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Study on the Prevalence of Strongyle Infection in Donkeys in and around Assosa Town, Benishangul-Gumuz Region, Western Ethiopia

[1*]Negesse Welde, [1]Moges Destaw,[1]Awoke Chaklu and [2]Mullusew Gashaw

[1*]Doctor of Veterinary Medicine, Assosa University College of Agriculture and Natural Resources, Department of Veterinary Science, Assosa, Ethiopia, Tel: +251-925-503-497, E-mail: negessewelde@gmail.com
[1]Bachelor Degree of Veterinary Science (BVSc), Graduate Student of Assosa University College of Agriculture and Natural Resources, Department of Veterinary Science, Assosa, Ethiopia
[2]Doctor of Veterinary Medicine, Amhara National Regional State Livestock Resource and Development Promotion Office Agency in North Administrative Zone Dawunt District, Tel: +251-941-626-272, E-mail:gashawmuller@gmail.com

Abstract: A cross sectional study was conducted from March 2019 to May 2019 in and around Assosa town to determine the prevalence of strongyle infection and to assess its associated risk factors in the study area in donkeys. A total of 200 animals were randomly selected from five different peasant associations in the study area and examined during the study period. Coprological examination for the detection of strongyle eggs was performed using floatation technique. The overall prevalence of strongyle parasites was 30.5% (61 from 200 donkeys). The study has also showed variation in prevalence of strongyle parasites among different body condition scores and between ages, higher prevalence was recorded in poor body condition (83.72%) and old (46.15%), respectively. In relation to selected peasant association the prevalence were found 38.88%, 32%, 23.52%, 17.64% and 30%, for Assoa 01, Assosa 03, Amba 4, Amba 5 and Amba 8, respectively. The risk factors, age and body condition, were significantly associated with the occurrence of strongyle parasites ($p<0.05$). In conclusion the current study revealed that stronglosis was found to be the major problem in the study area; hence strategic deworming and minimizing overworking and extensive open grazing should be implemented to reduce contamination.
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Key words: *Assosa, Donkey, Prevalence, Risk factor, Strongylosis*

1. Introduction

Ethiopia is a country naturally gifted with huge natural resources occupied different agro-ecological zones and suitable environmental conditions; this makes Ethiopia home for many livestock species and suitable for livestock production. The country is believed to have the largest livestock population in Africa with estimated livestock population 59.5 million cattle, 56.53 million heeds of chicken, 30.70 million sheep, 30.20 million goat, 8.44 million donkeys, 2.16 million horses, 1.21 million camels, and 0.41 million mules, are widely distributed across the different agro-ecological zones of the country (CSA, 2017).

Equids (donkeys, mules, and horses) play an important role as working animals in many parts of the world, employed for packing, riding, carting, and plowing. Equine power is vital for both rural and urban transport system which is cheap and provides the best alternatives in places where the road network is insufficiently developed (Getachew *et al*., 2008). Equines as a means of transport for men and materials provide livelihood to a number of rural and semi-urban population of the world. They have a prominent position in agricultural systems of many developing countries. It is suggested that donkey can play a great role in the frameworks of food security and social equity of high food insecure countries. In areas away from roads, many people use mule's and donkey as well as horses to transport food and other supplies to villages (Yoseph *et al*., 2008 and Woodford, 2009).

Even though, due to hardy and resistant nature of equines species used for different activity both in urban and rural part of the country, their service became limited by a number of health problems (Marquardt *et al*., 2000). Among which the most common entities leading to disease, suffering and finally death are infectious diseases and parasitism (endoparasites), which resulted in considerably reduced animals work output, reproductive

performance and most of all their longevity (Tamador *et al*., 2011).

Endoparasites are those parasites that live within the body of the host (Heinemann, 2001). Numerous internal parasites are known to infect equines. These include roundworms mainly of strongyle, flukes, tapeworm, protozoan and fly larvae that infest and damage the intestine, respiratory system and other internal organs (Pereira and Vianna, 2006; Taylor *et al*., 2007; Alemayehu and Etaferahu, 2013).

