

Prevalence of Equine Gastro Intestinal Parasites in and Around Meki Town, Oromia, Ethiopia

Dinka Ayana, Admasu Alemu, Hika Waktole and Hagos Ashenafi

Department of Parasitology and Pathology, College of Veterinary Medicine,
Addis Ababa University, Ethiopia

Abstract: A cross sectional study was conducted from December, 2017 to April, 2018 in and around Meki Town to determine the prevalence of gastrointestinal parasites in donkeys, horses and mules. A total of 384 animals (donkeys 198, horses 135 and mules 51) were randomly sampled. Fecal samples were collected and examined during the study period. During the examination, floatation and sedimentation technique were used. An overall prevalence of gastrointestinal parasites was found to be 70.6% (271/384) with 75.3% in donkeys, 65.2% in horses and 66.7% in mules. Donkeys were found more likely at risk of developing GIT parasites than horses (95% CI =0.38-0.99). The prevalence with regard to sex was 80.9% in female and 67.5% in male; while 69.9%, 68.5% and 78.8% in young, adult and old ages respectively. Similarly, 79.9%, 68.2% and 62.6% prevalence was recorded in poor, medium and good body condition scores respectively. From the risk factors, sex and body conditions were found to have significant association with the occurrence of GIT parasite. The prevalence of *Strongyle*, *Parascaris equorum*, *Oxyuris equi* and *Gastrodiscus aegypticus* was 55.1%, 19.1%, 2.5% and 6.6% in donkeys, 41.5, 14.1%, 8.1% and 6.7% in horses and 48.0%, 15.7%, 11.8% and 3.9% in mules, respectively. As the current study confirmed, GIT parasite prevalence was found to be high in equine species in the study area. Therefore, strategic deworming, rotational grazing good feeding and management systems with awareness creation to animal owners is recommended.

Key words: Donkey • Gastrointestinal Parasites • Horse • Meki • Mule

INTRODUCTION

Equines are widely distributed throughout the world. The total world equine population is 122.4 million consisting of 40 million donkeys, 15 million mules and 43.4 million horses. In developed countries, small numbers are kept as pets, as companions, or for work, in occupational therapy program [1]. In the developing countries, there are estimated 110 millions of equines. From this, 95% of donkeys and mules and 60% of horses are kept mainly for work [2]. The equine population in Africa consist 17.6 million donkeys, 2.3 million mules and 3.7 million horses [3]. In Ethiopia, 9.83 millions equine populations are found. From this, donkeys accounts 7.04 million while horses and mules are 2.03 and 0.4 million respectively [4]. There is one Equine for every four people in agricultural sector and every five person of the total population [5].

The presence of low level of development of the road transport network and the rough terrain of the country make the donkeys, horses and mules the most valuable, appropriate and affordable pack animals under the small holder farming system in Ethiopia [6]. According to Central Statistical Authority [4] most of the equines populations are found in highland areas, even though they are widely distributed in all agro ecological zones of the country (arid to alpine).

Beside their importance's equines are facing several challenges including helminthiosis as most common health constrain worldwide. Helminths cause various degrees of health problem depending on the species and number of parasite present, nutritional and the immune status of the animals [7].

Helminthosis have a considerable significance in the wide range of agro climatic zones in sub Saharan Africa and constitutes one of the most important constraints to

working equines [8]. From these, gastrointestinal nematodes have been given more attention as a serious threat to equine health and welfare. They decrease in the performance; production and productivity in the animals mainly in the reduction of body weight, failure to gain weight and even increase the mortality in acute case [9]. These parasites share with equines digestible nutrients and cause inflammation and petechial hemorrhages as a result of adherence and penetration of mucus of Endoparasites [10].

The most common equine internal parasites are small and large Strongyle species, Ascarids (*Parascaris equorum*) and pin worms (*Oxyuris equi*) [11]. The equine ingest infective eggs of those parasites that developing adults, reproduce and release age with feces which dispersed in the surrounding environment. Depending on the types of parasites, once the disease developed, nasal discharge, coughing, reduced growth rates, in appetite, rough hair coat and lethargy were observed. Intestinal obstruction also may occur with large worm burdens [12]. On the other hand, immunity against *Parascaris* spp. starts to develop by the age of 6 months [13] and horses older than 4 years seldom harbor these nematodes while cyathostomins also known as small strongyles are the most prevalent parasitic nematodes of adult equids.

