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Coproscopic prevalence of major helminth parasites of horses and mules in and around Bishoftu town, Oromia, Ethiopia

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Abstract

A cross-sectional study was conducted from December 2021 to June 2022 in and around Bishoftu town of East Shewa zone of Oromia to determine the prevalence of major Helminths parasite of horses and mules and to assess the associated risk factors. Fecal samples were collected from 384 randomly selected equine (357 horses and 27 mules) and examined with flotation and sedimentation techniques. Majority of the animals were found harboring many GI-parasites like *Strongyles*, *Parascarisequoroum*, *Oxyurisequi*, *Fasciola spp* and mixed each other. The overall prevalence of internal parasites was 55.5% (213/384) with the occurrence rate of 66.7% and 54.6% in mules and horses respectively. From the risk factors, sex (p=0.044) and body condition score (p=0.009) were found to have significant association with the occurrence of the internal parasites, while these difference were insignificant (P>0.05) between the two species and ages of animals. The prevalence in horses and mules were 49.3% and 63.0% for *strongyles*, 7.8% and 18.5% for *Parascaris quorum*, 3.4% and 11.1% for *Oxyuris equi* and 0.8% and 0.0% for *Fasciola* spp respectively. There were also mixed infestations like *Strongyle* and *Parascaris equarum*, *strongyle* and *Oxyuris equi*, *strongyle* and *fasciola*, *strongyle*, *Parascarisequi* and *Oxyurisequi* with total prevalence of 4.9%, 2.6%, 0.5% and 0.8% respectively. A significant difference was observed (P<0.05) in prevalence of *strongyles*and BCS (*x2*=12.728; p=0.002); for *Parascarisequorum*betweenage (*x2*=54.79; p=0.000) and for *Oxyruis equis* between spp. (*x2*=4.016; p=0.045) and BCS (*x2*=6.129; p=0.047). The current study disclosed tha tless attention was given to the control of GI helminths of horse and mules in the study area Therefore, regular deworming, sufficient feed supply to equidsand minimizing extensive open grazing is be devised.

Keywords: Bishoftu; Horse; Helminths; Mule; Prevalence; Risk factors

Introduction

In the developing countries, there are estimated 110 million of equines. From this distribution pattern, 98% of donkeys, 97% of mules and 60% of horses are kept mainly for work (Belay, 2011). The population of equines in Africa is known to be 17.6 million (11.6 million donkeys, 2.3 million mules and 3.7 million horses) (Ayana *et al.*, 2019). In Ethiopia, 9.83 million equine populations are found. From this, donkeys accounts 7.04 million while horses and mules are 2.03 and 0.4 million respectively(CSA, 2014).

Equines play a key role in the agricultural economy of Ethiopia where there is poor infrastructure, in area of very rugged topography and where transportation by vehicle is inaccessible. They are used for pack transportation, riding, carting, threshing, milk and farm cultivation of many developing countries (Geresu *et al.,* 2014).Equines power in both rural and urban transport system is cheap and viable, providing the best alternative in places where the road network is insufficiently developed and the terrain is rugged and mountainous and in the cities where narrow streets prevent easy delivery of merchandise (Regassa and Yimer, 2013).

The epidemiology of gastrointestinal parasites in equines varied depending on the local climatic condition, such as humidity, temperature, rainfall, vegetation and management practices. These factors largely determine the incidence and severity of various parasitic diseases in a region (Tesfu *et al*., 2014).

Intestinal parasites such as helminth usually produce insidious diseases in animals. Infected horse may show signs of weakness, emaciation, restlessness, unthriftiness, diarrhea, anemia and sometimes intestinal obstruction or perforation (Umar *et al*., 2013). Equines owners may not easily detect the effect of gastrointestinal parasites because of the subclinical nature of the infections (Bedada and Bizuayehu, 2018). Thus, the sub-clinical nematode infections are responsible for significant economic losses. They are responsible for immune-suppression and enhancing the susceptibility of the animals to other diseases. Once the clinical diseases are noticed, such economic losses in terms of animal productivity have already occurred (Andarge*et al.,* 2017).

