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Giardia lamblia infection And Associated Risk Factors Among Patients Who Are Seeking Stool Examination At Bule Hora University Teaching Hospital, West Guji Zone, Ethiopia

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Abstract

Background: Giardiasis is one of the major health problems in our country due to the use of contaminated water for drinking and the lack of awareness practices, such as washing fruit before eating and hand washing after latrine usage. Although few studies have been conducted in different parts of Ethiopia, there is a varied reported prevalence and associated factors. Therefore, the current study comes out with updated information.

Objective: To assess the prevalence of *G. lamblia* infection and associated risk factors among patients seeking stool examination at Bule Hora University Teaching Hospital, West Guji Zone, Ethiopia, in 2023.

Method: A facility-based cross-sectional study of 137 patients seeking stool examinations was conducted from February 15 to March 15, 2023. A systematic random sampling method was used to select the study participants. The stool samples were examined using the wet mount technique. Descriptive analysis and inferential analysis were performed. The chi-square test was performed. A p value of 0.05 was considered statistically significant.

Results: The results of this study revealed that the prevalence of*G. lamblia* infection was 18.7% [95%CI: 12.1-25.3]. This study revealed that factors such as residency ($\chi2 = 2.82$, $P = 0.027$), maintaining food hygiene ($\chi2 = 6.6$, $P = 0.03$), hand washing before a meal ($\chi2 = 4.25$, $P = 0.003$), source of water for drinking ($\chi2 = 12.6$, $P = 0.0001$), and patient finger nails ($\chi2 = 3.47$, $P = 0.026$) were significantly associated with *G. lamblia* among the patients.

Conclusions and recommendations: *Giardia lamblia* was seen among one-fifth of the patients seeking a stool examination. Health facility managers and health care providers work hard on patients' quality of stool microscopic examination and health education on ways of giardiasis transmission in order to decrease the prevalence of *G. lamblia*.

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Introduction

Giardia lamblia, a flagellate protozoan also known as Giardia intestinalis, is the most prevalent intestinal infection in the world. A group of parasitic protozoans known as Giardia infects both the small and large intestines of a variety of vertebrate hosts. Particularly in the tropics, it is one of the most prevalent human intestinal protozoa, and *G. duodenalis* can range in clinical severity from asymptomatic to very harmful. The clinical severity of giardiasis is assumed to be influenced by both host factors (such as nutrition, immunity, and co-infection with other agents) and pathogen factors (such as strain and infectious dose) [1].

Giardia lamblia infection results from ingesting environmental hard cysts through the anal oral route, contaminated food, or water [2]. A human infection can be brought on by ingesting as few as 10 cysts. The parasite can spread far and quickly in the community because mature cysts are infected when ejected there after person-to-person transmission occurs [3]. Although *G. lamblia* primarily infects humans, it can also infect dogs, cats, beavers, and other animals. These creatures have cysts on their faces, which can infect humans and contaminate water. Giardiasis is spread to humans through the consumption of cysts that are excreted in the feces of infected people or animals. The prevalence of intestinal parasitic infections is high in those with low socioeconomic status, unfavourable living conditions, crowded living conditions, poor environmental sanitation, improper garbage disposal, unsafe water supply, and unhygienic personal habits. A significant amount of the burden of disease and death in developing nations is caused by these variables [4].

Giardia lamblia is one of the intestinal protozoa that affects both some industrialized and most developing nations' public health [4]. The most prevalent protozoan parasite of people globally is *G. lamblia*, also known as *G. intestinalis*, with detection rates ranging from 2-5% in wealthy countries to 20-30% in underdeveloped countries [5]. Giardiasis symptoms are present in 200 million people in Asia, Africa, and Latin America, with 500,000 new cases occurring each year, mostly in children [6].

The gastrointestinal symptoms include steatorrhea, epigastria, soreness, abdominal cramps, greasy stools, flatulence, and diarrhoea, in addition to a full-blown malabsorption condition. However, infections that are not accompanied by such obvious signs do happen regularly, particularly in nations with limited resources. Despite the fact that these illnesses frequently go undiagnosed, epidemiological data indicate that they are nonetheless linked to a malabsorption phenotype [7].