Available information in different literatures indicated that, gastrointestinal parasites are the major causes of every demises of working equines in Ethiopia [14]. A number of surveys have been carried out to determine the prevalence of GIT parasite in different parts of Ethiopia. However, there is no such study in Meki, Oromia which needs to have a clear picture of current situation of prevalence of gastrointestinal parasite for control action in the area.

Therefore, the objectives of this study were:

- To estimate the prevalence of gastrointestinal parasites in equine in and around Meki, Oromia
- To identify the major GIT parasites species in study area
- To identify the associated risk factors with the occurrence of the parasites

MATERIALS AND METHODS

Study Area: The study was conducted in and around Meki town located in East Shewa Zone of Oromia Regional state, Ethiopia from December, 2017 to April, 2018. Meki town is the administrative center of Dugda district. Dugda is bordered on the southeast by Lake Zeway, on the south by Adami Tullu and Jido Kombolcha district, on the west by the Southern Nations,

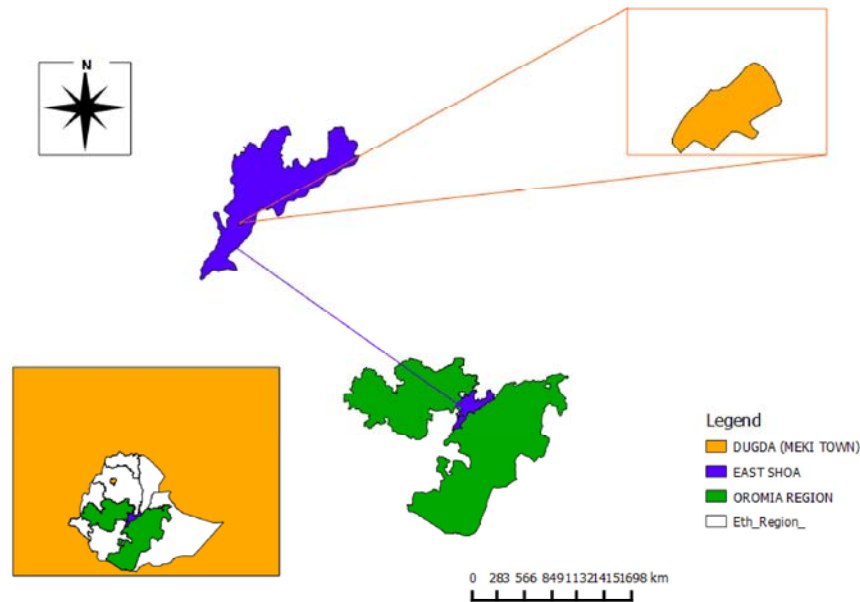
Nationalities and Peoples Region, on the northwest by the Southwest Shewa Zone, on the north by the Awash River which separates it from Ada'a Chukala, on the northeast by Koka Reservoir which separates it from Adama and on the east by the Arsi Zone. A survey of the land in this district shows that 36.9% is arable or cultivable, 8.7% pasture, 9.6% forest, 0.4% swampy and the remaining 44.3% is considered degraded or otherwise unusable. The agriculture is cereal based mainly maize and sorghum and depends on oxen (draught power) and mechanized machines to till the land. Fruits and vegetables are important cash crops. The latitude and longitude of Meki is 8°9'N38°49'E and elevations average of 1636 meters and altitudes of between 1500-2300 above sea level; Mount Bora Mariam (2007 meters) is the highest point [15].

The major animal species kept in the area include cattle, goat, sheep, horses, donkeys, mule, poultry and rarely camel. The total livestock population of the district was 228,686 cattle, 62,705 goats, 70,263 sheep, 20,017 donkeys, 5,193 horses, 2,166 mule and 183,665 poultries (Personal Communication from district Livestock Agency, 2016). The 2007 national census reported a total population for this district of 144,910, of whom 74,561 were men and 70,349 were women; 36,252 or 25.02% of its population were urban dwellers and the weather conditions is 24°C, Wind NE at 21 km/hrs, 33% Humidity for Meki. The distance from Addis Ababa to Meki is 132km [16].

