Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.54, 2016

Prevalence of Strongyle Infection and Associated Risk Factors in Horse and Donkeys in and Around Batu Town, Eastshoa, Oromia Regional State, Ethiopia

Bariisoo Mangassa[1] Wubit Tafese[2]*
School of Veterinary Medicine, Jimma University, PO. Box 307 Jimma, Ethiopia.

Abstract
A Cross sectional study was conducted from November 2015 to April 2016 in and around Batu town to estimate the prevalence of strongyle infection and assess associated risk factors in the study area in donkeys and horses. A total of 384 animals were randomly selected from four different peasant associations in the study area and examined during the study period. Coprological examination for the detection of strongyle eggs was performed using floatation technique. The overall prevalence of strongyle parasites was 46.1% (177 from 384) with 44.5% in donkeys and 48.2% in horses. The study has also showed variation in prevalence of *strongyle* parasites among different body condition scores and between dewormed and non dewormed, higher prevalence was recorded in poor body condition (59.26%) and Non-dewormed (57.77%) respectively. In relation to selected Peasant association the prevalence were found 41.14%, 60.94%, 42.19% and 50% for Batu town, Bochessa, kontola and Germama respectively. The risk factors, peasant association, Age, Body condition, Feed, and Deworming Status were significantly associated with the occurrence of strongyle parasites ($p<0.05$). In conclusion the current study revealed that stronglosis was found to be the major problem in the study area; hence Strategic deworming and minimizing overworking and extensive open grazing should be implemented to reduce pasture contamination.
Keywords: Donkeys, Horses, Strongylosis, prevalence, risk factor, Batu.

INTRODUCTION

Currently there are about 112.5 million domestic equidae in the world of which 44.3 million donkeys, 58.5 million horses and the remaining are mules (FAO, 2013).The number of equines in Africa is in the range of 17.6 million comprising 11.6 million donkeys, 2.3 million mules and 3.7 million horses (Belay, 2006). In Ethiopia there are about 6.75 million donkeys being the second largest donkey population in the world next to China, 0.35 million mules and 1.91 million horses (CSA, 2013).

Equines play an important role in socio-economic development by providing drought power. Equids (donkeys, mules and horses) play an important role as working animals in many parts of the world, employed for packing, riding, carting and ploughing.Equine power is vital for both rural and urban transport system which is cheap and provides the best alternatives in places where the road network is insufficiently developed, the terrain is rugged and mountainous and in the cities where narrow streets prevent easy delivery of merchandise (Getachew *et al.,* 2008). Equines as a means of transport for men and materials provide live hood to a number of rural and semi urban population of the world. They have a prominent position in agricultural systems of many developing countries. It is suggested that donkey can play a great role in the frame works of food security and social equity of high food in secure countries. In areas away from roads, many people use mules and donkeys to transport food and other supplies to villages (Yoseph, *et al*,2008).Horses involved in pulling carts often work continuously for 6 to 7 hours/day, carrying 3 to 4 persons in a single trip. They are provided with grasses during the night and allowed to graze on pasture town fringe during the day and some horse owner provides only the grain or mixed. Donkeys often are involved in more multipurpose activities than horses. They transport goods to and from markets, farms, and shops, traveling long distances. They also pull carts carrying heavy loads 3 to 4 times their body weight. They work from 4 to 12 hours/day, depending on the season and type of work.

Equids are hosts to a great number of gastrointestinal parasite species, of which nematodes of the family Strongylidae, commonly called Strongyle nematodes or Strongyles, are the most important. These parasites are ubiquitous and live as adults in the large intestine of equids. Strongyle nematodes of equids (horse, donkey and zebra) are classified into the subfamilies Strongylinae and Cyathostominae, sometimes categorized as large and small Strongyles respectively. Among the helminthes, large Strongyles are most devastating parasites of equines (Urquhart, 1996). Infections caused by strongyles constitute a severe impediment to successful equine management due to debility and death of animals, particularly when heavy burdens are involved. Even light infections can affect the development and the performance of equines. The damage caused by large strongyles (Subfamily: Strongylinae) is well known. The adult worms produce lesions in the gut wall as they feed and larvae make destructive migrations in various tissues of the animal body . Strongylus vulgaris (S.vulgaris) stands out as being particularly dangerous because the larvae develop in the mesenteric arterial system causing arthritis and thrombosis with serious consequences (Ogburne and Duncan, 1985). Patterns of transmission vary greatly with climate and management therefore no worming program is universally applied (Dunsmore and Jusue,

