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Original Article

Prevalence of the intestinal nematodes in equines with an assessment of the therapeutic approach using albendazole and doramectin

Walaa Mostafa[1], Ahmed Abdel-Rady [2], Fatma Ahmed Khalifa[3], Mohamed Morsi Elkamshishi[4], Hisham Awny[5], Wael Felefel[6]

[1]Department of Parasitology, Faculty of Veterinary Medicine, Sohag University, Sohag, Egypt. ORCID number: 0000-0001-6627-9962,[2]Department of Animal Medicine (Infectious Diseases), Faculty of Veterinary Medicine, Assiut University, PO Box 71526 9 Assiut, Egypt. Email: abdelrady14@aun.edu.eg, Consultant of Infectious Diseases in Dammam Veterinary Laboratory, Ministry of Environment, Water and Agriculture, Kingdom of Saudi Arabia, ORCID number: 0000-0003-1361-2092,[3]Department of Infectious Diseases, Faculty of Veterinary Medicine, South Valley University, Qena 83523, Egypt, ORCID number: 0000-0002-7003-448X,[4].Department of Animal Hygiene and Zoonoses, Faculty of Veterinary Medicine, Matrouh University, Matrouh 51744, Egypt, ORCID number 0000-0002-2145-0663,[5]PhD Biostatistics, high institute of public health, E. mail hishamawny2371977@gmail.com , ORCID number: 0009-0004-5964-4123,[6]Department of Parasitology, Faculty of Veterinary Medicine, Matrouh University, Matrouh 51744, Egypt, email: waelfelefel@yahoo.com, ORCID number: 0000-0002-3628-678X

Corresponding author: Dr. Walaa Mostafa,

E. Mail;
Walaa_saleh@vet.sohag.edu.eg

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Abstract

Intestinal nematode parasites of equines have emerged as a pressing and urgent challenge due to their worldwide impact on the health performance and economy; therefore, implementing a deworming regimen has become vital to keep a horse's parasite load at an acceptable level. The current study aimed to estimate the prevalence of nematodes infection, associated risk factors and evaluate the chemotherapeutic efficacy of two anthelmintic drugs by enrolling 195 fecal samples of working equines by using flotation concentration technique the positive cases were 137 working equines which the overall prevalence of intestinal nematode parasites in working equines 70.25%. Accordingly, animals were divided into four groups; Group **1** received albendazole orally, Group **2** received doramectin injection, Group **3** received a combination of albendazole and doramectin, and Group **4** was left untreated as a positive control. The recovered nematodes were *Strongylus* species, 87.17% followed by *Parascaris equorum* 30.76%, and *Oxyuris equi* 12.82%. Concerning treatment efficacy, the highest cure rate was among Group 3 (77.14%), followed by Group 2 (68.57%) and Group 1 (40%), but the difference between Groups 2 and 3 was statistically insignificant. Interestingly, the effect of doramectin injection was highly significant than others, especially for the reduction of *Strongylus* spp. and *Parascaris equorum* eggs according to Cohen's D test. Translating such a potent combination of drugs into endemic areas will provide significant support for deworming and control programs against intestinal parasites of equines, especially those in the migratory phase, more than albendazole alone, which has poor absorption as it requires a full stomach during administration.

Keywords: Anthelmintic, Cohen's D test; Efficacy, oral therapy, injection therapy

INTRODUCTION

Gastrointestinal nematodes infection is a significant health concern for the working equine population that impairs their fulfillment worldwide ***(Jajere et al., 2016)*.** Furthermore, the most common intestinal nematodes identified in equines are large strongyles includes (*Strongyles Vulgaris*, *Strongylus edentates*, *Strongylus equines*), small strongyles includes (*Cyathostomins* spp.), *Parascaris equorum*, and *Oxyuris equi* ***(Nielsen, 2012)***. Multiple anthelmintic drugs with different modes of action are used to deal with intestinal nematodes among equines including Albendazole, which acts on tubulin polymerization ***(Tjahajati et al., 2021)***, leading to loss of cytoplasmic microtubules in the nematodes' intestine and, ultimately, energy depletion and death of treated nematodes ***(Mostafa et al., 2023)*.** On the other hand, doramectin treat helminths; through inducing neurotoxicity in parasites by potentiating the glutamate-gated chloride ion channels increasing chloride ion permeability ***(Fesseha et al., 2020)***, and hyperpolarizing nerve cells, eventually paralyzing and killing the parasite (***Felefel et al., 2022)***. Furthermore, knowledge about Doramectin efficacy or resistance in equines is scarce, despite its periodically use among equine populations ***(Salem et al., 2017)***. Therefore, the current research was conducted to determine the prevalence and potential associated risk factors that influence the infection of intestinal nematodes in equines in Assiut Governorate, Upper Egypt, with a special reference to assess the chemotherapeutic efficacy of the co-administration of Albendazole and Doramectin.

