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Prevalence of Giardia lamblia among children in Sulaimani city, Iraq

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Abstract--Intestinal protozoan parasites *Giardia lamblia* (G.L) (*Giardia duodenalis*, *G. lamblia*, or *G. intestinalis*) is a flagellated zoonotic parasite are extremely common in impoverished nations, posing major public health risks. The majority of *Giardia lamblia* infections are asymptomatic. However, sometime abdominal pain, diarrhea, and fever are the most common clinical symptoms of giardiasis, especially in children. The aim of this study was to investigate the prevalence of G.L among children in Sulaimani city, North of Iraq. This study was conducted from January to April 2022. The incidence of giardiasis was investigated in Jamal Ahmad Rashid Pediatric Teaching Hospital. A total of (6600) samples from general stool exam (GSE) by direct microscopic examination were studied. Male and Female, Personal Hygiene, and Eating Habits were all investigated in order to identify a link between giardiasis prevalence and these characteristics. Out of 6600 samples of GSE examined, 19 (0.2%) were positive for *G.L*. The prevalence rate of *G.L* among males were 11 (57.9%) which is higher than female 8 (42.1%). In prevalence of *G.L* according to months, the highest prevalence rate was recorded in April and the lowest prevalence rate were in January and February for both (males and females). In conclusion, *Giardia lamblia* still one of the public health risks in children and giardiasis is more common among males than females.

Keywords---prevalence, *Giardia lamblia*, intestine infection, children, Sulaymaniyah, Iraq.

Introduction

Giardia lamblia (G.L) is a common intestinal parasite infecting a broad range of vertebrate species, including humans [Monis *et al.*, 2003]. Commonly found in the intestinal tract of humans and animals, resulting in large numbers of gastrointestinal infections. *Giardia duodenalis*, *G. lamblia*, or *G. intestinalis*) is a flagellated zoonotic parasite [Einarsson *et al.*, 2016]. Because of the genetic changes between isolates infecting different hosts, the protozoan is officially classified as a complex species [Monis and Thompson, 2003]. The fundamental life cycle of *Giardia* species (G.LSPP) comprises of two active trophozoites and cystic forms. This parasite spreads through the fecal-oral pathway by consuming infected cysts directly or indirectly. The incubation period after consuming cysts is 9 to 15 days [Cacciò and Ryan, 2008]. Enteric parasites are a major cause of diarrhea and other gastrointestinal problems worldwide [Ryan *et al.*, 2017]. It is the most prevalent parasite infection of the gastrointestinal tract in humans, with a wide range of symptoms ranging from asymptomatic carrying to long-term diarrhea with malabsorption [Samie *et al.*, 2009]. The severity of symptoms varies, which could be due to both host and parasite variables [Colli *et al.*, 2015]. In

around half of the instances, infection is asymptomatic, whereas symptomatic patients may experience severe diarrhea with vomiting, bloating, nausea, and/or exhaustion, and children may experience stunted growth. Worldwide, up to 280 million people are estimated to be infected with *Giardia duodenalis* [Einarsson *et al.*, 2016].

It was reported that the prevalence of G.L in humans ranges between 0.4% and 7.5% in developed countries, and between 8% and 30% in developing countries [Feng and Xiao, 2011]. Giardiasis is a parasite ailment that affects both children and adults in all parts of the world [Savioli *et al.*, 2006]. Children in poorer nations with poor sanitation and hygiene are more prone to the clinical effects of G.L infection [Feng and Xiao, 2011]. The harmful effect of giardiasis on growth and development in children has been observed in several studies and the potential effects of chronic malnutrition on cognition, intelligence, and psychomotor development have also been described [Simsek *et al.*, 2004]. Correct diagnosis of giardiasis is important for treatment and prevention of diseases. The laboratory diagnosis of G.L is mainly based on finding and demonstration of microscopic cyst in stool samples, but immunological-based assay and molecular methods also are available and are used for diagnostic or research purposes in developed countries. All diagnostic methods provide different sensitivity and specificity. This condition depends on some factors such as the method of test, the skill of operations, and the stage that the test has been performed [Elmi *et al.*, 2017]. Another method was developed in 2012 to detect and differentiate assemblages A and B in human fecal samples. The method involves a single-step polymerase chain reaction (PCR) using assemblage-specific primers and relies on the differences in PCR product sizes for assemblages A and B visualized by gel electrophoresis. This method has proven robust for detecting mixed infections and in terms of applicability in laboratories with basic molecular equipment [Vanni *et al.*, 2012]. The aim of this research is detected prevalence of the *giardia lamblia* in Sulaimani in Jamal Ahmed Rashid Pediatric teaching hospital from January to April 2022.

Material and Methods

Study Population

This surveillance study was carried out in Sulaimani city of January to April 2022. A total of 6600 samples were recorded from different age groups of the children who visited Jamal Ahmad Rashid Pediatric Teaching Hospital. In this hospital, about (50-60) GSE tests is done daily, which is nearly 55 samples per day so it is equal to 1650 tests per month as shown in letter F in Table (1).

