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Prevalence of *Fasciola* Infection in Slaughtered Animals in Kashmir

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Abstract- Fasciolosis is denoted as a significant veterinary health problem. During current study, a total of 714 cattle slaughtered at different abattoirs of Srinagar city (J&K) were examined for the presence of *Fasciola* sps in the liver from January 2014 to January 2016. There was moderate prevalence of 26.84% in the studied area. Predominance of *Fasciola gigantica* (20.86%) was seen as compared to *Fasciola hepatica* (3.361%) infection with mixed infection of 2.66%. Epidemiological determinants like age, gender, breed and body condition showed statistically significant ($p<0.05$) effect on bovine Fasciolosis. Seasonal data showed highest prevalence in autumn (39.87%) followed by winter (28.84%) with lowest prevalence in spring (16.40%).

Keywords: epidemiology, fasciola, cattle, abattoir and srinagar.

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Prevalence of *Fasciola* Infection in Slaughtered Animals in Kashmir

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Keywords: epidemiology, fasciola, cattle, abattoir and srinagar.

I. Introduction

Ruminant productivity around the world is majorily affected by trematode parasitism (Vercruysse and Claerebout 2001). Among them, Fasciolosis gains public concern not only due to its prevalence and economic significance to animal stock in all continents (Scheweizer *et al*., 2005, Mungube *et al*., 2006) but also to its zoonotic aspect. Bovine Fasciolosis is an impedent in profitable bovine farming and for butchers and consumers too. Parasite of genus *Fasciola* i.e *Fasciola hepatica* and *Fasciola gigantica* is the causative agent of Fasciolosis which occur in a wide range of definitive hosts. Over the last decade there has been a substantial increase in the number of fasciolosis cases recorded. It is spurred on by both environmental changes (warmer, wetter climate) and man-made modifications such as an increase in animal movements and intensification of livestock farming (Mas-Coma *et al*., 2005).

According to Annual Reports of Department of Animal Husbandry, Dairying and Fishries, species -wise incidence of Bovine Fasciolosis in India is tabulated as under:

Year	Outbreaks	Attacks	Deaths
2008-2009	85	391402	2
2009-2010	84	375237	6
2010-2011	105	345108	27
2011-2012	130	316363	74
2012-2013	195	509195	31
2013-2014	137	802698	11
2014-2015	129	3606	4

While comparing the apparent prevalence of liver fluke infection, detected by liver, faeces and bile examination it has been reported that examination of liver or bile samples was more sensitive than faecal examination (Braun *et al*., 1995 and Kumar *et al*., 2002).Thus the abattoir study was carried out to determine the prevalence.

II. Material and Methods

A two-year prospective systematic sampling study was undertaken from January 2014 to January 2016 to determine the relative occurrence of *Fasciola* infection in the livers of cattle presented to six abattoirs across the Kashmir. Samples were taken from the three studied localities i.e., Hazratbal, Parimpoora, and Gouskimber of Srinagar district but sampling effort was more important in Parimpoora locality, where four slaughterhouses were closely located.

The sample size was calculated using the formula given by Thrustfield, M. (2005).

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

Where n = required sample size
P_{exp} = expected prevalence= 50%
d = desired absolute precision=5%
Hence, d = 0.05 and p= 0.5 (50%).

The expected prevalence in the study area was 55 % (Akhoun and Peer, 2014). Thus the minimum desired annual sample size was calculated to 381. However, due to drastic floods only 316 cattle were examined in Year 2014 as collection areas were inaccessible and sample size was extended to 396 in Year 2015.

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III. Study of Epidemiological Parametes

a) Antimortem analysis

➢ Age, Gender and breed of animal

The age of each animal was confirmed by looking at the physical appearance of body and examining the dental pad and incisor teeth (Cockrill, 1974). The data was collected according to predesigned proforma: Young (1Yr-3Yrs), adult (3-6Yrs) and aged (Above 6 years). During survey the gender and breed of animals was also recorded.

➢ Assessment of Body condition

Body scoring of the cattle was made based on the method described by Nicholson and Butterworth (1986). Each scoring were given number from 1(L-, very lean) to 9 (F+, very fat) and these scores finally included under three body condition scores, good, medium and poor.

➢ Season

On the basis of temperature and precipitation, four seasons in a year recognized in Kashmir valley are: winter (December to February); spring (March to May); summer (June to August); autumn (September to November) (Dar *et al*., 2002).

b) Postmortem examination

➢ Types of infection

Infection based on causative agent were classified as *Fasciola hepatica*, *Fasciola gigantica*, mixed *Fasciola* species (*Fasciola hepatica*, *Fasciola gigantica*) infection.

c) Postmortem fluke recovery

Worms were recovered from infected livers by squeezing them manually to macerate the parenchyma and the flukes were carefully removed and placed in petridish containing 0.15M Dubecco's PBS buffer (pH 7.3) for initial washing. The flukes were stored in collection vials containing PBS and were transported to the laboratory of Department of Zoology, University of Kashmir, Srinagar. Fasciolids were identified primarily on differences in body shape and size of the adults, with the smaller *F. hepatica* exhibiting wide and defined shoulders compared to the slender *F. gigantica* having less defined shoulders and shorter cephalic cones (Soulsby, 1986). For permanent slide preparation flukes were rapidly killed in 70% ethyl alcohol to avoid shrinkage. The flukes were then transferred to vials containing 6-10% formalin for preservation. Flukes were stained with Borax Carmine, dehydrated in ascending grades of ethanol, cleared in Xylene and mounted in Balsam Canada and viewed under monocular light microscope.

d) Data Analysis

Data was recorded, entered and managed into MS Excel work sheet and analyzed using Minitab Version 13.Prevalence was calculated as percentage of infected among the examined samples. Chi square test was employed to examine the effect of above mentioned epidemiological determinants on the level of parasitism in host. In all statistical analysis, confidence level was held at 95% and P-value is <0.05 (at 5% level of significance) was considered as significant.

IV. Results

Fasciolosis in an area is influenced by a multifactorial system which comprises both definitive and intermediate hosts, parasite and environmental effects. Numerous factors (both intrinsic and extrinsic) form an association posing a potential epidemiological threat and it is important that the existence and localization of such an association should be recognized beforehand so that the situation can be brought under control. Thus in this portion of result, these factors have be assessed and potential reason behind the association have been well documented

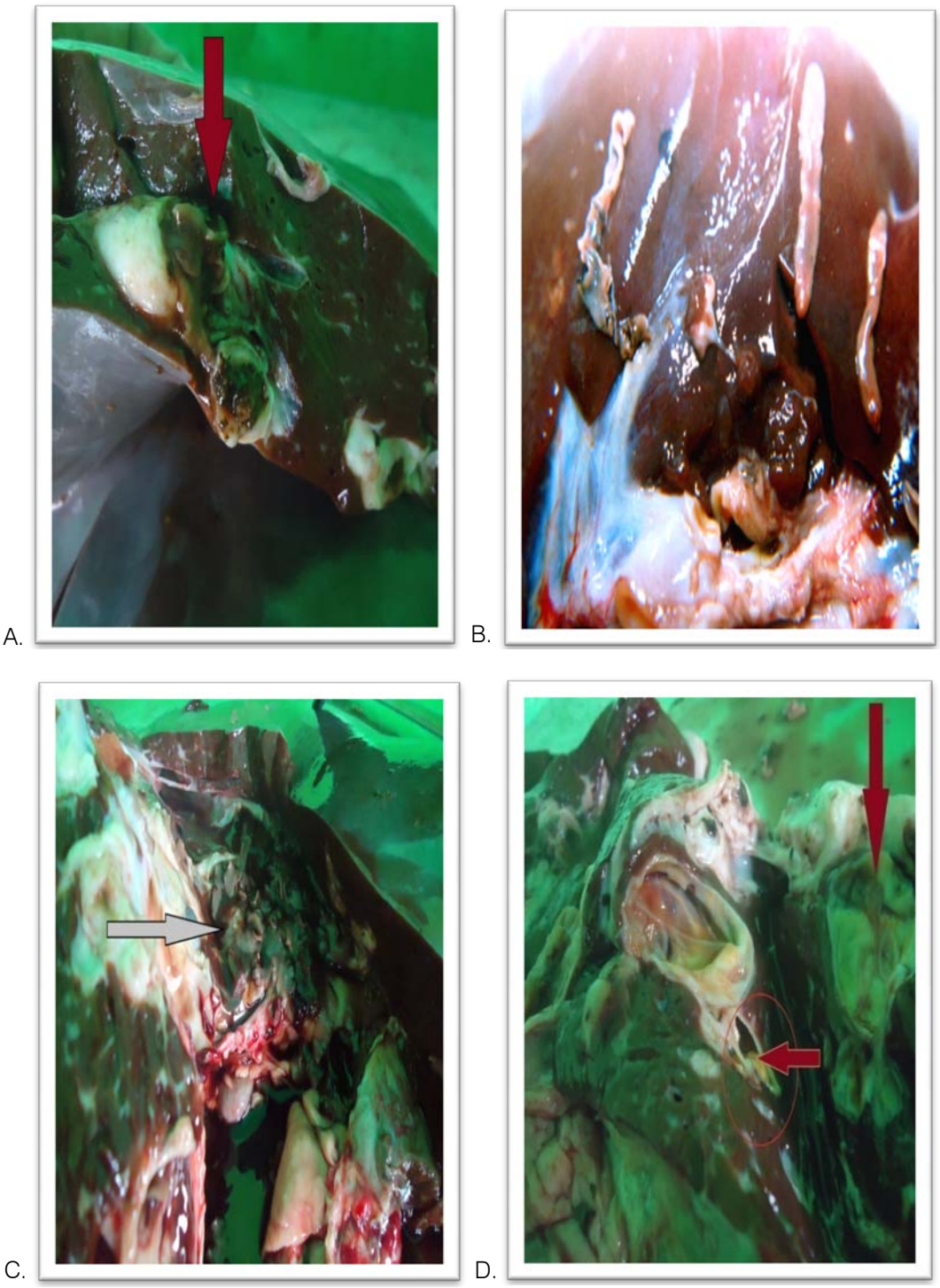


Pg 1: Fasciola hepatica



Pg 2: Fasciola gigantica

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Pg 1: Infected Liver Samples. (A) Bovine liver showing oozing parasite. (B, C) Parasites lying free and soaked in foul smelling fluid (D) Yellowish tissue

Overall Prevalence (Table 1)

The overall prevalence of Fasciolosis for the period of two years (2014-2015) was found to be 26.84% in the current study areas. In 2015, the percentage prevalence was higher (27.02%) than in 2014 (25.31%). There was an increase of 1.71% in prevalence rate from 2014 to 2015.But difference in prevalence rate was not statistically significant ($p>0.05$) as there was sampling error in year 2014 because of scarcity of data collection for a period of 2 months (September and October) due to Floods that affected the whole valley.

The result of current study indicated that Fasciolosis in cattle is spread relatively with moderate prevalence rate of 26.84% in the study area as compared to high prevalence of 51.42%,42.06% and

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43.63% in Ladakh and Srinagar province of Jammu and Kashmir (Kuchai *et al*. 2011; Akhoun and Peer, 2014 respectively).The reported difference may be attributed to different factors like mode of infestation, agroclimatic variations, technique used for data collection and different management conditions under which cattle are reared. However, the result of the present study is in close proximity to the prevalence rates of 29.38% and 25.40% reported earlier by Sheikh *et al*. 2007 and Fatima *et al*. 2012 in neighboring areas of Kashmir using the same abattoir survey. The prevalence rate was also within ranges of findings of other authors like 25.46% by Khan *et al*. 2009 from Pakistan; 27.26% and 25.2% by Kabir *et al*. 2010 and Afroze *et al*. 2013 from different provinces of Bangladesh; 25.9% by Mungube *et al.* 2012 from Kenya; 26.55% by Nega *et al*. 2012 from Ethopia; 23.96% reported by Asressa *et al.* 2012 from Andassa Livestock Research Center in North-West of Ethiopia.

Table 1: Yearwise Prevalence of Fasciolosis

YEAR	EX.	INF.	PREV	χ^2(P-Value)
2014	316	80	25.31%	0.183 0.669
2015	396	107	27.02%	
Total	714	192	26.84%	

The results revealed that the lowest prevalence of Fasciolosis for Year 2014 was in the month of May (14.2%) and highest being in the month of August (35.8%).However in Year 2015, the prevalence rate was highest in the month of September (44.66%) followed by October (39.66%) and lowest in May (9.3%). Moreover, the infection was reported throughout the year due to resistance of metacercariae for desiccation, especially during the dry season and continued presence of the shallow water, enough vegetation and humidity for continued exposure of the animals to encysted metacercariae and no restriction on cattle grazing habits and movement between the infected and treated localities which was also suggested by El Bahy, 1998.

These results are in agreement with Pfukenyi *et al*. 2006 and Faria *et al*. 2005 who reported high intensity in August-September in Zambian cattle and in dairy cattle herd in Minas Gerais, Brazil respectively. Similarly, Qureshi *et al*. 2012 recorded lowest prevalence in the month of May in Buffaloes of Northwestern Punjab, Pakistan which supports the findings of the current study. In both years, the lowest infection in May-June can be related to progression of hot dry weather, as the temperature was high and humidity was low in these months.

Month-wise prevalence (Fig. 1)

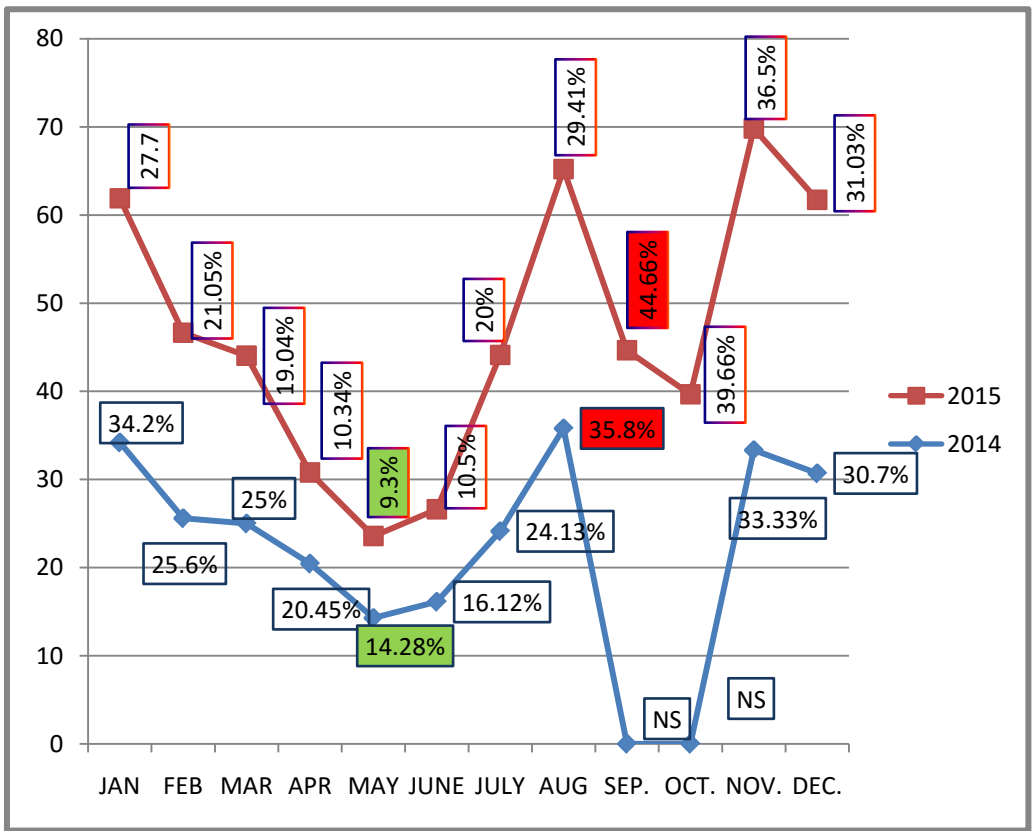


Figure 1: Monthwise prevalence of Fasiolosis (2014-2015)

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Season wise Prevalence (Table and Fig 2)

On seasonal basis, the current study showed maximum spread of disease in Autumn Season i.e. 33.33% and 40% in Year 2014 and 2015 respectively. The minimum infection was recorded in spring season showing prevalence of 20% and 12.9% in consecutive studied years. There was no statistically significant difference between seasons in year 2014 which has already been stated could be attributed to skipping the data of two months due to natural disaster Kashmir valley faced. However statistically significant difference was observed between seasons in year 2015.

