International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG(USA) Volume 4, Issue 6 - 2017

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2017.04.06.019

Study on prevalence of hemoparasitein small ruminants in and around Sebata town, Oromia regional state, Ethiopia

Dabi Mekuria[1] and Wale Tesfaye[1]
[1]School of Veterianry Medicine, Wolaita Sodo University, Wolaita Sodo, Ethiopia
*Corresponding author: *twalelgn@yahoo.com*

Abstract

A cross sectional study was conducted from November, 2016 to April, 2017 to assess the prevalence of hemoparasite in small ruminants in and around Sebeta Town, Oromia Regional State, Ethiopia. A total of 200 thin blood smears were done after blood sample collected from marginal ear vein of small ruminants (goats and sheep) from Sebata Awas districts. In this study the overall prevalence of hemoparasite was identified by examining thin blood smears under microscope at 100 x magnifications (oil immersion). Accordingly, the overall prevalence of hemoparasite in small ruminants was found to be 24.5%, 18.5% *theleria* and 6% *anaplama.* Some risk factors such as age and body condition score was showed statistical significant associations at (p=0.003 and 0.001 respectively) with infection of hemoparasite. The results showed that out of the 200 small ruminants examined, 49(24.5%) of the animals were infected with blood parasites. Of these infected animals, 6(3%) were goats, while 43(21.5%) were sheep. Sex wise prevalence showed that a slight higher prevalence was recorded in female (26.31%) than male (23.38%) but there was no statistical significant association (P=0.640%). Age wise prevalence showed that the highest prevalence was among young animals (40.38%) followed by adult (20.76%) and old (5.55%). Body condition of the animals showed highest prevalence recorded in animals with medium body condition (37.5%) followed by poor (37.14%) and good body condition (13.76%). Two species of hemoparasite were identified, from which *theleria* species recorded the highest prevalence rate of 18.5% in both sheep and goats than anaplsma (6%).

Keywords: *Anaplasma; Hemoparasites; Sebata; Small ruminants; Theleria*

Introduction

Ethiopia is estimated to have the largest livestock population in Africa and is ranked 10th in the world in number of domestic livestock (Waret-Szkuta *et al*., 2008). Livestock production plays a major role in the development of Ethiopia's agriculture and it is the main stay of the vast majority of Ethiopian people. Among this livestock population, small ruminant constitute a major part (Kassaye and Kebede, 2010). Ethiopian livestock population is estimated to be 53.9 million cattle, 25.50 million sheep, 24.06 million goats, 6.21 million donkey, 2.08 million horse, 1.10 million camels, 0.39 million mules and 50.38 million poultry (Central Statistics Authority (CSA, 2013). Despite this large population, Ethiopia's ruminant productivity is lower than the African average (Anon, 2009).

Small ruminants are important source of income for agricultural community and are one of Ethiopia's major sources of foreign currency through exportation of live animals, meat and skin. They are also a "living saving bank" and serve as financial reserve for a period of economic distress and crop failure as well as a primary source of cash income (Sheferaw *et al*., 2010).

Small ruminants are important contributors to food production in Ethiopia, providing 35% of meat consumption and 14% of milk consumption (Asfaw, 1997). Owing to their high fertility, short generation interval and adaptation even in harsh environments, sheep and goats are considered as investments and insurance to provide income to purchase food during seasons of crop failure and to meet seasonal purchases such as improved seed, fertilizer and medicine for rural households. However, due to several factors, the contribution from sheep and goats resource to either the national or the study area population income is significantly small (Walker *et al*, 2003). This may be due to improper management, diseases, nutritional deficiencies, harsh environment and genetic factors. Diseases of various etiological origins are among the numerous factors responsible for poor production and productivity (Abera *et al*., 2010; Bekele *et al*., 2011). Parasitic diseases are a global problem and considered as a major obstacle in the health and product performance of livestock (Abera *et al*., 2010).

