Epidemiological Study on the Prevalence of Gastrointestinal Parasites of Small Ruminant and Associated Risk Factors in Asossa District of the Benishangul Gumuz Regional State, Western Ethiopia

[1]Abebaw Abei, [1]Bossena Fantahun and [2]Birhanu Eticha

[1] Assosa Regional Veterinary Diagnostic, Surveillance, Monitoring and Study Laboratory, P.O. Box: 326, Assosa, Ethiopia.
[2] Benishangul Gumuz Regional State Livestock and Fisheries Resource Development Agency, P.O. Box 30, Assosa, Ethiopia; e-mail: brihanueticha12@gmail.com

Abstract: This study was conducted from November 2016 to May 2017 in Assosa town to determine the prevalence and associated risk factors of gastrointestinal parasites that affect sheep and goats and to recommend the possible control measures. Post-mortem examination was made on 384 animals (220 sheep and 164 goats) slaughtered in different bars and restaurants and an overall prevalence of 74% and 60.3% of GIT parasites in sheep and goats were registered respectively. Six species of Nematode, two species of Trematode, one species of each Cestode and Eimeria were identified in both sheep and goats. Prevalaence of 63.7%, 16.7%, 13.7%, 3.8% and 1.9% was recorded for Nematode, Trematode, Eimeria, mixed and Cestode infection of the study animals respectively. The prevalence of each GIT parasites in the present finding was 28.6%, 16%, 13.7%, 9.5%, 7.2%, 6.1%, 6.1% 4.2%, 3.8%, 2.6% and 1.9% for Haemonchus, Trichostrongylus, Eimeria, Paramphistomum, Fasciola, Strongylus, Trichuris, Chabertia, mixed infection with Eimeria and Trychostrongylus, Ostertagia and Monezia respectively. Statistically significant association was observed ($p<0.05$) with regard to GIT parasites infection and age and species of study animals while significant association was not seen with regard to sex and GIT parasites infection ($p>0.05$). To finalize, the finding of the present study revealed high prevalence of GIT parasites infection of sheep and goats implying the importance of devising strategic and holistic approach to control and mitigate the parasitic adverse effect on livestock production and health status in the study district.
[Abebaw Abei, Bossena Fantahun and Birhanu Eticha. **Epidemiological Study on the Prevalence of Gastrointestinal Parasites of Small Ruminant and Associated Risk Factors in Asossa District of the Benishangul Gumuz Regional State, Western Ethiopia.** *Rep Opinion* 2017;9(9):22-29]. ISSN 1553-9873 (print); ISSN 2375-7205 (online). http://www.sciencepub.net/report. 5. doi:10.7537/marsroj090917.05.

Key words: GIT parasites, Sheep and Goats, Prevalence and Risk Factors.

1. Introduction

Ethiopia lies within the tropical latitude of Africa and has an extremely diverse topography, wide range of climatic features and multitude of agro-ecological zones, which make the county suitable for different agricultural production systems. This in turn has contributed to the existence of a large diversely of farm-animal genetic resources in the country. The current livestock population of Ethiopia is estimated as 53.99 million heads of cattle, 25.49 million sheep, 24.06 million goats, 1.91 million horses, 6.75 million donkeys, 0.35 million mules, 50.38 million of poultry, 0.92 million of camels and 5.21 million of bee hives (CSA, 2012/13). Sheep and goats are among the major economically important livestock in Ethiopia. Ethiopian livestock production system are broadly characterized as low input, mixed crop-livestock, agro-pastoral and pastoral system; as well as medium input, per-urban and urban enterprises. These livestock are almost entirely managed by the poor small-holder farmers and pastoralists (Sissay, 2007).

The livestock sector accounts for about 30% of the agricultural GDP in sub-Saharan Africa and nearly 60% of the value of edible livestock products is generated by cattle. Over 90% of Africans small ruminants are found in east and West Africa. Small ruminants are mainly found in arid and semi-arid area of sub-Saharan Africa. Compared to cattle and camels, sheep and goats are contributing a larger proportion of readily available meat in the diets of pastoralists (WHO, 1995).

