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Research Article
Prevalence of Gastrointestinal Protozoans Infections Amongst Patients Attending the Bamenda Regional Hospital

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Abstract

Background and Objective: Gastrointestinal protozoans are among the high prevalent parasitic diseases causing a high significant socioeconomic impact on the health status of most developing countries. The study aimed to determine the prevalence of gastrointestinal protozoan infections in patients attending the Bamenda Regional Hospital. **Materials and Methods:** This study was hospital-based and carried out at the Bamenda Regional Hospital located in the Bamenda II subdivision. A well-structured questionnaire was administered to patients to collect demographic data (age, sex) and to determine their level of knowledge on gastrointestinal parasitic infections. A total of 100 stool specimens were collected from both male and female patients attending the Bamenda Regional Hospital. The collected stool samples were analysed using the direct wet mount method. **Results:** The overall prevalence in this study was 10% with 4% of patients infected with *Trichomonas hominis* and the rest had 2% infection each with *Entamoeba histolytica*, *Entamoeba coli* and *Iodamoeba butschlii*. There was no statistically significant difference ($p>0.05$) between the prevalence of men (10.42%) and women (9.62%). The prevalence among workers in the informal system (15.38%) was higher than among students (9.89%) and those in the formal system (0%). However, there was no statistically significant difference ($p=0.675$). Illiterates (27.27%) and primary school subjects (27.58%) were more infected. **Conclusion:** Current study revealed an association between gastrointestinal parasitic infections and potential risk factors in participants. Non-compliance with hygienic rules exposes these participants to parasitic infection. However, it will be important to extend the study to other hospitals in the country.

Key words: Protozoans, Bamenda, gastrointestinal infection, parasite, prevalence

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Gastrointestinal parasitic infections (GIPIs) have been recognized as a significant causes of illnesses and diseases worldwide[1]. According to Rashid *et al.*[2] significant economic loss and morbidity are attributed mostly to parasite such as helminths and protozoans. Abdominal pain, cramps, constipation, diarrhoea, lack of appetite and vomiting are symptoms associated with gastrointestinal parasitic infections. Most of these symptoms are common with other microorganism such as viruses, bacteria and other non-infectious diseases such as ulcerative colitis, pancreatitis and peptic ulcer[3]. Infected people mostly suffer from malnutrition and infection, resulting in excess morbidity, amongst which children are highly involved[4]. According to current estimates, one-quarter of the world's population is infected with gastrointestinal parasites, with developing countries highly concern with infected cases[5]. In some developed countries, the prevalence of gastrointestinal parasitic infections can reach up to 95%[6]. It has been reported that 3.5 billion people are affected and 450 million are ill due to these parasitic infection[7]. Intestinal parasitic diseases constitute a major public health problem in tropical and sub- tropical zones where climatic factors such as humidity, temperature, lack of hygiene, poverty and demographic conditions favour the development[8]. Parasitic groups leading to these gastrointestinal infections are protozoans and helminths. These parasites dwell mostly in the gastrointestinal tract of humans and other animals[9]. According to the World Health Organisation, nearly 2 billion people infected in the world are mostly school-age children and pregnant women[10]. Children living in Sub-Saharan Africa, Asia, Latin America and the Caribbean are highly infected[11]. It is estimated that soil-transmitted helminths affect over 2 million people worldwide, with Sub-Saharan Africa, America, China and East Asia having the highest number of infections[12]. *Strongyloides stercoralis* infection is one of the neglected tropical diseases and it is also thought to infect 30-100 million people worldwide[13]. Cameroon is highly infected with soil-transmitted helminths with over 10 million people are infected[12]. In Cameroon, 5.6 million people were infected with *A. lumbricoides*, 6.5 million with *T. trichiura* and 2.6 million with hookworms, according to Brooker *et al.*[14]

In developing countries, including Cameroon, these infections are among the most common public health issues. The epidemiology of gastrointestinal parasitic infections shows that these parasites are found in all age groups and both sexes[15]. Apart from causing mortality and morbidity, GIPIs has been associated with malnutrition, stunted growth, mental function, physical weakness and low educational achievements in school children[16]. The aim of this study was to determine the prevalence of gastrointestinal parasitic infections among patients attending the Bamenda Regional Hospital.

