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CHAPTER 33

MAIN ENDOPARASITES IN DOGS AND CATS: A RETROSPECTIVE STUDY

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ABSTRACT

Animal species and humans share much of their historical evolution and, as a consequence, can act as accidental or definitive hosts of pathogenic organisms, completing an anthropozoonotic cycle. Thus, it is essential to adequately control animal endoparasitosis in order to reduce the contamination of the environment by the infective forms of these parasites and, consequently, minimize the risks of human infection. Therefore, the present study aimed to determine the prevalence of endoparasites in fecal samples from dogs and cats treated at the Mario Dias Teixeira Veterinary Hospital, in the region of Belém, PA from May to November 2023. The diagnosis of endoparasitosis was conducted by means of coproparasitological examination for the direct morphological identification of cysts and eggs. The samples were processed in the Clinical Analysis Laboratory of the Veterinary Hospital at the Institute of Health and Animal Production of the Federal Rural University of the Amazon (ISPA-UFRA), using the techniques of Direct examination of feces, flotation in saturated solution of sodium chloride (Willis Method) and Spontaneous Sedimentation (Hoffman Method). Samples from 101 animals were analyzed, most of which were canine (69/68.3%) of the most diverse breeds and female. From the quantity analyzed, helminths belonging to 3 genera were found: Ancylostoma, Toxocara and Trichuris and 2 protozoa: Giardia and Cystoisospora. Ancylostoma spp eggs were the most prevalent (23/22.8%) of positive samples, followed by Toxocara spp eggs (3/3.0%), the other parasites had prevalences of (1/1%). Negative tests correspond to 72/71.3% of the results. The low positivity in the detection of endoparasites demonstrates that animals attended by spontaneous demand in hospitals or specialized clinics are usually the target of a more careful look by their owner and, therefore, receive preventive therapy (antiparasitics) more frequently, but domiciled animals should also assume importance in the contamination of public places, since these places are also intensely visited by these animals, with their tutors and, in this way, play an important role in the propagation of parasitic diseases of zoonotic potential.

Keywords: *Ancylostoma* spp. *Toxocara* spp. Giardia cyst. Techniques. Faeces.

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INTRODUCTION

Canines and felines play an important role in society, especially in post-modernity, and the privileges of human-animal coexistence are incalculable, for the improvement of physical, emotional and relationship conditions, especially for children, the elderly and people with special needs (LOVE; OVERALL, 2001; ROBINSON; PUGH, 2002; ALVES; GOMES; SILVA, 2005). In addition, they reduce the risk of cardiovascular diseases and general mortality rates, due to the reduction of sedentary lifestyle on the part of tutors (MUBANGA *et al*., 2017).

Animal species and humans share a large part of their historical evolution, in addition to cohabiting the same ecosystem, as a consequence of this long shared adaptive period, humans can eventually act as definitive and accidental hosts of pathogenic organisms, completing an anthropozoonotic cycle (STERNEBERG-VAN *et al*., 2016).

Dogs and cats are infected by various genera of parasites. Infestations are associated with variables, such as geography, climate, and animal handling conditions. Several gastrointestinal parasites that use dogs and cats as definitive and intermediate hosts can be transmitted to humans and cause diseases in this species (TORRICO *et al*., 2008).

Parasitic infection can be transmitted by the fecal-oral route, as well as by the parasite penetrating through the skin. Intestinal parasites can cause damage to their carriers, ranging from intestinal obstruction, spoliation that can cause malnutrition, iron deficiency anemia, diarrhea and malabsorption of nutrients, and can even progress to death (KUNZ *et al*., 2008). These infections are more frequent in newborn and young dogs and cats (TORRICO *et al*., 2008).

Among the parasitic diseases that commonly affect pets are endoparasitosis that are caused by protozoa or gastrointestinal helminths. Among the causative agents of helminths, nematodes are agents of great importance in veterinary clinic for causing gastrointestinal problems in dogs (FERRAZ et al., 2019) and cats (MARQUES et al., 2020).

Some gastrointestinal parasitosis represent a public health problem in the world, both for humans and animals, as they are classified as zoonoses (DANTAS-TORRES; OTRANTO, 2014). Infectious diseases that can be transmitted from animals to humans are called zoonoses (DE OLIVEIRA NETO *et al.* 2018)element. Among them, the larval forms of *Ancylostoma* spp. stand out. *(*cutaneous *larva* migrans) and *Toxocara canis* (visceral *larva* migrans);*Dipylidium caninum* and *Strongyloides stercoralis,* which can cause intestinal infection in humans. Among the protozoa that infect the gastrointestinal tract of dogs,

Giardia sp. and *Cryptosporidium* sp. stand out, which can also cause intestinal infection in humans (ACHA; SZYFRES, 1986; LONG, 1990; BENENSON, 1997).

Given the close coexistence of dogs with humans, it is essential to adequately control canine endoparasitosis, with the objective of reducing the contamination of the environment by the infective forms of these parasites and, consequently, minimizing the risks of human and canine infection (ROBERTSON *et al*., 2000).

Few veterinarians routinely discuss with owners the importance of correct diagnosis, both in the identification of the parasite and in the selection of treatment, as well as the zoonotic potential of the parasites of their pets, and most only recommend the prophylactic administration of anthelmintics during the animal's life. The lack of information associated with overconfidence in medication may have led to this complacency about the need to educate these individuals about the risks of zoonoses (PALMER *et al*., 2008). In addition, the concept of One *Health – One Medicine is increasingly strong and present*, which contributes to the integrated promotion of human and animal health and the global ecosystem (CONRAD *et al*., 2009) and under this concept the dissemination of information by veterinarians is increasingly relevant.

