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Prevalence of Equinehelminthiasis in Gedeb Hasassa District, Arsi Zone, South Eastern Ethiopia

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Abstract: A cross-sectional study was conducted from November 2014 to March 2015 with the objectives ofassessing the prevalence of equine helminthiasis and the associated risk factors in Gedeb Hasessa district. A total of 384 equines faecal samples were collected from horses (249), donkeys (99) and mules (36) and qualitative coprological fecalexamination were used for identification of eggs of helminthes. The overall prevalence of equine helminthiasis was 72.14% with the occurrence rate of 79.8%, 72.22% and 69.1 % in donkeys, mules and horses, respectively. Significant differences in prevalence were observed among age groups and body condition scores of equines (P<0.05). Qualitative fecal egg analysis revealed the highest prevalence of *Strongyles* spp (48.5%) and the least prevalence of *Dictyocaulus arnfieldi* (4.2%). *Anoplocephala* and *Oxyuris equi* species have shown significant difference among age groups and body condition scores of equines (P<0.05), while *Trichostrongylus axie* was statistically significant (P<0.05) among age group of equine. Based on the results of egg per gram faeces (EPG) counts, horses were severely infected with 8% of *Strongyles* spp., 1.1% of *Strongyliodwesteri* and 3.34% of *Parascaris equorum*, donkeys were severely infected with 5% *Strongyliodwesteri* and 10% *Parascaris equorum* and mules were severely infected with 33.3% *Strongyles* spp. Thus, our study revealed that gastrointestinal helminths are the major health problem of equines. It is recommended that to develop sustainable integrated diseases prevention and control through strategic deworming, rotational grazing and parasite species identification for proper dosing of antihelminthics.

Key words: *Anoplocephala* · Coprology · *Dictyocaulus arnfieldi* · *Oxyuris equi* · *Parascaris equorum* · Risk factors · *Strongyles* · *Trichostrongylus axie*

INTRODUCTION

Ethiopia has 21.7 million horses, 5.57 million donkeys (second largest in the world next to China) and 380 thousand mules [1]. In developing countries like Ethiopia, the contribution of equines in the energy scenario is the considerable significance as power source, for transportation, cultivation and post-harvest activities in places where the road network is insufficiently developed [2]. Only few regions in Northern, western and south eastern of Ethiopia use equines for ploughing and threshing of crops is practiced [3, 4].

As any other animal, equines are also vulnerable to a variety of diseases of biological origin, nutritional diseases or disorders and miscellaneous causes. Among which the most common entities leading to ill-health, suffering and early demise and finally death are infectious diseases and parasitism, which resulted in considerably reduced animals work output, reproductive performance and most of all their longevity [2].

Endo parasitic diseases dominated by gastro intestinal helminthes are the serious health problem contributing to poor body condition, reduced work out, poor reproductive performance and short life span. The deleterious effects of helminthes parasites on the equine hosts are well recognized globally and documented[5]. Large number of internal parasites has been identified in study done in some African countries including Ethiopia, Kenya, Zimbabwe, Burkina Faso and Morocco [3].

In Ethiopia various studies disclosed that *Strongyles*, *Parascaris equorum*, bot stomach worms, lungworms, tapeworms and liver flukes to be the most prevalent gastrointestinal parasites of equines [6]. In Ethiopia, equines are mainly found in highlands and middle

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altitudes. These altitudes are known by presence of fasciolosis and other parasitic diseases in livestock [2]. Despite the huge numbers of equine population and the increasing importance of equines in the Ethiopian economy, very little research relating to equine gastrointestinal helminths has been carried out in Ethiopia. Therefore, the aims of this study were to estimate the prevalence of gastrointestinal helminth infections in equines and to investigate the association between intensity of gastrointestinal helminths infection and risk factors in the study area.

