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Prevalence and species of major gastrointestinal parasites of donkeys in Tenta Woreda, Amhara Regional State, Ethiopia

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A cross sectional study was carried out from January 2014 to May 2015 in Tenta Woreda, Amhara regional state, Ethiopia to identify the species and determine the overall prevalence of gastrointestinal (GI) parasites of donkeys. A total of 300 fecal samples were collected from randomly selected donkeys and examined with flotation, sedimentation, McMaster and Baerman fecal examination techniques. The overall prevalence was found to be 72.33. The major GI parasites identified based on qualitative faecal examination techniques were Strongyles spp. (57.2%), *Parascaris equorum* (11.2%), *Strongyloides* spp. (10.4%), *Gastrodiscus aegypticus* (5.1%), *Oxyrus equi* (2.7%), *Fasciola* spp. (2.0%) and *Anoplocephal* spp. (2.6%). The prevalence in female and male animals was 58.5 and 41.5%, respectively. There was a statistically significant difference ($p<0.05$) for the prevalence and mean epg count of strongyles and *P. equorum* among different age groups. Accordingly, the prevalence as well as mean epg count was higher in young than adults and old age groups. Further analysis of positive samples using coproculture revealed the occurrence of *Strongylus vulgaris* (27.7%), *Strongylus edentates* (16.6%), *Strongylus equinus* (4.8%), *P. equorum* (11.2%), *Trichostrongylus axei* (8.3%) *Strongyloides westeri* (9.5%), *Dictyocaulus arnfieldi* (7.5%), *Oxyuris equi* (6.5%) and *Triodonthophorus tencollis* (1.3%). There was concurrent infection of donkeys with a maximum of two different GI parasites with prevalence of 33.48%. The findings of the present study clearly suggest that GI parasites of donkeys in the study area are still widespread and economically important constraints for the productivity and use of donkeys in rural towns. Hence, further and strengthened intervention is highly recommended taking into account the importance of these animals to the economy.

Key words: Coproculture, donkeys, egg per gram of faeces (epg), faeces, GI parasites, prevalence, Tenata, Ethiopia.

INTRODUCTION

Donkeys (*Equus asinus*) are among the early-domesticated equines that have been existing, dating back to the time of early men (Saul et al., 1997). Today, there are more than 40 million donkeys distributed

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throughout the world (FAO, 2013). In Africa, the donkey population is estimated to be 13 million (Starkey and Starkey, 2013) and Ethiopia has about four million donkeys or 32% of all the donkeys in Africa and 10% of the world population (Alemu et al., 2004). Donkey in Ethiopia is most commonly found in the dry and mountainous areas. There is one equine for every four people in the agricultural sector and for every five persons of the total population (Yilma et al., 1991).

Despite the increase in mechanization throughout the world, donkeys are still well deserving of the name beasts of burden. Their prominent position in the agricultural systems of many developing countries is shown by the wide spread use of donkeys in rural and urban areas. It is suggested that donkeys can play a great role in the frame works of food security and social equity of high food insecure countries (Pearson and Krecek, 2006).

The low level of development of road transport and rough terrain of Ethiopia make donkeys the most valuable, appropriate and affordable pack animals under the small holder farming system (Gebrewold et al., 2004). Donkeys appear to be an effective entry point for assisting women in domestic responsibilities (Marshall and Ali, 2004) and also in areas where draft power is a constraint to crop cultivation; a pair of well-conditioned donkeys could be used as an alternative draft power sources for secondary and tertiary land preparation (Abayneh et al., 2002).

Certain impediments hinder the maximum utilization of these animals to their potential. The most important ones are parasitic disease (Chhabra et al., 2011; Sumbria et al., 2014; Sumbria et al., 2016), especially gastrointestinal parasites, harness sores; infectious disease likes strangles and poor management system of these animals (Ministry of Agriculture and Rural development, 2012). Donkeys harbor a large quantity of parasite that prevail in the GIT including round worms (families: Stronglidae, oxyuridae, Trichostronglidae and Ascaridae), flat worms (Fasciolidae) and tapeworm (family: Anoplocephalidae) which damage the intestine depend on the species and number present, nutrition, age and natural defense of the individual equine (Pereia and Vianna, 2006). In donkeys, infection with endoparasites is responsible for problems including poor body condition, reduced power output, diarrhea, colic, emaciation, impaired growth, poor reproductive performance, short lifespan and predisposition to other infectious diseases (Elisabeth and Sevendesen, 1997; Fikru et al., 2005).