Study Animals: The studied animals were equine (horse, donkey and mule) in and around Meki town maintained under traditional small holder extensive management (production) system. During sampling, the animal species, sex, age and body condition were recorded.

Age and Body Condition Estimation: Age of the animals were determined from birth records and dentition characteristics. Equines less than two years of age were classed as young (n=83), those in range of two to ten years were classed as adults (n=235) and those beyond ten years were classed as old (n=66). This way of age classing was based on age of first work, productive age and the life span of Ethiopia equines [17]. The body condition scoring was based on the criteria of donkey sanctuary UK(1969) and body condition of animals was classified into poor, moderate and good.

Study Design and Sampling Strategy: A cross sectional study was conducted from December, 2017 to April, 2018 to determine the prevalence of equine gastrointestinal parasites and risk factors occurrence of



Source: Supported by QGIS

Fig. 1: Map of the study area

parasite. The study was conducted by randomization sampling method to examine the prevalence of equines gastrointestinal parasites and study animals were obtained from Meki Type B Open Air Clinic and visit made to Cart stations (Eelaa, Gamo, Bekele, Seeraa and Fiilaa) of Meki town.

Fecal samples were collected from each selected animal directly from the rectum using disposable plastic glove and each sample were labeled with all description of the animal which is include species, age, sex, body condition scores were recorded on a paper corresponding to the label to exclude repetition of sample collection of the same animal.

Fecal Sample Examination: Fresh fecal samples were collected and taken to Meki Veterinary Laboratory and Adami Tullu Agricultural and Research Center for parasitological examination techniques; sedimentation and floatation and followed by examination of microscopically to identify presence of the eggs in feces [18]. Identification of the parasite egg at species level was made on the basis of their morphology [19].

Sample Size Determination: The determination of the sample size was done on expected prevalence of 50% by considering there was no research work on prevalence of gastrointestinal parasites on three species donkey, horse and mule in the study area. The desired sample size for the

study will be calculated using the formula given by Thrusfield [20] with 95% confidence interval and 5% absolute precision.

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

$$n = \frac{3.84 \times 0.5 \times 0.5}{(0.05)^2} = 384$$

where

P exp = expected prevalence;

d= absolute precision;

n =sample size. The estimated sample size was 384 animals.

Data Analysis: The collected data was entered into Microsoft Excel-2013@ spread sheet. The data were filtered for any missing values or invalid entry and then transferred to SPSS 20 version for windows package (2007) for statistical analysis. The data were analyzed for the chi-square test considering the species, body condition, age and sex of animals.

Descriptive statistics were made and results of the analysis were presented through tables and figures. In all the analyses, confidence level was held at 95% confidence interval and P-values less than 0.05 were considered as significant ($P < 0.05$).

Table 1: The overall prevalence of gastrointestinal parasites in donkeys, horse and mule.

Species of animal	Number examined	Number positive (%)	χ^2 (p-value)
Donkey	198	149 (75.3)	4.350 (0.114)
Horse	135	88 (65.2%)	
Mule	51	34 (66.7%)	
Total	384	271 (70.6%)	

Table 2: The prevalence of gastrointestinal parasites by risk factors

Risk factors	Number examined	Prevalence (%)	χ^2	p-value	CI
Species					
Donkey	198	149(75.3%)	4.350	0.114	0.38 -0.99
Horse	135	88(65.2%)			
Mule	51	34(66.7%)			
Sex					
Male	295	199(67.5%)	5.948	0.017	0.27-0.88
Female	89	72(80.9%)			
Age					
Young	83	58(69.9%)	2.645	0.266	0.89-3.27
Adult	235	161(68.5%)			
Old	66	52(78.8%)			
Body condition					
Poor	121	96(79.3%)	7.514	0.023	1.22-4.51
Moderate	192	131(68.2%)			
good	71	44(62.6%)			

Table 3: The prevalence of each gastrointestinal parasite in equine

Parasite identified	Number of positive	Relative percentage
Strongyle	189	49.3%
<i>Parascaris equorum</i>	66	17.2%
<i>Oxyuris equi</i>	22	5.7%
<i>Gastrodiscus aegypticus</i>	24	6.2%

RESULTS

An overall 70.6% equine consist of 75.3% donkey, 65.2% horse and 66.7% mule were found positive for helminthosis showing no difference ($p=0.114$) among animal species(Table 1).

