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Questionnaire study on parasite control practices on Thoroughbred and Standardbred breeding farms in New Zealand

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Abstract

Against a global background of increasing anthelmintic resistance in parasites, little is known about the current parasite control strategies adopted within the equine industry in New Zealand. The aim of the study was to describe and compare the current parasite management and control practices used on Thoroughbred and Standardbred stud farms in New Zealand. An online questionnaire was used to collect data on the demographics of respondents, parasite control methods, grazing management, and use of faecal egg counts. Questions regarding parasite control strategy, how often horses were dewormed, number of treatments per year and stocking density were stratified by horse type: young stock (foals/weanlings/yearlings), wet mares (nursing a foal) or dry mares, and industry (Thoroughbred and Standardbred). Questions on grazing management were stratified by horse type and the breeding and non-breeding season. In total, 136 respondents completed the survey, of which most (66%; 90/136) were involved in the Thoroughbred breeding industry. Most (98%; 134/136) respondents used anthelmintic products to treat the horses on their property, and regardless of industry type most respondents were using interval drenching for young stock (86/129; 53%), dry mares (51/124; 41%) or wet mares (50/126; 40%). Of those respondents treating on regular interval, 55% (68/123), 42% (50/119) and 38% (46/122) were treating young stock, wet mares and dry mares every 6–8 weeks. The median number of treatments per year for young stock, dry mares and wet mares was 6 (IQR 4–8), 4 (IQR 3–6) and 4 (IQR 3–6), respectively; there was no difference in frequency of treatments by industry type. In the last 12 months respondents used a median of 2 (IQR 2–4) and 3 (IQR 2–4) different anthelmintic products to treat horses on Thoroughbred and Standardbred breeding farms, respectively. Of the respondents reporting the anthelmintic products used in the last 12 months, 95% used at least one product containing macrocyclic lactones. Overall, faecal egg counts were done by 20% (25/124) of respondents and over half of respondents in both industries were consulting their veterinarian for advice on worming products. This study identified a high reliance on anthelmintic products and limited on-farm control practices that would delay the development of anthelmintic resistance in equine parasites. Further research is now required to identify the level of resistance in the New Zealand equine parasite population.

Keywords parasite, management, control practices, anthelmintic resistance, racehorse

Introduction

The limited choice of anthelmintic products available for use in horses, combined with inappropriate parasite management strategies, has resulted in widespread reports of anthelmintic resistance (Kaplan and Nielsen, 2010; Nielsen et al., 2014a). Resistance to anthelmintics has been described in many of the major gastrointestinal parasites that affect horses, and to all the classes of anthelmintic products available for use in this species (Kaplan, 2004; Nielsen et al., 2014a). Whilst a number of horses may not show clinical signs of disease (von Samson-Himmelstjerna, 2012), high parasite burdens in horses can result in severe weight loss, diarrhoea, colic and death (Love et al., 1999). These clinical signs may not only affect performance of horses but may impact on the value of horses at sales (Pagan et al., 2006).

Previous studies have indicated horse owners' concerns over anthelmintic resistance (Allison et al., 2011; Relf et al., 2012), but also highlighted a lack of measures in place to slow the development of anthelmintic resistance. Traditionally, control measures have relied on frequent, year-round anthelmintic treatments (Nielsen et al., 2014a), with studies of Thoroughbred studs and training establishments in the UK reporting regular treatments to all horses every 6–8 weeks (Earle et al., 2002; Relf et al., 2012). Similarly, in two general surveys of Thoroughbred stud farms in New Zealand, anthelmintics were administered to weanlings every 6 or 7 weeks (range 3–14) (Rogers et al., 2007; Stowers et al., 2009).

New recommendations suggest that a move towards surveillance-based control programmes is required, utilising faecal egg counts to determine when treatment is required thus reducing the reliance on anthelmintic treatments for horses (Kaplan and Vidyashankar, 2012; Nielsen et al., 2014a). Whilst veterinary practices in the United States appeared to be incorporating more sustainable control programmes (Nielsen et al., 2014a), a survey of Thoroughbred stud farms in Kentucky indicated most respondents used traditional rotational programmes and appeared reluctant to adopt the new recommendations (Robert et al., 2014). Little is known about the level of veterinary involvement in parasite control or the current control strategies adopted within the equine industry in New Zealand. Whilst surveys of weanling, yearling and racehorse feeding and management have been conducted in New Zealand (Bolwell et al., 2012; Stowers et al., 2009; Williamson et al., 2007), there is a lack of specific data regarding parasite control practices and anthelmintic resistance on stud farms in New Zealand.

