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PREVALENCE OF *GIARDIA LAMBLIA* AMONG RESIDENTS OF HAWLER, SORAN AND CHAMCHAMAL CITIES, NORTH OF IRAQ



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Abstract

Giardia lamblia is an intestinal protozoan pathogen with high prevalence in developing countries, especially among children. The majority of *Giardia lamblia* infections are asymptomatic. However, especially in some children, giardiasis is associated with sub-acute or chronic diarrhea and intestinal irritation. This study was conducted to investigate the prevalence of *Giardia lamblia* in Hawler, Soran and Chamchamal Cities, North of Iraq. A total of 5258 samples were examined for detection of *Giardia lamblia* in Hawler, Soran and Chamchamal from July, 2018 to February, 2019 using direct microscopic examination. The data collected were coded, using a specially designed coding system and entered into Microsoft Excel sheets and then imported to a data management solution, statistically package for social sciences (SPSS) version 23. Out of 5258 samples examined, 219 (4.2%) were positive for *Giardia lamblia* by direct microscopic examination. The prevalence rate of *Giardia lamblia* among males (4.6%) was higher than females (3.4%) with a statistically significant difference. Highest rate of giardiasis was recorded in Chamchamal (8.5%), while the lowest rate was recorded in Soran (3.3%) and the difference was statistically significant. In prevalence of *Giardia lamblia* according to months, the results showed no significant differences, in spite of the highest rate of infection was recorded in July (4.9%) and lowest rate was observed in November (3.2%). Finally, in prevalence of giardiasis in both Chamchamal and Soran, there were higher infection rates in females in comparison to males, while in contrast to that, Hawler had higher male rates than females, and the result showed a statistically significant difference. In our study we concluded that giardiasis is more common among males than females. We also concluded that the rate of infection was affected by location and the technique used in hospitals and laboratories.

Keywords: Prevalence, *Giardia lamblia*, Residents, Hawler, Soran, Chamchamal, Iraq

INTRODUCTION

Giardia lamblia (synonymous: *Giardia duodenalis* and *Giardia intestinalis*) is unicellular eukaryotic microscopic enteric protozoa (1, 2). Giardiasis is a common intestinal disease that causes waterborne diarrhea (3). Also *G. lamblia* is responsible for traveler's diarrhea (Acute diarrhea) which is the most common illness among travelers, defined as the

passage of 3 or more unformed stools in 24 hours with at least one of the symptoms including fever, vomiting, nausea, abdominal cramps, tenesmus or bloody stools (4).

G. lamblia has a very simple life cycle of two-stages: trophozoite and cyst (5). Cysts are resistant forms and are responsible for transmission of giardiasis, both cysts and trophozoites can be found in the feces (Diagnostic stages). The cysts are hardy and can survive several months in cold water, infection occurs by ingestion of cysts in contaminated water, food, or by fecal-oral route (6). Giardia lives and replicates asexually on the small intestine's surface of hosts (7). Once excystation occurs, Giardia trophozoites use their flagella to "swim" to the microvillus-covered surface of the duodenum and jejunum, where they attach to enterocytes using a special disk located on their ventral surface (8). In addition, lectins on the surface of Giardia bind to sugars on the surface of enterocytes (9).

Giardia trophozoites scavenge nutrients in the intestinal lumen for sustenance and growth, glucose appears to be the primary energy source, with other sugars appearing not to be utilized, the amino acids alanine, arginine, and aspartate are readily used by Giardia trophozoites for energy production. It appears Giardia lacks the ability to synthesize most amino acids and is thus dependent on scavenging them from the intestinal lumen (10). The attachment process damages microvilli which interfere with nutrient absorption, rapid multiplication of trophozoites eventually creates a physical barrier between the enterocytes and the intestinal lumen, further interfering with nutrient absorption (8).

According to the most recent studies, giardiasis is a complex of pathophysiological alterations; one of them is the changed permeability of enterocytes (7). *G. lamblia* is the best as the organism responsible for "Beaver Fever" or "Backpacker's Diarrhea" because of its proliferation in streams and rivers, *G. lamblia* can completely destroy the surface of the mucosal barrier and subversion in small intestine barrier causes inflammation, reduction of surface area for nutrient absorption, lactose, sucrose intolerance and inability to digest fats and oils (11).

