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Prevalence of gastrointestinal nematode parasites in mules and donkeys in and around Debre Tabor

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Abstract

A cross sectional study was conducted from November, 2018 to April, 2019 in and around Debre Tabor, South Gondar administrative zone, northwest Ethiopia to identify the major gastrointestinal nematode parasites of donkeys and mules, to estimate prevalence of these parasites and their burden in equines. A total of 384 fecal samples (135 donkeys and 249 mules) were collected randomly for qualitative fecal analyses. In the present study, the overall prevalence of gastrointestinal nematode parasite was 53.38% in equines. The prevalence is 73.33% in donkeys and 42.57% in mules with statistically significant difference ($P < 0.05$) in prevalence. The parasites encountered in the study period were *Strongyle* species (45.92 and 32.93%), *Oxyuris equi* (8.88% and 4.82%) and *Parascaris equorum* (4.44% and 4.82% mixed with *Strongyle*), in both donkeys and mules, respectively. The prevalence of all identified parasites were statistically significant ($P < 0.05$) between species, age and sex except body condition. The findings of the present study indicated a high prevalence of helminth parasites affecting the health and welfare of equines. Sustainable prevention and control methods should be developed to prevent the burden of gastrointestinal nematodes of equines in and around Debre Tabor.

Keywords: Debre tabor, donkeys, Ethiopia, gastrointestinal nematodes, mules, prevalence

Introduction

Ethiopia is one of the developing countries in Africa, which is predominantly an agricultural country with over 85% of its population engaged in agricultural activity [1]. The country has the highest equine population probably with the highest density per square kilometer in the world and it has 6.9% and 42.4% in the world and Africa equine population respectively [2]. The equine population of the world is 122.4 million (40 million donkeys, 15million mules, 43.3million horses, and 24.1million camels). In the distribution pattern, 98% of all donkeys, 97% of all mules, and 60% of all horses are found in the developing countries. The number of equines in Africa is in the range of 17.6 million, comprising 11.6 million donkeys, 2.3 million mules and 3.7 million horses [3]. The equine population in Ethiopia is estimated to be 8.4 million (2.75million horses, 5.02million donkeys, and 0.63million mules [2].

Equine as a means of transport for men and materials provides livelihood to a number of rural and semi urban population of the world. They have a prominent position in the agricultural systems of many developing countries. It is suggested that donkeys can play a great role in the frame work of food security and social equity of high food insecure countries. In areas away from roads, many people use mules and donkeys to transport food and other supplies to villages [4].

Although equines play a significant role in the economy of the country, the government development programs and those of aid agencies are aimed towards meat, milk, egg and wool production of livestock, whereas equines have been completely neglected or omitted from the pastoral livestock programs. This is because, the contribution of equine power in the agricultural system and their role in the productivity are not yet well recognized and magnified [5]. Despite the increase in mechanization throughout the world, donkeys are still well deserving of the name 'beasts of burden' [6]. The most common internal parasites of equines include large strongyles, small strongyles, Ascaris and pinworms (*Oxyurisequi*). Additionally are less important infection of tapeworms, lungworms and the intestinal thread worms (strongyloid) [7]. Even though several studies on equine helminthes have been done in different parts of the country, work on gastrointestinal nematode parasites of equine is lacking in the

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Present study area. Therefore the objective of this study is:

- To determine the prevalence of major gastrointestinal nematode parasites in equine.
- To investigate associated risk factors that contributes to the incidence of the parasites.
- To compare prevalence of major gastrointestinal nematode parasites between mules and donkeys.
- To generate the base line data for further studies

Materials and Methods

Study Area

Debre Tabor is found 665 km away from Addis Ababa, North western part of Ethiopia. The area has a summer rainfall and mean annual temperature of 1850 mm and 26.5oc respectively. About 70% of the land is featured by plain plateaus and covered by various feature formation, high woods mainly ever green lands some semi-humid highland vegetation with major agricultural products like wheat, Barley, Potato and pulse crops. The landscape is marked with the altitude of 2560 meters above sea level and covers 3200km². Smallholder mixed farming dominates the area and livestock is an integral part of the farming system [20].

