found during ante mortem inspection required detailed post mortem examination of the carcass to confirm the cause and localities of these conditions. Post mortem inspection of the carcass of these animals revealed that the swelling were localized to one area and the lameness was due to trauma to the legs, while being driven to the abattoir. Hence, in both cases the affected parts were trimmed off and the rest part of the carcass was passed as fit for human consumption [28]. Nasal discharge was the major of the abnormalities encountered during ante mortem inspection. Nasal discharge was significantly varied between the species and place of the origin and this may be due to the epidemiological sources of the animals and the behavior of the two species [53].

In the present study out of the total 2982 small ruminants slaughtered at the HELMEX abattoir 1653, 1600, 268 and 188 of livers, lungs, kidneys and hearts were respectively rejected from market due to gross abnormalities. However, organs like lung and heart are not needed at international market but examined for the meat inspection purpose of breaking transmission cycle of animal disease.

During the study 1043 and 610 livers of caprine and ovine species, respectively, rejected from the total number of small ruminants examined in the abattoir. The most important and major disease conditions or abnormalities were encountered to render the liver to be condemned during the study period are as results of infection and non-infectious causes. The common and frequently pathological conditions and parasitic causes were *Stelesia hepatica* (18.18%), liver calcification (12.94%), hepatitis (10.87%), *Cysticercus tenuicollis* (6.33%), liver cirrhosis (2.18%), Fasciolosis (1.61%), liver mechanical damage (1.54%), other lesions of liver (1.31%) and liver absecessation (0.47%). Similarly causal findings were found at Gonder abattoir [27] and goats slaughtered in Nigeria [54]. In addition [54] isolated bacteria with public health significant from these condemned organs that might contaminate the carcass. As a result of this, losses from liver condemnation were assumed to occur since hepatic pathology is associated to infection that might have public importance [55, 56]. Statistical analysis has indicated that there was significant difference in the rejection rates of organs like liver between the two species and place of origin. The likely explanation for this difference may be the fact that difference in feeding behavior of the two species, epidemiological sources of the animals and relative indiscriminate management practices among different age groups of animals, carelessness of workers in evisceration process that caused significant number of livers rejected between the two species and place of origin due to mechanical damage [57].

Of all small ruminants slaughtered in the abattoir during the study period only 0.25% and 4.56% of livers of caprine and ovine species, respectively, were rejected for human consumption as a result of Fasciolosis. The statistical analysis has indicated that there was a significant difference in the rejection rate of liver due to Fasciolosis between the sites. This low prevalence of Fasciolosis in this study can be explained due to their origin from the lowland areas of the regions of the country where there are no conducive ecological factors for the survival of the snail intermediate host and trematodes (*Fasciola* species) in the environment [58, 59].

Research conducted by several investigators on ovine fasciolosis prevalence in different parts of the country revealed 6.9% in Debre Zeit HELMEX (Jibat, 2006), 40.6 % in Gonder [27], 53.3% in Eastern Gojam [60], 13.4% in Nekemt [61] and 30% in Ziway [62] and 2.55% in Debre Zeit ELFORA [53]. And, caprine fasciolosis prevalence in different abattoirs was 3.6% in HELMEX abattoir [28] and 1.76% in ELFORA abattoir [53]. In Ethiopia, fasciolosis has been reported to be one of the major disease problems of livestock industry and exist in almost all regions. However, the prevalence rates, epidemiology and *Fasciola* species involved vary significantly with locality. This is attributed mainly due to the variation in the climate and ecological conditions [3, 63, 64].

During the study period 1063 and 537 lungs of caprine and ovine species respectively rejected from the total number of small ruminants examined in the abattoir. The most important and major disease conditions or abnormalities were encountered and rendered the lungs to be condemned for not being used as pet food as a result of the major pathological lesions detected. The lesions found were pneumonia (46.81%), emphysema (3.66%) and calcification (1.07%), other lesions (0.94%), abscessation (0.67%) and hydatid cyst (0.50%). Pneumonia accounts 46.81% of the total number of small ruminants slaughtered in the abattoir during study period. This condition is indicative of violation of animals' welfares starting from farm to slaughter. (This may be due to poor management

for the animal in their life time). Statistical analysis has indicated that there was a significant difference in the rejection of lung due to pneumonia between the two species, while there was no significant difference between the sites. This may be due to feeding behavior of the two species and indiscriminate management practice.

Cysticercus tenuicollis, *Cysticercus ovis* and *Stelesia hepatica* have no public health significance but important cause of economic loss in the meat industry due to the fact that organs and carcasses of sheep and goats harboring them are rejected for aesthetic reasons. Moreover organs infected with these parasite stages are not accepted at international market. In the near future these might become a threat to the present market being practical by the newly emerging export abattoirs in the country. The threat these parasites pose to the small ruminants' meat industry in Ethiopia is evident due to the present situation of improper disposal of offal being practiced. Some stray dogs have free access to condemned organs. This may lead to the perpetuation of the life cycle between intermediate hosts and the final host in case of *Cysticercus ovis* and *Cysticercus tenuicollis* (in addition to *Cysticercus cerebralis* and hydatid cyst that are important from public health point of view [65, 66]. In addition to the stray dogs that have access to the condemned offal/organs, offal is sold to feed dogs and cats at road side in the towns like Bishoftu. This maintains the life cycle between the ruminant and dogs and human that may end in the establishment of the cystic disease [28].