LITERATURE REVIEW

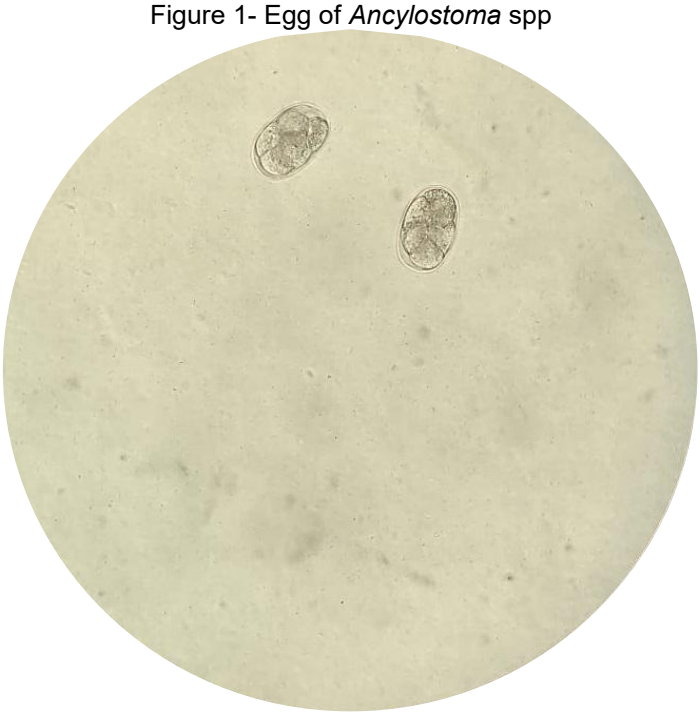
GENRE *ANCYLOSTOMA* SPP

Hookworms are endemic parasites in tropical countries (DA SILVA *et al*., 2008). They are small and belong to the *Ancylostomidae* family, which has dogs and cats as definitive hosts, however they affect humans, being considered zoonotic (DA SILVA, 2021). The main representatives found in cats are *Ancylostoma tubaeforme, Ancylostoma braziliense* and *Uncinaria stenocephala* (NORSWORTHY, 2018). In addition to these, *Ancylostoma caninum* can eventually infect cats (COELHO *et al.,* 2011).

Ancylostoma caninum and A.braziliensis are nematodes found in the gastrointestinal tract of dogs and cats, transmission usually occurs by the oral, cutaneous, transplacental and transmammary routes. The infection mainly causes anemia and diarrhea in dogs, in humans it can be associated with cutaneous larva migrans, known as geographic bug, which is a zoonosis related to the third larval stage found in the environment (HESS et al., 2019). Even if they have the ability to penetrate the skin of humans generating an inflammatory response, the larvae are unable to complete the biological cycle and end up dying over weeks or months, thus being considered a self-limiting disease (SOARES et al., 2018).

The so-called hookworms are parasites of the small intestine (BOWMAN, 2010). *Ancylostoma caninum* has a direct life cycle, sexual dimorphism, size that varies from 12 to 20 mm and demonstrates a peculiar characteristic of hypobiosis in which the parasite adapts being able to remain in the host's organism waiting for better living conditions in the infected animal's organism, especially in pregnant, being able to make transplacental or transmammary migration. This characteristic will vary according to the host's level of immunity, older animals, for example, have a greater resistance to the parasite while puppies are much more susceptible to infection (FILHO., 2019). They have oval-shaped eggs, with a thin and smooth shell and medium size: 56 to 75 µm in diameter × 34 to 45 in width and inside the egg, there are two to eight large blastomeres (MONTEIRO, 2017). They are hematophagous parasites, ingesting 0.04ml to 0.2ml of blood per day, in addition, they release anticoagulant enzymes that increase blood loss, causing anemia in the host and making it susceptible to other diseases that can lead to death. (AMIN; WADHWA., 2022) (Figure 1)

Figure 1- Egg of *Ancylostoma* spp



Source: Personal archive

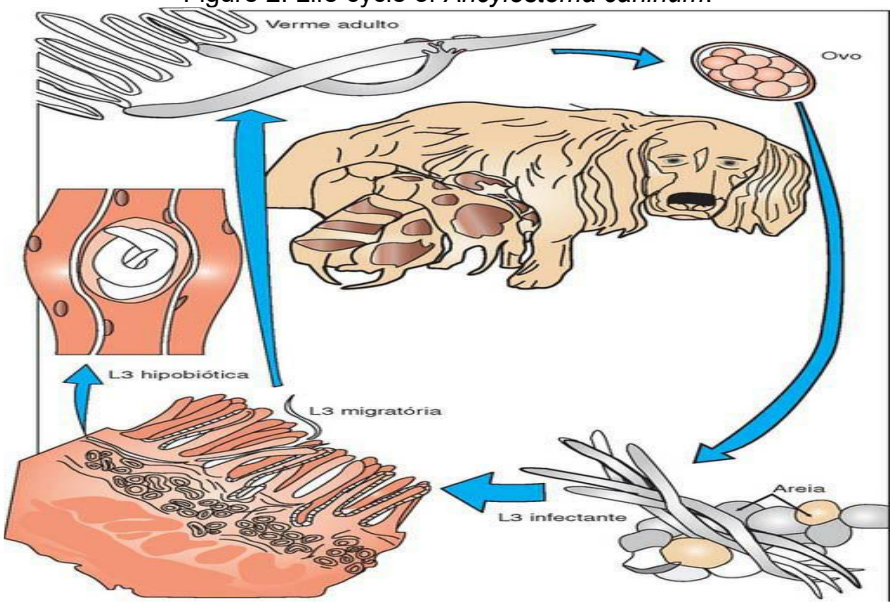
Hookworm larvae thrive well in shady areas of well-drained soils, but not in heavy, waterlogged soils or where they are exposed to sunlight and desiccation. At mild temperatures (23 to 30°C), moderate humidity and well-aerated media are ideal conditions for the hookworm egg morula to develop into an infective third-stage larva (L3) in two to eight days. The eggs and larvae of hookworms are destroyed by freezing. And they do not develop to the infective stage at temperatures below 15°C and above the optimal

development temperature (30°C), the larvae develop quickly to the infective stage. This can be achieved in 48 hours at 37°C, which is the highest temperature compatible with development (BOWMAN, 2010).

