



Prevalence and associated risk factors for *Giardia lamblia* infection among children hospitalized for diarrhea in The Pediatric Hospital

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Abstract

In pediatric hospitals, the epidemiology of *Giardia lamblia* infection presents distinctive challenges given children's heightened vulnerability to this protozoan parasite. The study aimed to ascertain the prevalence of *G. lamblia* and its associated risk factors at Benghazi Children's Hospital. Conducted from January to December 2019, the study involved the collection and microscopic examination of 1780 stool samples from hospitalized children. Personal data was also collected for statistical analysis during this period. Results revealed a prevalence rate of 7.40% (133 out of 1780) for *G. lamblia*. Factors such as gender and seasonal variations were identified as potential influencers of prevalence rates. The prevalence rate of giardiasis in male children (65.40%) was higher than in female children. Furthermore, differences in infection rates across different seasons and months of the year were observed, with the highest prevalence recorded in spring and by month in April (36.80%) and the lowest in May of the year.

Keywords: *Giardia lamblia*; Pediatric Hospitals; Prevalence; Risk Factors

1. Introduction

The parasite *Giardia lamblia*, an intestinal protozoan, is widely distributed and infects humans globally, leading to a condition known as giardiasis [1]. The diagnosis is based on clinical symptoms of children, and is confirmed through direct observation of cysts and trophozoites under a microscope [2]. The prevalence of this parasitic infection represents a critical public health issue, particularly in pediatric hospital settings. This infectious condition raises substantial health alarms given its capacity to induce diarrhea, dehydration, and malnutrition among younger patients. Its repercussions may encompass growth impediments, anemia, weight reduction, and a spectrum of physical and mental health complications, predominantly affecting children, as outlined by Daryani [3]. Furthermore, the seasonal variation could play an important role in the prevalence and risk factors of *G. lamblia* [4].

In Libya, several limited studies have been done and showed a prevalence of 1.2 to 11.4%; most of the results of these studies were hospital-based data [5]. The prevalence rate of 2.8% of *G. lamblia* infections has been reported in school-aged children in Tripoli, Libya [6]. Normally, the prevalence rate of gastrointestinal parasites varies from one area to another based on the degree of personal and community hygiene, sanitation, and climatic factors, and different diagnostic procedures could affect the detection [7].

The aim of the study was to determine the prevalence and identify the risk factors associated with *G. lamblia* infection among children who had attended the pediatric hospital (children's hospital) in Benghazi, Libya.

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2. Materials and Methods

A cross-sectional study was conducted at the Children's Hospital (Pediatric Hospital) in Benghazi, Libya. Stool samples were collected from children hospitalized for diarrhea, between January and December 2019. Personal data were gathered for statistical comparison during this period. Standardized collection and preparation of stool samples were followed, including microscopic examination. Abnormalities such as blood, mucus, diarrhea, and color variations (green or black) were detected. Additionally, the presence of fat droplets was noted. The slides were systematically studied and examined under a microscope, following a zigzag pattern from right to left and then from bottom to top for an accurate diagnosis.

2.1 Statistical analysis

The data obtained was formulated in a Microsoft Excel and analyzed using the Chi-Square test to show the rates of infection with the *G. lamblia* parasite in regards to gender, age group, place, time of the year, and the educational level of the parents.

3. Result

The results of the study showed that out of the total of 1789 samples, 133 (7.40 %) came back positive for giardiasis according to the direct method of studying them under a microscope (Table 1).

Regarding gender, the prevalence rate of giardiasis in male children was higher than in female children. The Fisher exact test statistic value is 0.0012, and the result is significant at $p < 0.05$ (Figure 1).

