



RESEARCH ARTICLE

DISTRIBUTION AND RISK FACTORS FOR *GIARDIA LAMBLIA* AMONG CHILDREN AT AMRAN GOVERNORATE, YEMEN

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Abstract



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Objective: The widespread prevalence of Giardiasis is a public health problem worldwide, and it is also common among Yemeni children. Hence, this work aims to identify the prevalent *Giardia lamblia* infection and risk factors among children admitted to health care centers in Amran governorate in Yemen.

Methods: Three hundred and thirty-four stool samples were collected from infected children between March and July 2019 and the parasite is identified by light-microscope according to standard parasitology methods. Also, relevant data was obtained using a designed questionnaire.

Results: The results showed that 181 cases (54.2%) were infected with *G. lamblia* infection. Total 57.5% of the infected children were from urban areas, while 42.5% of the cases were from rural areas. The highest incidence of *G. lamblia* was 60.3% among males compared to 47.5% among females. The results for age, residents and male children aged 8-14 years in both urban and rural areas recorded the highest prevalence of *G. lamblia* infection while the lowest was among females between 1 and 7 years and 8-14 years old, respectively, in the rural and urban area.

Conclusion: In conclusion, as described in this work, multisectoral efforts are needed that include hygiene practices, personal hygiene habits, the provision of safe drinking water and the provision of sanitation systems to efficiently reduce this infection from all governorates of Yemen.

Keywords: Amran Governorate, Giardiasis, *Giardia lamblia*, prevalence, Yemen.

INTRODUCTION

Giardia lamblia, a flagellate intestinal protozoan, is probably among the most common observed gastrointestinal parasites in the world. Globally, it is one of the most frequent that are diarrhea-causing among 200 million cases reported annually particularly in infants, young children, and young adults in developing countries^{1,2}. The highest prevalence of *G. lamblia* was recorded in developing countries between 10% and 50% compared between 2 to 5% in developed countries^{3,4}. *G. lamblia* is transmitted by consumption of contaminated food or water with mature cysts. Also, parasites transmission between community can occur via direct fecal-oral contact between family members and homosexual men^{5,6}. *Giardia* prevalence in Yemen is associated to some factors that include inadequate

hygienic practices, environmentally contaminated with fecal, lack of health awareness, and the lack of health infrastructure. These factors are resulting from the Saudi Emirati aggression started in March 2015 that destroyed the health system and increased the prevalence of infectious diseases especially among children suffering from severe malnutrition⁷. A few previous studies have reported the prevalence of *G. lamblia* infection among children in various governorates of Yemen; in Ibb governorate (23.6%)⁸, in Al-Mahweet governorate (3%)⁹, in Hadramowat (19.17%)¹⁰, and in Sana'a (16.7%)¹¹. Amran governorate lacks many epidemiological studies focusing on the prevalence and incidence of intestinal parasitic infections among the population. Hence, this work aims to identify the prevalent *G. lamblia*

infection and risk factors among children admitted to health care centers in Amran governorate in Yemen.

MATERIALS AND METHODS

Study Design and Area

This study is a cross-section study carried out in the medical laboratory at 22 May hospital in Amran City, Yemen, during the period from March to July 2019. This investigation was applied at Amran governorate in both of urban and rural areas; about 50 km north of Sana'a, the capital of Yemen.

Data Collection

Prior to specimen collection, the objectives of the study were explained briefly to all children. The data was collected in a structured questionnaire from the children's parents or adult guardians via face-to-face interview that includes data on social and demographic information (i.e. age, gender, parent education, and residence) and behavioral habits (i.e. hand washing after defecation and washing of fruits and vegetables), and environmental conditions such as type of water supply and presence of absence of a toilet. The age of participants in this study was categorized into two groups that were between 1-7 years and from 8 to 14 years.

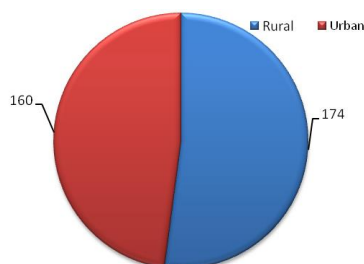


Figure 1: The distribution of specimens among areas.