MATERIALS AND METHODS

Study site

Study area: This study was carried out at the Bamenda Regional Hospital in 2022 from March to June. The Regional Hospital Bamenda is located in the Azire Health Area, Bamenda II sub division, Mezam Division and North West Region of Cameroon. The hospital is bounded to the North by the Ntamulung Health Area, to the South by the Atuakom Health Area, to the West by the Alakuma Health Area and to the East by the Ntambang Health Area.

Study duration

Inclusion and exclusion criteria: All patients attending the Bamenda Regional Hospital and who signed the informed consent form were included. Were excluded all patients who had taken anthelminthic medications in the last 2 weeks prior to sample collection.

Sample size: Lorenz's formula was used to calculate the sample size (StatCalc of the EPI Info software). The minimal sample size was 100 participants, based on a prevalence of 7% in Bamenda, Cameroon, an 80% power to detect significant associations or differences and a 5% accepted margin of error.

Data collection and parasitological examination: A well-structured questionnaire was administered to patients in order to collect demographic data (age, sex) and to determine their level of knowledge on gastrointestinal parasitic infections. A total of 100 stool specimens were collected from both male and female patients attending the Bamenda Regional Hospital. The patients were given sterile, capped specimen containers labelled with their unique identification number, sex, age and other personal information. They were instructed to open the stool container only at the time of stool collection. The collected stool samples were analysed using the direct wet mount method.

Parameters studied and prevalence: Associated risk factors such as gender, age range, level of education, job occupation, type of toilet, hand hygiene after using toilets, hand hygiene before meals and water consumed were studied.

The prevalence (P) was calculated using the formula:

$$\text{Prevalence} = \frac{\text{Number of individual infected}}{\text{Number of individual examined}} \times 100$$

Ethical considerations: Ethical clearance was obtained from the Faculty of Health Science of the University of Bamenda(N°2022/0032H/UBa/IRB). This work was done in accordance with the Helsinki Declaration. All ethical rules governing research with disadvantaged groups, such as prisoners, were followed. Patients were given complete freedom to participate in the study.

Statistical analysis: The collected data were analyzed by estimating the proportions and frequencies of variables using Excel 2016 (Microsoft Corp., Washington, USA) and the Statistical Package for the Social Sciences (SSPS Inc., Chicago, Illinois, USA) version 26. Multivariate logistic regression analysis was performed to identify the main risk factors and the Chi-Square test of independence was used to test the association between different risk factors and gastrointestinal parasites. A p-value of less than 5% ($p<0.05$) with an odds ratio >1 was considered statistically significant at 95% confidence intervals.

RESULTS

The overall prevalence of this study was 10% for 100 patients who harboured at least one protozoan species. The prevalence of gastro intestinal protozoans according to species were shown in Fig. 1. It follows from the analysis of this figure that 4% of the patients were infected with *Trichomonas hominis* and the rest had 2% of infection with each of the following species *Entamoeba histolytica*, *Entamoeba coli* and *Iodamoeba butschlii*.

Table 1 shows the prevalence of protozoans according to gender, age group and level of education. It appears that the male and female sexes were equally infected in terms of number. While age group 2-14 years and patients with a primary level of education were the most infected.

Table 2 shows the overall prevalence of protozoan infection according to gender, age group, level of education and job occupation. It follows from the analysis of this table that they were no statistically significant difference ($p>0.05$) between the prevalence of men (10.42%) and women (9.62%). Similar observations were observed in different age groups. The prevalence among workers in the informal system (15.38%) was higher than among students (9.89%) and those in the formal system (0%). However, there was no statistically significant difference ($p = 0.675$). The illiterates (27.27%) and primary school subjects (28.57%) were more infected.