Ethiopia posses the highest number of livestock resources in Africa. Despite the discrepancy in the numbers, it is widely expected that Ethiopia's resources of cattle, sheep and goats ranks first and second respectively in Africa. Sheep and goats are among the major economical important livestock which plays an important role in the livelihood of resources poor farmers and provide a vast range of products and services, such as meat, milk, skin, manures (Alemayehu, *et al*., 1995).

In the diverse agro-climatic zones of Ethiopia small ruminants are important sources of income for rural communities and are one of the nation's major sources of foreign currency from exports. However, the country is not using from her livestock as much

expected due to many production constraints circulating in animal population (Zeleke, 2009; Bonnet *et al*., 2011). Prevalent small ruminant disease, poor management, mal nutrition particularly pronounced during the long dry season and traditional management system practiced in these environments mainly affect productivity of small ruminants (Admosum, 1992; WHO, 1995).

Gastrointestinal parasites are recognized as a major constraint to livestock production throughout the tropics and elsewhere. They cause lowered productivity, mortality (Sykes, 1994, and high economic losses affecting the income of small holder farming communities (Pedreira *et al*., 2006). These was estimated at 48.4 million Ethiopian birr per year of which 46.5, 48.8 and 4.7% was due to mortality, lowered productivity (weight loss and reproductive problems) and organ condemnation due to ovine fasciolosis in the Ethiopian highlands, respectively (Ngategiize *et al*., 1993).

Even though, Ethiopia endowed with large number of sheep and goat population, little attempts has been made in the past to study the healthy aspect of these animals. Lack of well established data on the magnitude, distribution and predisposing factors of sheep and goat GIT parasites in the study area initiated this study. Therefore, the main objectives of this study were to: to identify the major GIT parasites of small ruminants in the study district; to investigate risk factors that might affect the presence of the diseases in small ruminants and to determine the prevalence of gastrointestinal parasite in sheep and goats slaughtered at different bars and restaurants and to recommend the possible strategic control measures against the diseases in the study area.

3. Materials And Methods

3.1 Study Area

The study was conducted from November 2016 to May 2017 to determine the prevalence of gastrointestinal parasites of small ruminants in and around Assosa town. Assosa town is the capital city of the Benishangul Gumuz region and was located at a distance of about 627 km away from Addis Ababa, lies at latitude of 8^{o} 30'-40^{o}.27' E and longitude of 34° 21'-39.1' W with elevation of 1144meter above sea level. The climatic condition of the area was "kola", with long rain fall (May to September), and winter dry season (November to April). The maximum and minimum annual rain fall and daily temperature ranges are between 1316mm and 16.5-27.9 □ respectively. This area is characterized by mixed farming system and small ruminants are the second most abundant livestock species of the district next to cattle according to Assosa Woreda Agricultural Office 2017 livestock enumeration data.

3.2 Study population

V A total of 37,205 small ruminants (14,726 sheep and 22, 479 goats) are present in Assosa district. The study was conducted on 384 small ruminants (220 sheep and 164 goats). Variables such as, species, sex and age groups were considered as risk factors during the study. Age categorization was made as young (<1 year) and Adult (> 1 year) according to Gaten by.

3.3 Sample size and Sampling Method

The type of sampling methods was simple random sampling to determine the prevalence and associated risk factors of the gastrointestinal parasites of small ruminants in the study area. The desired sample size was determined using the formula given by (Thrusfeild, 2007).

$n = 1.96^2 p_{exp} (1-p_{exp})/ d^2$

Where: n = require sample size

p_{exp} = expected prevalence

d = desire absolute precision

1.96^2 = z-value for the 95% confidence level

Accordingly, 384 small ruminants (220 sheep and 164 goats) slaughtered at different bars and restaurants found in Assosa town were included and faecal samples were also collected from the animals to detect some parasites that are not morphologically appreciated easily.

3.4 Study Design

A cross-sectional study was used to determine prevalence of gastrointestinal parasites of sheep and goats by post-mortem findings and coproscopic examination.

3.5 Study Methodology

Post-mortem examinations were conducted to isolate and identify the adult parasites by collecting gastro-intestinal contents from slaughtered sheep and goats in different bars and restaurants found in Assosa town and faecal samples were also collected to detect some parasites that are not morphologically appreciated easily.