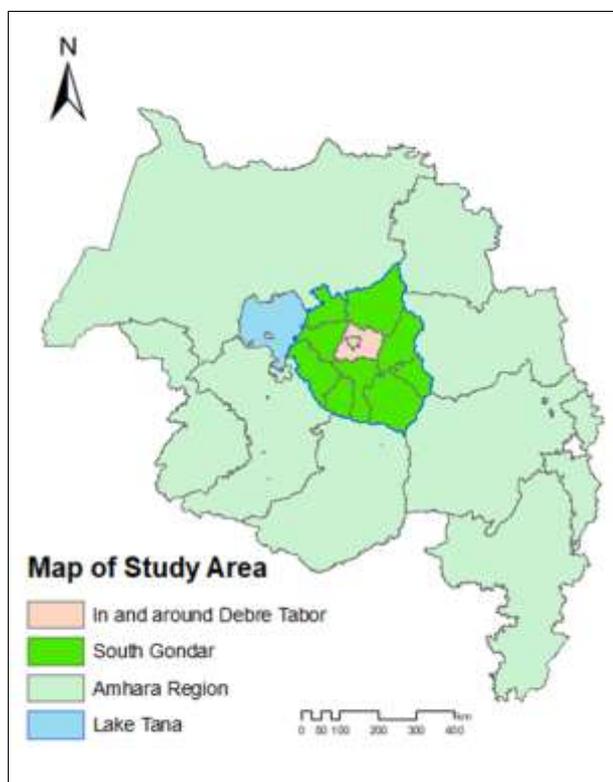


Fig 1: Map of study area in Amhara region south Gondar zone in and around Debre Tabor town 2018/19

Study Animals: The Study population was equine found in and around Debre Tabor from November 2018 to April 2019. These animals originated from different Kebeles of Debre Tabortown. The study animals were donkeys and mules of both sexes, with different age groups and different body condition scores.

Study Design and Period: A cross-sectional study was carried out from November to April in both Mules and Donkeys which is managed extensively in and around Debre Tabor. In this study random sampling of individuals from a

population was taken at a point of time.

Sample Size Determination: Sample size required for the study was determined based on sample size determination in random sampling for infinite population using expected prevalence of nematode parasite in equine at 5% desired absolute precision according to Thrusfield [21]. Since there was no similar study done previously on the study area, the expected prevalence was taken as 50%.

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

Where

n=required sample size

P_{exp}=expected prevalence

d=desired absolute

$$n = (1.96)^2(0.05)(1-0.05) / (0.5)^2 = 384$$

Therefore, using 50% expected prevalence and 5% absolute precision at 95% confidence interval, the number of animals in this study were 384.

Sample Collection and Coprological Examination

The samples were collected from the rectum by using rectal gloves and during defecation when circumstance allow. The samples were collected in clean sample bottles that contain preservative material (formalin) and were tightly closed until examination was performed. Each sample was labeled with animal identification, owner name and species corresponding to age, breed, sex, body condition and place. The floatation technique was employed to determine the prevalence of equine nematode parasite eggs in the feces.

Data Processing and Analysis: The information obtained from clinical examination, laboratory test and observation was entered on the spreadsheet of Microsoft excel. Descriptive statistics and Chi-square (χ^2) test was used to analyze the sample data.

Results

Over all Prevalence: A total of 384 animals comprising donkeys and mules were examined for the presence of gastrointestinal nematodes by fecal examination. Of this 205 (53.38%) were positive for species of *Strongyle*, *Oxyuris*, *Ascaris* and mixed infections.

Table 1: Over all prevalence of gastrointestinal nematodes in equine

| Species of animal | No. of animals examined | No. of animals positive | Prevalence (%) |
|-------------------|-------------------------|-------------------------|----------------|
| Donkey | 135 | 99 | 73.33 |
| Mule | 249 | 106 | 42.57 |

The prevalence was recorded as 73.33% and 51.71% in donkeys and mules respectively. The difference in the frequency of gastrointestinal nematode parasites between the species of animals was statistically significant ($P < 0.05$) and it was found to be higher in donkeys.