Table 1 Prevalence of *G. lamblia* among children in the pediatric hospital

Infected children	Frequency	%
NO	1656	92.50%
YES	133	7.40%
TOTAL	1789	100%

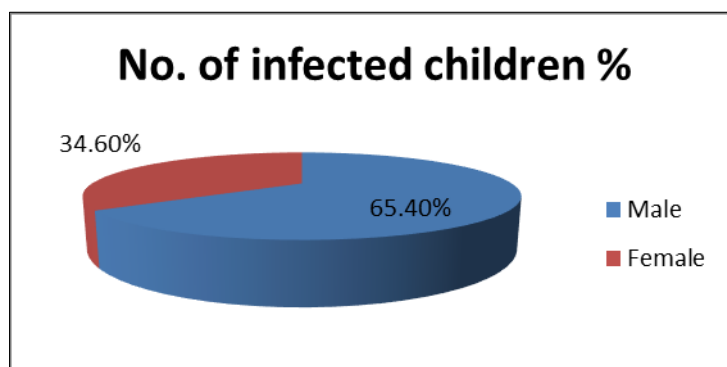


Figure 1 Prevalence of *G. lamblia* among patients, according to gender ($P < 0.05$)

In the distribution of infected children with *G. lamblia* across different months of the year, a significant difference ($P < 0.001$) was observed in the prevalence rate of giardiasis. The highest percentage of infections was in April (36.80%), followed by February and March (13.50%). The lowest incidence occurred in the last three months of the year, as shown in Table 2.

The results showed that temperature and humidity in the environment have no effect on the prevalence rate of giardiasis across different months of the year, as shown in figure 2.

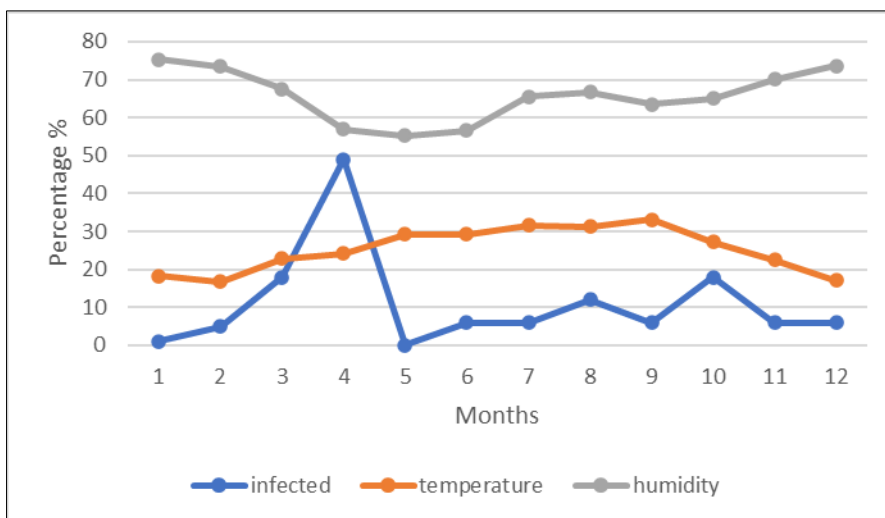


Figure 2 The effect of temperature and humidity of environment on prevalence rate of giardiasis

Table 2 Distribution of *G. lamblia* among children, according to the months

Months	No. of Infected children	Seasons	Rate of Infection (%)	p- value
January	1	Winter	0.80	0.001
February	5	12	3.8	
March	18	Spring	13.50	
April	49	67	36.80	
May	0		0	
June	6	Summer	4.50	
July	6	24	4.50	
August	12		13.60	
September	6	Autumn	4.50	
October	18	30	13.50	
November	6		4.50%	
December	6	Winter	4.50%	
Total	133			

4. Discussion

The aim of this study was to find the factors associated with the spread of *G. lamblia* among children who had attended the pediatric hospital (children's hospital) within a specific age group (younger than one year). According to the results of this study, the infection rate of all children registered during a full year, ranging from January to December in 2019 and across various Seasons was 7.4%. This may seem like an insignificant amount, but is an important indicator of the necessity in paying attention to the causes of this spread so that it does not become more prevalent, especially with the appearance of high infection rates during certain months and not others, according to the graphs, the month of April records the highest rate of spread of *G. lamblia*, followed by approximately the same percentage of March 3, August 8, and October 10. Although these increases do not constitute an understandable pattern. The study can conclude that the significant increase in April is since it is a breeding season for multiple vectors and shows a relative increase in the number of flies and cockroaches, which contribute to raising the rate of the infection's spread. Furthermore, there is an

increased infection rate during August in summer or October in fall where the temperature is still rather high (how high? Somewhat unclear) in the study area. This may be attributed to the same reason, primarily the spread of flies, cockroaches and other mechanical vectors helped by the increasing temperature and humidity. Environmental factors also influence the richness of parasite species and intensity of infection in the host species [8]. Temperature changes have been associated with parasitological development rates [9], and temperature has been regarded as one of the most critical factors in the survival of cysts in the environment [10].