3.5.1 Parasitological protocols

Gastrointestinal parasite from the abomasums, small and large intestine were isolated after slaughtering of animals. Abomasums, small and large intestine were legated at omasal-abomasal, abomasal-duodenal and ileo-caecal junction to prevent worm spilling from one location to another. The abomasums was cut and opened longitudinally; the content of abomasums was poured in 10 liter bucket. Abomasal wall was washed thoroughly under stream of water from a tap and mucous membrane rubbed with thumb finger to remove any adhering worms to it. The content of the bucket were sieved thorough tea strainer and washed with stream water. The tea strainer having food material and worms was inserted into another bucket and wash with stream of water. More water was added to make up total volumes of 4 liters which

was then agitated vigorously and sample was taken by wide mouthed pipette.

The sample was transferred to measuring cylinder until a total volume of 40ml was reached, small quantity of this 40ml were placed in Petri-dish and examined under stereo-microscope for worms count. The small, large intestines and abomasums were processed. Worm from abomasums, small and large intestines were collected and counted according to (Charles and Baker 1998).

The collected parasites were washed in physiological saline water (0.89gm/100ml distilled water), and were fixed in 70% ethanol for 24 hours. The worms were placed on microscopic slide and examined under10x magnification power of compound microscope and identified using standard key and morphological characteristic described by (Soulsby 1982; Hansen et *al*, 1994; Urquhart et *al*., 1996).

3.5.2 Carpological examination

From each gastrointestinal tract, fecal sample were taken directly from the abomasums, small and large intestine and the collected faecal samples were processed and examined by direct fecal smear (Annex 1) (Zajac and conboy, 2006), floatation (Annex 2) (Hansen and perry, 1994) and sedimentation techniques (Annex 3) (Hansen and perry, 1994), for qualitative investigation of gastro-intestinal helminthes eggs and oocyst following the standard procedures. Eggs of the different parasites were identified on the bases of their morphological appearance and size (Foreit, 1999). In this study the floatation solution used was Zinc sulphate prepared in the laboratory.

3.6 Data Analysis

Data entry and management was made using Microsoft Excel speed Sheets. Data analysis was made using STATA 7statistical tool.

Descriptive statistics was used to determine the prevalence of the gastrointestinal parasites and chi-square test (χ^2) was used to determine any association between the prevalence of GIT parasites with risk factors such as age, sex and species of animals. In all cases, confidence level was held at 95% and significance was considered when $p< 0.05$.

4. Results

From a total of 384 animals (220 sheep and 164 goats) examined, 262 (68.2%) animals were found to harbor one or more GIT parasites. The study comprised species, sex and age of study animals as risk factors that play a vital role for the existence of GIT parasites in the study area (Table 2).

4.1 **Prevalence of GIT Parasites**

Prevalence of GIT parasites infection according to the species of the study animals was found to be 163(74%) and 99(60.3%) for sheep and goats respectively. There was statistically significant association between prevalence of GIT parasites and species of study animals ($p<0.05$). This result shows that ovine species was more likely to be affected by GIT parasites when compared to that of caprine species. Sex- wise prevalence of GIT parasites infection was assessed and slightly higher prevalence was recorded in female (68.6%) than male (67.5%) animals, and it was not found statistically significant ($P>0.05$). The prevalence of the GIT parasites infection was higher (76.7%) in young than in adults (64.7%) animals and the association was found statistically significant ($P<0.05$) (Table 2).

Six genera of gastrointestinal nematode parasites were recovered during study period. Among these Haemonchus was the most prevalent 75(28.6%) followed by Trichostrongylus 42(16%), Strongylus (6.1%), Trichuris (6.1%), Chabertia 11(4.2%) and Ostertagia (1.8%).

The prevalence of some gastrointestinal parasites (Haemonchus, Eimeria, Trichostrongylus and Paramphistomum species) were higher in young animals than adults (Table 4). The prevalence of Haemonchus was higher in female animals than males whereas the prevalence of Eimeria species was higher in male animals (Table 4).

