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# Prevalence and Faecal Egg Load of Gastrointestinal Parasites in Horses in Maseru District, Lesotho

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**Abstract** | Among other several constraints facing horses in Lesotho, helminth infections play a central role and this often leads to deterioration of their body condition score which on the other hand limit their work potential and efficiency. The present study was carried out to determine the prevalence and abundance of parasite population of horses in the Maseru district, Lesotho. A total of 720 faecal samples were collected and analysed for the presence of gastrointestinal parasites (GIPs) using sodium chloride flotation technique. Binary logistic regression was utilized to ascertain the effect of risk factors (agro-ecological zone, sex and age) on the prevalence of GIPs. The association of faecal egg count with the risk factors was tested by Negative binomial and Poisson regressions. The overall prevalence of nematode was 88.8% and its variability in faecal egg load ranged from 0 to 4200 eggs per gram, the overall prevalence of coccidia was 4.2% and its variability in faecal egg load ranged from 0 to 300 eggs per gram while for cestodes the overall prevalence was 9.2% with variability in faecal egg load ranging from 0 to 500 eggs per gram. Sex and age significantly ($p<0.05$) affected both the prevalence and faecal egg load for nematode while their association with the prevalence and faecal egg load of coccidia and cestodes was nonsignificant ($p>0.05$). Agro-ecological zone did not affect both the prevalence and faecal egg load of cestodes and coccidia but, the faecal egg load of nematodes was higher ($p<0.05$) in the mountains than in the lowlands and foothills. These results demonstrated that nematodes are the major health threatening parasites for horses in the Maseru district, Lesotho with sex and age being the major risk factors determining both prevalence and burden of parasites.

**Keywords** | Gastrointestinal parasite, Age, Agro-ecological zone, Sex, Horse

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## INTRODUCTION

In spite the huge number and expanding significance of horses in Lesotho, information about the medical issues influencing their welfare is very minimal in the country and as a result they do not perform to their latent capacity. Parasites are commonly known to affect the wellbeing and work execution of horses and donkeys worldwide (Mezgebu et al., 2013). Various types of gastrointestinal parasites can infect horses consequently resulting in significant morbidity and mortality (Berhanu et al., 2014; Goraya et al., 2013). As per Oli et al. (2018) mortality of equines has been associated with strongyles, tapeworms, ascarids, trypanosomes and babesia species. Relf et al. (2013) reported that infestation may range from asymptomatic to life threatening, depending on the host, helminth species and parasite burden. Host and environmental risk factors play a central role at the onset of gastrointestinal parasites infections. As indicated by Zyinorova et al. (2016) environmental related factors which include agro-ecological conditions, weather conditions and animal husbandry practices determine the type, incidence and severity of various parasitic diseases.

Host related factors such as age, sex, body condition, physiological status, parasitic factors like species and intensity

of worm population have an effect on the development of gastrointestinal parasitic infections (Brik et al., 2019). Young and under nourished horses are increasingly powerless against gastrointestinal parasites (Belete and Derso, 2015). Old horses appear to develop immunity against the common gastrointestinal parasites and as a result they are not affected by parasite related problems as commonly as younger horses.

The investigation of Francisco et al. (2009) affirmed that the prevalence of ascarids and strongyles is influenced by sex, the females being more infected than the males and those discoveries are in accordance with Fikru et al. (2005). Furthermore, variations in terms of agro-ecological zones can have an effect on the endurance and development of infective larval stages of nematodes causing differences in the prevalence and egg loads of gastrointestinal parasites (Odoi et al., 2007). The current study was therefore conducted with an objective of determining the influence of risk factors (age, sex and agro-ecological zone) on the pervasiveness and intensity of worm population of horses in Maseru district.

## MATERIALS AND METHODS

The study was conducted in three distinctive agro ecological zones of Maseru district in which a cross sectional study was conducted on 120 randomly selected horses. Out of the 120 selected horses, 60 were males while, the other 60 were females. The age of the selected horses was determined using owners' information and dentition. Accordingly, animals were categorized as young (<2 years) and adults (>2 years). Sex of individual experimental animal was taken into consideration during data collection. The faecal samples were taken directly from the rectum using sterile disposable plastic gloves and placed in srewcapped plastic bottles. The clearly marked samples were packed in a cooler box containing ice packs and upon arrival at the National university of Lesotho laboratory, the samples were processed within 48 hours after collection. In the laboratory, a simple McMaster technique with a detection limit of 50 eggs per gram faeces (EPG) was used as described by Kyvsgaard et al. (2011).