MATERIALS AND METHODS

Study Area: The study was conducted in Oromia Regional State;West Arsi zone; GedebHasessa district which is located at 285km south east of Addis Ababa at altitude of 2300-3200m.a.s.l. The area covers 113500hectar in range lands. The area is bordered by different districts such as, Digalu and Tijo by north; Dodola by south; Kofale by west and Shirka by east. Topographically, it has 35% high land and 65% "mid land". It receives an annual range of rain fall from 600-700mm and the annual range of temperature from 5.7-23.8°C. It receives bimodal rainfall occurring from March to April (a short rainy season) and from July to October (long rainy season). It has a total of 64975 livestock of which 32858 were horses, 25651 donkeys and 742 mules.

Study Population: The study subjects include all grazing horses, donkeys and mules of different age groups and both sexes which are kept under traditional extensive production system in the study area. A total of 384 animals were sampled. Of these, 249 were horses, 99 donkeys and 36 mules.

The body condition of the selected animals was scored based on the criteria described by Pritchard *et al*. [7]. Body condition assessment was done by examining the animal from all sides without touching it. The equines body condition was scored as 0 to 5 (0 = very thin; 1 = thin, 2 = fair, 3 = good, 4 = fat and 5 = very fat). However, for the purpose of data analysis, body condition 0 to 5 was assigned to three distinct groups: Categories 0, 1 and 2 was grouped as "thin or poor", category 3 was defined as "medium" and body condition scores 4 and 5 was categorized as "good". The age of the selected donkeys and mules was determined from birth records of owners and by dentition [8]. Accordingly, donkeys and mules were grouped into three age categories: donkeys and mules from 1-2 years of age were classified as young; 3-10 years were considered as adult; and those beyond 10 years were classified as old. Whereas horses < 3 years were considered as young, while those 4-10 years were considered as adults and above 11 years were considered as old [9]. These age classes were based on age of first work, productive age and the life span of Ethiopian donkeys [6, 10].

Study Design: A cross-sectional study was conducted for determination of prevalence of equines GIT parasites by coprological examination.

Sample Size Determination: As previous study has not been conducted on equine gastrointestinal nematodes in the study area, the expected prevalence was assumed to be 50%. Therefore, the sample size calculated at 50% expected prevalence rate with a desired precision of 5% and 95% confidence interval was determined by using the formula given by Thrusfield [11].

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

were n = required sample size, Pexp = expected prevalence, d^2 = desired absolute precision. Therefore based on the above formula a total of 384 equine were examined.

Faecal Sample Collection: Faecal samples were taken directly from the rectum with strict sanitation using hand gloves and placed in air and water tight sample vials. The faecal samples labeled, preserved and then brought to Asella regional veterinary laboratory for coprological investigation.

Coprological Examination: The collected faecal specimens were processed and examined by qualitative coprological examination for identification of eggs of helminthes using egg morphology, shape and other visible structures [12]. Quantitative examinations of faecal samples were made using the modified McMaster technique following standard procedures. Those samples found positive for parasites were helminthes subjected to EPG counting. Intensity of infection were classified as light (1-500eggs), moderate (501-1000eggs) and high (>1001eggs) [13].

Data Analysis: The information and data collected on GI nematodes of cattle during the period were recorded in excel Sheet and analyzed using SPSS version 20. Prevalence was calculated using percentage. The

significance of association between and among the considered variables was determined using P-value, chi square (χ^2) test statistics. Association between variables was said to exist if the calculated level of significance is less than 5% (P<0.05) at 95% confidence level.

RESULTS

Overall Prevalence of Equine Helminthes During the Study Period among Risk Factors: Out of the total 384 equine species examined during the study period, a total of 277 (72.14%) were found positive for at least one helminthes parasites. The prevalence rate of 79.79%, 72.22% and 69.1% were observed in donkey, mule and horse species of equines, respectively. Statistical analysis showed that there was a highly significant variation (P<0.05) among age and body condition score groups whereas no significant difference was shown among age and between sex groups (Table 1).

Prevalence of Particular Helminthes Within Equine Species: The prevalence rate of 48.5%, 36.6%, 18.5%, 11.5%, 13%, 6.25%, 4.7% and 3.4% were observed in helminth parasite species of *Strongyles, Strongyloid westeri*, *P. equorum*, *T. axie*, *Anoplocephala* species, *Oxyuris equi*, *Fasciola* species and *D. arnfild* species (Table 2).