Sample Collection and Examination

The fecal samples were collected in clean, dry, plastic cap with wide opening and tight cover to prevent drying of samples and avoid contamination. The stool samples were examined macroscopically by naked eye for presence of color, blood, consistency, mucus, and nature of the feces. The samples were also examined by general stool examination (microscopic examination). Samples contain G.L cysts and/or trophozoites were regarded as positive for giardiasis.

Statistical Analysis

The data regarding gender, age groups of children collected. Data generated from this work were tabulated into Microsoft excel sheets. The results were presented as number and percentage. Results

Table 1: Prevalence of *Giardia lamblia* among male in Sulaimani Jamal Ahmad Rashid pediatric teaching hospital from January 2022 to April 2022.

Month	Age	Giardia Cyst	Appearance	Color	Undigested Food	Mucus	PH	Pus Cell	RBC	Bacteria	Manila	Oil Droplet	Total case	Symbols
January	7Y/11M/27 D	+	S	B	N	N	8	N	++	+	SE	N	2	A
January	2Y,8M2D	+++	SS	Y	N	N	7	1-2	N	+++	+	N		
February	6Y,8M,13D	SE	S	Y	N	N	7	N	N	+	+++	N	2	B
February	7Y.1M.23D	SE	S	B	N	N	7	N	N	++	+++	N		
March	8M,19D	+	SS	Y	N	N	6	N	2-3	+++	F	SE	3	C
March	4Y,1M,28D	+++	S	B	++	N	9	N	N	+	+++	N		
March	2Y,4M,1D	++	SS	Y	N	N	7	N	N	++	+	N		
April	1Y,3M,20D	++	L	G	N	N	7	N	F	+++	+	+	4	D
April	11Y,9M,20D	+	SO	Y	F	N	7	SE	0-1	++	++	N		
April	10Y,9M,2D	+++	SS	Y	F	N	7	1-2	N	SE	F	N		
April	4Y,6M,12D	+	S	Y	F	N	7	N	N	++	++	SE		

Notes: B = Brown, Y = Yellow, G = Green, S = Soft, SSM = Semi Soft Mucoid, SS = Semi Soft, SO = Solid, L = Liquid, SE = Seen, N = Negative. F = Few, YMD = Year Month Day of age, Note 1: Each plus equals to 10, A = Total case of *Giardia lamblia* (G.L) from January 2022, B = Total case of G.L from February 2022, C = Total case of (G.L) from March 2022, D = Total case of (G.L) from April 2022, Note 2: statistics of people Sulaimani (center) data 1,100,000 people nearly, Note 3: About general stool examination (GSE) data of Jamal Ahmad Rashid pediatric teaching hospital every day nearly have (50-60) samples, E = Mean of GSE test = $50 + 60 / 2 = 55$ test in one day, F = Number of GSE in one month = $55 * 30 = 1650$ test in one month, G = Percentage (%) of infection per number of GSE in male, $G = \text{number of infection male} / \text{total number of GSE} * 100$, $G = A / F * 100$, $G = 2 / 1650 * 100 = 0.1$. H = Percentage (%) of infection per number of GSE in female, I = Percentage (%) of infection of population number of Sulaimani city (center) in Male, $I = \text{Number of case male} / \text{Population number of Sulaimani city (center)} * 100$, $I = 2 / 1,100,000 * 100$, $I = 0.0001$. J= Percentage (%) of infection of population number of Sulaimani city (center) in female, K = Total male case from 4 months, L = Total female case from 4 months.

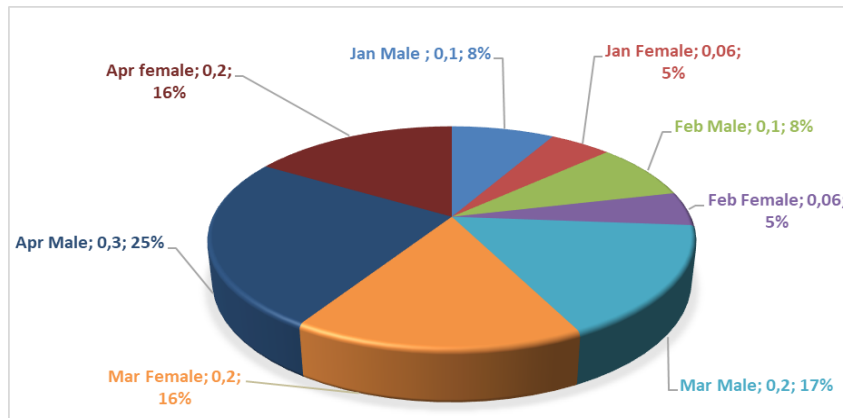
Table 2: Prevalence of *Giardia lamblia* among female in Sulaimani city from January 2022 to April 2022.