1985) .Whatever these parasites are one of the diseases affecting equine, previous study on equine strongylosis (Horses and Donkeys) in and around Batu town was not reported.Therefore the primary objectives of this study were: To estimate the prevalence of strongyles parasites in Horses and Donkeys in and around Batu Town and assess the associated risk factors

MATERIALS AND METHODS

Description of Study Area

A cross sectional study was conducted from November, 2015 to April, 2016 in and around Batu town, Eastshoa, Oromia regional State, Ethiopia. Batu is a town and separate woreda(administrative structure) which is in Adami Tulu Jiddokombolcha districts (ATJK) in central Ethiopia. It is located on the road connecting Addis Ababa to Hawassa at latitude and longitude of 7º56ʺN and 38º43ʺE and it is about 163km away from Addis Ababa in southeast direction. The altitude of Batu varies from about 1500m to 1670m above mean sea level. It receives mean annual rainfall of 760to 1000 mm. The average annual temperature ranges from 22 to 28ºC and relative humidity of 60% .The agro-ecological zone of the area is semi-arid and sub-humid in which 90% of the area is lowland while the remaining 10% is intermediate (Kebede, 2010). Batu has a total area of about 8000hactares, which has been subdivided into four urban kebele (least administrative structure) administrations). The 2007 national census reported a total population for Batu of 43,660, of whom 22,956 were men and 20,704 were women. According to ATARDO, 2015/2016 report there are 163520 heads of Cattle,27021 heads of Sheep,82230 heads of Goats,31212 heads of donkeys,5380 heads of horse,1305 heads of mule and 114571heads of Poultryin Adami Tulu Jiddokombolcha districts and the equine population of Batu and its surroundings are estimated to be 4680 (2670 donkeys and 2010 horses).

Study population

The study populations were indigenous breeds of Horse and Donkeys managed under the traditional husbandry system and animals kept mainly for traction, transport and cart pulling in which samples taken from four different Peasant association (Batu town,Bochessa,Kontola and Germama).

Study Design and Sampling Technique

A cross-sectional study was carried out to determine the prevalence of *strongyle* parasites in horses' and donkeys. Purposive and systematic random sampling techniques were the sampling strategies used to collate all the necessary data from Batu town and the surrounding areas of the study animals. The Sample size required for the study was determined using the formula given by Thrusfield (2005) since there was no previous works. To calculate the sample size, 95% Confidence level, 50% expected prevalence and 5 % of desired absolute precision (d=0.05) was used.

$$n = \frac{(1.96)^2 pexp\,(1-pexp)}{d^2} = \frac{(1.96)^2 0.5\,(1-0.5)}{(0.05)^2} = 384$$

Where, n = required sample size, pexp = expected prevalence, d^2= desired absolute precision at 95% Confidence level. According to the above formula 384 animals were sampled.

Study Methodology

Details about Species, Sex, Age, Body condition, Type of feed and history of deworming or Non-deworming of the study animals were gathered appropriately. Animals examined were also grouped in to three age groups as young (<4 years), adult (4-9 years), Old (>9years) by dentition according to the modified method described by(Crane, 1997) .The body conditions was scored following the guideline set by Svendsen (1997.) as poor, medium and good.

Sample collection and Examination

Fresh fecal sample were collected randomly from horses and donkeys from selected sites in and around Batu town. The samples were collected from the rectum using disposable plastic gloves and during defecation when circumstance allow and placed in into universal bottles. Each sample was labeled with necessary information and immediately transported to ATARC Animal health Laboratory. Samples were kept in refrigerator at 4°C when immediate processing was not possible. But, it was processed within 48 hours. Some samples were held using10%formalin. Parasitological examination was done by qualitative flotation techniques (Souls by, 1992.) following the standard procedures for nematode parasites and examined microscopically (10× and 40×). Identification of the eggs was made based on the basis of their morphology (Urquhart *et al*, 2003)

Data Management and Analysis

The collected data was coded and entered in to the computer Microsoft excels and then Statistical analyses were

performed using SPSS version 20. Descriptive statistics was used to calculate prevalence; dividing the number of positive animals by the total number of animals and Logistic regression to measure association between prevalence of the parasites, Species, body condition, age, sex, feed and history of deworming category of animals. In all the analyses, confidence levels at 95% were calculated and a p-value is less than 0.05 was used for statistical significance association between variables and Odds Ratios was used to see the strength and direction of the association.