Table 2: Prevalence of GIT parasites and associated risk factors

Risk factors		**No of Examined**	**No of Positives**	**Prevalence (%)**	**Chi^2**	**p-value**
Species	Ovine Caprine **Total**	220 164 **384**	163 99 **262**	74 60.3	8.262	0.004
Sex	Male Female **Total**	148 236 **384**	100 162 **262**	67.5 68.6	0.0045	0.947
Age	young Adult **Total**	112 272 **384**	86 176 **262**	76.7 64.7	5.345	0.021
Total		**384**	**262**	**68.2**		

4.2 Prevalence of Gastrointestinal Parasites Identified

Of the total 384 sheep and goats examined during the study, 262 (68.2%) were found infected with different species of gastro-intestinal parasites. Out of a total parasites identified, 75(28.6%), 42(16%), 36(13.7%), 25(9.5%), 19(7.2%), 16(6.1%), 16(6.1%), 11(4.2%), 10(3.8%) 7(2.6%) and 5(1.9%) were found to be Haemncus, Trichostropngylus, Emaria, Paramphistomum and Fasciola, Strongyloides, Trichuris, mixed infection with Ostertagia and Monezia species according to their descending order of prevalence respectively (Table 3).

Table 3: Prevalence of different species GIT Parasites in Sheep and Goats

Species of Parasites	Species of animals	No of examined	No of positive (%)	chi2	p-value
Haemnchus	Ovine	220	63	43.4003	0.000
	Caprine	164	12		
Trichostrongylus	Ovine	220	24	21.9590	0.000
	Caprine	164	18		
Strongyles	Ovine	220	10	7.7743	0.005
	Caprine	164	6		
Trichuris	Ovine	220	6	7.7743	0.005
	Caprine	164	10		
Emeria	Ovine	220	26	18.4975	0.000
	Caprine	164	10		
Paramphistomum	Ovine	220	18	12.4519	0.000
	Caprine	164	7		
Monezia	Ovine	220	3	2.3590	0.125
	Caprine	164	2		
Ostertagia	Ovine	220	4	3.3201	0.068
	Caprine	164	3		
Chaberia	Ovine	220	7	5.2732	0.022
	Caprine	164	4		
Fasciola	Ovine	220	14	9.3079	0.002
	Caprine	164	5		
Mixed	Ovine	220	5	4.7810	0.019
	Caprine	164	5		
Total		**384**	**262(68.2%)**		

Table 4: Prevalence of GIT Parasite based on different species of Parasites and Animals Variable

Animal species		No of animal examined	No and prevalence of positive animals (%)	Haemonchus	Trichostrongylus	Strongyloides	Trichuris	Ostertagia	Chabertia	Fasciola	Emeria	Monezia	Paramphistomum	Mixed infection
species	ovine	220	164(74.5)	63(28.6)	24(10.9)	10(4.5)	6(2.7)	4(1.8)	7(3.1)	14(6.3)	26(11.8)	3(1.3)	18(8.1)	5(2.3)
	caprine	164	99(60.3)	12(7.3)	18(11)	6(3.6)	10(6)	3(1.8)	4(2.4)	5(3)	10(6)	2(1.2)	7(4.2)	5(3)
Age	Adult	272	176(64.7)	48(17.6)	14(5.1)	7(2.5)	8(2.9)	3(1.1)	5(1.8)	12(4.4)	20(7.3)	2(0.7)	13(4.8)	5(1.8)
	Young	112	86(76.7)	27(24.1)	28(25)	9(8)	8(7.1)	4(3.5)	6(5.3)	7(6.2)	16(14.2)	5(4.4)	12(10.7)	5(4.4)
Sex	Male	148	100(67.5)	20(13.5)	15(10.1)	5(3.4)	6(4)	2(1.3)	4(2.7)	8(5.4)	19(12.8)	3(2)	11(7.4)	5(3.3)
	Females	236	162(68.6)	55(23.3)	27(11.4)	11(4.6)	10(4.2)	5(2.1)	7(2.9)	11(4.6)	17(7.2)	2(0.8)	4(1.6)	5(2.1)

