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Intestinal helminths induce haematological changes in dogs from Jabalpur, India

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Abstract

The effect of canine intestinal helminths on the haematological profile of 200 dogs, of both sexes and variable age, visiting university veterinary clinics for routine examination was investigated. The dogs were assigned to parasitized ($n = 39$) and non-parasitized ($n = 161$) groups of animals. Coprological examination revealed a 19.5% prevalence of different species of the helminths. Of these animals, 10.25% had mixed infections with *Ancylostoma caninum*, *Toxascaris* spp. and *Dipylidium caninum*. The intensity of *A. caninum* infection was the highest, with mean egg counts of 951.43 (standard error 88.66), followed by *Toxascaris* 283.33 (standard error 116.81) and *D. caninum*. The parasitized animals had significantly lower levels of haemoglobin, packed cell volume and total erythrocyte counts than non-parasitized animals ($P < 0.01$). Values of other parameters, except for lymphocytes and eosinophils, were not different between the two groups. Analyses of the haematological profile revealed normocytic hypochromic anaemia in the parasitized group of animals.

Introduction

Intestinal parasites exert deleterious effects and pose serious health problems in dogs, resulting in retarded growth, generalized ill health, lowered resistance to infectious disease and reduced work efficiency. The major clinical signs of infection are often non-specific, highly confusing and occasionally the hosts suffer from a subclinical asymptomatic course of disease (Bowman, 1999; Taylor *et al.*, 2007).

Symptomatology based diagnosis alone is inadequate or impossible. It is further complicated by trickle and multiple infections acquired by the host from the surroundings (Carrol & Grove, 1986). Sporadic documentation on the impact of intestinal helminth infection on the haemogram of infected dogs has appeared in the literature from India (Mittra & Sasmal, 1984) and from other parts of the world (Saror *et al.*, 1979). In the present study an effort has been made to generate haematological data on canine intestinal helminth infections acquired from the surrounding environment.

Materials and methods

Collection and examination of faecal and blood samples

Faecal samples were collected from 200 dogs (116 males and 84 females) attending the University Veterinary Clinic, Jabalpur for routine examination between December 2008 and November 2009. Dogs aged less than 12 months were classified as young ($n = 59$) and those above 1 year were taken to be adults ($n = 141$). Faecal samples were first examined grossly for the presence of gravid segments of tapeworms, followed by their qualitative examination by

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the centrifugal flotation technique (Sloss *et al.*, 1994). The eggs were identified by morphology and morphometry (Soulsby, 1986). In addition, the samples were subjected to quantitative examination by the modified McMaster technique (Sloss *et al.*, 1994). Based on the presence or absence of parasitic infections, the dogs were divided into parasitized ($n = 39$) and non-parasitized ($n = 161$) groups.

For haematological studies, a blood sample (2 ml) was collected from the cephalic vein of each dog into a sterile vial containing ethylenediaminetetraacetic acid (EDTA) as anticoagulant. Haemoglobin (Hb) percentage, packed cell volume (PCV) and total erythrocyte counts (TEC) were estimated by the method described by Feldman *et al.* (2000). Total leucocyte counts (TLC) and differential leucocyte counts in Geimsa-stained smears were monitored by the methods of Natt & Herrick (1952) and Ash & Orihel (1991), respectively. Erythrocyte indices, i.e. mean corpuscular volume (MCV), mean corpuscular Hb (MCH) and MCH concentration (MCHC), were calculated from haematological values (Feldman *et al.*, 2000).

Data analysis

Haematological data were statistically analysed using the Wilcoxon–Mann–Whitney test (Snedecor & Cochran, 1994).

Results

Of the 200 dogs coprologically examined, 39 (19.5%) harboured one or more intestinal helminth parasites. *Ancylostoma caninum*, *Dipylidium caninum* and *Toxascaris* spp. were found, respectively, in 33, 7 and 3 samples, with a prevalence rate of 16.5, 3.5 and 1.5%. Of the seven samples positive for *D. caninum*, six animals discharged mature proglotids and one animal discharged egg capsules in faeces. Polyparasitism was evidenced in four animals (10.25%). Three animals were positive for *A. caninum* and *D. caninum* and one animal was positive for *A. caninum* and *Toxascaris* infection. The intensity of *A. caninum* infection was highest, with mean egg counts of 951.43 (standard error 88.66), followed by *Toxascaris* spp. (283.33, standard error 116.81) and *D. caninum* (200).

Haematological data generated from parasitized and non-parasitized dog populations are summarized in table 1. The levels of erythrocytic parameters (Hb, PCV and TEC) were significantly lower ($P < 0.01$) in the parasitized than in the non-parasitized group of animals, whereas group differences for TLC, neutrophils, monocytes and basophils were non-significant. A significant increase ($P < 0.01$) in eosinophils and decrease in lymphocytes were also observed in parasitized compared to non-parasitized animals.