Giardiasis is typically characterized in humans by diarrhea, steatorrhea, maldigestion, abdominal cramps, bloating and weight loss (12). In chronic disease there may be evidence for malabsorption of fat, vitamin A & B12, protein, D-xylose, iron and lactose (13). Giardiasis is associated with poor sanitary conditions, insufficient water treatment, daycare centers and with institutional facilities such as nursing homes (14). Our study aims to investigate the overall prevalence of *G. lamblia* infection in Kurdistan Region, distribution of *G. lamblia* according to months, sex and locations.

MATERIAL AND METHODS

STUDY POPULATION

This surveillance study was carried out in Hawler City, Chamchamal and Soran during the period of July, 2018 to February, 2019. A total of 5258 samples were collected

(n=3532 males and n=1726 females) from different age groups, which were chosen randomly to include in this study.

SAMPLE COLLECTION

Fecal samples were collected in clean, dry plastic cap with wide opening and tight cover to prevent drying of sample and avoid contaminate it with urine which could kill trophozoites in fecal samples (15). Each sample was labeled with date, name and sex of the person (16).

MACROSCOPIC EXAMINATION

The stool specimens were examined by naked eye for presence of the color, consistency, blood, mucus and the nature of the feces (17).

MICROSCOPIC EXAMINATION

The samples were processed immediately without preservation. Two smears of direct wet film preparation were done for each sample at the same time and 1 slide was used for normal saline (0.85%) for detecting the actively motile trophozoites and Lugol's iodine (5%) for demonstrating the internal structures (18, 19). The average time between sample collection and processing was 20 minutes (20). Using clean, wood stick, the fecal specimen was touched in various sites, especially where streaks of blood or pus were noticed, then mixed thoroughly with each drop of normal saline and lugol's iodine agents on the prepared slides. After that, each slide was covered with a cover slip and the smear was examined thoroughly under the low (X 10) and high (X 40) powers of the microscope (12).

DATA ENTERING AND STATISTICAL ANALYSIS

The data collected were coded using specially designed coding system and entered into the Microsoft Excel sheets and then imported to a data management solution, Statistical Package for Social Sciences (SPSS) version 23.0. The association between two variables in this study was analyzed and assessed by chi-square test, while frequency analyses used for describing counting numbers and percentages of different variables. The T-test used to investigate the difference between two groups and $p \leq 0.05$ was considered statistically significant.

RESULTS

OVERALL PREVALENCE OF *GIARDIA LAMBLIA* INFECTION BY DIRECT MICROSCOPIC EXAMINATION

A total of (5258) fecal samples were examined for *Giardia lamblia* infestation in this study by direct microscopic examination. The overall percentage of infestation was (4.2%), while the remaining (95.8%) were negative as seen in Figure 1.

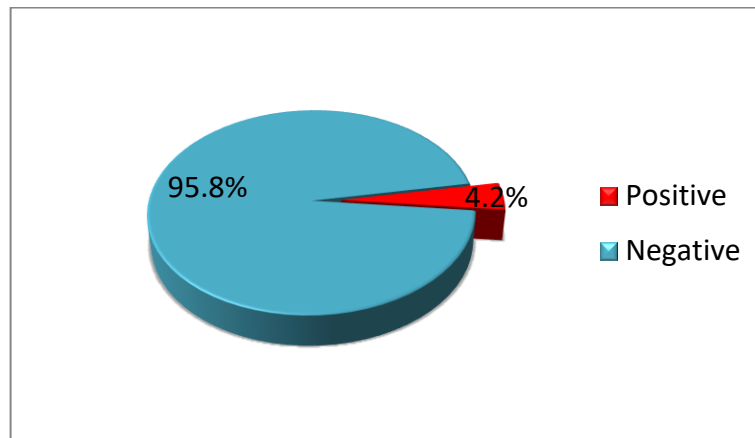


Fig. 1. Total prevalence of *Giardia lamblia* infection

RESIDENCE WISE PREVALENCE OF *GIARDIA LAMBLIA* INFECTION

As represented in Table I, the highest rate of infection was observed in Chamchamal which had a positive result of (8.5%) followed by (3.6%) in Hawler and the lowest rate of infection was observed in Soran which was (3.3%). The difference was statistically significant ($p = 0.001$).

