Internal parasites of equines and associated risk factors in and around Guder town, West Shewa, central Ethiopia

Diriba Debere[1], Yimer Muktar[1], Solomon Shiferaw[2]and Dinaol Belina[1]*

[1]College of Veterinary Medicine, Haramaya University, P.O. Box: 138 Dire Dawa, Ethiopia

*[*2]Department of Veterinary Laboratory Technology, College of Agriculture and Veterinary Sciences, Ambo University, P.O. Box 19, Ambo, Ethiopia*

**Corresponding author e-mail: solbruk40@yahoo.com*

Abstract

Internal parasites directly affect the health and production of working equines, which contributes to the reduction in their work output and ultimately in the income of the owner and the community. A cross-sectional study was conducted from November 2016 to April 2017 in and around Guder town, west Shewa, central Ethiopia to estimate the prevalence of equine internal parasites and assess the potential associated risk factors. A total of 384 faecal samples from equine species (152 donkeys, 107 horses, 125 mules) were collected and examined for the presence of eggs of parasites using standard coprological methods. Out of these, 341(88.8%) equines were found positive for one or more internal parasites. The prevalence of internal parasites in donkeys, horses, and mules was 95.4%, 89.7%, and 80% respectively.Out of 341 positive samples, the species of parasites found were *Strongylus* spp. (40.8%), *Parascaris equorum,* (25.5%), *Oxyuris equi,* (17.6%)*, Strongyloides* species(8.8%)*, Fasciola* (10.6%), *Dictyocoulus arnifieldi,*(10%) and *Anoplocephala* species (1.5%). Single (86.2%) and mixed (13.8%) parasite species. There was significant difference (*p<0.05*) in the prevalence between species (χ^2= 16.47, p=0.001) and the purpose of keeping equines (χ^2=12.41, p=0.006) in which more number of donkeys and pack animals were positive for parasites than other animals. However, there was no statistically significant difference among, age, sex, house, feed, and body conditions of study animals. In conclusion, this study revealed that the occurrence of internal parasites in equine species in the study area was common phenomenon, especially in donkeys. Hence,strategic prevention and control of internal parasites should be implemented.

Keywords: Distribution; Equines; Guder town; Identification; Internal parasites

Introduction

Livestock represents the major national resource and forms an integral part of the agricultural production system and it is one of principal means of achieving and improving living standards in many regions of the developing world. Ethiopia is believed to have the largest livestock population in Africa and the country has the livestock population of 56.7 million cattle, 58.4 million shoats, 9.9 million equines (FDRE- CSA, 2014). However, the productivity of livestock sector is lower than the average of other African countries. The low productivity of livestock is attributed to many factors; such as traditional husbandry and management system, poor nutrition, low genetic potential, poor productivity and performance of the indigenous breeds and prevalence of epidemic animal diseases. Parasitic diseases are one of the major factors that hinder the full productivity of livestock in Ethiopia (Asmamaw, 2002).

The equine population of the world is estimated at 122.4 which constitute 40 million donkeys, 15 million mules, 43.3 million horses and 24.1 million zebras and camel (Disassa *et al.,* 2015). The number of equines in Africa is 17.6 million comprising 11.6 million donkeys, 2.3 million mules and 3.7 million horses (Mulate, 2005). Ethiopia has more than 6 million donkeys, the second largest donkey population in the world next to China, 1.9 million horses and over 350, 000 mules (FAOSTAT, 2012). In Ethiopia, the low level of development of the road transport network and the rough terrain of the country make equines the most valuable, appropriate and affordable pack animals under the small holder farming system (Tolossa and Ashenafi, 2013). Historically equines have contributed much to human development and cultivations. Their survival can be influenced by work loads stress, poor management, nutrition and diseases (Melkamu, 2016). The care and management provided for equines are very low and relatively the attention given to donkeys has been far below to what it deserves (Ayele *et al.*, 2006).