Some of the previous works recoded the status of GIT parasites in different parts of the country with various level of occurrence rate. Thus, it was reported that the prevalence of endo-parasites of equine in Sululta and Gefersa districts of Central Ethiopia with 99.5% *Strongyles*, 53% *Parascarisequorum*, 9.8% *fasciola* species, 5.7% *Gastrodiscus aegypticus* and 2.8%*Anoplocephala* species (Zerihun*et al.,* 2011) and 66.5% for *Strongyles*, 15.1%for *Parascarisequorum* and 5.2% for *Oxyurisequi*was reported by Asefa and Dulo(2017) in and around Bishoftu town. Getachew*et al*. (2010) also reported that prevalence of GIT parasite in Ethiopia with the prevalence of 99% of *Strongyles* spp, 80% of *Fasciola*, 51% of *Parascaris* and 8% of *Tapeworm*.

The prevalence and type of internal parasites affecting eqiuds, in general, are ubiquitous with equines being continually exposed throughout their live (Graber, 2011). Previous studies indicated that the prevalence and type of internal parasites of equines have been determined to a great extent in Ethiopia. Moreover, available information indicated that gastrointestinal parasites are the major causes of every demises of working equines in Ethiopia (Taye, 2017).Although some of the above-mentioned findings are recorded in the country and also some studies were conducted in the Bishoftu town on donkey, and both horses and donkeys.However, in the study area there was no more recent study on the prevalence and their associated risk factors of helminthparasites in horses and mules. Therefore, the objective of this study wasto determine the prevalence of major helminth parasites affecting horses and mules and assess the risk factors associated with their occurrences.

Materials and Methods

Study area

The study was conducted in and around Bishoftu town in Oromia, Ethiopia from December 2021 to June 2022. Bishoftu is located 45 km south East of Addis Ababa. It is found at 9°N latitude and 40°E longitude and at an altitude of 1850 meters above sea level in the central high lands of Ethiopia. It experiences a bimodal pattern of rainfall with the main rainy season extending from June to September (of which 84% of rain is expected) and a short rainy season from March to May with an average annual rainfall of 875mm. The mean annual minimum and maximum temperatures are 14°C and 26°C, respectively, with an overall average of 20°C. The mean relative humidity is 61.3% (CSA, 2005).

Study Design and animals

Across-sectional study was conducted on 384 randomly selected equines (horses and mules) in and around Bishoftu town. Information about the species, age, sex, and body condition score was recorded during sample collection. The age of the animals were determined by dentition and owners information. The sampled equines were grouped into two age categories; those animals with the age of less or equal to four($\leq$ 4) years were considered as young while those greater than four(>4) year was included as adults according to the classification of age groups by (Loch and Bradley, 1998). The body condition scoring of each animal was classified into three categories as poor, medium and good. Poor: Emaciated; ribs, spines and tuber coxae are very prominent. Medium: palpable spinous processes; but not prominent, skin and coat are generally in good condition. Good: Spine processes are not easily palpable, well- muscled, shiny coat, intact skin overcoat (Carroll and Huntington, 1988).

Sample size

The sample size was calculated according to Thrusfield(2018)by considering 50% expected prevalence since there was no previous work in study area and 5% absolute precision at 95 % confidence interval using the following formula.

$$N=\frac{1.96^2 p_{exp}(1-p_{exp})}{d^2}$$

Where, N = sample size
1.96 = the value of Z at 95% confidence interval
P exp = expected prevalence (50%)
d = desired absolute precision (5%)

Therefore, by substituting the values of the variables in the formula the sample size was determined to be 384 animals (Horses and mules) were examined.

Study methodology

Fecal samples were collected directly from the rectum into universal bottle using sterile disposable gloves. Each sample was labeled with necessary information and immediately transported to the parasitology laboratory of College of Veterinary Medicine and Agriculture, Addis Ababa University for coprological identification of parasite ova. Samples were kept in refrigerator at 4°C when immediate processing was not possible. But, it was processed within 48 hours. Parasitological examination was done by flotation and sedimentation techniques following the standard procedures for Nematode and Trematode (*Fasciola*) parasites and examined microscopically (10× and 40×). Identification of the eggs was made on the basis of their morphology (Soulsby, 1992).

