

# Hematological evaluation and parasitological feces examination in shelter dogs

## *Avaliação hematológica e exame parasitológico de fezes em cães de abrigo*

Mayara Beto Massuda<sup>1</sup> ; Lucas Giordano Ono<sup>1</sup> ; Danielle Passarelli<sup>1</sup> ; Deise Carla Almeida Leite Dellova<sup>1</sup> 

<sup>1</sup>Universidade de São Paulo, Faculdade de Zootecnia e Engenharia de Alimentos, Departamento de Medicina Veterinária, Pirassununga – SP, Brazil

### ABSTRACT

This study aimed to assess the health status of shelter dogs in two cities in the interior of São Paulo State, Brazil, as part of a university extension initiative focused on collective and preventive veterinary care. The project was conducted in two editions. The first was held in 2013 in a shelter in the city of Pirassununga, and the second in 2016 in a shelter in the city of Santa Cruz da Conceição. In total, 24 parasitological examinations of feces from collective kennels and 127 blood counts were conducted. In both editions, a large number of dogs exhibited thrombocytopenia and hyperproteinemia. We also identified cases of anemia and changes in the leukocyte counts, which were consistent with infectious diseases. Most fecal samples tested positive for intestinal parasites. These findings can be partially attributed to the substantial number of dogs in both shelters, which poses challenges for sanitary control.

**Keywords:** Hematological changes. Ectoparasites. Endoparasites. Dog overpopulation.

### RESUMO

Este estudo teve como objetivo avaliar o estado de saúde de cães de abrigo em duas cidades do interior do estado de São Paulo, Brasil, como parte de uma iniciativa de extensão universitária focada em cuidados veterinários coletivos e preventivos. O projeto foi realizado em duas edições. A primeira foi realizada em 2013 em um abrigo na cidade de Pirassununga e a segunda, em 2016 em um abrigo na cidade de Santa Cruz da Conceição. No total, foram realizados 24 exames parasitológicos de fezes coletadas de canis coletivos e 127 hemogramas. Em ambas as edições um grande número de cães apresentou trombocitopenia e hiperproteinemia. Identificamos também casos de anemia e alterações na contagem de leucócitos, compatíveis com doenças infecciosas. A maioria das amostras de fezes foi positiva para parasitas intestinais. Estes achados podem ser parcialmente atribuídos ao número substancial de cães em ambos os abrigos, o que representa desafios para o controle sanitário.

**Palavras-chave:** Alterações hematológicas. Ectoparasitas. Endoparasitas. Superpopulação canina.

**Correspondence to:**

Deise Carla Almeida Leite Dellova  
 Universidade de São Paulo, Faculdade de Zootecnia e  
 Engenharia de Alimentos, Departamento de Medicina  
 Veterinária  
 Av. Duque de Caxias Norte, 225, Jardim Elite  
 CEP: 13635-900, Pirassununga – SP, Brazil  
 e-mail: leite-dellova@usp.br

Received: October 31, 2023

Approved: August 20, 2024

**How to cite:** Massuda MB, Ono LG, Passarelli D, Dellova DCAL. Hematological evaluation and parasitological feces examination in shelter dogs. *Braz J Vet Res Anim Sci.* 2024;61(special issue):e218078. <https://doi.org/10.11606/issn.1678-4456.bjvras.2024.218078>.

The population of animals in city shelters has increased in recent years in Brazil, with over 165,000 dogs living in these conditions, according to the most recent data from the Pet Brazil Institute (Instituto Pet Brasil, 2019). Dog overpopulation presents various challenges, particularly in disease control. Hence, the role of veterinary professionals becomes indispensable. This study performed laboratory tests on shelter dogs as part of a university extension project conducted in two editions and independent shelters. The first edition was held between August and December 2013 in a dog shelter in Pirassununga, São Paulo State, Brazil. The number of dogs in the shelter totaled 116, of which 61 (30 females and 31 males, with estimated ages from 1.5 to 14 years) underwent a general physical examination and blood collection. Fecal samples were collected from 13 kennels, which held around 8 to 10 dogs. The second edition was conducted between March and July 2016 in a dog shelter in Santa Cruz da Conceição, São Paulo State, Brazil. This shelter had approximately 200 dogs, and general physical examinations and blood collection were performed on 66 of them (42 females and 24 males, with estimated ages between 0.5 and 13 years). Fecal samples were collected from 11 kennels, which held around 3 to 5 dogs. In both editions of the project, the blood samples were collected from docile dogs, which allowed manipulation by the veterinary team. It was established that the feces would be collected from kennels with a cemented floor, thus avoiding contamination by dirt. Following this criterion, samples were collected from all kennels in the project's first edition and 30% of the kennels in the second edition. The fecal samples could not be individualized because the kennels housed several dogs.

