Evaluation of the Efficacy of Doramectin in the Control of Strongyle *(Strongylidae, Cyathostominae)* Infestation in Horses

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ABSTRACT

The aim of the study was to evaluate the efficacy of doramectin (Dectomax) in the control of strongyle (*Strongylidae, Cyathostominae*) infestations in horses. The research involved 24 horses of various breeds (stallions and mares), aged 1.5 to19 years of age. The prevalence and intensity of infestation were determined based on coproscopic examination using Willis-Schlaf and Mc-Master methods. Drug resistance was determined by fecal egg count reduction test (FECRT). Horses were injected subcutaneously with doramectin at a dose of 0.2 mg/kg bodyweight. Doramectin had an efficacy of 99.6% on day 14 and strongyles reappeared 2 months after doramectin administration. Subcutaneously injected doramectin proved highly effective in the control of strongyle (*Strongylidae*, *Cyathostominae*) infestations in horses.

Keywords: Horses,equine, *Strongylidae, Cyathostominae*, Dectomax, Doramectin, drug resistance.

INTRODUCTION

Diseases caused by parasites are still among the most common illnesses in equine populations despite great advances in anti-parasite drug development and use (1-4). Parasitic infestations cause digestive disorders, which result in emaciation, weakness, colic and even death. Nematodes of the families *Strongylidae* and *Cyathostominae* are the most common parasites of horses. Because of their wide distribution they are found in practically every team of horses, regardless of bioclimatic conditions, farm management methods or age. Even the best managed horses may be at risk of coming into contact with invasive forms of parasites (5). Parasitic diseases usually have a subclinical course, hence they often go unnoticed by both breeders and veterinarians.

One of the side effects of the widespread (prolonged and intensive) use of chemotherapeutic drugs in horses has been the emergence of drug resistance by parasites. Other factors that may lead to the development of parasite drug resistance in horses includes drug under-dosing, alternating administration of drugs belonging to the same class of chemical compounds, parasites coming into frequent contact with the active substance, and the fact that animals infect one another with drug-resistant strains (6). The European Medicines Agency indicates an increase of helminth resistance to three major classes of anthelmintics, namely macrocyclic lactones, imidazoles and benzimidazoles. The development of new anthelmintic drugs in the near future with a novel mode of action is unlikely to occur, making efforts to prevent drug resistance a priority (7). Modern anthelmintics should be effective, non-toxic, easy to administer, have a broad spectrum of activity, and cause no adverse effects.

Doramectin is an avermectin derived from the class of macrocyclic lactones. The substances of this group have no effect on protozoa, trematodes and tapeworms, but at low doses they are effective against nematodes and arthropods. Studies with cattle have shown that doramectin has a very

wide margin of safety. No side effects have been reported after using 25 times the recommended dose (8).

Research on the use of doramectin against nematode infections in horses has been carried out by Schuman (8), Perez *et al*. (9), Clarke *et al*. (10), and Davies and Schwalbach (11). In each research project, authors evaluated the reduction in eggs at 14 days after administration of doramectin. The efficacy of the drug in those studies ranged from 96-100%. No studies about efficacy of doramectin in horses have been carried out in Poland until now. Moreover doramectin is not registered as an active substance for horse treatment in Poland.

The aim of this study was to evaluate the efficacy of doramectin in the control of strongyle (*Strongylidae, Cyathostominae*) infestation in horses.

MATERIAL AND METHODS

Coproscopic examination was performed in 24 horses (Table 1) from an agri-tourism farm located in West Pomerania, NW Poland. A total of 264 fecal samples were analyzed. The horses were kept in loose boxes on shallow bedding. Stable manure was removed every day. When weather conditions permitted, the animals were kept on sand paddocks during the day. The horses were maintained in accordance with the requirements of animal welfare (12). They were subjected to anthelmintic treatment on the farm twice a year (in spring and autumn). In the autumn, the horses were dewormed with an anthelmintic including ivermectin as the active substance.