### Data Analysis

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS 16.00). The prevalence of gastrointestinal parasites was calculated by dividing the number of animals infested by a given parasite by the total number of examined animals. Binary logistic regression was used to measure association between prevalence of the parasites, age, sex, and the agro-ecological zone. The Generalized estimating equations (GEE) were utilized to analyse the Faecal Egg Count (FEC) where negative binomial and poison regressions were involved in the analysis. Odds Ratios were used to determine the strength and direction of the association. In all the analyses, a p-value less than 0.05 was used for statistical significance.

## RESULTS

Out of a total 720 faecal samples inspected the general predominance for nematodes, coccidia and cestodes was found to be 88.8%, 4.2% and 9.7% respectively as demonstrated in Table 1.

**Table 1:** The overall prevalence of gastrointestinal parasites in horses.

| Parasites | No. of sample examined | No. of sample positive | Prevalence (%) |
|---|---|---|---|
| Nematodes | 720 | 639 | 88.8 |
| Coccidia | 720 | 30 | 4.2 |
| Cestodes | 720 | 70 | 9.7 |

The results in Table 2 revealed variation on the prevalence of nematodes between male and female horses and the difference was significantly different ($p<0.05$). The prevalence of coccidia was similar ($p>0.05$) for both sex classes and the odds of horses displaying coccidia eggs insignificantly ($p>0.05$) increased by 1.15 times from females to males. In terms of cestodes, the results revealed the prevalence of 8.3% and 11.1% for male and female horses respectively, however this difference was statistically nonsignificant ($p>0.05$). The results on faecal egg count for nematode as depicted on Table 3, indicate that female horses had significantly ($p<0.05$) higher faecal egg loads than male horses and the incidences of infestation decreased significantly ($p<0.05$) by 27.50% from females to males. The faecal egg load for coccidia increased insignificantly ($p>0.05$) by 3.0% from female to male. In terms of cestodes, there was no significant difference ($p>0.05$) between females (15.56) and males (11.81).

The results outlined in Table 4 revealed variation in the prevalence of nematodes and demonstrated that young horses were significantly ($p<0.05$) more infestation than adult horses and the likelihood of old horses having nematode infestation significantly ($p<0.05$) increased by 1.83 times in comparison to young horses. On the other hand, the likelihood of infection by coccidia insignificantly ($p>0.05$) decreased by 0.83 times from old to young horses. The odd ratio of old horses having cestodes eggs insignificantly ($p>0.05$) increased by 1.51 times compared to young horses.

The results on faecal egg load for nematodes as demonstrated in Table 5 revealed that young horses were significantly ($p<0.05$) more infected than old horses and inciden-

**Table 2:** Prevalence of gastrointestinal nematodes, coccidia and cestodes in different sexes of horses

| Sex | No. of samples examined | Prevalence (%) | SE | Exp (B) |
|---|---|---|---|---|
| **Nematode** | | | | |
| Male | 360 | 85.3[a] | 0.019 | 0.49 |
| Female | 360 | 92.2[b] | 0.014 | 1 |
| Coccidia | | | | |
| Male | 360 | 4.4[a] | 0.011 | 1.15 |
| Female | 360 | 3.9[a] | 0.010 | 1 |
| Cestodes | | | | |
| Male | 360 | 8.3[a] | 0.015 | 0.73 |
| Female | 360 | 11.1[a] | 0.017 | 1 |

SE= Standard error, Exp(B)= Exponential Beta, Means with different superscripts within the same column differ significantly ($p<0.05$).

**Table 3:** Mean egg load of gastrointestinal nematodes, coccidia, and cestodes in different sexes of horses

| Sex | No. of samples examined | Mean | Exp(B) | SE | Exp(B) in % |
|---|---|---|---|---|---|
| **Nematodes** | | | | | |
| Male | 360 | 777.89[a] | 0.725 | 43.467 | 27.50 |
| Female | 360 | 1072.50[b] | 1 | 47.652 | . |
| Coccidia | | | | | |
| Male | 360 | 4.72[a] | 1.03 | 1.340 | 3.00 |
| Female | 360 | 4.58[a] | 1 | 1.498 | . |
| Cestodes | | | | | |
| Male | 360 | 11.81[a] | 0.759 | 2.605 | 24.1 |
| Female | 360 | 15.56[a] | 1 | 2.813 | . |

Means with different superscripts within the same column differ significantly ($p<0.05$), SE= Standard error, Exp (B) = Exponential beta