The sampling and laboratory analyses were performed similarly in both project editions. Briefly, blood was collected from the cephalic vein (0.5 to 2 mL) after an 8-12 h fasting

period and placed in a tube containing K2-EDTA for hematological examination. Feces were collected in the morning and transferred to sterile plastic containers without adding preservatives. Blood and fecal samples were kept refrigerated until analysis was conducted within 24 h. Blood counts were performed using a BC-2800Vet automatic blood analyzer (Mindray Bio-Medical Electronics Co., Shenzhen, China). However, differential leukocyte counting and searching for blood parasites were carried out manually from Giemsa-stained blood smears (Vieira et al., 2011). The concentration of total plasma proteins was determined by refractometry. The Willis-Mollay flotation technique detected helminth eggs and protozoan oocysts (Monteiro, 2011). The analyses were conducted at the Animal Veterinary Clinical Laboratory of the Faculty of Animal Science and Food Engineering of the University of São Paulo. Hematological parameters were compared with reference ranges described by Thrall (2007). Blood count changes and identifying helminth eggs and protozoan oocysts were presented in absolute numbers and percentages for each project edition (Tables 1 and 2, respectively).

All dogs included in the project were alert, responsive, and hydrated. However, in both editions, some animals presented pale mucous membranes, enlarged peripheral lymph nodes, a low body condition score, and dermatitis. Fleas and ticks were evident on some dogs. Another common point observed was that very moist feces were present in mucus.

In the first edition (Pirassununga shelter), most dogs presented thrombocytopenia and hyperproteinemia (possibly due to hyperglobulinemia). In addition, around one-third of the dogs had anemia, mainly of the normocytic normochromic type. Several changes were observed in the leukogram, emphasizing leukocytosis due to neutrophilia, lymphocytosis, and eosinophilia. *Ehrlichia canis* morulae were observed in the leukocyte cytoplasm of two female dogs, which also had thrombocytopenia and hyperproteinemia. Intraerythrocytic piroplasm of *Babesia* spp. was identified in another female dog with normocytic and normochromic anemia and neutrophilic leukocytosis. Most fecal samples were positive for helminth eggs, mainly *Ancylostoma* spp. and *Trichuris* spp., but protozoan cysts were also identified. Similar results were found in the project's second edition (Santa Cruz da Conceição shelter), based on the analyses of blood and fecal samples. However, in this second edition, the percentage of dogs with anemia and hyperproteinemia was lower, and *Babesia* spp. was identified in the red cells of a dog (Table 1), which also had normocytic and normochromic anemia and hyperproteinemia.

In both editions, clinical manifestations of the dogs and laboratory findings are commonly related to infectious

Table 1 – Absolute and relative frequency of changes in blood count of the dogs in each edition of the project

<b>Edition</b>	<b>1st August-December 2013</b>	<b>2nd March-July 2016</b>
Origin of dogs	Pirassununga	Santa Cruz das Palmeiras
Number of dogs	61	66
Blood count changes:		
Anemia	22 (36.1%)	15 (22.7%)
Thrombocytopenia	33 (54.0%)	23 (34.8%)
Thrombocytosis	3 (4.9%)	2 (3.0%)
Hypoproteinemia	4 (6.6%)	4 (6.1%)
Hyperproteinemia	35 (57.4%)	28 (42.4%)
Leukocytosis	10 (16.4%)	6 (9.1%)
Leukopenia	5 (8.2%)	2 (3.0%)
Neutrophilia	7 (11.5%)	6 (9.1%)
Neutropenia	1 (1.6%)	2 (3.0%)
Lymphocytosis	15 (24.6%)	15 (22.7%)
Lymphopenia	6 (9.8%)	11 (16.7%)
Eosinophilia	16 (26.2%)	18 (27.3%)
Eosinopenia	2 (3.3%)	1 (1.5%)
Monocytosis	3 (4.9%)	5 (7.6%)
Monocytopenia	8 (13.1%)	1 (1.5%)
Identification of hemoparasites in blood smear	<i>Ehrlichia canis</i> 2 (3.3%) <i>Babesia</i> spp.1 (1.6%)	<i>Babesia</i> spp. 1 (1.5%)

Table 2 – Absolute and relative frequency of helminth eggs and protozoan cysts in fecal samples from kennels in the dog shelters in each edition of the project

<b>Edition</b>	<b>1st August-December 2013</b>	<b>2nd March-July 2016</b>
Origin of dogs	Pirassununga	Santa Cruz das Palmeiras
Number of samples	13	11
Number of dogs per kennel	8 to 10	3 to 5
Negative	3 (23.1%)	2 (18.2%)
Positive	10 (76.9%)	9 (81.8%)
<i>Ancylostoma</i> spp.	9 (69.2%)	9 (81.8%)
<i>Trichuris</i> spp.	6 (46.2%)	2 (18.2%)
<i>Toxocara</i> spp.	1 (7.7%)	1 (9.1%)
<i>Cystoisospora</i> spp.	1 (7.7%)	1 (9.1%)
<i>Giardia</i> spp.	1 (7.7%)	0

