Veterinary Parasitology 202 (2014) 95–103

Contents lists available at ScienceDirect

Veterinary Parasitology

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

Review

Selective therapy in equine parasite control—Application and limitations

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ARTICLE INFO

Article history:
Received 11 October 2013
Received in revised form 10 March 2014
Accepted 13 March 2014

Keywords:
Selective therapy
Horses
Helminths
Egg count
Parasite control

ABSTRACT

Since the 1960s equine parasite control has relied heavily on frequent anthelmintic treatments often applied with frequent intervals year-round. However, increasing levels of anthelmintic resistance in cyathostomins and *Parascaris equorum* are now forcing the equine industry to change to a more surveillance-based treatment approach to facilitate a reduction in treatment intensity. The principle of selective therapy has been implemented with success in small ruminant parasite control, and has also found use in horse populations. Typically, egg counts are performed from all individuals in the population, and those exceeding a predetermined cutoff threshold are treated. Several studies document the applicability of this method in populations of adult horses, where the overall cyathostomin egg shedding can be controlled by only treating about half the horses. However, selective therapy has not been evaluated in foals and young horses, and it remains unknown whether the principle is adequate to also provide control over other important parasites such as tapeworms, ascarids, and large strongyles. One recent study associated selective therapy with increased occurrence of *Strongylus vulgaris*. Studies are needed to evaluate potential health risks associated with selective therapy, and to assess to which extent development of anthelmintic resistance can be delayed with this approach. The choice of strongyle egg count cutoff value for anthelmintic treatment is currently based more on tradition than science, and a recent publication illustrated that apparently healthy horses with egg counts below 100 eggs per gram (EPG) can harbor cyathostomin burdens in the range of 100,000 luminal worms. It remains unknown whether leaving such horses untreated constitutes a potential threat to equine health. The concept of selective therapy has merit for equine strongyle control, but several questions remain as it has not been fully scientifically evaluated. There is a great need for new and improved methods for diagnosis and surveillance to supplement or replace the fecal egg counts, and equine health parameters need to be included in studies evaluating any parasite control program.

Contents

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http://dx.doi.org/10.1016/j.vetpar.2014.03.020

1. Introduction

Intestinal helminths are ubiquitous in grazing horses, and their control requires constant attention on horse farms across the world. The four major parasite categories are cyathostomins (small strongyles), *Anoplocephala perfoliata*, *Parascaris equorum*, and *Strongylus vulgaris* (large strongyle), which have all been shown capable of causing clinical disease in naturally infected horses (Drudge, 1979; Clayton, 1986; Proudman et al., 1998; Love et al., 1999). The advent of the first modern affordable and safe anthelmintic formulations in the 1960s led to recommending preventive parasite control programs based on treatments applied with regular intervals year-round (Drudge and Lyons, 1966). A large number of questionnaire surveys have documented that frequent anthelmintic treatments applied prophylactically to all horses on every farm has become the norm for parasite control, and remains so in many regions of the world (Lloyd et al., 2000, Matthee et al., 2002; O'Meara and Mulcahy, 2002; Relf et al., 2012).

Over the past decades, anthelmintic resistance has been documented with increasing frequency in horse farms across the world. Benzimidazole resistance was reported in cyathostomins already in the 1960s (Drudge and Lyons, 1965), and is reported to be widely common today. Pyrantel resistance was next to be documented in cyathostomins the mid 1990s (Chapman et al., 1996) and remains relatively common today (Kaplan et al., 2004a; Traversa et al., 2009). Most recently, cyathostomin egg counts have been reported to return substantially sooner after ivermectin and moxidectin treatment (von Samson-Himmelstjerna et al., 2007; Lyons et al., 2009, 2010, 2011). These so-called reduced egg reappearance periods have been interpreted as signs of emerging cyathostomin resistance to these drugs. In addition, the large roundworm *P. equorum* has been documented widely resistant to ivermectin across the world (Boersema et al., 2002; Hearn and Peregrine, 2003; von Samson-Himmelstjerna et al., 2007; Schougaard and Nielsen, 2007; Lind and Christensson, 2009; Veronesi et al., 2010; Nareaho et al., 2011; Laugier et al., 2012). The pharmaceutical industry has not introduced new pharmacological drug classes for equine usage since ivermectin in the early 1980s, and it remains uncertain when new drugs with new modes of action will become available for equine usage.

For over 25 years, veterinary parasitologists have recommended to reduce the treatment intensity to delay any further development of resistance (Herd et al., 1985). One recommended approach is selective therapy (targeted selected treatments, selective chemotherapy), which was initially developed for the control of trichostrongyle infection in small ruminants (reviewed by Kenyon et al., 2009). The basic principle behind this strategy is to screen all animals with an appropriate parasite-related measure and then select those for anthelmintic treatment that exceed a predetermined threshold value. One excellent example is the FAMACHA anemia guide which is an objective system for evaluating mucosal pallor in sheep and goats (Malan et al., 2001; Burke et al., 2007). The degree of pallor is strongly associated to clinical parasitism caused by *Haemonchus contortus*, and by leaving the healthiest and unaffected animals untreated the treatment intensity can be reduced considerably (Kaplan et al., 2004b). Other indicators that have been used in small ruminants for selecting individuals for anthelmintic treatment includes weight gain, milk yield, and breech fecal soiling scores (Kenyon et al., 2009). In horses, selective therapy recommendations have been based on performing fecal egg counts from all horses in a given herd, treating those exceeding a pre-determined cut-off egg count value, and leaving the remainder of the herd untreated.

Although this concept has been recommended for more than 20 years (Gomez and Georgi, 1991; Duncan and Love, 1991), the large majority of questionnaire surveys performed in various countries did not reflect a large degree of implementation in horse establishments (Lloyd et al., 2000, Matthee et al., 2002; O'Meara and Mulcahy, 2002; Relf et al., 2012). However, restrictions of anthelmintic usage by prescription-only introduced in Denmark in 1999 disallowed prophylactic treatments and appears to have strongly facilitated the use of selective therapy in this country (Nielsen et al., 2006a). The Danish legislation has been followed by a European Union directive in 2006, which has led an increasing number of European countries to implement similar restrictions on anthelmintic usage over recent years. To the authors' knowledge these countries include Sweden, Finland, the Netherlands, Italy, and to some degree also United Kingdom. In the USA, egg count based parasite control programs are widely recommended and endorsed by the American Association of Equine Practitioners (AAEP) (Nielsen et al., 2013a). Taken together, the principle of selective therapy is a world-wide trend and egg counts are used increasingly as part of routine deworming programs.

When a well-established practice in veterinary medicine is undergoing major changes, it inevitably raises many questions and creates an urgent need for continuing education. Practitioners are faced with interpreting the egg count results on a daily basis, and are therefore seeking practical and useful advice. The role of academia is to communicate evidence-based advice and constantly generate new evidence to accommodate the needs generated by the veterinary industry. With the changing trends in