MATERIALS AND METHODS

1. Study design and animal population:

This cross-sectional study with a randomized control trial (RCT) was based on the total prevalence of parasites infected horses that were 15% among naturally infected horses in Luxor Governorate, Egypt and correlated with a total number of worked equines that totaled 40,000 according to Egypt's self-declaration ***(Ali, 2021)***. At a confidence level of 95% and a margin of error of 5%, the minimum number needed to achieve the objective of the current study was 195 working horses (*Equus caballus*)

and working donkeys (*Equus asinus*). Z-test between two independent groups was performed using the G power program. Meanwhile, the suspected infection rate was 73% through 10% pilot study at two tail levels, α error was 0.05% with β power of 0.95% and a 1:1allocation ratio. Therefore, the minimum number of infected cases per intervention group in the current study was 35 infected cases of working equines ***(Abd el-rady et al., 2021)***.

2. Animal sampling and husbandry

The study was carried out on 195 fecal samples from worked equines, including 80 worked horses and 115 worked donkeys, obtained during the period from first June 2021 to end May 2022 from different localities at the private horse stables at Dirout, Menflout, Sedfa and Assuit City in Assiut Governorate southern Egypt (27.252°E; 31.09°N). The working equine's age, season, and body condition score (BCS) were also investigated.

3. Parasitological examination

Fresh fecal samples were collected randomly from working equines using a sterile plastic bag for parasitological purposes. The samples were grossly examined using the hand lens to detect the adult parasite.

3.1 Flotation technique

Five grams of feces were mixed with a 15 ml saturated salt solution. The above-mentioned mixture was strained through a fine sieve (0.5 mm mesh) by thoroughly mixing with a wood stick. The suspension was transferred to a suitable centrifuge tube and centrifuged at 2000 g for three minutes. A few drops using a pipette were transferred from the surface of the flotation solution to a microscopic slide and then covered with a cover slide. Subsequently, the slide was inspected under 10 x and 40 x magnifications for the final assessment and existence of helminthic eggs using an Olympus optical microscope ***(Felefel et al., 2023)***.

3.2 McMaster egg counting technique

A mixture of 1 gram of fecal matter from each sample and 28 ml of saturated salt solution was sieved in another clean container. McMaster counting chambers were filled using a Pasteur pipette with the previous mixture. Then eggs were counted in both chambers. Eggs per gram (EPG) were calculated for all types of

recovered eggs through the following equation: EPG = total number of eggs under both chambers multiplied by 50 to get the total number of eggs per gram ***(Cain et al., 2020)***.

3.3 Scotch tape technique

The sticky side of a small piece of adhesive tape is applied to the perianal area and then attached directly to a glass slide for microscopic detection of the *Oxyuris equi* eggs ***(Rodrigues et al., 2023)*.**

4. Treatment regime

1. The positive cases of working equines were divided into four groups:

- Group **1** (Albendazole group standard treatment): 35 working equines were orally administered at 7.5 mg/kg body weight (b.w.) (two doses with three-week intervals); the drug was dissolved in drinking water to overcome the guttural pouch problem.
- Group **2** (Doramectin injection intervention treatment): 35 working equines were intramuscularly injected at 200 µg/kg b.w. (two doses with two-week intervals).
- Group **3** (A combination of Albendazole orally and Doramectin injection intervention treatment): the treatments were applied to 35 working equines in the same dose as groups **1** and **2** for each drug.
- Group **4** (Positive Control): 32 working equines were left without treatment.