**Table 4:** Prevalence of nematode, coccidia, and cestodes in different age groups of horses

| Age | No. of samples examined | Prevalence (%) | SE | Exp (B) |
|---|---|---|---|---|
| **Nematode** | | | | |
| Young | 191 | 92.7[a] | 0.019 | 1.83 |
| Old | 529 | 87.3[b] | 0.014 | 1 |
| Coccidia | | | | |
| Young | 191 | 3.7[a] | 0.014 | 0.83 |
| Old | 529 | 4.3[a] | 0.009 | 1 |
| Cestodes | | | | |
| Young | 191 | 12.6[a] | 0.024 | 1.51 |
| Old | 529 | 8.7[a] | 0.012 | 1 |

Means with different superscript within the same column differ significantly ($p<0.05$), SE= Standard error, Exp (B) = Exponential beta

**Table 5:** Mean egg load of gastrointestinal nematodes, coccidia, and cestodes in different age groups of horses

| Age | No. of samples examined | Mean | SE | Exp (B) | Exp(B) in % |
|---|---|---|---|---|---|
| **Nematodes** | | | | | |
| Young | 191 | 1143.19[a] | 69.741 | 1.351 | 35.1 |
| Old | 529 | 846.48[b] | 36.120 | 1 | . |
| Coccidia | | | | | |
| Young | 191 | 3.14[a] | 1.265 | 0.604 | 39.60 |

| | | | | | |
|---|---|---|---|---|---|
| Old | 529 | 5.20[a] | 1.288 | 1 | . |
| Cestodes | | | | | |
| Young | 191 | 18.06[a] | 4.345 | 1.493 | 49.3 |
| Old | 529 | 12.10[a] | 2.084 | 1 | . |

Means with different superscripts in the same column differ significantly (p<0.05), SE= Standard error, Exp (B) = Exponential beta

**Table 6:** Prevalence of nematodes, coccidia, and cestodes in horses in relation to different agro-ecological zones

| Agro-ecological zone | No. of samples examined | Prevalence (%) | SE | Exp (B) |
|---|---|---|---|---|
| Nematode | | | | |
| Lowlands | 240 | 89.6[a] | 0.020 | 1.18 |
| Foothills | 240 | 88.8[a] | 0.020 | 1.08 |
| Mountains | 240 | 87.9[a] | 0.021 | 1 |
| Coccidia | | | | |
| Lowlands | 240 | 5.0[a] | 0.014 | 1.53 |
| Foothills | 240 | 4.2[a] | 0.013 | 1.26 |
| Mountains | 240 | 3.3[a] | 0.012 | 1 |
| Cestodes | | | | |
| Lowlands | 240 | 8.3[a] | 0.018 | 0.74 |
| Foothills | 240 | 10.0[a] | 0.019 | 0.92 |
| Mountains | 240 | 10.8[a] | 0.020 | 1 |

SE= Standard error, Exp (B) = Exponential beta

**Table 7:** Mean egg load of gastrointestinal nematodes, coccidia, and cestodes in horses in relation to different agro-ecological zones

| Agro-ecological zone | No. of samples examined | Mean | SE | Exp(B) | Exp(B) in % |
|---|---|---|---|---|---|
| Nematodes | | | | | |
| Lowlands | 240 | 836.25[a] | 52.735 | 0.815 | 18.5 |
| Foothills | 240 | 913.75[ab] | 54.162 | 0.891 | 10.9 |
| Mountains | 240 | 1025.58[b] | 62.091 | 1 | . |
| Coccidia | | | | | |
| Lowlands | 240 | 5.83[a] | 1.922 | 1.750 | 75.0 |
| Foothills | 240 | 4.79[a] | 1.877 | 1.437 | 43.7 |
| Mountains | 240 | 3.33[a] | 1.368 | 1 | . |
| Cestodes | | | | | |
| Lowlands | 240 | 11.88[a] | 2.781 | 0.704 | 29.6 |
| Foothills | 240 | 12.29[a] | 2.851 | 0.728 | 27.2 |
| Mountains | 240 | 16.88[a] | 4.152 | 1 | . |

Means with different superscripts in the same column differ significantly (p<0.05), SE= Standard error, Exp (B) = Exponential beta

-ces of infestation increased significantly (p<0.05) by 35.1% from old to young horses. In terms of coccidia and cestodes, faecal egg load for both age groups was similar (p>0.05). Despite the insignificance, old horses were relatively more parasitized by coccidia while young horses were relatively more parasitized by cestodes. The results further indicated that in terms of coccidia the incidences of infection decreased insignificantly (p>0.05) by 39.6% from old to young horses. For cestodes it was observed that incidences of infestation increased insignificantly (p>0.05) by 49.3% from old to young horses.