The horses were dewormed in the spring (April) with doramectin. This drug is a broad-spectrum antiparasitic registered in Poland for veterinary use in cattle, sheep and pigs. Doramectin was administered to each horse individually, as a one-time injection at a dose of 0,2 mg/kg bodyweight. After the horses were dewormed, the stable and its equipment were washed and disinfected. During the tests the health of the horses was monitored daily by a veterinarian who took care of all the animals at the farm.

During the study no deviations were noticed in heart and respiration rate and rectal temperature. Also no colic occurred due to obstruction of gastrointestinal tract or diarrhea was observed and mucous membranes remained normal. There were no symptoms of apathy or anxiety.

Fecal samples were collected from each horse prior to doramectin administration and on days 7, 14 and 21 after anthelmintic treatment. In addition, horse feces were also examined for intestinal parasites 1, 2 and 3 months after doramectin administration. Drug resistance was determined by Fecal Egg Count Reduction Test (FECRT). This method, recommended by the World Association for the Advancement of Veterinary Parasitology (WAAVP), compares the mean egg count per gram of feces before administration of a drug and at certain periods of time after treatment (13). This test is used to estimate the efficacy of a drug activity. For the horses studied, efficacy of doramectin was determined after 14 days.

The prevalence and intensity of infection were determined based on coproscopic examination using Willis-Schlaf (qualitative method) and Mc-Master (quantitative method) methods, previously described by Ziomko *et al*. (14). Only positive

Table1: Breed, age and sex of the study group of horses

HORSE'S NAME	ALADAR	ELITA	FELA	GRUNWALD	HAREA	HATLA	HAWANA	HONDA	HORNETA	KAGERA	KAIR	KARMONA	KOMETA	KOPEREK	KORONA	LILA	OBELLE	OKTAWIA	PARYS	PASJA	PIRAT	RENA	RETORA	SEKATOR
AGE	7	6	6	19	5	5	5	5	7	9	9	6	7	9	1.5	6	7	4	3	12	5	6	7	9
SEX	G	F	F	G	F	F	F	F	F	F	M	F	F	G	F	F	M	F	G	F	G	F	F	G
BREED	HB	HB	HAFLINGER	S	HB	HB	HB	HB	HB	HB	MALOP.	HB	HB	PONY	HB	HAFLINGER	FRIES.	HB	HB	HB	HB	HB	HB	HB
BODY WEIGHT [kg]	600	300	300	600	500	500	500	500	500	500	500	500	500	300	300	300	600	500	500	500	500	500	500	600

F-female, M-male, G- gelding, HB - half-bred, S- Silesian, MAŁOP.- Malopolski, FRIES.- Friesian

fecal samples were tested using the quantitative method. The results obtained were used to calculate the mean prevalence of infection and eggs per gram of feces, and to determine the percentage of small and large strongyles in the parasitic gastrointestinal fauna of the horses. Eggs were identified based on morphological characteristics – shape, envelope structure, number and size of blastomeres and biometry using a key according to Foreyt (15) and Thienpoint *et al.* (16).

The experiment complied with the current laws of Poland. The material collected during routine veterinary procedures (subcutaneous injections) performed by veterinarians. In such cases, the agreement of the Local Ethical Committee on Animal Experiments is not required.

RESULTS

In this study the presence of nematodes of the families *Strongylidae* and *Cyathostominae* was found. Prior to deworming, mean prevalence of infestation with gastrointestinal parasites in the horses was 100% and mean intensity of infestation was 844 eggs per g of feces (Table 2).

Our results showed large differences between the prevalence of infestation with large strongyles (*Strongylinae*) and small strongyles (*Cyathostominae*). *Strongylinae* were found in 12% of the examined animals and *Cyathostominae* in 92%.

After the treatment (14 day) with the anthelmintic that included doramectin (Dectomax® Injectable Solution, Pfizer, New York, USA) as an active ingredient, the number of animals infested with *Strongylinae* declined to zero, while in the case of *Cyathostominae* to four horses. Seven and fourteen days after the horses were treated with doramectin, single nematode eggs were found in 4 horses from the investigated group. During this period, the doramectin had an efficacy of 99.6% (for examined *Strongylidae)* (Fig.1). However, its efficacy decreased to 82.4% at 28 days after administration. Two months after the treatment, nematode mean egg count raised considerably to 588 eggs per gram of feces (range: 350-1400 eggs per gram). During the same period, the prevalence of infection also increased to 75%. Three months after the treatment egg counts were similar to those before the treatment (750 eggs per gram).