Studies on endoparasites including haemoprotozoa in working donkeys across several countries of the world have disclosed the involvement of several species (Sotiraki et al., 1997; Wells et al., 1998; Matthee et al., 2002; Mushi et al., 2003; Uslu and Guclu, 2007; Sumbria et al., 2015). These investigations have revealed that in developing countries where nutrition and hygiene are generally poor, GI parasites are highly prevalent and are the major problems of donkeys. In Ethiopia where the health care is minimal, especially for equines, the prevalence, species composition and epidemiology of GI parasites affecting donkeys have not been investigated in detail (Getachew et al., 2009, 2010).

However, the available information suggests that gastrointestinal GI parasites are the main reasons for early demises of donkeys in the country (Yoseph et al., 2001; Fikru et al., 2005; Ayeleet al., 2006). Despite their invaluable contributions, donkeys in Ethiopia are the most neglected animals, accorded low social status. Apart from few studies in other parts of Ethiopia, there is no previous information on GI parasites of donkeys in Tenta woreda, Amhara Regional State, Ethiopia

Hence, the objectives of this study were to determine the overall prevalence of GI parasites of donkeys in Tenta woreda Amhara Regional State, Ethiopia. Besides, the level of infection based on the mean epg count and the relationship between measurable parameters and GI parasites were assessed.

MATERIALS AND METHODS

Study area

The present study was conducted in Tenta Woreda, Amhara Regional State, Ethiopia from January 2014 to May 2015. The livestock resources of the region consist of cattle, goats, sheep, camel, poultry and equines. Tenta is a town located in South Wollo Zone of the Amhara Region. It has a latitude and longitude of 11° 19′N 39°15′E / 11.317° N 39.250°E, with an elevation of 2972 m above sea level.

Study animals

Animals used in this study were systematically selected 300 donkeys from Tenta woreda Amhara Regional State, Ethiopia maintained under traditional small holder extensive management production system. The animals were owned by the individual farmers for the purpose of packing to generate income and for household use. Though selected animals represented different age and sex groups, but donkeys were randomly selected irrespective of age, sex and body condition scores and color.

Sample size determination

Sample size was calculated with an expected prevalence of 77.3% from the previous research work on prevalence of GIT parasite in similar highland area, South Wollo (Alemayehu and Etaferahu, 2013). The desired sample size for the study was calculated using the formula given by Thrusfield (2007) with 95% confidence interval and 5% absolute precision.

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

Where, Pexp = expected prevalence; d= absolute precision; n=sample size. Accordingly, a total of 300 donkeys were used in this study.

Table 1. Overall prevalence.

Parasite	Number positive	Prevalence (%)	Standard error	[95% Confidence interval]
Strongyles	138	57.2	0.0291536	[0.49-0.60]
Oxyrus equi	8	6.5	0.0169264	[0.06-0.13]
Parascaris equorum	27	11.2	0.0095369	[0.01-0.05]
Strongyloides spp.	25	10.4	0.0163485	[0.05-0.12]
Faciola spp.	6	4.0	0.0082881	[0.01-0.04]
Gastrodiscus aegypticus	15	8.1	0.0128976	[0.03-0.08]
Anoplocephala spp.	2	2.6	0.0048184	[-0.01-0.01]

Study design and sampling strategy

A cross sectional study was conducted from January 2014 to May 2015 in Tenta Woreda, Amhara Regional State, Ethiopia to identify, assess and determine the prevalence of the GI parasites. Sampling method followed was a household based systematic random sampling in which the study animals were randomly selected from respective village of the district and from the selected village, the house were also randomized systematically in every second household.

Age and body condition estimation

During sample collection, various potential risk factors including sex, age, and body condition score of donkey was recorded. The age of the selected donkeys was determined from birth records of owners and by dentition (Crane and Svendsen, 1997). Body condition score (BCS) was subjectively estimated based on the guides published (Svendsen, 1997). Accordingly, donkeys were grouped into three age categories: donkeys from 1-3 years of age were classified as young; 3-10 years were considered as adult; and those beyond 10 years were classified as old. These age classes were based on age of first work, productive age and the life span of Ethiopian donkeys (Svendsen, 1997; Yosef et al., 2001). Regarding BCS, the studied animals were grouped poor, moderate, ideal, fat and obese (NEWC, 2005).