According to Guimarães et al. (2005), Castro et al. (2005), Capuano; Rocha, (2006); and Labruna et al. (2006), the high number of dogs carrying intestinal parasites and with easy access to leisure places, such as campsites, children's play areas, beaches, squares, public parks, and that frequently defecate in these places, exposes visitors to contamination, caused by direct or indirect contact with feces contaminated by parasitic agents.

Infection typically occurs through soil contaminated by eggs, which are released in the feces of infected hosts, which may be able to infect humans through cutaneous penetration of the L3 larval stage. The increase in the incidence of the disease occurs in the summer and autumn months, where the parasites find favorable conditions for development with moderate temperatures around 27ºC, well-drained and oxygenated soils. (BOWMAN, 2010; AZIZ; RAMPHUL, 2022) (Figure 2).

Figure 2: Life cycle of *Ancylostoma caninum*.



Font: BOWMAN, 2010

Among the species of greatest concern for public health is *Ancylostoma braziliense*, as it is the main cause of cutaneous larva migrans in humans (CML) (NORSWORTHY, 2018), which, after direct contact with the skin of humans, usually trigger dermatitis accompanied by itching and rashes. Known as "serpiginous linear dermatitis" or "geographic bug", it is often located in the lower limbs, feet, buttocks, hands and to a lesser

extent on the face and scalp (GUIMARÃES *et al*., 2005, CASTRO *et al*., 2005, CAPUANO; ROCHA, 2006 ; LABRUNA *et al*., 2006; and LITTLE, 2015).

The most recent visible lesion is a very superficial erythematous formation that follows the course taken by the worm. Soon, a thin line that appears representing the location of the larva can be palpated. This line becomes visibly raised, more or less continuous and vesicular. Sometimes blisters form. The surface of the lesion becomes dry, resulting in a thin crust. When the parasite proceeds, it moves from less than a millimeter to several centimeters per day (BOWMAN, 2010).

Recreation areas contaminated by feces of animals infected with different parasites have a very important epidemiological role, as they serve as a vehicle for human infections. Thus, squares, beaches and other public places, where there are stray dogs and cats, can become areas at risk of transmission and infection by cutaneous migrans larvae (CML) (SANTARÉM; SARTOR; BERGAMO, 1998; MATOS, 1997).

GENUS *TOXOCARA* SPP

The genus Toxocara contains large ascariads that, as adults, are parasites of the small intestine of various mammals. *Toxocara canis and Toxocara cati* are two of the most commonly observed parasites in dogs and cats, respectively. The helminth *Toxocara canis* is common in puppies during the first few months after birth. Adults are up to 10 to 15 cm long and adult dogs infected with this parasite can be found, releasing eggs in their feces (MONTEIRO, 2017). The stages of development of the parasite comprise: anembryonated eggs, embryonated eggs, larvae in the second, third and fourth stages (L2, L3 and L4), and adult worm (CONCEIÇÃO *et al.,* 2011).

Within the routes of infection, the ingestion of infective eggs is observed: the dog ingests the embryonated egg, which appears in the feces 4 to 5 weeks after infection. This occurs through the ingestion of larvae and tissues from paratenic hosts (earthworms, ants, and other soil-dwelling invertebrates). Transplacental migration may occur, which leads the prevalence of *T. canis* in puppies to approach 100%. The larva also passes through the milk of the bitch that breastfeeds her puppies. The presence of larvae in colostrum is maximum during the second week of lactation. Concomitantly, the bitch may ingest T*. canis* larvae present in the feces or vomit of puppies, when they are cleaned. Finally, defecation by dogs in public squares contributes to environmental contamination with Toxocara eggs, favoring zoonotic transmission (CARVALHO; ROCHA, 2011).

According to Monteiro (2017) Toxocara eggs are very resistant to the extremes of the environment and remain infectious for years, especially in poorly drained clay and soils with

silt, so they accumulate in soil and dirt and inflict a threat to the progress of successful dog breeding over time. It has almost spherical or slightly oval eggs, with thick, granular, smooth, irregular or pale shells depending on the species (Figure 3).

Adult helminths live, on average, 4 months, and in about 6 months, almost all of them are spontaneously eliminated by the host. The female *T. canis* produces up to 200,000 eggs, which are resistant to hostile factors, and can remain viable for a long time in the soil. The eggs in the feces are not embryonated and therefore are not infectious. For embryonization to occur, adequate temperature conditions (15 to 35° C) and humidity are necessary, and under these conditions, 85% of the eggs become infectious in a period of 2 to 5 weeks (CARVALHO; ROCHA, 2011).

The infection cycle begins when eggs embryonated in the soil are ingested and the larvae are released into the stomach and small intestine, affecting the intestinal mucosa, the lymphatic system and then the liver. The larva reaches the lungs and heart and migrates to the somatic tissues, and can, from this stage, be transferred to the offspring in the womb (prenatal infection) or remain in the "latent" form. Dogs can become infected in several ways, including by transplacental migration, breastfeeding or ingestion of infective eggs. Unlike the hookworm, this genus is not hematophagous and has a despoiling action in the intestine (QUADROS et al., 2014).