In relation to body condition of the animals, higher relative prevalence's in poor (79.3%) than those in good (62.0%) and medium (68.2%). Prevalence in female (80.9%) animals was higher than male (67.5%) showing statistically significant difference ($P< 0.05$). The prevalence of GIT parasites according to age group was 69.9%, 68.5% and 78.8% in young, adult and old animals, respectively and was not statistically significant ($P>0.05$) (Table 2).

The parasites identified during study period were strongyle species, *Parascaris equorum*, *Oxyuris equi* and *gastrodiscus aegypticus*. Among the identified gastrointestinal parasites, the highest relative percentage was recorded for Strongyles (49.3%) followed by *Parascaris equorum* (17.2%), *Gastrodiscus aegypticus* (6.25%) and *Oxyuris equi* (5.7%) as shown in (Table 3).

Similarly, the highest rate of double infection was observed in case of Strongyles plus *Parascaris equorum* (5.2%) followed by Strongyles plus *Gastrodiscus aegypticus*(2.08),Strongyles plus *Oxyuris equi* (1.04%), *Parascaris equorum* and *Oxyuris equi* (0.26%), *Parascaris equorum* and *Gastrodiscus aegypticus* (0.26%) and *Oxyuris equi* and *Gastrodiscus aegypticus* (0.26%) (Figure 2).

DISCUSSION

The current study estimated an overall 70.6% prevalence of gastrointestinal parasites 75.3% in donkey, 65.2% in horse and 66.7% in mule. This finding relatively agrees with the report of Tesfu *et al.*[21] in Hawassa town andarge, B.,, Muhammed and Tibesso [22] in Jimma town, Getahun and Kassa [23] in Tenta district Amhara region. [23, 24] in South Wollo zone reported their respective prevalence of 72.7%, 72.25%, 72.33%, 75.6% and 70.4%. Whenever we compare prevalence between the species, lower prevalence in horses was recorded. This is due to feeding practices in the study area. All most all of the

