Cross-sectional survey of parasite control practices on Thoroughbred and Standardbred training yards in New Zealand.

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Abstract

Reasons for performing the study: Worldwide, there is growing concern regarding anthelmintic resistance in equine parasites. In order to improve parasite control practices and reduce the selection for resistant parasites, baseline data are required.

Objective: To describe the current parasite management and control practices used for racehorses.

Study design: Cross-sectional survey

Methods: Thoroughbred and Standardbred trainers were surveyed online regarding demographics, parasite control methods, grazing management and quarantine and the use of faecal egg counts (FEC), with questions stratified by horse type: racehorses (horses in training) and spellers (racehorses on a break from training) and industry (Thoroughbred and Standardbred). Multivariable logistic regression was used to examine associations with FEC use.

Results: In total, 234 respondents completed the survey for an estimated response rate of 16%. In total, 50.5% of trainers treated horses on an interval treatment strategy and treated a median of 6 (interquartile range (IQR) 4 to 7) and 6 (IQR 4 to 8) times annually for Thoroughbred and Standardbred racehorses, respectively. A total of 62.5% (130/208) of respondents reported seeking veterinary advice for deworming products, and FEC had been done by 20.1% (39/194) of respondents. The odds of a trainer doing FEC were 4 times higher if the trainer had consulted a veterinarian, compared to those that had not.

Conclusions: This study has highlighted an industry-wide overuse of anthelmintic products and few trainers were using surveillance based control strategies. The relationship between veterinarians and trainers should be explored further to enhance information dissemination and implement effective control strategies, to maintain horse health and delay the advance of anthelmintic resistance.

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

Introduction

Historically, the control of gastrointestinal parasites in horses has relied on regular treatment with anthelmintic products [1]. However, the frequent use of anthelmintics combined with inappropriate parasite management strategies and the limited choice of active ingredients has resulted in reports of anthelmintic resistance in horses in multiple species of parasites [1-4]. The recommendation to reduce the reliance on anthelmintics and consequently delay the advance of anthelmintic resistance, through the use of surveillance-based control programs has been suggested [1; 5]. However, uptake of this new strategy has been slow, and the regular treatment of horses in the racing industry is still widely reported [6-9].

New Zealand is one of few racing industries worldwide where both Standardbreds and Thoroughbreds are produced for racing. A previous study of parasite control practices in commercial stud farms in New Zealand identified a reliance on anthelmintic products and few practices identified that would delay the development of anthelmintic resistance on either Thoroughbred and Standardbred stud farms [8]. While the majority of horses in New Zealand are kept on pasture, Thoroughbred and Standardbred racehorses form a unique population by being intensively housed and managed [10; 11], whereby limiting exposure to parasites on pasture. Despite this, studies have identified the frequent use of anthelmintics without evidence of parasite burdens in Thoroughbred training establishments in the United Kingdom [6; 12]. To date, similar studies have not been undertaken in Thoroughbred racehorses in New Zealand nor have any studies investigated practices in Standardbred racehorses.

In order to effectively implement the surveillance-based control strategy, it is imperative to understand the current parasite control practices used within the racing industry and to identify factors that are potentially inhibiting the uptake of the new strategy. Resistance to ivermectin was recently identified in New Zealand in *Parascaris equorum* [13]. The various cyathostomine species are still considered susceptible to ivermectin but benzimidazole-resistance is likely widespread in this group [14]. There have been no reports of resistance to pyrantel in this country. The aim of the study was to describe the current parasite management and control practices used for Thoroughbred and Standardbred racehorses in New Zealand.

Materials and Methods

Target population and survey method

The target population for this study was Thoroughbred and Standardbred trainers registered with New Zealand Thoroughbred Racing (NZTR) and Harness Racing New Zealand (HRNZ), respectively. An online questionnaire was created using web-based software (survey Gizmo) for online surveys and was available online from 7th July to 20th September 2014. Thoroughbred trainers were notified of the survey through an automated email bulletin sent to members by NZTR. Trainers were notified through a news item listed on the NZTR and HRNZ website and a reminder email was sent directly to all trainers registered with NZTR (n=775) and HRNZ (n=690) five days before the survey closed.

