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Gastrointestinal Parasites of Equine in South Wollo Zone, North Eastern Ethiopia

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Abstract: A cross-sectional study was conducted from November 2011 up to March 2012 in North Eastern Ethiopia to estimate the prevalence of equine gastrointestinal (GIT) parasites and their mean egg count and to assess the associated risk factors. Fecal samples were collected from 385 randomly selected equine (154 donkeys, 130 horses, 101 mules) and examined with direct smear, flotation, sedimentation and McMaster techniques. The overall prevalence of GIT parasites was 70.4% (271/385) with the occurrence rate of 77.3%, 72.3% and 60.8 % in donkey, mule and horse, respectively. The occurrence of parasitic infection between horse and mule (x^2 = 11.5, p = 0.045) and horse and donkey (x^2 = 16.5, p = 0.001) significantly varied. The prevalence in donkeys, horses and mules were 70.9%, 58.5% and 67.3% for strongyles, 10.4%, 5.4% and 3.0% for *Parascaris quorum*, 4.5%, 3.8% and 4.0% for *Oxyuris equi* and 5.2%, 9.2% and 5.9% for Fasciola, respectively. The important risk factors for the occurrence of fasciolosis were sex (x^2=6; p=0.014), origin of the animals (x^2=21.6; p=0.000), body condition score (x^2=6.7; p=0.035); for *Oxyruis equis*: age (x^2=24.8; p=0.000) and body condition score (x^2=10.4; p=0.006); for parascaris: age (x^2=67.5; p=0.000); and for strongyles: body condition score (x^2=51.7; p=0.000) and purpose of keeping the animals (x^2=8.4; p=0.014). The likelihood of occurrence GIT parasites infection in male (OR = 2.4, 95%CI = 1.3, 4.6), age <3 years (OR = 3.8, 95%CI = 1.2, 12), animals used for packing (OR = 4.1, 95%CI = 1.1, 14.9) and for pack and transportation (OR = 3.1, 95%CI = 1.1, 9.2) and animals with poor (OR= 18.6, 95%CI =7.6, 45) and moderate (OR=3, 95%CI =1.3, 6.7) body condition score were found to be higher than the respective categories. Significant difference was observed in the mean egg count among the age categories (F = 11.44, p = 0.000), purpose of for which the animals were kept (F = 4.78, p = 0.009) and the body condition score of the animals (F = 7, p = 0.000). In conclusion, this work avail important information about the status of equine GIT parasites and associated risk factors.

Key words: Equine · GIT parasites · Mean Egg Count · Prevalence · Risk Factors · Ethiopia

INTRODUCTION

In Ethiopia, there are an estimated 5.2 million donkeys, 2.5 million horses and 0.5 million mules [1]. Equines play a key role in the agricultural economy of the country 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 meat production for human consumption and farm cultivation of many developing countries [2]. They appear to be an affective in assisting women both in domestic responsibilities and income generation activities, which otherwise they may not have had access. It was also mentioned that in Ethiopia, the low level development of the road transports and the rough terrain of the country make the equines to be the most valuable, appropriate and affordable pack animals under the small holder farming system [3]. Although there are large numbers of equines in the country with the great contributions to national economy, certain impediments hinder the maximum utilization of these animals to their potential. Some of these are the abundantly occurring infectious and parasitic diseases and the poor management system to these animals in the country [4]. Of the diseases that cause serious problems, parasitism represents a major impact on equine production in the tropic. Equines harbor a large quantity of parasite that prevail in the GIT including round worms (families: Stronglidae, Spiruridae, oxyuridae, Trichostronglidae and Ascaridae) and tapeworm (family: Anopiocephalidae) which act up and damage the intestine depend on the age and natural defense of the individual equine [5].

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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% *Parascaris equorum*, 9,8% fasciola species, 5.7% *Gastrodiscus aegypticus* and 2.8% Anoplocephala species [6]. Getachew *et al*. [7] 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*. Although some of the above-mentioned findings are recorded in the country so far, scarce information is available especially in the current study area. Hence, this research work was designed with the objectives of estimating the prevalence of equine GIT parasites, estimating the level of infection based on the count of eggs per gram of faeces and assessing the associated risk factor of the equine GIT parasites.

MATERIALS AND METHODS

Study area Description: The study was conducted at Dessie and Kombolcha districts, located in the northeastern parts of the country at 398 km and 375 km, respectively, from Addis Ababa. The altitude of the area ranges from 1500 to 1840m above sea level with agro-ecological proportions of 14% high altitude, 34% mid altitude and 52% low altitude.