Sample collection and examination

Faecal sample collection

Fecal samples were collected from donkey per-rectum from fresh deposits using plastic rectal gloves. Each sample was labeled with the animal number, date of collection, age, sex, BCS, number of animal owned and place of collection in edible pen. The collected samples were kept in icebox, having adequate ice and able to close tightly and transported to Woreda laboratory. The samples were kept in plus four refrigerators if immediate processing was not possible, but it had been processed within 48 h.

Faecal sample examination

Microscopic faecal examination was done by different qualitative and quantitative faecal examination technique for the presence of parasitic eggs and identification of larvae.

Qualitative faecal examination was carried out by sedimentation and floatation technique. For identification of parasite to species level, fecal samples were cultured and the larvae were recovered using Baerman apparatus technique and then identified under lower power microscope (10x objectives) based on the shape, relative size and shape of larvae's tail and under oil emersion (100x objectives) based on number of gut cells (Kaufmann, 1997). The floatation fluid used in the study was supersaturated solution of sodium chloride (Nacl) salt prepared in the laboratory. The procedure given by Gutpa and Singla (2012) was followed for the above parasitological methods.

Egg counts were also conducted using McMaster age counting technique. Severity of infection as obtained from the number of eggs per gram of faeces was determined less than or equal to 500 eggs/g of faeces regarded as mild infection; 500-1000 eggs/g of faeces as moderate infection; and above 1000 eggs/g of faeces as severe infection (Urquhart et al., 1996).

Data analysis

The entire collected row data were entered into Microsoft Excel spread sheet and coded. Statistical analyses were performed using STATA, version 11 software packages. Percentage was used to calculate prevalence. Additionally Chi-square was used to calculate degree of association between risk factors and prevalence of gastrointestinal parasites. In the analysis, a difference was taken as significant at a p-value less than 0.05 and the confidence level was held at 95%

RESULTS

Coproscopical examination

The present study revealed an overall prevalence of 72.33%. The parasites encountered in the study period includes: *Strongyles*, *Oxyrus equi, Parascaris equorum, Fasciola* spp., *Gastrodiscus aegypticus*, *Strongyliodes* spp. and *Anoplocephala* spp. (Table 1).

Quantitative faecal examination

The McMaster technique applied to determine the number of GI parasites egg per gram of feces revealed minimum and maximum epg value of 0 to 9000. Likewise, the study showed that the mean epg and prevalence of

Table 2. Mean epg and prevalence in different age groups.

Parasites	Mean faecal egg count(epg)			Prevalence (%)		
	Young	Adult	Old	Young	Adult	Old
Overall egg count	442	530.754	410	10.5	79.8	9.7
Strongyles	359.09	213.24	355.26	91	74	7.9
Fasciola spp.	75	300	0	0.9	1.9	0
Parascaris equorum	750	314.58	225	13.8	11.5	10
Oxyuris eaui	50	175	0	2.6	0	0
Strongyloides spp.	100	290	383.3	11.2	11.5	1.6
Gastrdiscus aegypticus	100	233.33	160	4.3	2.9	0
Anoplocephala spp.	0	0	150	0.9	0	0

Table 3. Eggs per gram of faeces in different age groups.

Level of infection	Percent		
	Mild infection	Moderate infection	Sever infection
Young	45.7	20	2.9
Adult	43.3	16.9	9.5
Old	45.6	22.8	8.8

Table 4. Intensity of infection of GI parasites on the basis of epg.

Degree of severity	Number of donkey	Percentage (%)	Standard error	[95% Confidence interval]
Mildly infected	130	44.4	0.0290741	[0.39-0.50]
moderately infected	54	18.4	0.0226901	[0.14-0.23]
Heavily infected	25	8.5	0.0163485	[0.05-0.12]

strongyle type nematode is significantly greater than the other GI parasites (Table 2).

The study showed that young donkeys were with greater proportion of mild, moderate and heavy level of epg than both young and old age donkeys (Table 3)

Intensity of infection

Based on the result of epg counts in the study area, 130 (44.4%) were mildly infected, 54 (18.4%) were moderately infected and 25 (8.5%) were severely infected (Table 3).

Larvoscopic examinations

Identification of L3 of GI parasites isolated by Baerman technique from coprocultured faeces showed the predominance of *Strongylus vulgaris, Strongylus edentatus* and *Parascaris equorum* than the other GI parasites (Table 4 and 5). Infections with one species of helminthes were more common, 139 (66.52%) than infections with two, 70 (33.49%) species of helminthes (Table 6).

