

Original article

## Haematobiochemical Changes in Gastrointestinal Parasites-Infected Horses in Al Jabal Al Akdar, Libya

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### ABSTRACT

**Keywords:**Hematological, Horses,  
Gastrointestinal Parasite.

This study investigated the prevalence of gastrointestinal parasites (GIPs) and their influence on hematological and selected biochemical parameters in horses. Our study was carried out on 110 horses of different ages and both genders during the period from April 2023 to May 2024 in Al Jabal Al Akhdar Region, Libya. Fecal and blood samples were collected for parasitological examination, hematological, and biochemical analysis by using an automatic cell counter and a spectrophotometer. The results showed that 59.09% of horses were infected with gastrointestinal (GI) parasites, *Cyathostomins* spp., which was the most prevalent species in this study among the infected horses; eight horses had mixed infections. The hematological analysis revealed a significant increase in basophils in infected horses, whereas no statistically significant differences were observed in Hb, Hct, RBCs, MCV, MCH, MCHC, WBCs, neutrophils, eosinophils, monocytes, lymphocytes, and platelets, or serum total protein levels.

### Introduction

Libya has recently witnessed an increase in horse breeding for several purposes, including producing quality breeds, competing in racetrack events, and taking part in formal equestrian competitions [1]. Horses belong to the equine group, and they are found in temperate, semi-arid, or mountainous regions, where they live in groups with other domestic animals such as sheep and goats [2]. The global horse population is approximately 124 million, and more than 60% are found in developing countries, which are used for various purposes [3]. Horses serve an essential function in both economic and social spheres. They are commonly maintained for agricultural tasks such as plowing, planting, and threshing [4]. Horses are susceptible to a wide range of parasitic infections that cause health problems [5] [6]. Equines are often infected by helminths, or parasitic worms, which rank among the most common parasites. These helminths include nematodes and cestodes [7].

Equine productivity is negatively affected by parasitic infections, especially those due to cyathostomum and large strongyles, which lead to anemia, weight loss, gastrointestinal disturbance, and impaired nutrient absorption, thereby reducing overall performance [7]. Gastrointestinal parasites (GIPs) significantly affect the economic value of equines, resulting in decreased fertility and work performance [8]. Horses may appear clinically normal; however, they may carry more than half a million GIPs, such as nematodes, protozoa, and cestodes [9]. The most common clinical symptoms observed in horses infected with nematodes are decreased appetite, weakness, loss of body weight, rough hair coat, diarrhea, and, finally, leading to death [10].

In addition, horses can host a large number of parasites without showing any clinical symptoms [11]. Among the various groups of helminths, large strongyles are the most common affecting horses [12]. Hematological parameters are useful in the diagnosis of infectious, parasitic, and metabolic conditions. They are also used to suggest therapeutic and to evaluate the overall health of a herd [13]. Therefore, this study aimed to identify the prevalence rate of gastrointestinal parasitic infection (GIPs) and investigate their influence on hematological and selected biochemical parameters in horses infected with (GIPs).

### Methods and Materials

#### Study area and animals

A cross-sectional study was carried out on 110 horses randomly selected from different ages, genders (65 female, 45 male), and different farms of the Aljabal Alakhdar region, located in Northeastern Libya. This part of the country is characterized by abundant rainfall, fertile soil, and a moderate climate [14].

## Samples collection and parasitological examination

### Fecal samples

A total of 110 fecal samples were obtained directly from the rectum of each animal individually, placed in nylon bags, and then sent to the laboratory on ice for parasitological examination. About 10 grams of fresh feces of each sample were tested within 24 hours of collection using a simple flotation test. This procedure was used to identify the presence of GIPs [15], which include eggs of helminths and protozoal cysts or oocysts.

## Hematological and biochemical analysis

### Blood samples

Blood samples were obtained from the jugular vein of each animal in the early morning, and each sample was placed in a tube containing EDTA for hematological examination. For biochemical measurement, blood samples were collected in plain tubes, kept at room temperature for clotting, and then centrifuged at 3000rpm for 10 minutes to obtain serum[16]. In this study, hematological parameters, including hematocrit (Hct%), hemoglobin (Hb), red blood cells (RBCs), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), white blood cells (WBCs), and platelets, were measured using an automated hematology analyzer (ABAXISVet Scan HM5). Serum total protein was estimated by using a specific reagent kit on a biochemical auto-analyser (Rapid Diagnostic Pvt. Ltd. STAR 21 plus). The biochemical parameter is total protein, which was estimated by using a specific reagent kit.

### Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 23. The descriptive statistics test was used to calculate the mean and standard error of the data. The normality of the data distribution was assessed using the Shapiro-Wilk test, and the equality of variances was evaluated using Levene's test. An independent-samples t-test was used to compare means between the infected and non-infected groups. A p-value of less than ( $< 0.05$ ) was assumed statistically significant. All parameters were reported as mean $\pm$  standard error.

### Ethical approval

This study was approved by the Al-Mukhtar committee for Bio-safety and Bioethics, Omer Al-Mukhtar University; approval number is NBC: 007. A. 26. 91.

## Results

As shown in (Table 1), out of 110 samples, 65 (59.09%) were found to be positive for GIPs. Six GIPs were reported in this study, including: three nematodes (cyathostomins spp, *Parascaris equorum*, and *Oxyuris equi*), one cestoda (*Anoplocephala* spp.), one protozoa (*Eimeria leuckarti*), and one arthropoda (*Gasterophilus* spp.). The infestations were single or mixed. *Cyathostomins* spp (small strongyles) were the most prevalent parasite among all types of GIPs helminth infections, it had the highest prevalence of 58.18% (64/110). Mixed infection with two or more parasites was detected in eight horses, 7.3% [8].

**Table 1. Fecal examination illustrates the prevalence of GIPs infection in horses**

Examined	Infected	Mixed	Cyathostomins spp. (small strongyles)	Parascaris equorum	Oxyuris equi	Anoplocephala spp sistoda.	Eimeria leuckarti	Gasterophilus spp.
110 Horses	65	8	64	4	3	1	1	1
Prevalence %	%59.09	%7.3	%58.18	%3.64	%2.73	%0.91	%0.91	%0.91

As summarized in (Table 2), the hematological and biochemical analysis revealed that there was no statistically significant difference documented in most hematological and the biochemical parameters in infected horses, including hematocrit (HCT%), hemoglobin (Hb), red blood cells (RBCs), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), Eosinophils (E), neutrophils (N), Lymphocytes (L), monocytes (M), and platelets as well as total serum protein. However, a significant increase in basophils in infected horses when compared to non-infected horses was observed.

**Table 2. Hematological parameters in infected horses compared to non-infected horses**

Blood parameter	Non-infected horses (N=45)	Infected horses (N=65)	P Value
Hct (%)	35.160±1.407	34.740±0.621	0.763
Hb (g/dL)	13.189±0.515	12.865±0.230	0.526
RBCs (per/ $\mu$ L)	7.702±0.302	7.565±0.135	0.646
MCV (fl)	44.862±1.020	45.860±0.022	0.241
MCH (pg)	16.584±0.377	16.722±0.235	0.746
MCHC (g/L)	36.754±1.027	42.131±5.123	0.390
WBC (per/ $\mu$ L)	10491±750	12254±859	0.125
N%	43.056±1.667	43.854±1.245	0.702
B%	0.169±0.046	0.326±0.051	0.025*
M%	4.491±0.200	4.745±0.200	0.371
L%	49.438±1.793	50.277±1.255	0.702
PLT	137.67±9.629	139.43±8.917	0.893
TP (g/d)	6.91±0.264	7.48±0.212	0.098
E%	0.638±0.093	0.955±0.177	0.116

## Discussion

In the current study, the prevalence of GIPs was recorded to be 59.09% (65/110). This prevalence was in close agreement with [17-20], who found a prevalence rate of 59.25%, 59.3%, 55.7%, 51.7% in North India, Mekelle Region, Kombolchu town, and Warmia of Mazury, respectively; however, it was higher than reported in Egypt (16%) by [21]. A higher prevalence rate of GIPs was obtained by [22,23,11], who recorded 92.71%, 76.1%, and 84.76% in Gondar town, Ethiopia, Nepal, respectively. In the present study, the highest prevalence was 58.18% for the infection with *Cyathostomins* spp (small strongyles). This finding is higher than the 13.3% reported by [24] and the 15.79% [25]; however, it is lower than the 88.4% recorded by [26]. The high prevalence of *Cyathostomins* spp indicated a significant equine health problem in the Al Jabal AL Khdar region, especially since the global distribution of these helminths is not restricted to specific climatic conditions or management programs [27]. The high prevalence could be due to the development of anthelmintic resistance, a globally documented issue, where *Cyathostomins* spp have been reported to exhibit resistance to multiple types of anthelmintic drugs [28]. Our findings could be alarming for that issue, particularly if the deworming programs are not effectively applied in the area.