Although, equines play a significant role in the economy of the country, the development programmes of the government and those of aid agencies pay more attention to the maintenance of cattle, because it provides meat, milk and hide production while equines have been completely neglected or omitted from the pastoral livestock programmes. Despite all these controversies, the contribution of equines in the agricultural system and their role in the produc-

tions is huge(Chemeda *et al*., 2016). Equines are extensively used for work, including transporting people, goods and water in Africa (Krecek *et al*., 1995). Parasitic nematodes directly affect the health and production of hard-working, stressed equines, which, in turn, results in reduction of their work output and ultimately in the income of the owner and the community. The socio-economic impact, multi-parasitism, production and economics in domestic animals, particularly on production and draught (traction) animals in Africa, has received attention (Zinsstag *et al*., 1998). Horses are prone to a number of infectious and non-infectious diseases. Horses are exposed to a complex mixture of intestinal parasitic helminths. Among these parasites such as large and small strongyles, Ascarids, pinworms, Gastrophilus, lungworms, flukes and tapeworms are the common problems encountered in most veterinary clinics and mixed infections are most commonly found to infect horses (Birihanu *et al*., 2014).

Equines are one of the major hosts for helminths and hemoprotozoan infections (Sumbria *et al*., 2014). Parasitic helminths are one of the most common health constraints and working performance of equines worldwide. There are more than 150 species of helminth parasites that can infect equines. The most common and troublesome are large strongyles, small strongyles, roundworms, tapeworms, lungworms, pinworms, thread worms and bots. They cause various degrees of damage depending on the species and number present, nutritional and the immune status of equines(Tolossa and Ashenafi, 2013). They pose a significant threat to the health of equines and cause serious pathological conditions, sometimes fatal. Parasitic infections are associated with reduced performance and physical condition, to severe pathological conditions such as colic, severe diarrhoea, and even death. Parasitic infection decreases the performance, production and productivity of equines mainly by reducing body weight or failure to gain weight or even increasing mortality in acute cases (Buzatu *et al*., 2016).

In Ethiopia where the health care is minimal, especially for equines, the prevalence, species composition, and epidemiology of internal parasites affecting equines have not been investigated in great extent (Mulugeta *et al*., 2010). Apart from few reports in other parts of Ethiopia, there was no specific previous information on internal parasites of equines in Guder town, West Shewa, Oromia region,Ethiopia. Therefore, this study was designed to estimate the prevalence and distrbtion of equine internal parasites and assess the associated risk factors in the study area.

Materials and methods

Study area description

The study was conducted in Oromia region, west Shewa zone in and around Guder town from November 2016 to April 2017.It is located at 123 km west of Addis Ababa. This area is found at an average altitude of 2187 meters above sea level and geographically located at a Latitude of 9˚11'N 38˚20'E and longitude of 9.183˚N 38.333˚E. The average rainfall of the area is 900mm (800-1000mm) while the area has an annual average temperature of 22.5˚C, ranging from 16˚C to 29˚C. The area has bi-modal rainfall distribution with the short rainy season from February to May and long rainy season from June to September.

Study design and study animals

Across-sectional study was conducted on 384 randomly selected local breed equines (horses, donkeys, and mules) in and around Guder town. Information about the age, sex, species and body condition was recorded during sample collection. The age of the sampled equines was estimated based on the technique given by Loch and Bradley (2000) accordingly: equines were grouped into three age categories: from 1-3 years of age were classified as young, 3-10 years as adult and those beyond 10 years as old. Body condition scores were estimated and categorized as good and poor according to the guides published previously (Hendrx.,1998).

Sample size determination and sampling procedure

The sample size was determined using the formula for random sampling (Thrusfield, 2007). Since there was no documented previous study in the area, the expected prevalence of 50% was used. Hence, the sample size was calculated to be 384 from which 152 donkeys, 125mules, and 107 horses proportionally sampled and included in the study. All the equines that are found in the household were included in the study.

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

Where, Pexp = expected prevalence; d= absolute precision; n=sample size.

Sample collection

Faecal samples were collected directly from the rectum and from freshly dropping faeces with great sanitation of 384 selected animals (donkeys, mules, and horses) using disposable gloves and put in faecal sample bottles. The collected samples were properly labeled with the necessary information and soon transported to Ambo UuniversityVeterinary Parasitology Laboratory. Samples were processed and examined on the day of collection and samples not processed on collection day were preserved in formalin for the next day to be processed. Faecal samples were examined using standard parasitological techniques (flotation, sedimentation and modified Baermann) and examined using 10x and sometimes 40x magnification power. Identification of the eggs and larva was made on the basis of their morphology (Soulsby, 1982).

Data management and analysis

Data were entered and managed using Microsoft Excel worksheet and descriptive statistics was utilized to summarize the data using SPSS version 20 statistical software. The prevalence was calculated for all data by dividing positive samples by a total number of examined samples and multiplied by hundred. Chi-square test has been used to assess if there is a statistically significant difference in equine internal parasite between sex, age, body condition scores, thepurpose of keeping the animal and management of animals (feeding and housing). For this analysis p-value, less than 0.05 was considered as significant.