Comparison of the prevalence using species of animals revealed the percentage prevalence of equine helminthes to be higher in donkeys than in horses and mules. In equines, the prevalence of all identified parasites only *Anoplocephala* species were statistically significant between the three species groups (P<0.05). In contrast, all studied parasites were not statistically significant (P>0.05) between horses, donkeys and mules (Table 2).

Prevalence of Helminthes Parasite of Equines in Relation to Risk Factors: Age-wise comparison of studied animals for hosting one or more types of parasites showed varied prevalence. The prevalence of parasites was higher in younger and older than their adult counterparts. Among each parasites *P. equorum, T. axie* and *Anoplocephala* species were statistically significant between age groups (P<0.05) (Table 3).

Table 1: Prevalence of equine helminthes in relation to different risk factors

Risk Factors	№ examined	Prevalence (%)	□²	P-value
Species				
Horse	249	172(69.1)	4.051	0.132
Donkeys	99	79(79.79)		
Mules	36	26(72.22)		
Age				
1-2	139	109(78.41)	9.584	0.008
3-10	140	88(62.86)		
>10	105	80(76.2)		
Sex				
Male	224	157(69.78)	1.12	0.29
Female	160	120(75)		
Body condition score				
Poor	202	152(75.25)	7.70	0.021
Medium	146	106(72.6)		
Good	36	19(52.8)		

Table 2: Prevalence of species of helminthes within equine species

Species	Horse	Donkey	Mule		
Species	Prevalence (%)	Prevalence (%)	Prevalence (%)	□²	P-value
Strongyle	119(47.8)	50(50.5)	17(47.2)	0.23	0.89
S. westeri	88(35.34)	41(41.4)	12(33)	1.32	0.52
Oxyuris equi	15(6.02)	6(6.06)	3(8.33)	0.08	0.96
P. equorum	45(18.1)	19(19.2)	7(19.4)	0.2	0.96
T. axie	31(12.45)	10(10.1)	3(8.33)	0.77	0.68
D. arnfild	6(2.41)	5(5.05)	2(5.56)	2.1	0.35
Fasciola	10(4.02)	5(5.05)	3(8.33)	1.4	0.5
Anoplocephala	10(4.02)	5(5.05)	3(8.33)	7.2	0.028

Table 3: Age wise prevalence of species of helminth parasites

Age	Young	Adult	Old		
Species	Prevalence (%)	Prevalence (%)	Prevalence (%)	□²	P-value
Strongyle spp	73(52.52)	64(45.7)	49(46.67)	1.5	0.5
S. westeri	51(36.7)	51(36.43)	39(37.14)	0.013	0.99
O. equi	15(10.8)	4(2.86)	5(3.6)	0.58	0.75
P. equorum	26(18.7)	28(20)	17(16.2)	8.04	0.018
T. axie	19(13.67)	7(5.05)	18(12.94)	9.77	0.008
D. arnfild	6(4.32)	3(2.16)	4(2.88)	1.08	0.58
Fasciola	10(7.2)	3(2.16)	5(4.76)	3.98	0.14
Anoplocephala	31(22.3)	6(4.3)	13(12.38)	20.04	0.000

Table 4: Prevalence of species helminth parasite by sex groups

Sex	Male	Female		
Species	Prevalence (%)	Prevalence (%)	□²	P-value
Strongyle	105(46.87)	81(50.6)	0.53	0.47
Strongyliod westeri	83(37.05)	58(36.25)	0.23	0.87
O. equi	13(5.8)	11(6.87)	0.24	0.87
P. equorum	42(18.75)	29(18.13)	0.18	0.67
T. axie	27(12.05)	17(10.63)	0.19	0.66
D. arnfild	9(4.02)	4(2.5)	0.66	0.42
Fasciola	9(4.02)	9(5.63)	0.54	0.46
Anoplocephala	28(12.5)	22(13.75)	0.17	0.72