The presence of diseases caused by hemoparasites is broadly related to the presence and distribution of their vectors. These diseases cause negative effects on the health of the livestock including production and productivity. Arthropod transmitted hemoparasitic diseases are economically important vector-borne diseases of tropical and subtropical parts of the world including Ethiopia. Small ruminants in Sub-Saharan Africa may be infected with a wide variety of vector-borne prokaryotic and eukaryotic hemoparasites. The hemoparasites that inhibits the blood of small ruminants include *Anaplasma*, *Babesia*, *Ehrlichia*, *Eperythrozoon*, *Theileria* and *Trypanosomes* (Urquhart *et al*., 2001). Of these, the most economically important genera are the rickettsiae, *Anaplsma* and *Ehrlichia (Cowdria)* and the protozoans' parasites *Theileria*, *Babesia* and *Trypanosomes* (Bell-Sakyi *et al*., 2004).

These parasites cause negative effects on the health of the livestock including production and productivity. These parasites are common blood feeders that cause anemia and reduced productivity and can lead to death in heavily infected animals (Githigia *et al*., 2001). Some haemoparasite species are only evident when the host is undergoing a clinical response to infection, while other members of the same genera may be seen in blood smears from apparently healthy animals. Infection with many of these hemoparasites species results in a state of pre immunity, in which the host becomes a long term often asymptomatic carrier serving as a source of infection for the tick or insect vector (Young *et al*., 1988). Although important studies have been carried out with respect to hemoparasite in small ruminants (sheep and goats), particularly in relation to their epidemiology, however, most of the studies are in cattle hence the need for such studies in small ruminants. Therefore, the objectives of this study were to determine the prevalence of hemoparasites infections in small ruminants and to assess the risk factors of hemoparasites infections in small ruminants

Materials and Methods

Study Area

The study was conducted from November, 2016 to April 2017 in and around Sebeta town. The study was conducted in Sebata town of Finfinne surronding Special Zone, Oromia National Regional State, Ethiopia. It is situated at 25km south west of Addis Ababa along Jimma road. Sebata town is located within approximate geographical coordinates of located at 8°55' N latitude and 38°37' E longitudes, at an altitude of 2356 meter (7730 feet) above sea level. With regard to relative location, it shares common boundaries with Addis Ababa in North, North east and east, Burayu town in the north, and rural villages of Sebata A was district to the south and west (CSA, 2013).

Study Population

The study subjects were indigenous sheep and goats of different ages and sexes which are reared under extensive or intensive management system in and around Sebeta town, were used for the study considering their age, sex and body conditions

Study Design

A cross-sectional study was carried out from November, 2016 to April, 2017 to estimate the prevalence of hemoparasites in small ruminants and its risk factors of hemoparasite infection in small ruminants in and around Sebeta Town, Finfinne Surronding Special Zone, Oromia National Regional State, Ethiopia. It was carried out by collecting blood samples from marginal ear vein from randomly selected sheep and goats.

Sample Size and Sampling Methods

The sample size for this study was determined by using Thrusfield formula (2005) with 95% confidence interval and 5% absolute precision.

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

Where: n= required sample size; P_{exp}=Expected prevalence; d=Desired absolute precision.

As previous studies shows, in this area the prevalence of hemoprasite in small ruminants was 4.35% (Setotaw *et al*., 2014). Depending on this prevalence, the sample size of this study were 63. But to increase the precise of the study, the sample of this study were 200. Systematic random sampling technique was employed to determine the prevalence of hemoparasite in small ruminants. A random sampling method was used to select the representative sample of the subject in this study. Accordingly, parameters like species, age, sex and body conditions were recorded to calculate the sample size.

Age, sex and body condition score determination

During sampling periods, sexes, ages and body condition score of each animal were recorded accordingly. Sex differentiation was made based on the appearance of external genitalia that is presence or absence of tests and udder. While, ages of the sampled sheep were considered in three age categories, young (0-1 year) and adult (2-3 year) and old (greater than 3 year) using owner's information and was supported by dentition as described by Hassan and Nwannenna, 2009).

Body condition scores were determined according to procedures documented by Thompson and Meyer, 1994), sampled animals as poor, medium, and good classes. A poor body condition score was given for sheep and goats which were extremely thin, having prominent spinous and transverse processes into which a finger could be easily pushed, and had less depth of loin muscle. A good body condition score was given for sheep when the spinous and transverse processes were smoothing, rounded, and well covered and with full loin muscle (Otoikhian *et al*., 2008; CFSPH, 2011; Shirzeyli *et al*., 2013).

