Veterinary Parasitology 221 (2016) 69–75

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Research paper

Objective evaluation of two deworming regimens in young Thoroughbreds using parasitological and performance parameters

Jennifer L. Bellaw[a,*], Joe Pagan[b], Steve Cadell[c], Eileen Phethean[b], John M. Donecker[d,1], Martin K. Nielsen[a]

[a] M. H. Gluck Equine Research Center, Department of Veterinary Science, University of Kentucky, Lexington, KY, USA
[b] Kentucky Equine Research, Versailles, KY, USA
[c] Hallway Feeds, Lexington, KY, USA
[d] Zoetis, Outcomes Research, Reidsville, NC, USA

ARTICLE INFO

Article history:
Received 14 October 2015
Received in revised form 19 March 2016
Accepted 19 March 2016

Keywords:
Foals
Deworming
Growth rate
Strongyle
Ascarid

ABSTRACT

Parasitic helminths of equids are capable of causing ill-thrift, clinical disease, and death. Although young horses are the most susceptible to parasitic disease and are the most intensively treated cohort, deworming regimens are rarely evaluated within this age group. This study objectively evaluated the impact of deworming regimen on fecal egg counts (FECs), growth rates, and body-condition scores in young Thoroughbreds. Forty-eight Thoroughbred foals from three central Kentucky farms were randomly allocated to two treatment groups: an interval dose program receiving bi-monthly rotations of pyrantel pamoate and ivermectin and a daily deworming group receiving daily rations of pyrantel tartrate feed additive throughout the study, oxibendazole at two months of age, and moxidectin treatments at 9.5 and 16.5 months of age. Pre- and post-treatment eggs per gram of feces (EPGs) of *Parascaris* spp. and strongyle family parasites, gel/paste dewormer efficacies, and monthly weights and body condition scores were collected. Ascarid and strongyle FECs were not significantly different between groups but were significantly influenced by horse age with strongyle counts continually increasing and ascarid counts peaking at 4.5 months of age. Reduced strongyle efficacies of ivermectin and moxidectin were observed on two farms with consistently low pyrantel pamoate efficacies on all three farms. Ivermectin also exhibited reduced ascarid efficacy. Average daily gain did not differ significantly between groups and was only significantly influenced by age, mirroring average daily gain reference data for Kentucky Thoroughbreds born in 2013. Body condition scores also did not differ between groups, remaining in the optimal range (5–6) for the duration of the study. Management practices resulting in growth rates matching the reference data and in optimal body condition scores compensate for the negative impacts of parasitism even in cases of reduced drug efficacy. Performance parameters can provide useful information in cases of suboptimal parasite control.

1. Introduction

Gastrointestinal parasitism is an omnipresent risk to the health of horses the world over. Major clinical disease caused by parasitic helminths of horses is rare. Principal among these is fatal larval cyathostominosis (Love et al., 1999). Horses under one year of age in particular are susceptible to a number of additional parasitic threats. Large numbers (>2000) of *Strongyloides westeri* eggs per gram of feces have been associated with severe foal diarrhea (Netherwood et al., 1996) and fatal strongyloidosis (Brown et al., 1997). *Parascaris* spp. is arguably the most pathogenic parasite of young horses (Austin et al., 1990). Clinical signs associated with migrating stages include coughing and nasal discharge (Austin et al., 1990). The major pathology of *Parascaris* spp. occurs, following anthelmintic treatment, when a large number of intestinal stages causes small intestinal obstruction resulting in painful colic and fatal intestinal rupture (Cribb et al., 2006). The majority of disease caused by Cyathostominae, *S. westeri*, and *Parascaris* spp., however, is associated with non-specific clinical signs including decreases in weight gain, weight loss, and poor body condition scores (Clayton and Duncan, 1978; Love et al., 1999) as well as

* Corresponding author.
E-mail address: jbe244@uky.edu (J.L. Bellaw).
[1] Present address: Convetra Inc., 707 Parkway Blvd., Reidsville, NC, USA.

http://dx.doi.org/10.1016/j.vetpar.2016.03.018
0304-4017/

diarrhea associated with Cyathostominae and *S. westeri* infections (Netherwood et al., 1996; Love et al., 1999; Dunkel and Wilkins, 2004).

Considering the ubiquity of these parasites, incidence of clinical disease is quite rare; prevalence of cyathostomins often approaches 100% of horses (Hoglund et al., 1997; Gawor et al., 2006; Maria et al., 2012), *S. westeri* prevalence ranges from less than 2% to surpassing 50% (Al-Anazi and Alyousif, 2011; Lyons et al., 2006, 2007; Lyons and Tolliver, 2014a,b), and prevalence of *Parascaris* spp. often exceeds 50% of horses under one year of age (Rieder et al., 1995; Laugier et al., 2012; Armstrong et al., 2014; Lyons and Tolliver, 2014b).

Determining the impact of these parasites on horse health is compounded by the non-specific nature of symptoms and the inaccurate reflection of worm burden provided by current diagnostic tools like fecal egg counts (FECs) (Nielsen et al., 2010). It is well established that cyathostomin FECs are not adequate indicators of worm burden size or risk of clinical disease as immature stages, which can spend a portion of their lives in an arrested state, are most often the source of clinical symptoms (Chapman et al., 2003; Nielsen et al., 2010). Similarly, a large proportion of the *Parascaris* spp. community is immature and does not contribute to total egg output (Clayton and Duncan, 1979), and fecundity of individual adult females varies greatly. Thus, FECs are limited to qualitative diagnostics, use in calculating anthelmintic efficacy, and general parasite surveillance.