Children under the age of five and schoolchildren account for the majority of prevalence rates in African nations. This shows that children's immune condition and ignorance of basic personal hygiene practices make them particularly vulnerable to Giardia infections. Giardiasis is understudied in Ethiopia, and a nationwide survey was carried out that specifically looked at *G. lamblia* among students and other people in 93 villages. The prevalence of other parasitic illnesses has, however, been the subject of numerous investigations in various parts of the nation [8].

Giardia lamblia infection is widespread in Ethiopia, partly because of poor environmental and personal hygiene standards as well as food and water contamination from improperly disposed of human waste. A significant aspect is also the absence of basic health promotion strategies [9]. Although few studies have been carried out across the nation, those that have reported varying prevalence and risk factors for *G. lamblia* infection. As a result, this study provides updated data on the *G. lamblia* infection among patients at Bule Hora University Teaching Hospital who requested a stool sample.

Methods

Study area and period

The study was conducted at Bule Hora University Teaching Hospital, which was founded in Bule Hora. Bule Hora, which is located in the southern part of the Oromia region, was found 467 kilometers from Addis Ababa. The Bule Hora has 41 administrative kebeles. The town has one general hospital, six health centers,, twenty-seven health posts, forty-nine primary schools, twenty-nine high schools, four preparatory schools, and one TVET college. It also has a population of 281,237.

The hospital provides inpatient and outpatient services to more than 300,000 people. The laboratory has different sections, namely, parasitology, urinalysis, ART, serology, reception, bacteriology, chemistry, and haematology [10]. The total number of patients sent for stool examinations at Bule Hora University Teaching Hospital last year was 2028. The study period was conducted from 15 February 2023 to 15 March 2023.

Study design and population

A facility-based cross-sectional study was conducted to determine the prevalence and associated risk of*G. lamblia* among patients who visited Bule Hora University Teaching Hospital for stool examination by using direct microscopy. All randomly selected patients who came to the laboratory for stool examination during the data collection period were our study population.

Inclusion and exclusion criteria

All randomly selected patients who requested a stool examination and were able to provide a stool sample were included in the study. Patients who took anti-protozoan drugs during or before the data collection period were excluded.

Sample size determination

The sample size was calculated by using a single proportion population formula and assuming a 95% confidence interval with a marginal error of 5%. The proportion of *G. lamblia* was 12.4% (0.124), based on a previous study conducted at Teda Health Centre [11].

$$n = \frac{Z^2_{\alpha/2}P(1-p)}{d^2} = \frac{(1.96)^2(0.124)(1-0.876)}{(0.05)^2} = 124$$

therefore by adding 10% (13) nonresponse rates, the final sample size required for this study was 137.

Where n is the number of study subjects, Z is the standardized normal distribution value for the 95% confidence interval (1.96), P is the prevalence of G. lamblia (6.5%), q is 1-1.124 =0.0.876, p is 0.124, and q is 0.876, and d is the margin of error taken as 5% = 0.05.

Sampling procedure

The number of study participants was determined by using an average of two months' worth of the last year's report of patients sent for stool examination. Then, the two-month last-year report of patients sent for stool examination (N) was divided by the total sample size (n) to obtain the interval (K): K = N/n, K = 338/137, k=2.4 ~ 2. The first study participants were determined by the lottery method. Then, using a systematic random sampling method, the data collectors interviewed the study participants at every two intervals until the required sample size was obtained.

Data collection procedures

A structured face-to-face interview questionnaire that had been pretested and modified after reading several types of literature [11][12][13][14][15][16][17] was used to gather the results. These include sanitary and environmental elements, sociodemographic features, and health-related issues. There were 4 segments and 23 items in the survey. Patients' stool samples were obtained using a standard laboratory service method of collection. A trained laboratory technician used direct microscopy to analyze the sample.