It has been accepted that resistance of the cyathostomes to the benzimidazole anthelmintics is widespread in New Zealand (Bishop et al., 2013; Scott et al., 2015). Furthermore, a recent study on three Thoroughbred stud farms in New Zealand indicated that resistance of Parascaris equorum to ivermectin has developed (Bishop et al., 2013). As indicated previously (Peregrine et al., 2014), research priorities need to focus on the identification of risk factors for anthelmintic resistance on equine properties and identify ways to move towards a more sustainable approach to parasite control. Therefore, there is a need to understand the current parasite control practices used in the racing and breeding industries in New Zealand, before interventions and changes to control regimens can be made. The aim of the study was to describe and compare the current parasite management and control practices used on Thoroughbred and Standardbred stud farms in New Zealand.

Materials and Methods

Target population and survey method

The target population for this study was Thoroughbred and Standardbred breeders registered with New Zealand Thoroughbred Breeders' Association (NZTBA) and Harness Racing New Zealand (HRNZ), respectively. The estimated number of breeders involved in both industries is 5500 (Anon, 2010), however, these include families and partnerships; the number of breeders registered with each group may be much less. An online questionnaire was created using web-based software (survey Gizmo) for online surveys. The aim of the study, a request for participation and a link to the online questionnaire was sent to the office administrator of NZTBA and the website administrator for HRNZ on 16 April 2014. Thoroughbred breeders were notified of the questionnaire through an automated e-mail bulletin sent to members by the NZTBA, and Standardbred breeders were notified through a news item listed on the HRNZ website. The questionnaire was available online for 8 weeks and a reminder was sent to Thoroughbred breeders by email and placed on the HRNZ website 4 and 2 weeks, respectively, before the questionnaire closed.

Questionnaire design

The questionnaire consisted of 31 questions: 27 were closed-ended questions, which consisted of multiple-choice, Likert scale and yes/no options, and four were open-ended questions (size of farm, number of horses on the farm, frequency of worming and stocking density). The questionnaire was divided into four sections that included: demographics of respondents, parasite control methods, grazing management, and use of faecal egg counts. Questions regarding parasite control strategy, how often horses were dewormed, number of treatments per year and stocking density were stratified by horse type (three categories): young stock (foals/weanlings/yearlings), wet mares (nursing a foal), and dry mares. Questions on grazing management were stratified by horse type and the breeding and non-breeding season.

Statistical analysis

A data extract was downloaded from the survey site and stored in Microsoft Excel. Questionnaire responses were included in the dataset if they were recorded as completed by the survey software or if they were partially completed with responses to the demographic questions and at least one question on worming practices. Data were checked for errors and any free text comments were checked and coded into categories where appropriate. Demographic and parasite control questions were stratified by industry type to compare practices in the Thoroughbred and Standardbred industries. The denominator for each question was not the same due to non-response and missing data, and for some questions the respondents could tick more than one option. Non-parametric data were summarised with median and interquartile range (IQR) throughout and categorical and binary data were summarised as counts and percentages. Multiple correspondence analysis (MCA) was used to describe how strongly and in which way parasite control practices were interrelated, by creating a data matrix and visualising them on a two-dimensional plot (Greenacre, 2007). Variables that group together similar to each other and those that group together at the centre of the plot are considered to represent the average profile (Greenacre, 2007). All descriptive summaries were conducted in Stata version 12.

Results

Survey respondents

In total, 223 responses were received of which 125 were complete and 98 were recorded by the survey software as partially completed. Eighty-four partially completed questionnaires did not meet the inclusion criteria and three questionnaires were completed by respondents from other areas of the equine industry (sport horse), resulting in 136 questionnaires for analysis. The denominator for each question varied as not all respondents answered every question.