Study Type and Study Animals: A cross-sectional study was conducted on 385 equine species (154 donkey, 130 horse and 101 mules).

Sample Size and Sampling Procedure: The sample size was determined using the formula for simple random sampling [8]. In this calculation, the expected prevalence of 49.4% reported by Regassa *et al*. [9] in Western highland of Oromia was used. Hence, the sample size was calculated to be 385 from which 150 donkeys, 101 mules and 130 horses proportionally sampled and included in the study. All the equines that were found in the household were included in the study.

Study Methodology: Fecal samples were collected from the animals that were not dewormed for at least three month, which was screened based on the owner interview. Samples were collected directly from rectum in clean plastic bags, labeled and kept in icebox and immediately transported to parasitology laboratory of Kombolcha Regional Laboratory and examined. The employed fecal examination techniques were direct smear, sedimentation and floatation. Egg counts were also conducted using McMaster Technique [10]. During sample collection various potential risk factors including sex, age, area, purpose of keeping these animals and body condition score were recorded. The age of equine was determined by dentition using the given standard [11] and body condition scores were also estimated based on the published guideline [12]. Equines were grouped into three age categories, under 3 years of age were classed as young (n= 45), those in range of 4 to 8 years grouped as adult (n=295) and those above 9 years were classified as old (n= 45).

Data Management and Analysis: Confidence interval and p-value was employed to assess the presence of association and Odds Ratios was used to see the strength and direction of this association using STATA statistical soft ware version 9. Additionally, the Analysis of Variance (ANOVA) was used to compare the average mean egg count and within categories difference was analyzed using *post hoc Bonferroni* multiple comparisons test.

RESULTS

Prevalence: The overall prevalence of gastrointestinal (GIT) parasites of equine in the study area was found to be 70.4% (271/385) with the prevalence of 77.3%, 72.3% and 60.3% in donkey, mule and horse, respectively. The chi-square analysis revealed the existence of significant difference in the occurrence of parasitic infection among the equine species between horse and mule ($x^2 = 11.5$, $p = 0.045$), horse and donkey ($x^2 = 16.5$, $p = 0.001$) while there was no significant difference observed between mule and donkey (Table 1).

Relative Proportion of Each Parasite: Among the identified gastrointestinal parasites, the highest relative percentage was recorded for Strongyles (74.9%, 203/271) followed by Parascaris (3.3%, 9/271), Fasciola (2.2%, 6/271) and *Oxyuris equi* (1.1%, 3/271). Similarly, the highest rate of double infection was observed in case of S*trongyles and Fasciola* (7.4%, 20/271) followed by *Strongyles* and *Parascaris* (6.3%, 13/271) and *Strongyles and Oxyuris equi* (4.8%, 17/271) (Table 2).

Proportion of Each Parasite with Risk Factors: The highest prevalence of all the isolated parasites was observed in donkey except for fasciola in which case a relatively higher percentage was observed in horse. The prevalence in donkeys, horses and mules were 70.9%,

Table 1: The prevalence of gastro intestinal parasite in the three species

Equine Species	Number examined	Number positive	Prevalence (95%CI)	x^2 (p-value)
Horse	130	79	60.8 (51.8, 69.1)	11.5 (0.045)
Mule	101	73	72.3 (62.4, 80.5)	16.5(0.001)
Donkey	154	119	77.3 (69.7, 83.5)	5.0 (0.224)
Total	385	271	70.4 (65.5, 74.9)	

Table 2: The relative proportion of the gastro intestinal parasites in the three species

Species of parasites	Number of positive	Relative Percentage
Strongyles	203	74.9
Parascaris	9	3.3
Fasciola	6	2.2
Oxyuris equis	3	1.1
Strongyles and Fasciola	20	7.4
Strongyles and Oxyuris equis	13	4.8
Strongyles and Parascaris	17	6.3
Total	271	

Table 3: The prevalence of each gastrointestinal parasite with respective categories of the risk factors in the study area

