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Efficacy of Deworming Protocols in Horses in Saudi Arabia

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Abstract: Several drugs to prevent parasitic infestation are aviable for veterinaraina and horse owners these drugs are marketed as in feed or oral preparations. The ivermectin praziquantel, fenbendazole are commonly used drugs in Saudi Arabai. The goal was to examine the efficacy of the ivermectin praziquantel, fenbendazole under field conditions in Saudi Arabia. Horses were examined at horse farms and at the veterinary teaching hospital, College of Veterinary Medicine, King Faisal University. Fecal count was made following direct smear, flotation and sedimentation techniques. Ivermectin cleared the strongyles and effectively reduced Oxyuris and Dictyocaulus while the reduction of Parascaris was low. Praziquantel cleared the strongyles and Oxyuris while Dictyocaulus and Parascaris were less effectively reduced. Fenbendazole cleared the strongyles, Dictyocaulus and Oxyuris and less effectively reduced Parascaris. Variation in drug efficacy under field conditions was evident.

Key words: Parasitic, medicine, drug, fecal count, Saudi Arabia

INTRODUCTION

The goal of control of gastrointestinal parasites in horses is to minimize the number of eggs and resultant infective L3s on the grazing areas therefore preventing clinical and subclinical diseases. Numerous types of anthelimintics are used for treating gastrointestinal parasites in horses. They are usually marketed as in feed or oral preparations. The ivermectin and moxidectine are highly effective in the treatment of strongyles, *D. arnfieldi* and *O. equi* parasites (Yaswinski *et al*., 1982; Hutchens *et al*., 1999; Lyons *et al*., 2006; Bairden *et al*., 2006). In contrast, *P. equorum* may become resistant to ivermectin and moxidectin where this resistance has been recorded in horses in the Netherlands, Canada, Germany, Swedish and USA (Boersema *et al*., 2002; Heran and Peregrine, 2003; Kaplan *et al*., 2006; Slocombe *et al*., 2007; Von Samson-Himmelstjerna *et al*., 2007; Craig *et al*., 2007; Lindgren *et al*., 2008). Oxibendazole and pyrantel salts are highly effective in the treatment of *P. equroum* infection (Lyons *et al*., 1974, 2006).

Other drugs that can be used in the treatment of gastrointestinal parasites in horses are fenbendazole which is highly effective in removing encysted small strongyles in the equine large intestinal mucosa (DiPietro *et al*., 1997). However, unlike the large strongyle (Strongylinae) group, anthelmintic resistance is common in the cyathostominae. These parasites (cyathotomin) demonstrate resistance to two classes of anthelmintics, the benzimidazoles (benzimidazole, fenbendazole, oxfendazole) and the tetrahydropyrimidines (pyrantel) (Von Samson-Himmelstjerna *et al*., 2001; Kaplan, 2002). Resistance to the widely used benzimidazoles class of drugs in the treatment of cyathostomins has been documented in numerous numbers of countries throughout the world (Lyons *et al*., 1999). In contrast, recent studies found no indication of reduced efficacy of macrocyclic lactones in cyathostomins (Wirtherle *et al*., 2004; Comer *et al*., 2006).

Thiabendazol is apparently the most effective anthelmintic for *D. arnfieldi* in the horse. Two treatments of 440 mg kg^{-1} that are administered orally on alternative days are recommended (Round, 1976; MacKay and Urquhart, 1979). The mebendazol and oxfendazol are highly effective against pinworm (Dung *et al*., 2001). Pyrantel embonate is recommended for treatment of *A. perfoliata* in horses. Numerous numbers of studies have been conducted on the efficacy of this drug (Lyons *et al*., 1989; Radostits *et al*., 2007; Owen and

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Slocombe, 2004; Reinemeyer *et al*., 2006). Additionally, the effectiveness of praziquantel for the treatment of *A. perfoliata* is high. This drug is given at 0.75-1.0 mg kg^{-1} (Lyons *et al*., 1998).

MATERIALS AND METHODS

Study area: The current study was carried out in the Eastern Province of Saudi Arabia. Covered areas included horse farms that were located in Gabal Arba, Gewatha and Eastern villages in Al-Ahsa. Also, Abohedrea road in Al-Dammam and Safwa, Aljadoria, Alawjam and Alkadeeh in Al-Qatief were included. Additionally, samples were also collected from horses referred to the Veterinary Teaching Hospital at the College of Veterinary Medicine and Animal Resources, King Faisal University, Al-Ahsa. The study lasted 1 year starting in May, 2007 until April, 2008.