Table 3 shows the prevalence based on toilet type, how individuals wash their hands and the type of water. It appears from this table that the prevalence was higher among people who use water closets (11.76%) than among people who use pit toilets (9.88%), but no statistically significant difference was found ($p = 0.932$). Similarly, no statistically significant difference ($p = 0.51$) was observed between those who washed their hands with soap after using the toilet (9.30%) compared to those who did so without soap (10.53%). On the

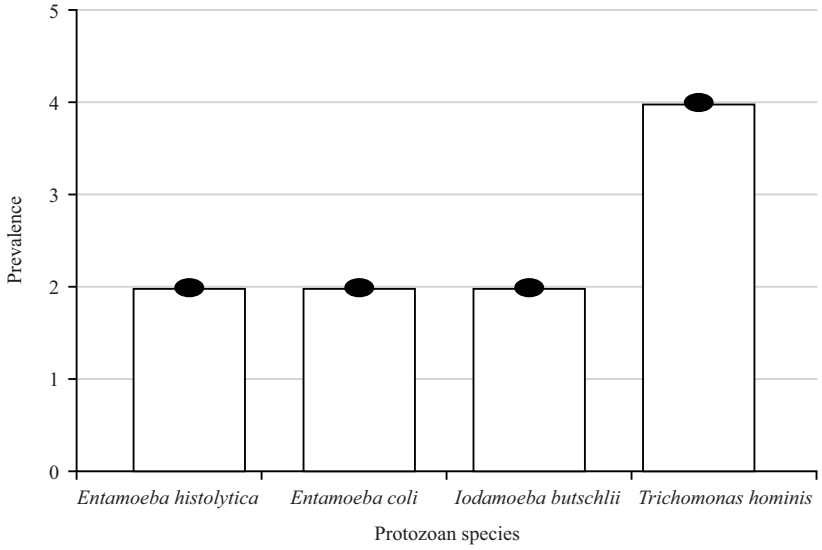

Fig. 1: Prevalence of gastro intestinal protozoans according to species

Table 1: Prevalence of protozoan species according to gender, age group and level of education

	Positive numbers n = 10 (%)				
Modality	*Entamoeba histolytica*	*Entamoeba coli*	*Iodamoeba butschlii*	*Trichomonas hominis*	Total
Gender					
Female	1 (1.0)	1 (1.0)	1 (1.0)	2 (2.0)	5 (5.0)
Male	1 (1.0)	1 (1.0)	1 (1.0)	2 (2.0)	5 (5.0)
Age range					
2-14	1 (1.0)	2 (2.0)	1 (1.0)	2 (2.0)	6
15-30	1 (1.0)	0 (0.0)	1 (1.0)	1 (1.0)	3
31-50	1 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	1
Level of education					
Illiterates	0 (0.0)	1 (1.0)	1 (1.0)	1 (1.0)	3
Primary	1 (1.0)	1 (1.0)	2 (2.0)	2 (2.0)	6
Secondary	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)	1
University	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0

Table 2: Overall prevalence of protozoan infection according to gender, age group, level of education and job occupation

Factors	Total examined	Number of positive cases	Prevalence (%)	p-value
Sex				
Female	52	05	09.62	0.894
Male	48	05	10.42	
Total	100	10	10.00	
Age				
1-14	31	06	19.35	0.104
15-30	43	03	06.97	
31-80	23	01	04.35	
Total	100	10	10.00	
Job occupation				
Informal system	26	04	15.38	0.675
Formal system	03	00	00.00	
Student	61	06	09.84	
Total	100	10	10.00	
Level of education				
Illiterates	11	03	27.27	0.01
Primary	21	06	28.57	
Secondary	32	01	3.125	
University	26	0	00.00	
Total	100	10	10.00	