5. Statistical Analysis

Statistical analyses were performed using SPSS version 21 and Microsoft Excel 2010. However, the Chi-square, Z-test, ANOVA, and Monte Carlo tests were used. Kolmogorov-Smirnova test and Shapiro-Wilk test were also applied to examine the normality of quantitative egg count which the quantitative variables were represented by mean $\bar{x}$ ± confidence interval CL at level 95%, and then a paired t-test was applied to predict the change pre- and post-treatment, followed by a calculated Cohen's D test to estimate the effect size of each intervention group. Finally, odds ratios and binary logistic regression were used to predict the risk factors. The receiver-operating characteristic curve value (ROC) was conducted to estimate the chemotherapeutic efficacy. BCS was evaluated from 1= (emaciated) to 9 = (obese) ***(Busechian et al., 2022)***.

5.1. Intervention treatment assessments

A fecal egg count reduction test (FECR%) was calculated eight weeks' post-treatment for all intervention groups using the McMaster egg counting technique as follows **(*Morgan ER et al., 2022*)**

$$FECR\% = \frac{\text{pre-treatment EPG - post-treatment EPG}}{\text{pre-treatment EPG}} \text{ X } 100$$

While the calculated cure rate percentage (%) was determined by the formula as follows **(*Balogun OS et al., 2020*)**

$$\frac{\text{the number of cured worked equine}}{\text{the number of infected worked equine}} \text{ X } 100$$

Furthermore, the following formula was applied to calculate the effect size using Cohen's D test **(*Lakens D, 2013*)**

$$\frac{\text{absolute value of t paird test}}{\sqrt{n}}$$

RESULTS

The overall prevalence of parasitic nematodes among the examined equines was (70.25%) 137/195, while (56.25%) 45/80 of working horses and (80.00%) 92/115 of working donkeys were found to shed nematode eggs with a statistically significant difference (P = 0.000). The odd ratio was 0.321 CL 95% (0.170-0.607); however, the area under curve (AUC) was 0.637(0.551-0.724). The obtained results revealed that; the frequency percentage of nematode infection among the female animals (73.33%) was higher than the male counterparts (66.66%), with a non-significant change (P =0.310) (Table 1.). Similarly, the prevalence increased in the younger ages, 79.36% in 1-year-old equines compared to 64.28% among the older ages 15-20. However, this marked difference was statistically insignificant (P=0.104). Even though the prevalence of nematode infection in case of low body condition score 1 (75.0%) was higher than that of the body score 3 (60.0%), this difference was statistically insignificant (P=0.188). Furthermore, the current study highlighted that helminthes infection in equines prevailed throughout the year, with the highest peak of occurrence during Spring (84.0%), followed by Autumn (75.0%) and Summer (66.66%), while the lowest rate was observed during Winter (55.55%), indicating an evident pattern in the seasonality of the infection with the significant difference (p=0.019) that was observed between the different seasons (Table 1).

Based on the ROC curve, which predicts the effectiveness of risk factors that influenced intestinal infection among examined equines. The results estimated that the species were considered high-risk factors that influenced the intestinal nematode infection rate more than other risk factors due to the highest value of the ROC curve 0.637(0.551-0.724) with a significant difference of P = 0.002;

thus, the horse was protected from getting the infection compared to the donkey, (Figure 1)

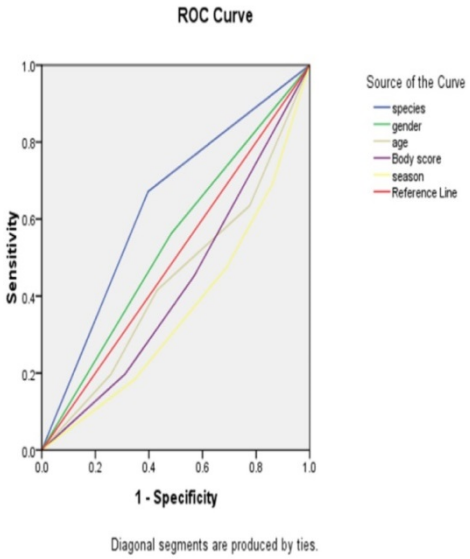

Figure (1): The impact of risk factors on the prevalence of equine intestinal nematodes.