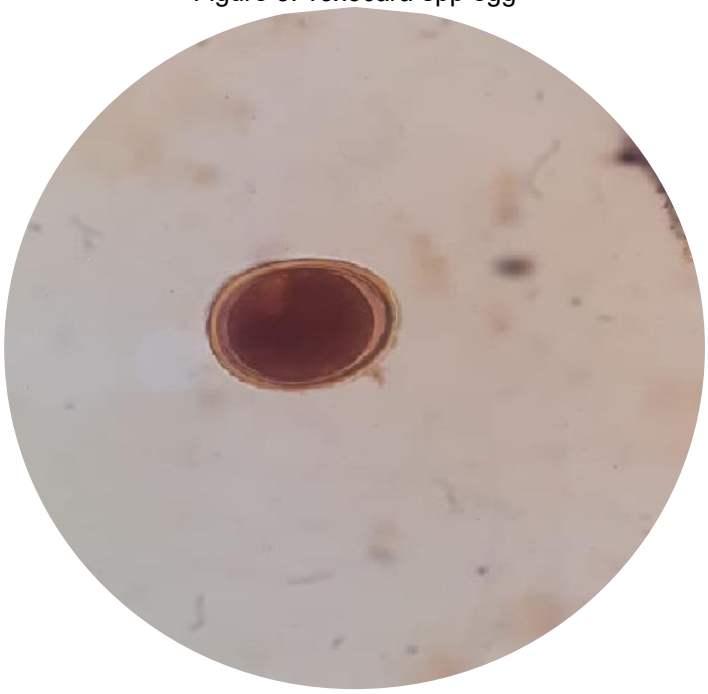
In an infection by *Toxocara* spp, among the multiple clinical conditions it produces, including asymptomatic cases, eosinophilic granuloma, hypereosinophilia, chronic weakness, abdominal pain, in addition to the classic visceral form of the disease (Visceral *Larva Migrans*), marked by hepatic and pulmonary involvement. Eventually they can reach the eyeball (Larva *Migrans* Ocular), causing retinal displacement and blindness in children (CAMPOS, 2003; BOWMAN, 2010; FORTES, 2004; TAYLOR *et al.,* 2017).

The ascarids that cause toxocariasis in the human host are *Toxocara canis and Toxocara cati* (CARVALHO; ROCHA, 2011). Man participates in the cycle of this parasite accidentally. When ingesting foods that have eggs containing L3, when they reach the small intestine of man, they release these larval forms, which are able to cross the intestinal mucosa and, through the lymphatic route, reach the circulation and, therefore, the liver. The larvae leave the liver and fall into the bloodstream, reaching the lungs. They cross the pulmonary capillaries and fall into the pulmonary circulation, then into the heart, spreading throughout the body through the systemic circulation. When T. canis larvae exceed the diameter of the blood capillaries, active and erratic migration occurs through the cell wall and host tissues. The migration phase causes an acute inflammatory reaction, with the presence of eosinophils, neutrophils, and sometimes monocytes. It also occurs in this

phase that metabolically active and antigenic products are released, called secretion-excretion antigens. It has been shown that these antigens are located in the epicuticle of larvae and are important receptors for antibodies (LAMBERTUCCI *et al*., 1996).

With the increase in population density in large cities and the consequent increase in dogs and cats, the urban environment has been increasingly affected by environmental contamination and fecal pollution of gardens and public parks. For all these reasons, toxocariasis is currently the most common parasitic zoonosis in developed countries (OTERO *et al*., 2014).

Figure 3: *Toxocara* spp egg



Source: Personal archive

GENRE *GIARDIA* SPP

The genus *Giardia* brings together flagellated protozoa with a direct life cycle, whose fecal-oral transmission occurs especially through water contaminated with cysts. It is one of the main causes of enteritis in humans and animals (THOMPSON, 2000; LALLO *et al*., 2009). According to Beck et al. (2005), transmission can also occur directly, especially in areas where animals are crowded (kennels, catteries).

Giardiasis is caused by a protozoan that affects the gastrointestinal tract, and the most common species is *Giardia lamblia*. It presents itself in two forms: cyst and trophozoite (PEDROSO AND AMARANTE, 2006). The infective form is the cyst, with a size of 8-10 µm, thick wall, oval shape and four nuclei. When the cyst reaches the upper region of the small intestine, it gives rise to four trophozoites (ARAUJO *et al*., 2018; CASTRO, 2001; LENZI, 2013). Trophozoites measure approximately 10-12 µm long by 5-7 µm wide (DESTRO *et*

al., 2019). It has only one host, that is, it has the monoxenic biological cycle (SANTANA, *et al.,* 2014).

Giardia trophozoites are adapted to adhere to the mucosal cells of the small intestine and are teardrop-shaped, with one side showing a depression, forming the suctorial disc. Inside the cell are two nuclei with large endosomes (Feulgen-negative nucleoli) that give the microorganism the appearance of a "tennis racket with eyes" when viewed from below under brightfield microscopy. All other intestinal flagellates inhabit the cecum and colon, but Giardia parasitizes the small intestine, where trophozoites can be observed adhered to mucosal cells through the suctorial disc. Trophozoites usually go through the encysting process before following intestinal transit. Mature cysts with the potential to form four trophozoites are the forms usually found in the feces of the infected host, although trophozoites can also be observed, especially in diarrheal feces, this form being unable to cause infection and not very resistant, dying quickly. (BOWMAN, 2010).

Based on epidemiological evidence, giardiasis was included in the WHO list of zoonoses in 1979 (ECKERT, 1989). In developed countries, giardiasis has increased recognized as a reemerging infection, especially in children kept in day care centers where the conditions for fecal-oral transmission are facilitated (TRAUB *et al*., 2004).

Its occurrence in dogs and cats is highly significant for both clinical and public health. In dogs, diarrhea usually begins before the 5th day after infection (ABBITT *et al*, 1986), with cysts appearing in the feces after about one or two weeks. The main clinical sign is diarrhea, resulting from intestinal malabsorption, the feces of infected cats are usually mucoid, pale, pasty and almost always foul-smelling (KIRKPATRICK, 1986). Malabsorption of fat-soluble vitamins and lipids occurs. Normally, there is no extra intestinal invasion, but trophozoites can migrate through the bile or pancreatic canals, thus causing inflammation (ARAÚJO *et al.,* 2018).

Giardiasis can also present in an acute form, in which, in a short period of incubation time, clinical signs appear. The chronic form is characterized by a longer duration of clinical signs, with intense diarrhea and malabsorption of nutrients, generating a worsening of the host's clinical and physical conditions (SANTANA *et al.,* 2014). The disease has been associated with atrophy of the intestinal villi, diffuse decrease of the microvilli, loss of epithelial barrier function, and increased permeability (PALMER *et al*., 2008a). Leading to dehydration, weight loss and death (MONTEIRO, 2017).