Sample Collection Method

Blood sample collection was done after proper restraining of the animal according to Urquhart *et al* (1996). For the blood collection, marginal ear vein was prepared for disinfection with the help of methyl alcohol (5%) and the hair around the intended area was shaved and blood samples were collected directly by puncturing of marginal ear vein of each small ruminant with a blood lancet.

Blood Smear Preparation, Staining Procedure and Microscopic Examination

After marginal ear vein was punctured and blood oozed, it was taken directly by microscopic slide and thin blood smear was made on the other clean microscopic slide and fixed by methanol after dried in the air for 3-5 minutes and transported to the National Animal Health Diagnostic and Investigation Center (NAHDIC) parasitological laboratory as soon as possible. All samples will be clearly labeled with the species, sex, age and body condition score of sheep and goats. After transported to NAHDIC parasitological laboratory, the fixed blood smears were stained with working solution of Giemsa for 30-45 minutes and washed with tap water to remove extra stain and was air dried and then the smears were examined for presence of parasites under microscope at x100 magnification (oil immersion) (Cheesbrough, 1999).

Data Analysis

The entire collected row data were entered into Microsoft Excel spread sheet and coded. Statistical analyses were performed using SPSS version 20 computer software. Percentage was used to calculate prevalence. Additionally chi-square was used to calculate degree of association between risk factors and prevalence of hemoparasites and species of parasite identification is mall ruminants. In the analysis, a difference was taken as significant at a p-value less than 0.05 and the confidence level was held at 95%.

Results

Out of 200 blood samples (thin smear) collected and examined 175 (87.5%) from ovine and 25 (12.5%) from caprine, 49 (24.5%) of them were infected by hemoparasites. From infected animals 37 (18.5%) were infected by *theleria* species and 12 (6%) were infected by *anaplsma* species (Table 1).

Table 1: Overall prevalence of haemoparasites in small ruminants

Hemoparasites identified	Number of infected animals (N=200)	Prevalence (%)
Theleria species	37	18.5%
Anaplasma species	12	6%
Total	49	24.5%

The hemoparasitic infection rate was higher in ovine 43 (24.57%) compared to infection rates in caprine 6 (24%). More ever, hemoparasite infection were found to be higher in male 29 (23.38%) compared to infection in female 20 (26.31%) of examined small ruminants. This study classified the body conditions scores into poor, medium and good body conditions and examine, hemoparasite infections were higher in medium 21(37.5%) when compared to small ruminants of poor 13 (37.14%) and good 15 (13.76%) body conditions. Considering the age of examined small ruminants, infection by hemoparasites were higher in young 21 (40.38%) when compared to adult 27(20.76%) and old 1 (5.55%) (Table 2).

Table 2: The prevalence of haemoparasites in small ruminants according to the examined animal species, age groups, sexes and body condition scoring.

Risk factors Parameters		No. of examined	No. of infected	Prevalence (%)	X^2 (*p*-value)
Species	Ovine	175	43	24.57%	0.004 (0.95)
	Caprine	25	6	24%	
Sex	Male	124	29	23.38%	0.218 (0.640)
	Female	76	20	26.31%	
Age	Young	52	21	40.38%	
	Adult	130	27	20.76%	11.564(0.003)
	Old	18	1	5.55%	
Body conditions score	Poor	35	13	37.14%	14.936 (0.001)
	Medium	56	21	37.5%	
	Good	109	15	13.76%	

Out of 175 examined ovine, 43 of them were infected by hemoparasites 35 (20%) *theleria* and 8 (4.57%) *anaplasma* and 25 caprine examined, 6 of them were infected with hemoparasites, 2 (8%) *theleria* and 4 (16%) *anaplsma*. From 124 male small ruminants examined 29 of them were positive 25 (20.16%) *theleria* and 4 (3.22%) *anaplasma* and from 76 female small ruminants examined, 20 of them were infected by hemoparasites 12 (15.78%) *theleria* and 8 (10.52%) *anaplasma.* In this study prevalence of hemoparasite infection in young sheep and goats was 40.38% which was higher than that of adult sheep and goats (20.76%). Out of 35 small ruminants with poor body condition examined, 13 of them were infected by hemoparasites, 8 (22.85%) *theleria* and 5 (14.28%) *anaplsma* and from 56 small ruminants with medium body condition examined, 21 of them were infected by hemoparasite, 15 (26.78%) *theleria* and 6 (10.71%) *anaplasma* and from 109 small ruminants with good body condition examined for hemoparasites, 15 of them were infected by hemoprasites, 14 (12.8%) *theleria* and 1 (0.917%) *anaplasma* (Table 3).

