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Short communication

Field testing of a fenbendazole treatment combined with hygienic and management measures against a natural *Giardia* infection in calves

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Abstract

The need of a combination of animal treatment and environmental measures against a natural *Giardia* infection in calves between the age of 1 and 6 months was emphasized and evaluated. Ten commercial farms with a total of 94 calves suffering from chronic diarrhea, ill thriving and impaired growth, were included in two subsequent studies. The first study indicated that treatment of all animals with fenbendazole at 15 mg/kg during 3 consecutive days combined with environmental measures on the final day of treatment, which were either removal of bedding, thorough cleaning and ammonia 10% disinfection or relocation of the treated animals to a *Giardia* free environment, resulted in a total reduction in cyst excretion for at least 2 weeks. In the second study, the immunofluorescence assay (Merifluor® *Cryptosporidium*/*Giardia*; Meridian Diagnostics Inc., Cincinnati, Ohio) was used quantitatively and confirmed that the combination of treatment and environmental measures resulted in a total reduction of cyst excretion during 2 weeks and in a significant ($P < 0.05$; $\geq$98.0%) reduction of the cyst excretion until at least 4 weeks after treatment. Furthermore, there was a noticeable improvement of the clinical symptoms in all animals towards day 28 after treatment and 4 months after treatment health in all calves was normal.

Keywords: *Giardia*; Calves; Fenbendazole; Disinfection; Infection pressure; Environment

1. Introduction

The intestinal protozoan parasite *Giardia duodenalis* is commonly identified in ruminants worldwide and can lead to morphological and functional alterations in the upper part of the small intestine, resulting in an intermittent and mucous diarrhea (Ruest et al., 1997). The economical implications of giardiosis in calves have never been experimentally determined, although there is clinical evidence that infection is associated with ill thrift and might have a negative impact on growth performance (O'Handley et al., 1999; Geurden et al., 2006). Several compounds like fenbendazole and albendazole (O'Handley et al., 1997, 2000; Xiao et al., 1996), and paromomycin (Geurden et al., 2006) can be used for treatment of giardiasis in calves. Fenbendazole (5–20 mg/kg bodyweight during 3 consecutive days) and paromomycin (50 or 75 mg/kg bodyweight during 5 consecutive days) resulted in a 100% reduction of the cyst excretion after treatment, although calves were re-excreting cysts within 2–3 weeks after treatment. Since *Giardia* cysts can survive for 1 week in cattle faeces and up to 7 weeks in soil (Olson et al., 1999), the effective treatment period of most treatment protocols (3–5 days) may be too short to

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prevent re-infection from a contaminated environment shortly after treatment. Furthermore, a high environmental infection pressure can result in an efficacy less than 100% from 1 week after treatment onwards, as in the albendazole trial of Xiao et al. (1996). Although in the fenbendazole trials of Xiao et al. (1996) and O'Handley et al. (1997) calves were housed in a clean and disinfected environment, leading to a 100% efficacy until at least 13 days after treatment, calves were re-excreting cysts after treatment, suggesting failure of disinfection, re-infection through faecal material on limbs or other parts of the calf or survival of *Giardia* trophozoites in the intestine (Xiao et al., 1996; O'Handley et al., 1997, 2000). The short term cyst-suppressing effect of treatment in a contaminated environment (Xiao et al., 1996; O'Handley et al., 2000; Geurden et al., 2006) emphasises the need for an integrated control program combining treatment with cleaning and disinfection of the environment at the end of the treatment period to further minimise risk of re-infection after treatment (Geurden et al., 2006). *Giardia* cysts are known to be resistant to commonly used disinfectants, such as chlorine. Alternative disinfectants, including chlorine dioxide, ozone and ultra violet irradiation have been the focus of research in drinking water treatment processes (Betancourt and Rose, 2004), although there are practical objections against most of these disinfection procedures for use in calf facilities. Alternatively, heat or desiccation (Olson et al., 1999) and disinfection with quaternary ammonium (Xiao et al., 1996; O'Handley et al., 1997) can be used in calf facilities.

In the present studies, the efficacy of a combination of animal treatment with fenbendazole and environmental cleaning and disinfection with ammonia 10% or relocation was evaluated on ten commercial farms with a total of 94 animals.

2. Materials and methods

2.1. Study design

Two studies were performed on 10 commercial farms, with a total of 94 animals. The farms were selected based on a history of chronic diarrhea, ill thriving and impaired growth in calves between the age of 1 and 6 months. The diagnosis of giardiasis was confirmed through identification of *Giardia* cysts in at least 50% of the animals. Coccidiosis was excluded on all these farms as a possible pathogen. The first study (study 1), which included five farms (farms 1–5) was performed during the winter of 2004–2005. In the second study (study 2) another five farms (farms 6–10) were visited during the winter of 2005–2006. On all farms animals were housed together in pens with concrete floor and bedding. Management consisted of adding straw to the bedding on a regular basis (2–3×/week), but the bedding was removed only once, twice or thrice a year. Disinfection was not performed or done with chlorine. Although treatment dosages as low as 5 mg fenbendazole/kg bodyweight are 100% effective in reducing *Giardia* cyst excretion in natural infections (O'Handley et al., 1997), a higher fenbendazole dosage (15 mg/kg during 3 consecutive days; Panacur® Intervet, Boxmeer, the Netherlands) was preferred in the present studies because the environmental infection pressure was considered to be high. One of the two possible environmental measure protocols was implemented on the last day of treatment. The choice of the final day of the treatment period for the application of the environmental measures was inspired by observations that the reduction in cyst excretion is maximised at the end of the treatment period (Geurden et al., 2006). The first protocol consisted of transferring the animals to a clean environment, which had not been used for animal housing for at least 1 year (transfer protocol). The second protocol was removal of all bedding material, through high pressure cleaning with water, followed by complete drying of the housing and disinfection with an ammonia 10% solution (ammonia protocol). A previously described and evaluated immunofluorescence assay (IFA, Merifluor *Cryptosporidium/Giardia*; Meridian Diagnostics Inc., Cincinnati, Ohio) was used for detection of *Giardia* cysts (Geurden et al., 2004). The IFA was used qualitatively in the first study and quantitatively in the second study. Clinical symptoms (diarrhea) and general appearance were evaluated at each sampling date and 4 months after the end of the treatment.

2.1.1. Study 1

On farms 2 and 3 animals were moved to a clean environment on the third day of treatment. No calves had been kept in these clean calf facilities at all (farm 2) or for at least 1 year prior to the treatment (farm 3). On farms 1, 4 and 5 the ammonia protocol was applied on the third day of treatment. Individual faecal samples were collected from all animals prior to treatment (D − 1) and weekly thereafter, until positive animals were identified or until 4 weeks after treatment (D7, D14, D21 and D28).

2.1.2. Study 2

On farm six animals were moved to a clean environment where no calves had been housed for at least 1 year prior to the treatment. On farms 7–9 the ammonia protocol was applied. On farm 10 the treatment was not combined with environmental measures, and the