Data management and analysis

The collected data were coded and entered into Microsoft Excel spread sheet. Statistical analyses were performed using SPSS, version 20 software packages. Percentage was used to calculate prevalence. Chi-square tests were applied to test the statistical association exists among different riskfactorssuch as; species, sex, age and body condition scoring with the occurrence of the infection. For all analyses, a P-value of less than 0.05 was taken as significant.

Results

Out of the 384 examined animals, 213 were positive for different parasites(GIT Nematodes and *Fasciola* parasites) and the overall prevalence was 55.5% and from the examined animals, 195 Horses and 18 Mules were positive with respective prevalence of 54.6% and 66.7% for different internal parasites(GIT Nematodes and *Fasciola* parasites)(Table 1).

Table 1: Overall coproscopicprevalence of helminths in horses and mules

Species of animal	No of examined Animals	Noof Positive Animals	Prevalence (%)
Horse	357	195	54.6
Mule	27	18	66.7
Total	384	213	55.5

Analysis of different risk factors with overall prevalence of helminthes parasites

Chi-square analysis of different risk factors showed that, between Sex of animals ($\chi 2$ =4.050, p=0.044) and Body condition score of animals ($\chi 2$ =9.353, p=0.009) were significantly associated with presence of internal parasites, however, between ages ($\chi 2$ =0.983, p=0.321)and species ($\chi 2$ =1.474, p=0.225) of animals was insignificantly associated with the prevalence of internal parasites (p>0.05) (Table 2).

Table 2: The association of different risk factors with overall prevalence of helminths parasites

Risk factors		No of examined animals	No (%) Positive	***χ2*-value**	P value
Species	Horse	357	195(54.6)	1.474	0.225
	Mule	27	18(66.7)		
Age	Young	97	58(59.8)	0.983	0.321
	Adult	287	155(54)		
Sex	Male	323	172(53.30)	4.050	0.044
	Female	61	41(67.2)		
Body Condition	Poor	52	39(75.0)	9.353	0.009
	Moderate	212	110(51.9)		
	Good	120	64(53.3)		

Relative proportions of eachhelminths parasite

During coprological examination, gastro intestinal nematodes and *fasciola* egg were found. These were*Strongyles, Parascarisequorum, Oxyurisequi, fasciola* and mixed infections of *Strongyle+ Parascarisequorum, Strongyles+ Oxyurisequi, strongyle + Fasciola* and *Strongyles+ Parascarisequorum+ Oxyurisequi* were identified. The highest percentage was recorded for *Strongyles*, followed by *Parascarisequorum*,*Oxyurisequi* and *Fasciola* egg and for mixed infections of *Strongyles + Parascaris, Strongyles + oxyurisequi, Strongyles + Parascarisequorum + Oxyurisequi and Strongyle + Fasciola* were 193(50.3%), 33(8.6%), 15(3.9%), 3(0.8%) and 19 (4.9%), 10(2.6%), 3(0.8) and 2(0.5%) respectively (Table 3).

Table 3: Prevalence of each and mixed infections of equine with intestinal nematodes and *fasciola* spp.

Genus of parasites	No of examined animals	Frequency of positive animals	Prevalence (%)
Strongyles	384	193	50.3
Parascaris	384	33	8.6
Oxyuris	384	15	3.9
Fasciola	384	3	0.8
Strongyle + Parascaris	384	19	4.9
Strongyle + Oxyuris	384	10	2.6
Strongyle + Fasciola	384	2	0.5
Strongyle + Parascaris + Oxyuris	384	3	0.8

Proportions of each parasites with Risk Factors

The highest prevalence of all the parasites was observed for *strongyles* infections in both species of mules (63%) and horses (49.3%) followed by *Parascarisequarum* (18.5%) and *Oxyurisequi* (11.1%) for mules, *Parascarisequarum*(7.8%), *Oxyurisequi* (3.4%) and *fasciola* egg (0.8%) for horses and *fasciola* egg (0.0%) for mules held their respective ranks in each species (Table 4)**.**