Laboratory stool examination

The wet mount technique was applied for stool examination. When the feces were solid, a few drops of saline were added to the microscope slide, and then the stool specimen was thoroughly mixed. To stop the organism from moving and keep the preparation from drying out, a cover slip was utilized. Following that, the entire smear area was examined with a 10x objective; if anything unusual was noticed, the region was magnified even further (40x) [17].

Data quality control

Tools were pretested on 5% of the study participants (7 study participants) at Bule Hora Health Centre in order to confirm the tools' quality. The tools were modified from related literature. A skilled language translator translated the English version into Afan Oromo and then back into English to assure the consistency of the surveys. The questionnaire was reviewed, checked for accuracy, and corrected at the conclusion of each day. The stool cups were examined to see if they had been cleaned, labeled, screwed, and/or had a top container with an ID number before the specimens were collected. Microscopy was examined to see if it was regularly maintained.

Data analysis and processing

The accuracy and consistency of the information gleaned from the study subjects were examined in the acquired data. The information was then exported to SPSS version 25 for analysis after being entered into Epi-Data Manager version 4.62. Both descriptive analysis and inferential analysis were carried out, using metrics including frequency, percentages, means, and standard deviation. A chi-square analysis was done. Statistical significance was defined as a p-value of 0.05. Text, tables, and charts were all used to present the findings.

Ethical Approval and Consent to Participate

The Bule Hora University Institutional Review Committee (BHUIRC/2023) was approved ethically before the study could begin. The informed consent had to be secured from the study participants by explaining the study's objectives; after this had been done, the person should not be harmed, and their dignity should always come first. Parents or guardians' permission was sought if the study participant was under the age of 18. Both the participant's privacy and the confidentiality of the data gathered have to be protected.

Results

Sociodemographic characteristics of the respondents

Data were collected from 134 participants, with a response rate of 97.81%. The minimum age of the respondents was 5 years, while the maximum was 70 years, with a mean age of 29.45 (SD ±15.63). Among the 134 study participants, 69 (51.5%) were women living in rural areas. More than one-third of the study participants were married (65.7%). About 50 (37.3%) study participants had no formal education (see Table 1).

Table 1. Sociodemographic characteristics of the respondents among patients seeking stool examination at Bule Hora University Teaching Hospital, West Guji Zone, Ethiopia, 2023

Variables	Categories	Frequency	Percent (%)
Sex	Female	72	53.7
	Male	62	46.3
Residency	Urban	65	48.5
	Rural	69	51.5
Marital status	Single	35	26.1
	Married	88	65.7
	Divorced	9	6.7
	Widowed	2	1.5
Religious	Orthodox	43	32.1
	Protestant	69	51.5
	Muslim	19	14.2
	Other	1	.7
Ethnicity	Oromo	97	72.4
	Amhara	30	22.4
	Tigre	1	0.7
	Other	6	4.5
Educational status	No formal education	50	37.3
	Primary education	62	46.3
	Secondary education	11	8.2
	Diploma and above	11	8.2
Occupational status	House wife	38	28.4
	Farmer	34	25.4
	Merchant	23	17.2
	Government employee	11	8.2
	Self-employee	2	1.5
Monthly income	Below 1000 ETB	83	61.9
	1001-2000ETB	30	22.4
	2001-3000ETB	8	6.0
	Above 4000ETB	13	9.7
Family size	1-2	50	37.3
	3	37	27.6
	>3	47	35.1

Health related factors of the respondents

Out of 134 respondents, 94 (70.1%) had a history of parasitic infection. Less than one-third (29.1%) of patients had a history of hospital admission. Of the respondents, 71 (53.3%) and 62 (46.3%) kept their food hygiene always and sometimes, respectively (see Table 2).