Results

Out of the 384 examined animals, 341 were positive for different parasites and the overall prevalence was 88.8% and the species-specific prevalence was higher in donkeys followed by horses and mules. There was statistically significant difference (χ^2=32.12, p= 0.001) in the prevalence of internal parasites among equines positive for single and mixed parasite species (Table 1).

Table 1. Single and mixed internal parasite species in equines in and around Guder town, west Shewa, central Ethiopia.

Egg/larva	Total (N=384)	Donkey (N=152)	Horse (N=107)	Mule (N=125)	χ^2(p-value)
Single	294 (86.2%)	137 (90.1%)	75 (70.1%)	82 (65.6%)	32.1 (0.001)
Mixed	47 (13.8%)	8 (5.3%)	21 (19.6%)	18 (14.4%)	
Overall	341 (88.8%)	145 (95.4%)	96 (89.7%)	100 (80%)	

Chi-square analysis of different risk factors showed that, species of equine (χ^2 =16.47, p=0.001) and purpose of keeping (χ^2=12.41, p=0.006) of the animal was associated with presence of internal parasites, however, sex, age, feed, and body condition score was not significantly associated with the prevalence of internal parasites (*p>0.05*) (Table 2).

Most of the identified parasites were found with thehighest proportion in donkeys than in the other equine species. Other host related risk factors including female, adult, poorly housed, poor body condition, pasture feeder and packing animals showed higher parasitism than their correspondent factors (Table 3).

Table 2. Prevalence of internal parasitesin equinesamong the different risk factors in the study area

Variables	No. examined (%)	No. positive (%)	X^2	p-value
Species				
Donkey	152 (39.6)	145 (44.6)	16.5	0.001
Horse	107 (27.9)	96 (28.2)		
Mule	125 (32.6)	100 (29.3)		
Sex				
Male	180 (46.9)	159 (46.6)	0.07	0.78
Female	204 (53.1)	182 (53.4)		
Age				
Young	58 (15.1)	50 (14.7)	0.46	0.79
Adult	261 (68)	233 (68.3)		
Old	65 (16.9)	58 (17)		
Body condition				
Poor	243 (63.3)	218 (63.9)	0.55	0.45
Good	141 (36.7)	123 (36.1)		
Housing				
Poor	252 (65.6)	227 (66.6)	1.2	0.27
Good	132 (34.4)	114 (33.4)		
Feeding				
Pasture	297 (77.3)	263(77.1)	0.1	0.77
Mixed	87 (22.7)	78 (22.9)		
Purpose				
Packing	184 (45.3)	163(47.8)	12.4	0.006
Cart	74 (21.9)	68 (19.9)		
Transport	111 (28.9)	95 (27.9)		
Packing-transport	15 (3.9)	15 (4.4)		

Table 3. Distribution of each parasite in equines inand around Guder town, west Shewa, central Ethiopia by risk factors.

Risk factors	Number examined	Strongylus species No.(%)	Parascaris equorum No.(%)	Anoploceph alaspecies No. (%)	Oxyurisequi No.(%)	Strongyloides species No.(%)	Fasciola No. (%)	Lungworm No.(%)
Species								
Donkey	152	51 (36.7)	40 (46.)	0	24 (40)	12 (40)	18 (50)	9 (26.5)
Horse	107	44 (31.7)	27 (31.)	4 (80)	15 (25)	5 (16.7)	11 (30.6)	11 (32.4)
Mule	125	44 (31.7)	20 (23.)	1 (20)	21 (35)	13 (43.3)	7 (19.4)	14 (41.2)
Sex								
Male	180	64 (46.)	45 (51.7)	1 (20)	23 (38.3)	12 (40)	17 (47.2)	18 (52.9)
Female	204	75 (54.)	42 (48.3)	4 (80)	37 (61.7)	18 (60)	19 (52.8)	16 (47.1)
Age								
Young	58	15 (10.8)	13 (15.)	1 (20)	8 (13.3)	5 (16.7)	9 (25)	5 (14.7)
Adult	261	103 (74.1)	59 (67.8)	2 (40)	36 (60)	18 (60)	25 (69.4)	22 (64.7)
Old	65	21 (15.1)	15 (17.2)	2 (40)	16 (26.6)	7 (23.3)	2 (5.6)	7 (20.6)
Body condition								
Poor	243	83 (59.7)	54 (62.1)	3 (60)	41 (68.3)	20 (66.7)	25 (69.4)	12 (35.3)
Good	141	56 (40.3)	33 (37.9)	2 (40)	19 (31.7)	10 (33.3)	11 (30.6)	22 (64.7)
Housing								
Poor	252	92 (66.2)	56 (64.4)	3 (60)	45 (75)	21 (70)	24 (66.7)	20 (58.8)
Good	132	47 (33.8)	31 (35.6)	2 (40)	15 (25)	9 (30)	12 (33.3)	14 (41.2)
Feeding								
Pasture	297	105(75.5)	66 (75.9)	2 (40)	49 (81.7)	21(70)	29 (80.6)	24 (70.6)
Mixed	87	34 (24.5)	21 (24.1)	3 (60)	11 (18.3)	9 (30)	7 (19.4)	10 (29.4)