Parasites were found alone or in mixed infections in fecal samples.

diseases, such as ehrlichiosis, babesiosis, and parasitic diseases (Fonseca et al., 2017). Furthermore, low intake of nutrients, such as proteins, fatty acids, vitamins, and minerals, can contribute to poor body condition (Rodrigues Junior, 2023). The number of parasites identified in the blood was small, but a negative result in the blood smear does not rule out the possibility of infection since this technique has limited sensitivity (Vieira et al., 2011; Ranatunga et al., 2022). In both project editions, we did not perform serological or molecular tests to diagnose infectious diseases. Intestinal parasitism is common in shelter dogs. According to Souza et al. (2023), fecal samples of 69.4% of dogs from shelters in the city of Cuiabá, Mato Grosso State, Brazil, tested positive for *Ancylostoma* spp., *Trichuris vulpis*, *Toxocara* spp., *Dipylidium caninum*, *Cystoisospora* spp., *Giardia duodenalis* and coccidia. It is worth emphasizing the zoonotic potential of parasites,

such as *Ancylostoma* spp., *Toxocara* spp., and *Giardia* spp. (Robertson et al., 2000).

Given the project's results, recommendations were made for cleaning the environments and treating dogs against intestinal parasites and ectoparasites in both shelters.

Although the project was carried out in different periods and dog shelters, the changes in animal laboratory testing were similar. This can be explained by the fact that both shelters had many dogs, making it challenging to control parasites and maintain healthy conditions. In both shelters, the number of new dogs received exceeded the number of adoptions, which increased overcrowding and boosted disease transmission. In this sense, veterinary assistance is crucial for disease diagnosis and control and dog shelter health management guidance.

### Conflict of Interest

The authors declared no conflict of interest.

## Ethics Statement

The experimental protocols were approved by the Ethics Committee on the Use of Animals of the Faculty of Animal Science and Food Engineering (protocol CEUA: 13.1.2368.74.3).

## References

Fonseca JP, Bruhn FRP, Ribeiro MJM, Hirsch C, Rocha CMBM, Guedes E, Guimarães AM. Hematological parameters and seroprevalence of Ehrlichia canis and Babesia vogeli in dogs. *Cienc Anim Bras*. 2017;18(1-9):e36095. <http://doi.org/10.1590/1089-6891v18e-36095>.

Instituto Pet Brasil. País tem 3,9 milhões de animais em condição de vulnerabilidade [Internet]. São Paulo: Instituto Pet Brasil; 2019 [cited 2023 Oct 29]. Available from: <http://institutopetbrasil.com/imprensa/pais-tem-39-milhoes-de-animais-em-condicao-de-vulnerabilidade/>.

Monteiro SG. Parasitologia na medicina veterinária. São Paulo: Roca; 2011.

Ranatunga RAS, Dangolla A, Sooriyapathirana SDSS, Rajakaruna RS. High asymptomatic cases of babesiosis in dogs and comparison of diagnostic performance of conventional PCR vs blood smears. *Acta Parasitol*. 2022;67(3):1217-23. <http://doi.org/10.1007/s11686-022-00549-x>. PMID:35612719.

Robertson ID, Irwin PJ, Lymbery AJ, Thompson RCA. The role of companion animals in the emergence of parasitic zoonoses. *Int J Parasitol*. 2000;30(12-13):1369-77. [http://doi.org/10.1016/S0020-7519\(00\)00134-X](http://doi.org/10.1016/S0020-7519(00)00134-X). PMID:11113262.

## Acknowledgements

We want to thank the undergraduate students in Veterinary Medicine who participated in this project and the Pro-rectory of Culture and University Extension of the University of São Paulo for the financial assistance and scholarship program.

Rodrigues Junior R. Nutrição e dermatologia. In: Jericó MM, Andrade Neto JP, Kogika MM, editores. *Tratado de medicina interna de cães e gatos*. 2. ed. Rio de Janeiro: Guanabara Koogan, 2023. p. 365-8.

Souza CTV, Dorr AP, Silva VLB, Silva FL, Silva EB, Ramos DGS, Pacheco RC, Sousa VRF. Occurrence of gastrointestinal parasites in dogs from Cuiabá, Mato Grosso. *Braz J Vet Parasitol*. 2023;32(1):e012422. <http://doi.org/10.1590/s1984-29612023004>. PMID:36651423.

Thrall MA. Hematologia e bioquímica clínica veterinária. São Paulo: Roca; 2007.

Vieira RFDC, Biondo AW, Guimarães MAS, Santos APD, Santos RPD, Dutra LH, Diniz PPVP, Morais HA, Mesick JB, Labruna MB, Vidotto O. Ehrlichiosis in Brazil. *Rev Bras Parasitol Vet*. 2011;20(1):1-12. <http://doi.org/10.1590/S1984-29612011000100002>. PMID:21439224.

---

**Financial Support:** This project was supported by development programs from the Pro-rectory of Culture and University Extension of the University of São Paulo.