Survey design

The survey design was similar to that described by Bolwell *et al.* [8]. Briefly, the survey consisted of 30 questions and the survey was divided into four sections that included: demographics of respondents, parasite control methods, grazing management and quarantine, and use of faecal egg counts (FEC). The survey was modified to capture practices specific to the management of racehorses with regards to the keeping of racehorses (horses in training) and spellers (racehorses on a break from training) and access to grass during turnout. Deworming measures for arriving and departing horses included information regarding i) racehorses, ii) spellers, iii) horses that were sold, but may be retained as racehorses or iv) horses that were retired and would no longer race. As described previously, data were retained in the dataset if the industry information was complete and at least one question regarding deworming practices had been answered [8].

Statistical analysis

Data were checked for errors and categorised where appropriate. Region was defined by the New Zealand Racing classifications: Northern, including Northland, Auckland, Waikato and Bay of Plenty, Central including Taranaki, Hawkes Bay, Manawatu and Wellington, and Southern, all regions in the South Island. Non-parametric data were summarised with median and interquartile range (IQR) throughout and categorical and binary data were summarised as counts and percentages, stratified by industry and by horse type. As respondents could choose not to answer some questions in the survey, and some questions allowed multiple answers, the denominator was different between sections. Anthelmintic products were not stratified by industry or horse type. All descriptive summaries were conducted in Stata version 12.

Logistic regression analysis was used to determine factors associated with the outcome of the use of FEC by trainers. Non-normally distributed data were categorised into quartiles and pasture management strategies were categorised into four frequency categories; >monthly, monthly, <monthly and never. Exposure variables were screened and those with a likelihood ratio test of $P<0.25$ were selected for inclusion in a multivariable model. A preliminary multivariable model was built using a manual backwards method of elimination in which variables were retained in the model if the likelihood ratio test statistic was $P<0.05$. To control for confounding, the number of horses trained and industry was retained in the final model. Biologically plausible two-way interaction terms between the main effect variables were considered in the multivariable model. Model diagnostics were conducted using summary measures of the goodness-of-fit of the final model [15] and the evaluation of the standardised Pearson's residuals and leverage scores. All logistic analyses were conducted in Stata version 11.

Results

Survey respondents

A total of 284 survey responses were received, of which 39 were blank, eight were unusable and three were completed by respondents not involved in Thoroughbred and Standardbred training;

resulting in 234 usable surveys. Based on an approximate figure of 1,465 trainers registered with NZTR and HRNZ, the response rate of the survey was 16%.

Demographics

Most respondents (56.4%; 132/234) were involved in Thoroughbred training, or 41.5% (97/234) in Standardbred training, and 2.1% (5/234) were described as training both Thoroughbreds and Standardbreds. Trainers were located in the Northern (89/234; 38.0%), Central (49/234; 20.9%) and Southern (96/234; 41.0%) regions. Most respondents were male (60.4%; 139/230), aged between 51-70 years (58.2%; 135/232), and most had been involved in the industry for 10 years or more (Supplementary Table 1). Table 1 summarises the number and type of horses kept by respondents. Two trainers kept spelling horses only, leaving 232 trainers with racehorses. Two trainers had horses in active training (horses in work), but did not specify the number of horses that they did or could train (n=230) and one trainer specified the number that they could train, but not the number that they currently had in active training (n=231). Overall, 33 trainers did not report keeping spelling horses (n=201). .

Parasite control methods

Eighteen respondents did not complete the remainder of the survey, leaving a maximum denominator of 216 for trainers with racehorses and 188 for trainers with spellers. When asked if horses were treated for gastrointestinal parasites, two respondents did not treat either racehorses or spellers, including the use of herbal products. Both of these trainers kept Thoroughbreds.

In total, 2.3% (5/215) and 5.4% (10/185) of respondents reported a worm-related illness in their racehorses and spellers, respectively, and 7.0% (15/215) with racehorses and 8.1% (15/185) with spellers were unsure if their horses had had a worm related illness.