DISCUSSION

The present study showed that prior to deworming all examined animals were infested with gastrointestinal parasites, which is comparable with the results of other authors (1, 17-

Table 2: The efficacy of doramectin in different periods of research.

	Before dewormed	After dewormed (day)					
		7	14	21	28	58	90
EPG	844	3	3	4	150	588	750
Range	500-2500	0-50	0-50	0-50	0-300	350-1400	350-1650
Prevalence (%)	100	16.67	16.67	16.67	42	75	91.67

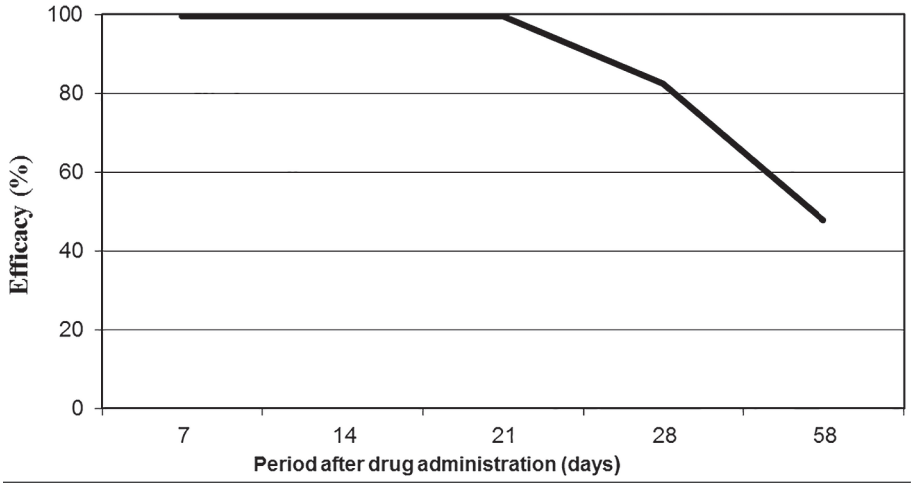

Figure 1: Evaluation of Dectomax (Pfizer) efficacy in the studied horses.

19). The presence of nematodes of the families *Strongylidae* and *Cyathostominae* were found. The prevalence of infection with small strongyles (*Cyathostominae*) was much higher than infection with large strongyles (*Strongylinae*) (92% *vs.*12%). Gawor and Kita (20) and Gawor *et al*. (21) consider this phenomenon to beassociated with the high efficacy of the commonly used anthelmintics against migrating larvae of nematodes of subfamily *Strongylinae*. As reported by Lyons *et al*. (22) and Tarigo-Martinie *et al.* (23), it is impossible to completely remove all small strongyles (*Cyathostominae*) from the population of infested horses. This is caused by hypobiosis, i.e. the presence of arrested-stage larvae (L4) in the gut mucosa.

After the treatment with doramectin, the number of animals infested with parasites (*Strongylinae*) declined to zero. However, deworming did not remove *Cyahtostominae* parasites from all the hosts, but considerably limited the prevalence of infestation in these animals. This could be associated with the restoration of the parasite population in the animal's body by arrested larvae that survived anthelmintic treatment (24). The highest efficacy (99.6%) of doramectin against the examined *Strongylidae* was observed at 7 and 14 days after treatment. Similar findings were reported by (25) for donkeys in Sudan, where doramectin had an efficacy of 99.24% at day 14. Daviesand Schwalbach (11) showed 100% efficacy in horses on day 14 after intramuscular injection of doramectin. Similar results were also obtained by Schumman (8) in horses after intramuscular treatment. Slightly lower efficacy was noted by Clarke *et al.* (10)after intramuscular administration, reaching a level of 96% in one year old horses. A comparison with the literature Monahan and Klei (26) indicates that doramectin has a similar efficacy to ivermectin and moxidectin. According to those authors, the efficacy of ivermectin and moxidectin against luminal cyathostomins was 99%, although as emphasized by Monahan and Klei (26) ivermectin did not act against hipobiotic larvae.