Table 3: Overall prevalence of identified haemoparasites in small ruminants according to the examined animal species, age groups, sexes and body condition scoring

Risk factors Parameters		No of animal examined	Species of parasite identified		
			Theleria	*Anaplasma*	X^2 (*p*-value)
Species	Ovine	175	35(20%)	8 (4.57%)	6.466 (.039)
	Caprine	25	2(8%)	4(16%)	
Sex	Male	124	25(20.16%)	4(3.22%)	4.726 (.094)
	Female	76	12(15.78%)	8(10.52%)	
Age	Young	52	16(30.76%)	5(9.61%)	11.672 (.020)
	Adult	130	20(15.38%)	7(5.38%)	
	old	18	1(5.55%)	0	
Body condition score	poor	35	8 (22.85%)	5 (14.28%)	18.753 (.001)
	medium	56	15 (26.78%)	6(10.71%))	
	Good	109	14 (12.8%)	1(0.917%)	

Discussion

In this study, the overall prevalence rate of hemoparasites in small ruminants was found to be 24.3%. These results were disagree with 34% in the Bauchi central abattoir located along Gombe Adamawa road in Northern Nigeria (Adamu *et al*., 2011), 40% (Olorunfemi *et al*., 2015), 34% in Central Anatolia (Turkey) (Abdullah *et al*., 2010), 43.39% (Anyanwu *et al*., 2016) in Karu Local Government Area of Nasarawa State, Nigeria, 3.03% reported by Ademola and Onyiche (2013), 57.6% reported by Ukwueze and Kalu (2015).

In the present study the prevalence of hemoparasite in small ruminants was higher in sheep (24.57%) than goats (24%). There was no statistical Significant difference (*p*= 0.95%) among examined species of small ruminants. This result disagree with the earlier report by of Anyanwu *et al. (*2016) in Karu Local Government Area of Nasarawa State, Nigeria) 18.46% in sheep and18.4% Balami Sheep from Maiduguri, Northeastern Nigeria (Amina *et al*., 2017) and agree with 24.85% in goats. This might be due to as it is naturally believed that goats are better equipped physiologically, to fight and ward off infections and vectors and sampling size.

The present study revealed that, the prevalence of hemoparasitic infection was lower in male (23.38%) than in female (26.31%) small ruminants, even if there was no statistical Significant difference (*p*= 0.640%) among sex of examined animals. This result agree to previous findings (Abenga *et al*., 2008; Ademola and Onyiche, 2013; Ukwueze and Kalu, 2015) who noted a higher prevalence in female small ruminants than males. Females are generally believed to be more prone to haemoparasitaemia due to their extended breeding for economic reasons (calving and milk production) as well as the stress of breeding, milking and cyclical hormonal changes associated with gestation, parturition and calving processes (Ademola and Onyiche, 2013; Ukwueze and Kalu, 2015).

In present study the prevalence hemoparasite in small ruminants was higher in young (40.38%) than adult animals (20.76%), which was disagree with the earlier report of Amina *et al*. (2017) in Balami Sheep from Maiduguri, Northeastern Nigeria, in adult (14%) and disagree in young (4.4%) with earlier report by Sitotaw *et al*. (2014). There was statistical Significant difference (*p*= 0.003%) among age of examined small ruminants. The reason for the differences in the reported Prevalence rates might be due to difference in climatic or geographical variation of study area, period of sample collections, sample size and breed variation of small ruminants.