Table 2. Health related factors of the respondents among patients seeking stool examination at Bule Hora University Teaching Hospital, West Guji Zone, Ethiopia, 2023

Variables	Categories	Frequency	Percent
History of parasitic infection	Yes	40	29.9
	No	94	70.1
Day care worker	Yes	25	18.7
	No	109	81.3
Hospital admission	Yes	39	29.1
	No	95	70.9

Sanitary and environmental factors of the respondents

The findings of this study showed that the majority of the study participants, 118 (88.1%), had latrine access, but of these, only 77 (57.5%) had a habit of using latrine. The majority of the respondents, 54 (40.3%), drank spring water, while 116 (86.6%) trimmed their fingernails (see table 3).

Table 3. Sanitary and environmental factors of the respondents among patients seeking stool examination at Bule Hora University Teaching Hospital, West Guji Zone, Ethiopia, 2023

Variables	Variables Categories	Frequency	Percent
Latrine access	Yes	118	88.1
	No	15	11.2
Habit of using latrine	Always	77	57.5
	Sometimes	49	36.6
	No	8	6.0
Washing hands after latrine usage	Yes	109	81.3
	No	25	18.7
Hands washing before eating the meal	Yes	114	85.1
	No	19	14.2
Source of water for drinking	Pipe	52	38.8
	Spring	54	40.3
	Hand well	8	6.0
	River	20	14.9
Washing fruit and vegetable before eating	Yes	79	59.0
	No	55	41.0
Having waste disposal pit	Yes	68	50.7
	No	66	49.3
Patients finger nail	Trimmed	116	86.6
	Not trimmed	18	13.4
Kept Food hygiene	Always	62	46.3
	Sometimes	71	53.0
	No	1	0.7

Prevalence of *Giardia lamblia* infection

The results of this study revealed that the prevalence of*G. lamblia* infection was 25 (18.7%) [95%CI:12.1-25.3] (Figure 1)

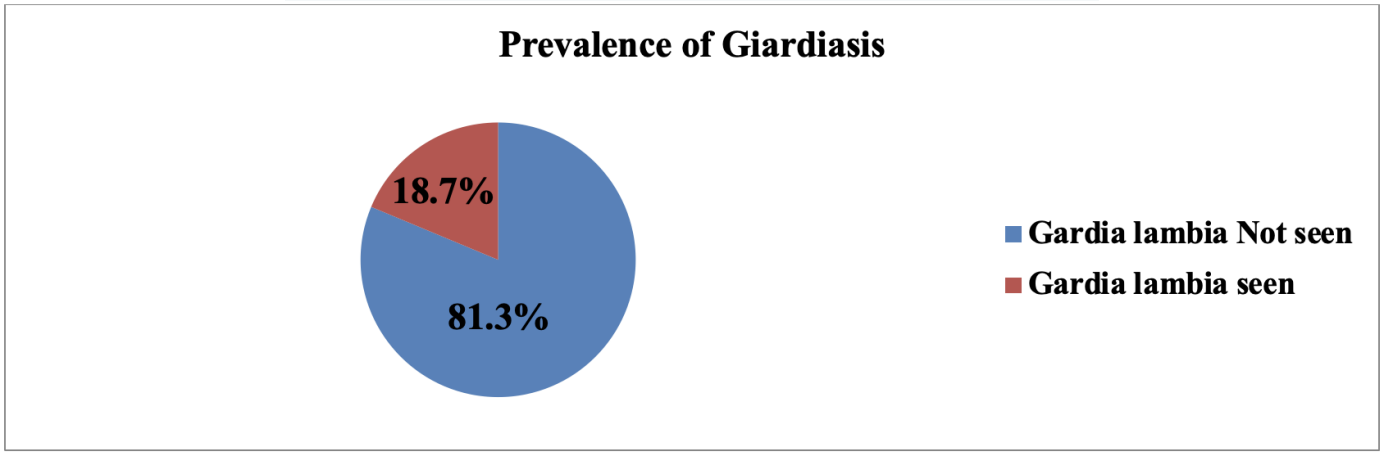

Figure 1. Prevalence of *G. lamblia* among patients seeking stool examination at Bule Hora University Teaching Hospital, West Guji Zone, Ethiopia, 2023