Risk factors	Number examined	Strongylus species No.(%)	Parascaris equorum No.(%)	Anoplocephalaspecies No. (%)	Oxyurisequi No.(%)	Strongyloides species No.(%)	Fasciola No. (%)	Lungworm No.(%)
Purpose								
Packing	184	58 (41.7)	44 (50.6)	2 (40)	31 (51.7)	13 (43.3)	19 (52.8)	9 (26.5)
Cart	74	26 (18.7)	12 (13.8)	0	15 (25)	9 (30)	5 (13.9)	13 (38.2)
Transport	111	46 (33.1)	28 (32.2)	3 (60)	12 (20)	8 (26.7)	10 (27.8)	10 (29.4)
Packing-transport	15	9 (6.5)	3 (3.4)	0	2 (3.3)	0	2 (5.6)	2 (5.9)
Total examined	384	139 (36.2)	87 (22.7)	5 (1.3)	60 (15.6)	30 (7.8)	36 (9.4)	34(8.9)

Double and triple mixed occurrence of parasitesin 47/341 positive animals showed that *Parascarisequorum*, *dictyocoulusarnifieldi*,*Strongyles*, *Strongyloides*, *Fasciola* spp., *Oxyurisequi* and *Anoplocephal*aspp.were with proportion of 46.8%,40.4%, 34%, 34%, 27.6%, 17% and 4.2% respectively (Table 4).

Table 4. Proportion of single and mixed presence of different internal parasites in equines

Type of occurence	Type of egg/larva of parasite observed	Frequency	Proportion (%)
Single	Anoplocephalaspecies	3	0.8
	Strongyloidesspecies	15	3.9
	Fasciola species	21	5.5
	Strongylusspecies	123	32.0
	Dictyocoulusarnifieldi	17	4.4
	Oxyurisequi	50	13.0
	Parascarisequorum	65	16.9
	Sub total	294	75.7
Mixed	*Oxyurisequi-Lungworm*	2	0.5
	Parascarisequorum-Anoplocephala	1	0.3
	Parascarisequorum-Fasciola	3	0.8
	Anoplocephala-Fasciola	1	0.3
	Parascaris equorum-Lungworm	7	1.8
	Parascarisequorum-Oxyurisequi	3	0.8
	Parascarisequorum-Strongyloides spp.	4	1.0
	Strongyle-Parascarisequorum	2	0.5
	Strongyle-Strongyloidesspp	7	1.8
	Fasciola-Lungworm	3	0.8
	Strongyloides spp-Fasciola	1	0.3
	Strongyloidesspp–Lungworm	3	0.8
	Oxyurisequi-Fasciola	2	0.5
	Strongyle-Fasciola	2	0.5
	Strongyle-Lungworm	4	1.0
	Parascarisequorum-oxyurisequi-strongyloides	1	0.3
	Strongyle-Parascarisequorum-Fasciola	1	0.3
	Sub Total	47	13.8
	Grand total	341	88.8

Discussion

The results of this study showed that internal parasites are highly prevalent in equines in and around Guder town, West Shewa, Central Ethiopia. A greater proportion of sampled equines were found positive for different internal parasites. An overall of 88.8% prevalence of internal parasites in equine species were recorded in the study area which was in line with reports of 88.2% by Takele and Nibret (2013) in Bahirdar. It was lower than some of the earlier reports of 96.9% by Birihanu *et al* (2014), 94.0% by Chemeda *et al* (2016), 98.2% by Ayele *et al* (2006) and 92.71% by Tolossa and Ashenafi (2013) in Hawassa, Ambo, Dugda Bora district and Gonder towns, respectively and higher than reports of 84.4% by Gulima (2006) and Seyoum *et al* (2015) in Awi zone and around Shashemene. This difference could be attributed to the variation in sampling time. Additionally, accessibility of equines to grazing land, deworming habit and giving supplementary feed to these animals affect its occurrence.