Variations of the prevalence rate could result from different management systems, climatic conditions, environmental hygiene, deworming programs, sampling method, and sample size [17,29,21]. Moreover, the prevalence variation in the current study may result from the geographic areas where it has been found that highland regions characterized by a cooler climate recorded a higher prevalence rate than those from lowland areas [30]. In our study, the prevalence of *Parascaris equorum* was 3.64%, which was close to that reported by [31] (4.6%) in Germany and slightly lower than that observed by [26] (5.1%) in Egypt and much lower than (43.8%) obtained by [22]. The reason for the lower prevalence rate of *Parascaris equorum* in this study can be attributed to the sample collection method.

Fecal samples were mostly from adult horses, where the infection with *Parascaris equorum* is common in horses less than 5 years old [32]. The prevalence rate of *Oxyuris equi* was 2.73%. This finding was slightly lower than those by [33] (4%) and [34] (4.7%); however, higher than reported by [22] (0.95%) and [23] (1.47%). A higher prevalence rate of 27.1% and 34.2% was reported by [35] and [29], respectively. A lower prevalence of *Oxyuris equi* may be attributed to the cooler climate in the study region [11]. In the current study, the mean of Hb, Hct, and RBCs in infected animals was slightly low or within the normal range of non-infected animals. This result was in agreement with [36] and [6]. These results can be associated with the nature of helminths where the clinical picture may appear with or without anaemia [27,6]. In addition, MCV, MCH, and MCHC remained within normal values as previously reported by [10]. In the recent study, the mean of WBCs in infected horses was (12254±859), which is within the normal range; however, many researchers have reported an increase in white blood cells in infected equines [36,37].

An increased WBC count may occur in response to the irritation of the intestinal mucosa caused by larval migration, leading to inflammation [38,6]. The mean basophils (0.326±0.051 %) were significantly elevated in infected animals, and this result was in agreement with [37]. Helminth infection is mainly associated with increased eosinophilia [39]. However, basophils have contributed to the immune defense against helminth infections for over 50 years by activating type 2 T helper cell responses and are also important in allergic responses [37,40]. Furthermore, the reason for the increase in basophils over eosinophils can be attributed to the fact that the predominant parasites were *Cyathostomins*. As gastrointestinal nematodes, they have

the ability to suppress immunity by producing factors inhibiting Th2 cells and eosinophil activities. Therefore, Cyathostomins may have a similar immunomodulatory effect [39].

The measurement of protein concentration in blood serum is one of the common tests in laboratory diagnosis. Changes in plasma protein levels may arise from variations in their synthesis, increased breakdown, or protein losses from the body. Biochemical studies in GI parasite-infected horses showed a decrease in total protein [10, 36]. However, in this study, the protein showed no significant alteration. It was in agreement with the study of [36,6]. Variations in hematological and chemical parameters can be attributed to several factors, including environmental and physiological conditions, breed, geographical sites, nutrition, and management programs. Although the high prevalence of infection with internal parasites in this study may be due to the absence of effective periodical deworming programs, the observed normal values of hematological and chemical parameters may be affected by the quantity and quality of the national regime, which reduced the damage caused by the parasites [6]. However, our findings revealed a significant increase in basophils in infected horses. This increase indicates an effective immune response played by basophils, specifically the activation of Type 2 immune responses. Therefore, future research should focus on the primary role of basophils in equine immunity. Furthermore, effective therapeutic programs should be performed, and the random use of anthelmintics should be limited. Significantly, anthelmintic resistance studies should be applied to determine the resistance levels, especially since the high prevalence of internal parasites in this study was due to Cyathostomins, which are globally known for their ability to develop resistance to anthelmintics.

## Conclusion

Our study showed the prevalence of GIPs in horses in AL Jabal Al Akdar; the main finding from the study was Cyathostomins spp. (small strongyles) followed by *Parascaris equorum*, then *Oxyuris equi*, and there were mixed infections of these parasites. Horses infected with gastrointestinal parasites showed a significant increase in basophils, while there were no changes in other measured parameters.