Trophozoites can be detected in diarrheal fecal preparations by direct examination, and are, on the other hand, impossible to demonstrate in formed feces (BOWMAN, 2010). The most efficient technique to identify cysts and trophozoites in feces; is zinc sulfate

flotation, better known as Faust's technique (OSMARI et al., 2021), if this technique is not available, a drop of lugol added to the fecal material in the slide will increase the contrast of the nucleus within the parasite, thus facilitating the identification of cysts and trophozoites (Figure 4). Giardia cysts are often seen in normal faeces of asymptomatic hosts, but in some cases of clinical giardiasis, neither cysts nor trophozoites are seen in faeces (BOWMAN, 2010; ZANELLA, 2016).

According to Lallo et al. (2003), giardiasis is mainly a waterborne disease, as both animals and humans acquire it, mainly through the ingestion of water contaminated with cysts. Therefore, maintaining the cleanliness of the environment, washing food well and only drinking filtered water are control measures that must be maintained. Cysts can survive for several months in the environment (BECK *et al*. 2005).

Figure 4: *Giardia* spp cyst stained with lugol

Source: Image courtesy of Suelen Lima

MATERIALS AND METHODS

METHODS OF ANALYSIS

The work is an observational cross-sectional study, whose casuistry involved the analysis of fecal samples from 101 animals from care provided at the Mario Dias Teixeira Veterinary Hospital (HOVET) by spontaneous demand from May to November 2023. The study population had several diseases and conditions that could or could not be linked to gastroenteric clinical signs. All dogs and cats that were requested parasitological examination of the feces were included in the study.

Fresh fecal samples from the animals treated at the Mario Dias Teixeira Veterinary Hospital (HOVET) were collected by the owners themselves at their homes or at the time of

the consultation in universal plastic vials, identified and transported to the Laboratory Medicine Unit (MedLab) for routine parasitological examination. The techniques of Direct Examination of the Feces (Direct Method), flotation in saturated solution of sodium chloride (Willis Method) and spontaneous sedimentation (Hoffman's Method) were used according to the Standard Operating Procedure of this Laboratory (Figure 5).

The diagnostic process was performed based on the morphological characteristics of the eggs, cysts and larvae observed. The results were considered positive when the visualization of one or more protozoan eggs and cysts was verified under an optical microscope. Because these are qualitative methods, the quantification of eggs on the slides was not performed. PPE was used to handle the samples and perform laboratory diagnosis. The waste was sent for external collection as infectious waste. The materials used in the analyses were decontaminated with 2% hypochlorite before washing or disposal.

Information related to species (canine and feline), breed (SRD and purebred), sex (female and male), age group (up to 12 months/ 2 years - 5 years/ 6 years - 10 years/ > 10 years and not informed) and origin (neighborhoods in the Municipality of Belém/ Others and not informed) were obtained from the requests for parasitological tests.

DIRECT METHOD FRESH FROM FECES

This technique is used in cases of suspected significant parasite load. Place two to three drops of 0.85% saline on a glass slide, then touch with the tip of a toothpick several points of the stool, transferring a small portion to the microscopy slide, spreading the stool and placing the coverslip and making the observation under the microscope. The thickness of the smear should not impede the passage of light. This method is mainly indicated for the search for protozoan trophozoites in newly emitted diarrheal feces; To identify protozoan cysts and helminth larvae, stain the preparation with lugol and place the coverslip and make the observation under the microscope.

It has the advantages of speed, little equipment required and ease of execution. As disadvantages, it can result in tests with false negative results due to the small amount of feces examined, which may not detect parasitism, and the accumulation of dirt on the slide can confuse the identification (MONTEIRO, 2017).

WILLIS METHOD

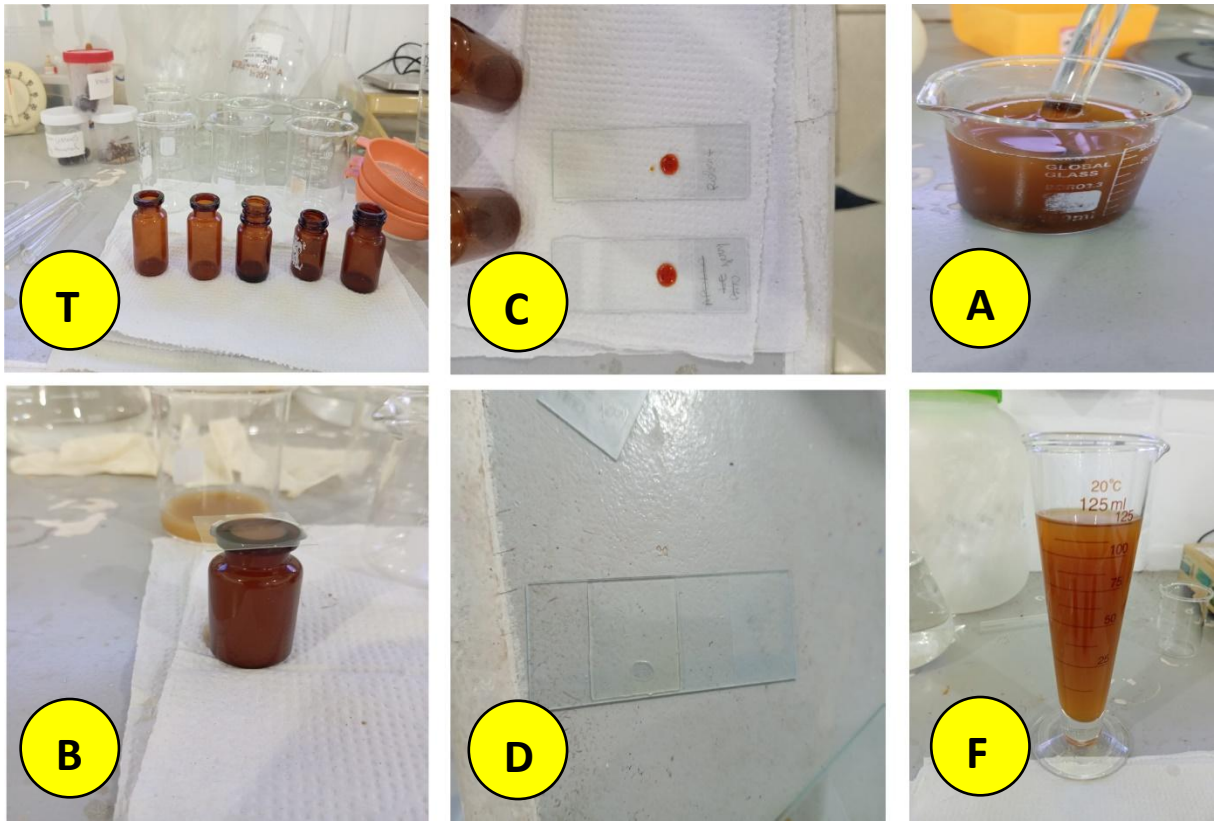
Willis' technique is based on two characteristics of the eggs to be analyzed. The first is density, as less dense bodies tend to float on a dense saline solution. Therefore, the less dense the eggs, the better their separation through this technique, which uses a saturated

