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Short communication

Ovicidal efficacy of fenbendazole after treatment of horses naturally infected with cyathostomins

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ABSTRACT

The ovicidal activity of benzimidazole (BZ) anthelmintics is unique and not seen in other drug classes. Such ovicidal efficacy is not widely reported for equine cyathostomins, nor has this activity been tested in the face of BZ resistance. Although the product label states that fenbendazole is for use against BZ-susceptible cyathostomins, susceptibility testing is rarely performed. In this field-based study, the ovicidal efficacy of fenbendazole in horses (n = 39) harbouring BZ-resistant cyathostomins was compared when dosed at 7.5 mg/kg body weight (BW) orally, as a single dose per os (n = 21) or daily for five consecutive days in feed (n = 18). Suppression of egg hatch rate was observed in the single and five- day treatment groups; a significant difference between pre- and post-treatment egg hatch rates ($P < 0.05$) was observed for three days after treatment with a single dose of fenbendazole (on premises with BZ-resistant cyathostomins), and for three days after treatment for five consecutive days with fenbendazole (on premises with BZ-resistant cyathostomins). Post treatment numbers of eggs and larvae remained significantly lower ($P < 0.05$) than pre-treatment levels to the end of the trial. We conclude that in the face of BZ-resistant cyathostomins the ovicidal effect of fenbendazole persist for three days after both a single oral dose of 7.5 mg/kg per os and after treatment orally for five consecutive daily doses at 7.5 mg/kg in feed.

1. Introduction

Benzimidazoles (BZ) are the only class of anthelmintics with ovicidal efficacy (Lacey, 1990). BZ resistance in cyathostomins in the UK continues increasing in prevalence (Lester et al., 2013). The marketing authorisation for fenbendazole states that it is only suitable for use in animals with BZ-sensitive cyathostomins (NOAH Compendium, 2013), however efficacy testing is not common practice in the field (Allison et al., 2011; Relf et al., 2011).

To date, most of the work investigating BZ ovicidal activity has been conducted on ruminant nematodes, particularly *Haemonchus contortus*. To the best of the authors' knowledge there are no published studies on BZ ovicidal efficacy on equine cyathostomins in the face of resistance.

The objective of this study was to investigate the ovicidal efficacy of fenbendazole in horses under field conditions when given at 7.5 mg/kg BW as a single dose, or on five consecutive days.

2. Materials and methods

2.1. Pilot study and sample size estimates

A pilot study was carried out (n = 6) to inform sample size estimates. Estimates were conducted in SiZ (Cytel v 1.0, Woburn, MA, USA), using a Wilcoxon-Mann-Whitney model. Using standard deviation data derived from this pilot study (0.141) we adopted a sample size of 40 horses (20 in each group) which gave 80% power and 95% confidence to detect a 7-fold difference in egg hatch rate.

2.1.1. Ethical consent

This study received ethical approval from the University of Liverpool Ethics Committee, RETH000363.

2.1.2. Sample population

From 109 animals at four premises in South-West England and one in South Wales, 39 horses met the inclusion criteria of: faecal egg count (FEC) ≥150 eggs per gram faeces (epg) (Coles et al., 2006), no anthelmintics within 13 weeks and in good health (Table 1). All farms harboured BZ resistant cyathostomins. Horses were sampled August – October 2012. The study population consisted of 19 females and 20 males, aged 0.5–20 years mean 6 ± 4.7 years.

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Table 1
Population data including parasite control strategies employed and premises FECR.

Premises	Type	Total Animals on Premises	Number Sampled (%)	Number of animals given a single dose of FBZ	Median Age years (range)	Treatment History	FECs in use	FECR% Mean of treated animals	FECR% Median of treated animals
1	Stud	10	6 (60)	3	6.5(0.5–15)	Blanket chemical – No BZ	No	–27	32
2	Dealer	21	8 (38)	4	7 (5–20)	Blanket chemical – No BZ	Randomly	61	86
3	Stud	4	4 (100)	2	8 (4–15)	Blanket chemical – No BZ	No	54	64
4	Stud	26	4 (15)	2	1 (0.5–7)	Blanket chemical – BZ	No	35	27
5	Stud	48	17 (35)	10	5 (1–14)	Targeted from FEC – BZ	Yes	38	83
All		109	39*(36)						

*Only 39 out of the 109 horses had FEC ≥150 epg

Breeds represented were: 20 Warmbloods, four Thoroughbreds, two Warmblood cross Thoroughbreds, seven native ponies, five cobs and one Irish Draft horse. Pre-treatment FEC for the population ranged from 150 epg to 1300 epg with an arithmetic mean of 550 epg ± 328 epg and a median of 475 epg. The remaining 70 horses that did not meet the inclusion criteria were 32 males and 38 females, ranging from 0.5–25 mean 9 ± 6.17 years, representing the breeds noted above, FEC <150 epg.

Premises one, two and three had not used BZ anthelmintics for 10 years, premises four and five used BZ infrequently (Table 1). Horse exposure to BZ prior to arrival on these premises was unknown. None of the premises quarantined new animals on arrival. Time on the current premises varied, <1 month to >5 years. Premises were deemed high risk for intestinal parasite transmission due to a high proportion of immunologically immature animals and frequent movement of horses on or off the premises (Nielsen et al., 2010a; Relf et al., 2011).

Body weight was estimated by weigh tape and rounded up by 50 kg for light/small breeds and 100 kg for heavy/large breeds to counter inaccuracy (Ellis and Hollands, 1998).

2.1.3. Treatment group allocation

At treatment BZ susceptibility was unknown. Treatment was not randomized; approximately 50% of treatments at each premises were single doses and the remaining 50% received a five day dose (Table 1). Allocation of delivery route depended upon management, e.g. feasibility of offering medicated feed once daily.

2.1.4. FECR sample collection and analysis

Prior to treatment a fresh, spontaneously voided, faecal sample was collected from each animal for FEC analysis. A modified McMaster method (Coles et al., 1992) was used, where each egg count represented 25 epg. A second FEC was conducted 14 days post-treatment to calculate FEC reduction (FECR) using 90% as the cut off for BZ resistance.

From FECR results, strongyle populations per premises were categorized post hoc as "BZ susceptible" or "BZ resistant". FECR results identified that on no premises could the strongyle population (in all tested horses) be classified as BZ susceptible. Two groups are considered in the analysis of the results from this study: a single dose group (n = 21) and a five day dose group (n = 18).

2.1.5. Anthelmintic treatment and sample collection for egg hatch tests

Before treatment a fresh faecal sample was collected from all animals and stored under anaerobic conditions (Coles et al., 1992). All 21 horses in the single dose group were administered a dose of 18.75% w/w fenbendazole at 7.5 mg/kg on day 0 orally using the oral dosing device supplied, ensuring that the entire dose was swallowed. Further faecal samples were collected, and stored, for five consecutive days from the day after dosing with fenbendazole. All 18 of the horses receiving five consecutive days' treatment were administered fenbendazole (10% w/v) at 7.5 mg/kg BW daily for five consecutive days (day −4 to 0), orally in feed following the manufacturer's recommendations. Feed intake was monitored to ensure the full dose was ingested. Further faecal samples were collected and stored from one day after the last dose of fenbendazole and then on days 3, 5, 7 and 9 post-treatment for the five consecutive day dosing group. All samples were stored as described by Coles et al. (1992) and were used for egg hatch testing.

2.1.6. Laboratory analysis

We modified the egg hatch assay described by Matthews et al. (2012), to an egg hatch test (EHT) that did not expose eggs to anthelmintics, simply testing the ability of excreted strongyle eggs