Table 5: Prevalence of species helminth parasite among body condition scores(BCS)

BCS	Poor	Medium	Good		
Species	Prevalence (%)	Prevalence (%)	Prevalence (%)	□²	P-value
Strongyle spps	96(47.52)	74(50.68)	16(4.44)	0.59	0.74
Strongyliodwesteri	72(35.64)	57(28.22)	12(33.33)	0.62	0.73
O. equi	18(8.91)	6(4.11)	0(0)	5.98	0.05
P. equorum	34(16.83)	30(20.55)	7(19.44)	0.80	0.67
T. axie	22(10.89)	17(11.64)	5(13.56)	0.28	0.87
D. arnfild	7(3.46)	4(2.74)	2(5.56)	0.71	0.70
Fasciola	11(5.45)	6(4.11)	1(2.78)	0.66	0.72
Anoplocephala spps	35(17.33)	11(7.53)	4(11.11)	7.3	0.02

Table 6: Mixed infection of species of helminth parasitesin equines

Types of parasites % +VE	
Strongyles spp and *S.westeri*	26.0%
Strongyles spp and *P.equorum*	11.9%
Strongyles spp and *T.axie*	7.6%
Strongyles spp and *Anoplocephala*spp	7.3%
Strongyles spp and *O.equi*	3.6%
S. westeri and *P. equorum*	7.8%
S. westeri and *Anoplocephala* spp	3.4%
P. equorum and *T. axie*	2.6%
P. equorum and *D. arnfild*	0.5%
Strongyles spp, *S. westeri* and *Anoplocephala* spp	2.3%
Strongyles spp, *P. equorum* and *Anoplocephala* spps	1.0%

In this study, the prevalence of all identified parasites were statistically not significant between the two sex groups (P>0.05) (Table 4).

In relation to BCS, the percentage prevalence of helminthic parasites was higher in animals with poor BCS and medium than animals with good BCS. *Anoplocephala* species were statistically significant among body condition of equines (P<0.05) (Table 5).

Mixed Infection of Helminthes among Equine Species: Significantlyhigh rate of mixed infection with at least two helmintheswas observed in equine with mixed prevalence

Table 7: Comparisons of eggs per gram of faeces among equine species

Species	Horse			Donkey			Mule		
Intensity	Low	Moderate	Sever	Low	Moderate	Sever	Low	Moderate	Sever
*Strongyles*p	29(33.3%)	15(17.2%)	7(8%)	7(35%)	4(20%)	0	0	1(33.3%)	1(33.3%)
S.westeri	32(36.8%)	0	1(1.1%)	7(35%)	0	1(5%)	0	0	0
O. equi	0	0	0	3(15%)	0	0	0	0	0
P.equorum	9(10.3%)	5(5.7%)	3(3.4%)	1(5%)	0	2(10%)	2(10%)	0	0
T.axie	9(10.3%)	0	0	0	0	0	1(33.3%)	0	0
Fasciola	3(3.4%)	0	0	0	0	0	0	0	0
Anoplocephala	5(5.7%)	0	0	2(10%)	0	0	0	0	0

of *Strongyles*spp and *S. westeri (*26.0%) and with mixed prevalence of *Strongyles*spp and *P. equorum* (11.9%) were observed in this study (Table 6).

Comparisons of Eggs per Gram of Faecesamong Equine Species: Based on the results of eggs per gram of fa*e*ces (EPG) counts in the study area, horses were severely infected with *Strongyles* spp (8%), *S.westeri* (1.1%) and *P. equorum* (3.34%), donkeys were severely infected with *S. westeri* (5%) and *P.equorum* (10%) and mules were severely infected with *Strongyles*spp (33.3%) (Table 7).