Table 2 summarises the treatment strategy used by trainers, and the treatment interval. Trainers reported using interval dosing for treating racehorses (50.5%; 108/214) and spellers (50.5%; 95/188) and 17.3% (37/214) treated racehorses and 14.4% (27/188) treated spellers on an interval specified on the deworming product. In total, 6.1% (13/214) used a targeted strategy based on FEC for racehorses and 4.8% (9/188) for spellers. Most trainers treated racehorses (46.7%; 98/210) and spellers (37.8%; 70/185) routinely every 6-8 weeks. In the 12 months prior to the survey, racehorses were dewormed a median 6 times annually for Thoroughbreds (IQR 4-7; max 15) and Standardbreds (IQR 4-8; max 12), respectively. Spellers were dewormed a median of 4 times annually for Thoroughbreds (IQR 4-6; max 15) and Standardbreds (IQR 4-6; max 12), respectively.

In the 12 months prior to survey, respondents used a median of 3 (IQR 2-4) anthelmintic products (brands) to treat horses. Of the 212 respondents, four respondents did not know the product they used to treat horses. There were a total of 32 products used to treat horses, with 16 ingredient or ingredient combinations reported. In the 12 months prior to survey, respondents reported a total of 710 different treatment occasions based on anthelmintic product, with most treatments containing a macrocyclic lactone (73.3%; 521/710). The most common anthelmintic ingredients used were abamectin (26.5%; 188/710), ivermectin (27.9%; 198/710) and moxidectin (19.0%; 135/710). Benzimidazoles were included in 42.3% (301/710) of anthelmintic products. When anthelmintics ingredients were combined in a product, most treatment occasions included praziquantel (49.9%; 354/710), macrocyclic lactones in combination with benzimidazoles (20.1%; 148/710), macrocyclic lactones or benzimidazoles in combination with pyrantel on (1.4%; 10/710) and (7.7%; 55/710) of treatment occasions, respectively.

A total of 13.2% (30/212) of respondents reported using the anthelmintic ingredients of levamisole or doramectin, products which are not licensed for use in horses. Four respondents reported using a herbal product, in combination with other athelminitics.

Oral treatments were used by 88.1% (104/118) and 82.4% (75/91) of Thoroughbred and Standardbred trainers, respectively, rather than injectable or pour-on treatments. Most trainers spent more than NZD$50 per horse on anthelmintic treatment in the last 12 months; 67.8% (80/118) and 64.7% (57/88) of Thoroughbred and Standardbred trainers, respectively. In total, 66.1% (78/118) of Thoroughbred and 57.8% (52/90) of Standardbred trainers had consulted their veterinarian for advice on deworming products.

Grazing management

Racehorses had a median of 8 (IQR 2-20) hours access to grass during turnout (time not spent in the stable, stall, barn or yard) per day whilst in training, and spellers received a median of 24 (IQR 24-24) hours access to grass per day. Grazing management by Thoroughbred and Standardbred trainers is summarised in Figure 1.

In total, 65% (128/195) of trainers always dewormed spellers when they returned from other properties and 71% (139/197) always dewormed new horses when they arrived at the training establishment. The deworming practices used by trainers for arriving and departing horses are shown in Figure 2.

Use of FEC

In total, 18.4% (20/109) Thoroughbred trainers and 22.2% (18/81) Standardbred trainers reported using FEC; 53.8% when illness was suspected, 48.7% as part of regular testing, 23.1% when a new horse arrived and 5.1% for other reasons. The frequency of FEC was not recorded. Two respondents reported that they had identified anthelmintic resistance; one Thoroughbred and one Standardbred trainer.

The industry, the number of horses in training, the frequency of harrowing and seeking veterinary advice were all retained in the final model. When the number of horses in training and frequency of harrowing were held constant, the odds of a trainer doing FEC was 4.25 (95% CI 1.54 to 11.69) times greater if the trainer had consulted a veterinarian, compared to trainers who had not (Table 3). The goodness of fit tests were non-significant and no values were removed from the final model due to high residual, leverage or influential values. Univariable results are presented in Supplementary Table 2.