This difference could be due to a variety of weather condition in each year. The highest prevalence in autumn was also reported by Chaudhri *et al*. 1993; Maqbool *et al*. 1994 and Ghirmire and Karki 1996; Abrous *et al*. 1999; Maqbool *et al*. 2002; Pfukenyi *et al*. 2005 and Haridy *et al*. 2006 who emphasized that the possible reason for the same could be availability of favourable temperature and moisture for the rapid propagation of the parasitic trematode life cycle in this very season.

Table 2: Season wise prevalence of Fasciolosis (2014-2015)

Year	2014			2015		
Season	Ex.	Inf.	Prev.	Ex.	Inf.	Prev.
Spring	115	23	20%	82	10	12.9%
Summer	99	26	26.26%	102	20	19.6%
Autumn	12	4	33.33%	146	59	40%
Winter	90	27	30%	66	18	27.27%
χ^2(p-Value)	3.218(0.486)			25.26(0.000)		

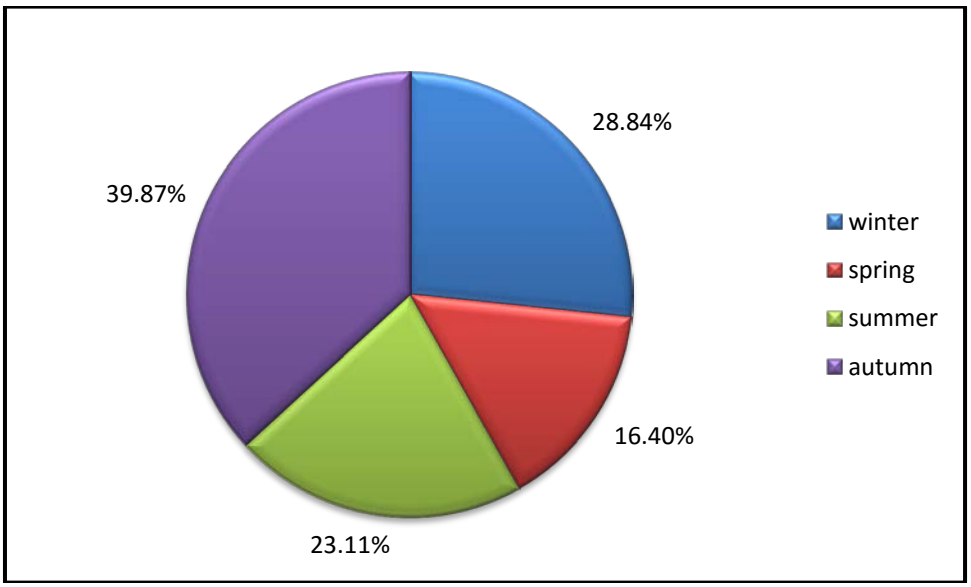


Figure 2: Cumulative Season wise prevalence

Distribution on the basis of infection type (Table 3)

Of the total 192 affected livers by fasciolosis, 149 (77.60%), 24 (12.5%) and 19 (9.89%) respectively showed *Fasciola gigantica, Fasciola hepatica* and mixed infection (*Fasciola hepatica* and *Fasciola gigantica).*

The finding of this study was in consistence with the earlier investigation by Ashrafi *et al*. 2004 from Gilan province; Mir *et al*. 2008 from Kashmir and Khan *et al*. 2009 from Punjab Province (Pakistan) and by Phiri *et al*. 2005; Abunna *et al*. 2009; Fufa *et al*. 2009; Mwabonimana, *et al*. 2009. The predominance of *Fasciola gigantica* could be due to the availability of appropriate environmental conditions and topography (lowland and middle altitude zone) which are favorable habitat to its intermediate host *L. natalensis* (Urquhart *et al*. 1996).However, inverse distribution was reported by Melugeta *et al*. 2011; Belay *et al*. 2012; Chakiso, *et al*. 2014 and Alemu and Abebe 2015. Mixed infection of *F.*

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hepatica and *F. gigantica* occurs presumably as a result of the movement of stock between high and low ground or through overlapping of the territories of the snail vector at altitudinal range of 1200-1800 M.a.s.l. (Kendel 1954 and Graber, 1975).

Table 3: Prevalence based on type of infection

Infection Type	Infected	Prev. Among Infected Ones (N=192)	Overall Prevalence (N=714)
F. gigantica	149	77.60%	20.86%
F. hepatica	24	12.5%	3.361%
Mixed	19	9.89%	2.66%
$\chi 2$		254.29(p=0.000)	186.22(p=0.000)

Age-wise distribution (Table4)

Out of 714 cattles, 166 heads were of age group <1-3Years, 396 of age between 3-6 years and 152 having age >6 Years. Among these 3 age categories, prevalence of Fasciolain livers was highest in >3-6 years age group (30.30%) followed by age group >6 years (28.28%) and least infection in bovines of age 1-3Years(17.46%).The results in current study were in consistency with Keyu *et* al. 2005;Rehman *et al*.2015.The sound explanation behind the lower prevalence in age group >6 yrs compared to younger age group(3-6yrs) could be due to self-cure phenomenon (Assanji, 1988) or high acquired immunity which increase with age (Dwinger *et al*. 1982). It has been also reported that *Fasciola* infected hosts may recover from parasitic infection with increasing age and hence become resistant (Yilma and Mesfin, 2000; Shiferaw *et al*.2011; Mufti, 2011.Mulcahy *et al*. 1999 suggested that resistance is not wholly immunologiical based rather resistance to reinfection may be due to hepatic fibrosis resulting from primary infection. Least infection in age group <1-3 years is possibly due to less chances of acquiring infection due to short exposure time as compared to older animals which is in agreement with (Anderson *et al*. 1999)and Teklu *et al*. 2015.

Table 4: Agewise prevalence of fasciolosis

Age	Ex.	Inf.	Prevalence	χ^2 p-Value
1Yr-3Yrs	166	29	17.46%	9.991 0.007
3Yrs-6Yrs	396	120	30.30%	
>6Yrs	152	43	28.28%%	

Genderwise prevalence (Table 5)

Out of 531 males and 183 females slaughtered during the survey period, males won by retaining lesser infection of 19.96% and were par to females who showed higher prevalence of 46.99%. The difference was highly significant and thus revealed sex as determinant influencing the prevalence of Fasciolosis rate. Our findings are in agreement with results of Daniel 1995; Molina *et al*. 2005; Bhutto *et al*. 2012 and Teklu *et al*. 2015 who reported higher prevalence of this parasite in female than male.

In the current studied abattoirs, the number of slaughtered male cattles (531) was far higher than the females (183). The number of positive females was higher in proportion than males even if the number of female cattle that come to abattoir were fewer in number. These results were in consistent to Kara *et al*. 2009. High infection rate in females can be multifactorial like high stress during parturition period (Spithill *et al*. 1999), weak and malnourished making them more susceptible to infection (Blood and Radostits, 2000) or due to the feeding conditions i.e females are generally being let loose to graze freely in pastures. The other possible reason for the same could be that the most of people traditionally feed their lactating cows with grasses during dry season which are grown around rivers and marshy areas for the sake of getting high milk yield as suggested by Gracy *et al*. 1999 and Tilahun *et al*. 2014. However, some authors revealed that male cattle are more prone to Fasciolosis than female counterparts like Khan and Maqbool 2012. But, Rahmeto 1992 and Dagne 1994; Keyyu *et al*. 2005; Phiri *et al*. 2005; Khan *et al*. 2009; Kabir *et al*. 2010; Kanyar *et al*. 2010; Assefa *et al*. 2015 reported no significant difference between the gender of animal and infection rate which could be associated with similar management given to both group of animals or probably due to common grazing pastures on which both are fed together, which expose them to the same risk of infection.

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Table 5: Genderwise prevalence of Fasciolosis

	Examined	Infected	Prevalence
Males	531	106	19.96%
Females	183	86	46.99%
$\chi 2$ (p-value)	49.221(0.000)		

Association of body condition with infection (Table 6)

Among all examined animals (n = 714), 30.53% (n = 218) were marked as poor (body score 1-3), 35.05% (n =250) as Medium (4-6) and 34.44% (n = 246) as Good (7-9) body conditions. 42.66% of infection (n_i=93) was recorded in animals with poor body condition, 22.40% of infection (n_i=56) in animals with medium body score and 17.47% of infection (n_i=43) in animals having good body condition. Thus, an inverse association was found between the body condition and infectious rate of Fasciolosis which was statistically significant ($p<0.05$). These findings are in accordance to Mihreteab *et al*. 2010; Tilahun *et al*. 2014 and Teklu *et al*. 2015.

The current findings that lean animals are associated with higher *Fasciola* infection compared to animals with medium and normal body condition could be attributed to emaciation due to lack of nutrients, loss of blood and tissue fluid and demage to liver parenchyma caused by presence of flukes. Similar findings were reported by Beckele *et al*. 2010; Tesfay *et al*.2012 and Assefa *et al*. 2015. Radostits *et al*. 1994 has mentioned that Chronic fasciolosis is the commonest disease in cattle and significantly characterized with weight loss.

Table 6: Effect of body condition on prevalence of Fasciolosis

Body Condition	Ex.	Inf.	Prevalence	χ^2 p-Value
Poor	218	93	42.66%	41.223 0.000
Medium	250	56	22.40%	
Good	246	43	17.47%	

Breedwise prevalence of Fasciolosis (Table7)

Out of the total 71 cattle examined, 213 were reared locally and 501 were imported from other states to the valley for slaughter purpose. The prevalence of fasciolosis was 40.80% and 20.90%for local and nonlocal breed cattle, respectively. There was statistically significant (χ^2 = 29.06, P = 0.000) association of fasciolosis with breeds. Our results are in agreement with study conducted by Teklu *et al*. 2015.

This diference in prevalence based on breed might be due to the management of the animals as most of the local animals were reared in the extensive system of management which makes them easily susceptible to the parasites

Table 7: Breed wise Prevalence of Fasciolosis

Breed	Ex.	Inf.	Prevalence	χ^2 p-Value
Locals	213	87	40.80%	29.06 0.000
Non-locals	501	105	20.90%	

V. Conclusion

Moderate intensity of fasciolosis was recorded in the current study. In line with above findings, it is recommended that strategic application of flukicides should be done and further epidemiological studies on biology and ecology of intermediate host should be carried out so to develop subastantiable planning for considerable success in control of Fasciolosis. There is need to carry out economic analysis so as to give appropriate economic losses directly by liver condemnation.

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Sero-Prevalence of *Toxoplasma Gondii* Infection and Associated Risk Factors in Animals Presented to Sholla and Akaki-Kality Veterinary Clinics, Addis Ababa

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Keywords: *toxoplasmosis, veterinary clinics, seroprevalence, risk factors.*

GJMR-G Classification: *NLMC Code: QX 140*



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Sero-Prevalence of *Toxoplasma Gondii* Infection and Associated Risk Factors in Animals Presented to Sholla and Akaki-Kality Veterinary Clinics, Addis Ababa

Abebaw Getachew [α], Alebachew Tilahun [σ], Alemu Aylate [ρ] & Wale Tesfaye [ω]

Abstract- A cross-sectional study on *Toxoplasma Gondii* in livestock was carried from October 2011 to March 2012 in Addis Ababa, Ethiopia to determine sero-prevalence and associated risk factors. A total 347 serum samples were collected from the jugular veins of each animal and heart of swine, presented veterinary clinics and abattoirs, respectively. The overall prevalence in the six animal species out of 347 animals sampled was 126 (36.1%) which were detected as sero-positive for toxoplasmosis. Prevalence based on animal species, out of 347 different animal species sampled were 71 (36.6%), 15 (37.5%), 11 (25%), 19 (47.5%), 7 (35%) and 3 (33.3%) in ovine, caprine, bovine, swine, equine and camel, respectively. In attempt look for the association between risk factors and sero-prevalence, a questionnaire survey was conducted and the result obtained showed economic loss due to abortion (30%), stillbirth (12%), neonatal mortality (18%), dystocia (17%), retained fetal membrane (8%) and endometritis (6%). Seventy two (72) of the respondents had cats in their household. The sero-prevalence on the basis of sex was significantly higher ($p < 0.05$) in males than females. No statistically significant association was noted among other factors and sero-positivity. Results of present study suggest widespread environmental contamination with *T. gondii* oocysts and that livestock could be a potentially important source of *T. gondii* infection if their infected meat is consumed undercooked.

Keywords: toxoplasmosis, veterinary clinics, sero-prevalence, risk factors.

I. Introduction

Toxoplasma gondii infections are prevalent in humans and animals worldwide (Dubey and Beattie, 1988). Felids are the key animal species in the life cycle of this parasite because they are the hosts that can excrete the environmentally-resistant stage, the oocyst. Humans become infected postnatal by ingesting tissue cysts from undercooked meat, consuming food or drink contaminated with oocysts, or by accidentally ingesting oocysts from the environment. However, only a small percentage of exposed adult humans or other animals develop clinical signs of disease. It is unknown whether the severity of toxoplasmosis in immune-competent hosts is due to the parasite strain, host variability or other factors. Recently, attention has been focused on genetic variability among *T. gondii* isolates from apparently healthy and sick hosts. It has been 100 years since the discovery and naming of *T. gondii*. The parasite was first found in laboratory animals (Dubey, 2007). Its medical importance remained unknown until 1939 when *T. gondii* was identified conclusively in tissues of a congenitally-infected infant in New York City, USA (Wolf *et al*., 1939), and its veterinary importance became known when it was found to cause abortion storms in sheep in 1957 in Australia (Hartley and Marshall, 1957).

Although infection does not clinically affect cattle, transmission of infection to humans from tissue cysts when eating raw or undercooked beef should not be discounted. Toxoplasmosis may be important in Ethiopia where raw or partially cooked meat is regarded as a delicacy (Bekele and Kasali, 1989). In Ethiopia, there are documented reports on serological survey of Caprine toxoplasmosis by Teshale and his colleagues in Central and Southern Ethiopia (Teshale *et al.,* 2006). The serological survey results on toxoplasmosis by Negash and his associates further confirm the presence of *T. gondii* infection in sheep and goat population in Ethiopia (Negash *et al.,* 2004). The results of a questionnaire survey in Debre Birhan and the surrounding area revealed that abortion was the major cause of lamb loss during 12 months studied period (Getachew and Tilaye, 2002). In addition, the Sero-prevalence, assessment of its zoonotic importance and identification of factors associated with Sero-prevalence was documented in Nazareth town, Ethiopia (Negash *et al*., 2008).

