Animal Health

Original

Prevalence and Factors Associated with Gastrointestinal Parasites in Working Dog Puppies in Camagüey, Cuba

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ABSTRACT

Background: Intestinal parasitoses in dogs are a relevant problem for Veterinary Medicine and Public Health. Canine breeding centers present conditions favorable to the transmission of these agents. **Aim.** To determine the prevalence and factors associated with these infections in puppies at the Breeding and Reproduction Center in Camagüey, Cuba. **Methods**: A total of 841 puppies from three breed categories were studied between 2022 and 2024. One fecal sample per animal was collected daily for coproparasitological analysis using the Mini-FLOTAC technique. A multinomial logistic regression model was applied to evaluate the effect of the variables year, breed, and season on the presence of the identified categories of intestinal parasites. **Results**: The highest prevalence corresponded to the category no parasites observed (60.70%), followed by *Giardia spp*. (25.10%) and *Ameba spp*. (7.50%). The model was significant ($p < 0.001$). The years 2022 (OR = 4.71; 95% CI: 2.41–9.19) and 2023 (OR = 7.71; 95% CI: 3.89–15.28) increased the probability of *Giardia spp*. infection compared with 2024. The German Shepherd breed increased the risk of infection with this parasite (OR = 2.19; 95% CI: 1.26–3.81), as did the dry season (OR = 1.74; 95% CI: 1.22–2.50). For *Ameba spp*., the Belgian Malinois breed showed a protective effect (OR = 0.07; 95% CI: 0.02–0.23) and the dry season reduced its probability (OR = 0.18; 95% CI: 0.07–0.51). **Conclusions**: The study revealed a high prevalence of intestinal parasitoses (39.30%) in puppies, with *Giardia spp*. being the most frequent agent. Identified risk factors included the German Shepherd breed, the dry season, and the year 2023 for Ameba *spp*.
Keywords: *Canis lupus familiaris*; *Giardia spp*.; intestinal parasites; prevalence; breeds (Source: *AIMS*)

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INTRODUCTION

Intestinal parasitosis in dogs remains a significant challenge for veterinary medicine and public health because of its impact on animal welfare and its zoonotic potential (Murnik *et al*., 2022; Sukupayo & Tamang, 2023). It takes on particular importance in high-density settings such as canine breeding and reproduction centers, and can cause a variety of clinical signs, including diarrhea, vomiting, weight loss, and growth retardation (Adhikari *et al*., 2023; Mushynskyi *et al.*, 2024).

The prevalence and distribution of these parasites — notably *Giardia spp*. (Sarria-Guzmán *et al*., 2022), *Ancylostoma caninum* (Kim *et al*., 2022), and *Toxocara canis* (Rostami *et al*., 2020) — are determined by environmental, management, and host-related factors (Elwakil, 2023). Other determinants such as low socioeconomic status, access to refuse, and lack of systematic deworming are key drivers (Souza *et al*., 2023). Specifically, age is a critical risk factor (Batista *et al*., 2024; Murnik *et al*., 2022; Jovanovic *et al*., 2024). Therefore, epidemiological monitoring is essential to implement effective control strategies.

Studies in Latin America have reported high prevalences of parasitoses in canine populations. For example, Tierra Carrasco *et al*. (2024) reported a 75% infestation rate in shelter dogs in Ecuador, with a predominance of zoonotic helminths such as *Uncinaria stenocephala* and *Ancylostoma spp*. Tovar *et al*. (2024) in La Paz, Bolivia, found an overall prevalence of 82.4%, with *Giardia* (42.4%) and *Ascaris* (39.2%) as the most frequent agents. In contrast, a study in Colombia reported a prevalence of 49.2% in owned dogs (Sarmiento-Rubiano *et al*., 2024), suggesting variations associated with population management and hygienic-sanitary conditions.

There are no bibliographic reports in Cuba on intestinal parasitoses in canine breeding centers. Although the Breeding and Reproduction Center for Dogs in Camagüey has detected the presence of these agents through routine parasitological analyses, a comprehensive study determining their current prevalence and systematically analyzing the factors associated with infection in the puppy population—the most vulnerable group—has not yet been conducted. Therefore, the present study aimed to determine the prevalence and associated factors of intestinal parasitoses in puppies at the Breeding and Reproduction Center for Dogs in Camagüey, Cuba.