In this study the prevalence of hemoparasite infection was higher in animal with medium body condition score (37.5%) than animal with poor (37.14%) and good (13.76%) body condition score with statistical Significant difference (*p*= 0.001%) among examined small ruminants according to their body conditions score. This result disagrees with the earlier report of Amina *et al*. (2017) 16.4% and 2% in animal with poor and good body condition respectively. This might due to sampling method and sample size.

In present study the prevalence of *theleria* infection was higher (18.5%) in examined animals than *anaplasma* species (6%). This result disagree with report of Olorunfemi *et al*. (2015), in Gwagwalada Metropolis, Abuja, North Central Nigeria which found the prevalence of *anaplasma* was higher than that of *theleiria.*

In this study the infection of small ruminants by *theleria* species was higher in sheep (20%) than goats (4.57%), with statistical Significant difference (*p*= 0.039%) among species of examined small ruminants in relation to identified blood parasites. This result was different from a study carried out in Turkey where 34.6% of the sheep and 10% of the goats surveyed were positive for *theileria* species by reverse line blot (RLB) (Aydin *et al*., 2013) and disagree with earlier report of Naz *et al*. (2012) 13,9% in sheep and agree with report of Naz *et al*. (2012) 8.2% in Goats in Lahore-Pakistan this might be due to the number of sampled animals difference, genetic variation among animals, breeds in resistance and different in study area.

The prevalence of *theleria* species between sheep and goats was more in sheep compared with goat that might be due to the nature of skin. The sheep were found to be more susceptible to *theleria ovis* than goats. The higher prevalence rate of this parasite in sheep may be attributed to the nature of skin. The goat has thin skin that seems to be more resistant for the tick compared to sheep. The ticks may easily get entangled in wool of sheep and subsequently may cause infestation (Durrani *et al*., 2012).

In present study the prevalence of *theleria* (20.16%) was more than that of *anaplsma* (3.22%) in male animals and theleria (15.78%) which was higher than that of *anaplsma* (10.52%) in female animals. There was no statistical Significant difference (*p*= 0.094%) among sex of examined small ruminants in relation to identified blood parasites. This result disagree with report Olorunfemi *et al*. (2015), in Gwagwalada Metropolis, Abuja, North Central Nigeria which found the prevalence of *anaplsama* (8.9%) was more than that of *theleria* (7%) in male and the prevalence of *anaplsama* (11.8%) and *theleria (*11.82%) in female and revealed female animals were more infected by hemoparasites.

Out of 52 examined young small ruminants 21 of them were infected by hemoparasites 16 (30.76%) *theleria* and 5 (9.61%) *anaplasma* and from 130 adult small ruminants examined, 27 of them were infected by hemoparasites 20 (15.38%) *theleria* and 7(5.38%) *anaplasma* and from 18 old small ruminants examined, one of them was infected by hemoparasite 1(5.55%) *theleria.* There was statistical Significant difference (*p*= 0.020%) among ages of examined small ruminants in relation to identified blood parasites. The prevalence of hemoparasite infection in young sheep and goats (40.38%) was higher than that of adult sheep and goats (20.76%) which disagree with the report of Olorunfemi *et al*. (2015)

The body condition of infected animals were statically significant (*p*= 0.001%) as compared to non-infected animals. This study revealed that, small ruminants with poor body condition was highly affected by hemoparasite, *theleria* (22.28%) and *anaplsma* (14.85%) than animal with medium, *theleria* (26.78%) and *anaplsma* (10.71%) and good, *theleria* (12.8%) and *anaplsama* (0.917%) body condition score.

References

Abdullah, Alparslan, Yildirim, Onder Duzlu, (2010): Identification of *Babesia* and *Theileria* species in small ruminants in Central Anatolia (Turkey) via reverse line blotting Turk. *Journal Vet. Anim. Sci*. 34(2): Pp: 205-210**.**

Abenga, J.N., Fajinmi, A., Idowu, T., Kalgo, A., Lawani, F., Samdi, S. (2008): Seasonal variation of trypanosomosis rates in small ruminants at Kaduna abattoir, Nigeria Africa. *Journal Biomed Res*. **11**(2): Pp: 229-232.

Abera, M., Mohammed, T., Abebe, R., Aragaw, K. and Bekele, J. (2010): Survey of ixodid ticks in domestic ruminants in Bedelle district, Southwestern Ethiopia. *Trop Anim Health Prod.* **42**: Pp: 1677-1683.