Toxoplasmosis is recognized as disease of great economic importance since it causes heavy losses through abortion, stillbirth, neonatal mortality, encephalitis and pneumonia particularly in sheep and goats (Radostits *et al*., 2007 and Singh and Msolla, 1994). If animals are important in the epidemiology of human toxoplasmosis it is well to have information concerning serological study in those hosts (Morris *et al*., 2007). In the present paper, we summarize

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information on serological prevalence of *T. gondii* infection in different animals species presented Veterinary Clinics and economic impact of the disease in the study area.

II. Materials and Methods

a) Study Area

The study was conducted in Addis Ababa which lies at an altitude of 2000-3000 meters above sea level. The mean annual rainfall is 1800 mm with a bimodal pattern. There are dry and rainy seasons in the area. The long rainy season extends from June to September, contributes about 84% of the total annual rainfall while the dry season lasts from October to February. The short rainy season lasts from March to May. The study was conducted from November 2011-March 2012 in Sholla and Akaki-Kality Veterinary Clinics, Addis Ababa. The mean annual minimum and maximum temperature are 14^0C and 21^0C respectively with an average rate of 17^0C the mean relative humidity is 61.3% (CSA, 2009).

b) Study Population

The study included all animals which came to Sholla and Akaki-Kaliti Veterinary Clinics and consisted of bovine, ovine, caprine, swine, camel and equine species regardless of their age, breed and disease case. Blood sample for swine and camel was taken from Addis Ababa Abattoir Enterprise.

c) Study Design

A cross-sectional study was conducted from October 2011 to March 2012 to determine the prevalence toxoplasmosis among animals coming to Sholla and Akaki-Kaliti Veterinary Clinics for various health problems. After reviewing daily patient flow (case) to the clinic, the expected patient population in the study period was taken as a sampling frame. A simple random sampling method was used to collect blood sample from different animal species.

d) Sample Size Determination

The required sample size for the study animals was determined by the formula given by (Thrusfield, 1995) assuming 95% of confidence interval and at 5% desired precision. This was estimated with the assumed toxoplasmosis prevalence of 34.5% based on previous study by (Getachew and Tilaye, 2002) by taking the average prevalence of 34% (sheep) and 35% (goat) in Debre Birhan and the surrounding areas. Accordingly the desired sample size was 347.

e) Study Methodology

i. *Serum collection and serological examination*

Approximately 5ml of blood was taken from jugular vein of each study animal but for swine it was taken directly from heart in abattoir and the serum was separated and stored at deep freezer until tested. *Toxoplasma gondii* antibody was determined by the Slide Agglutination Test using a commercial kit (HUMA TEX TOXO, Human Gesellsfür Biochemica und Diagnostoica mbH Max-Plank-ring21.65205 Wiesbaden. Germany). This method is quick, simple and requires smaller quantity of reagents. Agglutination reactions are more sensitive than immuno-precipitation tests. The tests are simple and have an added advantage of easily readability (Chauhan and Agarawal, 2006).

Comparable assessment of slide agglutination test shows that as sensitive as, and a more specific than latex agglutination test. The predictive value of a negative slide agglutination test is less than the latex agglutination test but produced results within minutes, although, quantitative results is not comparable to other assays. Slide agglutination presents a rapid alternative to the latex agglutination test as a screening assay toxoplasmosis, although patients at risk of life threatening infection require detailed serological examination using additional methods (Dunford and Johnson, 1991). In this test a clean dry glass with 6 cells was taken and a drop of antigen suspension was placed over the middle of area of each 6 cell and one drop of positive control serum (goat) in one of cell while the negative control serum was placed on the other cell and one drop of test serum was placed on the rest 4 cells. Then mixed with separate disposable sticks and spreader the fluid over the entire area of the particular cell the slide was tilted back and forth of 4 minutes so that rotates slowly inside the cell. Finally it was observed for clamping (agglutination) by naked eye and magnifying lenses in comparison with the two controls (positive and negative). The negative result was identified as negative control result which did not form agglutination (homogenous appearance) but distinct agglutination was indicator for positive toxo-Ab of at least 4 IU/ml similar with positive control.

ii. *Questionnaire Survey*

A pre-tested structural questionnaire was prepared to animal owners with respect to the case they brought which included both open ended and closed ended questions. The questions was concerned with hygiene, environment, management, nutrition, reproductive disorder history and nervous signs, ownership of cats, purpose of cat keeping as well as the mechanism of cat feces disposal. In addition, the habit of exposure of raw meat and milk were important questions that gave useful information for epidemiology of human toxoplasmosis.

f) Data Analysis

All data obtained from the study were entered into Ms Excel 2007 data sheet and analyzed using STATA 11, statistical software programme. The Sero-prevalence was calculated later on by dividing the sera were found positive to slide agglutination test to the total sample size multiplied by 100. The risk factors associated with toxoplasmosis were determined using

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percent values and using Pearson's Chi-square ($\chi 2$). A statistically significant association between variables was said to exist if the calculated level of significance is less than 5% ($p<0.05$) at 95% confidence level. The strength of associations between the exposure to the risk factors and sero-positivity is measured using odds ratio (Wasserthiel-smaller, 1995).

III. Results

a) Sero-prevalence

The overall Sero-prevalence rate of the test result were found in 126 of the 347(36.31%) animals (table 1) (6 different species of animals) examined for slid agglutination test (CI=31.22, 41.40, 95% level of confidence). Sero-prevalence by origin, age, species, management system, hygiene, reproductive abnormality, cat ownership as well as associated clinical findings is not significant while a statistically significant difference($p<0.05$). Sero-prevalence among males than females being observed. Higher prevalence was observed in males and females (table 5).

b) Risk Factors Associated with Sero-positivity

Factors closely related to the natural history of toxoplasmosis are presence of cats, origin, history of abortion or neonatal mortality or births of weak lambs and reproductive abnormalities, management practices, hygiene and clinical finding. These factors and its association with sero-positivity ($p>0.05$) is explained in (table 2,3,4,6,7,8,9, 10). Breed was not included in the analysis since most farmers in the area had local breeds.

c) Result of the Questionnaire Survey

A questionnaire survey was conducted on 100 livestock owners revealed that during the previous months lamb loss amounted to 60% (30% abortion, 12% stillbirth and 18% neonatal mortality). Birth of weak lambs amounted to 20% while reproductive abnormalities were 31% (17% dystocia, 8% retained fetal membrane and 6% endometritis). Seventy two respondents confirmed the presence of cats in their house hold kept for clearing rodents. Only 10% of interviewed individuals reported disposal of cat feces by burying in the ground. Thirty percent of them reported the disposal of cat feces on the backyard or grazing land, which increased the risk of exposure to toxoplasma oocyst and cats had close contact with most family members. The survey also showed that 83% of the interviewed people had a history of consumption of raw or under cooked meat. Sixty five percent of them had animals with poor hygienic management in their grazing area and drinking water. Fifty four percent of these owners informed that their livestock had a contact with dead animal carcass, which is improperly disposed. Thus further had contract the infection through ingestion of oocysts from these areas is a probable source of toxoplasmosis. In addition livestock owners revealed that there were wild cats coming to the grazing area of their livestock which act as a definitive host.

Table 1: Overall relative prevalence of toxoplasmosis in different species

Species	No. of animals examined	Positive	Prevalence (%)
Ovine	194	71	55.91
Caprine	40	15	11.53
Bovine	44	11	12.68
Swine	40	19	11.53
Equine	20	7	5.76
Camel	9	3	2.59
Total	347	126	100.00

χ^2= 1.2429 P=0.537

Table 2: Association between prevalence and origin of animals

Origin	No of examined	No of positive
Sholla vet clinic	74(21.33%)	28(22.22%)
Akaki Kaliti	215(61.96%)	75(59.22%)
A.A Abattoir Enterprise	58(16.71%)	23(18.25%)
Total	347(100.00%)	126(100.00%)

χ^2=0.5445 P=0.762

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Table 3: Association between Sero-prevalence and reproductive loss

Reproductive loss	No of examined	No. positive (%)
Present	269(77.52)	95(75.40)
Absent	78(22.48)	31(24.00)
Total	347(100.00)	126(100.00)

χ^2=0.5126 p = 0.474

Table 4: Association between prevalence and cat ownership

Cat ownership	No of examined	No. positive (%)
Present	113(32.56)	35(27.78)
Absent	234(67.44)	91(72.22)
Total	347(100.00)	126(100.00)

χ^2=2.0645 p=0.151

Table 5: Association between Sero-prevalence and sex

Sex	No of examined	No. positive (%)
Male	170(48.99)	76(60.32)
Female	177(51.01)	50(39.68)
Total	347(100)	126(100.00)

χ^2=10.1556 p =0.001

Table 6: Prevalence on the basis of age

Age	No of examined	No. positive (%)
Old	106(30.55)	34 (26.98)
Adult	149(42.94	56(44.44)
Young	92(26.51)	36(28.57)
Total	347(100.00)	126(100.00)

χ^2= 1.2429 p = 0.537

Table 7: Prevalence on the basis of sex and species

Species	Sex	No of examined	No. Positive	Prevalence (%)
Ovine	Male	76	36	47.37
	Female	118	35	29.66
Caprine	Male	29	9	31.03
	Female	11	6	54.55
Bovine	Male	26	8	30.77
	Female	18	3	16.67
Swine	Male	31	18	58.06
	Female	9	1	11.11
Equine	Male	7	4	57.14
	Female	13	3	23.08
Camel	Male	1	1	100.00
	Female	8	2	25.00

Table 8 : Association between prevalence and management system

Management	No of examined (%)	Positive (%)
Extensive	228(65.71)	147(66.72
Semi intensive	119(34.29)	74(33.48
Total	347(100.00)	221(100.00)

χ^2=0.1771 p=0.674

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Table 9: Association between prevalence and hygienic condition

Hygiene	No of examined (%)	Positive
Poor	151(43.52)	55(43.65)
Good	196(56.46)	71(56.35)
Total	347(100.00)	221 (100.00)

χ^2=0.00125 p=0.969

Table10: Association between prevalence and clinical finding

Clinical Finding	No of examined (%)	Positive (%)
Respiratory	116(33.43)	38(30.16)
GIT	69(19.88)	20(15.87)
Nervous	2(0.58)	2(1.59)
Skin and Mucosal	38(10.95)	16(12.70)
Metabolic	1(0.29)	1(0.79)
Poisoning (Toxicosis)	1(0.29)	0(0.00)
Normal	103(29.68)	44(34.92)
Traumatic Wound	3(0.86)	2(1.59)
Reproductive	14(4.03)	3(2.38)

IV. Discussion

The overall Sero-prevalence of 126(36.1%) in the 347 study animals of different six species .Of which ovine (56.35%), caprine (11.9%), bovine (8.73%), swine (15.08%), equine (5.56%) and camel (2.38%) lies midway between the three previous studies in Ethiopia. The overall prevalence of 36.6% in sheep in this study lies between the three previous studies in Ethiopia. Bekele and Kassali, Getachew and Tilaye, and Tamiru reported Sero-prevalence of 22.9%, 33% and 54.7% in sheep, respectively. This is in agreement with studies in other African countries with prevalence rates ranging from 11.5% to 34% (Deconinck *et al.,* 1996). In goats the overall Sero-prevalence in this work was higher than the results of the two previous studies in Ethiopia with prevalence of 11.9% and 26.7% but less than those reported from other African countries with prevalence rates ranging from 31.9% to 63% (Tamiru, 2000). On the other hand, the finding agrees with recent study reports of Getachew and Tilaye of 35% in goats (Getachew and Tilaye, 2002). In bovine the overall Sero-prevalence (25%) out of 44 cattle examined. Thought number of animals studied were not proportional relative to previous studies, it is higher prevalent than the reports of Bekele and Kasali (2002) who reported a prevalence of 6.6%. In swine although those animals serum was taken from Addis Ababa abattoir and its number of sample size was not proportional relative to other species constitute the largest Sero-prevalence which is 47.5%. This result agrees with published reports in other parts of the world, the sero-positive prevalence in swine is 22% with a range of 0-97 % (Radostits *et al.,* 2007). The overall Sero-prevalence in equine species (horse and donkey) was 35%. The overall Sero-prevalence in camel (*Camelus dromedarius*) species was 33.3% which is high. This result revealed that a higher Sero-prevalence when compared with previous studies in three ecologically different areas of Sudan (22.2%) (Khali *et al.,* 2007).

In the present study, no statistically significant difference in Sero-prevalence was noted among different origin, species, age groups, management system, hygienic condition, reproductive abnormalities, cat ownership and the associated clinical finding. This seems contradictory with the established facts, however, it is difficult to made firm conclusion as number of study animals is low in proportion with these factors. The odd ratio of the four factors (management system, reproductive abnormality, hygienic condition and cat ownership) is explained in figure 2. The prevalence would have been significantly higher in warm and moist areas than in cold or hot dry areas, increased with age, in extensive (small holder) management system than intensive type, prevalent in cat ownership and a major cause of abortion and neonatal mortality. The disagreement of the assessment of risk factors associated with sero-positivity to *T. gondii* in addition to the above reasons could be due to lack of the specificity of the serological test used. The slight variation in the results of Sero-prevalence observed can be attributed to variation in ecological conditions as most animals came from different areas to Addis Ababa. Variation may also be due to the diagnostic technique utilized (Assadi-Rad *et al*., 1995). Even though the test used (slide agglutination test) was not done in Ethiopia, the results showed a higher Sero-prevalence than the previous studies it is evidenced that it is more sensitive and the result is valued in all species.

The results of the questionnaire survey indicated that economic loss due to abortion, stillbirth, neonatal mortality and related reproductive abnormality are important in the study area. It is also important that the inclusion of the questionnaire survey on ownership

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of cats and purpose of cat keeping as well as the mechanism of cat feces disposal and the habit of raw meat and milk consumption. As oocysts are essential in the life cycle of *T. gondii* and in which both domestic cats and other felids may shed oocyst. These can contract the infection through contamination of grazing area as well as close contact with human (domestic cats) leading its public health hazard in addition to the owners habit of raw or under cooked meat as tissue cysts are the end stage of the parasite waiting to be eaten by animals and human (Morris *et al.*, 2007).The results of questionnaire survey based on its economic impact agrees with previous studies by Getachew and Tilaye in 2002 (abortion 30%, stillbirth 12%, neonatal mortality 18%, dystocia 17%, retained fetal membrane 8% and endometritis 6%). Seventy two (72) percent of the interviewed individuals had cats in their premises and kept for clearing rodents only together with livestock and almost all fed cats raw or under cooked meat. In general the maintenance of the cycle is achieved among the intermediate hosts, definitive host (cat) and environment (contaminated by infective stage of the parasite).

The Sero-prevalence in this study was significantly high both from public health and economic perspectives. Toxoplasmosis is a disease of economic importance as it is a major cause of abortion, stillbirth and neonatal mortality in sheep and goats (Getachew and Tilaye, 2002). Ovine abortion and neonatal mortality due to *T. gondii* are important problems in New Zealand, Australia, Canada, United States and the United Kingdom; in countries they are second in importance only to Chlamydia (Radiostits *et al*., 2007). Several studies conducted so far indicated that *T. gondii* infection in humans is widely distributed in most tropical countries (Negash, 2000). The high Sero-prevalence in the study animals and the results of the questionnaire survey ensured that Toxoplasmosis in Addis Ababa suggests a high risk to humans. The recent study in Adama town of Ethiopia is an evidence for its prevalence in that of 65% people examined for anti-*Toxoplasima gondii* antibodies by the MDAT, serologic evidence of Toxoplasmosis was found in 60% (39/65) (Negash *et al.,* 2008).

Statistical analysis revealed that there is significant association between males and females with males having higher Sero-prevalence than females. This is in agreement with findings by Getachew and Tilaye observed in goats (Getachew and Tilaye, 2002). This could be due to the fact male animals are stressed due to transport from different ecological areas and as most of them were kept for feedlot and breeding purpose for long time.