Prevalence in Donkeys

Prevalence of gastrointestinal nematode in donkeys: The study revealed that 99 animals were positive (73.33%) for gastrointestinal nematode infection. *Strongylespp* was found to be predominant followed by *Oxyurisequi* and *Parascaris equorum*.

Species wise prevalence: A total of 99 donkeys were positive for gastrointestinal nematodes. Of this *Strongylespp* were found to be predominant (45.92%) followed by *Oxyurisequi* (8.88%) and *Parascarisequorum* (4.44%). Mixed infection of *strongylespp* and *Oxyurisequi* constitute 11.11%. While that of *oxyuris* and *Parascarisequorum* was 2.96%. The difference in the frequency was statistically significant ($P<0.05$) (table 2).

Table 2: Species wise prevalence of gastrointestinal nematode parasites in donkeys

| Species of parasite | No. animals positive | Prevalence (%) |
|---|----------------------|----------------|
| <i>Strongylespp</i> | 62 | 45.92 |
| <i>Oxyurisequi</i> + <i>Parascarisequorum</i> | 4 | 2.96 |
| <i>Parascarisequorum</i> | 6 | 4.44 |
| <i>Strongyle</i> + <i>Oxyurisequi</i> | 15 | 11.11 |
| <i>Oxyurisequi</i> | 12 | 8.88 |
| Total | 99 | 73.33 |

$\chi^2=51.976$; p-value= 0.000

Age wise prevalence: Study on age wise prevalence of gastrointestinal nematode indicated that the infection occurs most commonly in adult animals aged 5-10 years 75 (75.76%) followed by old animals of more than 10 years 9(100%) and young below 5 years 15 (55.56%). Statistically significant difference ($p<0.05$) was observed in the prevalence of nematode infection among different age groups of animals (table 3).

Table 3: Age wise prevalence of gastrointestinal nematode parasite in donkeys

| Species of parasite | Young (< 5 years) | Adult (5-10 years) | Old (>10years) |
|---|-------------------|--------------------|----------------|
| <i>Strongyle</i> | 8(29.63%) | 51(51.51%) | 3(33.33%) |
| <i>Oxyurisequi</i> + <i>Parascarisequorum</i> | 1(3.7%) | 3(3.03%) | 0 |
| <i>Parascarisequorum</i> | 0 | 3(3.03%) | 3(33.33%) |
| <i>Strongyle</i> + <i>Oxyuris equi</i> | 6(22.22%) | 6(6.06%) | 3(33.33%) |
| <i>Oxyurisequi</i> | 0 | 12 (12.12%) | 0 |
| Total | 15(55.56%) | 75(75.76%) | 9(100%) |

$\chi^2=34.026$; p-value=0.001

Sex wise prevalence: Out of 51 female animals examined for gastrointestinal nematode infection 42(82.35 %) were positive whereas in 84 male animals 57 (67.85%) showed infection. The observed prevalence was higher in females than males and the difference was statistically significance ($P>0.05$) (table 4).

Table 4: Sex wise prevalence of gastrointestinal nematode parasite in donkeys

| Sex | No. animal examined | Total no. of positive animals | Prevalence (%) |
|--------|---------------------|-------------------------------|----------------|
| Female | 51 | 42 | 82.35 |
| Male | 84 | 57 | 67.85 |
| Total | 135 | 99 | 73.33 |

$\chi^2=22.747$; p=0.001

Prevalence based on body condition: Of the 99 animals positive for gastrointestinal nematode infection the prevalence was found to be higher in animals with medium body condition 63 (77.78%) followed by good 15 (71.43%) and poor 21 (63.63%) body condition. The prevalence of nematode infection was found different among different body

conditions and the difference was not statistically significant ($P>0.05$). The highest prevalence was observed in donkeys which are medium in body condition score (table 5).

Table 5: Prevalence of gastrointestinal nematode parasites according to body condition

| Body condition | No. animals examined | No. animals positive | Prevalence (%) |
|----------------|----------------------|----------------------|----------------|
| Poor | 33 | 21 | 63.63 |
| Medium | 81 | 63 | 77.78 |
| Good | 21 | 15 | 71.43 |
| Total | 135 | 99 | 73.33 |

$\chi^2=13.387$; p=0.342

Prevalence in Mules

Prevalence of gastrointestinal nematode in mules: The study revealed that 106 animals were positive (42.57%) for gastrointestinal nematode infection. *Strongyle* spp was found to be predominant followed by *Oxyuris equi* and mixed infections.

