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Prevalence study of *Giardia* among domestic dogs in Baghdad city

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ABSTRACT

Background and aim*: Giardia duodenalis* is a ubiquitous protozoan parasite in many animal and humans. The objective of this study was to determine the prevalence of *Giardia* among domestic dogs in Baghdad city.

Materials and Methods: Two hundred fecal samples were collected from October 2024 to February 2025. from pet dogs that had visited a small animal private clinic in Baghdad, Iraq, using three diagnostic methods; namely direct fecal examination, Card Agglutination Test and Enzyme Linked Immunosorbent Assay (ELISA).

Results: A total of 200 fecal samples were collected from domestic dogs during from October 2024 to February 2025. The total prevalence of *Giardia*sis was 18%, 20.5% and 24.5% using microscopy, card agglutination and ELISA methods as well. There was no significant difference ($P > 0.05$) in the rate of infection for female and male dogs; however, a significantly higher ($P < 0.01$) prevalence was found among puppies (<6 months) compared with older dogs (between 6 months-2 years). The highest prevalence was recorded in February (37.5%, 35%, and 45% for the three diagnostic methods) with the lowest being in November (7.5%, 2.5%, and 12.5%).

Conclusions: The relatively high prevalence of *Giardia*sis in domestic dogs poses a significant public health risk. As a result, it is highly recommended to apply regular diagnostic testing programs in house dogs for minimizing possible risk of zoonotic transmission in Baghdad city.

Introduction

Giardia is an enteric flagellated protozoan parasite that causes diarrheal disease following colonization and multiplication in the small intestine in the human and other domestic animal gut, especially dogs, cats and livestock. The parasite can complete its lifecycle entirely within one host, which is capable of producing an environmentally resistant non infective cyst stage that is passed in the feces and represents the principal mode of transmission [1, 2]. *Giardia*sis is particularly common in developing and low-income areas, where poor sanitation and hygiene enable large scale waterborne and environmental contamination with infective cysts [3]. Clinically, *Giardia*sis presents with a broad spectrum of symptoms; however, diarrhea and abdominal pain, anorexia, and progressive loss of body weight are the most common [4].The life cycle of *Giardia* includes two morphologically different stages. The trophozoite is pear-shaped with four pairs of flagella for movement and a ventral adhesive disc that helps it to adhere to the intestinal epithelium, and measures 15–20µm. The cyst form, however, is spherical to ovoid in shape and does not have flagella with presence of 4 nuclei enabling to survive outside the host and in an infective form [5, 6]. Various methods are available for the laboratory diagnosis of *Giardia*sis, most notably: Conventional fecal microscopic examination (the simplest and least expensive) Immunological assays Molecular Techniques All diagnostic procedures vary in their sensitivity and specificity [**7**]. Due to the importance of *Giardia*sis on public and animal health, the current study was planned for surveying *G. duodenalis* among household dogs from Baghdad city by means of various diagnostic tests.

Materials and Methods

Ethical approval

All methods that involve animals were performed in accordance with the relevant ethical guidelines and regulations, and were approved by an animal care and use committee. The experimental protocol was approved by the Ethics Committee of College of Veterinary Medicine, Baghdad University. This study was ethically approved (G.3) 26-8-2024.

Sample collection

Two hundred fecal samples (about 10 g in weight for each) were collected from October 2024 to February 2025. Samples were collected from healthy mixed-breed male and female pet dogs that had visited a small animal private clinic in Baghdad, Iraq (based on the age of less than 6 months and above 6 months) were considered as, young dogs, and adult dogs respectively. Feces were obtained fresh after spontaneous defecation immediately at the clinic or from dogs under supervision of their owners. At sampling, collection date, age and sex were documented for all animals.

For *Giardia* detection, the fecal samples (in 5 mL sterile tubes) were fixed 70% ethanol, followed by transportation to the Parasitology Laboratory of College of Veterinary Medicine. Each specimens was portioned in three parts: A one part used for direct microscopic examination by saline wet mount technique as according to standard parasitological procedures Markell *et al.* [8]; the second part was submitted to Card Agglutination Test (BVT Co., Ltd, Lion) and the third part of stools were tested for *Giardia* antigens by means of a commercially available enzyme-linked immunosorbent assay (ELISA) kit (IVD Research, Inc.).

Statistical analysis

Statistical analysis was conducted using SPSS software version 26. The differences between the groups were studied to determine whether the variations in infection rates, for each of the variables tested, were significant.