V. Conclusion and Recommendations

In general, the Sero-prevalence survey conducted in this study showed that toxoplasmosis is a widespread and well established infection among the six species (ovine, caprine, bovine, equine swine and camel) two veterinary clinics (Sholla and Akaki Kality) and Addis Ababa Abattoir Enterprise. The significance of toxoplasmosis as a disease of zoonotic importance and its economic impact was demonstrated. Therefore, prevention efforts should focus on educating cat owners about the importance of collecting cat feces in litter boxes, spaying cats, reducing the numbers of feral cats, cooking all meats, and promoting rigorous hand hygiene, reducing the numbers of wild rats is also important for control of toxoplasmosis. We think that further studies should be conducted to determine whether any host reservoirs exist amongst domestic and wild animals in this area, in which the disease was previously not found. This study will be the basis for further studies that will deepen our knowledge of the epidemiology of *T. gondii*. More extended studies are required to determine the sero-prevalence rates among populations of wild rats and other wild animals in difference areas, and the implications of *T. gondii* prevalence on both animal and human health.

Conflict of interest

The authors have no declared any conflict of interest

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Prevalence of Bovine Cysticercosis and Status of Human Taeniasis in and Around Asella Town, Tiyoworeda, South East Ethiopia

By Adem Edao, Feyera Gemeda Dima & Feyissa Begna Deressa

Jimma University

Abstract- *Background:* Bovine cysticercosis and human taeniasis is an important parasitic disease and more common in developing countries including Ethiopia where meat is an important component of human diet and traditionally consumed raw on several occasions.

Methodology: Cross-sectional study was conducted from November 2014 to April 2015 at Asella municipal abattoir in Arsi zone of Oromia to determine prevalence of bovine cysticercosis and status of human taeniasis with its associated risk factors around Asella town. Routine meat inspection method and questionnaire survey were performed for this study.

Result: From the total of 430 carcass inspected, 5(1.2%) were positive for bovine cysticercosis. The statistical analysis revealed that risk factors like sex, breed, body condition and ages are not associated with the prevalence of cysticercosis. The questionnaire survey showed that 44.3% of total respondents were infested with Taenia saginataat least once in their life time and out of these positive respondents 32% and 6.7% become positive only before and after 2000 E.C respectively, while 5.6 % wereinfested many times.

Keywords: *bovine, cysticercosis, taenia saginata, prevalence, risk factors, taeniasis.*

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Adem Edao [α], Feyera Gemeda Dima [σ] & Feyissa Begna Deressa [ρ]

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Conclusion: In general, the current study revealed that the presence of bovine cysticercosis was small but it's still a public health hazard in the study area which needs increased awareness about the health impact of taenisis.

Keywords: bovine, cysticercosis, taenia saginata, prevalence, risk factors, taeniasis.

I. Introduction

Livestock in developing countries play a crucial role in improving food security, generating cash income and are an asset. The total livestock population in Ethiopia according to 2014 estimation was 56.71 million cattle, 29.33 million sheep and 29.11 million goats (CSA, 2015), which places Ethiopia first in Africa and ninth in the world in terms of total stock population. From the total cattle population 98.95% are local breeds and the remaining are hybrid and exotic breeds. Cattle constitute large portion of livestock population and are managed by small holder farmers under extensive low input traditional system (CSA, 2015). However, its productivity remains marginal due to prevalent diseases, malnutrition and management constraints. Among that *T. saginata*/ bovine cysticercosis is the one which remaina major public and animal health problem (EARO, 2000).

Bovine cysticercosis is an infection of cattle caused by the larval stage *T. saginata* whichlive in human intestinal. This parasite is universally distributed in developing as well as in developed countries (Gracey and Collins, 1992; Cabaret *et al.,* 2002; Dorny *et al*., 2009). In humans, the disease is called taeniasis which is accompanied with symptoms like nausea, abdominal discomfort, epigastric pain, diarrhea, excessive appetite or loss of appetite, weakness, loss of weight and intestinal blockage. Sometimes, the mobile gravid segments may make their way to unusual sites such as the appendix and biliarytract and may cause serious disorders (WHO, 2013). Live cattle having *C. bovis* shows no symptoms, however, heavy infestation by the larvae may cause myocarditis or heart failure (Gracey and Collins, 1992). Cysticerci can remain alive in cattle anywhere from weeks to years and such infection in cattle is a public health problem as the infected raw or undercooked beef causes taeniasis in human (Garcia, 2003; Garcia *et al*., 2007). It has economic significance as well as the economic losses accruing from the condemned and downgraded carcasses and due to treatment of carcasses before human consumption is substantial (Yoder *et al.*, 1994; Onyango-Abuje, 1996; Giesecke, 1997).

Bovine cysticercosis and taeniasis are common where hygienic conditions are poor and the inhabitants traditionally eat raw or insufficiently cooked or sun-cured meat (Minozzo *et al.,* 2002). Inadequate health education and low availability of taenicides are the major obstacles for the control of such infections (Pawlowski, 1996). Due to these reasons, taeniasis is more common in developing countries including Ethiopia where meat is an important component of human diet and traditionally consumed raw on several occasions. Lack of awareness about raw meat consumption, existence of highest population density, poor hygiene and sanitary facilities some of the factors that facilitate transmission (Jones *et al*., 1997).

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The epidemiology of bovine cysticercosis/ human taeniasis various from one area to another so control measures appropriate in one area is not necessarily of value in another. Hence, it is essential to have adequate knowledge of the epidemiology of the disease before contemplating control programmes. In Ethiopia some studies have been conducted on bovine cysticercus at different times. But the studies performed were limited to few parts of the country and there was no information on prevalence of bovine cysticercosis and human taeniasisin and around Asella district. Therefore, the objectives of this study were:

- To determine the prevalence of bovine cysticercosis at Asella municipal abattoir,
- To estimate status of taeniasis and associated risk factors in and around the study area

II. Material and Methodology

a) Description of the Study Area

The present study was conducted at Asella municipal abattoir, and Asella town and its surrounding, Tiyoworeda. Asella town is a capital of Arsi Zone, Oromia regional state, Ethiopia. It is located about 175 km Southeast of Addis Ababa at 6° 59' to 8° 49' N latitudes and 38° 41' to 40° 44'E longitudes. The altitude of the area ranges from 2500 to 3000 m.a.s.l. Asella and its surrounding is characterized by mid sub-tropical weather, with minimum and maxim temperature ranging from 8.4 to 22.6°C, and the relative humidity ranging from 43 to 60%. The average rainfall is 2000mm. The area has a bimodal rainfall occurring from March to April (short rainy season) and July to October (long rainy season). According to Arsi Planning Economic and Development Office (APEDO, (2007)), the area is densely populated, with livestock population of 85,893 cattle, 57,118 sheep, 10,725 goats, 7841 horses, 15,642 donkeys, 517 mules and 35,489 poultry. The farmers in the area practice mixed crop-livestock farming system.

b) Study Population

The study animals comprise indigenous cattle brought to Asella Municipal abattoir for slaughter from different districts in and around Assela town and it includes cattle of different age, sex, breed and body condition categories. For the survey data, the target populations were residents of Asella town and surrounding kebeles (Burqa cilalo, Dosha, Harobilallo, Café Misoma and Gora silingo) and includes all age group >18 and both female and males

c) Study Design

A cross-sectional study was used to study the prevalence of bovine cysticercosis at Asella municipal abattoir by using routine meat inspection technique in municipality slaughter house for the presence of *C. bovis*. Moreover, a cross-sectional study was conducted by a semi-structured questionnaire survey to assess the status of *T. saginata*/taeniosis and associated risk factors.

III. Sample Collection Method

a) Active Abattoir Survey

Animal samples were collected by active abattoir survey. The study animals were selected using simple random sampling method and age, breed, sex and body condition of each study animals was recorded on prepared format paper at ante-mortem. Body condition scoring of the cattle was made based on the guideline provide by (Nicholson and Butter, 1986) and all animals included in the study were animals with, medium and good body condition. Age determination was carried out by means of their dentition as described by (De-lahunta and Habel, 1989) and all the inspected animals were at the age of adult and old age group. Prior to sampling, each selected animal were given an identification number by writing a code on its head by using unwashable ink.

Meat inspection was made in accordance with the procedures of Ethiopian Ministry of Agriculture Meat Inspection Regulation (MOA, 1972) for the detection of *T. saginata's* cysts. Because of owners' discomfort on multiple incisions for the thorough examination of major muscles, only the masseters muscle and internal organs such as tongue, heart, liver, kidney, lung and diaphragm were used as indicators of the presence of cysts in the carcass. Careful examination on the carcass of study unit was made through palpation of the organs followed by incision as follows: the surface and substance of tongue was examined visually, followed by longitudinal ventral incision from the tip of the root. Extensive deep incision was made into external and internal muscles of masseters parallel to the plane of the jaw (parallel to the jaw bone from the lower jaw). Visual inspection and longitudinal incision of the myocardium from base to apex was made. The muscles of diaphragm were examined visually and by making incision. Examination of kidney, liver, and the lung was also conducted accordingly by visualization, palpation and incision. Cysts observed in theses organs were carefully dissected and numbers and nature of cysts in each organ was recorded for each animal. The nature of the cyst was recorded as calcified and viable by visual observation of its appearance, as (Ashwani and Gebrehiwot, 2011*)* dead degenerated or calcified cystcerci clearly form identifiable spots of white and have fibrotic lesions, while the viable cysticerci are pinkish-red in colour.

b) Questionnaire survey

Semi-structured questionnaire survey used to asses, potential risk factors and its public health importance. Questionnaire survey on the disease

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occurrence and risk factor assessment was administered to 415 volunteer respondents who were selected based on convenience sampling method and the interview was conducted phase to phase. The potential risk factors of taeniasis considered in this study were :age, sex, religion, occupation, educational status, and habit of raw meat consumption. The awareness of the diseases, presence/absence of sanitation facilities like toilet and the drug used for treatment were also included in the questionnaire survey and at the end of interview some advices were provided to the respondents on how to control and prevents *T. Saginata* infection/cysticercosis.

c) Sample Size Determination

The desired sample size was calculated using the standard formula described by Thrus field (Thrus field, 2005) for simple random sampling method. Since there was no similar previous study at this area, expected prevalence was considered 50%, 5%desired absolute precision and 95% confidence level were used to calculate the minimal sample size. Hence, the sample size required was 384 heads of cattle. But to increase the precision of the study the sample size were increased and a total of 430 heads of cattle were included in the current study. For questionnaire survey sample size was calculated by using the formula given by Arsham (2002) which is:

$$N = 0.25/SE^2,$$

When: N= sample size, SE (standard error) =5%),

The sample size required for the questionnaire survey as per the above formula is 100 for each site (urban and rural). However, to include different risk factors and increase the precision of the result the total number was increased to 415individuals.

IV. Data Management and Analysis

The data collected were entered, recorded and stored in Microsoft excel spread sheets program version 2010. Descriptive and inferential analyzed was made by using SPSS version 20 software. Fisher's and Chi-square (X^2) tests were used to determine the variation in prevalence of infection between different groups for abattoir and questionnaire survey respectively. Statistical significance level was set at $P < 0.05$ at 95% confidence level to determine whether there are statistical significant differences between the parameters measured.

V. Result

Prevalence of *C. bovis*: the study showed that from a total number of 430 carcasses inspected, 5(1.2%) were positive for bovine cysticercosis. The statistical analysis of the data revealed that no significant difference ($p > 0.05$) was observed in the prevalence of cysticercosis in relation to the risk factors like: sex, breed, body condition and ages. But high prevalence of *C. bovis* was observed in local breed, old age and female animals relative to cross breed, adult age and male animals respectively, while almost no difference was indicated between animals of good and medium body condition as shown in Table 1.

Anatomical distribution of cysts: frequency analysis of active abattoir survey revealed that nearly the there was the same distribution of*C. bovis*in the examined organs as follows: liver (0.9%), heart (0.7%), tongue (0.5%) and masseters muscle (0.5%). From the total number of 16 *C. bovis* observed on different organs, 7(43.8%), 5(31.3%), 2(12.5%) and 2(12.5%) were localized on the liver, heart, tongue and masseters muscle (table 2)and out of the total cyst observed 6 (37.5%) of them were viable with organ distribution of 50%, 33.3% and 16.7% on liver, heart and masseters muscle respectively as indicated in table 2.

Questionnaire survey: Of the total 415 interviewed respondents 44.3% (184/415) had contracted *T. saginata* infection at least once in their life time and the respondents confirmed that they were positive by witnessing they observed proglotttids in their feces and/or under wear. Since due to religious purpose pork meat is not consumed in the study area, the proglottids observed were surely to be of *T. saginata*. From positive respondents 32% got taeniasis only before 2000E.C (2008G.C), while 6.7% got taeniasis after 2000 E.C (2008 G.C) and 5.5% were those remain positive both before and after 2000E.C. Out of those witnessed their positivity, 88.6% and 10.9% respondents used modern and traditional drugs for treatment respectively, while the remaining percent uses nothing for treatment as indicated by tables 4 respectively. Out of total respondents 90.6% (376/415) uses toilet, 73.5% (305/415) have awareness about human taeniasis.

Association of risk factors with prevalence of taeniasis: A statistical analysis showed that there was a highly significant variation between urban and rural, higher and lower age group, raw meat and cooked meat consumers, female and male, occupation group, and educational levels ($p<0.05$).High prevalence of humantaeniasiswas reported in rural area, male, higher age group, farmer, raw meat consumer and illiterate. But no statistical significance variation was seen among religion ($p>0.05$) as shown below by tables 5.

VI. Discussion

The prevalence of *C. bovis* among the carcasses inspected at Asella municipal abattoir was 1.2% which is comparable with the findings of (Birhanu, *et al*., 2013) who reported prevalence of 2.58% from Bahir Dar Municipal Abattoir, 2.59% from Wolaita soddo municipal abattoir (Dawit, *et al*., 2012), 3% from Zeway Municipal Abattoir (Bedu, 2011), 3.6% from Addis

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Ababa abattoir (Nuraddis and Frew, 2012), 3.65% from Jimma municipal abattoir (Taresa, *et al*., 2011), 3.11% indifferent agro climatic zones of Ethiopia (Tembo, 2001). But lower than the finding of (Dawit, 2004) 4.9% at Gondar, (Alula, 2010) 5.4% at Konbolcha, (Kebede, 2008) 18.49% in North West Ethiopia, (Abunna, 2008) 26.3% at Hawassa, (Hailu, 2005) 17.5% in East Shoa, (Fetene and Nibret,2014) 5.1%, at Jimma municipal abattoir, (Belay, 2014) 5.2% at Municipal Abbatoir of Shire, (Abunna, 2013) 12% at Yirgalem and (Lielt, 2015) 5.6 at BishoftuElfora abattoir. This difference might be resulted from difference in the level of personal and environmental hygiene, habit of raw meat consumption, number of incision made at inspection site in the abattoir, and management type of the animals practiced. The main reason with low prevalence of bovine cysticercosis in the current study could be due to low number of organs inspected and low incision made at inspection site at the abattoir. In Asella municipal abattoir the commonly inspected organs for presence of *C. bovis* were internal organs (liver, heart, lung, tongue, and kidney) and masseters muscle while other predilection sites are rarely inspected due to multiple mutilation of carcass causes reduction in marketability of the meat and the owners not permit multiple incision of heavy muscles. This may in turn lead to omitting of infected animals as the sensitivity of detecting the parasite will decline with limited number of incisions (Wanzala, 2003) and experimental studies showed a 5-50 times higher prevalence will be achieved by complete slicing of the predilection sites (Minozzo, 2002).