Species wise prevalence: A total of 106 mules were positive for gastrointestinal nematodes. Of this *Strongyle spp* were found to be predominant (32.93%) followed by *Oxyuris equi* (4.82%) and mixed infections. Mixed infection of *Strongyle spp* and *Oxyuris equi* constitute 3.61%.while that of *Parascaris equorum* and *Strongyle spp* was 1.20%. The difference in the prevalence was statistically significant ($P<0.05$) (table 6).

Table 6: Species wise prevalence of gastrointestinal nematode parasites in Mules

| Species of parasite | Total no. positive animals | Prevalence (%) |
|---|----------------------------|----------------|
| <i>Strongylespp</i> | 82 | 32.93 |
| <i>Strongyle</i> + <i>Oxyurisequi</i> | 9 | 3.61 |
| <i>Oxyurisequi</i> | 12 | 4.82 |
| <i>Parascarisequorum</i> + <i>Strongyle</i> | 3 | 1.20 |
| Total | 106 | 42.57 |

$\chi^2=51.976$; $P<0.001$

Age wise prevalence: Study on age wise prevalence of gastrointestinal nematode indicated that the infection occurs most commonly in adult animals aged 5-10 years 91 (45.27%) followed by old animals of more than 10 years 15 (31.25%). Statistically significant difference ($p<0.05$) was observed in the prevalence of nematode infection between them (table 7).

Table 7: Age wise prevalence of gastrointestinal nematode parasite in Mules

| Age groups of animals | Adult (5-10) | Old (above 10) |
|---|--------------|----------------|
| <i>Strongyle</i> | 73(36.32%) | 9(18.75%) |
| <i>Parascarisequorum</i> + <i>strongyle</i> | 3(1.49%) | 0% |
| <i>Strongyle</i> + <i>Oxyurisequi</i> | 6(2.99%) | 3(6.25%) |
| <i>Oxyurisequi</i> | 9(4.48%) | 3(6.25%) |
| Total | 91(45.27%) | 15(31.25%) |

$\chi^2=34.026$; p= 0.001

Sex wise prevalence: Out of 107 female animals examined for gastrointestinal nematode infection 48 (44.86 %) were positive where as in 142 male animals 58 (40.85%) showed infection. The observed prevalence was higher in females than males and the difference was statistically significant ($P>0.05$) (table 8).

Table 8: Sex wise prevalence of gastrointestinal nematode parasite in Mules

| Sex | No. animal examined | Total no. of positive animals | Prevalence (%) |
|--------|---------------------|-------------------------------|----------------|
| Female | 107 | 48 | 44.86% |
| Male | 142 | 58 | 40.85% |
| Total | 249 | 106 | 45.57% |

$X^2=22.747$; p-value=0.001

Based on body condition: Of the 106 animals positive for gastrointestinal nematode infection the prevalence was found to be higher in animals with good body condition 26 (42.62%) followed by medium 71 (43.56%) and poor 9(36%) body condition. The prevalence of nematode infestation was found to be different among different body conditions and the difference was not statistically significant ($P>0.05$). Low prevalence was observed in mules which were poor in body condition score (table 9).

Table 9: Prevalence of gastrointestinal nematode parasite in Mules according to body condition

| Body condition | No. animals examined | No. animals positive | Prevalence (%) |
|----------------|----------------------|----------------------|----------------|
| Poor | 25 | 9 | 36% |
| Medium | 163 | 71 | 43.56% |
| Good | 61 | 26 | 42.62% |
| Total | 249 | 106 | 42.57% |

$X^2=13.387$; p-value=0.342

Discussion

In the present study the overall prevalence of gastrointestinal nematode parasites was 53.38% in equines. The prevalence is 73.33% in donkeys and 42.57% in mules with statistically significant difference ($P<0.05$) in prevalence. The low prevalence in mules might be due to feeding and management practices in the study area. Most of the mules under this study were cart mules. They feed grain by products and are less exposed to pasture grazing and are dewormed regularly than donkeys in the study area.