Table 3: Prevalence based on toilet type, how individuals wash their hands and type of water

Factors	Total examined	Number of positive cases	Prevalence (%)	p-value
Type of toilet				0.932
Pit latrine	81	08	09.88	
Water closet	17	02	11.76	
Total	100	10	10.00	
Hand hygiene after using toilets				
Without soap	57	06	10.53	0.51
With soap	43	04	09.30	
Total	100	10	10.00	
Hand hygiene before meals				
Regularly	93	04	04.30	0.001*
Often	07	06	85.70	
Total	100	100	10.00	
Water consumed				
Tap	66	04	06.06	
Well	15	05	33.33	0.005*
Stream	19	01	05.26	

*Low association risk factors

Table 4: Risk factors

Factors	Total examined	Number of positive cases	Odds ratio	C I 95%	p-value
Sex					
Female	52	05	1.093	0.296-4.083	0.894*
Male	48	05			
Age					
1-14	31	06	3.900	1.014-14.99	0.037**
15-30	23	01	0.343	0.041-2.865	0.301
31-80	46	03	0.468	0.114-1.927	0.285
Job occupation					
Informal system	26	04	1.641	0.428-6.297	0.467*
Student	61	06	0.713	0.187-2.724	0.620
Level of education					
Illiterates	11	03	3.078	0.692-13.698	0.124*
Primary	27	06	4.929	1.27-19.129	0.013**
Secondary	32	01	0.201	0.024-1.662	0.103
Type of toilet					
Pit latrine	81	08	1.074	0.209-5.517	0.932*
Water closet	19	02			
Hand hygiene after using toilets					
Without soap	57	06	2.149	0.567-8.149	0.252*
With soap	43	04			
Hand hygiene before meals					
Regularly	93	04	133.5	12.33-1388.784	0.001**
Often	07	06			
Water consumed					
Tap	66	04	0.301	0.079-1.152	0.067
Well	15	05	8.00	1.967-32.54	0.001**
Stream	19	01	0.444	0.053-3.738	0.444

*Low association risk factors and **Strong association risk factors

other hand, a statistically significant difference ($p = 0.001$) was observed between those who regularly washed their hands before eating (4.30%) and those who did not (85.7%). Similarly, a statistically significant difference was observed between those who regularly washed their hands before eating (4.30%) and those who did not (85.7%), as well as among those who drank water from the well (33.33%), tap (6.06%) and borehole (5.26%).

Table 4 presents risk factors related to gender, age, occupation, education, toilet type, hand hygiene and water sources. It shows that the probability of infection increases with gender, age (1-14), occupation in the informal sector, type of toilet, personal hygiene before meals and after stools, frequency of hand washing, source of water consumed and level of education ($OR \geq 1$).

DISCUSSION

The aim of this study was to determine the prevalence of gastrointestinal protozoan infections amongst patients attending the Bamenda Regional Hospital. The results of this hospital-based study showed a relatively moderate prevalence of protozoan infection at 10%. This prevalence was lower than that of Cedric *et al.*[17] on the prevalence and risk factors of gastrointestinal protozoans in Ntamuchie, Mezam Division, North West Region, Cameroon, with a prevalence of 33%. Poor environmental and hygienic conditions such as playing with fingers on contaminated environment and dirtying their dresses, putting these contaminated fingers and objects in the mouth and moving barefoot may be attributed to the high prevalence observed.

This study found that the most prevalent protozoan was *Trichomonas hominis* (4%). The results of this study confirm those reported by Abdo *et al.*[18] in school-aged children in Egypt with a prevalence of 13.8% (25 out of 180 children) for *Pentatrichomonas hominis*. The findings of this study contradict those reported in Bambili, Cameroon, where, *E. histolytica* (8.9%) and *E. coli* (7.6%) were the most common intestinal protozoans[19]. This study also found that men (10.42%), were more affected than women (9.62%), but the difference was not statistically significant. This difference in prevalence observed in the two genders could be justified by the fact that males are much more interested in working and are therefore comparatively more exposed to contaminated soil and water, a predisposing factor for infection. However, this result corroborates that of Suntaravitun and Dokmaikaw[20] who found that men have a higher rate of exposure than females in the context of professional activities.