Table I. Prevalence of *Giardia lamblia* infection in Kurdistan Region north of Iraq

Risk factor	Total no. of samples	No. +ve	+ve %	No.-ve	-ve (%)	<i>p</i> value
Gender						
Male	3532	161	4.6	3371	95.4	0.041
Female	1726	58	3.4	1668	96.6	
Total	5258	219	4.2	5039	95.8	
Residency						
Hawler	3616	131	3.6	3485	96.4	0.001
Soran	981	32	3.3	949	96.7	
Chamchamal	661	56	8.5	605	91.5	
Total	5258	219	4.2	5039	95.8	
Month						
July, 2018	535	26	4.9	509	95.1	0.745
August	533	23	4.3	510	95.7	
September	737	31	4.2	706	95.8	
October	867	40	4.6	827	95.4	
November	716	23	3.2	693	96.8	
December	574	24	4.2	550	95.8	
January, 2019	607	20	3.3	587	96.7	
February	689	32	4.6	657	95.4	
Total	5258	219	4.2	5039	95.8	

* $p < 0.050$ (Significant)

PREVALENCE OF *GIARDIA LAMBLIA* INFECTION ACCORDING TO THE MONTHS OF STUDY

As shown in Table I and represented in Figure 2, statistically no significant differences (p value=0.745) were recorded in infection caused by *G. lamblia* according to the months.

Highest rate of infection was observed in July (4.9%) while the lowest rate was observed in November (3.2%).

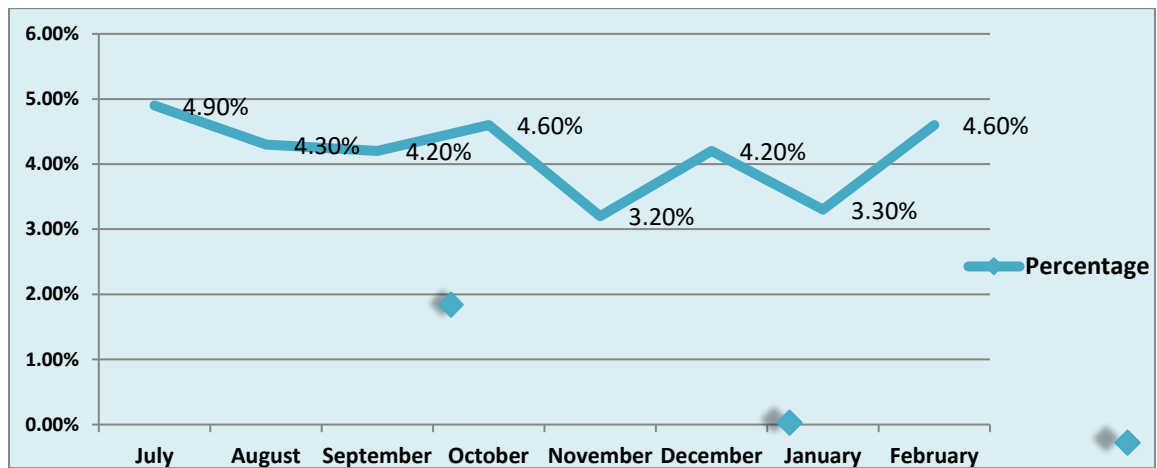


Fig. 2. Prevalence of *Giardia lamblia* infection according to the months of study

PREVALENCE OF *GIARDIA LAMBLIA* INFECTION AMONG MALES AND FEMALES IN RELATION TO THE RESIDENCY

Statistically significant differences ($p=0.001$) were recorded in infection among males and females in relation to residency. Higher female rates than males were observed in Chamchamal (10.1%) and Soran (3.4%). While in contrast to that, Hawler had higher male rates (4.5%) than females (Table II).