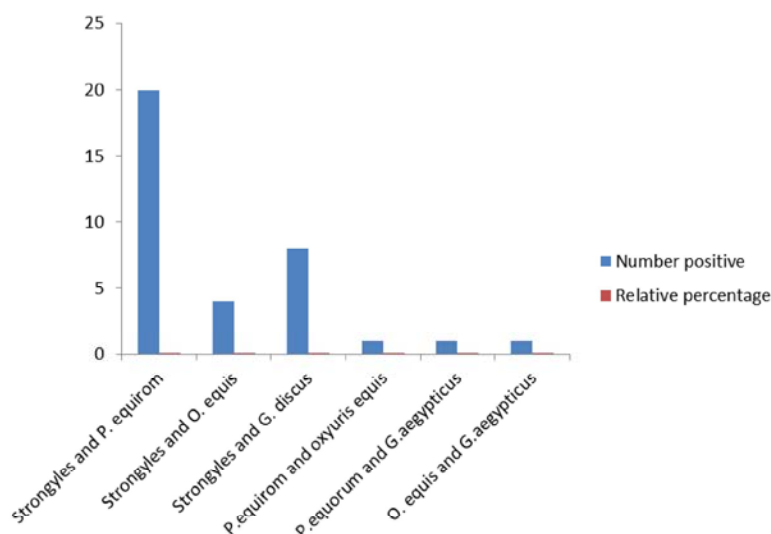


Fig. 2: The relative prevalence of mixed gastrointestinal parasite infections

Table 4: Prevalence of each gastrointestinal tract parasite by risk factors

Risk factors		<i>Strongyle</i>	χ^2 (p-value)	<i>P. equorum</i>	χ^2 (p-value)	<i>O. equi</i>	χ^2 (p-value)	<i>G. aegypticus</i>	χ^2 (p-value)
Species	Donkey	109 (55.1%)	5.954 (0.051)	39 (19.7%)	1.876 (0.391)	5 (2.5%)	8.66 (0.013)	13 (6.6%)	0.546 (0.761)
	Horse	56 (41.5%)		19 (14.1%)		11 (8.1%)		9 (6.7%)	
	Mule	24 (48.0%)		8 (15.7%)		6 (11.8%)		2 (3.9%)	
Sex	Male	139 (47.3%)	2.165 (0.148)	49 (16.6%)	0.298 (0.631)	19 (6.4%)	1.193 (0.434)	17 (5.8%)	0.473 (0.460)
	Female	50 (56.2%)		17 (19.1%)		3 (3.4%)		7 (7.9%)	
Age	Young	35 (42.7%)	2.665 (0.264)	20 (24.1%)	4.708 (0.095)	2 (2.4%)	3.097 (0.213)	5 (6.0%)	1.123 (0.570)
	Adult	117 (49.8%)		33 (14.0%)		14 (6.0%)		13 (5.5%)	
	Old	37 (56.1%)		13 (19.7%)		6 (9.1%)		6 (9.1%)	
Body condition	Good	28 (40.0%)	4.783 (0.092)	11 (15.5%)	5.843 (0.054)	3 (4.2%)	0.394 (0.821)	4 (5.6%)	0.426 (0.808)
	Medium	93 (48.4%)		26 (13.5%)		12 (6.2%)		11 (5.7%)	
	Poor	68 (56.2%)		29 (24.0)		7 (5.8%)		9 (7.4%)	

horses under this study were cart horses that fed grain byproducts and are less exposed to pasture grazing. The difference among these findings from different areas might be due to variation in management system, sample size and sampling method differences [24].

The gastrointestinal parasites prevalence (75.3%) observed in donkeys in the current study is lower than the reports of Ayele *et al.* [17], Ibrahim *et al.* [24], Yoseph, Feseha and Abebe [25], Fikru *et al.* [26] and Wannas, Dawood and Gassem [27], who reported 100%, 100%, 92.8% 100%, 96.9% and 100% in Wonchi Awraja, highlands of Wollo province, Western highlands of Oromia, in Dugda Bora District, in around Hawassa town, Ethiopia and Al Di- waniyah Governorate, respectively.

Donkeys are highly infected than horse and mules as most of horses and mules were used for cart and their feeding system was stall feeding method while grazing was the only method of feeding system in donkeys [17]. The observed higher parasitism in donkeys could be attributed to the fact that less attention is given to these animals that is by far lower than their work load

The highest gastrointestinal parasites (80.9%) in female than male regarding sex by risk factors. Between sexes of equines there is statically significant association with gastrointestinal parasites with p-value of 0.017. This study agrees with the study of Wedajo and Hadush [28] in and around sagure town higher prevalence in female (90%) than male (87%) because of the fact that most of females are not used for cart as a result exposure to grazing is very high and the fact that females have a close relation to their foals, which favors frequent recycling of the parasite between the dam and foal.

The study of gastrointestinal parasites shows that (79.3%) in poor than good and medium regarding the body condition. Between the body condition score there is statistically differences in associations with p-value of 0.023. This is similar with report of Tesfu *et al.* [21] and Wedajo and Hadush [28]. This might be due to the increased land of cultivation than which restrict animals on small communal grazing land which allows animals for continuous exposure and poor management [24].

The study of GIT parasites by age identify that there is relatively higher infection in old (78.8%) than the adult (68.5%) and young (69.9%). But the difference was not statistically significant ($\chi^2=2.645$, $p>0.05$). Similar result was seen by Tesfu *et al.* [21], Samuel *et al.* [29] and Wannas, Dawood and Gassem [27]. Such finding result might be due to prolonged exposure of elderly equines to the pasture contaminated with parasites throughout their life.