Regarding the recovered nematode species, *Strongylus* species (87.17%) was the highest intestinal nematode, followed by *Parascaris equorum* (30.76%) and then *Oxyuris equi* (12.82%). The prevalence of nematode species among horses was as follows: *Strongylus* species 75.0%, *Parascaris equorum* 25.0%, and *Oxyuris equi* 12.50%. While such prevalence among donkeys as follows: *Strongylus* species (95.65%), *P. equorum* (34.78%), and *O. equi* (13.04%). There is a significant difference for *Strongylus* species infection in donkeys compared to horses (P= 0.000), with an odd ratio of 0.136CL 95% (0.049-0.382), while *O. equi* had the lowest prevalence in the study areas, (Table 3) and different types of nematodes eggs revealed. (Figure 2)

Assessing the effectiveness of treatment was also demonstrated by detecting the reduction in the number of worm eggs per gram of feces (EPG) after treatment, which showed different results. The cure rate for albendazole was 40.0%, and that of doramectin was 68.57%, while the combination of both albendazole and doramectin was more effective 77.14% than a single treatment. However, the cure percentage rate difference between Group 1 and Group 2 was significant (z =-2.4017, P=0.0164), with the lowest AUC 0.674(0.584-0.764) for Group1. On the other hand, the difference in the cure rate between Group 2 and Group 3 determined by the Z-test was insignificant (z = -0.7995, P= 0.42372), and AUC 0.743 (0.660- 0.827) was higher in Group 2 of doramectin injection, (figure 3)

Cohen's D-test value was estimated among related groups pre- and post-treatment after measuring fecal egg count reduction to detect appropriate drug size effects on recovered nematode species. The result showed that the drug effect size for albendazole on *Strongylus* species, *P. equorum*, and *O. equi* was 1.65, 1.89, and 1.71, respectively; for doramectin, it was 2.60, 2.05, and 2.53, respectively; while for the combination of albendazole and doramectin, it was 2.37, 1.74, and 2.59, respectively, (Table 3). However, the magnitude of the effect of Doramectin injection and combination of albendazole and doramectin was notable.

Table (1): The prevalence of intestinal nematodes among working equine and association risk factor.

Risk factors		No. exam.	No. of positive	Pearson Chi-Square		Odd ratio 95%	Z test	
				X2	P		value	P
Species	Horse	80	45 (56.25%)	12.735	0.000	0.321(0.170-0.607)	-3.6026	0.00032
	Donkey	115	92 (80.00%)					
	Total	195	137 (70.25%)					
Gender	Male	90	60 (66.66%)	1.031	.310	.727(.393-1.346)	1.0198	0.30772.
	Female	105	77 (73.33%)					
Age	1-years	63	50 (79.36%)	6.166	0.104	**references**	ND	
	5- years	50	30 (60.00%)			0.468(0.195-1.126)		
	10 – years	40	30 (75.00%)			1.2(0.514-2.801)		
	15 -20 years	42	27 (64.28%)			0.6(.231-1.558)		
Body score	Body score 1	100	75 (75.00%)	3.344	0.188	**references**		
	Body score 2	50	35 (70.00%)			0.50(0.236 -1.057)		
	Body score 3	45	27 (60.00%)			0.643(0.275-1.503)		
Season	Spring	50	42 (84.00%)	9.974	0.019	**references**		
	Autumn	40	30 (75.00%)			0.238(0.091-0.620)		
	Summer	60	40 (66.66%)			0.417(0.165-1.0520		
	Winter	45	25 (55.55%)			0.625(.282- 1.386)		

Table (2): the prevalence of Nematodes parasites infection among examined equine.

Nematodes parasites	species	No. exam.	No. of positive %	Total	Pearson Chi-Square		Odd ratio CL 95%	Z test Proportions	
					X2	P		value	P
Strongylus species	Horse	80	60 (75.00%)	170/195(87.1%)	18.004	0.000	0.136 (0.049- 0.382)	-4.228	0.00001
	Donkey	115	110 (95.65%)						
Parascaris equorum	Horse	80	20 (25.00%)	60/195(30.7%)	2.12	0.145	0.625 (0.331-1.18)	-1.455	0.1443
	Donkey	115	40 (34.78%)						
Oxyuris equi	Horse	80	10 (12.50%)	25/195(12.8%)	0.012	0.911	0.952 (0.404-2.243)	-0.1028	0.92034
	Donkey	115	15 (13.04%)						

