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A Survey Analysis Focused on the Parasite *Giardia Lamblia* and the Role of Certain Determinants in Maysan Governorate

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Abstract

The present study was conducted to determine the prevalence of Giardia lamblia infection among the population of Maysan Governorate attending Al-Sadr General Teaching Hospital. The study had a total of 11,208 participants, of whom 280 (23.17%) were classified as uninfected, and 928 (76.82%) were classified as infected. The prevalence of the parasite was influenced by numerous factors including gender, as found in the present study: infection rate was greater in males (77.04%) compared to females (76.49%). The highest infection rate was observed in the age range of 3-5 years (92.18%) and the lowest infection rate (57.14%) was observed in the age group of children below the age of three years. Regarding residential area, the infection rate was greater in rural areas (78.82%) than in urban areas (74.55%). Season also played a varying influence. Highest infection rate was found in July (92.73%), followed by June (90.87%) and May (80%). Conversely, the lowest rates were observed in February, March, and April, at 67.26%, 55.68%, and 60.47%, respectively. It can therefore be concluded that gender, residential area, time of year, and age all have a clear impact on the prevalence of *Giardia lamblia* infection.

Keywords: *Parasite; Giardia lamblia; Diarrhea; clinical symptoms*

Introduction

Diarrhea is a health problem that people may encounter intermittently throughout the year, frequently resulting from internal, detrimental elements or lifestyle-related dangers. In certain cases, diarrhea acts as a protective biological mechanism a physiological occurrence designed to expel poisonous agents or eradicate pathogens like viruses, bacteria, and parasites from the gastrointestinal system (Al-Kalak and Al-Nuaimi, 2007). The parasite *Giardia lamblia* is a major contributor to diarrhea (Shehadeh and Al-Dabash, 2007) and accounts for millions of fatalities each year (Verweij et al., 2004). The World Health Organization has documented 200 million instances of infection by this parasite globally. The parasite invades the superior section of the small intestine in humans and some animals (Cox, 2010), resulting in a disorder referred to as giardiasis (Roberts and Janovy, 2000). The disease is more common in young people than adults and causes many repercussions such as malabsorption, weight loss, and stunted growth and development (David et al., 2011). The parasite is prevalent worldwide, especially in tropical and subtropical regions where its prevalence can reach 30% (Al-Zarfi, 2005). WHO (2000) reported that its incidence is particularly prominent in developing countries and in highly populated areas with inadequate sanitation. Furthermore, it is common in developed countries affecting about 2% of adults and 6-8% of children. In the United States and the United Kingdom, the parasite is responsible for 68% of waterborne diarrhea (Mohamadnezhad et al., 2008). The rate of infection varies between countries and even between geographical locations within a country. Rates of infection are influenced by

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factors such as age, geographic region, socioeconomic status, hygienic practices, and nutritional health (Ghandour et al., 2008). Several methods are available to identify the parasite include microscopic, immunological and molecular methods. The microscopic method is based on the detection of vegetative (trophozoite) and cystic forms of the parasite in the feces of the individual under study (Younas et al., 2008). The immunological strategy depends on the interaction of antibodies and parasite antigens (Behr et al., 1996). This molecular technique is based on the amplification of nucleic acid sequences by extracting a specific segment of DNA and making several copies of it (Marquardt et al., 2000). Giardia has been classified by its external appearance, internal architecture and the species of host it infects (Hill, 2001). Molecular studies have identified eight distinct variations which have been divided into groups A, B, C, D, E, F, G, and H. Types A and B affect humans, and types C and D impact dogs. Type E affects camels, sheep, goats, and pigs; type F targets cats; type H impacts animals; and type G has been identified in rats (Lebbad et al., 2008).

Detection of *Giardia lamblia* infection

Diagnosis of *Giardia lamblia* infection is based on the presence of clinical symptoms but a conclusive diagnosis requires specialized laboratory procedures for the detection of the parasite cysts and trophozoites such direct microscopic inspection (Younas et al., 2008). This includes preparation of a wet mount from a patient's feces sample by adding drops of physiological saline, mixing well, occasionally with the addition of an iodine stain, placing a coverslip over the slide and examination under a light microscope (Marquardt, et al., 2000). Concentration techniques can also be applied such as the flotation approach using zinc sulfate, sodium chloride or sugar solutions (Ballweber, 2001) or the sedimentation method with formalin-ethyl acetate for the detection of parasite cysts in feces (Marquardt et al., 2000). A negative result from a single stool sample analysis does not exclude infection as shedding of the parasite in stool might be intermittent (Al-Kawaz, 1992) and the sensitivity of a single stool sample analysis is rather poor (50-70%) (David et al., 2011). Hence in suspected instances, the test is usually repeated two to three times on successive days which enhances the sensitivity to 85-90% (Satoskar et al., 2009**).**

Immunological diagnostic methods

Several immunological methods have been developed for the diagnosis of *Giardia*, including the immunofluorescent antibody (IFA) assay and the enzyme immunoassay (EIA) (Mank et al., 1997). The IFA method relies on labeling *Giardi* cysts using fluorescent antibodies that bind to them (Garcia and Shimizu, 1997); this technique is particularly significant for detecting the parasite in environmental and food samples. The second method, EIA, is based on the interaction between antigens (the parasite) and enzyme-linked antibodies. This approach offers high diagnostic sensitivity, reaching up to 95% (Al-Saeed and Issa, 2010).