The prevalence was higher in the age group of 1 to 14 years than in the age group of 15 and above.

These findings corroborate those of the study conducted by Benouis *et al.*[21] in Algeria, confirming the hypothesis that

children face a high risk of infection, which may be explained by the fact that people in this age group do not respect hygiene skills and practices.

According to Benouis *et al.*[21] people working in the informal sector were more vulnerable to parasitic gastrointestinal infections than those working in the formal sector and students, which could be explained by a lack of health protection and education for people working in the informal sector. Those with a low level of education, that is, illiterates (27.27%), primary (28.57%) and secondary schoolers (31.25%), were the most infected. These findings were consistent with those of Yamssi *et al.*[17] where 17% had only completed primary school, 10% completed secondary school and 6% completed tertiary education. This probably indicates that a low educational level is a risk factor associated with protozoan infection. Since patients with a high level of education are more aware of the parasitic disease, it can be said that the high level of education is an aid to the knowledge of protozoan infection due to the presence of great opportunities to acquire scientific knowledge[17].

This study found that 81% of the population used latrines and was less infected than 17% using a water closet system toilet. These results were similar to those obtained by Kuete *et al.*[22], in a study carried out in the central prison of New Bell in Cameroon and according to these authors water closet system toilets are shared with people who are probably infected and adopt poor hygienic practices when using them.

Subsequently, 43% of participants who washed their hands with soap where less infected and it was the same with people who washed their hands regularly before eating meals. These practices were significantly associated with the appearance of gastrointestinal protozoan infections. These results were similar to those of Eshetu *et al.*[23], in a study conducted in Ethiopia, where most hygienic practices, such as washing hands with water after using the toilet, washing hands with soap and water after using the toilet, had statistically significant values.

Results showed that habits such as drinking water from the well and the stream without treatment were also risk factors for the participants. These results corroborate those of Yamssi *et al.*[17], where the highest frequency of infection occurred in people who used streams and rivers (13%) as their sources of water. According to Hajissa *et al.*[24], "poverty reduction, sanitation, hygiene and attention to preventive control measures are the keys to reducing the transmission of protozoan parasites".

To the Cameroonian Government this study, will create awareness on the level at which gastrointestinal protozoans infections amongst patients attending the Bamenda Regional Hospital is of a public health concern.

Given the gravity of the health problems caused by infections with gastrointestinal amoebiasis and trichomoniasis and also to continue to limit the rate of gastrointestinal helminth infections, it would be necessary that parents should be educated on the importance of mass drug administration campaigns and the need for them to encourage their children to always participate in such campaigns. Parents should endeavor to treat drinking water from sources such as wells and streams and to ensure that their children follow personal hygiene and food sanitation principles.

One of the limitations that we had in this study was that, some of the patients attending the Bamenda Regional Hospital refused to take part in the study.

CONCLUSION

The overall prevalence of protozoan infection was 10% among patients attending the Bamenda Regional Hospital. This study assessed the association of potential risk factors with the prevalence of protozoan. Hand washing, hygiene and others were found to be statistically significant risk factors for protozoan infection. However, it will be important to extend the study to other hospitals in the country.

SIGNIFICANCE STATEMENT

This study discovered the prevalence and associated risk factors of gastrointestinal protozoans' infections amongst patients attending the Bamenda Regional Hospital that can be beneficial for invaluable statistics needed for planning meaningful public control programs that aim at reducing the prevalence and morbidity of protozoan infections. This study will help the researcher to uncover the critical areas of protozoan infections that many researchers were not able to explore. Thus, a new theory on the risk factors of protozoan infections may be arrived at.

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