Month	Age	Giardia Cyst	Appearance	Color	Undigested Food	Mucus	PH	Pus Cell	RBC	Bacteria	Manila	Oil Droplet	Total case	Symbols
January	8Y,11M,14D	+	S	Y	+	N	7.3	1-2	N	++	+	SE	1	A
February	2y,3M.14D	+	S	B	+	N	8	1-2	N	++	+	SE	1	B
March	1Y.8M.13D	SE	S	B	F	N	7	N	N	+++	++	N	3	C
March	3Y.5M.18D	SE	S	Y	F	N	7	N	N	+++	++	N		
March	6Y,9M,11D	+	L	Y	++	N	7	N	N	++++	++	SE		
April	1Y,9M.22D	SE	S	Y	+	N	7.1	2-3	N	N	F	SE	3	D
April	6Y,9M,20D	+	S	Y	N	N	7	N	1-2	+++	++	N		
April	8Y,7M,23D	SE	S	Y	+	N	7	2-3	N	N	F	SE		

Table 3: Prevalence of *Giardia lamblia* among male and female in Sulaimani city from January 2022 to April 2022

Month	Case of male	Case of female	G %	H %	I%	J%
January	2	1	0.1	0.06	0.0002	0.0001
February	2	1	0.1	0.06	0.0002	0.0001
March	3	3	0.2	0.2	0.0003	0.0003
April	4	3	0.3	0.2	0.0004	0.0003
Giardia lamblia	K	L	Sulaimani city (center)			
	11	8				

Figure 1: Prevalence of *Giardia lamblia* among male and female in Sulaimani city from January 2022 to April 2022



Discussion

The present study is a record of the prevalence of giardiasis among children in Jamal Ahmad Rashid Pediatric Teaching Hospital in Sulaimani, Iraq. In this hospital, about (50-60) GSE tests were done daily which is nearly 55 samples per day so it is equal to 1650 tests per month as shown in letter F in Table (1). *Giardia lamblia* (*G.L.*) is a medically significant gastrointestinal protozoan that causes diarrhea in those who do not have access to clean drinking water. In underdeveloped nations, acute diarrhea is the leading cause of mortality and morbidity among children, particularly those under the age of five [Hoge *et al.*, 1995]. In the present study, out of 6600 samples of GSE examined, 19 (0.2%) were positive for *G.L.* In prevalence of *G.L.* according to months, the highest prevalence rate was recorded in April and the lowest prevalence rate were in January and February for both (males and females) (Table 1 and Table 2).

The results are consistent with study conducted in other regions of the world [Hoge *et al.*, 1995]. Poor hygiene and toilet use, overcrowding, low child education, low socioeconomic position, and climatic status are all aspects to consider. The high prevalence rate was obtained in age groups 1-8 years, this is maybe due to they have very active playing habits in the soil, which harbors this parasite and are less mindful of some very important personal hygiene practices such as the washing of hands with soap and water before eating, after playing in soil and after toilets use [Shenoy *et al.*, 1998]. In addition, another source of infection is the in leafy vegetables such as Leek, Celery, Cress and Green onion that sold in Sulaimani city markets [Al-taie and Ali, 2009].

Buying a lot of food from street vendors some of whom do not have a proper personal hygiene practice, may be regarded as carriers of the infective parasites [Takaoka *et al.*, 2016]. In the current study, the prevalence rate of *G.L.* among males was 11 (57.9%) which is higher than female 8 (42.1%) as shown in the table 3. Percentage number of infection of *G.L.* in all GSE in both male and female in months are equals to (0.1 in January, 0.1 in February, 0.2 in March and 0.3 in April), (0.06 in January, 0.06 in February, 0.2 in March and 0.2 in April).

Percentage of infection of population number of Sulaimani city (center) in both male and female in years are equal to (0.0002 in January, 0.0002 in February, 0.0003 in March and 0.0004 in April), (0.0001 in January, 0.0001 in February, 0.0003 in March and 0.0003 in April). Our results are in agreement with the study conducted in Hawler, Soran and Chamchamal Cities North of Iraq [Khudhair, 2020], and also consistent with other study [Júlio *et al.*, 2018] but contradicts the previous study conducted in Sulaimani and Chamchamal city [Al-taie and Ali, 2009]. This is probably due to the higher activity of male children and more contact with environment outdoors compared to females.

Conclusion

The present epidemiological study is a record of the prevalence of intestinal parasites *Giardia lamblia* among children in Jamal Ahmad Rashid Pediatric Teaching Hospital in Sulaimani, Iraq. Out of 6600 samples of GSE examined, 19 (0.2%) were positive for *G.L*. The prevalence rate of *G.L* among males were 11 (57.9%) which is higher than female 8 (42.1%). In prevalence of *G.L* according to months, the highest prevalence rate was recorded in April and the lowest prevalence rate were in January and February for both (males and females). In this study, we conclude that *Giardia lamblia* still one of the public health problems in children and giardiasis is more common among males than females, and in warmer season (January) than cooler season (April) and it's require good strategies and plans to prevent distribution of these parasites.

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