# Efficacy of parenteral administration of ivermectin in the control of strongylidosis in donkeys

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## ABSTRACT

Investigations into the efficacy of parenteral ivermectin (Pandex) administration for strongylidosis control in donkeys were carried out. The preparation was applied subcutaneously at a dose of 0.2 mg/kg (1 mℓ/50 kg body weight). One day prior to the treatment and 14 days post-treatment, individual coprological samples were obtained for faecal nematode egg counts and larval culture. The study was performed on 263 donkeys originating from different regions of Bulgaria. Prior to the treatment and 20 days after that, blood samples were obtained from 64 previously infected animals for monitoring of changes in eosinophil leukocyte counts. The subcutaneous application of ivermectin had an efficacy of 96 % in terms of reduction of faecal egg counts. In 92.2 % of infected donkeys, a complete reduction of faecal eggs count occurred (0 eggs per gram of faeces epg), whereas in the remaining 7.8 % of the infected donkeys, the egg counts were reduced by 72 %. The reduction in faecal egg counts did not result in changes in eosinophil counts. The results obtained as well as the lack of local changes after the subcutaneous application of ivermectin in donkeys allow us to recommend its use for control of strongyles in donkeys.


**Key words:** donkeys, faecal eggs counts, ivermectin (Pandex), strongylidosis.

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## INTRODUCTION

Strongylidosis in equids is a cosmopolitan disease of horses, donkeys, mules, hinnies, ponies and zebras[7,11–18,20,22]. The family Strongylidae comprises numerous species that are found in the large intestine and generally one animal may be infected by more than 10–15 species[3,6,12,13,18,22]. Almost all equids, grazing on pastures, are more or less infected with strongyles[7,18,20].

The most pathogenic strongyles belong to the genus *Strongylus* (*S. edentatus, S. vulgaris* and *S. equinus*), whose larvae are found under the peritoneum, in the wall of the *arteria mesenterica cranialis* and in the pancreas[5]. The small strongyles (subfamily Cyathostominae – *Cyathostomum catinatum* and *Cyathostomum pateratum*) are the most important parasitic pathogens because of their considerable widespread distribution[12,13,18]. In a study of naturally infected equids more than 90–95 % of infective larvae were found to be cyathostomes[23].

Published reports show an increased resistance of the cyathostomes to the benzimidazole derivatives (e.g. thiabendazole, mebendazole, cambendazole, fenbendazole and oxfendazole) and pyrantel embonate[4,12,14,21,22,24]. This has resulted from the extensive use of the drugs for the control of *Strongylus vulgaris*[12,14]. Ivermectin has been used for more than 20 years in equids, but up to now, there are no data about the appearance of resistance to this product in equid worms[9,12]. Ivermectin has a high efficacy (>90 % efficacy against adult strongyles and migrating larvae)[5,7,11,13,15,18,21–23,25] and a residual effect not seen with the benzimidazoles and pyrantel embonate[14,16].

Published data regarding the efficacy of ivermectin against strongyles have been obtained following oral or intramuscular administration[5,9,11,13,14–16,18,19,20,23,25]. There are limited data about its faecal egg count (FEC) reduction in donkeys following subcutaneous administration. Neither are there data on the effect of deworming with this compound by subcutaneous administration on blood eosinophil counts.

The purpose of the present study was to determine the efficacy of parenteral administration of ivermectin on the strongyle FEC in donkeys as well as the effect of deworming with ivermectin on blood eosinophil counts.

## MATERIALS AND METHODS

The studies were performed on 263 donkeys originating from various regions in Bulgaria. The animals were from both sexes (152 female and 111 male), aged between 10 months and 26 years, weighing from 70 to 380 kg. Prior to and during the studies, performed between April and October 2004, all animals were reared under grazing conditions and no history of deworming was available.

All animals were treated with ivermectin (Pandex injectable solution – Biovet, Pestera, Bulgaria), containing 10 mg ivermectin per 1 mℓ preparation. The preparation was applied subcutaneously in the region of the neck at a dose of 0.2 mg/kg body weight (1 mℓ/50 kg body weight).

A day prior to the ivermectin treatment and at day 14 post-treatment, individual faecal samples were obtained from the rectum of the animals. From 64 donkeys that were found to be infected pre-treatment and which had FECs of zero on the 14th day following the ivermectin treatment, blood samples were obtained immediately before treatment and by day 20 post-treatment from the jugular vein for the determination of eosinophil counts by means of an automated haematological analyser (Serono+System 150, USA). All animals were inspected daily for 7 days for the presence of local changes at the site of subcutaneous injection following the ivermectin administration.

Faecal nematode egg counts prior to and after ivermectin administration were determined by the MacMaster method[3]. One gram of faeces was weighed off per sample per animal per test.