Sample Collection and Examination

A total of three hundred and thirty-four (334) stool specimens were collected from infected children in clean plastic containers (60 ml) and labeled. The collected samples were directly processed and analyzed by direct smear to identify the presence of *Giardia* parasites (cysts and/or trophozoites) from fresh stool. Also, the wet mount preparation was used after formal-ether sedimentation technique according to Cheesbrough¹².

RESULTS

Three hundred and thirty-four (334) stool specimens were chosen of children from Amran governorate, 160(47.9%) specimens were from an urban area and 174(52.8%) specimens from a rural area (Figure 1). The obtained results were revealed that 181 (54.2%) cases were infected with *G. lamblia* parasite. Meanwhile according to resident high rate of giardiasis 104(57.5%) were recorded in stool specimens belong the urban area compared to 77(42.5%) cases from the rural area are shown in Figure 2. Table 1 shows that the high frequency of *G. lamblia* infection by sex was 105

(60.3%) in males when compared to 76 (47.5%) of females with *G. lamblia*.

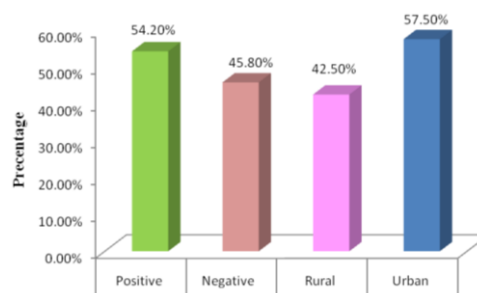


Figure 2: Rate and distribution of child infected and non-infected.

The current results related to gender and age showed that the highest prevalence of *G. lamblia* infection was reported among the age group of 8 to 14 years (81.90%) in males followed by 61.9% was among the age group of 1-7 years in females recorded urban area. Similarly, the highest rate of *G. lamblia* was 55.8% and 40.5%, respectively, observed among each age group of 8 to 14 years in males and females in rural area (Figure 3). Present work showed the associations between the frequency of *G. lamblia* infection and several behavioral and environmental factors. The highest prevalence of *G. lamblia* infection was (73.8%) found between parents of children with the uneducated level of education, use untreated water sources for drinking water (71.9%), eating unwashed vegetables and fruits (69.2%) and (66.4%), respectively. Also, high prevalence was (81%) observed between children lived in houses without toilets and those who didn't wash their hands after defecation (74.5%) as summarized in Table 2.

DISCUSSION

The overall rate of *G. lamblia* infection was 54.2% recorded between children. This study revealed a high frequency of *G. lamblia* infection among children compared to other studies in other governorates' in Yemen where it ranged between 23.6% and 23.94% in Ibb^{8,13}, 3% in Al-Mahweet⁹, 19.17% in Hadramawt¹⁰, and between 16.7% and 17.7% in Sana'a^{11,14}. The high frequency of *Giardia* infection between young children might be due to lower standards of personal hygienic practices and sanitary behaviors when compared to adults and older children^{15,16}. Amran governorate is a developing region in Yemen and the life of most people depended upon agriculture and live with domestic animals in the same house. Moreover, they lack the basic constituents in the health and educational systems^{17,18}. In current work, the highest prevalence of *G. lamblia* was 57.5% reported in an urban area compared to 42.5% in the rural area. In agreement with the unexpected results, Al-Haddad and Baswaid¹⁰ found that *G. lamblia* infection was (33.57%) more prevalent in the urban area than (32.06%) in the rural area. Furthermore, a study conducted in Taiz city showed that high prevalence of intestinal parasitic infection¹⁹. Also, Mekhlafi et al.,⁷ revealed that

G. lamblia was 16.1% registered among school children in rural area of Sana'a between the period of 2013–2015. It is difficult to explain the higher prevalence of *Giardia* parasite in urban area than rural area, but it may be due to some factors such as socio-demographic and socio-economic environmental of Amran city that does not differ in general than natural of habitats life in rural communities. In addition, the

Amran city lacks the piped-water supply and sewage disposal, as well as its population below the poverty line, are considered as factors. In this study, it was revealed that the prevalence of *Giardia* for males was 60.3% higher compared to the female by 47.5%, and likewise, a high percentage of *Giardia* infection was recorded in previous studies among males in Yemen; it was between 17-17.6% in Sana'a^{7,11} and 32.1% in Ibb⁸.