According to this study the prevalence of *strongyle spp* in donkeys was 45.92% and in mules it was 32.93%. Based on the current study, *Strongyle* infection is slightly higher in donkeys than mules. The data analysis shows statistical significance difference in the prevalence of *Strongyle* infections between donkeys and mules. This result is relatively lower than the report of Basazenew [23] who reported a prevalence of 82.7% in donkeys and 85% in mules in the same area. Low infection rate observed in this study might be due to proper management and regular deworming which could have reduced the chance of acquiring infection.

The prevalence of *Parascaris equorum* in donkeys was 4.44% and in mules 1.20% as mixed infection with *Strongyle*. This result is lower than the study by Bewketu [24] who reported the prevalence of *Parascaris equorum* in donkeys and mules as 10.46%, 13.68% respectively in the same study area. The relative low occurrence might be due to increased awareness and regular deworming provided by Bahir Dar regional veterinary clinic for equines and the enhanced diagnostic capacity of the parasitological techniques used.

In donkeys prevalence rate of *Oxyuris equi* is 8.88%. This is in agreement with Ayele [25, 26] and who have reported prevalence of 6% and 6.45%, respectively. In contrast Yoseph [27] reported 32.4% prevalence. The low prevalence recorded in this study might be due to the effect of relatively higher temperature in the present study area which desiccates the

highly susceptible *O. equi* eggs. Similarly in mules its prevalence was found to be 4.82%. Bamlaku [28] also recorded low prevalence of 1.85% in different study areas.

Mixed helminth infection of equine was observed with prevalence of 8.07% which is in agreement with that of Belay [5] who observed that poly parasitism was common and reported 10.4 % prevalence.

Data on age related prevalence indicates significant difference ($P<0.05$) among various age groups. The prevalence was higher in young equines (55.56%) while the prevalence in adult and old equines was relatively lower. The observed difference could be due to lack of immunity in younger population. This result agrees with works of Chitra [29] who reported that the level of strongyles and ascarids increased when the donkeys became older, but then decrease. For instance equines commonly develop marked resistance to *Parascaris equorum* after 6 months of age [5].

Female donkeys were found to have significantly higher infection of gastrointestinal nematode parasites than males as they might have lower immunity due to gestation, lactation and stresses associated during the period [30]. Even though statistically significant difference ($P<0.05$) was observed between the two sexes of mules the prevalence of gastrointestinal nematode parasites were only slightly higher in females than males. This might be due to the absence of gestation and lactation in the female mules.

In the present study the overall prevalence of gastrointestinal nematode parasites in equines was slightly higher in medium body condition. But the difference among poor, medium and good body condition scores was not statistically significant ($P>0.05$). On the contrary Shiferaw [31] stated that animals with good body condition had relatively lower infection. But in the current study higher prevalence was recorded in medium body condition animals. This might be due to sampling method as majority of samples were taken from working animals (mules and donkeys) which were in medium body condition.

Conclusion and recommendations

This study revealed that gastrointestinal nematode parasites occurring in and around Debre Tabor in equines were *Strongylespp*, *Oxyurisequi*, *Parascaris equorum* and mixed infections of these species. In the light of this result, the infections caused by nematodes, especially the *Strongylespp* and *Oxyurisequi* are significantly common with high prevalence in the study area. This also indicated that concurrent infection with two or more nematode parasites were also common. As the study showed, donkeys are at higher risk of infection than mules. Equines have crucial importance in the life system of developing countries especially in Africa, particularly for transportation. So, the existing livestock extension package program of the region and the country should focus on the management and health aspect of equines.

Based on the above conclusion the following recommendations are forwarded:

- For clear epidemiological picture of parasitic nematodes, systematic study should be launched in the area.
- Extension service focusing on health education and animal welfare must be strengthened to create awareness among equine owners and attendants.
- The government should formulate appropriate policies regarding equine management and health aspects.
- Control of gastrointestinal nematodes is an important issue for equine owners. So, strategic treatments

including regular deworming and improved pasture management should be followed to prevent excessive pasture contamination.

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