5. Discussion

The present finding revealed an overall prevalence of (68.2%) gastrointestinal parasites infection in the study district. The current finding was in agreement with the previous findings of (Tigist, 2008), (Temesgen, 2008) and (Regassa et al., 2006) who reported an overall prevalence of 66.6%, 70.2% and 70.2%, respectively in different parts of Ethiopia. In contrast, the result of the present study was slightly lower than the findings of (Bikila *et al*., 2013), (Melkamu,1991) in and around Kombolcha, (Bayou, 1992) in Gonder, (Yoseph,1993) in Mendayo district of Bale, (Genene, 1994) from four Awrajas of Eatern Showa, (Getachew, 1998) from Buno province, (Tefera *et al*., 2011) in and around Bedele who reported 84.3%, 91.4%, 90.9%, 92.2, 93.2%, 90.2%, 93.29%, respectively. In addition the present finding was much lower than the findings of (Abebe and Esayas, 2001) who reported an overall prevalence of 97.03% in different parts of the country. The difference in prevalence of the present and previous findings might be attributed to the difference in agro-ecology, variation in the climatic conditions of the localities and partly due to difference in the management practice of animals.

Post mortem examination was made and the result revealed that sheep and goats were infected by different species of gastrointestinal parasites like Haemonchus, Trichostrongylus, Chabertia, Ostertagia, Trichuris and strongyloides (nematodes) Monezia (Cestodes), Fasciola and Paramphistomum (Trematodes) and Emeria (protozoa). During this study, more than one species of the gastrointestinal parasites were identified from a single host animal. This finding was in harmonious with the previous studies conducted in different parts of Ethiopia by (Fikru *et al*., 2006), (Hailelul, 2002) and (Tefera *et al*., 2011).

In the present study, an attempt has also been made to compare prevalence of GIT parasites infection between sex groups. Slightly higher prevalence of infection was observed in female animals (68.6%) when compared to males animals (67.5%). This finding was inconsistent with report made by (Regassa *et al*., 2006), (Assefa and Sissay, 1998), (Fikru *et al*., 2006), (Getachew, 1998) and (Ghanem *et al*., 2009) which showed that sex of the animals did not show significant association with the prevalence of GIT parasites infection. The author's stated that this might be due to equal exposure of both sexes. Meanwhile, this finding disagrees with the findings of (Dagnachew *et al*., 2011), (Yosef, 2009), (Bashir *et al*., 2012), (Mirreteab and Aman, 2011) and (Desta, 2013) who reported higher prevalence of GIT parasites in females than in males animals. This might be due to the fact that female animals are exposed to different physiological stresses than male animals.

The study was also under taken to observe the prevalence of GIT parasites in age groups and the finding revealed that young animals were highly infected 89 (79.4%) when compare to that of adult animals 163 (59.9%). This finding was in agreement with the finding of (Fikru *et al*., 2006), (Gamble and Zajak, 1992), (Watson et al., 1994), (Coldtitz *et al.,* 2009) that young animals are more susceptible to parasites infection than adult ones. Moreover, other researcher also justified the result that it could be because adult animals might acquire immunity to the parasite through frequent challenge and expel the ingested parasites before they establish infection. Young animals are susceptible due to immunological immaturity and immunological unresponsiveness.

An effort has been made to identify different species of GIT parasites in sheep and goats at postmortem examination and the result revealed the different species of parasites with their prevalence like Haemonchus (28.6%), Trichostrongylus (16%), Emeria (13.7%), paramphistomum (9.5%), Fasciola (7.2%), Strongylus and Trichuris (6.1%), Chabertia (4.2%), mixed infection (3.8%), Ostertagia (2.6%) and Monezia (1.9%) species. As the result indicated, comparatively higher prevalence was found in Haemonmchus followed by Trichostrongylus and Emeria. The lowest prevalent parasite identified in this study area was Monezia (1.9%) species.

The 6.1% prevalence of strongyloides species in the present study was in consistence with the findings (Tigist, 2008) in and around Debre Zeit and (Tefera *et al*., 2011) in and around Bedelle who reported the prevalence of strongyloides species to be 8.2% and 13.04% respectively. This finding was lower when compared with 45.22% from Eastern part of Ethiopia by (Abebe and Esayas, 2001). Similarly, the prevalence of Trichurus species was 6.1% and this finding was in agreement with the findings of (Bersissa *et al*., 2011), (Tigist, 2008), (Temesgen, 2008) and (Regassa *et al*., 2006) who reported prevalence of strongyloides to be 7.9%, 5%, 3.3%, and 4.5%, respectively. The present finding however, was lower when compared to 30.25% from Eastern part of Ethiopia (Abebe and Esayas, 2001). This variation in prevalence might be attributed to the difference in agro ecology and climatic condition and partly due to the difference in the management practice of the study areas.

