Benzimidazole resistance in horses in western Canada

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As part of a study to establish the required frequency of use of anthelmintics in recently weaned horses on pasture in western Canada, oxfendazole-trichlorfon (Benzelmin B, Syntex Agribusiness, Mississauga, Ontario) was evaluated and found to be ineffective in suppressing strongylid fecal egg output. To our knowledge, this apparent benzimidazole resistance is only the second reported case of benzimidazole resistance in horses in Canada (1).

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The present study included 14 intact male recently weaned Standardbred horses three to nine months of age. The horses grazed on the same pasture and were fed alfalfa cubes, alfalfa-grass hay, whole oats and a vitamin, mineral and protein supplement. Well water was supplied *ad libitum*. A girth tape, calibrated to correlate girth circumference to weight, was used to estimate body weight for each horse prior to each treatment. On day 0, all horses in the group were treated with a paste preparation (Benzelmin B) formulated to deliver 2.5 mg of oxfendazole and 40 mg of trichlorfon per kg bodyweight. After the initial treatment on day 0, the horses were to be retreated with the oxfendazole-trichlorfon combination whenever the mean total fecal egg count exceeded 200 eggs per gram (epg). The mean total fecal epg was calculated by adding the sum of the strongyle epg count to the sum of the ascarid epg count for all horses, and dividing by the number of horses sampled.

Fecal specimens were obtained on days −7, 0 and every 14 days thereafter. The number of strongyle and ascarid eggs present in the feces was determined by the modified Wisconsin technique (2).

Following treatment on day 0, the mean total fecal egg output decreased from 571 epg to 125 epg (Table 1). The treatment eliminated ascarid egg output, but all horses continued to shed strongyle eggs in their feces (Table 2). To determine if the apparent product failure was due to benzimidazole resistance or to an inadequate dose of oxfendazole, the horses were retreated with another oxfendazole preparation (Benzelmin, Syntex Agribusiness, Mississauga, Ontario) formulated to deliver 10 mg/kg bodyweight of oxfendazole and no trichlorfon. This formulation was administered on day 42, when the mean strongyle fecal egg output had reached 332 epg, and reduced it to 240 epg. These horses were subsequently treated with ivermectin (Eqvalan Paste, MSD Agvet, Kirkland, Quebec) on day 70. This treatment was >99% effective in reducing fecal output of strongyle and ascarid eggs (Table 3).

TABLE 1
Pre- and posttreatment mean number of ascarid and strongyle eggs passed in the feces of horses (n = 14)

	Sample day								
Egg type	−7	0[a]	14	28	42[b]	56	70[c]	84	98
Ascarid	124[d]	381	0	0	0	0	11	0.1	0
Strongyle	113	190	125	201	332	240	130	0.7	0
Total	237	571	125	201	332	240	141	0.8	0

[a]Horses treated with oxfendazole-trichlorfon
[b]Horses treated with oxfendazole
[c]Horses treated with ivermectin
[d]Eggs per gram

TABLE 2
Numer of horses with positive fecal egg counts

	Sample day								
Egg type	−7	0[a]	14	28	42[b]	56	70[c]	84	98
Ascarid	11	13	0	0	0	0	2	1	0
Strongyle	14	13	14	14	14	14	14	1	0
Total	14	14	14	14	14	14	14	2	0

[a]Horses treated with oxfendazole-trichlorfon
[b]Horses treated with oxfendazole
[c]Horses treated with ivermectin

Small strongyles (cyathostomes) account for at least 95% of the strongylid eggs passed in equine feces (3,4). Although larval cultures were not performed on the samples, we assumed the majority of the strongyle eggs passed by these horses were cyathostome eggs. Initial treatment of these horses with oxfendazole-trichlorfon reduced the pretreatment strongyle fecal egg count by 34%. Retreatment with the higher dose oxfendazole formulation on day 42 reduced the strongyle fecal egg count by 28%. Previous investigators have suggested that posttreatment reductions in fecal egg output of 70% or less are indicative of anthelmintic resistance (5).

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TABLE 3
Percent efficacy of anthelmintic treatment based on posttreatment fecal egg count

	Sample day								
Egg type	0[a]	14	% Eff.	42[b]	56	% Eff.	70[c]	84	% Eff.
Ascarid	410[d]	0	100	0	0	—	11	0.1	>99
Strongyle	190	125	34	332	240	28	130	0.7	>99
Total	571	125	78	332	240	28	141	0.9	>99

[a]Horses treated with oxfendazole-trichlorfon
[b]Horses treated with oxfendazole
[c]Horses treated with ivermectin
[d]Eggs per gram
% Eff. = percent efficacy

$$= \frac{\text{\# of eggs before treatment} - \text{\# of eggs after treatment}}{\text{\# of eggs before treatment}} \times 100\%$$

In the present study, treatment with ivermectin significantly ($p < 0.05$) reduced the strongylid fecal egg output in horses which were shedding strongyle eggs despite treatment with oxfendazole or oxfendazole-trichlorfon. The efficacy of ivermectin against benzimidazole-resistant small strongyles has been described (6).

Oxfendazole had never been used to treat horses on the study site. The normal practice on the farm is to deworm the mares every eight weeks. During the previous 12 months, they had been treated with febantel on one occasion and fenbendazole on another. Other treatments used were either pyrantel pamoate or ivermectin. Prior to the trial, the weanlings in this study had been treated with pyrantel pamoate every four weeks. Although oxfendazole had not been used on this farm, the results of this study indicate that an oxfendazole-resistant strain of small strongyles was present. Investigators have previously documented the phenomenon of benzimidazole cross-resistance in small strongyles (1,7). The source of the benzimidazole-resistant nematodes cannot be ascertained because the horses on the farm came from numerous sources and some may have harbored a benzimidazole-resistant strain of small strongyle prior to their arrival. Although this is only the second reported case of benzimidazole-resistant equine small strongyles in Canada, practicing veterinarians should be aware of the potential for the development of resistance and should routinely perform posttreatment fecal examinations to ensure optimum parasite control.

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