DISCUSSION

The present study using microscopic faecalexamination showed that helminthiasiswas an important equine health significant disease/condition in the study area. The overall prevalence of equine helminthes (72.14%) recorded in the current study was relatively lower than some of the earlier reports of Shiferaw *et al*. [6], Fikru, *et al*. [14], Ibrahim *et al.* [15], Mezgebu *et al.* [16], Adem and Bulla [17], Gulima [18] and Ayele *et al*. [19], who have reported the prevalence of helminthic parasites to be 100%, 100%, 96.9, 92.71, 89.9, 84.4 and 100% in donkeys of Wonchi, Highlands of Wollo province, around Hawassa Town, at around Gonder, in and around Asella, Awi Zone and Dugda Bora District, respectively. This difference could be attributed to the variation in sampling time as seasonality affects the occurrence of the parasites. The relative low occurrence of helminthic parasites in the study area might be associated with the agro-ecological differences, veterinary services provided by district veterinarians for equines and the diagnostic capacity of the parasitological technique used. Additionally, accessibility of equines to grazing land, deworming habit of the equines and giving supplementary feed to these animals affect its occurrence. In this study, relatively higher overall prevalence of helminthes parasites was recorded in donkey (79.79%) than in mule (72.22%) and horses (69.1%).

The insignificant difference and similarity in prevalence of helminthes parasite burden between species and sex groups within and among equine species is similar with work of Fikru *et al.* [14]. This could be due to equal exposure of all species and sex groups of equine in a mixed grazing system in the study area. Similar reasoning was given by Francisco *et al.* [20], Radostits *et al.* [21], Soulsby [12] in which the management systems such as mixed grazing are one of the risk factor for exposure and infection with helminthes. Our study also showed higher occurrence of parasitism in young (1-2 years) than in adult (3-10years) equines. This could be attributed to the earlier explanation by Radostits *et al*. [21], who reported that younger ones do not have well organized immune system which can result in the higher chance of parasitism than in adult equine.

Likewise, in the current study equine with poor body conditions had higher chance of harboring the parasites. More prevalent helminthes parasites were in animals with poor body condition than well condition ones and similar work was reported by Ayele *et al*. [19]. 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.

The occurrence rates of almost all the identified parasites werehighest in donkeys compared with other equine species. Mezgebu *et al*. [16] also reported similar finding that there is higher occurrence rate of GIT parasitism in donkeys (97.13%) than in horses (80.95%). This might be associated with negligence; donkeys were given less attention by their owners and were kept under poor management conditions than their counterparts, horses and mules (personal communication with the owners of equines) and mules may have higher resistance than donkeys.

The occurrence of 8 types of helminthic parasites in different percentage in the study area might also be associated with (1) suitable humidity and moisture provided by warm and wet conditions throughout the year for the eggs to develop to larval stage (L3) [22]; (2) temperature that was favorable for the development and maturation of the larvae of the most helminthic species [23] and (3) ample provision of water that facilitated the migration of larvae from manure to the herbage [24].

The relative percentage of equine helminthes reported in this study indicated that *Strongyle* species was observed to have higher occurrence rate than other helminth parasites which is in line with the previous works[16- 18].This might be due to suitability of marshy environment in the study area. Similar reasons were given by Urquhart *et al.* [25] in that marshy environments are suitable for developments of large *Strongyles* in their long pre-patent period which ensures that larvae acquired in one grazing season where it only reach maturity during the next season. The 50.5%, 47.8% and 47.2% respective prevalence of *Strongyles*spp 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 [26].

The highest prevalence of strongyles infestation seen in female donkeys and horses than their counterpart males was in agreement with the work of Sapkota [27] as they might have lower immunity due to gestation, lactation and stresses occurred during this period. Generally, it is assumed that sex is a determinant factor that influences the prevalence of parasitism. The highest prevalence of *Strongyles* infestation was seen in animals of old and young age in equines than in their adult. This finding was in agreement with the work of Ibrahim *et al*. [15] in Hawassa and its surrounding, Ethiopia, respectively. The probable reason may be due to waning body conditions and immunity.

The present 36.7% prevalence of *Strongyloideswesteri* among equine is nearly the same with 32% reported by Ayele *et al.* [19] in donkeys as determined by coproculture in Dugda Bora district in the same season. But it is higher than 7.3% finding of Adem and Bulla [17]. This difference might be due to difference in techniques of helminthesidentification, pre-patent period and the study areas. Similar reasoning was given by Soulsby [12].