Analysis of risk factors

Analysis of different risk factors showed that age and body condition score was significantly associated with the risk of infection with GI parasites ($p<0.05$), whereas sex of the animal was not significantly associated with GI parasite infection(Table 7).

The prevalence of GI parasites in both body condition groups (good and poor) was determined in larvoscopy. The larvoscopy results revealed that, the prevalence of GI parasites in moderate body condition donkeys were *Dictyocaulus arnfieldi* (50%) which was the top species of parasites and the least were *Triodontophorus tenuicollis* and *Anoplocephala* spp. (0%). In ideal body condition, *T. tenuicollis* (100%) was the highest. Similarly, in poor body condition animals, the highest prevalent parasites was *Anoplocephala* spp. *(*100%) and least was *T. tenuicollis*

Table 5. Species of GI parasites identified from coprocultured faeces of donkey in Sendafa district, Oromia Regional State, Ethiopia.

Species of parasite	Number positive	Prevalence (%)	Standard error	[95%Confidence Interval]
Strongylus vulgaris	84	27.7	0264639	[0.23-0.34]
Strongylus edentatus	43	16.6	0.0207083	[0.11-0.19]
Strongylus equinus	11	4.8	0.011124	[0.02-0.06]
Dictyocaulus arnfieldi	16	7.5	0.0132966	[0.03-0.08]
Tricostrongylus axie	21	8.3	0.0150951	[0.04-0.10]
Strongyloides westeri	25	9.5	0.0136811	[0.03-0.08]
Triodonthophorus tencollis	1	1.4	0.003413	[0.003-0.01]
Cythostomum spp	17	7.9	0.0095369	[0.01-0.04]
Parascaris equorum	27	11.2	0.0095369	[0.01-0.05]
Oxyrus equi	8	6.5	0.0169264	[0.06-0.13]

Table 6. Concurrent infections.

Concurrent infection	Number of positive donkeys	Percentage (%)
One species	139	66.52
Two species	70	33.48

Table 7. The relative prevalence among the sex category.

Parasites	Total	Sex	
		Female	Male
Strongyles	159	95(59.9%)	64(40.3%)
Parascaris equorum	27	14(51.9%)	13(48.1%)
Oxyuris equi	8	4(50%)	4(50%)
Fasciola spp.	6	4(66.7%)	2(33.3%)
Anopleocephalus spp.	2	2(100%)	0
Gastrodiscus aegyrticus	15	9(60%)	6(40%)

Table 8. Prevalence between body conditions.

Species of parasite	Poor	Moderate	Ideal	X^2value	p-value
Strongylus vulgaris	59.5	36.9	3.6	33.511	0.000
Strongylus edentateus	55.8	41.9	2.3	14.264	0.003
Strongylus equinus	45.5	44.5	0	4.115	0.249
Strongyloides westeri	52.0	48.8	0	9.077	0.028
Parascaris equorum	51.9	44.4	0	8.23	0.042
Triodontophorus tenuicollis	0	0	100	28.397	0.000
Dictyocaulus arnfieldi	43.8	50.0	6.2	3.486	0.323
Gastrodiscus aegypticus	66.7	33.3	0	6.887	0.076
Anoplocephala spp.	100	0	0	3.073	0.381
Trichonema spp.	70.6	29.4	0	9.065	0.028
Trichostrongylus axei	57.1	33.3	9.5	4.72	0.254

(0%). There was statistically significant difference ($p<0.05$) in prevalence of *S. vulgaris, S. edentates Strongyloides westeri, P. equorum, T. tenuicollis* and *Trichonema* spp. between the body conditions as examined by larvoscopy (Table 8).

The prevalence of GI parasites in different age groups

Table 9. Age wise prevalence.