Molecular Methods

In the 1990s, the Polymerase Chain Reaction (PCR) technique was used as a supplementary diagnostic test. By the end of the 20th century, however, it began to replace many other techniques, having demonstrated high efficacy and excellent accuracy (David et al., 2011). As a laboratory technique, it functions by amplifying DNA copies outside of a living system essentially serving as a method for replicating DNA in a laboratory setting. Therefore, it is an important biotechnological technique to clone certain pieces of DNA and to produce many copies for different experiments and analysis (Markell et al, 1999). The autonomy of living biological systems and the accurate regulation of the quantity of DNA are two of the most important elements that have contributed to the widespread use of this approach (Marquardt et al., 2000). PCR is believed to be a highly sensitive technique able to detect an infection even when a single parasite is present in a stool sample, which is why it is a preferred strategy in epidemiological investigations (David et al., 2011). There have been many studies on molecular diagnostics of Giardia in human and animal. One of them is the study of Nikaeen et al. (2003) in which the sensitivity of PCR method was studied and it was shown that the PCR method was more sensitive than the microscopic examination in detection of the Giardia cysts. The results also showed that PCR can be utilized as a sensitive detection method for Giardia in water sources. In their study on

the detection of Giardia lamblia from stool samples using the polymerase chain reaction (PCR) method, Verweij et al. (2004) demonstrated that the application of this technique in the laboratory results in a significantly higher diagnostic accuracy of parasitic diarrheal infections compared to the microscopic examination. A review of such studies highlights the importance of this method for diagnosing parasitic infections; despite its associated costs, its high sensitivity, precision, and speed-combined with the ability to process dozens of samples simultaneously-make it an excellent diagnostic tool, particularly for epidemiological studies.

Materials and Methods

Study Groups:

Statistical data were collected regarding both inpatient and outpatient individuals at Al-Sadr General Teaching Hospital, located in the center of Maysan Governorate, to investigate the prevalence of the parasite *Giardia lamblia*. The study encompassed individuals examined over a six-month period. To gather relevant information about these individuals, a specific questionnaire was designed for each participant, covering the following details: date of examination, gender, age, and the nature of their residential area. Furthermore, the methodology for isolating the parasite from the stool samples of patients was identified, as conducted within the laboratory department (parasitology section).

Examination Methods:

1. Gross Examination

The stool sample was examined macroscopically (grossly) prior to microscopic analysis. This examination included observing the quantity, form, consistency, and color of the stool.

2. Microscopic Examination

In this method, a drop of normal saline (0.9%) was placed in the center of a glass slide. A small amount of the stool sample—approximately the size of a match head—was collected from several different parts of the specimen using a wooden stick. This was then thoroughly mixed with the drop of normal saline, and a coverslip was placed over the preparation. The samples were examined under a light microscope using a 40x objective lens to screen for the presence of the parasite.

Statistical Analysis:

The study samples were evaluated by the percentage technique, total subjects were counted, impacted and unaffected subjects were identified and their respective percentages were calculated. Furthermore, the percentages for both groups (affected and unaffected) were established according to the month of the year, age, location of residence and gender.

Results and Discussion

Parasitic Infection:

Table (1) shows the number of infected and uninfected and the associated percentages of infection with the parasite Giardia lamblia. There were 928 infected individuals (76.82% infection rate) and 280 uninfected persons (23.17%).

Table 1: shows the prevalence of the parasite within the study sample.

NO. of individuals examined	Infected		Uninfected	
	NO.	Percentage (%)	NO.	Percentage (%)
1208	928	76.82	280	23.17

The results presented in the table above indicate an infection rate of 76.82%. This figure is higher than the 50.41% infection rate reported by Jasim et al. (1997) in Diyala Governorate, and it also exceeds the rate recorded by Rhadi

(1994) in Basra Governorate. This variation in the overall prevalence of the parasite can be attributed to differences in economic and health standards across the various regions, as well as a lack of health and cultural awareness and the absence of preventive measures.

Effect of Gender:

Table (2) illustrates the number and percentage of *Giardia lamblia* infections among males and females. The infection rate for males was 77.04%, while the rate for females was slightly lower, at 76.49%.

Table 2: shows the prevalence of the parasite by gender among the study sample.

Gender	NO. of individuals examined	Infected		Uninfected	
		NO.	Percentage (%)	NO.	Percentage (%)
Males	723	557	77.04	166	22.96
Females	485	371	76.49	114	23.51
Total	1208	928	153.53	280	46.47

An examination of the results in the table above reveals that the rate of parasitic infection was higher in males than in females. This higher prevalence among males is attributed to their behavior in interacting with their surrounding environment often due to working outdoors as well as a lower tendency to adhere to hygiene practices compared to females. This finding is consistent with the results reported by Al-Bayati (2000).