In this study, relatively higher overall prevalence of internal parasites was recorded in donkeys (95.4%) than in horses (89.7%) and mules (80%). Tolossa and Ashenafi (2013) also reported similar finding that there is higher occurrence of internal parasitism in donkeys (97.13%) than in horses (80.95%). The observed higher parasitism in donkeys could be attributed to the fact that less attention was given to these animals. Also it might be related with the feeding practices as all donkeys under the study were at free grazing that they have high chance of ingesting large amount of internal parasite eggs and larvae.

Mixed presence of parasites comprising of double or triple types were encountered in 47 (13.8%) of equines which was lower than the finding of Tolossa and Ashenafi (2013) in Arsi-Bale highlands of Oromia Region, Uslu and Guclu (2007) in Turkey, (Chemeda *et al*., 2016) in Ambo town; who reported 59.1%, 50% and 25%, respectively and higher than 5% finding of Mahfooz *et al* (2008) in Pakistan. This could be due to difference in management, deworming activities, targets of those study and seasonality. *Parascaris equorum*(46.8%) in this study was found to be the most frequently mixed parasite which was the same with report of Ragassa and Yimer (2013). This could be related to their worldwide distribution and being from most pathogenic nematode parasites of equine wherever there are grasslands (Johnstone, 2000). The challenge of mixed infections exacerbates the compromised health condition of the animal which could result in debilitation and death of the animal (Jesca *et al.*, 2016).

The relative percentage of equine internal parasitism reported in this study indicated that *Strongyle* species was observed to have higher occurrence (40.7%) than other internal parasites which is in line with the previous works of Tolossa and Ashenafi (2013) and Ayele *et al* (2006). The 33.5%, 35.2% and 41.1% respective prevalence of *Strongyus* spp. in donkeys, horses and mules in the current study was found to be lower than the previous 100% recorded prevalence of these parasites in equine at Western highland of Oromia, Wonchi area and highland of Wollo Province by Regassa *et al* (2005), Shiferaw *et al* (2001) and Muleta (2005), respectively. This may be related to difference in climatic conditionand seasonality of the study.

The prevalence of *Parascaris equorum* was 25.5%.This finding is higher than the reports of Tolossa and Ashenafi (2013) in horses of Arsi-Bale highlands of Oromia Region, Shiret and Samuel (2015) around Mekelle, Abdo *et al* (2014) in Kurfa Chale, East Hararghe, Mahfooz *et al* (2008) in Pakistan, Uslu and Guclu(2007) in Turkey, Regassa *et al* (2005) in Ethiopia highlands and Aftab *et al* (2005) in horses of Lahore-Pakistan who reported 11.7%, 1.8%, 15.5% 16.2%, 12%, 10.81% and 17.1%, respectively. This finding is lower than report by Chemeda *et al* (2016) and Getachew *et al* (2009) 32.8% and 51% respectively. These differences in prevalence might be due to the variation in the length of the study period, the season of the study period, ecology of the study area, intervention with anthelminthic (deworming) and the ecological and climatic differences among localities.

Oxyuris equi with the prevalence of 17.6% was lower when compared with the work of Shiferaw *et al* (2001) in Wonchi who reported 32.4% and relatively higher than Chemeda *et al* (2016), Shiret and Samuel (2015), Regassa and Yimer (2013), Getachew *et al* (2009) and Abdo *et al* (2014) who have reported11.2%, 8.8%, 4%, 2%and 1.5%in Ambo, around Mekelle,South Wollo zone,working donkeys of Ethiopia and in Chale, East Hararghe respectively. The difference of prevalence in this study might be due to variation in management system and relatively dry season during sample collection time in the present study which desiccates the highly susceptible *Oxyuris equi* eggs. The parasite is ubiquitous but more prevalent in areas of high rainfall (Radostitis *et al.,* 2007).