Demographics

Most (66%; 90/136) respondents were involved in the Thoroughbred breeding industry, 30% (41/136) in the Standardbred industry and 4% (5/136) were involved in both breeding industries. In both industries more respondents were male (Thoroughbred 60% and Standardbred 83%) than female, most (82% 111/135) were aged between 51 and 70, and most had been involved in the industry for 10 years or more. The median property sizes were 10 (IQR 5–45; max 28,830) and 14 hectares (5–40; max 1700) for respondents from the Thoroughbred and Standardbred industry, respectively. In total, 85 respondents in the Thoroughbred industry had a median of 3 (IQR 2–8; max 200) young stock, 3 (IQR 2–6; max 200) mares and 2 (IQR 1–3; max 4) stallions per property in the last 12 months. Forty respondents in the Standardbred industry had a median of 4 (IQR 2–10; max 50) young stock and 30 respondents had a median of 3 (2–6; max 35) mares on their property in the last 12 months; five respondents had a median of 1 (IQR 1–2) stallion.

Parasite control methods

Most (98%; 134/136) respondents reported that they used anthelmintic products to treat the horses on their property. Regardless of industry type, most respondents were using interval drenching (drenching at a set interval) for young stock, dry mares, and wet mares (Fig. 1). Overall, 68% (91/133) of respondents used the same worming strategy for their horses regardless of stock class. Of those respondents treating on regular interval, 55% (68/123), 42% (50/119) and 38% (46/122) were treating young stock, wet mares and dry mares every 6–8 weeks, respectively (Fig. 2). Aside from routine treatment, 89% (105/118) of respondents dewormed new horses when they arrived on the property, 29% (34/118) treated at signs of disease and 19% (22/118) treated based on veterinary recommendation. The median number of treatments for young stock, dry mares and wet mares was 6 (IQR 4–8), 4 (IQR 3–6) and 4 (IQR 3–6), respectively; no difference in frequency of treatments was seen by industry.

In the last 12 months respondents used a median of 2 (IQR 2–4) and 3 (IQR 2–4) different anthelmintic products (brands) to treat horses on Thoroughbred and Standardbred breeding farms, respectively. Five respondents did not know the product they used to treat horses, whilst 54 respondents did not know the anthelmintic ingredient in the products they used. A total of 351 products were used by 127 respondents in the previous 12 months. Of the respondents reporting the anthelmintic products used in the last 12 months, 95% used at least one product containing macrocyclic lactones. The most common anthelmintics administered by respondents in the last 12 months were abamectin and praziquantel (77%; 98/127), and ivermectin (39%; 49/127). Of the respondents specifically reporting the anthelmintic (active ingredient rather than product) (n = 75) used in the last 12 months, 91% used macrocyclic lactones and their combinations, 28% used benzimidazoles, and 13% reported using anthelmintics not licensed for use in horses (such as levamisole, monepantel and doramectin).

In both breeding industries, most respondents used oral pastes and most respondents spent more than $50 per horse on anthelmintic products in the last year (Table 1). Across both industries, anthelmintic products were commonly rotated at random, every 6 months, or yearly. Over half of respondents in both industries were consulting their veterinarian for advice on anthelmintic products (Table 1).

The MCA results are shown in Fig. 3. In total, 80% of the variation is explained by the variables plotted and most of the variation in the graph was explained by the variables in Dimension 1. Respondents from farms that used one product per year, did not seek veterinary advice, rotated products randomly, had less horses and did not conduct FEC, appeared to group together. Respondents conducting FEC grouped with those farms with more horses on average, with those seeking veterinary advice. Respondents from farms using 2–3 products per year grouped with those that were not removing droppings.

Grazing management

Overall, young stock, wet mares and dry mares were kept in groups of 2 (IQR 2–4; max 50), 2 (IQR 2–4; max 35), and 3 (IQR 2–4; max 34), respectively, whilst at pasture. During the breeding season, 71% (89/125), 68% (83/122) and 60% (74/124) of respondents used rotational grazing for young stock, wet mares and dry mares, respectively. During the non-breeding season 56% (74/131) of respondents used rotational grazing and 24% (31/131) used set stocking for broodmares.

In the Standardbred industry, 37% (13/35) of respondents did not cross graze their horse paddocks, 40% (14/35) cross-grazed them with cattle and 14% (5/35) with both sheep and cattle. Just under half of respondents from the Thoroughbred industry cross-grazed their paddocks with cattle (49%; 43/88) and 20% (18/88) with sheep and cattle. The frequency of harrowing, cross-grazing, rotating paddocks and removing droppings from paddocks is shown in Fig. 4. Most respondents never removed droppings from the paddocks and most paddocks were harrowed or rotated a few times per year.