		Strongyles		*Parascaris equorum*		*Oxyruis equis*		Fasciola	
Risk factors	Number examined	Number (%) positive	x^2 (p value)	Number(%) positive	x^2 (p value)	Number (%) positive	x^2 (p value)	Number (%) positive	x^2 (p value)
Species									
Donkey	154	109 (70.8)	4.9	16 (10.4)	5.9	7 (4.5)	0.1 (0.951)	8 (5.2)	2.0
Horse	130	76 (58.5)	(0.079)	7 (5.4)	(0.051)	5 (3.8)		12 (9.2)	(0.378)
Mule	101	68 (67.3)		3 (3.0)		2 (4.0)		6 (5.9)	
Sex									
Female	89	57 (64.0)	0.15	7 (7.9)	0.26	2 (2.3)	1.0	11 (12.4)	6.0
Male	296	196 (66.2)	(0.701)	19 (9.7)	(0.608)	14 (4.7)	(0.319)	15 (5.0)	(0.014)
Age									
<3 years	45	29 (64.4)	2.2	16 (35.6)	67.5	8 (17.9)	24.8	5 (11.1)	2.2
4-8 years	295	190 (64.4)	(0.331)	8 (2.7)	(0.000)	8 (2.7)	(0.000)	17 (5.7)	(0.335)
>9 years	45	34 (75.6)		2 (4.5)		0		4 (8.8)	
Area									
Borumeda	131	86 (65.6)	0.1	9 (6.8)	0.17	5 (3.8)	0.4	19 (14.5)	21.6
Kombolcha	137	89 (65)	(0.959)	10 (7.3)	(0.918)	5 (3.6)	(0.814)	7 (5.1)	(0.000)
Degan	117	78 (66.7)		7 (6)		6 (5.1)		0	
Purpose									
Cartpull	64	32 (50)	8.4	0	6.0	1 (1.6)	1.3	4 (6.3)	0.1
Packing	283	195 (68.9)	(0.014)	22 (7.8)	(0.501)	13 (4.6)	(0.528)	19 (6.7)	(0.944)
Pack/Transp	38	26 (68.4)		4 (10.5)		2 (5.1)		3 (8)	
BSC									
Poor	95	81 (85.2)	51.7	10 (10.5)	4.0	9 (9.5)	10.4	8 (8.4)	6.7
Moderate	215	147 (68.4)	(0.000)	14 (6.5)	(0.129)	7 (3.3)	(0.006)	18 (8.3)	(0.035)
Good	75	25 (33.3)		2 (2.7)		0		0	

58.5% and 67.3% for strongyles, 10.4%, 5.4% and 3.0% for *Parascaris quorum*, 4.5%, 3.8% and 4.0% for *Oxyuris equi* and 5.2%, 9.2% and 5.9% for Fasciola, respectively. Fasciolosis prevalence significantly varied between sexes (x^2=6; p=0.014), origin of the animals (x^2=21.6; p=0.000) and the body condition score (x^2=6.7; p=0.035) while the significant variation in the occurrence rate of *Oxyruis equis* was observed among the age categories (x^2=24.8; p=0.000) and the body condition score (x^2=10.4; p=0.006). Similarly, it was observed that age was the important factor for the variation in the occurrence rate of parascaris (x^2=67.5; p=0.000) while the occurrence of strongyles was significantly influenced by body condition score (x^2=51.7; p=0.000) and the purpose for which the animals were kept (x^2=8.4; p=0.014) (Table 3).

Analysis of Risk Factors: The logistic regression analysis of the risk factors indicated the presence of strong association between the occurrence of infection and among the species of animals, age, purpose for which the animals were kept, body condition score and between the sexes ($p < 0.05$). Hence, the likelihood of occurrence of infection of GIT parasites in male (OR = 2.4, 95%CI = 1.3, 4.6), age <3 years (OR = 3.8, 95%CI = 1.2, 12), animals used

Table 4: Univariate and multivariable logistic regression analysis of potential risk factors in association with occurrence of gastrointestinal parasitism in equine

			Univariate Analysis		Multivariable Analysis	
Risk factor	Number examined	Number (%) positive	Crude OR (95%)	P -value	Adjusted OR (95%)	p-value
Sex						
Female	89	61 (68.5)	1	0.663	1	0.008
Male	296	210 (70.9)	1.1 (0.7, 1.9)		2.4 (1.3, 4.6)	
Age						
<3 years	45	41(91.1)	1		1	
4-8 years	295	195 (66.1)	5.2 (1.8, 1.5)	0.002	3.8 (1.2, 12)	0.021
>9 years	45	35 (77.8)	2.9 (0.8,10.2)	0.910	1.5 (0.4,6.2)	0.551
Area						
Borumedia	131	94 (76.6)	1		1	
Kombolcha	137	95 (69.3)	1.1 (0.7,1.9)	0.665	1.3 (0.7, 2.6)	0.428
Degan	117	82 (70.1)	1.1 (0.6,1.9)	0.772	1.1 (0.5,2)	0.883
Purpose						
Cart pulling	64	32(50.0)	1		1	
Packing	283	212 (74.9%)	3.0 (1.7, 5.2)	0.000	4.1 (1.1, 14.9)	0.028
Pack/Trans	38	27 (71.0%)	2.5 (1.5, 8)	0.040	3.1 (1.1, 9.2)	0.032
BCS						
Poor	95	86 (90.5%)	1		1	
Moderate	215	159 74.0%)	3.4 (1.6, 7.1)	0.020	18.6 (7.6,45)	0.005
Good	75	26 (34.7%)	1.8 (7.8, 41.5)	0.000	3 (1.3,6.7)	0.000