Strongyle nematodes are important equines gastrointestinal parasite species, belongs to the Superfamily Strongyloidea, family Strongylidae, genus strongylus and comprising of three species *S. vulgaris*, *S. edentatus* and *S. equines*. These parasites are ubiquitous and live as adults in the large intestine of equids (Bariisoo and Wubit, 2016). Equine strongylids divided into two as small and large strongyles. From those, the large Strongyles recognized as being the most pathogenic to the equine species. Strongylosis is a serious problem in young horses reared on permanent horse pasture, although cases of severing disease may occur in adult animals kept in suburban paddocks and subjected to overcrowding and poor management (Admasu *et al*., 2014).

Strongylus vulgaris and *Strongylus edentatus* are among the most common equine health problems causing strongyle species in Ethiopia and more rarely *Strongylus equines* (Abayeneh *et al*., 2002). The common name of *S. vulgaris* called as double tooth strongyle, *S. edentatus* is called as toothless strongyle and *S. equinus* is called as tripled toothed strongyle. *S. vulgaris* is smaller than the other two large strongyle species (Mandal, 2012).

Even though different research had been done by different researcher in different study area concerning about equine gastrointestinal parasite particularly of genus strongyle, the research output is not much enough. Particularly, the current study is the first of its kind since there was no previous single study conducted in the present study area pertaining about prevalence of strongyle infection in donkeys. However, donkeys are the major source of income for some individuals, so that, investigation on the prevalence of strongyle infection in donkey have paramount importance to design methods that minimize the risk of the disease in the study area. Therefore, the objectives of the present study were:

- To determine the prevalence of strongyle infection, and
- To determine the associated risk factors of strongyle infection in donkeys in and around Assosa town.

2. Literature Review

Strongyle nematodes are important equines gastrointestinal parasite species, belongs to the Superfamily Strongyloidea, family Strongylidae, genus strongylus and comprising of three species *S. vulgaris*, *S. edentatus*, and *S. equines*. These parasites are ubiquitous and live as adults in the large intestine of equids (Bariisoo and Wubit, 2016).

2.1. Etiology

Members of the genus Strongylus live in the large intestine of horses and donkeys and, with Triodontophorous, are commonly known as the large Strongyles (Taylor *et al*., 2007). Horses asses, and mules host a far greater variety of Strongylide parasites than ruminants and other domestic animals do. Even an apparently healthy horse may be infected with tens or even hundreds of thousands of small Strongyle worms (cyathostominae) (Bowman, 2003). The Strongylus species found in equines are *S. vulgaris*, *S. edentates* and *S. equines* (Belay*et al*., 2016).

2.2. Morphology and Identification

Strongylus parasites are robust dark red worms which are easily seen against the intestinal mucosa. The well-developed buccal capsule of the adult parasite is prominent, as is the bursa of the male. Male are 2.3-2.8 cm in size and females 3.3-4.4 cm and the head end is wider than the rest of the body. Male are 2.6-3.5 cm in size and females 3.8-4.7 cm and the head end is not marked of from the rest of the body and Male are 14-16 mm in size and females 20-24 mm and the head end is not marked of from the rest of the body are atypical features of *S. edentates*, *S. equines* and *S. vulgaris*, respectively (Taylor *et al*., 2007).

Species identification is based on size and the presence and shape of the teeth in the base of bucal capsule. *S. vulgaris* has two ears shaped, rounded teeth and *S. equines* possess three conical teeth, and one is situated dorsally and is larger than the others whereas *S. edentates* has no teeth (Belay *et al*., 2016).

2.3. Life Cycle

Outside the donkey: Strongyles live as adults in the large intestine (cecum, ventral colon, and dorsal colon) of the donkey and horse and lay eggs that are voided in the feces. In the environment, an egg embryonates to the first stage larva (L1) which hatches and then develops to the second stage larva (L2), and finally to the third stage larva (L3) which is the infective stage. The L1 and L2 feed on organic matter, but the L3 does not feed but subsists on internal nutrients. The L3 is the infective stage which typically crawls up on pasture vegetation, especially under moist conditions which make movement easier than dry situations, and is then accidentally ingested by the grazing horse. Inside the donkey the L3 develops to

the fourth (L4) and then fifth (L5) (adult) stage (Hendrix, 2006).

Inside the donkey: Within the genus Strongylus are three species *S. edentatus*, *S. equinus* and *S. vulgaris*. These species are the most pathogenic of the strongyles because they can cause colic and even death of donkeys. *Strongylus vulgaris* is the most damaging of the three species. Detrimental effects of these parasites usually are most evident during migration of immature stages in organs outside the gastrointestinal tract (Taylor *et al*., 2007).