The results in Table 6 indicate a non-significant (p>0.05) difference in the prevalence of nematodes across the three agro-ecological zones of Maseru district. The results further disclose that the chances of having nematode infestation from the mountains to the foothills and from the mountains to the lowlands decreased insignificantly (p>0.05) by 1.08 and 1.18 times respectively. On the other hand, the chances of infestation by nematode for a change

from the lowlands to the foothills insignificantly (p>0.05) decreased by 0.99 times. The prevalence of coccidia was similar across the three agro-ecological zones as presented in Table 6. The results also indicated that the chances of infection insignificantly (p>0.05) increased by 1.26 and 1.53 times for a change from mountains to foothills and from mountains to lowlands respectively. From the lowlands to the foothills the odd ratio of infection by coccidia decreased insignificantly (p>0.05) by 0.83 times. In terms of cestodes, the prevalence was statistically similar (p>0.05) across the three acro-ecological zones, however, the horses in the mountains were found to be insignificantly (p>0.05) more susceptible to infection than those in the foothills and lowlands. The results in Table 6 also indicate that the odd ratio of having cestodes infestation from mountains to foothills and from the mountains to the lowlands decreased insignificantly (p>0.05) by 0.92 and 0.74 times respectively. The likelihoods of having cestodes infestation from lowlands to the foothills increased insignificantly (p>0.05) by 1.20 times.

The results on nematode infestation as illustrated in Table 7 revealed the significant difference (p<0.05) between the horses in the mountains and lowlands where horses in the mountains were heavily parasitized. On the other hand, horses in the mountains were not statistically different (p>0.05) from those in the foothills while the ones in foothills were also statistically similar (p>0.05) to those in the lowlands. Moreover, the results indicated that the prevalence of infestation by nematodes decreased insignificantly (p>0.05) by 10.9% from the mountains to the foothills while from the mountains to the lowlands the prevalence of infestation decreased significantly (p<0.05) by 18.5%.

Horses from the three agro-ecological zones had similar infection for coccidia (Table 7). Despite the similar fecal egg counts (FECs) between horses in different agro-ecological zones, horses in the lowlands (5.83) had higher infestation than those in the foothills (4.79) and the mountains (3.33). The results suggest that prevalence of infection increased insignificantly (p>0.05) by 43.7% and 75.0% from the mountains to the foothills and from the mountains to the lowlands respectively. In terms of cestodes infestation, the results of this study showed that the horses in the three agro-ecological zones were statistically similar (p>0.05), however, the horses in the mountains (16.88) had higher infestation than those in the foothills (12.29) and the lowlands (11.88). The results also revealed that prevalence of infestation by cestodes decreased insignificantly (p>0.05) by 27.2% and 29.6% from the mountains to the foothills and from the mountains to the lowlands respectively.

## DISCUSSION

Our results demonstrated that nematodes are the most prevalent GIPs for horses in Maseru with an overall prevalence of 88.8%, which is in close proximity with the observations of Mengesha and Tola (2018) who reported the prevalence of 83.84% in Asella, Central Ethiopia. The results of this study are also in line with the report of Mezgebu et al. (2013) who reported 80.95% prevalence of nematodes in horses in and around Gondar Town, Ethiopia. Furthermore, Matto et al. (2015) reported a higher prevalence of nematodes than other GIPs. Moreover, this study revealed a relatively lower prevalence for cestodes which is consistent with the findings of Matto et al. (2015) and Francisco et al. (2009) who reported a lower prevalence of cestodes. With respect to the prevalence of coccidia the findings of this study are in concurrence with the findings of Ghahfarrokhi et al. (2014) and Studzinska et al. (2008) who reported 7.69% and 7.00% prevalence of coccidia respectively. Similarly, Wannas et al. (2012) reported the prevalence of 6.81% for coccidia which is close to the one obtained (4.2%) from the current study.

Current study results illustrated that female horses had significantly (p<0.05) higher prevalence and faecal egg load of nematodes are in accordance with the findings of Francisco et al. (2009) and Fikru et al. (2005) who showed that females were more infected than males. Similarly, Nielson et al. (2018) stipulated that male equids showed lower nematode egg counts than females. Similar gender differences in strongyle FECs have been reported by Debee et al. (2016). Our findings of this study also supported by the results of Dagnachew et al. (2011) who reported higher prevalence of parasites in females when compared to males despite being exposed to similar husbandry practices and these findings also coincide with the work of Oli and Subedi (2018). The findings of the present study could possibly be associated with the fact that in Lesotho males are comparatively well cared with minimal grazing hence will always have lower FECs than females. This assumption is confirmed by some authors who indicated that all grazing animals can accumulate large number of worms because their pasture is contaminated in most of the times (Matthews, 2014).