The 18.9% *P. equorum* infection in equine species is in agreement with 17.3% findings of prevalence reported at Western Ethiopia [14]. This might be due to similarity in the topography and ecology of the study area. But it is lower than the work of Mezgebu *et al.* [16], who reported 42.29% at Gonder, Northern Ethiopia. The prevalence of 18.1% *Parascaris equorum* in horse is also lower than some of the previous findings of 40% in central Ethiopia [28]. 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.* [16] 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. Heavy infections of *P. equorum* cause impaction and perforation leading to fatal peritonitis [19, 25].

The 6.8% *Oxyuris equi* prevalence among equines was in agreement with 6% and 4.4% that reported by Ayele *et al.* [19] and Adem and Bulla [17] at Dugda Bora District in donkeys and in and around Asella in equines, respectively. Similarly, Melissa *et al*. [29] reported 6.2% prevalence in horses in Lesotho. The 12.45% prevalence of *Trichostrongylusaxei*among horses observed in this study was lower than the reports byBewketu [30], who reported 42.45% and 31.97 in donkeys and mules, respectively. This might be due to the difference of ecology of the study area which favors the maintenance of this parasite.

The current 5.8% prevalence of *Anaplocephala* species is found to be similar with 5.7% and 7.6% reports of Adem and Bulla [17] andAyele *et al.* [19] in equines and donkeys, respectively. This could be due to the seasonality of vectors which is the Orbited mites. Soulsby [12] indicated that the occurrence of *Anaplocephala* species is associated with the vector prevalence.

The 5.8% *Fasciola* species recorded in the present study was in agreement with Mezgebu *et al*. [16], who reported 5.7%. But, the prevalence of *Fasciola*spp was 5.05% in donkeys in the current study is lower than work of Getachew *et al.* [31], who reported 80% in donkeys. The lower prevalence of Fasciolaeggs in the current study compared to the reports of Getachew *et al.* [31] is due to the geographical location of the area which is not comfortable for the snail population, the intermediate host of *Fasciola*. Only very few areas, where summer tributaries are dried off are found to be swampy. As Hammami and Ayadi [32] have reported that permanent dampness, suitable luminosity, basic pH of the soil and water and temperature contribute to multiplicity of snails in a given ecology.

In other cases 1.5% and 1.04 *Fasciola* species were reported by Ayele *et al.* [19] and Adem and Bulla [17] in donkeys and equines, respectively.

The current prevalence of *D. arnfieldi*is 5.06% in mules nearly the same with the work of Bewketu [30], who reported 8.14% in mules in and around Bahir Dar and the prevalence of this parasite in donkeys was reported 9.67% in Turkey [33]. The donkey is the only natural host for this parasite.

The highest co-infection of equine species in the study area with *Strongyles* and *S. westeri* could be from agro ecology of the study area which favors the parasites. Similar idea was also generated by Radostits *et al.* [21] and explained that horses, donkeys and mules are host for high number of internal parasites. The horse is susceptible to more than 60 internal parasites and may harbor several species of worms at any one time [34]. Moreover, Hednrix and Charles [35] suggest that *Strongyles*are ubiquitous parasites in the world.

CONCLUSION

This study revealed that the parasites affecting equines were *Strongyles*spp, *S. westeri, P. equorum, O. equi*, *T. axei*, *D. arnfieldi*, *Anoplocephala*spp and *Fasciola*. Mostly the disease affects young animalsand equines with poor and medium body condition scores. In addition, absence of prophylactic and control strategy against invading parasite, poor management practice and the presence of favorable climatic situation for the development of these is parasites in the study area are some of the conditions which predispose the equines for such type of parasites. The highest prevalence of helminthes parasites in the study area was a serious threat to the all grazing horses, donkeys and mules of different age groupswhich are kept under traditional extensive production system in the study area; hence, strategic and regular anthelmintic treatment of equine population is required.

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