Strongylus vulgaris highlighted because it is the most pathogenic parasitic nematode species in donkeys and horses. When L3 are ingested they penetrate the intestinal mucosa, mainly of the posterior part of the small intestine, cecum, and ventral colon, and enter arterioles in the walls of these organs. About two weeks later they begin arriving and accumulating primarily in the cranial mesenteric artery (CMA). There they undergo development to the L4 and L5 (Lefevre *et al*., 2010).

2.4. Epidemiology

Equine Strongyle species infection occur specifically in domestic equines, i.e., horses, donkeys and their hybrids, but they are also frequently found in large numbers in zebras. The host is important in terms of susceptibility to disease with the horse being the most susceptible to infection and disease especially through bred horses (Lefevre *et al*., 2010). Strongylosis is a common disease of horses throughout the world and causes deaths when control measures are neglected. In areas with cold winters and mild summers, egg deposition peaks in spring and remains high over summer. At this time, temperatures are suitable for larval development and massive infective larvae may occur in late summer and early autumn, when young susceptible donkeys are present (Saeed *et al*., 2010). Strongylosisis most frequently a problem of in young horse pastures, although cases of sever disease may occur in adult animals kept in sub urban paddocks and subjected to overcrowding and poor management (Armour *et al*., 1996).

2.5. Pathogenesis

The disease processes associated with the Strongylus can be divided in to those produced by migrating larvae, those provoked by the mass emergency of mucosal larvae and these associated adult worms. Heavy intestinal infection can alter intestinal motility, intestinal permeability and carbohydrate absorption (Radostitis *et al*., 2007). The larvae of *S. vulgaris* are the most pathogenic, causing arthritis, thrombosis and thickening of the wall of the cranial mesenteric artery. Emboli may break away and lodge in smaller blood vessels, leading to partial or complete ischemia in part of the intestine, thus producing colic. The result of this depends on the length of the segment of the intestine affected and the ability of the collateral blood supply to become established before necrosis and gangrene occur (Taylor *et al*., 2007). The disease is due to migrating *S. vulgaris* larvae that are responsible for verminous arthritis. In case of massive infection, the clinical picture is severe with rapid weight loss; liquid diarrhea and frequent bouts of sever colic (Lefevre *et al*., 2010).

2.6. Clinical Findings

The clinical picture varies in line with the intensity of parasite burden, the prevalence of certain parasitic species, and to the stage of development of the worms. Moderate infections due to larvae stages or adult worms result in sub clinical or chronic diseases with general clinical signs among which weight loss is the most common (Lefevre *et al*., 2010). Grazing horses usually carry a mixed burden of large and small Strongyles and the major signs associated with heavy infection in animals up to 2-3 years of age are unthrifness, anemia, colic and sometimes diarrhea (Hendrix, 2006). Marked clinical signs are less common in older animals although general performance may be impaired (Belay *et al*., 2016). The effect of Strongyle species in more chronic infestation results persistent low grade fever, poor appetite, intermittent colic and poor weight gain (Radostitis *et al*., 2007).

2.7. Diagnosis

Diagnosis of mixed Strongyle species infection is based on demonstration of eggs in the feces. Strongyle species eggs are oval, and thin shelled and are most of them observed during standard fecal flotation of faeces (Hendrix, 2006). A specific diagnosis is diffcult to achieve in every case. Few clinical observations or laboratory results are pathognomic for the disease syndromes associated with Strongyle species infection. Often a judgment has to be made on an overall appraisal of clinical history, presenting signs and laboratory finding (Radostitis *et al*., 2007). The presumptive diagnosis of strongylosis due to adult worms are appropriate in young animals after weaning and in case of poor body condition, intermittent colic and irregular bots diarrhea (Lefevre *et al*., 2010).

2.8. Treatment

Treatment may be targeted against immature and adult large strongyle worms in the lumen of intestine, against migrating Strongyle species larvae particularly *S. vulgaris* or against cyathostomins larvae, in the intestine mucosa (Radostitis *et al*., 2007). Antihelmentic, ivermectin and moxidectin at a standard dosage are effective against the larval stages (L_4 and L_5) of effective against larval infection. A number of antihelmentics including the bezimidazoles, pyrantel, and ivermectin, are effective against adult large Strongyle species (Kahn, 2008).

