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Original Research

Efficacy of Ivermectin Pour-on Against Nematodes Infecting Foals on Pasture: Coprological and Biochemical Analysis

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ABSTRACT

The efficacy of topical ivermectin (IVM) on foals naturally infected by parasitic nematodes was evaluated. Two dosages of IVM were applied pour-on (F-Nor0.5; 0.5 mg/kg body weight [BW] and F-Nor1; 1 mg/kg BW) and results compared with the oral administration (F-Eq0.2; 0.2 mg/kg BW of IVM). The efficacy was measured by estimating the reduction in the fecal egg counts (fecal egg count reduction) and in the numbers of horses shedding parasite eggs (positive horse reduction). Several biochemical and enzymatic serum parameters were measured in the groups F-Eq0.2 and F-Nor1. Before the deworming of the horses, eggs of *Parascaris equorum*, *Cyathostomum*, *Gyalocephalus* spp, and *Oxyuris equi* were identified. In all the treated groups, the excretion of ascarid eggs ended 4 days after the treatment. The orally administered IVM suppressed the egg output of strongyles and pinworms 4 days after the treatment, whereas for the F-Nor1 group this occurred 8 days after the treatment. Eggs of strongyles were detected in the F-Nor0.5 group throughout the study. The levels of blood urea nitrogen, creatinine, total proteins, albumin, globulins, and lactate dehydrogenase (LDH) reduced significantly after the administration of IVM, but values not within the normal range were only achieved for LDH. A significant positive correlation between the fecal egg output of cyathostomins and the LDH was investigated. Clinically, no adverse reactions in the horses receiving the topical IVM were observed. It was concluded that the pour-on administration of 1 mg/kg BW IVM provides similar results to the oral administration, and offers a very useful tool to control infestation by the intestinal nematodes affecting wild grazing horses.

1. Introduction

Grazing or silvopasturing (combining forestry and grazing of domesticated animals in a mutually beneficial way) horses have a high probability of ingesting herbage infected with different parasites (trematoda, nematoda, cestoda), which enhances the simultaneous infection with various endoparasites [1,2].

It is well known that most strategies for parasite control rely on the use of anthelmintic drugs [3], but individual administration to wild grazing equids is problematic in practice because of the difficulty in ensuring their correct

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The current investigation complies with the current laws for Animal Health Research in Spain and with the EC Directive 86/609/EEC for animal experiments.

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immobilization to receive the right dosage. By considering that the topical administration decreases the risk of injury for both user and animal [4], it seems particularly convenient for the control of parasites affecting indigenous animals [5]. However, currently available pour-on preparations have been licensed only for use in cattle, sheep, and pigs.

Ivermectin (IVM) is the most used macrocyclic lactone (ML) for the deworming of livestock. In horses receiving an oral (paste or liquid) dose of 0.2 mg/kg body weight (BW) of IVM, a high efficacy (95%-100%) against adult and most fourth-stage larvae of cyathostomes, large strongyles, ascarids, or pinworms has been demonstrated [6]. Some investigations verified the absence of strongyle eggs for about 8 weeks after treatment for horses that were administered IVM [7,8], although a decrease in the strongyle egg reappearance periods has been also pointed out and related to the anthelmintic resistance [9,10].

There are a scarce number of investigations regarding the pour-on administration of anthelmintics in horses. Although an 82% to 97% reduction in the counts of eggs per gram of feces was obtained after the topical administration of 0.5 mg/kg BW of IVM [11], a 100% efficacy was recorded by increasing the dose to 1 mg/kg BW in silvopasturing horses [5]. The main goal in the current investigation was to assess the efficacy of two doses of IVM administered pour-on. The changes in several biochemical and enzymatic serum indicators were also analyzed.

2. Materials and Methods

2.1. Horses

Naturally infected foals (age: 7 months; BW: 100-120 kg) from the autochthonous Pura Raza Galega and Pura Raza Asturcon breeds were used to test a ML pour-on commercially available for cattle, IVM (0.5% w/v, Noromectin, Norbrook Laboratories Ltd, Carlisle, Cumbria, England, UK).

These animals are maintained outdoors where they graze freely on natural pastures characterized by annual grass species, and supplementation is seldom provided by their owners. The main benefit that these horses provide is based on reducing the unwanted vegetation, and very few economic benefits can be achieved by meat production; therefore, insufficient feeding and veterinary attention are often provided.

For the duration of the study, the foals were confined indoors to stables and fed with wheat straw and barley.

2.2. Experimental Design

Between September and October 2009, two experiments were carried out. In the first, the efficacy of two doses of IVM topically administered was evaluated, and the results compared with that obtained after the oral administration of the ML. In all, 48 foals were distributed into four groups with each containing 12: F-Eq0.2 (0.2 mg/kg BW Eqvalan through oral administration; IVM 1.87%, Merial, Spain), F-Nor0.5 (0.5 mg/kg BW of IVM pour-on), F-Nor1 (1 mg/kg BW of IVM pour-on), and F-Control (untreated foals). The weight was calculated by using a girth tape. Deworming of the foals was performed on day 4 of the study.

A second trial was conducted to assess the variations in different biochemical and enzymatic blood parameters after the administration of the IVM, as demonstrated in Table 2. For practical reasons and by taking into account the results from the experiment 1, the F-Control, F-Eq0.2, and F-Nor1 groups were considered in this assay.

2.3. Sampling

Foals in the present investigation were sampled by introducing them into a chute, and then later were returned back to the stables.

Six samples of feces and blood were obtained during 20 days. In all cases, feces were individually collected from the rectum in each foal, and fecal egg counts (FEC) performed using a McMaster-modified technique based on 5 g of feces with a minimum detection level of 10 eggs per gram of feces [5]. Strongyles were identified after the feces samples were cultured at 25°C for 15 days [12].

The routine probe for the detection of infection by pinworms is based on the perianal tape test because the adult female worms crawl partly out of the anus to deposit their eggs on the adjacent surface. The eggs hatch outside of the horse's body, fall to the ground, and wait for their next host. However, when feces are individually collected from the rectum in each foal, the collecting gloves become contaminated easily, suggesting that pinworm eggs are present in the feces and can be detected by the flotation probe.

The laboratory technician conducting the microscopic analysis was blinded to the group origin of each sample.

Blood samples were obtained by jugular puncture and sera analyzed by using commercial kits (IDEXX, Barcelona, Spain) along with a biochemical autoanalyzer (VetTest Chemistry Analyzer, IDEXX).

2.4. Deworming Efficacy

The efficacy of the treatment was determined by calculating the reduction in the FEC values (fecal egg count reduction, FECR) and in the percentage of positive horses (positive horse reduction, PHR) as follows:

$$\text{FECR}\ (\%) = [1 - (\text{FEC}_{\text{treated}}/\text{FEC}_{\text{controls}})] \times 100$$

$$\text{PHR}\ (\%) = [1 - (\text{number of positive horses}_{\text{treated}}/\text{number of positive horses}_{\text{controls}})] \times 100$$

Arithmetic means for each group were determined from individual FECR [13].

2.5. Statistical Analysis

By considering that the eggs distribution is not normal, the values for the egg shedding in the feces were expressed as the median and the range, and analyzed by means of the nonparametric Kruskal–Wallis and Mann–Whitney U two-sided tests ($\alpha = 0.05$), and significant differences were considered when $P < .05$ [14].

Data from biochemical and enzymatic serum activity tests were analyzed by means of an analysis of variance.