Detection of highest prevalence of *Strongyle* eggs in equines (55.1% in donkey, 41.5% in horse and 48% in mule) agrees with work of Wannas, Dawood and Gassem [27], Cirak and Gulegen [30] who reported 58.50% and 68% prevalence of strongyle in horses, in Lahore and western Turkey respectively and who reported predominance of *Strongyle* eggs with a prevalence of 50% in horse and 57.14% in donkeys. Saeed *et al.* [31] also reported 58.50% (117 from 200) *Strongyle*-type eggs in horses and Andarge, B., Muhammed, C. and Tibesso [22], 79.31% 63.72%, 51.85% in donkey, horse and mule respectively. 57.2% of prevalence also works of Getahun, T. and Kassa [23] agree with this result. It's lower than Mezgebu's report in horse which is Mezgebu, Tafess and Tamiru [32] and reports of Ayele *et al.* [17] shows that the prevalence of *Strongyle* was 93% in Bereh, 87% in Boset and 95% in Adaa.

The prevalence of 17.2% *Parascaris equorum* recorded in the current study is in agreement with Yoseph, Feseha and Abebe [25], Fikru *et al.* [26] reported 15.7% and 17.3% in Wonchi Ethiopia and western highland of Oromia High prevalence in young animal is relatively agreed with Asefa *et al.* [7] Ibrahim *et al.* [24], Reinemeyer. CR and Nielsen [33], Fikru *et al.* [26], Gebreab [34]. This could be due to the development of immunity with increasing of age [35] and Urquhart *et al.* [6].

About 5.7% prevalence of *Oxyuris equis* in this study was relatively agreed with the work of Aftab *et al.* [36]. In equine of Lahore-Pakistan who reported 6.3%. The prevalence of *Oxyuris equis* based on age, sex and body condition score. On this study *oxyuris equi* is statically significant between species of the equines ($p<0.013$). The low prevalence in this study might be the effect of relative higher temperature in the study area which desiccates the highly susceptible *Oxyuris equi* eggs.

The prevalence of *Gastrodiscus aegypticus* in the present study were 6.6%, 6.7% and 3.9% donkeys, horse and mules respectively. The finding of the current study is agree with Ayele *et al.* [17] also reported 6% prevalence in donkeys of Dugda Bora district and lower than report of Getachew *et al.* [37] shows (30%) in donkeys and

higher than Report of Mezgebu, Tafess and Tamiru [32] shows 2.86% and 3.58% in horses and donkey respectively. In this study, donkeys were seen to be 1.64 and 1.53 times at risk of acquiring gastrointestinal parasites than horses and mules respectively.

The highest rate of double infection was observed in case of *Strongyles* plus *Parascaris equorum* (5.2%) followed by *Strongyles* plus *Gastrodiscus aegypticus* (2.08), *Strongyles* plus *Oxyuris equi* (1.04%), *Parascaris equorum* and *oxyuris equi* (0.26%), *Parascaris equorum* and *Gastrodiscus aegypticus* (0.26%) and *Oxyuris equi* and *Gastrodiscus aegypticus* (0.26%). This result is lower than the report of Taye [38] in Mekelle which was 10.4% for mixed gastrointestinal tract parasite infection.

CONCLUSION

The optimum utilization of equine was hindered by a variety of diseases in which parasitic diseases are most common factors that constrain the health and working performance of equine. In the current study area *Strongyle*, *Parascaris equorum*, *oxyuris equis* and *Gastrodiscus aegypticus* are the major gastrointestinal parasites affecting different equines species. From those, strongyle had the highest relative prevalence, than other parasites under the study area. The results also showed, GIT parasite infection was highly prevalent in donkeys, in female, in old and in poor body condition animal where as age and species of animal was not significantly associated with prevalence of GIT parasites. Although equines considerably contribute to the existing rural and urban economy of nation, they received less attention in terms of feeding, health and management cares.

Based on the above conclusion, the following recommendations are forwarded:

- Public awareness creation to equine owners on proper deworming, sufficient feed supply, balancing of the work load and duration and minimizing extensive open grazing of equine is important.
- To get clear epidemiological picture of parasitic helminthes and to develop and practice integrated, cost effective and strategic treatment and control options pertinent to local situation a comprehensive study should be launched in the area.