Factors associated with *Giardia lamblia* infection prevalence

Based on the chi-square (χ^2) test, statistically significant associations were shown between *G. lamblia* and the associated factors. According to this study, factors such as residency (χ^2=2.82, P = 0.027), maintaining food hygiene (χ^2= 6.6, P = 0.03), hand washing before a meal (χ^2= 4.25, P = 0.003), source of water for drinking (χ^2= 12.6, P = 0.0001), and patient finger nails (χ^2= 3.47, P = 0.026) were significantly associated with *G. lamblia* infection (see table 4).

Table 4. Factors associated with *G. lamblia* among patients seeking stool examination at Bule Hora University Teaching Hospital, West Guji Zone, Ethiopia, 2023

Variables	Categories	*G. lamblia*		χ^2	df	P value
		Positive N (%)	Negative N (%)			
Residency site	Urban	7(10.94)	57(89.06)	2.82	1	**0.027***
	Rural	18(25.71)	52(74.29)			
Educational status	No formal education	11(22)	39(78)	3.99	3	0.262
	Primary education	8(18.9)	54(81.1)			
	Secondary education	4(36.36)	7(63.63)			
	Diploma and above	2(19.19)	9(81.81)			
Occupational status	House wife	7(18.42)	31(81.58)	0.91	4	0.94
	Farmer	7(20.59)	27(79.41)			
	Merchant	4(17.39)	19(82.61)			
	Government employee	1(9.1)	10(90.9)			
	Self-employee	6(21.43)	22(78.57)			
History of parasitic infection	Yes	12(29.27)	29(70.73)	2.55	1	0.53
	No	13(13.98)	80(86.02)			
Family size	1-2	11(22)	39(78)	0.81	2	0.69
	3	7(18.92)	30(81.08)			
	>3	7(14.9)	40(85.1)			
Day care worker	Yes	3(12)	22(88)	1.85	1	0.41
	No	22(20.19)	87(79.81)			
History of patients hospital admission	Yes	11(28.22)	28(71.78)	2.27	1	0.88
	No	14(14.84)	81(85.26)			
Keeping of food hygiene	Always	6(8.68)	56(90.32)	6.6	2	**0.03***
	sometimes	19(26.76)	52(73.24)			
	No	0	1(100)			
Habit of using latrine	Always	11(14.29)	66(85.71)	3.17	2	0.216
	Sometimes	13(22.53)	36(73.47)			
	No	1(12.5)	7(87.5)			
Washing hands before eating the meal	Yes	14(13.21)	92(86.79)	4.25	1	**0.003****

	No	11(29.29)	17(60.71)			
Source of water for drinking	**Pipe**	5(9.6)	47(90.4)	12.6	3	**0.0001*** **
	Spring	10(18.5)	44(81.5)			
	Hand well	4(50)	4(50)			
	River	6(30)	14(70)			
Washing fruit and vegetable before eating	**Yes**	13(16.46)	66(83.54)	1.42	1	0.501
	No	12(21.82)	43(78.18)			
Patients having waste disposal pit	**Yes**	13(19.12)	55(80.88)	1.06	1	1
	No	12(18.19)	54(81.81)			
Patients finger nail	**Trimmed**	18(13.52)	98(84.48)	3.47	1	**0.026***
	Not trimmed	7(38.89)	11(61.11)			

indicate P<0.05, **indicate p<0.01, * indicate p<0.001, N=Number χ2= Chi square, df=degree of freedom*

Discussion

According to this study, the overall prevalence of *G. lamblia* infection was 18.7% [95% CI: 12.1-25.3]. The findings of this study were in line with a study done in Yabelo, Ethiopia, which reported 15.3% of *G. lamblia* [18], Adama, Afar, and Dire Dawa, Ethiopia, which reported 16% [19], and Gambo Rural Hospital in southern Ethiopia, which reported 15%[20]. However, this study was higher than that of studies performed in Turkey, 11.1% [21], Thailand, 6.2% [22], Shahura Health Center, Northwest Ethiopia, 7.4% [23], and Gamo Gofa area, south Ethiopia, 10.6%[24]. These inconsistencies may be caused by differences in the study environment as well as cultural and sociodemographic diversity. The methods used for stool examination, the variety of health conditions, water supply, feeding practices, cultural practices in the various study areas, the study period, age variations, and geographical differences may all have played a role in the discrepancies between the studies' findings.