Discussion

This study has provided baseline data on the parasite control practices utilised by racehorse trainers in New Zealand and has identified a reliance on anthelmintic products, despite limited evidence of parasitism in these horses or opportunity for infestation due to restricted access to pasture for racehorses in active training. A surveillance-based control strategy is now considered to be the best way to control parasites in horses and slow the development of anthelmintic resistance [2; 16]. However, the findings of the current study alongside the frequent treatment of horses on commercial stud farms [8] is indicative of a systemic failure in the dissemination and/or the uptake of surveillance based control strategies.

Half of both Thoroughbred and Standardbred trainers were utilising an interval regimen for spellers and racehorses. The reliance on the interval strategy is consistent with previous studies of Thoroughbreds and Standardbred stud farms in New Zealand [8; 14]. Similarly, the median number of treatments horses received annually was comparable to the number of treatments on stud farms, with racehorses treated as frequently as yearlings at up to 15 times annually [8]. Worldwide, the treatment of Thoroughbreds at intervals and with a high frequency is commonplace in training establishments [6; 12] and stud farms [6; 7; 9]. However, the concern is the systematic overuse of anthelmintic products occurring industry-wide, and the future implications of these practices.

Macrocyclic Lactones were the most commonly used family of anthelmintics used by respondents in the current study, with abamectin and ivermectin the most commonly used. This is consistent with previous studies [7; 17]. While it is unclear what factors are driving trainer’s choices of anthelmintic; product availability, economics, efficacy or knowledge of anthelmintic resistance, it does raise concerns regarding the selection for parasite resistance to the macrocyclic lactone anthelmintics. There are emerging reports of resistance to the macrocyclic lactones, with studies reporting shortened egg reappearance periods when horses were treated with this family of anthelmintic [18-21], rather than reduced efficacy immediately post-treatment in FEC reduction tests [21]. Consistent with a previous study from New Zealand [8], 13% of trainers reported the off-licence use of anthelmintics, including levamisole and doramectin. The former is poorly safe for use in horses [22] and in the latter the efficacy is unknown when given as an injectable preparation [23]. In the current study, 4% of trainers reported dosing horses using injectable products despite no products being licensed for this route of administration for horses in New Zealand. Similarly, pour-on products are not licensed for use in horses in New Zealand.

Racehorses in the current study had limited, or no access to grass, compared to spelling horses, which were at pasture all the time. In a study of training yards in the United Kingdom, 7% of horses had no access to pasture [24], while in previous studies in New Zealand, only 50% of racehorses had access to pasture [11]. At least fortnightly, one-third of trainers removed faeces from paddocks and 15% rotated horses between paddocks. Hillyer et al. [24] reported regular rotation of paddocks by 25% of trainers. Faeces removal has been reported in the United Kingdom as being practised regularly by 12% of trainers [24], at least weekly by 44% of trainers [12] and 51% of trainers reported removing faeces, but not necessarily often enough to avoid pasture contamination [6]. The removal of faeces, the rotation of paddocks and the use of cross-grazing may serve to reduce pasture infectivity and thus may ultimately slow down the development of anthelmintic resistance. However, these practises could also be seen as a considerable constraint on the potential for a refugia on pasture, potentially increasing selection for anthelmintic resistance when high treatment frequencies are maintained [25]. The lack of refugia on pasture, combined with the frequent movement of racehorses [26-28] and the inconsistent application of deworming procedures applied to horses arriving at stud farms [27] or by racehorse trainers, indicate that once anthelmintic resistance develops, resistant parasites would be likely to be spread throughout the racing population.

The response rate in the current study is comparable to previous studies of the racing industry [8; 29] and this group of respondents had previously indicated their preference for email or online contact [29]. The distribution of respondents, both in age, experience and geographically are representative of the underlying populations of Thoroughbred and Standardbred trainers [11; 26; 30]. While this study has identified that practices are relatively uniform between industries and between breeding and training facilities [8], care should be taken in interpreting the generalizability of these results and further work should be undertaken in this area.