solution of high-density sodium chloride to induce the eggs to float to the surface. The eggs on the surface will come into contact with the underside of a glass slide, due to another characteristic of these eggs, tigmotropism. Bodies with this property tend to adhere to solid surfaces after physical contact with them. By combining these two characteristics, the Willis technique allows the fixing of low-density eggs from a fecal sample on a slide, by floating them on a very dense solution. These eggs are then observed microscopically. It is a highly efficient method, which, due to its purification, facilitates the observation under the microscope of hookworm eggs and protozoan cysts (CHIEFFI, 2001; DE CARLI, 2007; REY, 1992; VERONESI, 1982).

HOFFMAN'S METHOD

The Hoffman technique, or spontaneous sedimentation method, basically consists of mixing feces with water, filtering them through a surgical gauze (or parasitofilter) and maintaining them at rest, forming a consistent sedimentation of fecal debris at the bottom of the calyx. An aliquot of the sediment is pipetted onto a slide and the coverslip is placed and observed under the microscope. This method detects the presence of eggs in the feces, especially heavy ones. And after 2 to 24 hours of sedimentation, protozoan cysts and helminth larvae can also be found more easily (CHIEFFI, 2001; DE CARLI, 2007; REY, 1992; VERONESI, 1982).

Figure 5: Material used for direct examination of feces, flotation in saturated sodium chloride solution, and spontaneous sedimentation.

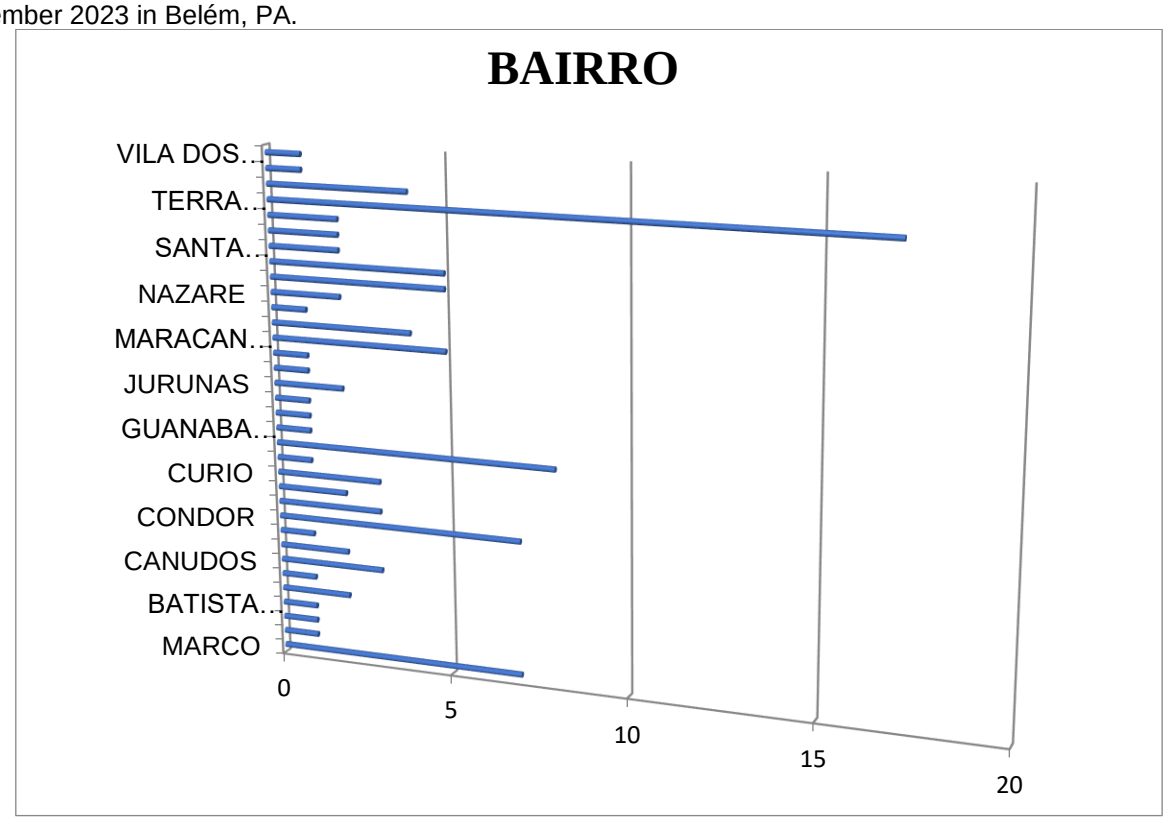


Legend: A: Material used for parasitological examination of feces. B: Amber glass with coverslip; Willis technique. C: Slides with lugol, for direct examination of the feces. D: Blade with coverslip after the waiting time for flotation; Willis technique. E: Beaker with saturated sodium chloride solution and feces for homogenization. F: Resting feces in the glass goblet for spontaneous sedimentation; Hoffman's method.

RESULTS AND DISCUSSION

The survey took place from May to November 2023, with a sample number of 101 animals, where in this period it was observed that 93.1% (n=94) of the animals came from the neighborhoods of the Municipality of Belém, 5.9% (n=6) from other municipalities and 1.0% (n=1) the neighborhood was not informed (Figure 6).