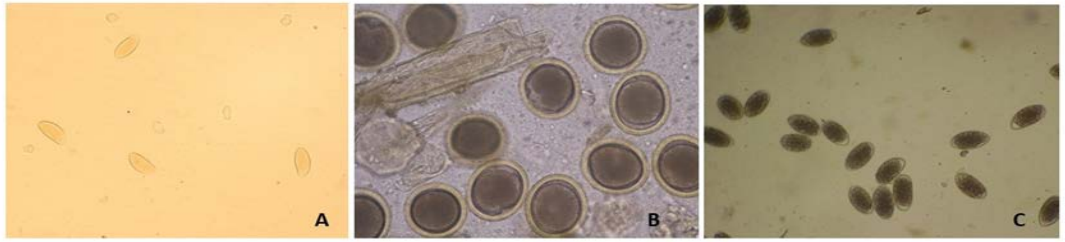

Figure 2: Different types of revealed nematodes eggs.

A: *Oxyuris equi* egg, B: *Parascaris equorum* egg, C: *Strongylus* spp. Egg under power 40 x

Table (3): expositions the cure rate of treatment groups of Nematodes infection

treated group	Cure	Non cured	Monte Carlo .Sig		ANOVA		Z test Proportions	
			Value	P	F	P	Z	P
Group 1 (Albendazole)	14(40.00%)	21(60%)					-2.4017	0.0164
Group 2 (Doramectin)	24(68.57%)	11(31.43%)	56.857	0.000*	24.15	0.000	-0.7995	0.42372
Group 3 (Combination)	27(77.14%)	8(22.86%)						
Positive control	0(0.00%)	32(100.00%)						

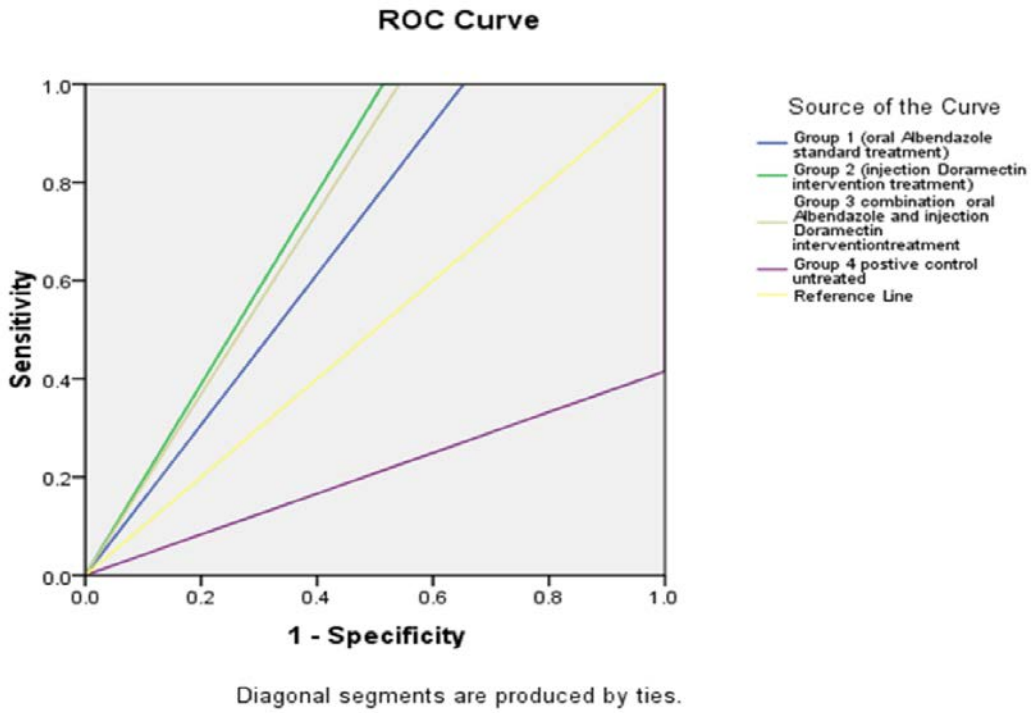

Figure 3: The cure rate of treatment groups of Nematodes parasites species infection by using ROC curve

Table (4): presentations the fecal egg count reduction test FECR% and effect size Cohen's D test among differences study groups.