FEC and clinical signs

Most respondents reported that horses had not been affected by worm related illness in the last 12 months. Some (43%; 57/134) respondents reported clinical signs associated with worm related illness, such as worms in faeces (21% 28/134), tail rubbing (21%; 28/134) and pot belly (15%; 20/134). Most respondents were not aware of any anthelmintic resistance on their property (Table 1). Overall, faecal egg counts were done by 20% (25/124) of respondents, as part of regular testing (16/25), when illness was suspected (8/25) or when a new horse arrived on the property (5/25). Most (90%; 110/122) respondents did not do faecal egg count reduction tests for their horses.

Discussion

This study has identified a high reliance on anthelmintic products and limited on-farm control practices that would delay the development of anthelmintic resistance in equine parasites. The reliance on anthelmintics included the dosing of horses at frequent intervals and the limited use of positive FEC to determine whether treatment was necessary. Other practices that have been associated with increasing the selection of resistant parasites were also identified, including pasture management strategies that would limit or reduce refugia.

In the current study, interval dosing between 6 and 12 weeks was the most common strategy used to control parasites. Interval dosing is based on traditional, year-round control practices and has been implicated in the development of anthelmintic resistance (Kaplan and Nielsen, 2010). Our results are consistent with the treatment strategies and intervals previously reported for Thoroughbreds in the UK (Earle et al., 2002; Relf et al., 2012) Kentucky (Roberts et al., 2008) and previous reports within New Zealand (Scott et al., 2015). These results highlight that the interval dosing strategy has not changed in New Zealand in recent years. The premise of interval strategies was to limit a horse's contact with infective larvae on pasture (Drudge and Lyons, 1966), and stem from a time when treatments were ineffective against the larval stages of many parasites (Scott et al., 2015). Studies have identified reduced ERP as one of the early indicators of anthelmintic resistance in cyathostomins, with ERP following treatment with ivermectin decreasing to as little as 4 weeks post treatment (Lyons et al., 2011; Stratford et al., 2011; von Samson-Himmelstjerna et al., 2007). Therefore, if resistance is present in the parasite population, the interval strategy used by most respondents may be becoming less effective at controlling parasites, if treatment is being given after eggs have reappeared in faeces and increased the burden of larvae on pasture.

Surveillance-based control programmes of treatment following a positive FEC result have been suggested as the recommended strategy for parasite control for a number of years (Gomez and Georgi, 1991; Kaplan and Nielsen, 2010). Recently, renewed emphasis has been placed on the need to reduce the reliance on anthelmintics and increase the use of FEC, resulting in new recommendations by the American Association of Equine Practitioners to adopt such practices (Nielsen et al., 2014a). However, uptake appears to be slow, with Robert et al. (2014) reporting that 13% of Thoroughbred stud managers in Kentucky were using treatments based on positive FEC, while 17% followed a strategy that combined interval and surveillance-based strategies, depending on the age and class of the horse. In the current study, less than 10% of respondents reported targeted dosing as the strategy they used to control parasites in young stock, dry mares and wet mares, although 20% reported that they had used FEC, often when new horses arrived or when illness was suspected. These results indicate that whilst some breeders are aware of FEC, few are integrating these methods to reduce reliance on anthelmintics at the whole-herd level. Given that most respondents had consulted their veterinarian for advice, it is unclear whether the lack of up-take is due to a lack of owner or veterinarian awareness; awareness of the strategy itself, awareness of the benefits of targeted treatments, or that there are other reasons. Further research will be required to determine the reasons behind the slow adoption of surveillance based methods, some of which may be due to a lack of extension of research findings to both veterinarians and the breeding industries.

Like previous studies (Relf et al., 2012; Stratford et al., 2014), macrocyclic lactones were the most commonly used family of anthelmintics in this study. To date, macrocyclic lactones have had high efficacy against luminal cyathostomins, despite frequent use (Comer et al., 2006; Kaplan, 2002), however there have been reports of resistance in P. equorum to ivermectin in young horses (Boersema et al., 2002; Hearn and Peregrine, 2003). The continued reliance on this family of anthelmintics will further select for resistance in these parasites. Of greater concern were the 13% of respondents who reported the off-licence use of anthelmintics, including doramectin, monepantel and levamisole. While doramectin may be safe for use in horses, the efficacy of this anthelmintic if given as an injectable versus an oral dose is not known (Pérez et al., 2010), and 6% of respondents reported dosing horses using the injectable route. While levamisole is efficacious against cyathostomes (Lyons et al., 1975), the safety of this drug in horses is low (DiPietro and Todd, 1987). Using anthelmintics off-licence could further increase the selection pressure for resistance genes, as limited efficacy due to insufficient dosing or product unsuitability may select for resistant parasites through exposure of parasites to sub-optimal drug concentrations.