The prevalence of coccidian parasites in the present study was 13.7% which is in line with the findings of (Nuraddis *et al*., 2014) in and around Jimma town who reported 11.7% prevalence. However, the present finding was lower than the

finding of (Kanyari *et al*., 2009) who reported 35% prevalence of coccidian infection in Kenya. This variation in prevalence of coccidian infection might be due to the difference in the agro-ecological and climatic conditions of the two countries and it may be difference in management practice.

Among the Cestoda, Monezia was the only observed species in the present study with prevalence of 1.9%. This finding was lower when compared to 61% prevalence reported by (Sissay *et al*., 2008) in the eastern part of Ethiopia. The difference in the prevalence might be due to the fact that the area was previously occupied by pastoralits and animals were very congested, which increase the transmission of the parasites.

The present finding of Fasciola and paramphistomum species was 7.2% and 9.5%, respectively and this finding was lower than the findings of (Nuraddis *et al*., 2014) and (Kanyari *et al*., 2009) whose findings were 22.4% and 19.6% for Paramphistomum; and 37%, 30% for Fasciola species. The result of the above finding might be correlated with the availability of environmental condition suitable for successive perpetuation of intermediate hosts for the parasites life cycle.

Among the different gastrointestinal parasites identified from the faeces of sheep and goats, the prevalence of Nematode species accounted for 43.5% followed by Eimeria species (13.7%), paramphystomum (9.5%), Fasciola (7.2%) and Monezia species (1.9%). This finding is in accordance with the findings of (Fikru*, et al*., 2006), (Bikila *et al*., 2012) and (Abebe and Esayas, 1999) who reported Nematode species to be dominant in western Oromia, Gechi district of south West Ethiopia, Eastern part of Ethiopia respectively.

6. Conclution And Recommendation

The overall high prevalence of gastrointestinal parasites obtained in sheep and goats of Assosa town and its surrounding areas indicated the importance of the problem and its contribution to hampering the product, productivity, and general health status of these animals. The predominant GIT parasites identified in the study district were Nematodes, Trematodes and Cestodes. Species, age and sex of animals were considered as potential risk factors for the presence of the GIT parasites in the study animals. The prevalence of parasitosis was 74% and 60.3% in sheep and goats respectively. This finding suggests that Assosa town and its surroundings are favorable for the successive perpetuation of the mentioned parasites and for their subsequent transmission to susceptible host. Moreover, majority of sheep and goats in the study district were largely kept under traditional extensive management system that might increase the chance of exposure to GIT parasites.

Therefore, based on the above conclusion, the following recommendations are forwarded:

- ❖ A strategic antehelmintic treatment should be adopted and extended to farmers taking in to account the specific situation of each agro-ecology;
- ❖ Farmers have to be educated about the impact of gastrointestinal parasites infection on the health and productivity of small ruminants as to implement participatory approach in the control of the diseases;
- ❖ The role of veterinarian in giving professional advice regarding preventive and control measures against gastrointestinal parasites should be enhanced
- ❖ Use of alternate grazing system for different host species and integrated rational grazing practices adjustment of stocking rate and separation of animals according their age group should be practiced.
- ❖ Further epidemiological studies should be conducted in different agro-ecological sites in the country.