Adamu, B., Samaila, Balarabe, L., Musa. (2012): Prevalence of Haemoparasites of Sheep and Goats Slaughtered in Bauchi Abattoir IJABR Vol**. 4**(1and 2): 128 **-**133.

Ademola, I.O.and Onyiche,T.E. (2013): Haemoparasites and haematological parameters of slaughtered Ruminants and pigs at Bodija Abattoir, Ibadan, Nigeria. Africa. *Journal Biomed. Res*. **16**: Pp: 101-105.

Amina, M. B; Jallailudeen, R. L; Jamila, D; Yakaka, W; Esther ,S. M; Musa, I.A. and Abdullahi, A.B. (2017): Prevalence of haemoparasites in Balami Sheep from Maiduguri, Northeastern Nigeria. *Journal of veterinary medicine and animal science*. vol. **2** (2), pp: 28-35.

Anyanwu, N.C., Iheanacho, C. N. and Adogo, L. Y. (2016): Parasitological Screening of HaemoParasites of Small Ruminants in Karu Local Government Area of Nasarawa State, Nigeria. *British Microbiology Research Journal*. **11**(6): Pp: 1-8.

Asfaw, W. (1997): Country Report: Ethiopia. In Proceedings of a Seminar on Livestock Development Policies in Eastern and Southern Africa. Mbabany, Organized By CTA, OAU/IBAR and the MoA and Cooperative, Swaziland

Aydin, M.F., Aktas, M., Dumanli, N. (2013): Molecular identification of Theileria and Babesia in sheep and goats in the Black Sea Region in Turkey. *Parasitol Res*. **112**: Pp: 2817-2824.

Bekele, J., Tariku, M. and Abebe, R. (2011): External parasite infestations in small ruminants in Wolmera district of oromia region, central Ethiopia. *J ournal Anim Vet Adv*. **10**(4): Pp: 518-523.

Bell-Sakyi, L., Koney, E.B., Dogbey, M. O. and Walker, A.R. (2004): Incidence and prevalence of tick borne haemoparasites in domestic ruminants in Ghana. *Veterinary Parasitology*. **124**: Pp: 25-52.

Central Statistical Authority (CSA) (2013): Agricultural sample survey. Report on livestock and livestock characteristics, *Statistical Bulletin* No. 505: Addis Ababa, Ethiopia.

CFSPH (2011): Body Condition Score Small Ruminants. Training manuals for the USDA APHIS National Veterinary Accreditation Program. NVAP Module 21: Animals' Fitness to Travel. The centre for food security and public health, Iowa State University

Cheesbrough, M. (1999): District Laboratory Practice in Tropical Countries. Part 1: *Low Price eds*., Cambridge University Press, Pp: 280 -291.

Durrani, S. Z. K., Khattak, R. M., Andleeb, M., Ali, M., Hameed, H., Taqddas, A., Faryal, M., Kiran, S., Anwar, H., Riaz, M., Sajid, M., Sheikh, R. S., Ali, M. and Iqbal, F. (2012): A comparison of the presence of *Theileria* ovis by PCR amplification of their SSU rRNA gene in small ruminants from two provinces of Pakistan. *Asian Pacific Journal of Tropical Disease*. **2**: Pp: 43-47

Githigia, S.M., Thamsborg, S.M., Munyua,W.K. and Maingi, N. (2001): Impact of gastro-intestinal helminthes on production in goats in Kenya. *Small Rum. Res*. **42**: Pp: 21-29.

Hassan , Z. A. and Nwannenna, A.I .(2009): Animal handling and restraint. An instructive Approach 1st Ed Ndahi Press. Pp: **61**. ISBN: 9781-2530-2533.

Kassaye, E. and Kebede, E. (2010): Epidemiological study on mange mite, lice and sheep keds of small ruminants in Tigray region, northern Ethiopia. *Ethiop Vet J;* **14** (2): 51-65.

Naz, S. A., Maqbool, S., Ashraf, N., Ahmed, K., Saeed, M., Latif, J., Iqbal, Z., Ali, K., Shafi and Nagra, I. A. (2012): Prevalence of Theileriosis in Small Ruminants in Lahore-Pakistan S. *Journal Vet. Anim. Sci*. **2**: Pp: 16-20.