MATERIALS AND METHODS

Location, Duration, Animals

The study population comprised 841 puppies of both sexes, distributed across three breed categories: Belgian Malinois (PBM) 52.10% (n = 439), German Shepherd (GS) 29.70% (n = 250), and Springer Spaniel (SP) 18.00% (n = 152). All animals originated from the Breeding and

Reproduction Center for Dogs in the city of Camagüey, Cuba, and the study period spanned 2022–2024.

Sample Collection and Processing

A single individual fecal sample was collected daily from puppies weaned at eight weeks of age. Each specimen was obtained by direct rectal collection using a gloved, lubricated little finger, from which approximately 5 g of feces were extracted, roughly the size of a human pinky nail.

Samples were immediately transferred into amber glass jars without the addition of preservatives and transported to the laboratory within the first 2 hours after collection. All analyses were performed at the Laboratory of the Regional Polyclinic for Canine Technique using the Mini-FLOTAC technique described by Barda *et al*. (2013).

Parasites were identified morphologically and categorized for analysis as follows: No parasites observed (NSO); *Giardia spp*.; *Ameba spp*.; *Isospora spp*.; and Other (grouped due to low frequency: *Ameba-Isospora*; *Ancylostoma spp*.; *Coccidia spp*.).

Statistical analysis

The data were processed using IBM® SPSS® Statistics, version 24. A descriptive analysis was performed to calculate prevalences. To evaluate the effect of the independent variables (year, breed, season) on the identified parasite category, a multinomial logistic regression model was applied. This model was chosen because it allows assessment of multiple predictors on an outcome variable with more than two nominal categories without assuming any ordering among them.

The reference category for the outcome variable was "NSO" (No parasites observed). The significance of the overall model and of individual parameters was evaluated ($p < 0.05$). Odds ratios (OR) with their 95% confidence intervals (95% CI) were calculated. Because some parasitic categories had a small number of observations (e.g., *Isospora spp*. and Other), results for those categories are interpreted with caution.

RESULTS

General distribution of parasite categories

Of the 841 puppies studied, the majority were classified in the no parasites observed (NSO) category (60.70%, n = 512). The most frequent parasitosis was *Giardia spp*. (25.10%, n = 212), followed by *Ameba spp*. (7.50%, n = 63). The *Isospora spp*. and "Other" categories showed low prevalences (0.40%, n = 3 and 6.30%, n = 53, respectively).

Fitting the Multinomial Logistic Regression Model

The multinomial logistic regression model that included the variables year, race, and season was statistically significant (χ^2 = 313.89; df = 40; p < 0.001) compared with the null model. Pseudo-R^2 measures indicated that the model explains a moderate proportion of the variability in the dependent variable (Cox and Snell: 0.31; Nagelkerke: 0.35; McFadden: 0.17).

Factors Associated with the Main Parasitic Categories

Table 1 presents the estimates of the statistically significant parameters (p < 0.05) from the multinomial model. For the *Ameba spp*. category, the probability of infection was significantly higher in 2023 compared with 2024. The PBM breed showed a markedly lower probability of being infected with *Ameba spp*. compared with SP. Likewise, the dry season was associated with a lower probability of *Ameba spp*. infection compared with the rainy season.

For the *Giardia spp*. category, the years 2022 and 2023 showed a higher probability of infection compared with 2024. The PA breed had a higher probability of *Giardia spp*. infection than the SP breed. The dry season increased the probability of *Giardia spp*. infection relative to the rainy season.

The results for the *Isospora spp*. category should be interpreted with extreme caution due to the low number of cases (n = 3). The model estimated an extremely high OR for the PA breed (OR = 3.56 × 10 8), with a very wide confidence interval, reflecting instability in the estimate because of the insufficient sample size in this cell.