*Conflict of interest.* Nil

## References

1. No P, Ramadan A, Mohamed A, Imbayyah A, Ashteebah A. Assessment of internal parasite infection in horses from various farm types in the western area of Libya. *Afr J Adv Pure Appl Sci.* 2025;4(2):21–7.
2. Ramadan A, Mohamed A, Mohammed A, Sirtiyah A, Jalboub M, Alhadi K, et al. A field study to evaluate the efficacy of medicinal plants, *Artemisia herba-alba*, *Coriandrum sativum*, *Allium sativum*, and their combination on internal parasites. *North Afr J Sci Publ.* 2025;3(1):124–31.
3. Ola-Fadunsin SD, Daodu OB, Hussain K, Ganiyu IA, Rabi M, Adah AS, et al. Gastrointestinal parasites of horses (*Equus caballus* Linnaeus, 1758) and risk factors associated with equine coccidiosis in Kwara and Niger States, Nigeria. *Sokoto J Vet Sci.* 2019;17(3):[page range if available].
4. Belay W, Teshome D, Abiye A. Study on the prevalence of gastrointestinal helminth infection in equines in and around Kombolcha. *J Vet Sci Technol.* 2016;7(5):[page range if available].
5. Al-Ezzy AIA. Haematological changes associated with gastrointestinal parasites infection in domestic animals attended to outpatient clinic of Faculty of Veterinary Medicine of Diyala University, Iraq. *Diyala J Vet Med.* 2014;(Jan):[page range if available].
6. Aboashia FA. Internal parasites (nematode) infestation in pure Arabian horses: field study. *Open Vet J.* 2023;13:481–4.
7. Ullah A, Geng M, Chen W, Zhu Q, Shi L, Zhang X, et al. Effect of parasitic infections on hematological profile, reproductive and productive performance in equines. *J Equine Vet Sci.* 2025;1–29.
8. Taye A. Epidemiological study on equine gastrointestinal helminth parasites in Mekelle, North Ethiopia. *J Vet Med Anim Health.* 2017;121–30.
9. Mohammed A, Tukur SM, Kayeri BK, Sani M, Mustapha AH, Midala CA, et al. [Article title missing]. *Sokoto J Vet Sci.* 2025;23(1):38–45.
10. Katre R, Waghmare SP, Pajai KS, Hajare SW, Ali SS. Haemo-biochemical alteration in gastro-intestinal nematode infection in horses. *J Parasit Dis.* 2020;9(4):15–7.
11. Oli N, Subedi JR. Prevalence of gastro-intestinal parasites of horse (*Equus caballus* Linnaeus, 1758) in seven village development committees of Rukum District, Nepal. *Nepal J Sci Technol.* 2018;22(2):70–5.
12. Devkota RP, Subedi JR, Wagley K. Prevalence of gastrointestinal parasites in equines of Mustang district, Nepal. *Biodiversitas.* 2021;22(9):3958–63.
13. Agina OA. Haematology and clinical biochemistry findings associated with equine diseases: a review. *J Equine Sci.* 2017;9(1):1–21.
14. Mohammed ZMA, Ibrahim WM. A morphopathological study on ovine pulmonary adenocarcinoma in Libya. *Libyan J Vet Med.* 2022;32(2):23–32.
15. Thammarat S. Prevalence of gastrointestinal and blood parasites in horses of Nakhon. *Vet World.* 2024;17:[page range].