Prevalence of lungworm was (9.9%) in the present study which is in line with reports of 7.5% by Kasa and Getehun(2016) in Tenta district, Amhara region. It was lower as compared to Ayele *et al* (2006) who reported 32% in Dugda Bora

District and Takele and Nibret(2013) who reported 22.2% in and around Bahir Dar town. It was found higher than findings of Chemeda *et al* (2016) in Ambo town that was 4.7%. This difference in prevalence might be due to the ecological and climate difference among localities.

The overall prevalence of *Fasciola* was 10.5 % which is comparable with the results of Gebreab *et al* (1998) who reported prevalence of 9.0 % in central Ethiopia, lower than the finding of Eshete (2000), Tolossa and Ashenafi (2013) who reported 27.1%, 23.1 % in Bahirdar and Arsi-Bale highlands respectively. But it was found higher than the report of 2% by Getahun and Kassa (2016) in Tenta district Amhara region. This is due to the presence of wide marshy and swampy vast communal grazing areas which is common in many part of Ethiopia. This higher prevalence suggests that *Fasciola* species is common in areas where equines share the same grazing area with ruminants that are considered as primary hosts of liver fluke and favourable ecological conditions which allow multiplication and spread of intermediate snail host as has been reported by Getachew *et al* (2010).

The prevalence of Strongyloides species in the present study was 7.8%, which contradicts with the work of Birihanu *et al* (2014) Tolossa and Ashenafi (2013), Wannas *et al* (2012) in Romania and Uslu and Guclu (2007) in Turkey who reported 28.4%, 0.7%, 22.72%, 9.6% and respectively. However, the current study is in harmony with Morariu *et al* (2010) who reported prevalence of 7.2%, respectively. This might be related to the difference in area and time of study.

Lower prevalence of *Anoplocephala species,* 1.5% recorded in this study is in line with respective finding of Chemeda *et al* (2016) in Ambo town and Abdo *et al* (2014) in KurfaChale district, East Hararghe which was 1.5% .When compared to reports by Regassa *et al* (2005), Getahun and Kassa (2016), Shiferaw *et al*(2001) and Getachew *et al* (2010) difference could be due to seasonality of orbited mite intermediate hosts and differences in study period and locations.

Equines that were used for packing and transport were found to be with higher prevalence of parasitism than animals used for cart pulling and this might be confounded by the difference in the management (care) given to these group of animals. These could be due to lower access to common grazing land which actually reduce the chance of getting infection and cart-pulling equines feeding system was cut and carry while grazing was less practiced in the current study

area and habit of giving especial care (for the equines used for cart pulling) such as deworming and supplementary feed.

Conclusion

Internal parasites are important health problems of equines in the study area with an overall prevalence of 88.8% especially highest in donkeys with 95.4%. Host species and purpose for which animals were kept were associated with the occurrence of the disease. *Strongylus* spp, *Parascaris equorum*, *Oxyuris equi*, *Dictycolous arnifieldi*, *Fasciola*, *Strongyloides* and *Anoplocephala* spp were the most dominant internal parasites affecting equines in the study area. In order to minimize losses attributed to the equine internal parasites in the area, equine owners should be informed of the economic importance and methods of control and prevention of helminths of equines through management improvements together with strategic deworming of equine. Further research should be conducted on the economic importance, epidemiology and time of treatment of internal parasites of equines in the study area.

Acknowledgements

Authors thank all staff of Ambo University, Department of Veterinary Laboratory Technology for their support and contribution during the period of this research.

Conflict of interest

The authors declare that there is no conflict of interest.

Refrences

Aftab, J., Khan, M. S., Pervez, K., Avais, M.and Khan, J.A., 2005. Prevalence and Chemotherapy of Ecto-and Internal parasites in Rangers Horses at Lahore-Pakistan, *Int. J. Agri. Biol*., 7,5.

Asmamaw, K., 2002. Descriptive study of husbandry practice and their effect on the dairy cows in Small holder system in and around Debrezeit DVM thesis, Faculty of Veterinary Medicine Addis Ababa University, Debrezeit Ethiopia.

Ayele, G., Gebreab, F., Endebu, B. and Joe, A, 2006. Prevalence of gastrointestinal parasites of donkeys in Dugda Bora District, Ethiopia. *J. Livest. Res. Rural Dev*.18, 2-6.

Beldomenico, P., M and Begon, M., 2010. Disease spread susceptibility and infection intensity: viciouscircles? *Trends Eco. Evol., 25 (1), 21-27.*

Belete, S. and Derso, S., 2015. Prevalence of major gastrointestinal Parasites of horses in and around Mekelle (Quiha and Wukro). *World J. Ani. Sci. Res.,*3(3), 1–10.