RESULTS

Out of 384 animals, horses (n=164) and donkeys (n=220) examined 177were found to be infected with strongyle parasites. The overall prevalence of strongyle infection for both species in the present study was 46.1 % (95% CI, 0.41- 0.51).

Table 3: Over all prevalence of Strongyle infection in Donkeys and Horses.

Species	Number examined	Number positive	prevalence	95%CI[lower-upper]	P-value
Donkeys	220	98	44.5%	[0.38-0.511]	0.481
Horses	164	79	48.2%	[0.405-0.558]	
Total	384	177	46.1%	[0.41-0.51]	

Out of animals sampled, (n=276) were males while about (n=108) of them were females. Having respective prevalence of 134(48.55%) and 433(9.81%) in male and female (Table 4) with no statistical difference between the two sexes (p=0.123).

The prevalence of stronglye infection was 62.86%, 41.42% and 37.23% in young, adult and old respectively (Table 4) with statistically significant variation among age groups (P=0.000). the prevalence of *strongle* parasite were 59.26%, 43.17% and 30.6% in poor, medium and good body condition scores, respectively with statistically significant difference among the different body condition scores (P=0.000). (Table 4). Out of 384 horse and donkeys sampled, 247, 73 and 64 were fed pasture, grain and mixed respectively. The Coprological prevalence among feed were 53.44%, 32.88% and 32.81% for pasture, grain and mixed respectively (Table 4) with statistically significant difference among the feed (P=0.001).

Prevalence of strongyle parasite infection was found to be 24.06% and 57.77% in dewormed and non-dewormed species, respectively and it's statistically significant (P=0.000). Thus, almost prevalence of strongle parasite was higher in non-dewormed animals. (Table 4).

Table 4: Prevalence of Strongyle infection regarding to associated risk factors

Risk factors	Number examined	Number positive	prevalence	OR	95%CI[lower-upper]	P-value
Species						
Donkeys	220	98	44.5%	0.935	[0.574-1.565]	0.481
Horses	164	79	48.2%	Ref	-	
Sex						
Male	276	134	48.55%	1.463	[0.866-2.473]	0.123
Female	108	43	39.81%	Ref	-	
Age						0.000
Young	105	66	62.86%	2.848	[1.64-4.95]	
Adult	169	70	41.42%	1.19	[0.727-1.95]	
Old	110	41	37.23%	Ref	-	
BCS						0.000
Poor	108	64	59.26%	3.29	[1.61-6.760]	
Medium	227	98	43.17%	1.72	[0.888-3.33]	
Good	49	15	30.61%	Ref		
Feed						0.001
Pasture	247	132	53.44%	2.35	[1.31-4.19]	
Grain	73	24	32.88%	0.926	[0.41-2.09]	
Mixed	64	21	32.81%	Ref	-	
Deworming status						
NDW	251	145	57.77%	Ref	-	0.000
DW	133	32	24.06%	0.268	[0.17-0.61]	
PAs						0.042
Batu town	192	79	41.14%	0.69	[0.396-1.234]	
Bochessa	64	39	60.94%	1.56	[0.773-3.15]	
Kontola	64	27	42.19%	0.729	[0.363-1.47]	
Germama	64	32	50%	Ref	-	
Total	***384***	***177***	***46.1%** [0.41-0.51]*			

*Ref =Reference DW=Dewormed **NDW=Non-dewormed***

DISCUSSION

In the current study, an overall of 46.1% prevalence of strongyle parasites with 44.55 % in donkeys and 48.17% in horses were found. The overall prevalence of current study is in line of agreement with works of Ashenafi *et al* (2015) who reported 47.4% in horse and donkey in and around Kombolcha town and that of Pandey (1990) with a prevalence of 48%. The 44.55% prevalence of Strongyles in donkeys and 48.2% in horses of the current study is higher than the result of Disassa, *et al* (2013) who reported, 5.82% and 4.92% in donkeys and horses in and around Dangila town. The low prevalence in and around dangile town may due to be the fact that the deworming program by Bahirdar donkey sunchery at the beginning and end of rainy season in the study area (Disassa *et al*., 2013)**.** The current report is less than the reports of Getachew *et al* (2010) from east shoa and Adaa, Akaki and Bost of Eastshoa that revealed 100% and 99% in donkeys and in horses and Hassan *et al*.(2004) in Sudan reported a higher prevalence of 99.15%. The report also lower than that of Feseha *et al* (1999) with a prevalence of 100% in donkeys and Tola.,*et al* (2013) in and around Gondar,Tesfu,*et al* (2014) in and around Hawassa town and Alemayehu and Etaferahu (2013) in south wollo zone who they reported 87.81%,76%,70.8%, in donkeys and 66.67%,64.9%,58.5% in horses respectively.