16. Guzel S, Tanriverdi M, Senlik B. Selected biochemical parameters in strongyle infections of horses and its relationship with the parasite burden. *Kafkas Univ Vet Fak Derg.* 2014;20(5):1233–6.
17. Altaş MG, Sevgili M, Gökçen A. Şanlıurfa yöresi kıl keçilerinde sindirim sistemi nematodlarının yayılışı. *Türkiye Parazit Derg.* 2009;33(1):20–4.
18. Belete S, Derso S. Prevalence of major gastrointestinal parasites of horses in and around Mekelle (Quiha and Wukro). *J Vet Sci Technol.* 2015;3(3):1–10.
19. Enigidaw S, Assefa A, Mekonnen N, Belete S. Prevalence of gastro intestinal nematode parasitic infections of horses and donkeys in and around Kombolcha town. *Glob Vet.* 2015;10(4):228–34.
20. Sokół R, Raś-Noryńska M, Michalczyk M, Raś A, Rapacz-Leonard A, Koziatek S. Estimation of infection of internal parasites in horses from different type of farms. *Pol J Vet Sci.* 2015;61(3):189–92.
21. El-Rady LMA, Dyab AK, Mahmoud S, Mohamed SA. Prevalence of gastrointestinal parasites in horses in Aswan Governorate, Egypt. *J Egypt Soc Parasitol.* 2021;67(171):12–20.
22. Mezgebu T, Tafess K, Tamiru F. Prevalence of gastrointestinal parasites of horses and donkeys in and around Gondar Town, Ethiopia. *J Vet Med Anim Health.* 2013;2013(Oct):267–72.
23. Sultan A, Ayele G, Tadesse B, Ahmed A. Prevalence of gastrointestinal parasites of horses and donkeys in Kurfa Chale District, East Hararghe, Ethiopia. *J Vet Sci Technol.* 2015;26(7):1–9.
24. Elshoura EE, Elseadawy RM, Al-Araby MA, Abu-Elwafa SA. Epidemiological study on variety of gastrointestinal helminths infecting equine in Dakahlia Governorate, Egypt. *J Adv Vet Res.* 2026;88:109–19.
25. Nasser SS. [Title missing – incomplete reference].
26. Salem SE, Abd El-Mawla AM, Hamad EG, Abdelaal AM, Elsheikh HA, Hamid AA, et al. Prevalence of gastrointestinal nematodes, parasite control practices and anthelmintic resistance patterns in a working horse population in Egypt. *Equine Vet J.* 2021;53(2):339–48.
27. Corning S. Equine cyathostomins: a review of biology, clinical significance and therapy. *Parasit Vectors.* 2009;2(Suppl 2):S1–6.
28. Traversa D, von Samson-Himmelstjerna G, Demeler J, Milillo P, Schürmann S, Barnes H, et al. Anthelmintic resistance in cyathostomin populations from horse yards in Italy, United Kingdom and Germany. *Parasit Vectors.* 2009;2(Suppl 2):S1–7.
29. Town AH, Berhanu T, Ibrahim N, Deressa B, Tolosa T. Prevalence of helminth parasites of horses in Adami Tulu Jido Kombolcha District, Ethiopia. *J Vet Med Res.* 2018;5(1):7–11.
30. Holland WG, Do TT. Strongyle infections in horses from north Vietnam. *Vet Parasitol.* 2000;89(1-2):3–5.
31. Boelow H, Krücken J, von Samson-Himmelstjerna G. Epidemiological study on factors influencing the occurrence of helminth eggs in horses in Germany based on sent-in diagnostic samples. *Parasitol Res.* 2023;122:749–67.
32. Scala A, Tamponi C, Sanna G, Predieri G, Meloni L, Knoll S, et al. *Parascaris* spp. eggs in horses of Italy: a large-scale epidemiological analysis of the egg excretion and conditioning factors. *Parasit Vectors.* 2021;14:246.
33. Regassa A, Yimer E. Gastrointestinal parasites of equine in south Wollo zone, north eastern Ethiopia. *J Anim Vet Adv.* 2013;11(6):824–30.
34. Adeppa J, Ananda KJ, Krishna CM, Satheesha GM. Incidence of gastro-intestinal parasites in horses of Shimoga region, Karnataka state. *J Parasit Dis.* 2016;40(3):919–21.
35. [Author missing]. Prevalence of gastro-intestinal parasites in horses used for cadets training in Nigeria. *J Vet Adv.* 2013;3(2):43–8.
36. Salem NY, Yehia SG, El-Sherif MA. Hemato-biochemical and minerals status in mixed parasitic infection in Arabian foals. *J Equine Vet Sci.* 2015;35(10):28–31.
37. Singh P, Hasnani JJ, Patel PV, Singh N, Kumar A. Haematological alterations in gastrointestinal helminths infected horses at Anand district of Gujarat, India. *J Parasit Dis.* 2019;8(4):45–51.
38. Deplazes P, Eckert J, Mathis A, von Samson-Himmelstjerna G, Zahner H. *Parasitology in veterinary medicine.* Wageningen (NL): Wageningen Academic Publishers; 2016.
39. Moreau E, Chauvin A. Immunity against helminths: interactions with the host and the intercurrent infections. *J Biomed Biotechnol.* 2010;2010:428593.
40. Peng J, Siracusa MC. Basophils in antihelminth immunity. *Front Immunol.* 2022;13:829186.