But the current study's result was higher relative to the finding of (Zdolec *et al*., 2012) and (Blessing *et al*., 2011) who reported 0.11% and 0.2% from Croatia and South Africa. This could be due to strict application of meat inspection and public health extension rules and difference in hygiene measures in the study countries. It's known that sanitation facilities are better in the developed countries than in the developing countries in which poor environmental hygiene increase the prevalence of the diseases in the environment. More number of *C. bovis* was observed in the liver than other organs inspected. The reason is that absence of specific predilection site for *C. bovis* as stated by (Scandrett, 2009) so more number of larvae collected through mesenteric and portal veins residing in the liver.

Questionnaire survey indicated that human taeniasis was common in the study area with prevalence of 44.3%. This agree with the finding of (Mesfin and Nuraddis, 2012) 44% in Hawassa town and (Dawit and Temesgen, 2013) 44.44% in Shire Indasilassie district. But this result is lower relative to the finding of (Lielt *et al.,* 2015) 64% in Bishoftu, (Dawit, 2012) 62.5% in Wolaittasoddo, (Fetene and Nibret, 2014) 58%, (Abunna, 2013) 70% in Yirgalem, (Bedu *et al*., 2011) 56.7% at Zeway, (Abunna *et al*., 2008) 64.2% in Awassa town and (Megersa *et al*., 2010) 56.7% Jimma town. The reason for reporting lower prevalence of human taeniasis in the current study area could be due to the difference in the religious composition of the respondents, and sample size taken. Out of total respondents of the current study, 45.1% were Muslims that they have traditionally low habit of consuming raw meat than Christians and from the total respondents only 50.8% were raw meat consumers. Raw meat consumption is the only way of getting *T.saginata* infection, so as raw meat consumption decrease in the area the infection also decrease. The other is sample size difference and as sample size increase the precision will also increases. In the present study the sample size is very large (415) while in the above finding very small (not greater than 170). The other point is that some respondents shy to openly tell about taeniasis and this could also end up with low recovery of positive people in the study area.

It was revealed that *T.saginata* infection was more prevalent in the rural area than urban. This could be due to low level of personal and environmental sanitation facilities and absence of meat inspection in the rural area than urban area. This finding agrees with the statement of (Minozzo *et al.,*2002) who stated that taeniasis are common where hygienic conditions are poor and the inhabitants traditionally eat raw or insufficiently cooked or sun-cured meat.

The current study indicates that the ages of respondents have strong association with the prevalence of *T.saginata* infection and high in higher age group (>35 years) than other age group (<18 and 18-35 years) (table 5) which is in agreement with the previous study of (Abunna *et al*., 2008; Adugna *et al*., 2013; Lielt *et al.,* 2015). This might be due to that the habit of raw meat consumption increase with age and the higher age group have better income to consume raw meat and more prone to *C.bovis*. But lower age groups are student that they have no sufficient access to raw meat from butcher's houses as commonly raw meat was eaten at this site and they are less invited than elder on different ceremony where raw meat consumption culturally practiced.

In this study *T. saginata* was more prevalent in men than in women which is a similar report with findings of (Hailu, 2005; Abunna, 2013; Lielt *et al*., 2015) in other parts of Ethiopia. This may be due to cultural practice in Ethiopia that men not commonly prepare their dishes at home rather they frequently visiting but cheries and restaurants than women for beef consumption. In this study no statistically significant difference were observed between the proportion of taeniasis in Muslim and Christian community which is in consent with the previous reports of (Tembo, 2001; Abunna, 2007; Dawit *et al*., 2012). The reason behind may be they share same culture and habit of raw meat

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consumption in the study area regardless of their religion.

The current study revealed that raw beef consumers had contracted taeniasis infection more frequently than the non raw beef consumers which is inlined with the report of (Megersa, 2010; Fetene and Nibret, 2014). The reason is well known that in the consumption of raw meat the degree of ingesting *C.bovis* with meat is higher (Gajadhar *et al*., 2006; Garcia *et al*., 2007). *T. saginata* infection is highly prevalent in the illiterate than literate respondents and this report agrees with the finding of (Abunna *et al*., 2008; Kebede *et al*., 2009; Adugna *et al*., 2013) and also the current study revealed that the farmers had contracted taeniasis than individuals with other occupational status. This difference might be from low level of awareness in the illiterate and farmers than literate individuals and other occupational status. The other reason for reporting high prevalence of taeniasis in the farmer community is that most of Ethiopian farmers are illiterate and from rural area where environmental hygiene is low and backyard slaughter was practiced with very low awareness about the diseases.

The questionnaire survey result showed that the prevalence of taeniasis in human population is decreasing and it also indicated that there was strong relationship between occurrence of *T.saginata* infection and residence area, age, sex, habit of raw meat consumption, occupational and educational status of the respondents. Therefore, continues public education should be provided to avoid consumption of raw meat and encourage use of latrines and improved standards of human hygiene and backyard slaughtering of cattle should be restricted and slaughter house which fulfills the necessary facilities and with qualified meat inspector should be constructed.

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Table 1: Prevalence of bovine cysticercosis in cattle based on breed, sex, body condition and age from Assella, Tiyo woreda, Ethiopia

Risk factor	Category	No. of examined	No. of affected	Prevalence (%)	Fisher's exact p- value
Breed	Local	418	5	1.2	0.868
	Cross	12	0	0	
Age	Old	58	2	3.45	0.136
	Adult	372	3	0.8	
Sex	Male	413	4	1	0.183
	Female	17	1	5.9	
BCS	Medium	281	3	1.1	0.564
	Good	149	2	1.3	
	Total	430	5	1.2	

Table 2: Frequency distribution of *C.bovis* in different organs examined and number of organs infected from cattle slaughtered at Assela, Tiyoreda Abattoir

Organs inspected	No. of organs inspected	No. of positive organs	Prevalence (%)	Total No of cyst on organ	cyst viability (%) per organs
Tongue	430	2	0.5	2	0(0/6)
Masseters muscle	430	2	0.5	2	16.7(1/6)
Heart	430	3	0.7	5	33.3(2/6)
Liver	430	4	0.9	7	50(3/6)
Lung	430	0	0	0	0
Kidney	430	0	0	0	0
Total	1720	11	0.64	16	100

Table 3: Indicates status of taeniasis in study area in relation to time period considered

	Frequency	Percent
Taeniasis		
Positive before 2000 E.C	133	32.1
Positive after 2000 E.C	28	6.7
Positive both before and after 2000 E.C	23	5.5
Total positive	184	44.3
Total respondents	415	100.0

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Table 4: Shows the drug used by Taeniasis positive respondents

Taeniasis positive individuals		
Drug used	Frequency	Percent
Modern drug	163	88.6
Traditional drug	19	10.3
Non drug users	2	1.1

Table 5: Prevalence of human taeniasis with risk factors (address, age, sex and religion of respondents) in and around Asella, Tiyo woreda, Ethiopia

Variables	Categories	No of interviewees	No infected	Prevalence%	X^2	P –value
Residential area	Rural	307	151	49.2	11.2	0.001
	Urban	108	33	30.6		
Age	<18	92	19	20.7	67.1	0.000
	18-35	199	74	37.2		
	>35	124	91	73.4		
Sex	Male	216	113	52.3	11.6	0.000
	Female	199	71	35.7		
Religion	Christian	228	109	47.8	2.4	0.07
	Muslim	187	75	40.1		
Educational status	Illiterate	173	103	59.5	28.9	0.000
	Elementary	153	52	34		
	High school	54	20	37		
	College/above	35	9	25		
Occupational status	Student	128	25	19.5	55.2	0.000
	Farmer	205	125	61		
	Civil workers	25	10	40		
	Other private workers	57	24	42		
Raw meat	Consumers	211	131	62.1	54.8	0.000
	Non-consumer	204	53	26		
	Total	415	184	44.3		

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Epidemiological Study of Small Ruminant Diseases in Selected Districts of Kaffa and Bench- Maji Zone, Southern Nations Nationalities and Peoples Regional State (SNNPRs), Ethiopia

By Fisseha Mengstie & Amenay Assefa
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Abstract- An epidemiological survey of small ruminant disease was conducted in Boka-Shuta, Konda-Zuriya and Debre-Work kebelles of Kaffa and Bench-Maji zone, Southern Nations, Nationalities and people's regional state (SNNPRs), Ethiopia from July 2012 to June 2013. The objective of the study was to assess diseases of small ruminants affecting production and productivity; their occurrence and distribution; and associated risk factors. For these, Semi structured questioner format was prepared and survey was conducted. The result revealed that, 90.6%, 76.0% and 65.6% of interviewed farmers describe the multi-factorial causes of respiratory diseases; systemic diseases; and Gastro-intestinal parasite respectively were the most prevalent diseases irrespective of agro-ecology difference. The type of disease conditions documented in each agro-ecology had differences. Bloating (accumulation of excess amount of fluid in their abdominal cavity and blood tinged internal organs observed when slaughtered) followed by head circling in Boka-Shuta (highland); gastro intestinal parasite and head circling in Debre-Work (midland); and bottle jaw and orf in Konda-Zuriya (lowland) were the most prevalent and had serious problems in small ruminant production and productivity.

Keywords: *agro-ecology, diseases, epidemiology, production, small ruminant, susceptible.*

GJMR-G Classification: *NLMC Code: WC 900*

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Epidemiological Study of Small Ruminant Diseases in Selected Districts of Kaffa and Bench- Maji Zone, Southern Nations Nationalities and Peoples Regional State (SNNPRs), Ethiopia

Fisseha Mengstie [α] & Amenay Assefa [σ]

Abstract- An epidemiological survey of small ruminant disease was conducted in Boka-Shuta, Konda-Zuriya and Debre-Work kebelles of Kaffa and Bench-Maji zone, Southern Nations, Nationalities and people's regional state (SNNPRs), Ethiopia from July 2012 to June 2013. The objective of the study was to assess diseases of small ruminants affecting production and productivity; their occurrence and distribution; and associated risk factors. For these, Semi structured questioner format was prepared and survey was conducted. The result revealed that, 90.6%, 76.0% and 65.6% of interviewed farmers describe the multi-factorial causes of respiratory diseases; systemic diseases; and Gastro-intestinal parasite respectively were the most prevalent diseases irrespective of agro-ecology difference. The type of disease conditions documented in each agro-ecology had differences. Bloating (accumulation of excess amount of fluid in their abdominal cavity and blood tinged internal organs observed when slaughtered) followed by head circling in Boka-Shuta (highland); gastro intestinal parasite and head circling in Debre-Work (midland); and bottle jaw and orf in Konda-Zuriya (lowland) were the most prevalent and had serious problems in small ruminant production and productivity. Regarding the diseases occurrence and distribution, the highest cases were recorded in summer followed by autumn. Ewes/doe and lambs/kids were the most susceptible age group. Each specific disease conditions occurrence and distribution in this study had its own specific risk factor. In general, however, disease management methods and practices by the farmers, susceptible age groups and seasons of occurrence were important risk factors playing an important role. Thus, the production and productivity of small ruminant was highly determined by diseases conditions. The result presented here suggests that, ewes/doe and lambs/kids need special attention to prevent them from diseases to improve production and productivity. And also, the small ruminant flock should get appropriate vaccination prior to the disease occurrence. Thus, the farmers' disease management and practices method need to be improved through training on small ruminant disease and their management. In addition, further studies should be conducted to identify the specific diseases types and their associated risk factors.

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Keywords: agro-ecology, diseases, epidemiology, production, small ruminant, susceptible.

I. Introduction

Indigenous small ruminants constitute greater percentage of ruminant population in Africa (Lebbie *et al.,* 1994). These flocks of animals are commonly found in the rural areas where they are owned and managed under extensive system (Otchere, 1986). Small ruminants play an important role in the lives of most people especially rural farmers who livelihood entirely depend on them. They provide source of animal protein through their meat and milk (Fajemisin, 1991). Not with standing, they fetch a source of income when sold to meet some other family needs as well as play a vital social roles during ceremonies and festivals.

The importance of small ruminants (ie sheep and goats) to the socio-economic well being of people in developing countries in the tropics in terms of nutrition, income and intangible benefits (eg savings, insurance against emergencies, cultural and ceremonial purposes) cannot be overemphasized (Kosgey, 2004). Sheep and goats are important livestock species in developing countries because of their ability to convert forages, and crop and household residues into meat, fibre, skin and milk.

For an improved animal protein intake, there is need for improvement in the production of meat and other protein sources from the livestock industry. Sheep and goats offer a great potential in this respect due to their relative ease of breeding, management, ability to subsist on forages, hardiness, adaptation to a wide range of ecological zones and distribution among others. In recent times, sheep and goats production is becoming popular even among urban dwellers as result of the aforementioned merits (Umunna *et al.,* 2014).

Small ruminant management is seriously hindered by diseases in the tropics. Diseases are very important to farmers and affect the production of small ruminants in several ways. It increases cost of

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production, lowers production level, reduces the quality and quantity of animal products and generally causes great loss to the farmer (Abdullahi *et al.,* 2013).

In Ethiopia, There are more than 38 millions of cattle and 30 million small ruminants (CSA, 2007). However, the country is not making use of this huge potential attributed to different constraints among which disease stands in the front line (Samson and Frehwot, 2010; Firew, 1999). Diseases of various origins (bacterial, viral, parasitic, etc.) directly or indirectly are among the numerous factors responsible for poor production and productivity (Firew, 1999; Feyesa *et al.,* 2010) which results the major barriers for the improvement of livestock production, reproduction and marketing. The annual total economic losses due to diseases, mortality and reduced productive and reproductive performance were estimated by 150 million USD (Berhanu, 2002).

In Ethiopia, Sheep and goats contribute 25% of the meat domestically consumed with a production surplus mainly being exported as live animals (Alemayehu and Fletcher, 1991; Tibbo, 2006). Both species also contribute 50% of the domestic needs in wool, about 40% of skins and 92% of the value of hides and skin exported (ILCA, 1993). The total income share of small ruminants tends to be inversely related to size of land-holding, suggesting that small ruminants are of particular importance for landless people. In some settings where, agriculture (crop production) provides only seasonal employment, rearing small ruminants would provide employment and income as a subsidiary occupation (Coppock *et al.,* 2006).

However in Ethiopia, Small ruminant contribution to food consumption, rural income and export economy is below the expected potential, because of their husbandry is constrained by compound effect of disease, poor feeding, and poor management (Chalachew, 2001). Among many factors which limit the economic return from small ruminant production diseases stands in the front line (Firew, 1999). As a result of small ruminant diseases, 5-7 million sheep and goats die each year (Sileshi and Lidetu, 2007) and 35% of sheep and 56% of goat skins rejected due to skin parasites (Bayou, 1998) which leads serious economic loss to small holder farmers, the tanning industry, and the country as whole (ESGPIP, 2009) in which Many of the diseases in Ethiopia are still uncontrolled and are causing devastating effects both to the producers and to the national economy (EARO, 1996).

Even if small ruminants play a very important socio-economic role, little is known about health problems of these animals in the study area. In order to design relevant disease control strategies, assessment of the existing small ruminant diseases in the area is vital to devise appropriate technological interventions as well as for further study. Therefore, the aim of this study was, to assess diseases of small ruminant affecting production and productivity; their occurrence and distribution; and associated risk factors in selected districts of Kaffa and Bench Maji zone.

