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Evaluation of the prevalence of giardiasis and associated factors in Wardak province, center of Afghanistan

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ABSTRACT

Introduction: *Giardia* intestinalis is a causative agent of gastrointestinal infections worldwide. Contaminated food, feces, drinking water (orofecal route), and factors like economic conditions, culture, and behavioral factors contribute to its transmission. Wardak province is located in the central region of Afghanistan, divided into eight districts, with a population of 656,720.

Methods: A total of 274 patients with diarrhea referred to Wardak Hospital were studied, and among them, 17 individuals (10 males (58.8%) and 7 females (41.2%) tested positive for *Giardia* spp. by microscopy during 2023. In this cross-sectional study, socioeconomic, cultural, and symptomatology information were collected. The association between risk factors and intestinal parasitic infections was analyzed using Chi-Square and Fisher's exact tests with SPSS 26 and GraphPad Prism 8 software at a significance level of $P \leq 0.05$.

Results: More than half of the patients were under 30 years old. Most cases of the disease were observed in hot seasons (spring and summer). A significant correlation was found between the prevalence of giardiasis and factors such as close contact with animals, the use of unfiltered water, soil contact, and warmer seasons. No significant correlation was observed between economic status and travel history. 85% of patients had watery diarrhea, and 15% had bloody diarrhea.

Conclusion: This is the first epidemiological study conducted in Wardak province, central Afghanistan. The findings reveal the prevalence of giardiasis and its interaction with multiple risk factors. This study suggests that giardiasis is an important causative factor for gastrointestinal diseases in the study region.

Kewwors: Giardiasis, prevalence, diarrhea, Wardak, Afghanistan.

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1. Introduction

Diarrheal illnesses are a prominent source of morbidity and mortality worldwide, especially among children in developing countries (1). Intestinal parasites pose a threat to approximately 3.5 billion people globally, with 450 million cases of morbidity, notably among children (2). Among infectious agents, *G. lamblia* is one of the major causes of diarrhea, particularly in areas where fresh vegetables and drinking water sources are contaminated with sewage pollutants and consumables are obtained from street vendors (3-5). Giardiasis, caused by *Giardia lamblia*, is a global health burden responsible for an estimated 200 million episodes and 500,000 deaths per year, primarily affecting children in underdeveloped nations (6, 7). A relatively higher prevalence of this protozoan has been recorded in rural areas, poor communities, male children, older individuals, and HIV-positive patients, with a prevalence of 9.2% in Pakistan (9) and 10% in Iran (10).

The flagellated protozoan *Giardia lamblia*, also known as *Giardia intestinalis* or *Giardia duodenalis*, parasitizes the small intestines of various vertebrates (11). *G. lamblia* exists in two stages: trophozoite and cyst (12). When ingested by the host, cysts excyst in the duodenum, releasing trophozoites. By adhering to the walls of the small intestine and forming environmentally resistant cysts, trophozoites cause clinical conditions in humans. Symptoms include diarrhea, flatulence, excessive fatigue, nausea, foul-smelling stools, abdominal cramps, and weight loss (13). The cysts, which are contagious and cause disease transmission, enter the colon through feces and are disseminated through contaminated food, drink, surfaces, and direct physical contact. The contribution of zoonotic transmission to the epidemiology of *Giardia* infections in humans remains uncertain (14).

Afghanistan, a country with limited resources, high rates of infectious disease incidence, congested living conditions, financial obstacles, and poor sanitation, is experiencing a serious health crisis that disrupts healthcare functionality. Although Korzeniewski et al. and Rahimi et al. have provided information on the situation in the provinces of Kandahar, Ghazni, and Parwan, there is currently a lack of significant published data from Afghanistan regarding the prevalence of giardiasis and its associated factors in other provinces (15, 16). This study examines the frequency of giardiasis infection among patients with diarrhea in Wardak Province to provide important epidemiological data.

2. Materials and Methods

A cross-sectional study was conducted in Wardak Province, the central region of Afghanistan, from January 2023 to December 2023. Wardak Province spans an area of 10,348.3 km2 with an estimated population of 656,720, predominantly residing in rural areas (17). A total of 274 patients presenting with diarrhea were included in the study to investigate the presence of giardiasis. Each patient completed a questionnaire capturing comprehensive medical and demographic information, economic status, hygiene practices, drinking water sources, sanitation facilities, and primary symptoms.

Stool samples from patients with diarrhea were collected and sent to the laboratory for microscopic examination. Two types of direct wet film preparations were performed on each sample: one slide with normal saline (0.85%) to detect cysts or motile trophozoites, and another slide with Lugol's iodine (5%) for structural visualization. Microscopic examination involved screening all samples

using 10× and 40× magnification lenses to identify *G. lamblia* cysts and trophozoites. Each sample was examined three times to ensure accuracy, confirming Giardia infection based on the presence of actively motile flagellated trophozoites and characteristic thick hyaline-walled cysts.

Data were entered into Microsoft Excel (Microsoft Corp., Redmond, WA) and analyzed using SPSS 26 software (SPSS Inc.; Chicago, IL, USA). Graphs were generated using GraphPad Prism 8 (GraphPad Software Inc.; San Diego, CA, USA). The χ2-square test was employed to assess differences in parasite prevalence among age groups, genders, and various symptoms (diarrhea, nausea, fever, and gastrointestinal complaints). Statistical significance was set at a probability (P) value < 0.05 with an alpha risk of 5%. The Ghalib University Ethics Review Committee issued ethical approval for this study using the code: AF.GKU.REC.1402.003.