The World Association for the Advancement of Veterinary Parasitology reports that drug resistance is considered to exist when FECRT is below 90%. According to Watson (27), this does not mean that there are no drug-resistant parasites in the population.

There was a reinfestation of parasites in the horse group studied. We observed that the efficacy of doramectin decreased to 82.4% on day 28 and 47.8% on 58 day. This indicates a shorter time of protection against these parasites compared to other avermectins. Taylor and Kelly (28), Jacobs *et al.* (29) and Monahan and Klei (26) reported that the egg reappearance period for moxidectin was 15-24 weeks, and only 8-14 weeks for ivermectin. Because doramectin is not registered for horses in Poland, the manufacturer provided no information concerning the period of protection against infestation. Pérez *et al*. (9) reported that subcutaneously injected doramectin is more effective than oral administration and remains in the body for a longer time periods (3-4 weeks), thus providing longer protection against parasites. The authors found that subcutaneously administered doramectin is excreted more slowly in feces (for a period of 60 days) and may be more effective in the control of migrating larvae and those remaining in the tissues of animals being treated.

Subcutaneously injected doramectin proved highly effective in the control of strongyle (*Strongylidae*, *Cyathostominae*) infestations in horses and no adverse effects were observed. The disadvantage of this substance is the short lived protection of doramectin against the stongyles.

REFERENCES

1. Gawor, J.: Internal parasites of horses – epidemiology and control. Mag. Wet. 18: 1068-1074, 2009.
2. Kuzmina, T.A., Kharchenko, V.A., Starovir, A.I. and Dvojnos, G.M.: Analysis of the strongylid nematodes (Nematoda: *Strongylidae*) community after deworming of brood horses in Ukraine. Vet. Parasitol. 131:283-290, 2005.
3. Rötting, A.K., Freeman, D.E., Constable, P.D., Moore, R.M., Eurell, J.C., Wallig, M.A. and Hubert, J.D.: The effects of *Strongylus vulgaris* parasitism on eosinophil distribution and accumulation in equine large intestinal mucosa. Equine Vet. J. 40: 379-384, 2008.
4. Slivinska, K., Gawor, J. and Jaworski, Z.: Gastro-intestinal parasites in yearlings of wild Polish primitive horses from the Popielno Forest Reserve, Poland. Helminthologia 46: 9-13, 2009.
5. Romaniuk, K., Jaworski, Z. and Snarska, A.: Rate of *Trichostrongylidae* nematode infestation in Polish Konik horses and their foals. Med. Weter. 58: 467-469, 2002.
6. Wędrychowicz, H.: Prevalence and drug resistance mechanisms of trematodes and nematodes parasitizing herbivores. Med. Weter. 52: 494-497, 1996.
7. EMEA 2007: Guideline on the summary of product characteristics for anthelmintics. European Medicines Agency Veterinary Medicines and inspections, London. EMEA/CVMP/EWP/170208/. (http://www.emea.europa.eu)
8. Schumann, K.: Strategic controlling of parasites against worm infections in horses with macrocyclic lactones, Doctoral dissertation, Freien Universität Berlin, 2001.
9. Pérez, A., García, M.A., Quijada, J., Aguirre, A., Cartañá, M.L. and Santiago, A.: Strongyles parasitism in wild Venezuelan horses from Hato El Frío (Apure State, Venezuela). Preliminary Study. Rev. Cient. 20: 32-36, 2010.