Results

In microscopic analyses, it *Giardia* cysts were detected in dog fecal samples observed that *Giardia* cysts in dog feces are positive. The cyst form was described morphologically as having 2 to 4 nuclei, contracted cytoplasm with paired axonemes and 2 median bodies (Figure 1). Sex distribution of *Giardia* infection (Table 1) shows the sex distribution of *Giardia* infection determined by three diagnostic methods- direct microscopic examination, Card Agglutination Test and ELISA in this study. The prevalence rates on the whole *Giardia*sis in dog were found 18 % (36/200), 20.5 % (41/200), and 24.5% (49/200) respectively and comparative results were presented in (Figure 2). From microscopic examination, 16 females (17.77 %) and 20 males (18.18%) tested positive for *Giardia*. There was no statistically significant association between sex and the infection (χ^2 = 0.005; P = 0.94). Similarly, card agglutination test detected infection in 21 (23.00%) females and 20 (18.18%) males. Prevalence was slightly, but not statistically significantly, higher in females (χ^2 = 0.81, P = 0.37). ELISA positive for *Giardia* antigens was detected in 23 (25.55%) females

and 26 (23.63%) males. Similar comparison was made and there were no significant differences in sex ($\chi^2 = 0.10$, P = 0.75) in the later comparisons as well. The overall prevalence of *Giardia*sis was not significantly ($p > 0.05$) sex-associated with respect to the type of method used for diagnosis and therefore no significant sex difference in susceptibility to *Giardia*sis was observed over both sexes (male and female).

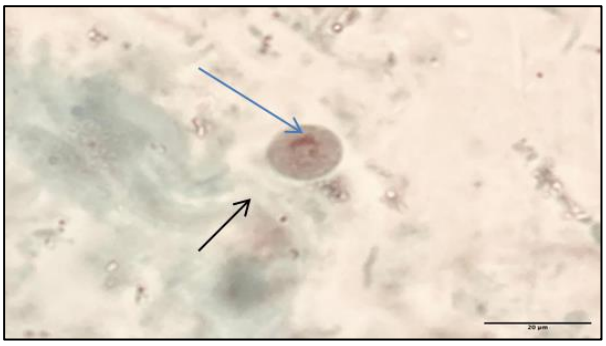
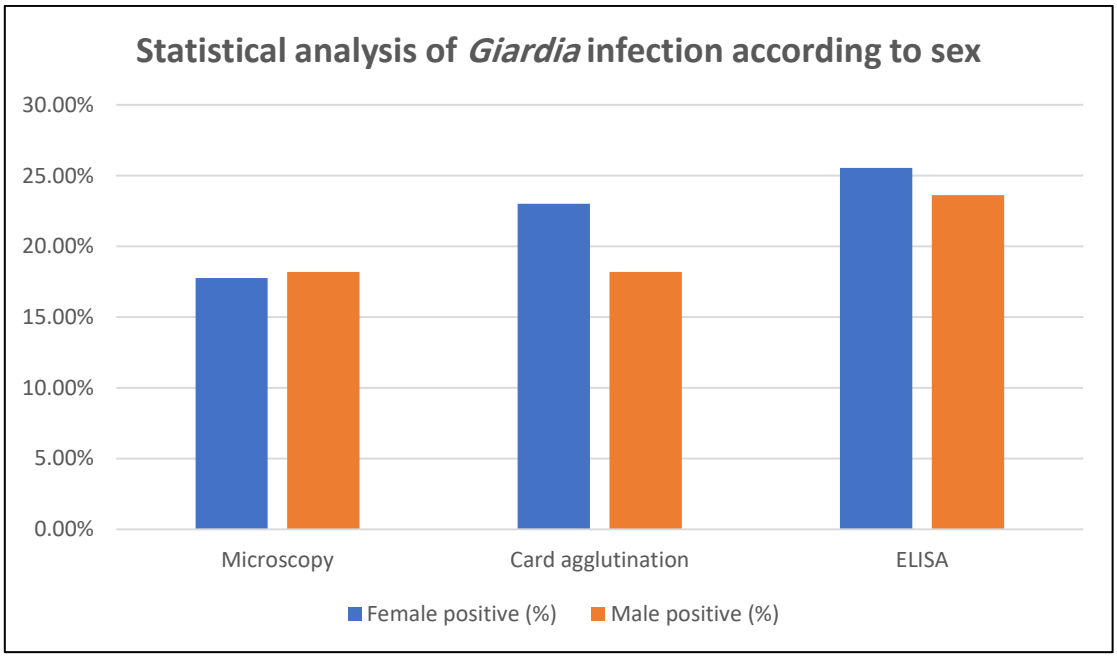