REFERENCES

1. Alujia, A. and F. Lopez, 1991. Donkeys in Mexico. In: Fielding D and Pearson R A, (Editors). Donkeys, Mules and Horses in Tropical Agricultures Development, pp: 1-7.

2. Fielding, D. and Pearson, R. 1991. Donkeys, Mules and Horses in Tropical Agricultural Development Proceedings of the First International Colloquium, University of Edinburgh, UK Journal of Animal Science 3: 203-209.
3. Agajie, T., D. Tamirat, A. Pearson and T. Temesgen, 2000. Socio economic Circumstance of equines use and management in the rural and urban areas of central parts of Ethiopia. In: proceedings of the workshop on promoting the pre urban livelihood through better horse welfare and Management of Donkeys. Debre Zeit, Ethiopia, (Edinburgh, CTVM), pp: 16-18.
4. Central Statistical Authority, 2014/15. Federal democratic republic of Ethiopia, Agricultural Sample Survey, Report on Livestock and live stock characteristics. Addis Ababa, pp: 16-17.
5. Crane, M., 1997. Medical, In: Svendsen E.D (ed), The professional hand book of the donkey, 3rd edition, USA, pp: 19-36.
6. Urquhart, G., J. Armour, J. Duncan, A. Dunn and F. Jennings, 1996. Veterinary parasitology, 2nd ed., The Faculty of Veterinary Medicine, University of Glasgow, Scotland, pp: 4-57.
7. Asefa, Z., B. Kumsa, A. Gizachew and T. Merga, 2011. Endoparasites of donkeys in Sululta and Gefersa districts of Central Oromia, Ethiopia. Journal of Animal Veterinary. Adv., 10: 1850-1854.
8. Stoltenow, C. and C. Purdy, 2003. Internal Parasites of Horses. NDSU Extension Service, North Dakota State University of Agriculture and Applied Science and U.S. Department of Agriculture Cooperating, 543: 1-6.
9. Ramaswamy, N., 1994. Draught Animals and Welfare, Rev.Sci. Tech. Office of International Epizootics, 13: 195-216.
10. Radostitis, O., C. Gay, K. Hincchiff and P. Constable, 2007. Veterinary Medicine: A text book of the disease of cattle, sheep pigs, goats and horses, 10thedn. WB Saunders Elsevier, London, pp: 1556-1563.
11. Mansman, R., 1982. Equine medicine and surgery. 3rd edn. American Veterinary Publications: California, USA, 67.
12. Cribb, N., N. Coté, L. Bouré and A. Peregrine, 2006. Acute small intestinal obstruction associated with *Parascaris equorum* infection in young horses: 25 cases (1985-2004). New Zealand Veterinary Journal, 54: 338-343.
13. Clayton, H., 1986. Ascarids: recent advances veterinary clinical north. America: Equine Practice, 2: 313-328.
14. Svendsen, E., 1997. Parasites abroad. The professional handbook of the donkey. 3rdedn. Whittet Books Limited, London, pp: 166-182.
15. Socio-economic profile of East Shewa (last accessed 1 August, 2006. Government of Oromia Region.
16. <https://en.wikipedia.org/wiki/dugda>: Ethiopia October 10, 2017.
17. Ayele, G., G. Feseha, E. Bojiaand A. Joe, 2006. Prevalence of gastro-intestinal parasites of donkeys in Dugda Bora District, Ethiopia. Livestock Research for Rural Development, 18: 1-5.
18. Coles, G., C. Bauer, F. Borgsteede, S. Geerts, T. Klei, M. Taylor and P. Waller, 1992. World Association for the Advancement of Veterinary Parasitology Methods for the detection of anthelmintics resistance in nematodes of veterinary importance. Veterinary Parasitology, 44: 35-44.
19. Soulsby, E.J.L., 1982. Helminthes, arthropods and protozoa of domesticated animals. 7th edn. BailliereTindall, London, pp: 809-811.
20. Thrusfield, M., 2000. Veterinary Epidemiology. 3rd ed.UK: Blackwell Science Ltd., pp: 229-245.
21. Tesfu, N., B. Asrade, R. Abebe and S. Kasaye, 2014. Prevalence and Risk Factors of Gastrointestinal Nematode Parasites of Horse and Donkeys in Hawassa Town, Ethiopia. Journal of Veterinary Science & Technology, pp: 5-210.
22. Andarge, B., C. Muhammed and G. Tibesso, 2017. Prevalence of Major Intestinal Nematodes of Equines in Jimma Town, South Western Ethiopia. International Journal of veterinary science Oromia Agricultural Research Institute Batu, Oromia, Ethiopia, pp: 69-73.
23. Getahun, T. and T. Kassa, 2016. Prevalence and species of major gastrointestinal parasites of donkeys in Tenta Woreda, Amhara Regional State, Ethiopia Journal of veterinary Medicine and animal Health. Ethiopian Institute of Agricultural Research, Holeta Agricultural Research Center, Holeta, Ethiopia. pp: 24-27.
24. Ibrahim, N., T. Berhanu, B. Deressa and T. Tolosa, 2011. Survey of Prevalence of Helminths Parasites of Donkeys in and Around Hawassa Town, Southern Ethiopia. Global Veterinary. Science, 6: 223-227.
25. Yoseph, S., G. Feseha and W. Abebe, 2001. Survey on helminthosis of equines in Wonchi, Ethiopia. Journal of Ethiopian Veterinary Association, 5: 47-61.
26. Fikru, R., D. Reta, S. Teshale and M. Bizunesh, 2005. Prevalence of equine gastrointestinal parasites in western highlands of Oromia, Ethiopia. Bulletin of Animal Health and Production in Africa, 53: 161-166.