Table 5: Analysis of difference in Mean EPG Count of equine GIT parasites with Bonferroni Multiple Comparisons Test along with various potential risk factors

						Bonferroni multiplecomparisons test	
Risk factor	Number of animals	Mean	SD	F	p -value	Categories	P-value
Species							
Donkey	151	761	924	1.61	0.2013		
Horse	129	590	844				
Mule	96	628	654				
Sex							
Female	86	686	843	0.05	0.8235		
Male	290	663	835				
Age							
<3 years	40	1250	1356	11.44	0.000	age <3 and age 4-8	0.000
4-8 years	292	600	737			age <3 and age >9	0.001
>9 years	44	591	628			age <9 and age 4-8	1.000
Area							
Borumedia	126	755	911	2.92	0.055		
Kombolcha	134	720	959				
Degan	116	515	529				
Purpose							
Cart pulling	64	381	564	4.78	0.009	Cart-pull and packing	0.006
Packing	274	736	901			Cart pull and both	0.301
Both Pack/Transport	38	660	613			Packing and both	1.000
BCS							
Poor	92	1417	1191	77.88	0.000	Poor and medium BCS	0.000
Medium	209	532	498			Poor and good BCS	0.000
Good	75	131	239			Medium and good BCS	0.000

EPG = Egg per gram

for packing (OR = 4.1, 95%CI = 1.1, 14.9) and for pack and transportation (OR = 3.1, 95%CI = 1.1, 9.2) and animals with poor (OR= 18.6, 95%CI =7.6, 45) and moderate (OR=3, 95%CI =1.3, 6.7) body condition score were found to be higher than the respective categories. On the other hand, no significant difference was observed in the prevalence of GIT parasites with the study areas (Table 4).

EPG Count: The mean eggs count analyzed by analysis of variance indicated the existence of significant difference in the mean egg count among the age categories (F = 11.44, p = 0.000), purpose of for which the animals were kept (F = 4.78, p = 0.009) and the body condition score of the animals (F = 77.88, p = 0.000). Further examination of *post hoc Bonferroni* multiple comparisons test indicated that the mean egg count is significantly higher in equine of age below 3 years (p = 0.000, EPG=1250) and 4-8 years old (p = 0.001, EPG= 600). On the other hand, EPG mean comparisons between the age group of 4-8 years and >9 years did not show significant difference (p = 1.000, Mean EPG= 591). Concerning the purpose of keeping these animals, significant (p = 0.006) difference in EPG count was observed between the counts of equine used for cart pulling (average EPG = 381) and that used for packing (average EPG = 736), while the rest two comparison did not reveal any significant associations. Likewise, *Bonferroni* multiple comparisons test indicated the existence of significant difference (p = 0.000) in the EPG count between all the categories of body condition score as indicated in Table 5: between poor and medium BCS, between poor and good BCS and between medium and good BCS.

DISCUSSTION

The overall prevalence of GIT parasites (70.4%) recorded in the current study was relatively lower than some of the earlier reports of 92.71% [13], 96.9% [14], 98.2% [15] and 84.4% [16] at around Gonder, around Hawassa Town, Dugda Bora District and Awi Zone, respectively. This difference could be attributed to the variation in sampling time as seasonality affects the occurrence of the parasites. Additionally, 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, relatively higher overall prevalence of GIT parasites was recorded in donkey (77.3%) than in mule (72.3%) and horses (60.8%). The occurrence rate of all the identified parasites, except fasciola, (Strongyles: 70.8%; Parascaris: 10.4%; *Oxyruis equis*: 4.5%) was higher in donkeys compared to other equine species. Mezgebu *et al*. [13] also reported similar finding that there is higher occurrence rate of GIT 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 is given to these animals that is by far lower than their workload.

The relative percentage of equine GIT parasitism reported in this study indicated that strongyle was observed to have higher occurrence rate (74.9, 203/271) than other GIT parasites which is in line with the previous works [13, 15]. The 70.8%, 58.3% and 67.3% respective prevalence of Strongyles in donkey, horse and mule 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 [9], Wonchi area [17] and highland of Wollo Province [18]. On the other hand, Mezgebu *et al*. [13] reported lower prevalence of 87.81% in donkeys and 66.67% in horses, which is relatively similar with our current report.