Our results further demonstrate that sex did not affect both prevalence and faecal egg load for coccidia and cestodes, however male horses were more parasitized by coccidia than female horses while female horses were more parasitized by cestodes than males. In agreement with these results, the findings of Ghahfarrokhi et al. (2014) revealed a higher prevalence for coccidia in males than females in Shahrekord, Iran. On the contrary, De Souza et al. (2009) revealed coccidia infection only in females. Studzinska et al. (2008) have indicated that this wide dispersion of results might be rooted from various ages of examined horses as well as the coproscopy methods used. Moreover, in support of the results of the current study, Francisco et al. (2009)

reported a higher prevalence of cestodes in females than in males. Similarly, the findings of Tomczuka et al. (2017) have also revealed higher cestodes prevalence in females (28.8%) than in male (12.0%) horses.

Current study also revealed that young horses had significantlyhigher prevalence and faecal egg load of nematodes. In agreement with the results of this study, Relf et al. (2013) and Fritzen et al. (2010) also reported higher prevalence of nematodes in foals and young horses. Similarly, the study conducted by Kornas et al. (2010) presented the most elevated egg per gram in yearlings and two-year-old horses which concurs with Nielson et al. (2018) who stipulated that young horses had higher ($p<0.05$) nematode FECs than old horses. Furthermore, some researchers also proved a higher susceptibility of young animals to infestation (Tirosh-Levy et al., 2015; Hinney et al., 2011; Kornas et al., 2010). The possible reason for low prevalence in old animals could be that immunity against the common gastrointestinal parasites begins to develop with age and as a result older horses tend not to be affected by parasite related problems like younger horses (Belete and Derso, 2015). In our study, age did not affect the prevalence and faecal egg load of coccidia. Contrary to the our results, Lyons et al. (2007) reported higher coccidia infection in foals than in old horses. Ghahfarrokhi et al. (2014) have also stated that the infection of coccidia concerns mainly young horses especially foals. The disparities on coccidia prevalence and FECs between the current study and other studies could be brought by the variations in the use of medication and many other factors like management systems and environmental factors that can influence the level of immunity to infection and manifestation of the parasitic infections. Despite the insignificance on the prevalence and faecal egg load for cestodes between the two age groups, young horses were relatively more parasitized.

The observation on the prevalence of cestodes in this study contradicts the ones reported in other study which showed the lowest prevalence rate in foals up to 1-year-old and rising with the age of an animal (Kornas et al., 2007). According to Tomczka et al. (2017) young horses have low cestodes prevalence because their jaws are weak hence they only feed on the grass tips, which are infrequently occupied by oribatid mite which is an intermediate host for cestodes while the older horses on the other hand have strong jaws that can bite deep into the pasture turf, where the mite concentration is the highest, thereby, exposing themselves to cestodes infestation.

Despite the insignificant difference on the prevalence of nematode and coccidia across the three agro-ecological zones, horses in the lowlands were relatively more infected and these tally with the findings of Dagnachew et al. (2011) who stipulated that the prevalence of nematodes in the lowlands was higher than the infection in the mountains. Similarly, in a study that was conducted in Tunisia, Slimane (2014) reported horses in the lowlands having the highest prevalence. A relatively higher cestodes infection in the mountains as reflected in Table 6 tally with the work of Holland et al. (2001) who indicated a higher prevalence for helminthes in the highlands than in the lowlands. The non-significant ($p>0.05$) differences in both prevalence and faecal egg abundance of GIPs obtained in this study could be attributed to uncontrolled movement of animals from one area to another in Lesotho which poses the risk of cross contamination between different areas resulting in uniform infection.

In terms of faecal egg loads for nematode, the findings of this study corroborates with the report of Holland et al. (2001) which stipulated that the higher FECs for helminthes was found in the highlands than in the lowlands. However, Dagnachew et al. (2011) indicated the highest FECs of helminthes in the lowlands for nematode infestation with the lowest in the mountains.

## CONCLUSION

Among the gastrointestinal parasites recovered in this study nematodes represent the major health threatening parasites for horses in the Maseru district in Lesotho with sex (female) and age (young) being the major risk factors determining both prevalence and burden. Horses in the highlands are at the higher risk of infestation by nematodes.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study, in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

## AUTHORS CONTRIBUTION

All authors have greatly contributed towards the conceptualization and design of the work, methodological approach,

analysis and interpretation of the data and writing. Moreover, all authors have approved the submitted version, and agree to be personally accountable for their own contributions and for ensuring that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and documented in the literature.

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