In order to implement changes in the current parasite control practices to surveillance based control strategies, trainers will require evidence of financial benefit and effectiveness. Lester *et al.* [31] estimated that a surveillance based control strategy of treatment with ivermectin or pyrantel following a FEC of greater than 200 eggs per gram would be financially beneficial compared to an interval strategy based on quarterly treatments of either moxidectin (two treatments) or moxidectin and praziquantel and no FEC. The additional cost of conducting FEC was offset by a lower frequency of anthelmintic treatment and treatment with cheaper products. While only 5% of trainers were using FEC as part of a targeted control strategy, 20% of trainers were using FEC within their training establishment. Therefore there is scope to increase the use of FEC for parasite control.

Unlike some European countries where the sale of anthelmintics for horses is restricted and most horse owners purchase anthelmintics from veterinarians [32], the purchase and use of anthelmintics in New Zealand is not restricted. This study illustrates a knowledge gap in the control of parasites and it is unclear which methods and sources trainers use to inform their choices regarding anthelmintic use or anthelmintic resistance and whether and how trainers acted upon this information. However, racehorse trainers who sought veterinary advice in relation to anthelmintic products were more likely to conduct FEC compared to yards that did not seek veterinary advice.

The finding that trainers adopting practices that would reduce the reliance on anthelmintics were also seeking veterinary advice suggests veterinarians can have a positive impact on parasite control practices and may currently have an underutilised role regarding communicating best-practice parasite control practices. The veterinarian-trainer relationship requires further exploration in order to ensure effective dissemination of current and future knowledge.

Conclusion

With low levels of disease attributed to gastrointestinal parasitism, limited access to parasites on pasture and a high treatment cost per horse, it is difficult to advocate the continued use of interval based parasite control strategies for horses in training. The current study has highlighted a high reliance on anthelmintic use by both Thoroughbred and Standardbred trainers (for both spelling and in training horses) and provides baseline information regarding control practices. The targeted treatment of horses (based on positive FEC results) was limited despite surveillance-based control strategies being widely advocated for equine parasite control. Currently, while trainers are consulting veterinarians regarding anthelmintic products, best practice parasite control practices are not being implemented by all trainers who seek advice.

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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)