Olorunfemi, C. J., Emmanuel, O.S., Sunday, O., Maxwell, O., Olutayo, D. O. (2015): Haemoparasitismin Small Ruminants in Gwagwalada Metropolis, Federal Capital Territory, Abuja, North Central Nigeria IJAVMS, **9 (**5): Pp: 186-191

Otoikhian, C.S., Otoikhian, A.M., Akporhuarho, O.P., Isidahoman, C.O. (2008): Correlation of body weight and somebody measurement parameters in Quda sheep under extensive management system.

Radwan, E., Ali, F. and Hamied, O. (2013): Epidemiological studies, molecular diagnosis of Anaplasma marginale in cattle and biochemical changes associated with it in Kaliobia Governorate, Egypt. *American Journal of Infectious Diseases and Microbiology*.**1**: Pp: 46-49.

Setotaw, T., Regassa, F., Zeru, F. and Kahsay, G. (2014): Epidemiological significance of major hemoparasites of ruminants in and around Debre-Zeit, Central Ethiopia. *Journal of Parasitology and Vector Biology*. **6**: Pp: 16-32.

Sheferaw, D., Degefu, H. and Banteyirgu, D. (2010): Epidemiological study of small ruminant mange mites in three agro-ecological zones of Wolayta, Southern Ethiopia. *Ethiop Vet Journal*. **14** (1), Pp: 31-38.

Shirzeyli, S.H., Lavvaf ,A. and Asadi, A.(2013): Estimation of body weight from body measurements in four breeds of Iranian sheep. Songklanakarin. *Journal of Science and Technology*. **35**(5): Pp*:* 507-511.

Thompson, J.M. and Meyer, H.H. (1994): Body condition scoring of sheep. EC1433 Oregon State University Extension Service.

Thrusfield, M. (2005): Veterinary epidemology 2nd ed. *Black well science*, UK. Pp: 182-189.

Ukwueze, C.S. and Kalu, E.J. (2015): Prevalence of haemoparasites in red sokoto goats slaughtered at Ahiaeke Market, Umuahia, Abia State, Nigeria. *Journal Vet. Adv*. **5**(2): Pp: 826-830.

Urquhart, G. M., Armour, J., Duncan, J.L., Dunn, A.M. and Jennings, F.W. (1996): Veterinary Parasitology Second Edition. *Black well Science.* Pp: 1-133, 217-234.

Urquhart, G.M., Armour, J., Duncan, A.M. and Junnings, F.W. (2001): Veterinary parasitology, 2nd ed; Scotland, Black well science. Pp: 39-58.

Walker, A. R., Bouattour, A., Camicas, J.L., Estrada-Pena, A., Horak, I.G., Latif, A.A., Pegram, R.G. and Peston, P.M. (2003): Ticks of Domestic Animals in Africa. A Guide to Identification of species. International Consortium on Ticks and Tick-borne Diseases (ICTTD-2), *Bioscience Reports*, the University of Edinburgh, UK. 221p.

Waret-Szkuta, A., Roger, F., Chavernac, D., Yigezu, L., Libeau, G., Pfeiffer,D.U., Guitián, J. (2008): Peste des petits ruminants (PPR) in Ethiopia: Analysis of a national serological survey. *BMC Vet*. *Res*.**4**: Pp: 34.

Young, A.S., Groocock, C.M. and Kariuki, D.P. (1988): Integrated control of ticks and tick borne disease of cattle in Africa. *Journal of Parasitology*. **96**: Pp: 403-432.

Access this Article in Online	
	Website: www.ijarbs.com
Quick Response Code	Subject: Veterinary Medicine
DOI:10.22192/ijarbs.2017.04.06.XXX	

How to cite this article:
Dabi Mekuria and Wale Tesfaye. (2017). Study on prevalence of hemoparasitein small ruminants in and around Sebata town, Oromia regional state, Ethiopia. Int. J. Adv. Res. Biol. Sci. 4(6): 128-135.
DOI: http://dx.doi.org/10.22192/ijarbs.2017.04.06.019