2.9. Control and Prevention

The goal for control of donkey strongyle infection is to minimized the number of eggs and resultant infective L_3 larvae on the grazing areas and there by prevent clinical and sub clinical disease. Environmental contamination by infective larvae is the main determinant to the infective parasite control (Kaufmann, 1996). The concept of preventing parasite contamination of the environment can be accomplished by eliminating egg shedding back into the environment by strategically timed deworming ((Belay *et al*., 2016)). Regular treatment of all animals including any age group of donkey, starting from the weaners, is typically used to eliminate adult. Strongyle species and these prevent heavy contamination of pastures with eggs and infective L_3 larvae (Lefevre *et al*., 2010).

3. Materials and Methods

3.1. Study Area

The study was conduct in and around Assosa Town, from March 2019 to June 2019. Assosa is the capital city of the Benishangul-Gumuz Regional State and composed of 74 administrative peasant associations, which is located at 8°30'and 40°27' N latitude and 34°21' and 39°1' E longitude 687kms Northwest of Addis Ababa (CSA, 2015). The altitude of Assosa ranges from 580 to over 1560 meter above sea level. The area is characterized by low land plane agro- ecology which has 'kola' micro climate with land covering 2317km^2 areas, according to National Meteorological Service Agency (NMSA) with average annual rainfall of 850-1316mm with uni-modal type of rainfall that occurs between April and October. Its mean annual temperature ranges between 16.75 °C and 30 °C. Assosa zone has 35.6% of the livestock population of the region constituting 61, 234 cattle, 19,729 sheep, 25,137 donkeys, 439,969 poultry and 73,495 beehives (CSA, 2015).

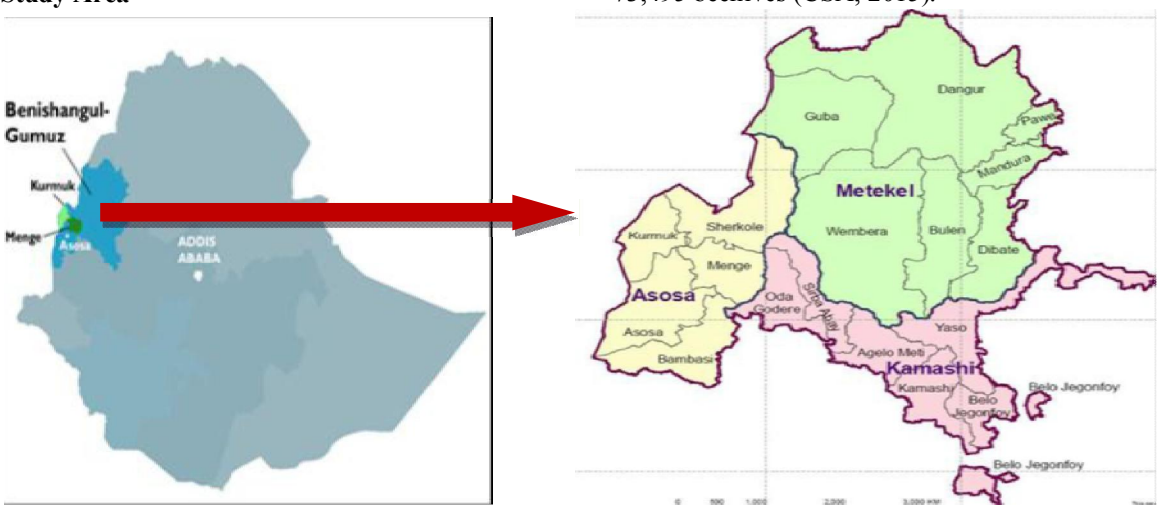

Figure 1: Map of the study area **(Source: www.google.com)**

3.2. Study Population

The study populations were apparently healthy indigenous breeds of Donkeys managed under the traditional husbandry system and animals kept mainly for traction, transport and cart pulling in which samples taken from five different Peasant associations (Assosa 01, Assosa 03, Amba 4, Amba 5 and Amba 8).