II. Materials and Methods

a) Study Area and Study Design

A cross-sectional study to assess diseases of small ruminant affecting production and productivity; their occurrence and distribution; and associated risk factors was conducted from July 2012 to June 2013 in Boka-Shuta and Konda-Zuriya of Kaffa zone; and Debre-work of Bench-maji zone. The study areas were selected purposively based on altitude variations, accessibility and availability of small ruminant. Thus, Boka-Shuta (highland), Konda-Zuriya (lowland) and Debre-work (Midland). The interviewed households with in each study areas were selected using systematical random sampling technique.

b) Sample Size Determination and Data Collection

Before conducting the formal survey, group discussion was made with experts of each respective zonal and district agriculture and rural development office on small ruminant production problems and diseases in particular. Semi structured questioner format was prepared. Then, it was pre-tested and modified as necessary and finally the formal survey was conducted and data was collected using single-visit-multiple-subject formal survey technique (ILCA, 1990). Accordingly, a total of 96 households were interviewed and data's were collected on major small ruminant disease and health problems; their occurrence and distribution; and associated risk factors.

c) Data Management and Analysis

The data was analyzed using STATA version 11. Descriptive statistics was employed to determine the prevalence and Chi-square (X^2) test was used to measure the effect of predisposing factors on the distribution of different diseases. A significance level ($p<0.05$) and confidence level (95%) was set to determine the presence or absence of statistically significant difference between the given parameters. And also, multivariate logistic regression was tested to confirm the stated factors.

III. Results and Discussions

a) Importance of Livestock Species

The overall importance of livestock species irrespective of agro-ecology difference indicated that, cattle had the highest proportion (90.6%) followed by poultry (68.8%) (Figure 1). The different animal species are distributed throughout the three agro-ecologies of the study areas; and these could suggest that, the areas have a potential to favorably support live stock

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production and productivity. However, the proportion of livestock species had differences amongst the different agro-ecologies. Thus, small ruminants had the highest level of proportion than other livestock species; goat (54.5%) in Konda-Zuriya (lowland) followed by sheep (49.2%) in Boka-Shuta (highland). These could indicate that, the production potential for selected species of animals in different agro-ecologies (figure 2). The present finding was supported by Enwelu et al (2015) from Nigeria; the farmer's preferred goat than sheep due to a number of reasons. These were; prolificacy (54.2%); profitability (36.1%); longevity (long life span) (5.6%); and type of meat/animal dung (2.8%).

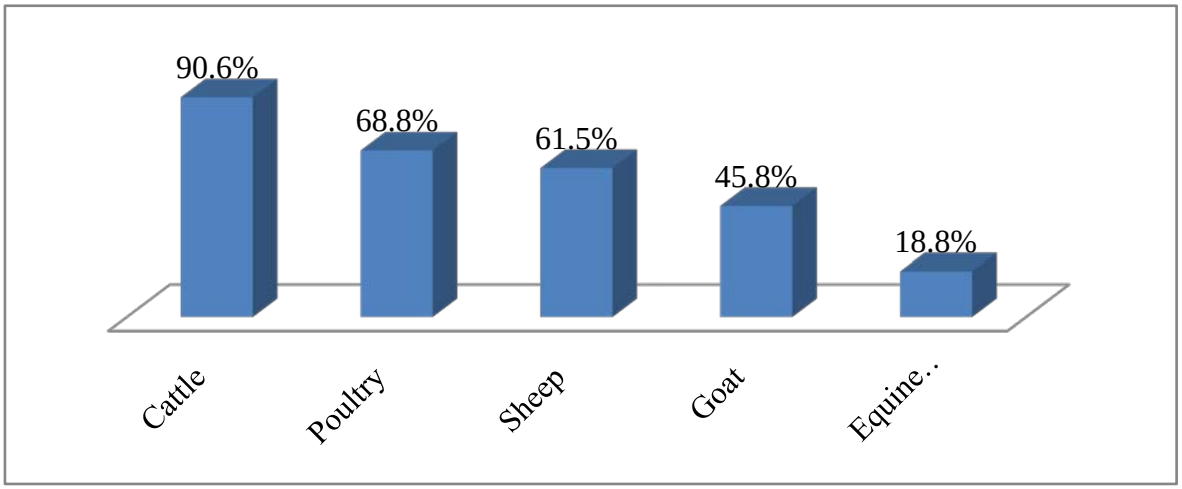


Figure 1: Overall proportion of livestock species importance in Boka-Shuta, Debre-Work and Konda-Zuriya of southern Ethiopia

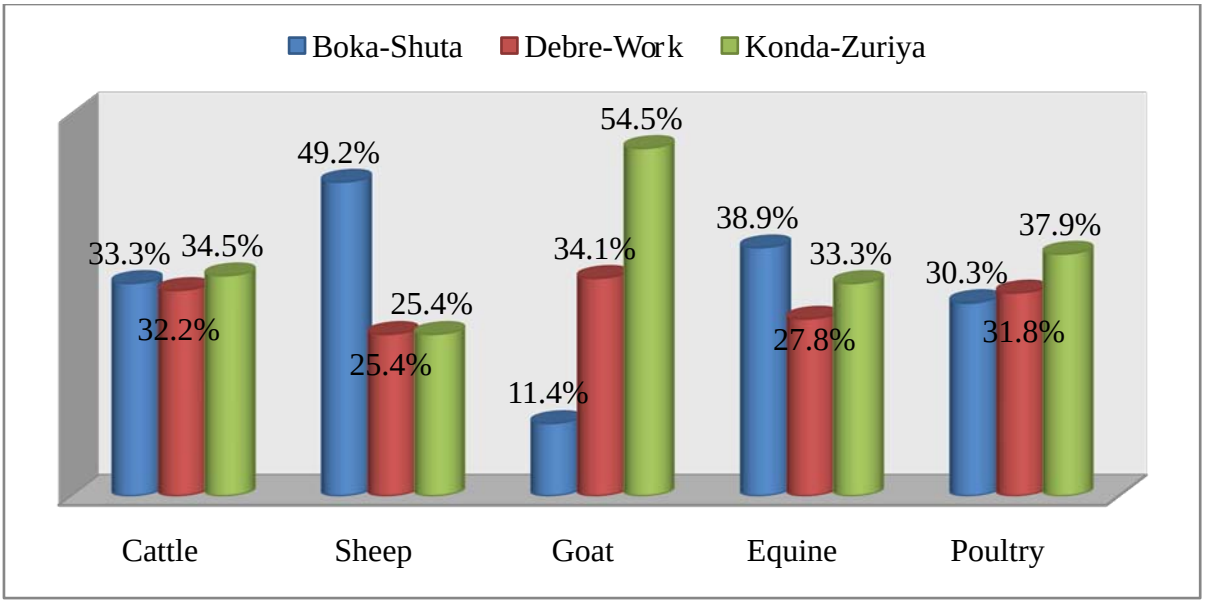


Figure 2: Proportion of livestock species importance in Boka-Shuta, Debre-Work and Konda-Zuriya of southern Ethiopia

b) Small Ruminant Diseases and Their Prevalence

Farmers listed different types of small ruminant diseases conditions that could cause mortality and morbidity in the study areas during the questioner survey. Among these, respiratory disease, systemic diseases, diarrhea, swollen head, Gastro-intestinal parasite and head circling had most frequently recorded. 90.6% of the respondents mentioned, diseases of the respiratory system (with signs of coughing and nasal discharge) which could be multifactorial caused followed by 76.0% for systemic diseases (with signs of erected hair, depression and inappetent) were the most common. The multi symptomatic gastro-intestinal parasitism (in the present case could be manifested in diarrhea, emaciation or bloating) had significant occurrence (Figure 3).

Different research reports in Ethiopia indicated that, diseases are the main constraints limiting small

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ruminant production. Among these, internal parasitic infestation followed by occurrence of persistent nasal discharge and coughing had the highest incidence limiting small ruminant production and could cause serious problems in kids and lambs (Urgessa *et al.,* 2012; Solomon *et al*., 1995; Yohannes *et al*., 1995; Solomon and Gemeda, 2000; Markos, 2006).

The study report by Abebe et al (2013) in north western Ethiopia confirmed that, Sheep diseases were one of the main constraints for sheep production and Foot rot, skin disease, pasteurellosis, orf and internal parasites were the main. The authors extended their findings and; sheep diseases were the major constraints (ranked first) amongst several constraints limiting small ruminant production. Other authors from South Sudan revealed that; internal parasite followed by pneumonia and external parasite were the most prevalent small ruminant diseases (Lado *et al.,* 2015).

The occurrence of small ruminant diseases conditions with respect to agro-ecologies indicated that; bloating (accumulation of excess amount of fluid in their abdominal cavity and blood tinged internal organs observed when slaughtered) followed by head circling were the most prevalent in Boka-Shuta. Whereas, gastro intestinal parasite and head circling in Debre-Work; and bottle jaw and orf in Konda-Zuriya were the most prevalent and had serious problems in the small ruminant production and productivity (Figure 4).

And also, statistical significant differences of diseases occurrence among the study areas were observed. Thus, systemic diseases followed by gastro-intestinal parasite and head circling had highest in Midland; whereas, Orf followed by tick infestation in Lowland. Lowest proportion of diseases occurrence was observed in Highland (Boka-Shuta) and these could be due to several intervention activities in the area by Bonga Agricultural research center for controlling and preventing diseases occurrence in small ruminant (like regular vaccination against ovine pasturellosis disease, anthrax, PPR, sheep and goat pox disease; routine treatment of cases; and regular deworming with broad spectrum antihelimentics), since it was one of Bonga sheep breed improvement community/cooperative (Table 1).

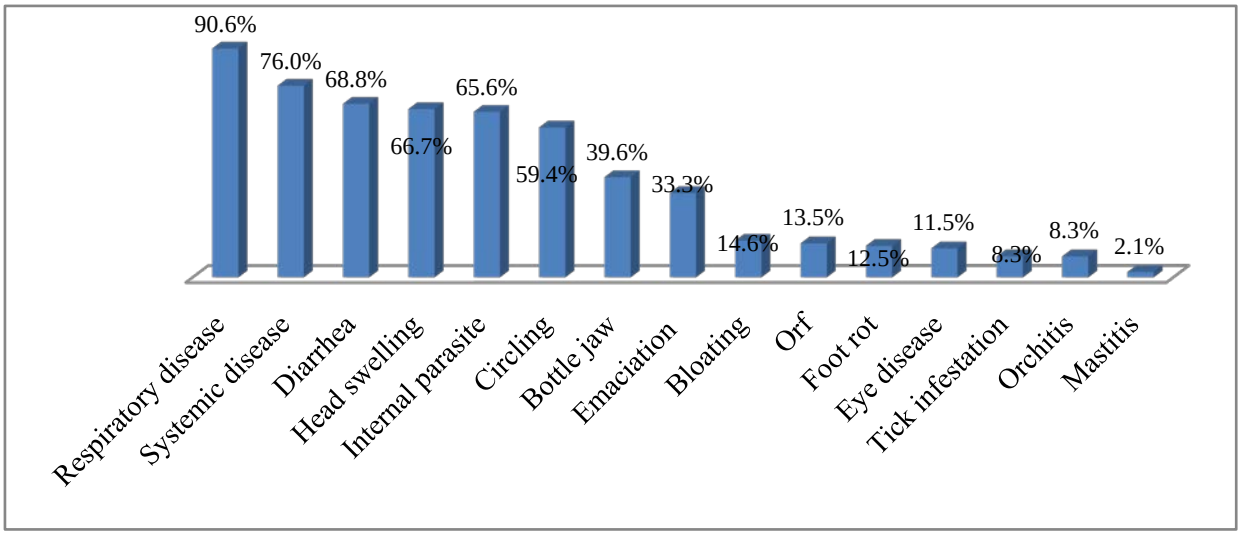


Figure 3: Overall Prevalence of small ruminant disease conditions of Boka-Shuta, Debre-Work and Konda-Zuriya, southern Ethiopia

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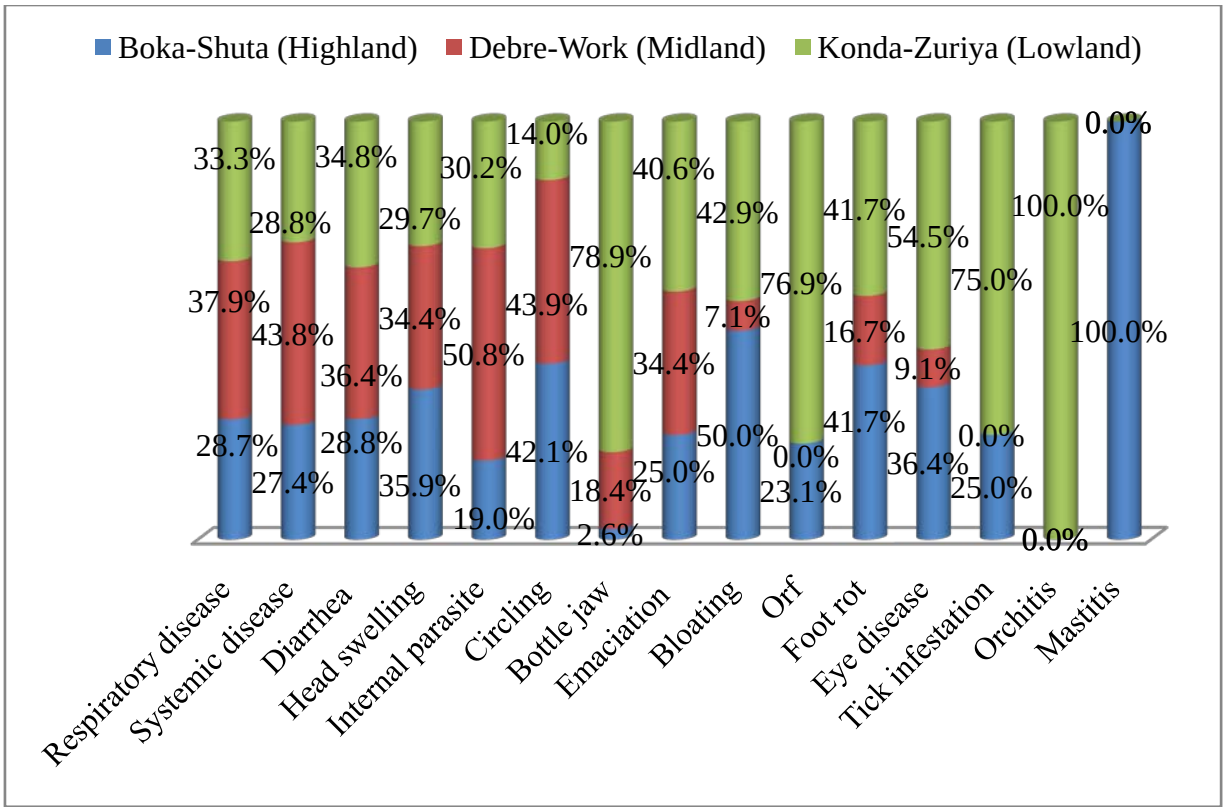


Figure 4: Prevalence of small ruminant disease conditions with respect to agro-ecologies, southern Ethiopia

Table 1: Prevalence of small ruminant disease conditions having statistical significant difference with respect to agro-ecologies, southern Ethiopia

Health related problems	N	Study areas			Percentage (%)	Sig.
		Boka-shuta (Highland)	Debre-Work (Midland)	Konda-Zuriya (Lowland)		
Respiratory disease	87	25(28.7)	33(37.9)	29(33.3)	90.6	0.074
Systemic disease	73	20(27.4)	32(43.8)	21(28.8)	76.0	0.002
Diarrhea	66	19(28.8)	24(36.4)	23(34.8)	68.8	0.817
Head swelling	64	23(35.9)	22(34.4)	19(29.7)	66.7	0.145
Internal parasite	63	12(19.0)	32(50.8)	19(30.2)	65.6	0.000
Head circling	57	24(42.1)	25(43.9)	8(14.0)	59.4	0.000
Bottle jaw	38	1(2.6)	7(18.4)	30(78.9)	39.6	0.000
Emaciation	32	8(25.0)	11(34.4)	13(40.6)	33.3	0.671
Bloating	14	7(50.0)	1(7.1)	6(42.9)	14.6	0.052
Orf	13	3(23.1)	0(0.0)	10(76.9)	13.5	0.002
Foot rot	12	5(41.7)	2(16.7)	5(41.7)	12.5	0.368

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Eye disease	11	4(36.4)	1(9.1)	6(54.5)	11.5	0.153
Tick infestation	8	2(25.0)	0(0.0)	6(75.0)	8.3	0.031
Orchitis	8	0(0.0)	0(0.0)	8(100)	8.3	0.000
Mastitis	2	2(100)	0(0.0)	0(0.0)	2.1	0.094
Total	96	29(30.2)	33(34.4)	34(35.4)	100.0	

c) Small Ruminant Diseases Management and Practices by the Farmers

In general, small ruminant disease management by modern treatment in veterinary clinics was significantly different among the study areas. For example, 77.1% the interviewed household in Konda-Zuriya had better trend and awareness for treating their sick animals in veterinary clinics (Table 2). But, in areas were veterinary clinics are remote from farmers' residences (like in case of Boka-Shuta out of the reach of intervention areas by the research center); the farmers manage their sick animals either by treating with home remedy and herbs or slaughtered for skin. Few households were also mentioned that, they used drugs by buying from the market and shop to treat their animals by themselves. The present finding was strongly supported by the study from South Sudan that; inadequate knowledge of small ruminant management was the most common challenge facing small ruminant production (Lado *et al.,* 2015).