Figure 6: Neighborhoods served by the Mario Dias Teixeira Veterinary Hospital, of the Institute of Health and Animal Production of the Federal Rural University of the Amazon (ISPA-UFRA). During the period from May to November 2023 in Belém, PA.



Of the participating animals (dogs and cats), regarding their breed: 61.4% were of mixed breed (n=62) and 38.6% of different breeds (n= 39). Regarding gender: 51.5% were females (n= 52) and 48.5% were males (n=49).

Among the dogs (n=69), 31 were mixed-breed (SRD) and 38 were of different breeds; 36 were females and 33 males; 14 were (up to 12 months), 21 up to (5 years), 22 up to (10 years), 10 (over 10 years) and 2 dogs whose age was not informed. As for origin, 63 came from the neighborhoods of the Municipality of Belém and 6 from other municipalities.

Among the cats (n= 32), 31 were SRD and 1 was Siamese; 16 were females and 16 were males; 20 were up to (12 months), 5 up to (5 years), 5 up to (10 years) and 2 (over 10 years). As for the origin, the 32 animals came from the neighborhoods of the Municipality of Belém.

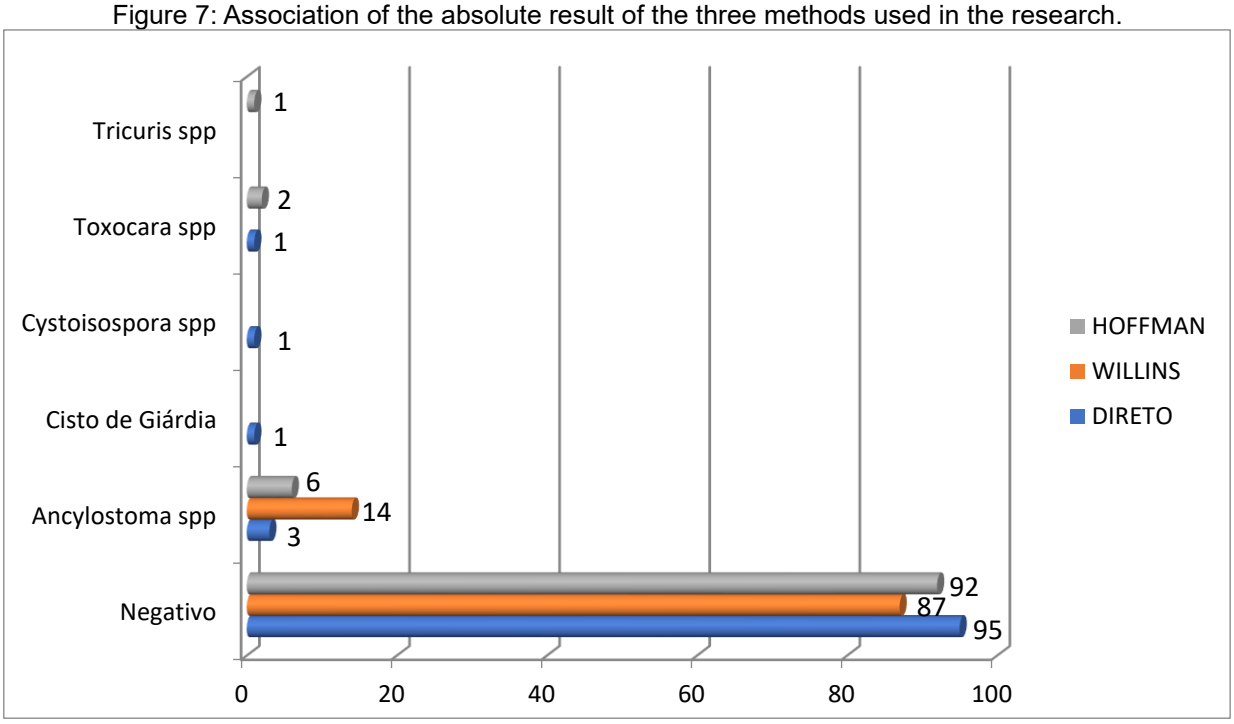
The largest sample was composed of the canine species: 68.3% up to 12 months of age, 33.7% of mixed breed and 61.4% of the Municipality of Belém, with the highest demand for tutors who live in the same neighborhood of Terra Firme, which is where the Veterinary Hospital is located (Table 1).

Table 1: Distribution of the number and percentage obtained for each variable described for the animals included in the study, attended at HOVET/ISPA-Ufra

Variables described	n	%
Species		
Dogs	69,0	68,3
Cats	32,0	31,8
Race		
SRD	62,0	61,4
Defined race	39,0	38,6
Sex		
Female	52	51,5
Male	49	48,5
Age group		
Up to 12 months	34	33,7
2 years to 5 years	26	25,7
6 years to 10 years	27	26,7
More than 10 years	12	11,9
Not informed	2	2,0
Origin		
Municipality of Belém	95	94,0
Other Municipalities	6	6,0

The positivity rate for intestinal parasitosis in dogs and cats was 28.7% (n= 29), of which 22.8% were positive for *Ancylostoma* spp (23/29); 3% for *Toxocara* spp (3/29); 1% for *Cystoisospora* spp (1/29); 1% for *Tricuris* spp (1/29); 1% for Giardia cyst (1/29), consequently 71.3% (n= 72) of the results were negative (Figure 7). This result was lower than those obtained by Uehlinger *et al*. (2013) and Pasqua and Pedrassani (2012), who found superior results, with 49.0% and 78.6%, respectively, of positivity, when analyzing fecal samples of free demand from Hospital and Veterinary Clinic from different parts of the world.

Figure 7: Association of the absolute result of the three methods used in the research.