3.3. Study Design and Sampling Technique

A cross-sectional study was carried out from March 2019 to June 2019 to determine the prevalence of strongyle parasites in donkeys. Purposive sampling technique was employed as sampling strategies used to collect all the necessary data from Assosa town and the surrounding areas of the study animals.

3.4. Sample Size Determination

The Sample size required for the study was determined using the formula given by Thrusfield (2007) since there was no previous works on the prevalence of stongyle infection in donkey. To calculate the sample size, 95% confidence level, 50% expected prevalence and 5 % of desired absolute precision (d=0.05) was used.

$$n = \frac{Z^2 Pexp(1-Pexp)}{d^2} = \frac{(1.96)^2 .0.5(1-0.5)}{(0.05)^2} = 384$$

Where; n is the sample size, Z (1.96) is the statistic corresponding to level of confidence 95%, P is the expected prevalence and d is precision which was taken as 5%. Therefore, a total of 384 samples were needed to conduct the research, but only 200 samples were collected due to shortage of time.

3.5. Study Methodology

Details about sex, age and body condition of the study animals were gathered appropriately. Animals

examined were also grouped in to three age groups as young (<4 years), adult (4-9 years), old (>9years) by dentition according to the modified method described by Crane (1997). The body conditions were scored following the guideline set by Svendsen (1997) as poor, medium and good.

3.6. Sample Collection and Examination

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

3.7. Data Analysis

All the necessary data were collected and registered precisely. The data obtained at the time of study were classified, entered, filtered and coded using Microsoft Excel® 2010 spreadsheet. Before subjected to statistical analysis, the data were thoroughly screened for errors and improper coding. Then the data subjected to chi-square test in order to assess the association between comparable variables by making use of SPSS version 20 for appropriate statistical analysis. Descriptive statistics was used to calculate prevalence by dividing the number of positive animals to the total number of animals to measure association between prevalence of the parasites, species, body condition, age, origin and sex category of animals.

4. Results

In the present study out of 200 (n=200) donkeys examined 61 were found to be infected with strongyle parasites. So that the overall prevalence of strongyle infection for donkeys out of 200 examined samples was found to be 30.5%. Out of 200 animals sampled 155 were males while the remaining 45 were females having respective prevalence of 46(29.67%) and 15(33.33%) in male and female (Table 2) with no statistical difference between sexes (p=0.639). The prevalence of stronglye infection were found 41.07%, 19.04% and 46.15% in young, adult and old, respectively (Table 2) with statistically significant variation among age groups (P=0.001).

The prevalence of strongle parasite were 83.72%, 19.6% and 9.09% in poor, medium and good body condition scores, respectively with statistically significant difference among the different body condition scores (P=0.000) (Table 2). The highest prevalence was recorded in poor body condition followed by medium and good. The prevalence of stronglye infection were found 38.88%, 32%, 23.52%, 17.64% and 30% in Assosa 01, Assosa 03, amba 4, amba 5 and amba 8, respectively with no statistical difference between the five peasant association (P=0.415) (Table 2).

Table 1: General characteristics of study participants

Character		Frequency	Percent
Sex	Male	155	77.5%
	Female	45	22.5%
Age	Young	56	28%
	Adult	105	52.5%
	Old	39	19.5%
Body condition			
	Poor	43	21.5%
	Medium	102	51%
	Good	55	27.5%
Peasant association			
	Assosa 01	54	27%
	Assosa 03	25	12.5%
	Amba 4	34	17%
	Amba 5	17	8.5%
	Amba 8	70	35%
Result	Positive	61	30.5%
	Negative	139	69.5%

Table 2: Prevalence of strongyle infection according to sex, age, body condition and peasant association of animals.