Strongyles (50.9%) have their highest prevalence in Adults while*Parascarisequarum*(26.8%), *Oxyurisequi*(5.2%) and*fasciola* (1.0%) were high in prevalence in youngs. *Strongyles* (59.0%), *Parascarisequarum* (13.1%), *Oxyurisequi* (6.6%) and *fasciola* (1.6%) are high prevalence in females.*Strongyles* found with highest prevalence in poor body conditions (73.1%) followed by good BCS (48.3%) and medium BCS (45.8%). *Parascarisequarum* held high prevalence in poor body conditions (11.5%) followed by good BCS (8.3%) and moderate body condition score (8.0%),*Oxyurisequi* has high prevalence in poor BCS (9.6) followed by medium BCS (3.8%) and good BCS (1.7%) and *fasciola*has high prevalence in poor BCS (1.9%) followed by medium BCS (0.9%) and there was no prevalence in good body condition scores (Table 4).

Table 4: The association of different risk factors with prevalence of helminth parasites

Parasites	Risk factors	Number of examined animals	No (%)Positive	χ^2-value	P value
Strongyles	Horse	357	176(49.3)	1.874	0.171
	Mule	27	17(63.0)		
	Young	97	47(48.5)	0.169	0.681
	Adult	287	146(50.9)		
	Male	323	157(48.6)	2.224	0.136
	Female	61	36(59.0)		
	Poor	52	38(73.1)	12.728	0.002
	Moderate	212	97(45.8)		
	Good	120	58(48.3)		

	Horse	357	28(7.8)	3.642	0.056
	Mule	27	5(18.5)		
	Young	97	26(26.8)	54.79	0.00
Parascaris	Adult	287	7(2.4)		
	Male	323	25(7.7)	1.89	0.17
	Female	61	8(13.1)		
	Poor	52	6(11.5)	0.674	0.714
	Moderate	212	17(8.0)		
	Good	120	10(8.3)		
	Horse	357	12(3.4)	4.016	0.045
	Mule	27	3(11.1)		
	Young	97	5(5.2)	0.539	0.463
	Adult	287	10(3.5)		
Oxyuris					
	Male	323	11(3.4)	1.358	0.244
	Female	61	4(6.6)		
	Poor	52	5(9.6)	6.129	0.047
	Moderate	212	8(3.8)		
	Good	120	2(1.7)		
	Horse	357	3(0.84)	0.229	0.633
	Mule	27	0(0.0)		
	Young	97	1(1.0)	0.104	0.747
	Adult	287	2(0.7)		
Fasciola					
	Male	323	2(0.62)	0.689	0.401
	Female	61	1(1.6)		
	Poor	52	1(1.9)	1.891	0.388
	Moderate	212	2(0.9)		
	Good	120	0(0.0)		

Discussion

The overall prevalence of 55.5% internal parasites recorded in the current study was relatively lower than in some previous reports by Gulima (2006) in the Awi Zone, Mezgebu *et al*. (2013) in and around Gondar and Regasa and Yimer (2013) in South Wollo Zone, show prevalence of84.4%, 92.71% and 70.4%, respectively. This difference can be due to variations in sampling time, as seasonality affects the appearance of parasites, accessibility to veterinary clinics, and deworming strategy of equines. In addition, accessibility of equines to grazing land, deworming habit of the cart pulling horses and giving supplementary feed to these animals affect its occurrence.

In this study, the prevalence of mules was 66.7% higher than that of horses 54.6%which was agrees with the prevalence of 72.3% in mules and 60.8% in horses by Regasa and Yimer (2013) in south wollo zones. Differences in prevalence may be due to differences in management in the area, because most of the horses in the area were better managed than mules. According to sex risk factors, 67.2% of female had a higher prevalence of endoparasites than male 53.3%. There is a statistically significant association with gastrointestinal parasites between equine sexes with a p-value of 0.044.Because of the fact that most of females are not used for cart as a result exposure to grazing is very high. This current study disagrees with the study of Hailuand Ashenafi (2013) in Arsi-Bale highlands of Oromia Region andMezgebu*et al*. (2013) in and around Gondar Town. Both showe insignificant results for sex under the study of internal gastrointestinal helminth parasites in equine having p > 0.05.This difference may be due to different study areas, seasonal variation in sampling times that affects the occurrence of the parasites, nutritional status of the animal, accessibility to veterinary clinics and deworming strategy of equines.