Table 1. ***Estimates of significant parameters from the multinomial logistic regression model for the Ameba spp. and Giardia spp. categories***

Parasite	Variable (Comparison)	B	Standard error.	Sig	OR (Exp(B))	CI (95%)
Ameba spp	Intercept	-2.756	0.279	<0.001		
	Year (2023 vs 2024)	0.834	0.330	0.012	2.303	1,205-4,398
	Breed (PBM vs SP)	-2.629	0.598	<0.001	0.072	0,022-0,233
	Season (dry vs rainy)	-1.701	0.528	0.001	0.183	0,065-0,514
Giardia spp	Intercept	-0.784	0.154	<0.001		
	Year (2022 vs 2024)	1.549	0.341	<0.001	4.708	2,411-9,190
	Year (2023 vs 2024)	2.042	0.349	<0.001	7.708	3,887-15,284
	Breed (PA vs SP)	0.784	0.282	0.005	2.191	1,260-3,809
	Season (dry vs rainy)	0.556	0.184	0.003	1.743	1.215-2.500

DISCUSSION

This study shows a high overall prevalence of intestinal parasitism (39.30%) in puppies from a specialized breeding center in Cuba, with *Giardia spp*. being the most frequent agent (25.10%). This prevalence is comparable to that reported by Murnik *et al*. (2022) for *G. intestinalis* (29%), and reinforces the relevance of this protozoan as a major enteric pathogen in young canine populations under intensive rearing (Mateo *et al*., 2023; Peruzzo *et al*., 2023).

The significant influence of the temporal factor (year) highlights the variable dynamics of these infections. The higher risk associated with 2022 and 2023 for *Giardia spp*., compared with 2024, could reflect interannual fluctuations in unmeasured environmental factors, variations in the effectiveness of sanitary protocols, or changes in infection pressure within the facility (Cobban, 2024; Visscher *et al*., 2022). This underscores the need for continuous and adaptive parasitological monitoring.

The observed breed differences are notable. The greater susceptibility of the PA breed to *Giardia spp*. aligns with previous findings that identify certain breeds as more prone to specific parasitic infections (Suvorov & Melnychuk, 2023). Conversely, the marked protective effect of the PBM breed against *Ameba spp*. suggests the possible existence of genetic or immunological factors conferring resistance, an aspect that warrants future investigation.

The seasonal association showed opposite patterns for *Giardia spp*. and *Ameba spp*. While the dry season increased the risk of giardiasis, it reduced the risk of amebiasis. This finding for *Giardia spp*. differs from that reported by Tangtrongsup *et al*. (2020), who found higher prevalence in the rainy season in Thailand.

Our results suggest that, in the climatic and management context of Camagüey, the conditions of the dry season (possibly related to water availability or cleaning practices) could favor the transmission of *Giardia*. In contrast, the lower probability of *Ameba spp*. during the dry season is consistent with the known dependence of these protozoa on environmental moisture for their survival and dispersal (Masangkay *et al*., 2022; Rossi *et al.*, 2024).

The main limitation of the study lies in the instability of the estimates for parasitic categories with very low frequency, such as *Isospora spp*., which prevents drawing solid conclusions for these agents. Future research with larger sample sizes or longer study periods could clarify these associations.

CONCLUSION

A high overall prevalence of intestinal parasitism (39.30%) was confirmed in puppies from the studied breeding center, with *Giardia spp*. being the most frequent agent. Specific risk factors were identified: the German Shepherd breed and the dry season for *Giardia spp*., and the year 2023 for *Ameba spp.*

RECOMMENDATIONS

To implement reinforced deworming and sanitary management protocols targeted to the German Shepherd breed, particularly during the dry season. To establish a continuous epidemiological surveillance system to detect interannual fluctuations and adjust control strategies accordingly.

To expand future research to include a larger number of animals and additional management factors to achieve a more comprehensive understanding of parasitic dynamics.

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AUTHOR CONTRIBUTION STATEMENT

Research conception and design: VLM, SPL, PERF, MALD, AVV, MGD; data analysis and interpretation: VLM, SPL, PERF, MALD, AVV, MGD; writing of the manuscript: VLM, SPL, PERF, MALD, AVV, MGD.

CONFLICT OF INTEREST STATEMENT

The authors state there are no conflicts of interest whatsoever.