Prevalence and biodiversity of helminth parasites in donkeys (*Equus asinus*) in Iran

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Abstract: There are over two million equine animals in Iran, of which approximately 75% are donkeys. Despite this, very little is known about their parasite status and the impact of this on their work output. Usually, it is the alimentary canal, body cavity and liver that harbor parasites in equine species. In this study, 45 donkeys *(Equus asinus)* were examined at necropsy. The contents of the stomach, small intestines and large intestine were washed separately and examined for helminth parasites. Their livers were sliced into 1×3cm pieces, squeezed in warm water and examined for helminths. The skin, eyes and all other internal organs underwent a search for parasites. Twenty-two species of nematodes were identified, which included one species of cestode, two species of trematodes and one species of gastrophiliid. The species included ascaridae(×1), atracidae(×1), oxyuridae(×1), trichostrongylidae(×1), spiruridae(×1), anoplocephalidae(×1), fasciolidae(×1) dicrocoeliidae(×1), gastrophiliidae(×1), strongylinae(×3), habronematidae(×3), and cyathostominae(×12). The most abundant group with regards to the number of species and their intensity of infection was Cyathostominae (small strongyles), in which *Cylicocylus nassatus* and *Cyathostomum tetracantum* were the most prevalent and abundant species. *Strongylus vulgaris* was the commonest species among the large strongyles.Of the three species of *Habronema, H. muscae* was the most prevalent species, followed by *H. majus* and *D. megastoma*. *Probstmayria vivipavra* was collected from 20% of donkeys, and more than 450,000 worms were collected from a single animal. *Gastrophilus intestinalis* was collected from 66.6% of the donkeys that were examined in this study. The prevalence and intensity of the other helminths were low. The presence of mixed infections was the rule in this study, as this was found in all 45 donkeys. The consequent effect of such infections on the health of donkeys needs further investigation.

Keywords: Helminth, parasites, donkey, Iran

Introduction

Despite the increase in mechanization throughout the world, donkeys still deserve the title of "beasts of burden". They have a prominent position in the agriculture system of many developing countries including Iran. The low level of development of the roads in some regions and rough terrain in other parts make the donkey the most

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valuable, appropriate and affordable pack animals, especially under the smallholder farming system. Millions of people in the world depend on the donkey daily for transportation and agriculture. More than 90% of the estimated 44 million donkeys in the world live in developing countries (Matthee *et al*., 2000). Although the donkey has often been described as a sturdy animal, they succumb to a variety of diseases. According to Lichtenfels, (1975) equids are the host to more than 75 species of helminths. A heavy internal parasite burden can affect the health of a donkey adversely, particularly when they are worked hard and, as is often the case, is concurrently undernourished and stressed (Herd, 1990; Love *et al*., 1992; Mair, 1994; Krecek and Gouthrie, 1999).

Although there are some reports with regards to the species of Cyathostominae (Eslami and Kiai, 2007) and tapeworms (Eslami and Nadealian, 1987) in donkeys from Iran, no comprehensive study has been carried out on the prevalence and abundance of helminth infections in donkeys and their pathogenicity.

The objectives of this study were to determine the spectrum of species of helminths that infect donkeys and to assess the importance of each group of helminth species for the health of donkeys in Iran.

Materials and Methods

This study was conducted during the January to March of 2006. Forty-five slaughtered donkeys were collected from different regions of Iran that would have been used otherwise to feed the wild carnivores at Tehran Zoo. These organs would be examined for helminth infections. The sex and estimated age of each animal were recorded. At necropsy, the internal organs were analyzed for parasites. The gastrointestinal tract and abdominal organs were removed and examined macroscopically for the presence of adult parasites and their larvae. The gastrointestinal tract was then divided into three compartments: the stomach, small intestine and large intestine. Each of these three parts and their content were examined and processed separately, including the whole contents of each stomach. Aliquots of one-tenth by mass of the total contents of the small and large intestines were collected for microscopic examination.