The highest prevalence of this gastrointestinal parasite was observed in 59.8% of young animals than 54.0% of adult animals. Although there is insignificant differences between animal ages (P> 0.05).Thisis agrees with the prevalence of equine internal parasite infection is insignificant (p>0.05) reported byBayou and Abu (2018)between two age groups because of care to management system, all animals are equally susceptible and which avoid communal grazing of animals of all age groups together.

The current study of gastrointestinal parasites shows that the prevalence of75.0% in poor BCS followed by53.3% good BCS and 51.9% moderate BCS, regarding the body condition. There is a statistically significant association between Body Condition scores with a p-value of 0.009.This is similar with report of Tesfu *et al.* (2014)in Hawassa town andAyana *et al. (*2019)in and Around Meki Town. This may be related to the fact that poor body condition animals have weakened immunity and as a result, could not resist the load of parasites compared to good body condition animals.

Different species of helminthic parasites identified in the current study, the relative percentage of internal parasitism reported in this study indicated that *strongyles* were the dominanting ones. The prevalence of 49.3% in horses and 63.0% in mules are found to be recorded in the study area and agrees with the work of Ciraket al (2005) in Turkish and Wannas (2012) who reported 68% and 58.50% strongyles in horses respectively, and also Andarge et al (2017)in Jimma Town who reported 63.72% and 51.85% in horses and mules respectively. The 49.3% and 63.0%respective prevalence of *Strongylus* in horses and mules in the current study was found to be lower than the previous 100% recorded prevalence of those parasites in equine at Wonchi area, Wollo zones and Western highland of Oromia province by Shiferawet al(2001); Mulate(2005); Regassaet al (2005) respectively. This may be related to difference in climatic condition and seasonality of the study area.

In the current study, the prevalence of *strongyles* was indicated that male equine species 48.6% and female equines species 59.0% were observed. This study revealed that there was not statically variation between the two sex groups of equine species (p>0.05). This means the present study shows that the prevalence of equine *strongyles* is not sex influences. This was agrees with the work of Jemal (2008) in and around Assela. The prevalence of *strongyles* was high in Horses and mules of poor BCS (73.1%) followed by good BCS (48.3%) and moderate BCS (45.8%). There is a significance variation (p<0.05) association between body condition scores (BCS) of in equine *strongylosis* infection. This reason may be associated with the fact that animals with poor BCS have waning immunity and as a result they could not resist the parasites burden when compared with animals of good BCS (Sapkota, 2009).

In the current study, *Parascarisequoroum* is the second most important helminthic parasite in

horses and mules, with a prevalence of 8.6%. Which was agree with the study by Taye (2017)in Mekelle. The prevalence of *Parascaris* in horses under current study was 7.8%, which is lower than reported by Mezgebu*et al*. (2013) in Gondar town,Berhanu *et al*. (2014) in Hawassa town, Chemeda *et al*.(2016) in and around Ambo Town and Asefa and Dulo (2017) in Bishoftu town, were 43.8%, 55.8%, 32.8% and 15.1% respectively. On the other hand, the prevalence of *Parascaris* was higherin this study than in the previous reports by Tesfu *et al*. (2014) in Hawasa and Belete and Derso (2015) in Mekelle Town with the infestation rate of 4.6%and 1.8% 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.

The prevalence of *Parascarisequorum*is higher in animals of young (26.8%) than adult (2.4%) in both horses and mules. There was a significance variation ($p<0.05$) association between equine age of *Parascarisequorum* infection and agrees with significant difference in the prevalence of P. equorum between age groups was reported by Zerihun (2008) in different areas of Ethiopia. This is because of Acquired resistance to *Parascarisequorum* usually develops before the second year of life and therefore, cases were highly reported from younger animals.