In the present study, infections by *Ancylostoma* spp and *Toxocara* spp. were the most frequent. Among the canine samples analyzed, 27.5% were positive (19/69), with a predominance of *Ancylostoma* spp eggs in the fecal samples (23.2%), whose most prevalent age was from 2 years to 5 years and from 6 years to 10 years, corresponding to 5% and 6%, respectively. It was also detected, in a smaller proportion, the presence of *Cystoisospora* spp, Giardia cyst, and *Tricuris* spp, representing (1.4%) each one and aged from 6 years to 10 years, 2 years to 5 years, and 6 years to 10 years, respectively. In cats, of the samples analyzed, 31.2%, 10 were positive (10/32), with a predominance of *Ancylostoma* spp eggs in fecal samples (21.9%), distributed between the ages of up to 12 months and from 2 years to 5 years, with 4% and 3%, respectively, and in a smaller proportion is *Toxocara* spp, with (9.3%) positive samples aged up to 12 months.

The results found in the research corroborate with Torrico *et al*., (2008) who analyzed 1012 fecal samples from dogs and cats in the routine of the Unesp-Botucatu laboratory, where among the positive samples for dogs the parasite most found in dogs was *Ancylostoma caninum* (38%) evaluated by the Willis-Mollay and Faust technique. Youssef *et al*., (2020) in the region of Marilia - SP, who analyzed 75 feces of asymptomatic animals (52.0%) with parasitism by *Ancylostoma* spp. and (40.0%), *Toxocara* spp., analyzed by the Faust method, which is based on the use of a solution with zinc sulfate (ZnSO2) at 33%.

Ferraz et al. (2019) analyzed 474 fecal samples, 449 from dogs and 25 from cats, at the Laboratory of Parasitic Diseases (Ladopar) of the Veterinary School of the Federal University of Pelotas (UFPEL), during 2017. Of the canine samples, 268 (59.7%) were

positive for enteroparasites, while of the feline samples, 56.0% were positive. In 91.4% of the samples examined from dogs, eggs of the genus *Ancylostoma* spp. were present. In the samples from cats, there was a higher frequency of *Toxocara* sp. (71,4%). In 12 (26.7%) samples of dogs and 8 (38.1%) of cats, there were cysts of *Giardia* sp.

Labruna et al. (2006) analyzed 95 animals in street conditions in Monte Negro, Rondônia, and obtained high positivity with 80 positive cases. In this study, infection by *Ancylostoma* spp. (73.7%) followed by *T. canis eggs* (18.9%) analyzed by Willis' coproparasitological methods, centrifugal-flotation in sucrose solution and centrifugal-sedimentation in water-ether were the most prevalent.

De Paula et al. (2021), when analyzing 91 fecal samples from dogs and cats of animals from a municipal kennel in the Zona da Mata region of Minas Gerais, found a positivity in 69 (75.8%) among dogs and cats. Of the 56 samples analyzed from adult dogs, the presence of parasite eggs and/or cysts was verified in 73.21% (41/56) of them, and 64.28% (36/56) had only *Ancylostoma* spp., 1.78% (1/56) only *Toxocara* sp. In adult cats, of the 16 fecal samples analyzed, 68.75% (11/16) were positive for the presence of parasite eggs or cysts and, among them, 6.25% (1/16) of *Ancylostoma* spp., 6.25% (1/16) of *Platynossomum* spp., 6.25% (1/16) of *Cystoisospora* spp. and 50% (8/16) of *Toxocara* spp.

The low positivity in the detection of endoparasites can be explained by the fact that animals treated by spontaneous demand in hospitals or specialized clinics are usually the target of a more careful look by their owner and, therefore, receive preventive therapy (antiparasitics) more frequently than other animals.

On the other hand, domiciled dogs should also assume importance in the contamination of public places, since these places are also visited by these animals, when walking with their owners. In addition, it should be noted that cats, especially stray cats, are also sources of infection for *Ancylostoma braziliense* and should be included in any control program in urban centers (FREITAS, 1977).

In the present study, parasite frequency was analyzed associated with age, regardless of the host species, we observed that in animals over one year of age they had a greater presence of intestinal parasites. Similar results were also pointed out by Ribeiro *et al*. (2015) that obtained a higher frequency of positivity in animals over one year of age and by Monteiro *et al*. (2014) that did not observe any difference between the two groups (older and younger than one year old). In contrast, the results found by Ramirez-Barrios *et al*. (2004), Alves *et al*. (2005), Labruna *et al*. (2006) and Fontanarrosa *et al*. (2006) observed that animals less than one year of age had a higher presence of intestinal parasites. When

comparing sex (males and females) and race (mixed breed and purebred), no significant difference was found.

The variability of the frequencies found in the studies involving the demands of veterinary hospitals and other population groups can be attributed to different factors such as: the methodology employed, the variations in the sensitivity/specificity indexes; the diversity of the regions studied and their geographical characteristics; and, mainly, of the animal population in question and even in the face of the methodological differences between the parasitological surveys carried out, *Ancylostoma* spp has always been the most frequently reported genus of helminth in dogs in Brazil (LABRUNA *et al*., 2006).

Although many animals are asymptomatic, making diagnosis and treatment difficult, they are central elements in perpetuating the spread of cysts and parasite eggs in the environment, and, consequently, the increase in the risk of infection in humans. Thus, it is necessary to reduce the parasite load through health promotion and prevention measures and appropriate diagnoses and treatments, to reduce human exposure to zoonoses of interest to single health (BELTRÃO 2022).

CONCLUSION

Although infections caused by parasites of veterinary interest have already been described in Brazil, knowledge should be increasingly disseminated, as well as guidance to tutors. The difficulty in establishing a more precise clinical and laboratory diagnosis may be one of the causes of the low positivity detected at work. It was also shown that dogs and cats were positive in the most diverse ages, sex, gender or breed. And that *Ancylostoma* spp was more prevalent mainly through the detection technique by the Willis Method, a technique for detecting light eggs and that has less dirt, facilitating detection. Thus, the importance of parasitological control is highlighted, even in asymptomatic animals, but in a conscious way and with veterinary guidance. It is important to develop studies that evaluate the relationship between animals and parasitosis, its possible associations with other diseases and its zoonotic potential.

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