Overall, regardless of age, the frequency of treatment reported in the current study was higher than reported for Thoroughbreds in Kentucky (Robert et al., 2014), in German riding horses (Schneider et al., 2014) and Danish horses (Nielsen et al., 2014b). In the Danish study, most foals and horses 1 to 3-years-old were treated twice a year, while less than 5% of horses in these age-groups were treated four or more times, and older horses were treated less often (Nielsen et al., 2014b). In the current study, a proportion of horses across all stock classes, were being treated on intervals less than six weekly; the equivalent of more than eight treatments per year. Prior to the restriction of anthelmintic use in Denmark, a study by Lendal et al. (1998) indicated that horses were being treated nearly as frequently as reported in the current study. Subsequently, unlimited access to anthelmintics in Denmark was changed to prescription only and on confirmation of parasitism in order to reduce unnecessary use of anthelmintics (Nielsen et al., 2006). In contrast, there are no restrictions on the use of anthelmintics in New Zealand, possibly accounting for the higher frequency of treatments reported in this study. Additionally, horses in New Zealand are predominately kept at pasture all year in a moderate climate and at high stocking densities (Rogers et al., 2007), which may result in a perception by breeders that horses are continually at risk as there is less environmental pressure inhibiting worm development.

Multiple correspondence analysis identified that the following practices reported by respondents grouped together: random rotation of anthelmintics, the use of one product in a year, not using FEC, a lack of veterinary advice regarding parasite control practices, and pasture maintenance practices that would reduce or minimise the refugia on pasture. Together these practices could select more strongly for resistant parasites on breeding farms using such methods. The frequency of pasture maintenance practices, including harrowing and the removal of faeces from pasture, was lower than reported on Thoroughbred breeding farms in the UK (Relf et al., 2012). Although maintenance of parasite populations in refugia has not yet been shown to slow the development of anthelmintic resistance in horse parasites, it has been shown for the parasites of sheep

(Leathwick et al., 2012; Van Wyk, 2001; Waghorn et al., 2008). Consequently, it has been argued that refugia populations would act in a similar manner for equine parasites (Nielsen et al., 2007) and should be considered as part of a resistance mitigation programme.

This study has provided baseline data on the parasite control practices utilised on breeding farms in New Zealand. The method of questionnaire administration, using an online survey platform, may have resulted in a selection bias, targeting those breeders that were more familiar with or frequently used email and the Internet as sources of information. Whilst a previous survey identified that websites were a preferable source of information for people involved in the breeding industry (Bolwell et al., 2013), it should be noted that the results of this survey covering a selected number of respondents may not be representative of the wider population of Thoroughbred and Standardbred breeders in New Zealand.

Conclusion

It is difficult to advocate for change in treatment regimens in order to slow the development of anthelmintic resistance if the current treatment regimens or levels of anthelmintic resistance in the population are unknown. The current study has highlighted a high reliance on anthelmintic products by both Thoroughbred and Standardbred breeders. Despite growing scientific evidence to support the targeted treatment of horses based on FEC, few breeders used positive FEC results prior to anti-parasitic treatment. Of added concern was the off-licence use of anthelmintics in high value animals, including products with poor safety margins and without confirmed efficacy in horses. Further research is now required to identify the level of resistance in the New Zealand equine parasite population, as there is little evidence that the practices used by breeders would be delaying the development of resistance in equine parasites.