Oxyurisequi was found with the prevalence of 3.9% and this is agrees with Fikru *et al.* (2005); Ayele*et al*. (2006) which reported prevalence between 2% and 3%and also Regassa and Yimer(2013) which reported prevalence of 4%. The current finding was lower when compared with the work of Shiferaw *et al. (*2001); Chemeda *et al. (*2016) who reported 32.4% and 11.2% in Wonchi and Ambo respectively and relatively higher than the prevalence of 1.8% who reported by Dersema *et al*.(2006). 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 *Oxyurisequi* eggs. The parasite is ubiquitous but more prevalent in areas of high rainfall (Radostitis *et al.*, 2007).

The current prevalence of *Oxyurisequi*in horses is3.4% which is agree with the Regasa and Yimer (2013) who reports 3.8% in south wollo zone and lower than the previous reported of different areas of Ethiopia by Belete and Derso (2015);Chemeda *et al*.(2016); Asefa and Dulo (2017) the prevalence of 8.8%, 11.2% and 5.2% in Mekelle, in and around Ambo Town and Bishoftu respectively. However, it was higher than reports described 0.4% by Mezgebu *et al*. (2013) in Gondar. The prevalence of *Oxyurisequis* is higher in mules (11.1%) than horses (3.4%) and there is a significance variation ($p<0.05$) association between equine species (mules and horses). And also based on the BCS of *Oxyurisequis* is higher in animals of poor BCS (9.6%) followed moderate BCS (3.8%) and good BCS (1.7%) in both horses and mules. There are a significance variation ($p<0.05$) association between body condition scores (BCS) of in equine *Oxyurisequis* infection. The low prevalence in this study might be the effect of relative higher temperature in the study area which desiccates the highly susceptible *Oxyurisequi* eggs and this might be due to the effect of parasites on the body condition of animals.

The overall prevalence of *Fasciola hepatica* is 0.8% which seems it was relatively agree with the report of 2% by Getahun and Kassa (2016) in Tenta district Amhara region and 2.5% by Hailu(2016)in Tiyo District of Oromia Region and lower than the previous results, who reported by Eshete(2000); Tolossa and Ashenafi (2013) prevalence of 27.1%, 23.1% in Bahirdar and Arsi-Bale highlands respectively. Lower prevalence was recorded and this might be due to the differences in ecological conditions of the study areas.

The permanent dampness, suitable luminosity, basic Ph of soil, water and temperature contribute to the multiplicity of snails (Hammami and Ayadi, 1999) and presence of wide marshy and swampy vast communal grazing areas which is common in many part of Ethiopia and 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 has been reported by (Getachew *et al.,* 2010).

The current prevalence of *Fasciola* in horses was 0.8%, which is lower than the work of Ayana *et al*.(2017); Debere *et al*. (2018); Mathewos *et al*. (2021) who reported 24%, 30.6% and 13.7% prevalence in Holeta town andHawasa respectively. Comparative prevalence of equine *Fasciola* where 0.62% for male and 1.6% for female with not significance difference in this value (p>0.05)and there are also statistically insignificant differences (*P*>0.05) in the prevalence of equine fasciolosis between age groups (young *Vs* adult), species of equines (horses *Vs* mules) and BCS (poor Vs moderate Vs good). This insignificance might be due to the fact that all equines were equally exposed to infection and susceptible and due to less attention given to fasciolosis while treating of equines.

Conclusion and Recommendations

The prevalence was found to be 66.7% and 54.6% in mules and horses respectively. The common equine parasites recorded in the current study area were *Strongyles*, *Parascarisequorum*, *Oxyurisequi* and *Fasciola*. Among the identified GIT parasites, the highest relative percentage was recorded for *Strongyles* while less occurrence rate was observed for *Parascarisequorum* followed by *Oxyurisequi* and *Fasciola*. It was also observed that species, age, sex and body condition scores were found to be the important risk factors for the occurrence of Helminths parasite in equine. The prevalence of major helminths of horse and mules in the study area was lower than many other previous reports in different parts of Ethiopia. However, the problem due to gastrointestinal helminths of horses and mules in the study area was given less attention because of its sub clinical in nature. Further study should be conducted in consideration of seasonality of helminth infection in order to design effective and integrated control programs. Education to equine owners on proper regular deworming, sufficient feed supply and minimizing extensive open grazing are also important.

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