Table 2: Small ruminant diseases management and practices by the farmers

Variables		Study areas			Total (%)	Sig.
		Boka-shuta	Debre Work	Konda-Zuriya		
Small ruminant disease management (controlling and prevention)	Self treatment using home remedy and herbs	14(28.6)	17(34.7)	18(36.7)	49(51.0)	0.932
	Modern treatment in veterinary clinics	17(23.0)	24(32.4)	33(44.6)	74(77.1)	0.001
	Slaughtering diseased sheep for skin	8(61.5)	2(15.4)	3(23.1)	13(13.3)	0.029
	Selling to market	11(26.2)	21(50.0)	10(23.8)	42(43.8)	0.148
	Vaccination against small ruminant diseases	14(40.0)	19(54.3)	2(5.7)	35(36.5)	0.000
Pasture management for disease transmission	Separate grazing/browsing house hold herd and flock from the community	14(23.3)	19(31.7)	27(45.0)	60(62.5)	0.030
	Communal grazing/browsing house hold herd and flock from the community	17(34.7)	17(34.7)	15(30.6)	49(51.0)	0.516
Quarantine system	Free movement of animal within and across the areas	27(40.3)	24(35.8)	16(23.9)	67(69.8)	0.000
	Restricted movement of animal within and across the areas	2(6.9)	9(31.0)	18(62.1)	29(30.2)	0.000
	Total	29(30.2)	33(34.4)	34(35.4)	96(100)	

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d) Temporal Distribution of Small Ruminant diseases

The occurrence of small ruminant diseases conditions in different seasons of the year had significantly varied. Thus, the highest occurrence was documented in summer (50.0%) followed by autumn (21.9%). On the other hand, seasons with high risk of disease occurrence were identified; and thus, autumn and summer with 32.3%. For these, different factors were identified. Grazing on immature fresh grass (22.9%) was the main predisposing factor followed by unknown reason (20.8%) (Table 3). The present finding was justified by Abebe et al (2013); Sheep death occurs mainly at the end of the rainy season. This may be due to feed shortage and the suitability of the environment for the disease causing organisms. These also further aggravated by the introduction of animals into the area from different places and markets which might introduce different diseases.

Table 3: Temporal distribution of small ruminant disease conditions, southern Ethiopia

Variables		Study Areas			Total (%)	Sig.
		Boka-shuta	Debre-Work	Konda-Zuriya		
		N(%)	N(%)	N(%)		
Occurrence of diseases in different seasons	All season	3(75.0)	0(0.0)	1(25.0)	4(4.2)	0.000
	Autumn	5(23.8)	14(66.7)	2(9.5)	21(21.9)	
	Spring	2(66.7)	0(0.0)	1(33.3)	3(3.1)	
	Summer	5(10.4)	17(35.4)	26(54.2)	48(50.0)	
	Winter	14(70.0)	2(10.0)	4(20.0)	20(20.8)	
Seasons with high risk of disease occurrence	All season	3(75.0)	0(0.0)	1(25.0)	4(4.2)	0.000
	Autumn	6(19.4)	16(51.6)	9(29.0)	31(32.3)	
	Autumn & Summer	1(20.0)	4(80.0)	0(0.0)	5(5.2)	
	Spring	3(75.0)	0(0.0)	1(25.0)	4(4.2)	
	Summer	4(12.9)	7(22.6)	20(64.5)	31(32.3)	
	Winter	12(66.7)	3(16.7)	3(16.7)	18(18.8)	
	Winter & Autumn	0(0.0)	3(100)	0(0.0)	3(3.1)	
Factors for seasons of high risk of disease occurrence	Communal grazing	0(0.0)	1(100)	0(0.0)	1(1.0)	0.000
	Feed shortage	1(14.3)	6(85.7)	0(0.0)	7(7.3)	
	Feed shortage and unfavorable weather	9(52.9)	0(0.0)	8(47.1)	17(17.7)	
	Grazing on meshy areas	0(0.0)	0(0.0)	1(100)	1(1.0)	
	Immature fresh grass	6(27.3)	14(63.6)	2(9.1)	22(22.9)	
	Immature fresh grass and biting flies	0(0.0)	1(11.1)	8(88.9)	9(9.4)	
	Not known	3(15.0)	7(35.0)	10(50.0)	20(20.8)	

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	Unfavorable weather & dusts	5(100)	0(0.0)	0(0.0)	5(5.2)	
	Unfavorable weather	5(35.7)	4(28.6)	5(35.7)	14(14.6)	
Total		29(30.2)	33(34.4)	34(35.4)	96(100)	

e) Occurrence of Disease Outbreak in Small Ruminant flock

Significant variations for the occurrence of small ruminant disease outbreak in different seasons were recorded. Thus, 33.3% were during winter followed by 25% in autumn. Diseases manifesting respiratory signs had 50% of probability for causing outbreak (Table 4). The present finding was justified by Abebe et al (2013) report; disease mainly occurs during feed shortage periods (dry periods).

Table 4: Occurrence of small ruminant diseases outbreak, southern Ethiopia

Occurrence of small ruminant disease outbreak		Study Areas			Total	Sig,
		Boka-shuta	Debre-Work	Konda-Zuriya		
		N(%)	N(%)	N(%)	N(%)	
Occurrence of disease outbreak in small ruminant		14(38.9)	4(11.1)	18(50.0)	36(37.5)	
Seasonal distribution	Autumn	3(33.3)	3(33.3)	3(33.3)	9(25.0)	0.035
	In any of the seasons	0(0.0)	0(0.0)	8(100)	8(22.2)	
	Spring	3(75.0)	0(0.0)	1(25.0)	4(11.1)	
	Summer	2(66.7)	0(0.0)	1(33.3)	3(8.3)	
	Winter	6(50.0)	1(8.3)	5(41.7)	12(33.3)	
Factors for diseases outbreak	Anthrax	1(50.0)	1(50.0)	0(0.0)	2(5.6)	0.027
	Bloating	2(100)	0(0.0)	0(0.0)	2(5.6)	
	Head circling	2(100)	0(0.0)	0(0.0)	2(5.6)	
	Diarrhea	0(0.0)	1(50.0)	1(50.0)	2(5.6)	
	Respiratory disease	2(11.1)	2(11.1)	14(77.8)	18(50.0)	
	Respiratory disease with diarrhea	1(100)	0(0.0)	0(0.0)	1(2.8)	
	Swollen head	2(100)	0(0.0)	0(0.0)	2(5.6)	
	Swollen head with coughing	0(0.0)	0(0.0)	2(100)	2(5.6)	
	Swollen head with coughing and diarrhea	0(0.0)	0(0.0)	1(100)	1(2.8)	
	Swollen head with diarrhea	1(100)	0(0.0)	0(0.0)	1(2.8)	
	Unknown disease	3(100)	0(0.0)	0(0.0)	3(8.3)	

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f) Distribution of Small Ruminant Diseases Conditions in Different Age Groups

The occurrence and distribution of small ruminant diseases conditions in different age groups were significantly vary even if, 22.9% were documented in all age groups. Thus, the highest was in ewes/doe and lambs/kids (26%) as compared to other age groups (Table 5).

Table 5: The occurrence and distribution of small ruminant disease conditions in different age groups, southern Ethiopia

Diseases distribution in different small ruminant age group		Study area			Total (%)	Sig.
		Boka-Shuta	Debre-Work	Konda-Zuriya		
		N (%)	N (%)	N (%)		
Age group	Adult	0(0.0)	1(100)	0(0.0)	1(1.0)	0.000
	Adults and lambs/kids	8(66.7)	2(16.7)	2(16.7)	12(12.5)	
	All age	6(27.3)	2(9.1)	14(63.6)	22(22.9)	
	Ewes/doe	7(46.7)	5(33.3)	3(20.3)	15(15.6)	
	Ewes/doe and lambs/kids	7(28.0)	5(20.0)	13(52.0)	25(26.0)	
	Lambs/kids	1(4.8)	18(85.7)	2(9.5)	21(21.9)	
Total		29(30.2)	33(34.4)	34(35.4)	96(100)	

g) Factors Associated with the Occurrence and Distribution of Small Ruminant Diseases

Based on multivariate logistic regression analysis, different determinant factors were found significantly associated for the occurrence and distribution of small ruminant disease conditions (Table 6). According to the model, holding the effect of other variables constant, the risk of acquiring infection with disease conditions manifested by swelling of head was 6.9% higher for those not treated in veterinary clinic (didn't get Modern treatment) than treated. The risk of getting head circling was 13.6% higher for Ewes/doe and lambs/kids than Lambs/kids alone; and season of occurrence was 39.6% higher in summer than winter. For GIT parasite infestation, the risk was 0.9% lower in Boka-Shuta than Konda-Zuriya which is justified by the regular deworming intervention by the research center in the study area. Traditional treatment practice by the farmers in the study areas for GIT parasite infestation indicated that, the risk was 21.2% higher for those not treated by herbal remedy than treated. For the occurrence and distribution of disease conditions like emaciations and eye diseases, market was significantly associated as a source of infection where diseased animals could disseminate the disease causing organism to the areas.

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Table 6: Multivariate logistic regression analysis result - lists of significant variables after insignificant factors were excluded

Diseases conditions	Variables	Categories	OR	95% CI for OR	P value
Swollen head	Disease management method and practice	Modern treatment (No vs. Yes)	6.882	1.191, 39.8	.031
	Susceptible age	all ages vs. Lambs/kids	21.037	2.088, 211.9	.010
Head Circling	Study area	Konda-Zuriya vs. Boka-Shuta	.001	.000, .033	.000
	Susceptible age	Ewes/doe and lambs/kids vs. Lambs/kids	13.578	.950, 194	.055
	Season of occurrence	Summer vs. Winter	39.632	1.508, 1041.4	.027
GIT parasites	Study area	Boka-Shuta vs. Konda-Zuriya	.009	.000, .604	.028
	Disease management method and practice	Traditional treatment (No vs. Yes)	21.164	1.691, 264.8	.018
	Season of occurrence	summer vs. winter	.010	.000, .407	.015
Emaciation	Disease management method and practice	Selling to market	.129	.022, .763	.024
Bottle jaw	Study area	Boka-Shuta vs. Konda-Zuriya	.001	.000, .062	.001
		Debre-Work vs. Konda-Zuriya	.009	.000, .231	.005
Eye diseases	Disease management method and practice	Selling to market	.002	.000, .635	.035

IV. Conclusions and Recommendations

The distribution and production of small ruminant was highly determined by diseases conditions. Of which, multi-factorial cause of respiratory diseases and Gastro-intestinal parasite are most prevalently occurred. The occurrence and distribution of those disease conditions had differences in seasons where the highest was in summer followed by autumn; and ewes/doe and lambs/kids were most frequently affected. Each specific disease conditions occurrence and distribution in this study had its own specific risk factor. In general, however, disease management methods and practices by the farmers, susceptible age groups and seasons of occurrence were important risk factors playing an important role. Thus, the production and productivity of small ruminant was highly determined by diseases conditions. The result presented here suggests that, ewes/doe and lambs/kids need special attention to prevent them from diseases to improve production and productivity. And also, the small ruminant flock should get appropriate vaccination prior to the disease occurrence. In addition, the farmers' disease management and practices method need to be improved through training to create awareness on small ruminant disease and their management. In addition, further studies should be conducted to identify the specific diseases types and their associated risk factors.

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Major Causes of Liver Condemnation and Associated Direct Financial Losses in Bovine Saughtered at Assela Municipal Abattoir Arsi, South Eastern Ethiopia

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Abstract- A study was conducted from October, 2013 to March, 2014 on cattle slaughtered at Assela municipal abattoir with the aim of determining major causes of liver condemnation and to estimate the direct financial losses attributed to the condemned liver. Ante mortem and post mortem inspection procedures were followed throughout the study and abnormalities encountered were recorded. A total of 384 cattle were examined at ante mortem and 9 animals were found to have abnormalities/conditions like lameness, blindness, rough hair, amputated tail and branding. Out of 384 cattle slaughtered, 274 (71.4%) livers were totally condemned. The major causes of liver condemnation were due to hydatidosis (64.6%), fascilosis (20.8%), calcification (7.7%), coinfection of hydatid cyst with fasciola (4.7%), cirrhosis (1.5%) and abscess (0.7%). Comparison of liver condemnation rate was carried out for different age, animal origin and body condition however, statistically significant difference was observed only between age groups.

Keywords: *abattoir, assela, cattle, condemnation, financial loss, liver.*

GJMR-G Classification: *NLMC Code: WI 141*



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Major Causes of Liver Condemnation and Associated Direct Financial Losses in Bovine Saughtered at Assela Municipal Abattoir Arsi, South Eastern Ethiopia

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Abstract- A study was conducted from October, 2013 to March, 2014 on cattle slaughtered at Assela municipal abattoir with the aim of determining major causes of liver condemnation and to estimate the direct financial losses attributed to the condemned liver. Ante mortem and post mortem inspection procedures were followed throughout the study and abnormalities encountered were recorded. A total of 384 cattle were examined at ante mortem and 9 animals were found to have abnormalities/conditions like lameness, blindness, rough hair, amputated tail and branding. Out of 384 cattle slaughtered, 274 (71.4%) livers were totally condemned. The major causes of liver condemnation were due to hydatidosis (64.6%), fascilosis (20.8%), calcification (7.7%), coinfection of hydatid cyst with fasciola (4.7%), cirrhosis (1.5%) and abscess (0.7%). Comparison of liver condemnation rate was carried out for different age, animal origin and body condition however, statistically significant difference was observed only between age groups. The direct financial loss due to liver condemnation was calculated to be 418,761 ETB per annum, rendering them unfit for local market for eusthetic reason or considering their zoonotic risks to human beings. To this end, public education on the effects of animal disease, application of strict control measures accompanying epidemiological studies and exercising appropriate meat inspection procedures were forwarded to minimize liver condemnation and as well as to safeguard the welfare of the public.