Birihanu, T., Ibirahim, N., Dheresa, B. and Tolosa, T., 2014. Prevalence of Helminth Parasites of Horses in and Around Hawassa Town, Southern Ethiopia. *Acta Parasitol. Globa.* 5 (1), 07-11.

Buzatu, M C., Mitrea, I L, Lyons, E, and Ionit, A. M., 2016. Epidemiological Study on Parasite Infections in Horses from Different Types of Equine Establishments, Romania. *Agro. Life Scientific J.*, 5(1), 31-35.

Chemeda, R., Mekonnen, N., Muktar, Y., M and Terfa, W., 2016. Study on prevalence of internal parasites of horses in and around Ambo Town, central Ethiopia. *American-Eurasian J. Agri. Environ. Sci.*, 16 (6),1051-1057.

Disassa, H., Alebachew, A., Zenebe T., and Kebede, G., 2015. Prevalence of Strongyle Infection in Horses and Donkeys in and around Dangila Town, Northwest Ethiopia. *Acta Parasitol. Globalis,* 6 (1), 14-19.

Eshete, G., 2000. A preliminary study on health and productivity status of "Ghari" mules in and around Bahirdar, DVM thesis, Addis Ababa University, Faculty of Veterinary Medicine, Bishoftu.

FAOSTAT., 2012. Food and Agricultural organization Statistical Database: http://www.fao.org/corp/statistics/ access online/.

FDRE-CSA., 2014. Agricultural sample survey agricultural sample survey, volume II. Report on livestock and livestock characteristics livestock and livestock characteristics.

Gebreab, F, Abdela, M. and Jobre, Y,. 1990. Vermicular Endoparatisim in donkeys of Debrezeit and Menagesha, Ethiopia, Strategic treatment with Ivermectin and Fenbendazole, Paper presented at the International Colloquium on Donkeys, Mules and Horses in tropical Agricultural Development, Held in Edinburgh, Scotland 3rd to 6th September 1990, (1) 51-55.

Getachew, A. M., Trawford, A. F., Feseha G. and Reid, S. W. J., 2010. Gastrointestinal Parasites of Working Donkeys in Ethiopia. *Trop. Anim. Hlth. Prod.*, 42, 27-33.

Getahun, K.T., and Kassa, T. Z., 2016. Prevalence and species of major gastrointestinal parasites of donkeys in TentaWoreda, Amhara Regional State, Ethiopia. *J. Vet. Med. Anim. Hlth.,* 9(2), 23-31.

Gulima, D., 2006. Epidemiological study of helminthosis in traction horses in Awi Zone, Northwestern, Ethiopia. *Ethiop. Vet. J.,* 10, 37-54.

Guye, W., Bariso, B., Jeylan, M., Ahimed, O., Kadiro, E., Merzuk, H., and Mukarim, A., 2016. Prevalence of Major Gastrointestinal Parasites in Donkeys in Dodola District, West Arsi, Oromia Regional State, Ethiopia. *World J. Agri. Sci.,*12 (2), 119-124.

Hendrx, C. M., 1998. Diagnostic veterinary Parasitology 2nded. st.Lovis London. Philadelphia Sydney Toronto Pp. 48-59.

Jesca, N., William, K., Daniel A., and Duke, O., 2016. Prevalence of endo-parasites in donkeys and camels in Karamoja sub-region, north eastern Uganda. *J. Vet. Med. Ani. Hlth.,* 9(1), 11-15.

Johnstone, C, 2000. Parasites and Parasitic Diseases of Domestic Animals.University of Pennsylvania, School of Veterinary Medicine and Merck. URL : http://cal.vet.upenn.edu/merial/index.

Krecek, R. C., Cornelius, S. T. and McCrindle, C. M.,1995. Socio-economic aspects of animal diseases in southern Africa: research priorities in veterinary science. *J. S. Afr. Vet. Assoc*., 66, 97–100.

Loch W. and Bradely M, 2000. Determining age of horses by their teeth.Department of Animal Science, University of Missouri-Colombia,URL: http://muextension.Missouri.edu/xplor.

Mahfooz, A., Masood. M.Z., Yousaf, A., Akhtar, N. and Zafar, M.A., 2008. Prevalence andanthelmintic efficacy of Abamectin against gastrointestinal parasites in horses. *Paki. Vet. J*., 28(2), 76-78.