Reference

1. Abebe, w. and Esayas, G. (2001): survey of ovine and caprine gastrointestinal helminthosis in eastern part of Ethiopia during the dry season of the year. Revue. Med. Vet. 152(5): 379-385.
2. Abebe, W. and Esayas, G. (1999): Survey of ovine and caprine gastro-intestinal helminthosis in eastern part of Ethiopia during the dry season of \ the year. Department of pathology and parasitology, Faculty of Veterinary Medicine, \ Addis Ababa University, Debre-Zeit, Ethiopia. Ademosum, A. (1992): Constraints and prospects forsm all ruminant's research and development in Africa. Sma. Rum. Dev, Afri. 1:1-5.
3. Admosum, A. (1992): constraints and prospects for small ruminant's research and development in Africa. Sma. Rum. Dev. Afri.1: 1-5.
4. Alemayehu, Z. and Fletcher, I. (1995): Small ruminant productivity in the central Ethiopia mixed farming system. Insti. Of agri. Proced., 4:1941-1947.
5. Assosa Woreda office of Agricultural and Rural Development (AWOARD). (2017): Animal population information desks, Assosa, Ethiopia.
6. Bayou, A. (1992): Prevalence of gastrointestinal helminth of small ruminants in buno province, Illubabor Administrative region. DVM thesis. Faculity of veterinary medicine, Addis Ababa University, Debre-zeit. Ethiopia. Pp: 131.
7. Bersisa, K., Tigidt, T., Teshale, S. Reta, D. and Bedru, H. (2011): Helminthes of sheep and goats in central oromia (Ethiopia) during the dry

season. Jour. Of Anim, and Vter. Advan., 10:1845-1849.
8. Bikila, E., Yeshitla, A., Worku, T., F. and Benti, D. (2013): Epidemiology of gastrointestinal parasites of small ruminants in Gechi district, South west Ethiopia. Dvm thesis. Jimma University College of Agricalture and
9. Veternary Medicine and Jigjiga University College of veterinary medicine, Ethiopia. Advan. Biol. Res., 7(5):169-174.
10. Bonnet P, Lancelot R, Seegers H and Martinez D (2011): world organization for animal health. Seventy ninth General sessions world Assembly, Paris 22-27 may 2011.
11. Byou, A. (1992): Prevalence of gastrointestinal helminthes of small ruminants in buna province, Illubabor Administrative Region. DVM thesis. Faculty of veterinary medicine, Addis Ababa University, Debre- zeit. Ethiopia. Pp: 131
12. Charles, M. And Robinson, E. (2006): Diagnostic parasitology for veterinary technicians. 3rd ed. Elsevier, Philadelphia, USA. Pp: 43-45.
13. CSA. 2012/13. Agricultural sample survey. Report on livestock and livestock characteristics. The Federal Democratic republic of Ethiopia, Central Stastical Agency (CSA). Private peasant holdings. Stastical Bulletin 570, Addis Ababa, Ethiopia, April, 2013.
14. Dagnachew, S., Amamute, A. and Temesgen, W. (2011): Epidemiology of gastrointestinal helminthiasis of small ruminants in selected sites of North Gonder zone, North West Ethiopia. Ethiopia. vet. J., 15 (2): 68.
15. Fikru, R., Teshale, S., Reta, D. and Yosef, K. (2006): Epidemiology of gastrointestinal parasites of ruminants in western Oromia, Ethiopia. *Inter. Jour. Appl. Res. Vet. Med*., 1:451-57.
16. Foriet, W. (1999): Reference Manual of Veterinaryn Parasitolgy.5th ed. Wiley Blakwell, New York, USA. Pp.22-26.
17. Gambel, H. R. and Zajak, A. M. (1992): Resistance of St. Croix lambs to Haemonchus contortus in experimentally and naturally acquired infections. *Veter. paras.*, 41:211-225.
18. Getachew, G. (1998): prevalence of ovine and caprin GIT helminthes in Mekele and its sorroundings. DVM Thesis, faculty of veterinary medicine, Addis Ababa University, Debrezeit. Ethiopia. Pp: 260.
19. Ghanem, Y. M., Nser, M. H., Abdelkader, A. H. and Heybe, A. (2009): An epidemio-coperiological study of protozoan and nematode par asites of ruminants in tropical semi-arid district of somalian D (Northern of Somalia). Vet. Med. J. 3rd Sci. Congress, 1:768-787.
20. GIT helminthes of small ruminants in and around Wolayta Sodo, southern Ethiopia. DVM thesis, Faculty of veterinary medicine, Addis Ababa Univesity, Debre zeit. Ethiopia. Pp: 353.
21. Kanyary, P. W. N., Kagira, J. M. and Mhoma, R. J. (2009): Prevalence and intensity of endoparasites in small ruminants kept by farmers in kisumu Municipality. Department of veterinary pathology, Microbiology and parasitology, Faculty of Veterinary Medicine University of Nairoby, Kenya.
22. Melkamu, T. (1991): Prevalence of gastrointestinal helminthes of small ruminants in four Awrajas of Eastern Shoa Administrative Regions. DVM Thesis. Faculty of Veternary Medicine, Addis Ababa University, Debre-Zeit. Ethiopia. Pp:116.
23. Mihreteab, B. and Aman, A. (2011): Ovine lungworms in Tiyo District, South-East Ethiopia: Prevalence, effect of altitude and major host related risk Factors. *Glob. veteri*. 7(3): 219- 225.
24. Nigategize, P., Bekele, T. and Tilahun, G. (1993): Financial losses caused by ovine fasciolosis in the ethiopian highlands. Trop. Anim. Health. And Pro.,25:155-161.
25. Nuradis, I., Mulugeta, T., Mihreteab, B. and Sissay, A. (2014): Prevalence of GIT parasites of small ruminants in and around Jimma, Town, Western Ethiopia, Jimma University, School of Veterinary Medicine,:- Jimma, Ethiopia. *Actaras. Glob*.5(1):26-32.
26. Regassa, F., Sori, T., Dhuguma, R. and Kirros, Y. (2006): Epidemiology of gastrointestinal parasites of Ruminant in western Oromia, Ethiopia. Inte. Appl. Res. Vet. Med., 4(1): 7-11.
27. Regassa, F., Sori, T., Dhuguma, R. and Kirros, Y. (2006): Epidemiology of gastrointestional parasites of ruminant in western Oromia, Ethiopia. *Int. Appl. Res. vet. Med*., 4(1): 7-11. 28. Regassa, F., Teshale, S., Reta, D. and Yosef, K. (2006): Epidemiology of gastrointestinal parasites of ruminants in western oromia, Ethiopia. Inte. J. Appl. Res. Vet. Med., 4): 51-57
28. Sissay, M. (2007): Helminthes parasites of sheep and goats in eastern Ethiopia. Epidemiology, and anthelminthic resistance and its management. Doctoral thesis, Swidish Unoversity of agricultural science, Uppsala, Sweden.
29. Sissay, M., Uggla, A. and Waller. P. J. (2008): prevalence and seasonal incidence of larval and adult cestode infections of sheep and goats in eastern Ethiopia. Trop. Ani. Hea. Produ. 40: 387-394.
30. Tefera, M., Batu, G. and Bitew, M. (2011): Prevalence of gastrointestinal parasites of sheep