Species of parasite	Age group			X^{2-} value	p- value
	Young (%)	Adult (%)	Old (%)		
Strongylus vulgaris	14.3	61.9	23.8	2.458	0.293
Strongylus edentatus	7.0	79.0	14.0	2.630	0.268
Stronglus equinus	9.1	63.6	27.3	0.478	0.787
Stronyloides westeri	8.0	64.0	28.0	1.467	0.480
Oxyuris equi	12.5	75.0	12.5	0.256	0.880
Parascaris equorum	92.6	7.4	0	95.013	0.000
Triodontophorus tencollis	0	0	100	7.644	0.022
Dictyocaulus arnifieldi	18.8	43.8	37.5	5.013	0.082
Fasciola spp,	0	83.3	16.7	0.950	0.622
Anoplocephala spp,	0	50.0	50.0	1.308	0.520
Cythostomum spp,	11.8	58.8	29.4	1.172	0.557
Gastrodiscus aegypicus	0	86.7	13.3	2.945	0.229
Trichostrongylus axei	9.5	61.9	28.6	1.467	0.480

revealed that *P. equorum* (92.6%) was the highest and *G. aegypticus, T. tenuicollis, Anoplocephala* spp. and *Fasciola* spp. (0%) the lowest in the young. In old age, the highest was *T. tenuicollis* (100%) and the lowest was *P. equorum* (*0*%). In adults, *G. aegypticus* (86.7%) and *T. tenuicollis* (0%) were the highest and lowest, respectively. There was statistically significant difference ($p<0.05$) in prevalence of *P. equorum* between different age groups (Table 9).

DISCUSSION

The coprological examination done in this study using floatation and sedimentation method revealed an overall GI parasite prevalence of 72.33% in the study area, which was relatively lower than some of the earlier reports of 98.2% by Ayele et al. (2006), 84.4% by Gulima (2006), 96.9% by Ibrahim et al. (2011) and 92.71% by Mezgebu et al. (2013) at and around Gonder, Hawassa Town, Dugda Bora district and Awi Zone, respectively. This difference could be attributed to the variation in sampling time as seasonality. Additionally, accessibility of donkeys to grazing land, deworming habit of the donkeys and giving supplementary feed to these animals affect its occurrence.

The prevalence of strongyles was 57.2%. This figure was much lesser than the earlier finding of Zerihun et al. (2009), Yoseph et al. (2001), Muleta (2005), Fikru et al. (2005) who reported prevalence of 100, 100, 100 and 98.2% in Sululta and Gefersa, Wonchi, highlands of Wollo province and western highlands of Oromia, respectively. This is most probably attributed to the difference in the study area or due to nutritional status of the animal in the respective study area which can influence the level of immunity to be infected by the parasite. Additionally, it could be affected by deworming strategy and accessibility to veterinary clinic.

The prevalence of 11.2% *P. equorum* recorded in the current study is lower than the previous reports of Fikru et al. (2005), Ayele et al. (2006) and Zerihun (2008) who reported 43, 17.3 and 42.8% in Western highlands of Oromia, Dugda Bora district, and highlands of Wollo provinces, 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 and mean epg of *P. equorum* was significantly ($p<0.05$) higher in young donkeys than the other age groups. This is most probably due to the fact that young donkeys have less immunity against *P. equorum* infection than both adult and old donkeys. This agrees with the earlier report by Zerihun (2008) in central Showa, Ethiopia. However, this finding contrast the research of Ayele et al. (2006) and Getachew et al. (2009) who reported absence of statistically significant differences in the prevalence of *P. equorum* among donkeys of different age groups that may reflect differences in the study design and geographic locations.

The prevalence of 4% for *Fasciola* spp. recorded from intervention area in the current study is higher than the previous report by Ayele *e*t al. (2006) who reported 1.5% in Dugda Bora district. This higher prevalence suggests that *Fasciola* spp. is common in highlands where donkeys share the same grazing area with ruminants that are considered as primary hosts of liver fluke and favorable ecological conditions which allow multiplication and spread of intermediate snail host in both study districts as has been reported by Getachew et al. (2010). As compared to other reports in the central highlands of Ethiopia (Yoseph et al., 2001) in Wonchi (Muleta, 2005),

South and North Wollo zones) lower prevalence of *Fasciola* was recorded. This lower prevalence might be due to the differences in season of sample collection and effect of deworming.

Lower prevalence of *Anoplocephala* spp, 2.6% recorded in this study as compared to reports by, Yoseph et al. (2005), Fikru et al. (2005) and Getachew et al. (2010) might reflect the seasonality of orbited mite intermediate hosts and differences in study period and locations. The negative value of confidence interval for *Anoplocephala* spp. indicates that they are rare parasites in the study area that indicate cross sectional study which is not a better study method. The prevalence of 8.1% for *G. aegypticus* recorded in the current study is in agreement with previous research done by Zerihun et al. (2009) reporting 5.7% in Sululta and Gefersa districts of central Oromia.