Keywords: abattoir, assela, cattle, condemnation, financial loss, liver.

I. Introduction

One of the losses from endemic disease is expressed in terms of organ condemnation. The most commonly affected organs are liver and lung due to fasciolosis (for liver) and hydatidosis (for both) (Teka, 1997). Each year significant loss results from death of animals, inferior weigth gain, condemnation of edible organs and carcasses at slaughtered. This production loss to the livestock industry is estimated at more than 900 million USD annually (Abebe, 1995).

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A through meat inspection procedure requires two-steps namely antemortem and postmortem inspection. 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 slaughterhouse. Ante mortem inspection should be done within 24 hours of slaughter and repeated when slaughter has been delayed over a day (Teka, 1997; Mezgebu, 2003).

Postmortem inspection is screening or sorting process to separate the normal from abnormal. It is the center around which meat hygiene revolves since it provides information indispensable from the scientific evolution of clinical signs and pathological process that affect wholesomenesss of meat. Routine post mortem inspection of carcass and organs should be carried out as soon as possible after completion of dressing (Gracey, 1986).

The final judgment to be taken with an organ and carcass or parts of a carcass is based on the total evidence produced by observation, palpation, incision, smell, and any ante mortem signs (Teka, 1997). It is necessary to be aware the extent to which the public is exposed to certain zoon otic diseases detected in abattoirs and financial losses attributed to condemnation of affected organs and carcass (Nfi and Alonge, 1987). This is due to the fact that, meat is the main source of particular importance to the public such as hydatidosis, fasciolosis, tuberculosis and cysticercosis (Sirak, 1991).

Bovine liver is one of the largest visceral organs in the animal body which performs numerous functions and very reach sources of vitamins and minerals (Radostitis *et al.,* 2007). The tissue is much sought by consumers due to its palatability and easy to consumption. However, it is one of the most commonly condemned visceral organs during routine meat inspection (Phiri, 2006).

Parasites in the tropics are responsible for greater losses to the meat industry than any other diseases (Jobre *et al,* 1996). Similarly like many other tropical countries of Africa, it is well known that parasitic diseases are among the major factors responsible for

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the low productivity of livestock in Ethiopia (Abebe, 1995; Jobre *et al.,* 1996).

Cystic echinococcosis/Hydatidosis is a parasitic infection caused by larval stage of Echinococcus granulosus, which is small tapeworm, for which dogs and other canids are typical definitive hosts. The adult parasite found in small intestine of carnivours while the metacestode (hydatid cyst) is found in different organs of a wide varities of herbivours including (sheep, goats and cattle), pig, horse and man (Soulsby, 1982).

Fasciolosis in cattle is chronic wasting disease caused by the presence in the liver and bile ducts respectively of immature and adult Trematode of the genus fasciola. The disease is found in vast areas of the world with the smaller fasciola hepatica (3.5x1cm) in temperate countries and the large fasciola gigantic (7.5cm) in tropical regions (Andrews *et al.,* 1999).

Various researchers have undertaken studies at abattoir surveys to determine the prevalence and economic importance and cause of meat condemnation (hydatidosis, Fasciolosis,Cystcercosis) as these are mainly to be of major economic and public health importance in meat inspection (Jobre *et al.,* 1996). Therefore, the objective of this study was to identify the major causes of liver condemnation in cattle slaughtered in Assela municipal abattoir and to estimate the magnitude of direct economic losses attributed to this condemnation.

II. Materials and Methods

a) Study area

The study was conducted at Assela municipal abattoir, from October 2013 to march 2014. Assela is located 175Km South East of Addis Ababa at an altitude of 2350-2400 meters above sea level and has a climatic condition of "Woynadega". The annual average rainfall is 1300-1350mm. A day and night temperature of the area ranges from 10-25^{0}c and 10-20^{0}c respectively. The area has a biomodal rainfall occurring from March to April (short rainy season) and from july to October (long rainy season) with mean annual rain fall of 1300-1350mm with the relative humidity of 43-60^{0}c (CSA, 2009).

b) Study animals

A total of 384 randomly selected cattle were inspected at Assela municipal abattoir. Out of which, 373 (97.14%) were males and only 11 (2.86%) were females. From the total of 384 cattle slaughtered, 348 were old and 36 were adults. Majorities of cattle came to Assela municipal abattoir for slaughters were originated from the market places of Sagure, Kersa and Assela.

c) Study Design

A cross-sectional study was employed to identify the major cause of liver condemnation and to evaluate the direct financial losses. The study animals were selected using simple random sampling method by taking the age, body condition and origin of the animals into consideration. The desired sample size for this study was calculated by using the formula given by Thrusfied (1995) with 95% confidence interval, 5% absolute precision and 50% expected prevalence

d) Study Methodology

i. *Ante-Mortem Examination*

Ante-mortem examination was conducted on individual animals, while the animals were entering in to the lairage and in mass after they entered into the lairage. Both sides of the animals were inspected at rest and in motion. Moreover, the general behavior of the animals, sign of diseases and abnormality of any type were recorded according to the standard antemortem inspection procedures (Gracey, 1986). Following the judgment guideline by (FAO, 2003), animals fit for human consumption were allowed for slaughter.

ii. *Post-mortem Examination*

Post-mortem examination involved visual inspection, palpation and making systemic incision of liver to look for the presences of cysts, adult parasites and other abnormalities. Pathological lesions were differentiated and judged based on (FAO, 2003) guidelines on meat inspection for developing countries.

iii. *Financial Loss Assessment*

The direct financial losses due to liver condemnation from market were considered. The analysis was based on the annual slaughter capacity of the abattoir considering market demand, the current average price of one liver in Assela Butcherhouse and the rejection rate of liver. The direct financial loss incurred due to liver condemnation was estimated by using the formula indicated below (Ogunrinade and Adesoke, 1982).

$$ALC = CSR \times LC \times P$$

Whereas

ALC = Annual loss from liver condemnation
CSR = Mean annual cattle slaughtered at Assela municipal abattoir
LC = Mean cost of one liver at Assela
P = Liver condemnation rate

e) Statistical Data Analysis

Data collected during the study were entered in to Excel spread sheet (Microsoft Excel 2007) and analyzed by statistical methods using SPSS 16.0 version. Descriptive statistics such as percentage was used to determine the level of liver condemnation rate. The association between condemnation rate of liver and the age, sex, body condition and origin of the animal assessed by Pearson chi-square (x^2) and the *p*- value < 0.05 were considered significant.

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III. Results

a) Ante-Mortem Examination

Of the total 384 cattle examined at ante-mortem, 9 cattle were found to have the abnormalities listed bellow (Table 1). Some abnormalities encountered during antemortem inspection were rought hair coat, lameness, branding on skin, blindness and amputated tail.

Table 1: Abnormalities encountered during ante mortem examination

Abnormalities	No. of animals with disease condition	Judgment
Lameness	2	Passed for slaughter but with precaution
Blindness	1	Passed for slaughter but with precaution
Rough hair coat	4	Passed for slaughter but with precaution
Branding on skin	1	Passed for slaughter but with precaution
Amputated tail	1	Passed for slaughter but with precaution
Total	9	Passed for slaughter

b) Post-Mortem Examination

Out of 384 cattle slaughtered in Assela municipal abattoir, 274 livers were totally condemned due to various reasons (Table 2). The current study revealed the overall proportion of liver condemnation rate due to various pathological findings was 71.4%. The occurrence of hydatidosis was the highest (64.6%); followed by fasciolosis (20.8%), calcification (7.7%), coinfection of hydatid cyst with fasciolosis (4.7%), cirrhosis (1.5%) and liver abscess (0.7%).

Table 2: Major causes of liver condemnation, Frequency and its proportion

Major cause of liver condemnation	Frequency	proportion
Hydatid cyst	177	64.6
Fasciolosis	57	20.8
Calcification	21	7.7
Coinfection of hydatid cyst with fasciola	13	4.7
Cirrhosis	4	1.5
Abscess	2	0.7
Total	274	100

Comparison of rejection rate of liver was carried out for different age, animal origin and sex groups. From the total of 384 sampled animals, 340 were from sagure while only 44 animals were from (Assela and near surrouinding). The proportion of liver condemnation was 71.8% and 68.2% from sagure and (Assela & near surrounding) respectively. However, no statistically significance difference was observed in the liver condemnation rate between the two areas.

Regarding sex, the overall liver condemnation rate was 71.8% in male and 54.5% in female and no statically significant difference was observed between the two sexes (Table 3). This study also showed that a highest liver condemnation rate in older age groups (> 5 years) than adults (< or = 5 years). The rejection rate was 73.3% in old and 52.8% in adult (Table 3). From the analysis, it was observed that as age increase, the rejection rate was also found to increase. This difference in the rejection rate between the age groups was significant (Table 3).

Table 3: Liver condemnation rate based on Age, Sex, Animal origin and body condition

Variables		No. exam	No. (+)	%	x^2	p-value
Origin	Sagure	340	244	71.8	0. 245	0.621
	A&S	44	30	68.2		
Sex	Male	373	268	71.8	1.565	0.211
	Female	11	6	54.5		
Age	old	348	255	73.3	6.707	0.010
	Young	36	19	52.8		
BCS	Good	250	184	73.6	1.768	0.184
	Medium	134	90	67.2		

A&S = Assela and near surrounding
No. exam = number of animals examined
No. (+) = number of positive animals
BCS = body condition score

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c) *Annual Financial Losses Estimation*

The annual slaughter rate of the abattoir for the last three years were 6800, 6900 and 6998 in 2010, 2011 and 2012, respectively. So the direct annual financial loss due to rejection of liver was calculated based on the price of a liver at Assela (Table 4). By using necessary information and formula, the annual direct financial loss incurred due to condemnation of liver was calculated to be 418,761 ETB or 22,040 US$ per annum.

Table 4: Average annual estimated financial loss due to liver condemnation

Annual slaughter rate	Cause of liver condemnation	Annual rejection rate of liver	Average price of one liver
6900	Hydatid cyst	3181	85 ETB
	Fasciola	1024	
	Calcification	377	
	Hydatid cyst with fasciola	234	
	Cirrhosis	72	
	Abscess	36	

IV. Discussion

In the present study, routine ante-mortem and post-mortem inspection was carried out to detect any abnormalities encountered in Assela municipal abattoir. Branding, lameness, rough hair, blindness and amputated tail were found in some animals during ante mortem examination and animals with such abnormalities were passed for slaughter by considering that the problems were localized and simply related to (rough or low management system) and not due to bad pathological condition.

From the total of 384 cattle slaughtered, 274 (71.4%) liver were condemned due to various causes. This finding is in agreement with one of previous study, where 66.55% liver was condemned in Kombolcha ELFORA industrial abattoir (Nurit *et al.,* 2012). But slightly higher than 53.7% that have been done in Kombolcha (Jemal, 2009) and 51.95% in Mekelle (Shegaw *et. al.,* 2009). On the other hand, it is significantly higher than 31.1% and 17.61% reported by (Yifat *et. al.,* 2011*)* in Gonder and (Mellau *et. al.,* 2011*)* in Tanzania respectivily.

In the present study, the major cause of liver condemnation were hydatidosis (64.6%) followed by fasciolosis (20.8%). In the present study, the rejection rate of liver due to hydatidosis is 64.6%, which is highly greater than the findings of (Nurit *et. al.,* 2012) with 14.2% and (Jemal, 2009) with 9.2% in both are at Kombolcha ELFORA industrial abattoir, 4.2% in Tanzania (Mellau *et. al.,* 2011) and (Yifat *et. al.,* 2011) with 3.7% in Gondar.

The rejection rate due to faciolosis is high when it is compared with the rejection rate of 12.7, 14.05 and 8.6% by (Fufa *et al.*, 2009)] at Welaita Sodo, (Swai and Ulicky, 2009)] at Hawi and (Mellau *et al*., 2011) at Tanzania, respectively. On the other hand it was slightly similar with 24.32% by (Gebretsadik *et al.,* 2009) at Mekelle, but significantly lower than 68.7% in Kombolcha (Jemal, 2009) and 86.4 % in Gondar (Yifat *et. al.,* 2011). This may be due to climate and ecological condition of the study areas considered.

The finding of 1.5% of liver condemnation due to cirrhosis was significantly lower than 16.06% reported by (Nurit *et al.,* 2012) at ELFORA and (Raji, *et al*., 2010) with 10.4% at Zaria abattoir. However, it is almost similar with 1.1% reported by (Yifat *et al*., 2011) at Gondar.

A 0.7% liver condemnation due to abscess was recorded in the present study. This is a little bit smaller than the report by (Cadmus and Adesokan, 2009) with 2.9% condemnation rate of liver due to hepatic abscess in western Nageria and (Ahmedullah *et al.,* 2007), who reported 3.8% liver condemnation rate in Bangladesh. On the other hand it was similar to the report of (Mellau and Nongaond, 2010) with 1.1% at Arusha abattoir.

Calcifications were also among the lesions which significantly contributed to the liver condemnation in the study abattoir. During this study, 7.7% of liver were condemned as a result of calcification, which is relatively higher than the finding of (Mellau and Nongaond, 2010) which is 1.9% at Arusha, Tanzania. On the other hand, it is similar with the finding of (Nurit *et. al.,* 2012) with 8.18% done at ELFORA.

The analysis of the result on the bases of age indicated the total liver rejection rate was higher in older animals and a significant difference was observed between the two age groups. This may be due to most of liver diseases are chronic and the older animals are mostly affected by many diseases.

The direct financial loss incurred as result of condemnation of liver in the present study was 418,761 ETB or 22040 US$ per annum. This is so much higher than 1800 US$ per annum due to fasciolosis liver condemnation reported by (Mwabonimana, 2008) at Arusha abattoir, Tanzania.

V. Conclusion

In general, liver condemnations as have been reported in this study impact negatively on the economic status of the traders and the livestock industry at large. This constituted a substantial loss to the economy of the

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slaughter stock owners under study as such an amount of money would have been harnessed into livelihood improvements. Though infected livers were condemned and rendered unfit for human consumption, there exist some public health threats from animals slaughtered at the abattoir due to the possibility of some missed cases as a result of poor cooperation between butchers and meat inspectors and other malpractices including hiding of infected meat from meat inspectors to avoid economic losses on their side. Indeed, the condemnation of cattle livers at slaughterhouse in Assela municipal abattoir represents a significant economic loss. Some of the conditions described however can be prevented. Cases of hydatidosis could be reduced by better control of stray dogs. Since most liver conditions were caused by parasites, deworming programmes coupled with good animal husbandry would likely be effective in lowering their incidence. Some of the limitations, however; encountered in this study included the use of only gross pathology in the diagnosis of the diseases, thus only those diseases with gross pathological lesions that are pathognomonic were likely to be diagnosed. In spite of the limitation mentioned, the public health implications of the quantity of infected livers condemned at Assela municipal abattoir on the consumers and the role which post-mortem inspection plays in safeguarding the health of the public cannot be overemphasized. Therefore, there is a need for adequate meat inspection in Assela municipal abattoir in order to reduce wastages, identify diseases and thereby minimize associated public health risks.

VI. Acknowledgments

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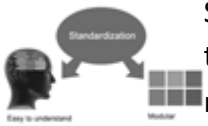


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Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5.STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

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Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

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- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

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Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

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28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

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30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

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34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

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Key points to remember:

- Submit all work in its final form.
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A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

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· Use present tense to report well accepted

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- Fundamental goal
- To the point depiction of the research
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- Significant conclusions or questions that track from the research(es)

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- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
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- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
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- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

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The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.



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Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

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- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

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References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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