The percentage of animals found to have positive egg counts was calculated by the equation:

$$\text{Percentage of animals positive on FEC} = \frac{\text{Number of infected animals}}{\text{Total number of animals studied}} \times 100.$$

The efficacy of ivermectin treatment was determined on the basis of the reduc-

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tion in FEC following treatment according to the equation:

$$\% \text{ Efficacy} = \text{Average FEC prior to treatment} - \frac{\text{Average FEC after treatment}}{\text{Average FEC prior to treatment}} \times 100.$$

Prior to ivermectin treatment and 14 days afterwards, bulk faecal samples were prepared by pooling a 2 g sample for each faecal sample found to be positive for strongyle eggs. The samples were cultivated for 14 days at room temperature and were periodically dampened. The larvae thus obtained were isolated by the method of Baerman[2] and killed with a few drops of Lugol's solution. The genera were differentiated by examination of 100 larvae from both pre- and post-treatment cultures.

The significance of differences in eosinophil counts was determined with the Student-Fisher *t*-test. A level of significance of $P < 0.05$ was used.

## RESULTS AND DISCUSSION

The results of the faecal egg counts and the percentage of donkeys infected prior to and after treatment with ivermectin are given in Table 1. Eighty-three per cent of the animals were infected with strongyles prior to treatment. In infected donkeys, the faecal egg counts varied between 200 and 8200 eggs per gram of faeces (epg) with an average of 1440 epg.

Calculation of the reduction in faecal egg counts following treatment gave a value of 96 %, which indicated a high efficacy.

Results on the efficacy of subcutaneously administered ivermectin in donkeys are similar to those for in horses following oral or intramuscular administration of other commercial formulations of ivermectin[9,11–13,16,20,23,25]. The high efficacy of ivermectin is further evidenced by the fact, that in 92.2 % of infected donkeys, a complete reduction in egg counts occurred (0 epg) after the treatment with ivermectin. In the 7.8 % that remained infected after the treatment, the FECs were reduced by 72 %.

Significant changes were observed in the percentage of larvae isolated from the faecal samples prior to and after treatment of the donkeys with ivermectin (Table 2). Before treatment, the larvae from the subfamily Cyathostominae prevailed (74 %). Our data are similar to those reported elsewhere[1,12,13,18,23]: in naturally infected equids, over 90 % of cultured larvae were Cyathostominae. After the treatment, only larvae from the genera *Cyathostomum* and *Poteriostomum* were isolated. Identical changes after treatment of horses with ivermectin were reported by Borgsteede and colleagues[1], in whose studies 100 % of isolated larvae post-treatment were from the subfamily Cyathostominae.

Table 1: **Changes in the faecal egg counts and the percentage of donkeys with strongyles prior to and after subcutaneous treatment with ivermectin at 0.2 mg/kg body weight.**

| | **Prior to treatment** | | **After treatment** (14th day) | |
|---|---|---|---|---|
| | **Percentage infected** | **Average FEC** (epg)[a] | **Percentage infected** | **Average FEC** (epg) |
| Infected | 83.3 | 1440 (200–8200) | 13.8 | Average (200–1200) |
| Non-infected | 16.7 | 0 | 86.2 | 0 |
| Total | | 1162 (0–8200) | | 46 (0–1200) |

[a]Faecal strongyle egg counts in eggs per gram of faeces. Range in brackets.

Table 2: **Changes in the percentage of strongyle larvae prior to and after subcutaneous treatment with ivermectin at 0.2 mg/kg body weight in donkeys.**

| **Subfamily of Strongylidae** | **Genus/species** | **Third-stage larvae** (%)[a] | |
|---|---|---|---|
| | | **Prior to treatment** | **After treatment** (14th day) |
| Strongylinae | *Strongylus vulgaris* | 4 | 0 |
| | *Strongylus edentatus* | 9 | 0 |
| | *Triodontophrus* | 13 | 0 |
| Cyathostominae | *Cyathostomum* | 35 | 69 |
| | *Poteriostomum* | 27 | 31 |
| | *Cyalocephalus* | 12 | 0 |

[a]Percentage third-stage nematode larvae found. Number of larvae examined = 100 per culture.

Local changes at the site of injection with ivermectin were not observed.

Eosinophil leukocyte counts in infected animals ($n = 64$) averaged $1.42 \pm 0.51 \times 10^9/\ell$ one day prior to the ivermectin treatment. By day 20 post-treatment, in the animals with negative FECs on day 14 there were no statistically significant changes – average eosinophil leukocyte counts on day 20 was $1.39 \pm 0.48 \times 10^9/\ell$ ($P > 0.05$).

The high eosinophil counts prior to the treatment correlated with the high level of infection (up to 8200 epg) as well as with the fact that the animals had never been treated for parasites. Other authors have recommended that donkeys be dewormed as a prerequisite for studies aimed at determining the reference range for eosinophil leukocyte counts[8,10]. The present study showed that there were no changes in eosinophil counts by day 20 post-treatment, despite the fact that the FECs were zero. The fact that the counts did not change may be related to an effect of ectoparasites and other endoparasites, not studied by us. The eosinophil counts are further influenced by the breed, age, climate and geographic factors[8,10].

## CONCLUSIONS

Subcutaneous administration of ivermectin at 0.2 mg/kg body weight in donkeys gave a 96 % efficacy in reducing the average FECs. Blood eosinophil counts were not influenced by the antiparasitic treatment.

Since the present study provided evidence for a high efficacy of ivermectin against strongyles in donkeys and since no local changes were seen at the injection site its use in the control of strongylidosis in donkeys recommended.

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