Comparing temperature and humidity over the last year (table 7), our results show that the humidity last year was constant, and the temperature was low in the beginning of year, with highs in the middle and decrease towards the end of the year. This explains *G. lamblia* the higher distribution in April's percentage (36.8%) and October's percentage (13.5%) .Despite the direct decline that occurs in the following month which contradicts this hypothesis.

Comparison of results from a study conducted in the same year in Malaysia where samples were collected during the wet and dry seasons [4] where the prevalence of *Giardia* during the rainy season increased compared to the rest of the year indicating that seasonal variability plays an important role in the prevalence and risk factor of *G. lamblia* infection on the indigenous community.

On the other hand. An unconventional result that requires further study has emerged, where the prevalence rate of giardiasis in male children was higher than in female children, with 65% rate among males compared to only around 34% among females. We cannot be sure on why this occurs, but hypothetically sex hormones may have a role in the extent of resistance to infection, but because the age group included in this study is very small, under the age of one year, and at this stage hormones are not enough to support the hypothesis of the effect, we call for increased research and studies in this regard. These results agree with those reported by other investigators [11, 12] that males have a higher rate of infection compared to females, showing that a difference in prevalence of giardiasis exists between genders. Although clinical studies of humans and field studies of animals suggest several potential affecting factors, such as exposure rates and social behavior, habitat and diet cannot be held constant and thus could also contribute to the observed differences between males and females in parasite infection rates [13].

This study revealed that *G. lamblia* have shown persistent and significant annual increase, the alarming rise of this parasites could be due to emergence of resistance to the currently employed antiprotozoal drug, Metronidazole. [14].

Hospitals in general around the world face diverse challenges because of endemic parasites that are usually influenced by a variety of factors. To reduce the infectious disease load in communities, health care centers have a variety of intervention apparatuses; however, the effectiveness of these apparatuses is impacted by environmental cultural, and socioeconomic conditions [15,16]. The effectiveness of these interventions, however, is impacted by many other reasons [17]. Comparisons of results from the present study with these from other developing countries in the region, such as Yemen [18] and Kuwait [19] show that considerable differences can be found in the incidence of individual parasites, and moreover, the overall prevalence of parasites. These differences can be explained by the influence of environmental factors and hygienic and alimentary habits of different nations on the endemicity and transmission of intestinal parasites. Due to low levels of health in developing countries, infection with some intestinal parasites mostly occurred in the early years of life but in developed countries the infection can be easily linked and transmitted starting from the ages of children in nurseries and daycare centers.

These findings underscore the importance of understanding specific risk factors associated with *Giardia lamblia* infection in pediatric hospital settings to implement targeted prevention and control measures

5. Conclusion

In conclusion, the study confirmed the infection of 7% of all admitted cases of children under the age of one. More work is needed to find out the reasons for the spread of infection in this young age group, especially reasoning behind the higher incidence among males compared to the infection rates among females. The study also confirmed that there is no significant effect in the combination of temperature and humidity on expansion rates.

Overall, the results of this study highlight the critical need for increased awareness and prevention strategies for *G. lamblia* infection in pediatric hospitals. The high prevalence of this parasitic infection among children admitted to hospitals underscores the importance of implementing robust infection control measures, such as proper hand hygiene and environmental disinfection protocols.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflicts of interest have been declared by the authors.

Statement of ethical approval

The study protocol as well as the questionnaire were approved by the department of laboratory medicine at the public health faculty. The study was conducted in the pediatric hospital after getting approved by the administration of the hospital. No identifying information was requested from participants to protect their privacy. The plan was discussed with the heads of the units, and an explanation was given regarding the purpose of the study and the ethical aspect of collecting data from the hospital registry.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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