The wall of the large intestines was washed separately and these washings were collected for subsequent examination. All of the helminth parasites that were collected were fixed in 10% formalin and preserved in 70% alcohol and 5% glycerin. The identification of the helminths was carried out according to the recommendations of the World Association for the Advancement of Veterinary Parasitology Workshop on the systematic assessment of cyasthostomes (Litchtenfels *et al.*, 1987), and the keys developed by Litchtenfels (1975), Tolliver (2000), Anderson (1992) and Schmidt (1986).

Independent sample t-tests were used for the quantitative dependent variables against the single factors of age and sex. Pearson's correlation coefficient was used to provide evidence of a linear relationship between the number of adult strongyles and the number of eggs per gram (EPG) of feces per donkey.

Results

Twenty-five species of helminth and one gastrophiliid larvae were identified in the donkeys that were examined. These comprised of one ascarid, one atracid, one oxyurid, three habronematids, one setariid, one trichostrongylid, one anoplocephalid, one fasciolid, one dicrocoeliid, and 14 strongylids, of which 11 were small and three were large strongyles. The results are recorded in Tables 1 and 2.

One hundred percent of the donkeys harbored one or more species of parasite. *Cyliococyclus nassatus* was the most prevalent and abundant worm species, followed by *Cyathostomum tetracantus* and *Coronocyclus labratus. Strongylus vulgaris* was the most prevalent and abundant species among the large strongyles. No significant difference was noticed between the mean number of the large small strongyles (32.5 vs. 104.5 per animal, respectively; $p > 0.05$). Of the three species of *Habronema* that were

detected, *H. muscae* was the most prevalent species and *H. majus* was the most abundant. In a single donkey, more than 450,000 *Probstmayria vivipara* was found. *Gastrophilus intestinalis* was among the most abundant and prevalent species of all of the parasites found in donkeys in this study. No significant difference was observed between the sex, age and mean number of different groups of helminths in this cohort of animals, including *Habronema* sp. ($p = 0.0635$), *Parascaris equorum* ($p = 0.44$), large ($p = 0.81$) and small strongyles ($p = 0.665$). The correlation (R) between the number of strongyles and EPG was significant ($R = 0.638$; $p = 0.019$).

Table 1: The prevalence of some species of helminth in a cohort of 45 donkeys in Iran.

Location	Prevalence (%)	Intensity	
		Mean	Range
Alimentary tract ***Nematode*** *Hobronama muscae*	80	39.5	4-130
H. microstoma	66.6	51.5	5-288
Draschia megastoma	13.3	12	1-17
Trichostrongylus axei	6.6	10	2-12
Oxyuris equi	6.6	7	3-9
Parascaris equorum	20	2.6	1-8
Prostmayaria vivipara	20	186.000	10.000-450.000
Cestode *Anoplocephala perfoliata*	12.3	3.6	1-7
Ostrid fly larva *Gastrophilus intestinalis*	66.6	20.5	2-68
Abdominal cavity *Setaria equina*	6.6	3	1-3
Liver *Fasciola hepatica*	6.6	18	7-17
Dicrocoelium denderiticum	6.6	61.6	17-87

Table 2: Prevalence of the strongylidae nematode family in 45 donkeys in Iran

Genus and Species	Prevalence (%)	Intensity		Overall relative abundance (%)
		Mean	Range	
Strongylus sp.	46.7	28.7	3-120	3.81
S. vulgaris	33.3	35.5	3-120	3.35
S. equinus	6.6	12.0	-	0.23
S. edentatus	6.6	12.0	-	0.23
Cylicocyclus sp.	100	220.9	2-1003	62.77
C. auricularis	20.0	42.0	13-80	2.39
C. nassatus	100	208.3	2-1003	59.19
C. radiatus	20.0	21.0	3-24	1.19
Coronocyclus sp.	73.3	74.6	1-186	15.54
C. coronatus	13.3	37.0	7-67	1.40
C. labratus	73.3	64.1	1-186	12.14
C. labiatus	13.3	53.0	28-78	2.00
Cyathostomum sp.	53.3	112.5	1-334	17.04
C. tetracantum	53.3	111	5-334	16.81
C. alveolatum	13.3	6	1-11	0.32
Cylicostephanus sp.	13.3	8.5	6-11	0.32
C. goldi	6.6	11	-	0.21
C. longibursatus	6.6	6	-	0.11
Triodontoforus serratus	6.6	28	-	0.53