The 10.4% prevalence of *Parascaris equorum* in donkeys in the current study is lower than the 17.3% prevalence reported at Western Ethiopia [9], 42.29% at Gonder, Northern Ethiopia [13] and 15.7% at central Ethiopia [17]. The prevalence of 5.4% parascaris *equorum* in horse is also relatively lower than some of the previous findings of 40% in central Ethiopia [3], 17.3% at Western Highland of Oromia [9], 43.8% at Gonder [13], 33.7% in Central Ethiopia [15], 11.7% Awi Zone [16] and 44% at North eastern Ethiopia [18]. This variation observed in these studies could be due to the variation in the length of the study period, the season of the study period and ecology of the study area. Mezgebu *et al.* [13] mentioned that the difference in prevalence of *Parascaris equorum* from different reports in developing countries is somewhat conflicting and this could be due to compromised immune responses relating to concurrent disease, but is worthy of further investigation.

Lowest prevalence of *Oxyuris equi* was recorded in this study with 4.5% in donkeys followed by 4.0% in mule and 3.8% horses. This finding is in agreement with some of the earlier reports in different areas including the 4.3% in donkeys and 0.95% in dorses in Gonder [13], 3% [15] and 2% [19] in donkeys in central Ethiopia and 2.1% prevalence in horses in Western parts of Ethiopia [9]. Similarly, Melissa *et al*. [20] reported 6.2% prevalence in horses in Lesotho.

In some cases, lowest prevalence of the GIT parasites may be recorded when there is relatively higher temperature in the area, which can result in the desiccation of their eggs. Furthermore, the effect of treatment can result in the lower occurrence of these parasites when there is deworming activities.

Regarding the risk factor analysis, higher prevalence was observed in male equines than in females. This could be associated with the more workload in males than females, which could create stress and consequent

immuno-suppration in male and this may facilitate the parasitism. In this study area, females usually have more cares as they use for breeding purpose. Our study also showed higher occurrence of parasitism in youngers (<3 years) than in older equines. This could be attributed to the earlier explanation by Radostits *et al*. [21] who reported that young ones do not have well organized immune system which can result in the higher chance of parasitism than in older equine.

Likewise, equine with poor body condition had higher chance of harboring the parasites. This could be due to the fact that animals with poor body condition might be immuno-compromised probably due to malnourishment and higher workload and as a result be exposed to parasitism. On the other hand, poor body condition score could also be due to the parasitism and in such case, body condition score is considered as a dependent factor not as a risk factor. However, in the current study we consider it as a risk factor for the parasitism under consideration. More prevalent helminthes parasites were in animals with poor body condition than well condition ones and similar work was reported by Ayele *et al*. [15].

Concerning the purposes for which the animals were kept, equine that was used for packing and transport was 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 groups of animals. There is a habit of giving especial care (for the equines used for cart pulling) such as deworming and supplementary feed. Moreover, the chance of grazing for these animals was less as they are on work, which actually reduce the chance of getting infection and cart-pulling equines feeding system was cut and carry while grazing was the less practice in the current study areas. Gebreab [3] and Regassa *et al*. [9] also reported similarly higher occurrence of parasitism in 'younger animals', whereas Getachew *et al*. [20] and Getachew *et al.* [22] reported the absence of associations between *P. equorum* infection and age in both horses and donkeys. Likewise, the recorded higher mean egg count among the young animals in the current study could be attributed to the fact that the young ones do not have well-organized immune system which result on the higher chance of parasitism which means there was higher egg production. Equines used for packing also found with high amount of eggs (EPG= 736) which might be due to lack of nutrition and consequent weakening of immunity and exposed GIT parasite and this is in consistent with the previous reports of [23] in Sweden. Similar situations observed in animals with, poor body condition scores (EPG= 1417).

In conclusion, study revealed the importance of equine GIT parasites with the overall prevalence of 70.4%. The prevalence was found to be 77.3%, 72.3% and 60.3% in donkeys, mules and horses respectively. The common equine GIT parasites recorded in the current study area Strongyles, *Parascaris equorum*, *Oxyuris equi* and Fasciola. Among the identified GIT parasites, the highest relative percentage was recorded for Strongyles while less occurrence rate was observed for *Parascaris equorum* followed by Fasciola and *Oxyuris equi.* It was also observed that species, age, purpose and body condition scores were found to be the important risk factors for the occurrence of GIT parasite in equine, which was assessed by their prevalence and mean eggs count.

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