The prevalence of *Strongyle* eggs in horses was 48.17% in the current study which is in close agreement with 58.50% report of Saeed *et al* (2010) and that of Melkamu (2012) who reported 47.7% and higher as compared to the results of Samuel and Shiret (2010) who reported 27% in horses in and around Mekelle and that of Ashenafi *et al* (2015) who reported 36.8% in and around kombolcha. The current result is lower than work of Fikru *et al* (2005) who reported 91%. The lower prevalence in the present study could be due to some of the sampled horses of current study were less exposed to contamination area and in some cases totally restricted from contaminated pasture and dewormed regularly. In my study, strongyle infection is slightly higher in horses than in donkeys but no statistical significant difference was observed within two species ($p>0.05$).This insignificance agrees with that of Alemayehu and Etaferahu (2013).

Age was considered as a risk factor and higher prevalence (62.86%) observed in young animals while 41.42% and 37.23% prevalence observed in adult and old age groups respectively. This result in disagreement with works of sultan *et al* (2013) who reported 25.7%, 61% and 13.2% in young, adults and olds respectively. The difference prevalence among the different age groups was statistically significant in the current study ($P<0.05$). This is in harmony with Ashenafi *et al* (2015).But insignificant according to Alemayehu and Etaferahu (2013), Tesfu *et al*(2014) and Saeed(2010). The percentage prevalence of Strongyle parasite was higher in younger ages. Higher infection rates and more severe infections indicate a low immunity in younger population (Soulsby, 1992).

Body condition scores was found to be a major risk factor ($P <0.05$) in the prevalence of strongyle parasite infection. The prevalence according to body condition was 59.26%, 43.17%, and 30.6% in poor, medium and good body condition scores, respectively. This prevalence lower the findings of Tesfu *et al* (2014) that was reported 72.5%, 71.6%, and 70.7% in poor, medium and good body condition scores, respectively. Body condition score was significantly associated with the prevalence of the strongyle parasite and this agrees with the findings of FAO (1996.) Francisco *et al.* (2009) and Khallaayoune. (1991).This significant association might indicate that strongyle parasite is one of the factors for poor body condition score of the horses and donkeys. On top of this, the difference might indicate that the poor body condition animals are at high chance of acquiring the parasite as compared to the medium and good body condition animals because of the poor immunity due loss of body weight.

The feed of animals was found as a major factor for the variation ($P=<0.05$) in the prevalence of strongly parasite infection. The prevalence of 53.44%, 32.88% and 32.81% on pasture, grain and mixed was recorded, respectively. This result was lower than the works of Mezgebu *et al* (2013) who reported 97.14%, 80.43% and 83.33% in pasture, mixed and grain feeding respectively in and around Gondar town. The might be due to different climatic condition and seasonality of study.

History of deworming of the animals was found as a major risk factors for statistical variation ($P<0.05$) in the prevalence of the strongyle parasite. Higher prevalence was recorded in non-dewormed animals and lower prevalence in dewormed. The reason why dewormed equines infected might be either due to the anthelmintic used in the area for the treatment only temporarily suppress egg production of the adult worms or parasite may become resistant to anthelmintic used. It may also be related to the poor quality of anthelmintic used in the country. In contrast, 42.23% of non- dewormed animals were not infected by strongyle parasites; this might be due to development of acquired immunity from previous exposure (Blood *et al*., 1997; Urquhart *et al*., 1996) or it due to non-exposure to the infective stages of the parasites. Similarly, at the time of examination, the adult parasite might not shed eggs because either it is in the prepatent period which lasts about 5–7 months (Nielsen *et al* 2011) or larvae may become arrested (hypobiotic) for up to 5 months when there is unfavorable condition.

Different prevalence of strongyle parasite were found among the animals from different selected peasant association for study namely Batu ,(41.14%),Bochessa(60.94%),Kontola (42.19%) and Germama (50%).The relative high prevalence in bochessa was due to high humidity as a result of it is nearest to Lake Ziway ('Hara Dambel') and also presence of large Communal grazing land.