3. Results

A total of 247 patients presented with diarrhea at hospitals during the study period. The overall prevalence rate of a microscopically positive *G. lamblia* infection was about 0.7% (17 out of 247 patients). Gender did not significantly affect the prevalence of *G. lamblia* (P = 0.467), with 10 (58.8%) males and 7 (41.2%) females testing positive. Age analysis revealed that individuals under 30 years old were more susceptible to *G. lamblia* infection compared to those over 45 years old. The frequency of *Giardia* infection was significantly higher among individuals consuming well water (82.35%) compared to those using purified water (17.65%), demonstrating a significant association (P < 0.008).

Furthermore, the study found a significant difference (P = 0.029) in the prevalence of *Giardia* infection between swimmers and non-swimmers. Patients with a home garden showed a statistically significant higher prevalence of *Giardia* infection (P < 0.002), with 88% of patients reporting having a garden at home. Income level also influenced infection rates, with a significant difference observed (P = 0.006). Families earning more than 20,000 Afghanis per month had the lowest prevalence at 11% among all patients.

Seasonal variation was evident, with higher infection rates observed in summer and spring compared to other seasons (P < 0.029), with a ratio of 3:1 between the first and second halves of the year. Patients with *G. lamblia* commonly reported symptoms such as stomach pain and discomfort (94.1%), fever, particularly watery diarrhea (82.4%), headaches, and nausea/vomiting (Figure 1). Additionally, significant evidence (P = 0.002) indicated that close contact with animals increased the likelihood of *Giardia* infection, whereas the frequency of infection did not significantly differ between travelers and non-travelers.

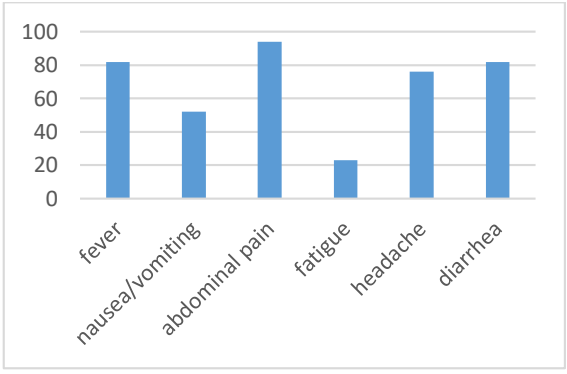

Figure1. The frequency of the signs and symptoms of giardiasis among the patients

4. Discussion

This study aimed to assess the prevalence of *G. lamblia* infection among patients with diarrhea and explore associated risk factors in Wardak province, Afghanistan. Giardiasis is a common intestinal parasite with varying prevalence worldwide, influenced by socioeconomic factors, cultural practices, water quality, hygiene standards, and geographical conditions (20). The prevalence of giardiasis in our study population was found to be 6.88%, which aligns with global patterns but contrasts with higher rates reported in neighboring regions such as Kabul (9%), Khost province (9.2%), and Pakistan (11.8%) (21-23). Similar prevalence rates were reported in various districts of Iran (Hamadan 10.9%, Sari 10.6%, and Golestan 9.9%) (24, 25). Children and young adults under 30 years old constituted the majority of infected individuals, consistent with findings from other global studies highlighting higher vulnerability among younger age groups (26).

Several factors contribute to the higher prevalence observed in certain regions, including poor hygiene practices, limited previous exposure to Giardia, and environmental conditions conducive to parasite survival and transmission (27). Significantly elevated prevalence rates in regions like Ghazni (38.3%) and among Afghan refugees (37.7%) underscore challenges related to sanitation, overcrowded living conditions, inadequate access to clean water, and suboptimal hygiene practices (28, 29). Our findings support previous research linking untreated water consumption to an increased risk of Giardia infection, as demonstrated in studies conducted in developed countries like the United States (30). Approximately three-quarters of our patients reported consuming untreated water, highlighting the critical role of water filtration and treatment in preventing waterborne diseases. Seasonal variation in infection rates was evident, with a higher prevalence observed during the spring and summer months, coinciding with increased outdoor activities such as camping and swimming in potentially contaminated water sources (31, 32). Swimming in untreated surface water emerged as a significant risk factor, underscoring the importance of water treatment and adherence to hygiene practices in recreational settings (33, 34).

Our study revealed a statistically significant association between home gardening and Giardia infection ($P < 0.002$). Soil contamination from infected feces in home gardens poses a potential transmission route, emphasizing the need for improved hygiene and sanitation practices in agricultural settings. *Lamblia* is known to infect both humans and animals, with potential zoonotic transmission pathways requiring further investigation using molecular epidemiological approaches (35). Understanding species-specific genetic assemblages is crucial for developing targeted prevention strategies. Effective measures to reduce giardiasis incidence include enhancing water sanitation, promoting hygiene education, ensuring access to clean drinking water, and implementing rigorous infection control measures (36). These strategies are essential for mitigating the impact of giardiasis in endemic regions and improving public health outcomes.

Conclusion

This study highlights a 0.7% prevalence of *G. lamblia* infection among diarrhea patients in Wardak province, Afghanistan. Key risk factors include untreated water consumption and seasonal variations, emphasizing the need for improved water sanitation and hygiene practices. Addressing these factors through

targeted interventions is essential for reducing giardiasis prevalence and improving public health outcomes in the region.

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