To address this, many studies have monitored weight gain and body condition to assess parasitism and subsequent risk of clinical disease in equids (Matthee et al., 2002; Ayele and Dinka, 2010; Burden et al., 2010; Valdez-Cruz et al., 2013; Bernahu et al., 2014). Some studies have even used these performance parameters to evaluate and/or compare specific deworming regimens (Craig et al., 1993; Matthee et al., 2002; Reinemeyer et al., 2003, 2014). Significant differences in weight gain and/or body condition scores between equids of differing deworming regimens have been reported (Matthee et al., 2002; Reinemeyer et al., 2003, 2014; Silva et al., 2016), attesting the importance and utility of monitoring these performance parameters. Those studies conducted outside of the United States were constrained to use of working, poorly managed equids, and all referenced studies were largely limited to short term examination of naturally infected equids of more than one year of age; therefore, evaluation of *Parascaris* spp. has also been limited.

Ever escalating levels of anthelmintic resistance in equine parasitic nematodes have resulted in a drastic paradigm shift in deworming practices of adult horses (Kaplan and Nielsen, 2010). Surveillance based approaches, relying heavily on FECs, have been highly recommended and may someday supplant or be integrated into rotational deworming regimens of adult horses (Kaplan and Nielsen, 2010; Robert et al., 2014). These approaches, however progressive, are still woefully inappropriate for young horses where parasite control programs must be age-defined as well as evidence based (Reinemeyer and Nielsen, 2016). With proposed decreases in treatment intensities and the inadequacy of evidence based approaches, there is a need for methods, in addition to the FEC, to better monitor and evaluate the overall success of deworming regimens in maintaining general horse health (Kaplan and Nielsen, 2010).

The primary goal of this study was to objectively evaluate the impact of two discrete deworming regimens on FECs, growth rates, and body condition scores in Thoroughbred horses from birth to yearling sales. This study aims to provide information on the value of incorporating performance parameters in the evaluation of parasite control programs.

2. Materials and methods

2.1. Animal care and use

This study was approved by the University of Kentucky's Institutional Animal Care and Use Committee under protocol number 2012–1044.

Three Central Kentucky thoroughbred farms utilizing an established, monthly horse weighing system with Hallway Feeds in Lexington, Kentucky were enrolled, including a total of 48 foals born February-May, 2013. These horses remained enrolled until sold or the termination of the study in September, 2014. At approximately two months of age, foals within each birth-month cohort were blocked by gender and ranked by body weight within gender. Each pair of consecutively ranked foals comprised a replicate. Each foal within a replicate was randomly allocated to one of two treatment groups: Group 1, interval dose program; Group 2, daily deworming regimen.

All three farms followed feeding regimens devised by Kentucky Equine Research in collaboration with Hallway Feeds. Specific feeds used included Prep 14, Edge 14, and Staminoats (Hallway Feeds, Lexington KY, USA). Daily rations met or exceeded National Research Council 2007 guidelines for nutrient requirements of horses (http://nrc88.nas.edu/nrh/). Foals were housed with their dams in individual stalls every morning from approximately 9am to 1pm. All anthelmintic treatments and fecal samplings were carried out during this time. Foals and mares were then turned out on pasture until next morning. All horses were turned out on improved Kentucky pastures that include bluegrass, fescue, orchardgrass, and clover species. Foals were weaned at approximately five months of age and followed the turnout schedule described above.

All treatment dosages were based on recent body weights and in compliance with label recommendations for all products and were administered by farm staff.

Horses from both treatment groups were co-grazed, separated only by gender as is general practice.

2.2. Treatment programs

The interval dose program comprised bimonthly treatments. At approximately two months of age, each foal received a purge treatment of pyrantel pamoate (Strongid® Paste, Pfizer Animal Health, New York City, NY, USA) orally at 6.6 mg pyrantel base per kg of body weight. Thereafter, treatments rotated between pyrantel pamoate, administered as described above, and ivermectin/praziquantel (Zimectrin® Gold, Merial Limited, Duluth, GA, USA) orally at 0.2 mg ivermectin base and 1 mg praziquantel base per kg of body weight.

Foals within the daily deworming program received a purge treatment of oxibendazole (Anthelcide® EQ, Pfizer Animal Health, New York City, NY, USA) orally at 10 mg oxibendazole base per kg of body weight. Immediately thereafter, foals began receiving pyrantel tartrate (Strongid® C 2X™, Pfizer Animal Health, New York City, NY, USA) feed additive at 2.65 mg pyrantel base per kg of body weight, daily. Pyrantel tartrate rations were added to pelleted feed as directed and offered to each foal while mares were restrained and fed separately. Uneaten pyrantel tartrate/feed was discarded, and the time at which the majority of horses began to eat their entire rations was noted. Additionally, at 9.5 and 16.5 months of age, horses also received moxidectin/praziquantel (Quest® Plus Gel, Fort Dodge Animal Health, Fort Dodge, IA, USA) orally at 0.4 mg moxidectin and 2.5 mg praziquantel per kg of body weight.

All horses in both treatment groups also received a final, blanket ivermectin treatment (Zimectrin® Gold) in late August in preparation for the September, 2014 sales regardless of status within deworming regimen.