Risk factors	Number of examined animals	Number of positive animals	Prevalence (%)	$\chi 2$	P-value
Sex					
Male	155	46	29.67%	0.220	0.639
Female	45	15	33.33%		
Age					
Young	56	23	41.07%		
Adult	105	20	19.04%	13.958	0.001
Old	39	18	46.15%		
Body condition					
Poor	43	36	83.72%		
Medium	102	20	19.6%	75.059	0.000
Good	55	5	9.09%		
Peasant association					
Assosa 01	54	21	38.88%		
Assosa 03	25	8	32%		
Amba 4	34	8	23.52%	3.932	0.415
Amba 5	17	3	17.64%		
Amba 8	70	21	30%		

5. Discussion

In the current study, an overall prevalence of donkey strongyle infection in the study area was found to be of 30.5%. The overall prevalence of current study is in agreement with the works of Samuel and Berihun (2012) who reported the overall prevalence of strongyle infection in donkeys was 32.6% in and around Wollo Combolcha. The current result is higher than the result of Disassa *et al* (2013) who reported, 5.82% in donkeys in and around Dangila town. This low prevalence in and around dangile town may be due to the fact that the deworming program by Bahirdar donkey sunchery at the beginning and end of rainy season in the study area (Disassa *et al.*, 2013). However the result of the current study was lower than the report of Mangassa and Tafese (2016) who reported 44.55 % in donkeys around Batu town, the reports of Getachew *et al* (2010) from east shoa and Adaa, Akaki and Bost of East shoa that revealed 100% in donkeys and Hassan *et al* (2004) in Sudan reported as 99.15%. The current result also lower than the report of Feseha *et al* (1999) and Tola *et al* (2013) in and around Gondar with a prevalence of 100% in donkeys. Additionally prevalence of donkey strongyle also reported as 87.81%, 76% and 70.8% by Tesfu *et al* (2014) in and around Hawassa town, Alemayehu and Etaferahu (2013) in south wollo zone, respectively which are higher than the current result.

Age was considered as a risk factor and higher prevalence observed in old animals (46.15%) while 41.07% and 19.04% prevalence observed in young and adult age groups, respectively. This result disagrees with works of sultan *et al* (2013) who reported 25.7%, 61% and 13.2% in young, adult, and old, respectively. The prevalence difference among the different age groups was statistically significant in the current study ($P<0.05$). The prevalence of Strongyle parasite was higher in old and younger ages. Higher infection rates and more severe infections indicate a low immunity in older and younger population (Soulsby, 1992).

Body condition scores was found to be a major risk factor ($P<0.05$) in the prevalence of strongyle parasite infection. The prevalence according to body condition was 83.72%, 19.6%, and 9.09% in poor, medium and good body condition scores, respectively. This prevalence lower than the findings of Tesfu *et al* (2014) that was reported 71.6%, and 70.7% in medium and good body condition scores, respectively. Body condition score was significantly associated with the prevalence of the strongyle parasite. This significant association might indicate that strongyle parasite is one of the factors for poor body condition score of the donkeys. On top of this, the difference might indicate that the poor body condition animals are at high chance of acquiring the parasite as compared to the medium and good body condition animals because of the poor immunity due loss of body weight.

Different prevalence of strongyle parasite were found among the animals from different selected peasant association for study namely Assosa 01, (38.88%), Assosa 03(32%), Amba 4(23.52%), Amba 5(17.64%) and Amba 8 (30%). Within the five peasant association there is no statistical significance association ($P>0.05$).

6. Conclusion and Recommendations

In present study moderate prevalence of equine (donkey) Strongylosis was obtained when compared

with prevalence reported by different researchers at different areas. Based on the results of the present study, the prevalence of equine strongyle was highest in young and old animals than the adult ones. In addition to this, higher infection rate was recorded in donkeys with poor body conditions than in medium and good body animals it might be due to reduced immunity of old animal and inadequate development of the immune system in young animals. Moreover, as compared to other literature reports, body condition and age of the animals were found to be the important risk factors associated with equine Strongylosis infection whereas, sex and origin of the animals had no association with equine Strongylosis infestation in the current study animals. Owing to the huge donkey population in the study area, considerable contamination to the communal pasture grazing system could be the other factor which favors the survival of the parasite. Therefore**,** the following recommendations were forwarded.

❖ To get clear epidemiological picture of parasitic helminthes, comprehensive study should be launched in the area.

❖ Donkeys also require good management and awareness should be created regarding effective regular deworming.

❖ To control the burden of parasites, regular and strategic deworming programs with efficacious anthelminthics should be carried out regularly.

❖ Improved housing and feeding management system should be implemented to decrease the incidence of parasites in donkeys.

❖ The government should formulate and implement policies regarding management and health aspect of equines.

❖ All newly introduced equines into the herd must be quarantined and properly screened and treated to prevent environmental contamination with helminth parasites.

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