Discussion

The present investigation, in which 25 species of helminths and one species of gastrophiliid were recorded, is the most comprehensive and thorough study carried out in Iran on the nature of parasitic infections in donkeys. A previous study reported the presence of *Fasciola hepatica* (16.6%), *D. dendriticum* (30%), *A. magna* (3.3%), hydatid cysts (6.6%)(4) and *Ornithobilharzia turkestanicum* infections in donkeys in Iran (Massoud, 1973). Meanwhile, the identification of small strongyles in Iranian donkeys revealed the presence of 15 separate species, of which four species (*Cyathostomum pateratum, Cylicocyclus insigne, C. elongates* and *Cylicodontophorus bicoronatus*) were absent in the

present study. This could be due to the different geographical regions of origin of these donkeys, and the numbers of animals that were examined in the different studies. In both studies, *C. nassatus* was the most prevalent species of parasitic infection.

There is a marked variation in the species of small strongyles of equines in different parts of world, including Africa (Matthee *et al*., 2000). The recovery of ten and 15 species of small strongyles in the present and previous study, respectively (Eslami and Kiai, 2007), correlates with the findings of several authors from different parts of the world (Eysker and Pandey, 1993; Matthee *et al*., 2000), but is in contrast with others (Vercruysse *et al*., 1986). The average total adult strongylid burden determined in our study was 365 parasites per donkey compared to 2,901 and 16,113 in Burkina Faso (Vercruysse *et al*., 1986) and Zimbabwe (Pandey and Eysker, 1990), respectively. The high numbers of *P. vivipara* recorded in Iranian donkeys concurs with the findings from donkeys in Zimbabwe (Pandey and Eysker, 1990) and North American (Tolliver *et al*., 1985).

For most of the parasitic species reported in Iranian donkeys, the worm burden was low. Therefore, it would appear the donkeys in this study were not severely infected with different parasites. This may be due to several factors, such as physical distribution, the general health and nutrition of these animals and the condition under which the animals are kept. In fact, donkeys of Iran receive very little or any veterinary intervention including deworming. On the other hand, Iran is a semi-dry country and whole country suffers from a scarcity of suitable pasture to produce enough food for large numbers of livestock. Additionally, this study was carried out in winter when adult cyathostomes and other worms are considered to reach their lowest level, which was a process recorded by Reinemeyer and Herd (1986).

The high prevalence of *C. tetracantum* in this cohort of donkeys is similar to that of the population of horses in France (Collobert-Lauegier *et al.*, 2002), but is in contrast to a study by Lichtenfels in North American horses (1975) and in the Panamanian horse (Foster and Ortiz, 1937). More recent studies from ponies and horses in the USA have also contrasted with the results of this present study (Klei and Torbent, 1980; Wescott *et al*., 1982).

The prevalence of *Fasciola hepatica* (6.6% and 16.6%) and *D. dendriticum* (6.6% and 30%) in this and a previous study, respectively, indicated that donkeys are a potential reservoir of fascioliasisand dicrocoeliasis, which are two of the most important and prevalent species of trematodes in ruminants. Fascioliasis is also prevalent in humans (Moghadam *et al*., 2004) in Iran. Therefore, all equines including donkeys should be considered for the preventive and control measures of fascioliasis that exist for ruminants and zoonoses.

In our study, the majority of donkeys had a mixed infection. Three animals each harbored nine, ten and 13 species, nine animals had four separate infections, 15 animals had five infections and 12 harbored six different parasitic species. Therefore, the specific identification of these parasites contributes to an understanding of their impact on the overall health status of donkey, as well as to an assessment of the extent of their specific adverse effects. In general in Iran, as in many other parts of the world, the attention given by donkey owners to their animals is below the level that it should be. This might be partly due to the incorrect perception that donkeys do not require a lot of care, but it can be concluded that the elimination of their parasites would improve the adaptation of the animals to the harsh dry season and also the cold winter in most regions of Iran.

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