In parasitized dogs, the calculated value for MCV was lower than in non-parasitized animals: however, the difference between the groups was non-significant. The MCHC in parasitized dogs was, however, significantly lower ($P < 0.05$) than in non-parasitized animals, suggestive of normocytic hypochromic anaemia in the former group of animals.

Table 1. Mean values of haematological parameters in parasitized and non-parasitized dogs (mean ± SE).

Parameter	Parasitized ($n = 39$)	Non-parasitized ($n = 161$)	Value of z
Hb (g/dl)	11.31 ± 0.23	12.18 ± 0.18	−4.351**
PCV (%)	35.41 ± 0.96	40.23 ± 0.50	−4.351**
TEC ($\times 10^6/\mu l$)	5.30 ± 0.16	6.19 ± 0.12	−3.983**
TLC ($\times 10^3/\mu l$)	13.84 ± 0.82	12.78 ± 0.29	−0.244
DLC			
N (%)	62.54 ± 1.01	62.27 ± 0.80	−0.264
L (%)	28.33 ± 0.73	33.36 ± 1.31	−2.923**
E (%)	6.10 ± 0.74	2.20 ± 0.13	−6.062**
M (%)	3.15 ± 0.57	2.22 ± 0.17	−1.872
B (%)	0.03 ± 0.03	0.04 ± 0.02	−0.188
MCV (fl)	67.81 ± 2.84	68.72 ± 1.67	−0.547
MCH (pg)	22.10 ± 0.83	20.83 ± 0.56	−1.764
MCHC (g/dl)	32.28 ± 0.49	33.49 ± 0.36	−2.318*

n, Number examined; Hb, haemoglobin; PCV, packed cell volume; TEC, total erythrocyte count; TLC, total leucocyte count; DLC, differential leucocyte count; N, neutrophil; L, lymphocyte; E, eosinophil; M, monocyte; B, basophil; MCV, mean corpuscular volume; MCH, mean corpuscular haemoglobin; and MCHC, mean corpuscular haemoglobin concentration.

Significance: * $P < 0.05$; ** $P < 0.01$.

Discussion

Parasitism is manifested by a wide variety of clinical signs and pathophysiological changes in livestock, including dogs. The combined impact of multiple parasitism makes the situation more complicated and confusing for the clinician on account of non-specific signs. Interestingly, the findings reported in the present paper have revealed a lower prevalence of intestinal helminth infections (19.5%) than in other parts of India (Jani *et al.*, 1995; Sharma *et al.*, 2006). This could be attributed to a better awareness amongst owners about healthcare and zoonotic significance and easy accessibility to veterinarians. Amongst the parasitized group of animals suffering from multiple helminth infections, the prevalence of cestode (*D. caninum*) and ascarid infection was negligible. The predominance of hookworm (*A. caninum*) in the population was in conformity with earlier reports (Yacob *et al.*, 2007; Palmer *et al.*, 2008; Little *et al.*, 2009). *Ancyclostoma caninum* reported in this study is a proven zoonotic nematode that can cause creeping eruptions in humans (McCarthy & Moore, 2000). The specific use of anti-hookworm drugs in pregnant bitches and prophylactic therapy in pups may further reduce the prevalence rate of the parasite in Jabalpur, India.

Members of the Ancylostomatidae family dwelling the small intestine of the host have been recognized as a major cause of anaemia. *Ancyclostoma caninum* is a haematophagous nematode, causing traumatic lesions by biting the mucosa: feeding sites continue bleeding for a considerable period of time before the nematode moves to another site and inflicts yet another lesion. These factors could contribute to the significant fall ($P < 0.01$) in erythrocytic indices in the parasitized group of animals, as documented elsewhere (Mekenna *et al.*, 1975; Mittra & Sasmal, 1984; Naggar, 1994).

A significant increase in eosinophils is a recognized sign of parasitic infection (Saror *et al.*, 1979). Eosinophils are potent effector cells associated with the killing of helminths, as evidenced from their close association with damaged or dead parasites in histological sections and

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positive correlation with acquired resistance by the parasitized host (Meeusen & Balic, 2000; Kirkova *et al.*, 2005). In massive infections, cell counts may increase 10–30 times. Eosinophils exert their phagocytic function through enzymes in their secretions that injure and kill the parasite *in situ* (Tizard, 1996).

Profuse infiltration of lymphocytes in the traumatized and oedematous intestinal submucosa at the feeding sites of parasites, as reported elsewhere (Kirkova *et al.*, 2005), might have contributed to their significant fall in the circulation of the parasitized group of animals. The mobilized lymphocytes in the intestinal submucosa inhibit the activities of deeply penetrating helminths through the immunological response (Tizard, 1996).

In conclusion, intestinal helminths, especially *A. caninum*, were found to exert deleterious effects on haematological parameters and cause normocytic hypochromic anaemia in a parasitized group of animals. Further studies on the pathophysiology of anaemia in the parasitized dog population seem essential to understand this precisely and to assess the deleterious impact on the health of the host.

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