Figure1. (Black arrow), Cyst of *Giardia* ,(blue arrow) nuclei by direct smear (X100)

Table 1: Infection rate of *Giardia* in domestic dogs according to sex

Sex	Dogs	microscopic exam. infected (%)	Card Agglutination infected (%)	ELISA infected (%)
Female	90	16(17.77%)	21(23%)	23(25.55%)
Male	110	20(18.18%)	20(18.18%)	26(23.63%)
Total	200	36(18%)	41(20.5%)	49(24.5%)
Pv		0.94	0.37	0.75
χ^2		0.005	0.81	0.10
χ^2 test showed no significant difference between male and female dogs (P > 0.05).				



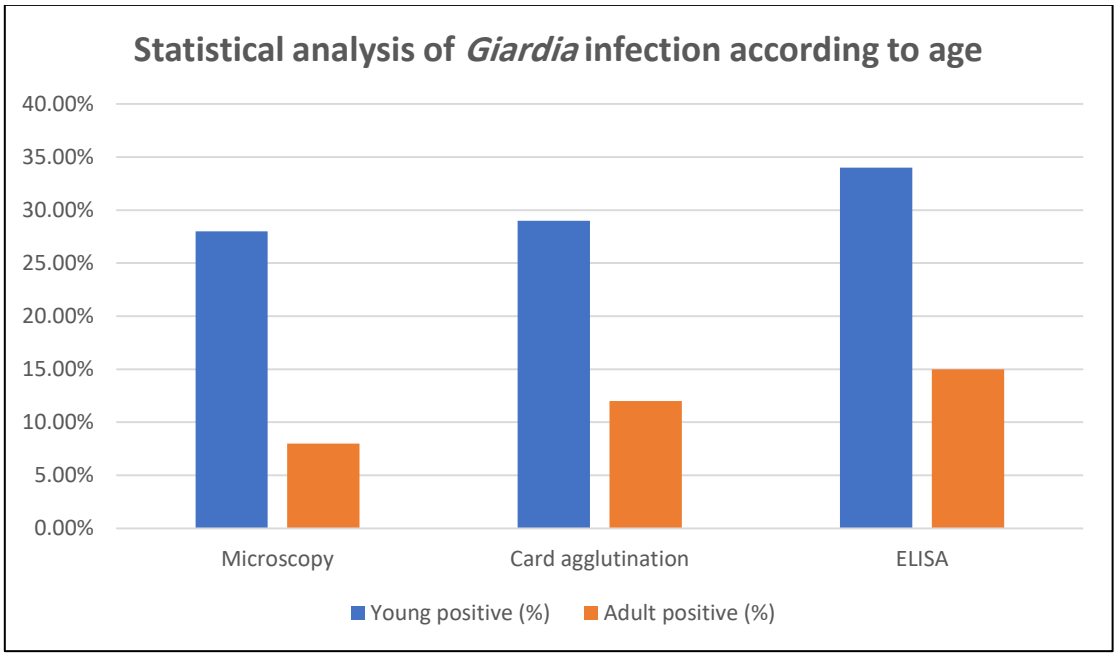
Figrue2.Statistical analysis of *Giardia*

Infection rate of *Giardia* in domestic dogs according to age:

Microscopically the infection rate seemed to be very high in young dogs (28%) compared with adults (8%). The difference between the two age groups was statistically significant ($\chi^2 = 12.50$, P < 0.001). Older animals (adult dogs) were less infected as demonstrated by higher positives in the younger group 31% of young and 13% adult dogs ($chi^2 = 9.09$, P = 0.003). ELISA was the most sensitive examination and its examination frequency in young and older dogs were 34% and 15%, respectively (Table 2) and (Figure 3). This difference was significant ($\chi^2 = 9.76$, P = 0.0018). These findings support the belief that younger ages are more vulnerable to *Giardia* activity, regardless of the diagnostic test.

Table 2. Infection rate of *Giardia* in domestic dogs according to age

Diagnostic method	Young/<6 months positive (%)	Adult/6 months-2 years positive (%)	χ^2	P-value
Microscopy	28/100 (28%)	8/100 (8%)	12.50	<0.001
Card agglutination	29/100 (29%)	12/100 (12%)	8.64	0.003
ELISA	34/100 (34%)	15/100 (15%)	9.76	0.0018
χ^2 test showed a highly significant difference between young and adult dogs (P < 0.01).				