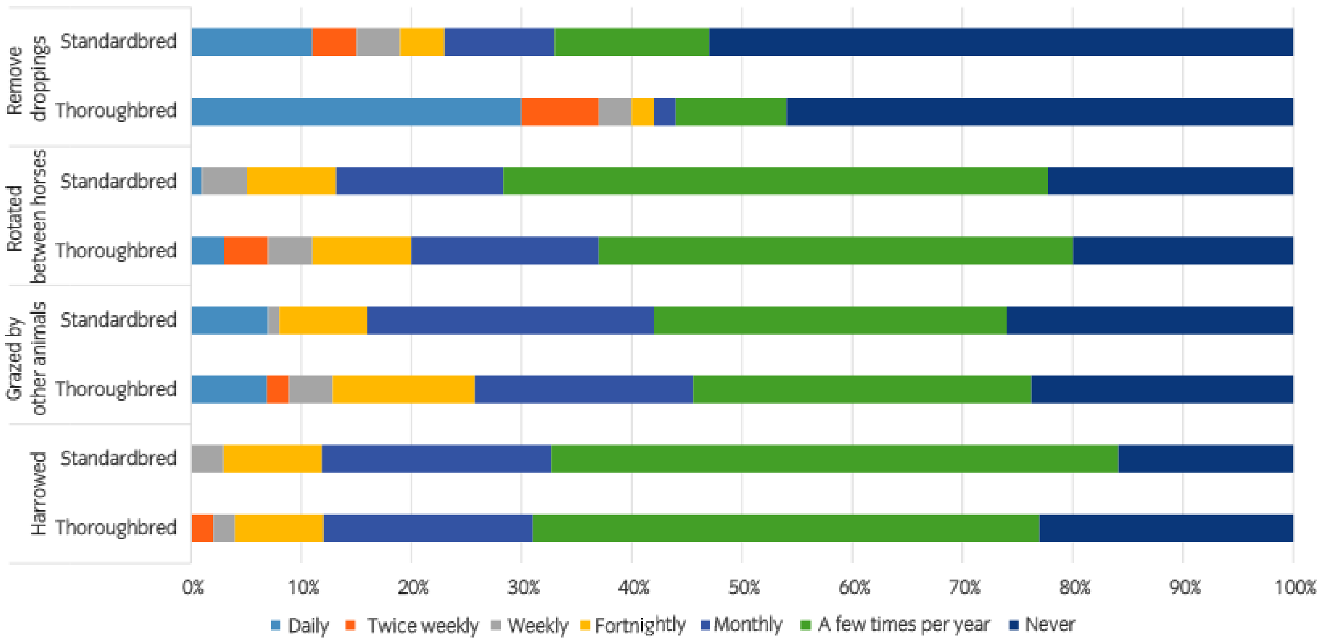

Figure 2: The frequency of deworming arriving (A) and departing horses (B and C) as reported by respondents of an online survey of parasite control practices on Thoroughbred and Standardbred training yards in New Zealand (n=234)