Table II. Prevalence of *Giardia lamblia* infection among males and females in relation to their residency

City of residence	Total no. of samples		Number & % of infected samples	
	Male	Female	Male	Female
Hawler	2512	1104	114 (4.5%)	17 (1.5%)
Soran	657	324	21 (3.2%)	11 (3.4%)
Chamchamal	363	298	26 (7.2%)	30 (10.1%)

$p = 0.001$

* $p<0.050$ (Significant)

DISCUSSION

Diarrheal diseases including giardiasis are more common among people in developing countries and they are responsible of a considerable amount of morbidity and death rates particularly among children, based on report received by WHO and UN. The diarrheal diseases are still the most common cause of death among children under five years of age worldwide (3).

The differences in these results might be due to environmental, nutritional, socioeconomic, geographical conditions, demographic and health-related behavior as well as number of patient samples in screening study and the diagnostic method which is used (29). In this study the infection rate was found to be higher among males (4.6%) than female (3.4%) (Table 1) and this difference was statistically significant ($p=0.041$). Similar

results were obtained by other studies carried out in Basra (16) and in Kashmir Valley, India (27), while another similar study conducted in Baghdad Province/Iraq (30) have shown no significant difference between male and female positive rates of *Giardia lamblia* infection.

The cause of increase in male infection rate belonging to those who visit out clinic and inpatient in the hospital in contrast with number of females, and maybe due to the role of social habitat in this case, such as more care to males than females (15). This also probably was because males are more exposed to unhygienic conditions in fields during outdoor activity while females may remain in houses (31).

The highest occurrence of *Giardia lamblia* infection was in Chamchamal City which had 8.5% followed by 3.6% in Hawler and the lowest rate was observed in Soran 3.3% (Table 1). The differences were statistically highly significant ($p=0.001$). Our results were in agreement with other studies in Iraqi provinces (31) and in northern Jordan (32). In contrast to our findings, a study conducted in Samara City by Al-Ammash 2015 (15) has shown no significant differences in prevalence of *Giardia lamblia* infection according to residency.

The higher rate which was observed in Chamchamal could be due to the nature of life (drinking water from unhygienic sources as river or streams, contact with animals as well as use of their untreated droppings to fertilize vegetables) that increases incidence of infection (15). Another reason for this high prevalence could be the sample size and technique used for diagnosis in addition to the experience of laboratory technicians for examining the samples.

Our study showed that there was no relation between *Giardia lamblia* infection and season (months of study), though the highest rate was observed in July (4.9%) and the lowest rate was observed in November (3.2%) with p value=0.745 (Table I). This result was in consistent to a study done in Nineveh, Iraq (33). While in disagreement with a study in Basrah – Iraq (34) where they observed a significant difference between *Giardia lamblia* infection and period of study (months). The differences in the percentage of infection were related to various factors such as number of samples, environmental condition, age, gender, immunity status and stress (33).

We also observed in our study that there was a highly significant difference in the prevalence of giardiasis among males and females in relation to residency, $p=0.001$ (Table II). Male rate in Hawler was 4.5% which was higher than females. In contrast, Chamchamal (10.1%) and Soran (3.4%) higher female rates were observed comparing males. Our study was disagreed with the results reported by a study done in East-South Baghdad (35). This might be due to the female gender as a risk factor for giardiasis could be related to the women's role as caretakers of children and direct contact with infected children and changing diapers. Nursing has been identified as a risk factor for giardiasis in the communities where the infection rate is high in children, thus, there might be some

differences in the transmission routes of human giardiasis between males and females living in the same area (36).

CONCLUSION

In our study we concluded that the incidence of *Giardia lamblia* infection was low (4.2%). There was a significant effect of gender and residency on the prevalence of giardiasis. But no significant difference was observed in infection according to months.

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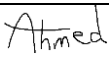
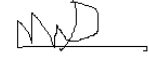
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