27. Wannas, H., K. Dawood and G.Gassem, 2012. Prevalence of Gastro-intestinal Parasites in Horses and Donkeys in Al Diwaniyah Governorate, AL-Qadisiya Journal of Veterinary Medical Science, 11: 841-855.
28. Wedajo, A. and T. Hadush, 2017. Prevalence of Gastrointestinal Nematode Parasites of Horses and Donkeys in and Around Sagure Town, Ethiopia. Middle-East Journal Application Science, 3: 16-22.
29. Samuel, E., A. Ashenafi, M. Natnael and B. Shiret, 2015. Prevalence of Gastrointestinal Nematode Parasitic Infections of Horses and Donkeys in and around Kombolcha Town. American-Eurasian Journal of Scientific Research, 10: 228-234.
30. Cirak, V. and E. Gulegen, 2005. The prevalence of strongyles infections and persistent efficacy of pyrantel embonate, Ivermectin and Moxidectin in Turkish horses. Turkish Journal Veterinary Animal Science, 29: 175-181.
31. Saeed, K., Z. Qadir, K. Ashraf and N. Ahmad, 2010. Role of intrinsic and extrinsic epidemiological factors on strongylosis in horse. The Journal of Animal and Plant Sciences, 20: 277-280.
32. Mezgebu, T., K. Tafess and F. Tamiru, 2013. Prevalence on gastrointestinal parasites of horse and donkeys in Gondar town, Ethiopia. Open Journal of Veterinary Medicine, 3: 267-272.
33. Reinemeyer, C.R. and M.K. Nielsen, 2009. Parasitism and colic. Vet. Clin North Am Equine Pract., 25: 233-245.
34. Gebreab, F., 1998. Helminths parasites of working equids, The African perspective. In: proceedings of the 8th international Conference on Infectious disease of Equines, Dubai, UAF, pp: 318-324.
35. Hendrix, C., 1998. Diagnostic veterinary parasitology. 2. London: Mosby.
36. Aftab, J., M. Khan, K. Pervez, M. Avais and J. Khan, 2005. Prevalence and Chemotherapy of Ectoparasites and Endoparasites in Rangers Horses at Lahore, Pakistan, International Journal Agricultural Biology, pp: 7-5.
37. Getachew, M., A. Trawford, G. Feseha and S. Reid, 2010. Gastrointestinal parasites of working donkeys of Ethiopia. Tropical Animal Health and Production, 42: 27-33.
38. Taye, A., 2017. Epidemiological Study on Equine Gastrointestinal Helminths Parasites in Mekelle, North Ethiopia. Open Journal of Veterinary Medicine, 7: 121-130.