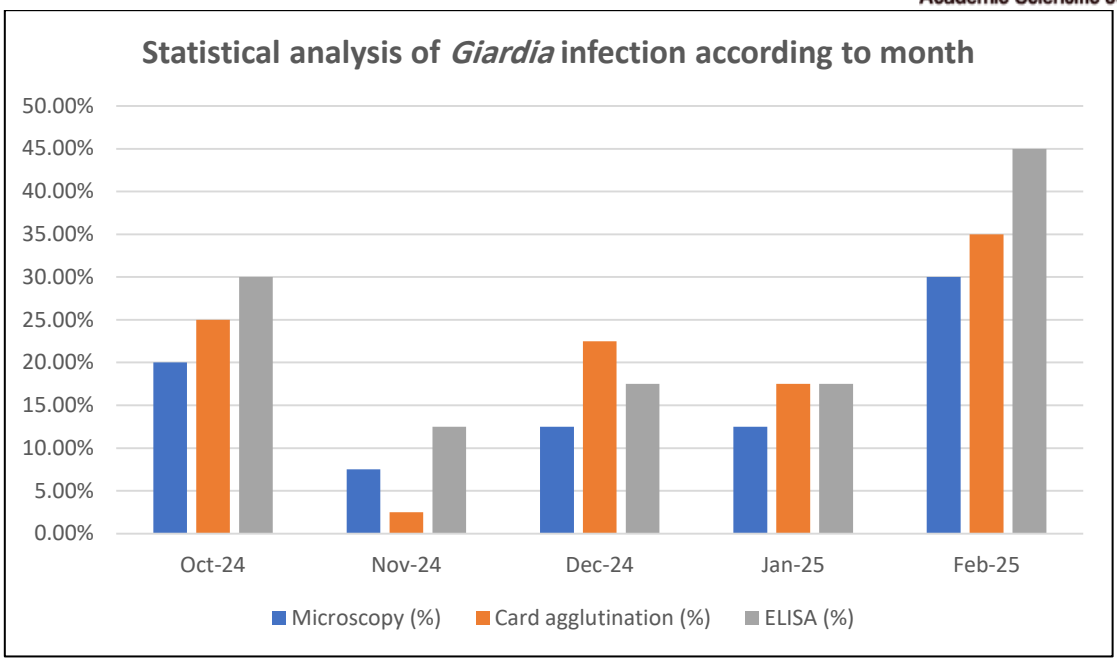
Figrue3**.** Statistical analysis of *Giardia* infection according to age

Infection rate of *Giardia* in domestic dogs according to Months

The monthly distribution of *Giardia* infection between October 2024 and February 2025 is described in (Table 3) and (Figure4). The number of dogs presented in each month was 40. The microscopic examination revealed that the monthly prevalence was the highest in February (30%) while it was lowest during November (7.5%). Agglutination card and ELISA also behaved in the same pattern, with the highest prevalence for February (35%, 45%, respectively). Chi-square testing indicated a temporal effect of *Giardia* transmission, with no independence between infection rates and months (χ^2 = 16.19, P = 0.003).

Table 3. Infection rate of *Giardia* in domestic dogs according to Months

Month	Microscopy (%)	Card agglutination (%)	ELISA (%)
October 2024	8/40 (20%)	10/40 (25%)	12/40 (30%)
November	3/40 (7.5%)	1/40 (2.5%)	5/40 (12.5%)
December	5/40 (12.5%)	9/40 (22.5%)	7/40 (17.5%)
January 2025	5/40 (12.5%)	7/40 (17.5%)	7/40 (17.5%)
February	15/40 (30%)	14/40 (35%)	18/40 (45%)
χ^2 test indicated statistically significant differences in the prevalence of *Giardia* infection between months with February reporting highest rates (P < 0.01).			



Figur4. Statistical analysis of *Giardia* infection according to month

Discussion

Giardia is an intestinal flagellate protozoan of worldwide distribution, infectious to humans and many kinds of animals, both domesticated and wild [9]. Although based on direct microscopy, in the current study, a prevalence of 18% against *Giardia* observed among the households' dogs were evident to confirm presence these parasites in study area. This result is similar to the previous epidemiological study conducted in Japan (14.6%) by [10] and in Yugoslavia (14.4%) in study of [11]. Higher frequencies were reported in previous Iraqi studies but still under the present result, where 26% by [12] recorded from dogs of Nineveh Province and 40% recorded by [13] from Basrah City. However, infection rates are at the opposite end of the scale in North America, where [14] reported prevalence in dogs to be 7.2%.