CONCLUSION

In present study high prevalence of equine Strongylosis was obtained when compared with prevalence reported by different researchers at different areas. Based on the results of the present study, the prevalence of equine stronyle was highest in young animals than the adult and old ones. In addition to this, higher infection rate was recorded in equines (horses and donkeys) with poor body conditions than in medium and good body animals it might be due to inadequate development of the immune system in young animals.The prevalence of infection rate was found higher in animals in non dewormed animals than in dewormed ones. The prevalence of infection rate was also found higher in animals feed on pasture than grain and mixed. More-over, as compared to other literature reports, body condition, age, deworming status, feed and origin of the animals were found to be the important risk factors associated with equine Strongylosis infection. Whereas, sex and species of the animals had no association with equine Strongylosis infestation in study animals. Owing to the huge equines population in the study area, considerable contamination to the communal pasture grazing system could be the other factor which favors the survival of the parasite. The findings of this study indicate that strategic deworming and rotational grazing programs are important.

REFERENCES

Alemayehu Regassa and Etaferahu Yimer (2013): Gastrointestinal Parasites of Equine in South Wollo Zone, North Eastern Ethiopia, *Global Veterinaria* **11** (6): 824-830.

Ashenafi, A., Samuel, E, .Natnael,M and Shiret,B.(2015):Prevalence of Gastro Intestinal Nematode Parasitic Infections of Horses and Donkeys in and Around Kombolcha town. *Journal of Scientific Research**10***: 228-234

ATARDO (2015/2016): Adamitulu Agricultural and Rural Development Office.

Belay, M.(2006):Preliminary study on helmenthosis of equines in south and north wollo zones. *Veterinary Parasitology, **140**: 289-295*.

Blood, D.C., Radiostitis, O.M., Gray and Hincheeliff, K.W. (2000): A text of book of the disease of Cattle, Sheep, Pigs and Horses. 8th Ed., Harcourt Publisher Ltd, London,Pp: 1246-1253.

Crane, M. (1997): Medical, In: E.D. Svendsen, (Ed.). The professional Hand Books of the Donkey. 3rd Ed., Whittet Books Limited, London, Pp: 29-31.

CSA (2013): Central Statistics Authority, Ethiopian Agricultural Sample survey

Disassa, H., Addise, A., Tilahun,Z and Girma,K(2013):Prevalence of Strongyle Infection in Horses and Donkeys in and Around Dangila Town, Northwest Ethiopia. *Acta Parasitologica Globalis, **6**:* 14-19

Dunsmore, J. and L.P. Jusue,(1985):Prevalence and epidemiology of the major gastrointestinal parasites of horses in Perth, Western Australia. Equine *Veterinary Journal, **17***: 208-213.

FAO (2013): Economic and social department. The statics division, online data base FAO

FAO (Food and Agricultural Organization) (1996): Production year books, FAO, Rome, Italy, Pp: 158

Feseha, G.G., Alemu,K., Friew,I.,Abule,Yand Ketema,A(1999):Donkey utilisation and management in Ethiopia.ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA), Wageningen. Donkey, People and Development, Pp: 46-52.

Fikru R, Teshale S and Bizuneh M (2005): Prevalence of Equine gastrointestinal parasites in Western highlands of Oromia, Ethiopia.*Bulletin of Animal Health and Production in Africa. **53***: 161-166.

Francisco, I., M. ArMorrondo, R. Sanchez-Andrade, P. Diez-Banosandias, F.J. Cortinas, R. Francisco, E. Mochales, V. Dacal, J.L. Suarez, J. Uriarte, P. A. Paz-Silva.(2009):Intrinsic Factors influencing the infection by helminth parasites in horses under an oceanic climate Area (NW Spain). *Journal. Parasitol Research*

Getachew, M.A., Trawford, G.,Feseha,G and Reid,J.S.W(2010):Gastrointestinal parasites of working donkeys of Ethiopia. *Tropical Animal Health and Production, **42***: 27-33

Getachew, M.G., Feseha, A.,Trawford, S.W and Reid, J (2008): A survey of seasonal patterns in strongyle faecal worm egg counts of working equids of the central midlands and lowlands, Ethiopia. *Tropical Animal Health and Production, **40*:** 637-642.