and goats in and around Bedelle, South-Western Ethiopia. *Int. J. Vet. Med.*,8:60-65.
31. Tefera. M., Batu, G. and Bitew, M. (2011): prevalence of gastrointestinal parsites of sheep and goats in and around Bedelle, South-Western Ethiopia. Inte. J. Vet. Med.,8:60-65
32. Thrusfield, M. (2005): veterinary Epidemiology 3rd edition. UK, Blackwell publishing. Pp: 183.
33. Tigist, T. (2008): Gastrointestinal parasitosis of small ruminants in and around Debrezeit. DVM thesis, HU, FVM, Haramaya, Ethiopia.
34. Urquhart, G., Armour, J., Duncan, J., Dunn, A. and Jennings, F. (1996): Veternary parasitology 2nd ed. Blackwell science, United Kingdom. Pp: 307.
35. Urquhart, G., Armour, J., Dunn, A. and Jennings, F. (1996): Veterinary parasitology 2nd. Blackwell science, United Kingdom. Pp:307.
36. Yosef, A. (1993): prevalence of ovine gastrointestinal helminthes in and around Assela. DVM thesis. Faculty of Veterinary Medicine, Addis Ababa University, Debre zeit. Ethiopia. Pp: 170.
37. Zajac A. M. (2006): Gastrointestinal nematode of small ruminants: life cycle, anthelminthics, and diagnosis. Nrth Am Vet Cln, Food Animal Practice, 22:529-541.
38. Zajac. A. M. and Conboy G. A (2006): Veternary Clinical parasitology 7th ed, Black well, USA Pp:18-27.
39. Zeleke T (2009): Common defects of sheep and goat skin in Ethiopia and cauises, Ethiopia sheep and goat productivity Technical Bulletin No. 19:1-15.

9/25/2017