Collection and processing of samples: Purposive sampling was performed to conduct an epidemiological study on gastrointestinal parasites in horses at 90% level of confidence and 5% desired absolute precision and 50% expected prevalence as described by Thrusfield (1995). Samples were examined using three techniques after macroscopic examination of samples for consistency, color and presence of blood or mucus and also worms. These included direct smear, flotation and sedimentation techniques. McMaster slide was used for counting parasites ova. Micrometry using a Graticule was performed for measuring ova and larvae. Direct smear was performed to identify parasitic protozoa as described by Sloss and Kemp (1978). Flotation technique was carried out as described by Sloss *et al*. (1994). Sedimentation technique was used for diagnosing trematode ova (Urquhart *et al*., 1987). The test was carried out as described by Zajac and Conboy (2006). Fecal egg count technique was adopted using a modified McMaster technique as described by Zajac and Conboy (2006).

Statistical analysis of the data was carried out using SAS statistical program (SAS, 1986). Differences among means were detected by chi-square and t-test. The $p<0.05$ was considered significant.

RESULTS

Not all owners used anthelmintics in their farms but some used anthelmintic drugs for the purpose of deworming. Used anthelmintic drugs were assessed for effective combat of gastrointestinal parasitic infections. The results shown in Table 1 revealed that administered drugs were not equally effective in combating parasitic infections and acted individually as clearance and/or reduction of parasitic load was observed as if, each nematode responded more to the effect of a specific anthelmintic. According to the obtained results, ivermectin cleared the strongyles and effectively reduced Oxyuris and Dictyocaulus while the reduction of Parascaris was less effective. Praziquantel cleared the strongyles and Oxyuris while Dictyocaulus and Parascaris were less effectively reduced. Fenbendazole cleared the strongyles, Dictyocaulus and Oxyuris and less effectively reduced Parascaris.

Table 1: Efficacy of anthelmintics

Anthelmintics	Parasites	Deworming (%)	No. of administered horses
Ivermectin	Strongyles	0 (0)	245
	P. equorum	25 (10.20)	
	D. arnfieldi	2 (0.81)	
	O. equi	1 (0.40)	
Praziquantel	Strongyles	0 (0)	12
	P. equorum	2 (16.66)	
	D. arnfieldi	1 (8.33)	
	O. equi	0 (0)	
Fenbendazole	Strongyles	0 (0)	6
	P. equorum	1 (16.66)	
	D. arnfieldi	0 (0)	
	O. equi	0 (0)	
With no administered anthelmintics	Strongyles	4 (10.26)	39
	P. equorum	10 (25.64)	
	D. arnfieldi	4 (10.25)	
	O. equi	0 (0)	

Table 2: The association between the occurrence of *P. equorum* and management and clinical factors

Factors	Total No.	+ve	%	χ	p-value
Sex					
Male	128	8	6.2	8.100	0.004**
Female	174	30	17.2		
Age (years)					
<2	56	15	26.8	12.608	0.001**
≥2	246	23	9.3		
Treatment period					
No treatment	39	10	25.6	13.126	0.022*
Every month	6	0	0.0		
Every 2 month	50	1	2.0		
Every 3 month	4	1	25.0		
Every 4 month	15	1	6.7		
Every 6 month	188	25	13.3		
Locality					
Al-Ahsa	202	29	14.3	7.531	0.023*
Al-Dammam	44	0	0.0		
Al-Katief	56	9	16.1		
Symptoms					
No signs	28	22	57.9	62.117	0.001**
Colic	2	2	5.3		
Emaciation	8	4	10.5		
Coughing	10	9	23.7		
Itching	1	0	0.0		
Nasal discharge	1	1	2.6		

**High significance ($p<0.005$); *Significance ($p<0.05$)

Factors that may have effects on the occurrence of parasitic load were put in consideration. Therefore, such considered factors included; sex, age, treatment period, locality, season and symptoms. The occurrence of *P. equorum* with sex, age and symptoms was highly

Table 3: Factors associated with the occurrence of *D. arnfieldi*

Factors	Total No.	+ve	%	χ	p-value
Anthelmintics					
No treatment	39	4	10.2	15.355	0.002**
Ivermectin	257	2	0.8		
Fenbendazole	6	0	0.0		
Treatment period					
No treatment	39	4	10.2	14.722	0.012*
Every month	6	0	0.0		
Every 2 month	50	2	4.0		
Every 3 month	4	0	0.0		
Every 4 month	15	0	0.0		
Every 6 month	188	1	0.5		