Hassan, T., Salih, M. and Abakar, A. (2004): A Survey of Gastrointestinal Nematodes of Donkeys. (Equus Asinus. In Khartoum State Sudan. Grace Publications Network. *Journal of Animal and Veterinary Advances **3**:* 736-739

Kebede, T. (2010): Assessment of on-farm breeding practices and estimation of genetic and phenotypic parameters for reproductive and survival traits in indigenous Arsi Bale goats. M.Sc. Thesis. Haramaya University. Dire Dewa, Ethiopia.Pp: 8

Khallaayoune, K. (1991): Benefit of strategic de worming program in working horses in Morocco. In worming program in working horses in Morocco. In fielding D and Pearson RA (eds). Donkeys, Mules and Horses in tropical agricultural development CTVM, Edinburgh, pp: 174-180.

Melkamu,S (2012):Study on the Prevalence of Equine Strongly in and Around Mersa Town of South Wollo Zone,

Amhara Regional State, Ethiopia ,International *Journal of Research and Innovations in Earth Science Volume **3***: 21-28

Mezgebu T, Tafess. K, Tamiru. F (2013): Prevalence of gastrointestinal parasites of horse and donkeys in Gondar town, Ethiopia. *Open Journal of veterinary Medicine **3***: 267-272.

Nielsen,C.,JKyvsgaarda,J.,Jenny,L.,Andreasena,L.,Luz,A.,Olivaresb,L.,Martin,KandJesper,M(2011):Prevalence of strongyles and efficacy of fenbendazole and ivermectin in working horses in El Sauce, Nicaragua. Veterinary Parasitology.**181**: 248– 254.

Ogbourne, C.P. and Duncan.J.H (1985): Strongylus vulgaris in the horse: its biology and veterinary importance (2nd edition).Common wealth Agricultural Bureaux, Farnham Royal, United Kingdom Misc. Publ. Inst. *Parasitol.* **4**: 68.

Pandey, V.S. and Eysker,M (1990):Internal parasites of donkeys from the high-veld of Zimbabwe,*veterinary Journal,**21***:27-32

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

Saeed, K., Qudir, Z., Ashraf, K and Ahmad, N (2010): Role of intrinsic and extrinsic epidemiological factors on strongylosis in horses. *Journal of Animal and Public Science, **20***: 277-280.

Samuel and Shiret,B (2010):Prevalence of major gastrointestinal parasites of horses in and around mekelle (quiha and wukro).*World Journal of Animal Science Research . **3***: 1 - 10

Soulsby,E.T.L.,(1992):Helimenthes,Arthropods and Protozoa of Domestic animals. 7thedn. Bailliere Tindall, London, UK, Pp: 688-723.

Sultan, A., Ayele, G., Tadesse,B and Ahmed,A (2013):Prevalence of gastrointestinal parasites of horses and donkeys in Kurfa Chale District, East Hararghe, Ethiopia *Livestock Research for Rural Development,**26**:119.*

Svendsen, E.D. (1997): Parasites abroad: The professional hand book of the donkey, 3rd Ed., Pp: 166-182

Tesfu N, Asrade,B, Abebe,R, Kasaye,S (2014): Prevalence and Risk Factors of Gastrointestinal Nematode Parasites of Horse and Donkeys in Hawassa Town, Ethiopia. *Journal Veterinary Science Technology,**5***: 156-166

Thrusfield, M. (2005): Veterinary epidemiology 3nd Ed., Veterinary Clinical Studies Royal (Dick) School of Veterinary Studies University of Edinburgh, Pp: 233.

Tola Mezgebu, Ketema Tafess and Firaol Tamiru (2013): Prevalence of Gastrointestinal Parasites of Horses and Donkeys in and around Gondar Town, Ethiopia *Open Journal of Veterinary Medicine* **3**:267-272.

Urquhart,G.M.,Armour, J.,Dunn,A.M and Jennings,F.W (2003): Veterinary parasitol.3th ed. Pp.: 4-78.

Urquhart,G.M.,Armour,J.,Duncan,J.I.,Dunn,A.M and Jennings,F.W (1996): Veterinary. Parasitology. 2nd ed. Blackwell Science Ltd., Oxford, Pp.: 42-4

Yoseph, S, mith, D. G. Mengistu, A. Teklu, F Firew, T. and Betere, Y.(2005):"Seasonal Variation in the Parasite Burden and Body Condition of Working Donkeys in East Shewa and West Shewa Regions of Ethiopia," *Tropical Animal Health and Production*, **37** (1). 35-45. http://dx.doi.org/10.1007/s11250-005-9004-3