Effect of Age:

In the present study the percentage of prevalence of Giardia lamblia infection were estimated in different age groups. As indicated in Table (3), the highest infection rate was in the age group 3-5 (92.18%), then the age group 12-14 (96.91%) and the lowest infection rate was in the group under the age of 3 years (57.14%).

Table 3: shows the prevalence of the parasite according to age groups among the study sample.

Age Groups	NO. of individuals examined	Infected		Uninfected	
		NO.	Percentage (%)	NO.	Percentage (%)
Under 3 years	168	97	57.14	71	42.26
3 – 5	179	165	92.18	14	7.82
6 – 8	244	184	75.41	60	24.59
9 – 11	256	151	58.98	105	41.02
12 - 14	361	332	96,91	29	8.03

Table (3) showed that the prevalence of parasitic infection was very high in age groups below 11 years old. The infection rate was modest in the 6-8 age range and lower in the 9-11 age group, in particular. The higher prevalence in children under the age of 11 years can be explained by the lower level of knowledge and understanding of personal and general hygiene and the fact that they are very active, playing and having direct contact with soil and with each other both inside and outside the home, as well as at school. The comparatively high infection rate among adults is attributed to social behaviors, frequent outdoor activities and intake of exposed and unsanitary food and beverages. These results are in agreement with the report of Abd al-Abbas et al. (2003) and also in agreement with the results obtained by Mawloud et al. (1993) in Diyala Governorate.

The Effect of the Months of the Study:

The results show a difference in the quantity and the percentage of infections along the months of the study. This is demonstrated in Table (4) which shows the number and percentage of infections with the parasite Giardia lamblia in

each month. Highest infection rate was observed in month July (92.73%) and lowest infection rate was observed in month March (55.68%).

Table 4: shows the prevalence of the parasite by the months of the year.

Months of The Year	NO. of individuals examined	Infected		Uninfected	
		NO.	Percentage (%)	NO.	Percentage (%)
February	**168**	**113**	**67.26**	**55**	**32.74**
March	**176**	**98**	**55.68**	**78**	**44.32**
April	**172**	**104**	**60.47**	**68**	**39.53**
May	**195**	**156**	**80**	**39**	**20**
June	**208**	**189**	**90.87**	**19**	**9.13**
July	**289**	**268**	**92.73**	**21**	**7.27**
Total	**1208**	**928**	**447**	**280**	**152.99**

The results of the current study indicate that the incidence of *Giardia lamblia* infection was high during the summer months, reaching 90.87% in June and 92.73% in July. This finding aligns with the research of several scholars, including Al-Nahi (1998), Al-Kubaisi (2002), and Al-Musawi (2004). The higher prevalence of the parasite during the summer is attributed to the fact that it thrives and spreads more effectively in warm climates than in cold ones. Furthermore, it may be linked to the increased presence of disease-carrying insects such as the common housefly, which acts as a mechanical vector for intestinal protozoan cysts and helminth eggs (Al-Hadithi, 2000) as well as the frequent consumption of cold refreshments and juices sold by street vendors, which can serve as a suitable medium for the transmission of the parasite.

The Impact of the Nature of the Residential Area:

Table (5) illustrates the relationship between the nature of the residential area and the recorded infection rates, based on the area where each subject resides. As shown in the table, the recorded rate in rural areas was higher, at 78.82%, compared to urban areas, where the infection rate was 74.55%.

Table (5) shows the prevalence of intestinal parasites by the nature of the residential area.

The Residential Area.	NO. of individuals examined	Infected		Uninfected	
		NO.	Percentage (%)	NO.	Percentage (%)
urban areas	**495**	**366**	**74.55**	**129**	**26.06**
rural areas	**713**	**562**	**78.82**	**151**	**21.18**
Total	**1208**	**928**	**153.37**	**280**	**47.24**

The results in the table above indicate that the highest infection rate was recorded among individuals living in rural areas, reaching 78.82%, while the lowest rate was found among those residing in cities (urban areas), at 74.55%. This may be attributed to poor sanitary conditions in rural areas, inadequate cleanliness of drinking water, low levels of education among families particularly mothers or the use of human waste and untreated sewage water as fertilizer for various crops (Caccio et al., 2003). Furthermore, the high number of animals in these areas may attract insects, such as flies, which serve as highly effective mechanical vectors for protozoan cysts and helminth eggs (Molan and Miro, 1990). These findings are consistent with the results of studies conducted by Al-Musawi (2004) in the city of Karbala, Al-Fahdawi (2002) in the city of Ramadi, and Fatouhi et al. (2007) in the governorate of Nineveh.

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Conclusions

The prevalence of the parasite *Giardia lamblia* in Maysan Governorate and its surrounding areas was found to be relatively high. The infection rate was higher among males than females, and it was observed that the incidence of the parasite increases during the warmer months. Furthermore, the 3–5 age group exhibited the highest infection rates among all age groups studied. It was also noted that the prevalence of the parasite is higher among individuals living in rural areas.

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