During the study period helminthes were the major causes of liver and lung condemnation of small ruminants slaughtered in the abattoir. These helminthes were *Stelesia hepatica* (18.18%), *Cysticercus tenuicollis* (6.33%), fasciolosis (1.61%) and hydatidosis (0.5%). *Stelesia hepatica* accounts for 18.18% of the total number of small ruminants slaughtered in the abattoir during study period. Statistical analysis has indicated that there was significant difference in rejection rate of liver due to *Stelesia hepatica* between the sites and species.

Hydatidosis is an important cylozoonosis of major economic and public health significant in many countries of the world. Factors governing the prevalence of hydatidosis in a given locality may be associated with the prevailing specific social, cultural, environmental and epidemiological situations [67, 68, 69]. In Ethiopia the wide spread of backyard animal slaughtered practice, the corresponding absence of rigorous meat inspection procedure, feeding of dogs with condemned organ facilitate and maintain the perfect life cycle of the parasites in the ruminants[25, 26]. The threat of these parasites that post to the small ruminants' meat industry in Ethiopia is evident due to present situation of improper disposal of offal's being practiced and free access of condemned organs to stray dogs [28].

During the present study, 268 kidneys of total of small ruminants slaughtered in the abattoir were totally condemned due to gross pathological abnormalities. These were nephritis (5.3%), others lesion of kidney (1.97%), nephrosis (0.84%), calcification (0.5%) and abscessation (0.37%). Nephritis accounts for 5.3% of the total number of small ruminants slaughtered in the abattoir. Stastical analysis has revealed that there was no significant difference in the rejection rate of kidney due to nephritis between the sites and species.

During the study period 188 hearts were totally condemned due to different pathological gross abnormalities. These abnormalities were pericarditis (4.26%), other lesions of heart (1.21%), calcification (0.70%) and abscessation (0.13%). Pericarditis accounts for 4.26% of the total number of small ruminants slaughtered in the abattoir during the study period. Statistical analysis has also revealed that there was no significant difference in rejection rate of heart due to pericarditis between the two species while significance difference was observed between the sites.

Furthermore, different lesions of infectious and non-infectious causes like abscess, pericarditis, nephrites and calcification were found to be important causes for the condemnation of edible organ like liver, kidney and heart [69, 70, 71, 72, 73, 74]. Similarly the same causes were found at Gonder [27] and goats slaughtered at Nigeria [54].

CONCLUSION

Identifying major diseases problems prevalent in different part of the country via proper disease surveillance is helpful. According to the result of this study during post mortem examination *Stelesia hepatica*, liver calcification, hepatitis, pneumonia, nephritis, *Cysticercus tenuicollis*, emphysema and pericarditis are the most and major causes for respective organs to be rejected in Borana, Afar and Jinka. The improper management practice of animals on farm or at home and improper disposal or handling of offal's in the control of

parasitic diseases results in severe economic loss and consequently exclude the country from attractive international market thereby greatly reducing the country's foreign exchange earnings.

The major parasitic helminthes in the three different geographical locations (Borana, Jinka and Arba Minch) of the study animals the *Strongyle* nematodes were found to be predominant endo-parasite followed by *Trichuris*, *Fasciola*, *Monieza*, *Dictyocaulus* and *Paramphistomum* species.

The study has also indicated that high mean burden of *Strongle* nematodes compared to other helminthes in the three different geographical locations.

These all indicate that Borana, Jinka and Arba Minch areas are favorable for the successive perpetuation of the mentioned parasites and for their subsequent transmission to susceptible host that necessitate regular parasitological investigations and application of effective prophylactic and control measures.

In line with the findings of this study, the following recommendations are forwarded:

- Backyard slaughtering in different localities should be discouraged as the activity of humans in such slaughtering system contributes to maintenance of parasites life cycle.
- Detailed epidemiological studies should be conducted on the prevalence and species distribution of endoparasites of small ruminants in different seasons, relatively long duration and involving all age and sex groups
- Force dog owners to regularly deworm their animals with anthelmenthics to break the perfect life cycle of parasites that might have public health importance.
- Immediate, safe and controlled elimination of all condemned abattoir materials and sale of contaminated offal and heads as dogs' feed should be prohibited by law.

ACKNOWLEDGEMENTS

I would like to express my heart felt gratitude to my advisor Dr. Reta Duguma for his scholarly guidance, rectifying the manuscripts and constant encouragements throughout the study time. I would like to express my gratitude to the staff member of the HELMEX abattoir for their cooperation during my study period. The moral and financial support of Akililu Lemma Foundation during the study period would never be forgotten.

List of Abbreviations:

AAU	Addis Ababa University
DVM	Doctor of Veterinary Medicine
EPG	Egg per Gram of Faeces
EVA	Ethiopian Veterinary Association
FAO	Food and Agricultural Organization of the United Nations
FVM	Faculty of Veterinary Medicine
GIT	Gastro Intestinal Tract
HELMEX	Hashim Nurs' Livestock and Meat Export abattoir
ILCA	International Livestock Center for Africa
ILRI	International Livestock Research Institute
NAHDIC	National Animal Health Diagnosis and Investigation Center
NMSA	National Meteorology Service Agency
NVI	National Veterinary Institute
SNNP	Southern Nation Nationalities and People of regional state
SOZA	South Omo Zone Agricultural Office
TLU	Tropical Livestock Unit
UNDP	United Nations Development Program
USD	United State Dollar
WHO	World Health Organization

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