Helminth	Statistic test	study groups								
		group 1			group 2			group 3		
		Pre	post	%	Pre	Post	%	pre	post	%
Strongylus species	Mean (CI 95%)	303.43 (245.95-360.91)	19.71 (13.09-26.34)		324 (283.18-364.82)	8.23 (3.93-12.53)		336.86 (288.7-385.01)	2.66 (0.85-4.47)	
	t value	-9.784			-15.412			-14.063-		
	P	0.000*			0.000*			0.000*		
	Cohen's D	1.65		93.5	2.60		97.46	2.37		99.21
Parascaris equorum	Mean (CI 95%)	142.85 (121.72-163.98)	23.14 (16.42-29.85)		132.80 (111.66-153.93)	7.45 (3.50-11.41)		129.62 (104.48-154.77)	3.85 (1.30-6.40)	
	t value	-11.202			-12.116			-10.291		
	P	0.000*			0.000*			0.000*		
	Cohen's D	1.89		83.8	2.05		94.38	1.74		97.02
Oxyuris equi	Mean (CI 95%)	85.51 (74.26-96.76)	20.82 (14.71-26.94)		88.68 (78.78-98.58)	6.82 (3.10-10.55)		84.51 (73.69-95.33)	2.85 (1.01-4.70)	
	t value	-10.126			-14.974			-15.353		
	P	0.000*			0.000*			0.000*		
	Cohen's D	1.71		75.64	2.53		92.3	2.59		96.61

DISCUSSION

Intestinal nematode infection has a direct effect on the health and productivity of the working equines, resulting in poor production, a decrease in weight gain of young animals due to low feed payment, and increased susceptibility to infectious diseases ***(Debere et al., 2018)***. However, in some cases, death of animals occurs, resulting in low owner revenue ***(Gavrilova et al., 2019)***. The aim of the current study is determining the prevalence of intestinal nematodes in equines in Assiut Governorate and assess the associated risk factors and therapeutic effect of albendazole and doramectin.

In this study, the overall prevalence of parasitic nematodes among examined equines was 70.25%. These findings are nearly similar to the prevalence recorded by ***Baranova et al. (2022)*** at 65%, and lower than that investigated by ***Debere et al. (2018)*** at 88.8%, and by ***Mathewos et al. (2021; 2022)*** at 78.5% and 94.5%, respectively. Regarding the analysis of variables potentially associated with an increased risk of infection, the prevalence of intestinal helminths in donkeys is estimated to be higher (80%) than in working horses (56.25%). However, this percentage was similar to the studies performed in Ethiopia was 96.9% in donkeys ***(Ibrahim et al., 2011)***. Furthermore, the discrepancies in the ratio of prevalence of intestinal infection in equines could be attributed to the variation of geographic areas, climatic changes, pasture grazing of animals, a lack of deworming, and inadequate management applied for them ***(Mezgebu et al., 2013)***.

The data of the present study also showed that nematode infection among equines varied insignificantly according to sex, from 73.33% in females to 66.66% in males, these results were in line with those obtained by ***Scala et al., (2020)*** who stated that gastrointestinal infection among females is higher than males. ***Andarge et al., (2017)*** showed that there is no significant difference in the prevalence of intestinal nematodes with the sex of the animal, although it is relatively higher in male than female individuals. This phenomenon might be due to pregnancy stress, birth, and lactation, which expose the females to infection ***(Scala et al., 2020)***. According to the results of the current study, the epidemiological peak of horses' infections was noted in younger

animals of one year with a ratio of 79.36%. This rate was more significant than those observed for other age groups (five years ,10 years, and 15-20 years), at 60.0%,75% and 64.28%, respectively. On the contrary to present study by ***Mathewos et al., (2022)*** they observed that; old-aged donkeys the odds were 3.11 times more infected than horses. Thus, our results corroborated the theory that parasitic infection is highest in young animals due to their underdeveloped immune systems and the difficulties of helminthes control strategies in young animals ***(Mathewos et al., 2022)***.