10. Clark, V.Y., Gülegên,E., Yildirim, F. and Durmaz, M.: A field study on the efficacy of Doramectin against strongyles and its egg reappearance period in horses. Dtsch. Tierarztl. Wochenschr. 114, 2: 64-66, 2007.
11. Davies, J.A. and Schwalbach, L.M.: A study to evaluate the field efficacy of ivermectin, fenbendazole, and pyrantel pamoate, with preliminary observations on the efficacy of Doramectin, as anthelmintic in horses. J. South Afri. Vet. Assoc. 71: 144-147, 2000.
12. Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes. Official Journal L 221, 08/08/1998, p. 0023-0027.
13. Betlejewska, K.: Strain of small strongyles (*Cyathostominae)* resistant to Banminth, Eqvalan, Panacur Paste and Rintal Plus in horses. Med. Weter. 56: 395-397, 2000.
14. Ziomko, I. and Cencek, T.: Outline of parasitology diagnosticin breeding animals. In: National Veterinary Research Institute, Puławy, Poland, 1995.
15. Foreyt, W.J.: Veterinary parasitology reference manuall, Blackwell Publishing, Ames, 2001.
16. Thienpoint, D., Rochette, F. and Vanparijs, O.F.J.: Diagnosing helminthiasis by coprological examination, Jannsen Research Foundation, Beerse, 1986.
17. Betlejewska, K.: The dynamics of small strongyles (*Cyathostominae*) invasion in horses during an annual cycle. Med. Weter. 56: 36–38, 2000.
18. Geringer de Oedenberg, H., Śpiewak, J., Jagła, E. and Budzińska, M.: Parasites invasions of horses from selected stables located of Lower Silesia region. Zesz. Nauk. UP Wroc. 579: 115-123, 2010.
19. Nowosad, B., Prasilova, I., Napravnik, J. and Fudalewicz-Niemczyk, W.: Prevalence of gastrointestinal nematodes in horses from selected studs in Poland and Czechoslovakia. Zesz. Nauk. AR Krak. Zoot. 27: 22-43, 1990.
20. Gawor, J. and Kita, J.: Practical observations on antiparasitic treatment in horses. Życie Wet. 81: 753-756, 2006.
21. Gawor, J., Kornaś, S., Charčenko, V., Nowosad, B. and Skalska M.:Intestinal parasites and health problems in horses in different breeding systems. Med. Weter.62: 331-334, 2006.
22. Lyons, E.T., Tolliver, S.C. and Collins, S.S.: Probable reason why small strongyle EPG counts are returning "early" after ivermectin treatment of horses on a farm in Central Kentucky. Parasitol Res. 104: 569-574, 2009.
23. Tarigo-Martinie, J.L., Wyatt, A.R. and Kaplan, R.M.:Prevalence and clinical implications of anthelmintic resistance in cyathostomes of horses. J. Am. Vet. Med.Assoc. 218: 1957-1960, 2001.
24. Kornaś, S., Skalska, M., Nowosad, B. and Gawor, J.: The communities of cyathostomes (Cyathostominae) in one-year-old and two-year-old Pure Blood Arabian mares. Wiad. Parazytol., 53: 325-329, 2007.
25. Seri, H.I., Hassan, T., Salih, M.M., Abakar, A.D., Ismail, A.A. and Tigani, T.A.: Therapeutic efficacy of Doramectin injectable against gastrointestinal nematodes in donkeys (*Equus asinus*) in Khartoum State, Sudan. J. Anim. Vet. Adv. 3: 726-729, 2004.
26. Monahan, C.M. and Klei, T.R.: The use of macrocyclic lactones to control parasites of horses. In: Vercruysse, J. (Eds.): Macrocyclic Lactones in Antiparasitic Therapy. CAB International, UK, p. 463, 2002.
27. Watson, J.: Drug resistance in equine parasites: a cautionary tale. J. Equine. Vet. Sci. 28: 54-55, 2008.
28. Taylor, S.M. and Kenny, J.: Comparison of moxidectin with ivermectin and pyrantel embonate for reduction of faecal egg counts in horses. Vet. Rec. 137: 516–518, 1995.
29. Jacobs, D.E., Hutchinson, M.J., Parker, L. and Gibbons, L.M.: Equine cyathostome infection: suppression of faecal egg output with moxidectin. Vet. Rec. 137: 545, 1995.