Table 4: Factors affecting the occurrence of strongyles

Factors	Total No.	+ve	%	χ	p-value
Seasons					
Warm	171	0	0.0	5.291	0.021*
Cold	131	4	3.1		
Anthelmintics					
No treatment	39	4	10.2	27.336	0.001**
Ivermectin	257	0	0.0		
Fenbendazole	6	0	0.0		
Symptoms					
No signs	28	1	25.0	53.629	0.001**
Colic	2	0	0.0		
Emaciation	8	3	75.0		
Coughing	10	0	0.0		
Itching	1	0	0.0		
Nasal discharge	1	0	0.0		

**High significance ($p<0.005$); *Significance ($p<0.05$)

significant ($p<0.005$) while the treatment period and locality were just significant ($p<0.05$) as shown in Table 2.

The occurrence of *D. arnfieldi* with the anthemintics was highly significant ($p<0.005$) and with the treatment period was only significant ($p<0.05$) as shown in Table 3. The occurrence of strongyles with anthelmintics and symptoms was highly significant ($p<0.005$) while the season factor was only significant ($p<0.05$) as shown in Table 4.

DISCUSSION

In the current investigation it was found that susceptibility of *P. equorum* to ivermectin was remarkably low. This was not surprising since it is well documented that this parasite is fairly resistant to ivermectin (Boersema *et al.*, 2002; Slocomb *et al.*, 2007; Von Samson-Himmelstjerna *et al.*, 2007; Craig *et al.*, 2007; Lindgren *et al.*, 2008). On the other hand, other researchers found that preventive treatment of animals every month, significantly reduced the prevalence of *P. equorum* to a very low level ($p<0.022$) (Boyle and Houston, 2006).

D. arnfieldi infection in horses is characterized by a chronic cough (Radostits *et al.*, 2007). This was evident in the current researchers in which cough was associated with *D. arnfieldi* in the examined horses. Horse owners who used ivermectin and fenbendazole as prophylaxis had successful outcome at highly significant level ($p<0.002$) in combating such parasite. It is known that ivermectin and fenbendazole are efficient as prophylaxis against this parasite and have been recommended to be given at regular intervals (every month). In the current investigation such monthly intervals had shown a significant level of effect ($p<0.012$) in combating this parasite (Kahn *et al.*, 2006; Radostits *et al.*, 2007; Hutchens *et al.*, 1999; Britt and Preston, 1985). The discrepancy amongst those prevalence rates in different areas could be a result of the use of ivermectin. In fact, the use of ivermectin has reduced the prevalence of *D. arnfieldi* over the last 20 years (Boyle and Houston, 2006). *D. arnfieldi* infection should be addressed in the routine worm control programs of all horses and ponies co-grazing with donkeys. One of the most effective ways to prevent *D. arnfieldi* infection is by not exposing horses to the parasite by preventing horses from grazing with untreated donkeys, mules, unless they are confirmed to be free of lung worms. A similar regimen should be practiced in donkey studs where the visiting animals should be isolated in separate paddocks (Urquhart *et al.*, 1987; Reed *et al.*, 2004; Boyle and Houston, 2006).

Ivermectin and fenbendazole are highly effective against strongyles infection in horses (Lyons *et al.*, 2006; DiPietro *et al.*, 1997; Slocombe and McCraw, 1984). In this study, the use of ivermectin and fenbendazole as prophylaxis against strongyles infection showed a high significance ($p<0.001$) in reducing infections in horses. Limited number of cases were found positive for *O. equi* which makes it difficult to draw conclusion. *O. equi* is easily controlled since most available equine anthelmintics are highly effective against both mature and adult large pinworms (Bowman *et al.*, 2003). In *O. equi* infection the control depends on high standard of stable hygiene. Effective control measurements such as careful, regular washing at 4 days intervals of the perineal skin and underside of the tail head for removing egg masses before the development of L3 are adequate (Kassai, 1999).

CONCLUSION

In this study the results shows that most of the gastrointestinal parasites that were detected in horses in the Eastern Province of the Kingdom of Saudi Arabia were nematodes and protozoa in spite of the deworming programs. The risk factors varied between parasites, however, treatment with ivermectin was found to be significantly effective only against some group of parasites. The importance of deworming rotation program cannot be overemphasized.

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