Melkamu, S., 2016. Study on the prevalence of equine strongile in and around Mersa Town of South Wollo Zone, Amhara Regional State, Ethiopia. *Intern. J. Res. Innova. Earth Sci.,* 3(1), URL: http://www.ijries.org/administrator/components/com

Morariu, S., Bogdan, A,. T and Darabus, G., 2012. Helminth parasites in horses from ten locations of Timis country. *Bull. Univers. Agri. Sci. Vet. Med. Cluj-Napoca*., 69(1/2), 381-384.

Mulate, B., 2005. Preliminary study on helminthosis in equines in South and North Wollo zones. *J. Vet. Assoc.* 9, 25-37.

Mulugeta, G., Trawford, A.,Gebreab, F., and Reid, S.W., 2010. Gastrointestinal parasites of working donkeys in Ethiopia. *Trop. Anim. Hlth Prod.*, 42, 27-33.

Navarro, C, Marzal,A, Lope de, F, and Møller, A P., 2003. Dynamics of an immune response in house Sparrows Passer domesticusi in relation to time of day, body condition and blood parasite infection. *OIKOS* 101, 291–298.

Radostits, O. M., Gay C. C., Hinchcliff, K. W. and Constable P. D., 2007. Veterinary Medicine. A textbook of the diseases of cattle, sheep, goats, pigs and horses.10thedition. Saunders-Elsevier, Pp. 1311-1315.

Regassa, A., and Yimer, E., 2013. Gastrointestinal Parasites of Equine in South Wollo Zone, North Eastern Ethiopia. *Global Vet.,*11(6), 824-830.

Regassa, F., Dhuguma, R. and Mideksa, B.,2005.Prevalence of equine gastrointestinal parasites in western highlands of Oromia, Ethiopia. *Bull. Anim. Hlth. prod. Afr.,* 53(3), 161-166.

Seyoum, Z., Tefaye, M., Mulualem, T and Derso, S., 2015. Prevalence, intensity and risk factors of infestation with major gastrointestinal nematodes in equines in and around Shashemane, Southern Ethiopia. *Bull. Anim. Hlth. prod. Afr.,* 47, 1515–1521.

Shiferaw., Y, Gebreab, F., G. and Wossene, A., 2001. Survey of helminthosis of equines in Wonchi. *Ethiop. Vet. J.,* 5, 47-61.

Soulsby, E., 1982. Helminths, Arthropods and Protozoa of Domestic Animals, Bailliere Tin Dall, Toronto.

Sultan, A., Ayele, G., Tadesse, B. and Ahmed, A., 2014. Prevalence of gastrointestinal parasites of horses and donkeys in KurfaChale District, East Hararghe, Ethiopia. *Livesto. Res. Rural Dev.,*26, 7 URL: http://www.lrrd.org/lrrd26/7/sult26119.htm

Sumbria, D., Singla, L, D., Sharma, A., and Moudgil, A, D., 2014. Equine trypanosomosis in central and western Punjab: Prevalence, haemato-biochemical response and associated risk factors. *Acta Trop*., 138, 44-50.

Takele, B., and Nibret, E., 2013. Prevalence of gastrointestinal helminthes of donkeys and mules in and around Bahir Dar. *Ethiop. Vet. J*., 17(1), 13-30.

Thrusfield, M., 2007. Veterinary epidemiology.3^{3rd} Ed.. Singapore, Blackwell Science, Pp. 233.

Tolossa, Y. H., and Ashenafi, H., 2013. Epidemiological study on Gastrointestinal Helminths of horses in Arsi-Bale highlands of Oromia Region, Ethiopia. *Ethiop.Vet. J*., 17, 51-62.

Uslu, U., and Guclu, F., 2007. Prevalence of internal parasites in horses and donkeys in turkey, *Bull. Vet. Inst. Pulawy* 51(2), 237-240.

Wannas, H.Y., Dawood, G.H. and Gassem, G, A., 2012. Prevalence of gastro-intestinal parasites in horses and donkeys in Al Diwaniyah Governorate. *AlQadisiya J.Vet. Med. Sci*., 11(1), 148-155.

Zinsstag, J., Ankers, P., Ndao, M., Bonfoh, B., and Pfister, K., 1998. Multiparasitism, production and economics in domestic animals in Sub-Saharan West Africa. *Parasitol. Today*, 14, 46–49.