Regarding the body condition score (BCS), there is an insignificant change between the prevalence of nematode infection and the body score. However, similar results were obtained through recording that BCS is not associated with the level or intensity of parasitic infection ***(Cain et al., 2018)***. Other studies reported that he poor body conditions of equines showed a statistically significant difference with the occurrence of intestinal nematodes, so the disagreement between the two observations might depend on several variables, including the workload, the amount of feed intake, and underlying disease conditions ***(Devkota et al., 2021)***.

In the current study, *Strongylus* species (87.17%) were the predominant species, followed by *Parascaris equorum* (30.76%) and *Oxyuris equi* (12.82%) among gastrointestinal parasites identified from fecal samples of working equines. These results disagreed with those in Egypt, which reported that *P. equorum* is the most endemic nematode and represents the primary cause of parasitic gastroenteritis in equines ***(Morsy et al., 2016)***. Our investigation yielded that the prevalence of *Strongylus* spp. in horses was 75%, similar to the findings obtained by ***Wubishe, (2017***) who detected the prevalence of *Strongylosis* at 79.4%. In contrast, ***Bariisoo and Wubit, (2016)*** detected a low prevalence of *Strongyle* infection at 48.2%.

The incidence of *Parascaris equorum* was 25%, which is contrary to those reported by ***Hinney et al., (2011)*** was 3% in Germany and ***Salem et al.***, ***(2021)*** estimated 5.1% occurrence of Strongylosis in Zagazig, Egypt. The variation in the incidence percent could be due to sampling time, the lifespan of a nematode in its definitive host, and host-physiological factors like

stress, lactation, and immunity state that can impair worm egg laying throughout the fecal mass ***(Salem et al., 2021)***.

The fecal examination of working donkeys revealed that the prevalence of *strongyle* eggs was 95.65%, followed by *Parascaris equorum* at 34.78% and *Oxyuris equi* at 13.04%. These results were comparable with the previous research highlighted by ***Attia et al., (2018)*** in Egypt, who founded the following parasites; *Strongyle* spp. (80%), *Parascaris equorum* (25%), and *Oxyuris equi* 50%. Similarly, by ***Fesseha et al., (2022)*** in Ethiopia who displayed *Strongyle* spp. (100%), *Parascaris equorum* (23.8%), and *Oxyuris equi* (10.1%). Irreversibly, ***Tedla and Abichu, (2018)*** in Ethiopia detected a low prevalence rate of Strongyles (44.7%), *Parascaris equorum* (5.3%), and *Oxyuris equi* (11%). We could explain that the disparities in the prevalence of infection might be attributed to the access of working donkeys to a poor management system that increases the likelihood of their exposure to the variety of intestinal parasites. Moreover, the use of anthelmintic drugs remains the best way to control the strategy of intestinal parasites in equines in Egypt. However, anthelmintic resistance to parasites is now a threat issue in Egypt. Oral administration of broad-spectrum albendazole is the drug of choice as it is easily applicable, especially for owners, and has been found effective in reducing parasites. Therefore, we hypothesized that the combination treatment of two drugs could provide good efficacy, a synergetic effect, and protection against drug resistance, as mentioned in ***(Gokbulut and McKellar, 2018)***. Our data was the first to introduce colossal evidence of the possible increased efficacy and extended effects of combined albendazole and doramectin treatment compared to albendazole alone, as they showed accrued rate of 77.14% and 40.0%, respectively. Similar findings were demonstrated by Hürlimann and his colleagues in 2022 when the co-administration of albendazole and Ivermectin was applied to school-aged children and adults infected with soil-transmitted parasites ***(Hürlimann et al., 2022)***.

Measuring the size effect of each drug alone and in combination pre- and post-treatment using Cohen's D test showed that injection of Doramectin alone is satisfactory and showed the

highest significant reduction rate for all parasites recovered than orally taken Albendazole. These investigations were discussed depending on the systematic effect of doramectin against the mobile phase of the parasite included in this study; however, it might be the reason for the more effective elimination of the parasite with doramectin than albendazole alone, as the latter requires an almost full stomach for easy absorption, which is challenging to provide with worked equines. The reduced digest flow rates and overdue GI transit time diminished the rate of passage of the anthelmintic drug down the GIT tract due to low aqueous solubility in the starved stomachs of working equines ***(Sanchez, 2018)***.