Acknowledgements

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Figure 1: The frequency of harrowing, cross-grazing and rotating paddocks, and removing droppings as reported by respondents of an online survey of parasite control practices on Thoroughbred and Standardbred training yards in New Zealand (n=234)

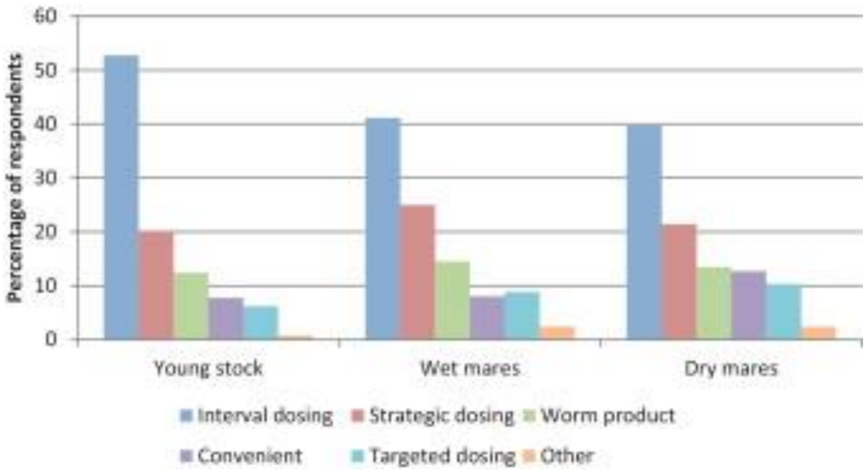

Figure 2: Worming intervals used to treat young stock, wet mares and dry mares as reported by respondents of an online cross-sectional survey of worm control practices on Thoroughbred and Standardbred breeding farms in New Zealand.

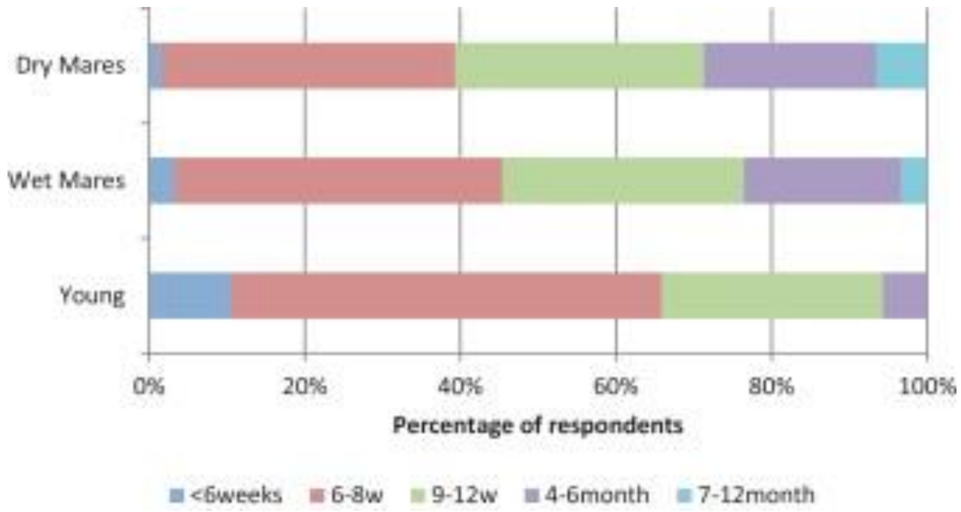

Figure 3: Multiple correspondence analysis of selected demographic characteristics and parasite control practices used on Thoroughbred and Standardbred breeding farms, from an online survey of parasite control practices in New Zealand. Variables include: (1) Alternate wormers: never, frequently, yearly, randomly; (2) number of horses on the farm: 1–3, 4–5, 6–11. 12+; (3) conducts FEC: respondent uses a faecal egg count yes/no; (4) Seeks veterinary advice: respondent seeks veterinary advice for worm control yes/no; (5) removes droppings yes/no; (6) number of wormers used: number of worming products used in last 12 months 1, 2–3, 4–5, 6+.