The difference in prevalence rates reported among various studies, including the present study, may be attributed to a number of factors including geographical and climatic differences, variation in dog population and size of the sample studied, Nutritional quality و management practice, differences in sensitivity and specificity of diagnostic techniques used. In the current study, 20.5%positive samples for *Giardia* infection were observed by Card Agglutination Test. This is in agreement with the results reported by [15] and [16] highlighted the practicality and time-saving of immunochromatographic tests, being helpful to improve the performance in laboratory diagnostics for *Giardia*sis. Moreover, commercially available ELISA kit (*Giardia* Microwell ELISA, USA) illustrated out an infection rate of 24.5% on antigen- detection basis of the study participants. This concurs also with ELISA prevalence data in Hungary had a 58.8% prevalence [17]. These findings are consistent with higher sensitivity of ELISA technique for detection of sub-clinical and low-level infections when compared to routine microscopy.

In relation to host factors, the infection rate of *Giardia* was not significantly different between female and male dogs, indicating that gender does not seem to be a key factor influencing susceptibility. This is in agreement with previous work [18]. Age was, however, recognized as the main risk factor as dogs up to six months age had a much higher infection rate than adults. This pattern agrees with other reports [2, 19] and indicates that young dogs young dogs may contribute substantially to environmental contamination by cyst shedding, risk of zoonotic infection for humans. The higher sensitivity detected in younger animals could be related to a gradual development of acquired immunity with age and to behavioral factors, such as typical chewing or licking behavior exhibited by dogs over objects potentially contaminated based on the report from [20].

Seasonal variation was also reported in this study, and the highest infection rate was recorded in February which consistent with that by [21]. Such a seasonal trend may be attributed to lower temperatures in the environment (which are more conducive for cysts to survive longer) and thus facilitating transmission into better transmission dynamics.

Conclusions

The findings of the current study underscore the need for ongoing monitoring of *Giardia*sis in pet dogs, especially among younger animals and during times of lower ambient temperature. Strengthening public education programs, as well as the practice of preventive measures such as good hygiene and regular veterinary check-ups, are necessary to decrease dog-to-human risk of zoonotic transmission within Baghdad city.

Conflict of interest

They have no conflict of interests.

Acknowledgement

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Declaration of interests

The authors have no conflicts of interest to declare.

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Publication consent

The authors agree to publication.

Data and material availability

All data analyzed during this study are included in this article.

Author contribution

The authors contributed equally to the article.

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دراسة انتشار الجيارديا بين الكلاب المنزلية في مدينة بغداد

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الملخص

خلفية البحث والهدف: الجيارديا المعوية طفيلي أولي واسع الانتشار يصيب العديد من الحيوانات والبشر.هدفت هذه الدراسة إلى تحديد مدى انتشار طفيل الجيارديا بين الكلاب المنزلية في مدينة بغداد.

المواد وطرق العمل :جُمعت 200 عينة براز من كلاب منزلية في العيادات الخاصة خلال الفترة من تشرين الاول 2024 الى نهاية شباط 2025. باستخدام ثلاث طرق تشخيصية: الفحص المباشر للبراز، واختبار التراص على البطاقة، واختبار المقايسة المناعية الإنزيمية المرتبطة (ELISA) .

النتائج: بلغ معدل انتشار الجيارديا 18%، و20.5%، و24.5% باستخدام طرق الفحص المجهري، واختبار التراص على البطاقة، واختبار ELISA على التوالي. لم يُلاحظ فرقٌ ذو دلالة إحصائية ($P > 0.05$) في معدل الإصابة بين الكلاب الإناث والذكور؛ إلا أنه لوحظ انتشارٌ أعلى($P < 0.01$) بشكلٍ ملحوظ بين الجراء (أقل من 6 أشهر) مقارنةً بالكلاب الأكبر سنًا (بين 6 أشهر وسنتين). بلغت نسبة الإصابة ذروتها في شباط (37.5%، 35%، و45%) وفقًا لطرق التشخيص الثلاث، بينما كانت أدنى نسبة في تشرين الثاني (7.5%، 2.5%، و12.5%).

الاستنتاجات : يُشكل الانتشار المرتفع نسبيًا لداء الجيارديات في الكلاب المنزلية خطرًا كبيرًا على الصحة العامة. لذا، يُوصى بشدة بتطبيق برامج فحص تشخيصي دورية للكلاب المنزلية للحد من خطر انتقال العدوى من الحيوان إلى الإنسان في مدينة بغداد.

الكلمات المفتاحية: داء الجيارديا، مجهريا ،الفحوصات المناعية، الكلاب.