O. equi with prevalence rate of 6.5% was lower when compared with the work of Yoseph et al. (2001) in Wonchi who reported 32.4% and relatively similar to Alemayehu and Etaferahun (2013) who have reported 4% in south wollo zone. The low prevalence in this study might be the effect of deworming by the woreda veterinary clinic, variation in management system and relatively dry season during sample collection time in the present study area which desiccates the highly susceptible *O. equi* eggs. The parasite is ubiquitous but greater prevalence in areas of high rainfall (Radostitis et al., 2007).

Lower prevalence (7.5%) of *D. arnfieldi* was recorded in the present study as compared to Ayele et al. (2006) who have reported 32% in Dugda Bora District and Bewketu and Endalkachew (2013) who have reported 22.17% in and around Bahir Dar town. This difference in prevalence might be due to the ecological and climatically differences among localities.

Analysis of the degree of infection by GI parasites as determined by epg of donkey showed that the greatest proportion of young donkeys were with mild degree (45.7%) followed by moderate degree (20.0%) whereas the majority of adult and old donkeys were with mild degree of infection 43.3 and 45.6%, respectively. This observation is lower than the previous research of Matthee et al. (2002) and Getachew et al. (2009). This might be due to the effect of deworming in the study area. The difference in parasite prevalence between sexes might be due to the fact that females are found to have higher infection rates as they might have lower immunity due to gestation and lactation as stated by Ram (2009). The co-infection pattern observed in this study showed that donkey has the high chance of concomitant exposure to different GI parasites. Similar findings were reported by Yoseph et al. (2001).

This study confirmed that there is significant difference in the prevalence of the parasite among the different body condition scores and it is shown that GI parasites are more prevalent in animals with poor body condition than well-conditioned animals which are in agreement with the results of Ayele et al. (2006), which implies that the body condition score is a good indicator of parasitic burden, which can be used by farmers to identify donkeys with immediate requirement of anthelmintic remedies.

This study result is in agreement with Ayele et al. (2006) that there was no statistically significant difference ($p>0.05$) between age groups for GI parasite infections except *P. equorum.* This might be due to increased land of cultivation which restricts donkeys on small communal grazing land which allows the animals for continuous larvae exposure.

Identification of infective larvae of GI parasites showed that *S. vulgaris* (29.7%) and *S. edentatus* (16.7%) were the major larvae encountered. The prevalence of *P. equorum* and *D. arnfieldi* were 11.2 and 7.5%, respectively. This finding disagrees with observations of Ayele et al. (2010) and Yoseph et al. (2001) who reported 100%. These differences in prevalence might be due to intervention with anthelminthic and the ecological and climatic differences among localities.

Conclusion

The current study showed a decrease in prevalence of helminthes of donkeys in both coproscopic and larvoscopic methods of examination in the study area. This suggests that the mass deworming given by Woreda Veterinary Clinic reduce the parasitic infection. This study revealed that the major GI parasites that occurred were *S. vulgaris, P. equorum, S. edentatus, O. equi, D. arnfiedi* and *Cythostomum* spp. In the light of the results, it is considered that the infections caused by GI parasites, especially the *S. vulgaris, S. edentatus* and *P. equorum* are common in the region of the study, so greater importance should be given to this situation. This research indicated that infection with one parasite was found to be very common in this study than concurrent infection with two and three parasites. This study confirmed that there is significant difference in the prevalence of the parasite among the different body condition scores and it is shown that GI parasites are more prevalent in animals with poor body condition than well-conditioned animals.

RECOMMENDATIONS

1. Owners should be trained to improve the management system, especially in terms of the level of nutrition so that the animal can have good body condition that confers some level of resistance against GI parasite infection.
2. The decrease in the prevalence of parasite due to mass deworming is not necessarily satisfactory, so strategic parasitic control program should be designed with broad spectrum anthelmintic drugs with regular

evaluation of efficiency of anthelmintic.
3. Donkey owners should be educated on the economic importance and methods of control of helminthes of donkey.
4. Government and non-governmental organization should work together to improve the health and welfare of donkeys in the study area.
5. Further research on the economic importance, epidemiology and time of treatment of GI parasites of donkey in the study area is recommended.

Conflict of interest

The authors declare that they have no conflict of interest

Abbreviations: BCS, Body condition score; **CI,** confidence interval; **epg,** egg per gram of faeces; **GI,** gastrointestinal; **MOARD,** Ministry of Agriculture Rural Development; **rpm,** revolution per minute.

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