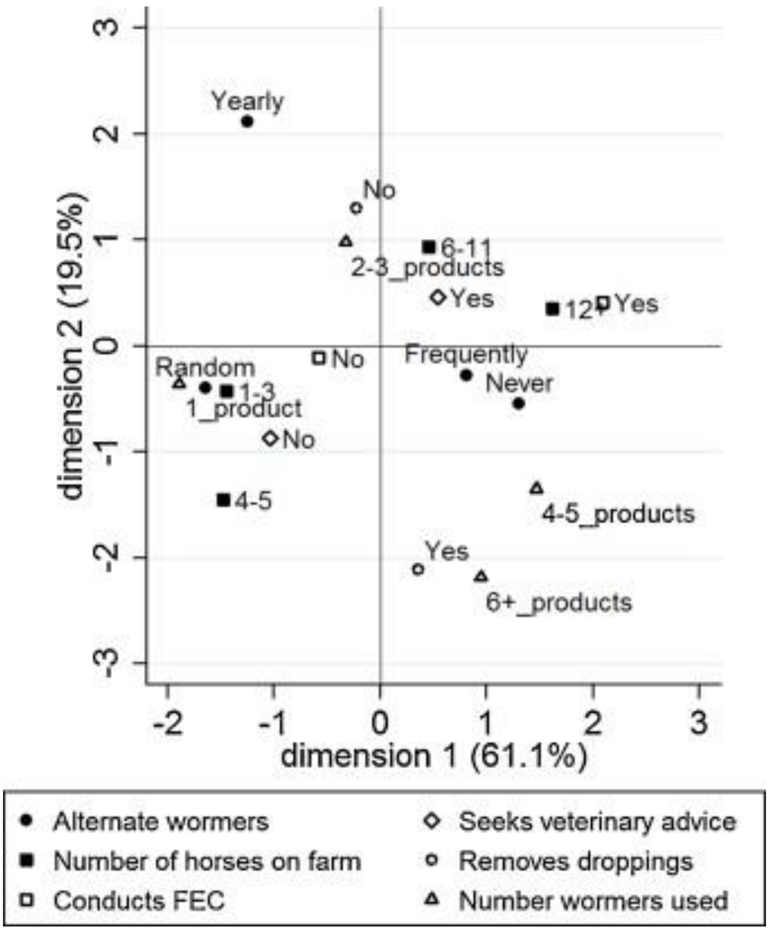

Table 1: Description of parasite control practices used on Thoroughbred and Standardbred breeding farms as indicated by 128 respondents from an online crosssectional survey of parasite control practices in New Zealand.

Variable	Level	Thoroughbred		Standardbred	
		Number	Percentage	Number	Percentage
Method of worming					
	Oral	77	86	31	82
	Injection	5	6	1	3
	Stomach tube	1	1	0	0
	Pour-on	0	0	1	3
	Other	7	8	5	13
Frequency alternate worming products[a] (n = 127)					
	Every application	11	12	6	16
	2–3 monthly	16	18	5	13
	6 monthly	19	21	8	21
	Yearly	9	10	8	21
	At random	23	26	9	24
	Never	4	4	2	5
	Other	7	8	0	0
Seeks advice from veterinarian on worming products					
	No	31	34	16	42
	Yes	59	66	22	58
Average spent on worming products per horse (last 12 months NZ$)					
	$<20	4	4	1	3
	$21–31	15	17	7	18
	$31–40	1	1	8	21
	$41–50	9	10	5	13
	$51–100	26	29	6	16
	$101–150	18	20	7	18
	$151+	17	19	4	11
Cross graze with other animals (n = 123)					
	No	13	15	13	37
	Sheep	12	14	3	9
	Cattle	43	49	14	40

	Sheep and Cattle	18	20	5	14
	Other	2	2	0	0
Perform faecal egg counts on horses (n = 121)					
	No	68	78	29	85
	Yes	19	22	5	15
Aware of resistance on property (n = 121)					
	No	86	99	33	97
	Yes	1	1	1	3

[a] Or brand not the active ingredie

Table 3: Multivariable logistic regression model of whether trainers used faecal egg counts. Data based on a survey of racehorse trainers in New Zealand (n=234)[a].

Variable	Level	Odds ratio	95% confidence interval	Wald P value	LRT* P value
Industry	Thoroughbred	REF			0.80
	Standardbred	1.17	0.50 – 2.74	0.72	
	Both	0.50	0.03 – 7.69	0.62	
	0-2	REF			0.09
Number of horses in training	3-5	0.98	0.29 - 3.32	0.97	
	6-11	0.82	0.23 - 2.95	0.76	
	12+	2.95	1.00 - 8.70	0.05	
Seeks veterinary advice about worming	No	REF			<0.01
	Yes	4.25	1.54 - 11.69	0.01	
Harrows paddocks	More than monthly	REF			<0.001
	Monthly	4.09	0.94 - 17.88	0.06	
	Less than monthly	0.63	0.15 - 2.70	0.53	
	Never	0.83	0.16 - 4.62	0.82	

*****LRT = Likelihood ratio P value

[a] total number of observations n=180

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