CONCLUSION

The results of this study indicate that the co-administration of injection doramectin and oral albendazole does not provide any additional benefit over injection Doramectin alone for treating intestinal nematodes in working equines. This is because injection Doramectin has a larger effect size (Cohen's D test value) than co-administration of oral Albendazole and injection Doramectin, and oral Albendazole is insufficient therapy for treating intestinal nematodes in working equines due to side effects as guttural pouch and poor absorption, which requires a full stomach of food.

Ethics and consent to participate:

The respective animal protocols were reviewed and approved by the ethics committee of Alexandria University, Egypt, under permit numbers 0306115 at 14/5/2023, (FWA No: 00018699 and IRB No: 00012098). Oral consent was obtained from each owner of the animal participant. The owners of equine involved in this study were informed about the goals of study and contact information to obtain the results of drug intervention.

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الملخص العربى

انتشار الديدان الخيطية المعوية في الخيول مع تقييم العلاج باستخدام البيندازول ودورامكتين

ولاء مصطفى١ و احمد عبد الراضي٢ و فاطمه احمد خليفه[٣] و و محمد مرسي الكمشيشى[٤] و هشام عونى[٥] و وائل فليفل٦

[1]قسم الطفيليات كليه الطب البيطري جامعه سوهاج و [٢]قسم طب الحيوان الامراض المعديه جامعه اسيوط و قسم الامراض المعديه وزاره الزراعه بالدمام بالسعوديه و [٣]قسم الامراض المعدية كليه الطب البيطرى جامعه جنوب الوادى و و[٤] قسم الصحه كليه الطب البيطري جامعة مطروح و [٥]دكتوراه فى الأحصاء –المعهد العالى للصحة العامة-جامعة اسكندرية و ٦قسم الطفيليات كليه الطب البيطري جامعه مطروح

الخلاصة:

ظهرت الطفيليات الخيطية المعوية لدى الخيول كا تحدي ملح وعاجل بسبب تأثيرها الكبير على صحة وأداء هذه الحيوانات في جميع أنحاء العالم؛ لذلك، أصبح تنفيذ نظام التخلص من الديدان أمرًا حيويًا للحفاظ على حمل الطفيليات لدى الحصان عند مستوى مقبول. تهدف الدراسة الحالية إلى تقدير مدى انتشار الإصابة بالديدان الخيطية وعوامل الخطر المرتبطة بها وتقييم فعالية العلاج الكيميائي للأدوية الطاردة للديدان المختلفة عن طريق تسجيل 195 عينة براز من الخيول العاملة باستخدام تقنيات تركيز التعويم. تم تقسيم علاجات الخيول إلى أربع مجموعات؛ العلاج القياسي للمجموعة 1 (ألبيندازول عن طريق الفم)، علاج التدخل للمجموعة 2 (حقن دورامكتين)، علاج التدخل للمجموعة 3 (مزيج من ألبيندازول ودورامكتين)، وترك المجموعة 4 دون علاج كمجموعة تحكم إيجابية. بلغ معدل انتشار الطفيليات الخيطية المعوية في الخيول العاملة 70.25%. وكانت الديدان الخيطية المستردة من نوع الاسترونجليس بنسبة 87.17% يليها البارا اسكارس ايكويرم بنسبة 30.76% ثم الاوكزيبرس ايكواى بنسبة 12.82%. فيما يتعلق بفعالية العلاج، كانت أعلى نسبة شفاء بين المجموعة 3 (77.14٪)، تليها المجموعة 2 (68.57٪) والمجموعة 1 (40٪)، ولكن الفرق بين المجموعتين 2 و 3 كان ضئيلا إحصائيا. ومن المثير للاهتمام أن تأثير حقن الدورامكتين كبير جدًا عن غيره، خاصة في تقليل طفيل الاسترونجليس. وبيض البارا اسكارس ايكويرم وفقًا لاختبار كوهين D. إن ترجمة مثل هذا المزيج القوي من الأدوية إلى مناطق موبوءة سيوفر دعمًا كبيرًا لبرامج التخلص من الديدان ومكافحتها ضد الطفيليات المعوية للخيول، وخاصة تلك الموجودة في مرحلة الهجرة، أكثر من ألبيندازول وحده، الذي يتميز بضعف الامتصاص لأنه يتطلب معدة ممتلئة أثناء تناولة.