In contrast, this study was lower than the studies conducted in Pakistan (27.3%), Sudan (21%), and Sidama (27.1%)[25]. Since our study was done at a university hospital in an urban environment, changes in the study site may be the cause of these discrepancies. The other likely explanation for the difference could be related to advancements made in hospital laboratory services, particularly regarding quality. In a similar vein, this study's prevalence was lower than that of a The true distinction may lie in the enhancement of the medical center's services and the demographics of the study population. Additionally, the variance may result from the many infrastructures found in healthcare facilities, such as laboratory tests, water, and medical equipment.

This study found that the residency of study participants was associated with *G. lamblia* infection. It is similar to a study conducted in Cuba [12], in Portugal [13], and in Thi-Qar, southern Iraq, which showed that living in the Sidama zone[25]. Lack of personal and environmental hygiene may be the most likely explanation. The results of the current investigation showed that *G. lamblia* and maintaining food hygiene were related. This was similar to a previous study conducted in Goiânia, State of Goiás, Brazil, which revealed family size and food hygiene [16]. This may be because poorly handled food hygiene was easily contaminated with parasites.

Furthermore, the findings of this study showed that hand washing before a meal was associated with a G. lamblia infection. This was similar to a study conducted in the Sidama zone [25]. This can be a result of washing hands before eating, which can get rid of parasites on the hands and reduce the risk of ingesting parasites. Additionally, the present study revealed that the source of water for drinking was related to *G. lamblia*. This report agrees with the study done at Gonder Hospital [26] and Nekemte Specialized Hospital [27]. This may be because poorly protected water sources could be reservoirs of parasites, and people who drink from them might be easily infected by parasites.

Moreover, the current study revealed that the patient's fingernails were significantly associated with*G. lamblia* prevalence among patients. The potential cause could be a parasite eaten when eating that was hidden under untrimmed fingernails. Another possible explanation is that the untrimmed fingernails make it easy for the parasite to hide.

Strengths and limitations of the study

The strength of the study was the primary and laboratory data from randomly selected patients. The limitations of the study were the small sample size and cross-sectional study design, which did not show a cause-and-effect relationship. The study failed to report the *G. lamblia* distribution among the age groups of the participants. The study was conducted only for a single season, and microscopy stool examination, which is poorly able to detect parasite cyst stage, was used. Chi-square analysis may not show the strength of the association.

Conclusion

The results of the current study concluded that less than one-fourth of*G. lamblia* was seen by laboratory examination among patients seeking a stool examination. According to this study, risk factors such as residency, maintenance, food hygiene, hand washing before a meal, source of water for drinking, and patient finger nails were found to be significantly associated with *G. lamblia*. Based on the findings of the current study, the following recommendations were forwarded to the concerned bodies: Health care providers should provide health education on the modes of*G. lamblia* transmission through food hygiene, hand washing, drinking water sources, personal hygiene, and environmental sanitation in order to decrease the prevalence of *G. lamblia*. Researchers should recommend conducting the study in multiple settings, including both health centers and primary and general hospitals, with a large sample size in multiple seasons.

Statements and Declarations

Availability of data and materials

Upon reasonable request, the relevant author will disclose the datasets used and/or analyzed during the current work.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AA: conceptualization, resources, laboratory analyses, and analyzing data. **NT** and **GA** data curve and analysis supervised and visualized the data collection, prepared and edited the manuscript, and approved the final version. All authors read and approved the final manuscript.

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