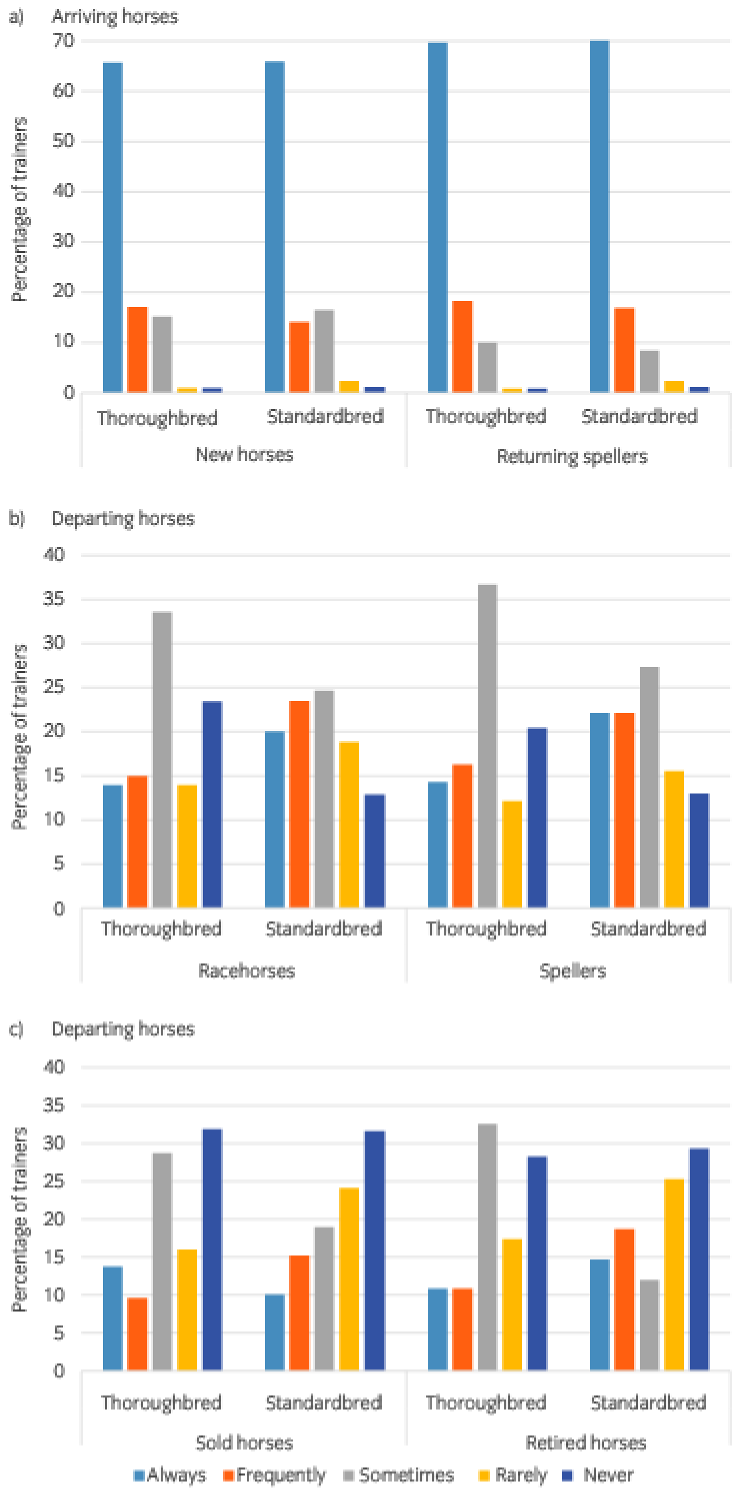

Table 1: Description of the number of racehorses in training, racehorses trained and spellers kept by trainers, stratified by industry type. Data based on a survey of racehorse trainers in New Zealand (n=234).

Variable	Industry	Number of respondents (%)	Median	Interquartile Range	Maximum
Number in training[a]	Thoroughbred	130 (98.5)	4	2 – 10	50
	Standardbred	97 (100)	4	2 – 8	46
	Both	4 (80)	4	3 - 4.5	5
Number trained[b]	Thoroughbred	129 (97.7)	6	2 – 12	80
	Standardbred	96 (99)	4	3 – 10	60
	Both	5 (100)	10	6 – 12	13
Number of spellers[c]	Thoroughbred	112 (84.8)	5	2 – 10	50
	Standardbred	84 (86.6)	4.5	2 – 10	510
	Both	5 (100)	4	2 – 4	10

[a] Two trainers kept only spelling horses and one trainer did not specify the number of horses in training.
[b] Two trainers only kept spelling horses and two trainers did not specify the number of horses they could train
[c] 33 trainers did not keep spelling horses

Table 2: Description of treatment strategy and treatment frequency used by trainers for racehorses and spellers, stratified by industry type. Data based on a survey of racehorse trainers in New Zealand. Interval dosing: at a set interval; strategic dosing: at specific times of the year; Deworming product: as often as recommended on the worming product; convenient: at a time convenient on the property; targeted: based on faecal egg counts.

Deworming practice	Level		**Thoroughbred**		**Standardbred**		**Both**	
			Number	Percentage	Number	Percentage	Number	Percentage
Deworming strategy	Deworming product	Racehorses[a]	17	14.4	20	22.0		
		Spellers[b]	12	11.4	15	19.2		
	Interval dosing	Racehorses	61	51.7	45	49.5	2	40.0
		Spellers	56	53.3	36	46.2	3	60.0
	Strategic dosing	Racehorses	22	18.6	12	13.2	1	20.0
		Spellers	16	15.2	13	16.7		
	Targeted	Racehorses	6	5.1	5	5.5	2	40.0
		Spellers	6	5.7	1	1.3	2	40.0
	Convenience	Racehorses	11	9.3	8	8.8		
		Spellers	14	13.3	12	15.4		
	Other	Racehorses	1	0.9	1	1.1		
		Spellers	1	1.0	1	1.3		
Interval of treatment	Don't use an interval	Racehorses[c]	3	2.6	5	5.6		
		Spellers[d]	2	1.9	6	7.9	1	20.0
	Less than 6 weeks	Racehorses	9	7.7	9	10.1		
		Spellers	7	6.7	2	2.6		
	6 to 8 weeks	Racehorses	55	47.0	42	47.2	1	25.0
		Spellers	41	39.4	28	36.8	1	20.0
	9 to 12 weeks	Racehorses	37	31.6	28	31.5	2	50.0
		Spellers	41	39.4	22	28.9	1	20.0
	4 to 6 months	Racehorses	12	10.3	5	5.6	1	25.0

	Spellers	12	11.5	17	22.4	2	40.0
7 to 12 months	Racehorses	1	0.9	0	0		
	Spellers	1	1.0	1	1.3		

Total number of respondents with racehorses was 216 and with spellers 188

[a] 2 missing values (n=214)

[b] 0 missing values (n=188)

[c] 6 missing values (n=210)

[d]3 missing values (n=185)

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	
Number of horses in training	0-2	REF			0.09
	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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