Table 1: The prevalence of *G. lamblia* infection concerning sex.

Resident	Male			Female		
	No. of Samples	Positive (%)	Negative (%)	No. of Samples	Positive (%)	Negative (%)
Urban	85	59 (69.4)	26 (30.6)	79	45 (5.69)	34 (.431)
Rural	89	46 (51.7)	43 (48.3)	81	31 (38.3)	50 (61.7)
Total	174	105 (60.3)	69 (39.7)	160	76 (47.5)	84 (52.5)

Table 2: Factors associated with *G. lamblia* infection among children.

Variables	No. examined	Infected (%)
Parents' educational status	Graduate	56
	Secondary	79
	Primary	119
	Not educated	80
Source of drinking water	Treated water	100
	Not treated	204
Washing vegetables before eating	Yes	242
	No	91
Washing fruits before eating	Yes	191
	No	143
Presence of toilet in a house	Yes	255
	No	79
Hand washing after defecation	Yes	197
	No	137

In contrast, Qasem *et al.*,¹³ noted that the high prevalence of *Giardia* was 64.4% among females. The higher prevalence of the *Giardia* infection among males in this work than females is due to the males in the study area are contributing to some works and they

remain for a long time outside the home. Results from this work revealed that the highest infection rate (81.90%) was between the age group 8 to 14 years in males followed by (61.90%) among the age group of 1-7 years in females in the urban area.



Figure 3: Distribution of infected children regarding gender and age.

Whereas, the highest prevalence of *Giardia* infection was 55.80% among males aged 8-14 years and lowest 35.90% between males aged 1-7 years in a rural area. A similar study was investigated by Mekhlafi *et al.*,⁷ and showed that the high rate of *G. lamblia* infection was (18.6%) recorded among less than 10 years. Qasem *et al.*,¹³ also reported that the age group of 9-12 years was 51.1% highly infected by *G. lamblia*. Findings of the current work showed that the

prevalence rates of *Giardia* infection were influenced by the educational level of parents and the type of water sources used for the drink. The high prevalence of *Giardia* infection was more between children of parents with a low level of education. Moreover, children who eating unwashed vegetables and fruits as well as not used the toilet and not washed hands after defecation were found to be highly infected with *Giardia* infection. These results were supported

by studies conducted in Yemen found a significant association between *Giardia* infection and type of drinking water, methods of food preparation, and the status of personal hygiene^{9,19}. Most people in the rural area depend entirely on dams and surface water such as rivers and springs as a major source of drinking water because this area lacks deep wells. These types of water sources are easily contaminated by intestinal parasites resulting from the human and animal sources during the rainy season¹⁸. However, it was reported that the contaminated hands play an important role in transmitting fecal-oral in developing countries and washing hands after defecation or before eating have been considered as a secondary barrier¹⁹.

CONCLUSIONS

In conclusion, the results show that the prevalence of *Giardia* infection remains high among children and constitutes a major threat that challenges the health system in developing countries. It has been frequently observed among children living in poor communities that lack good water supplies, low personal hygiene practices, and poor environmental hygiene. Therefore, the different control measures are needed for combatting present levels of *Giardia* infection among children.

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AUTHOR'S CONTRIBUTION

Alshahethi MA: writing original draft, methodology. **Edrees WH:** supervision, formal analysis, conceptualization. **Mogalli NM:** editing, methodology. **Al-Halani AA:** investigation, conceptualization. **Al-Shehari WA:** data curation, conceptualization. **Reem A:** data interpretation. All authors revised the article and approved the final version.

DATA AVAILABILITY

Data will be made available on request.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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