

Original Article

A demographic survey on the prevalence of gastrointestinal parasites based on socioeconomic determinants in Pakistan

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Abstract

Introduction: The present study was conducted to investigate prevalence of intestinal parasites and the risk factors related to socio-demographic characteristics of patients admitted in pathology ward, General Hospital, Gujranwala.

Methodology: 318 stool samples were collected from patients and examined under light microscope by using wet mount technique. While socio-demographic information was collected in the form of a questionnaire.

Results: The results showed seven (n = 7) species of intestinal parasites were prevalent in stool samples of patients. Among them, four (n = 4) were helminth and three (n = 3) were protozoan parasites causing single and mixed infections. Overall prevalence of intestinal parasites was 78.3% (n = 249/318) considering both male and female patients. Highest prevalence was recorded for *A. lumbricoides* (n = 125, 39.3%) followed by *H. nana* (n = 10, 3.1%), *S. stercoralis* and *T. saginata* (n = 6, 1.9%). Among protozoan parasites, higher prevalence was recorded in *G. lamblia* (n = 23, 7.2%) followed by *E. histolytica* (n = 21, 6.6%). Among single infections, the most prevalent parasite was *A. lumbricoides* and less prevalent parasites were *S. stercoralis* and *T. saginata*. The factors that had significant effect ($p < 0.05$) on prevalence of parasitic species were contaminated water, food, soil, and surrounding environment.

Conclusions: The present study determined that the parasite helminth (*A. lumbricoides*, *H. nana*, *S. stercoralis*, *T. saginata*) and protozoan (*G. lamblia* and *E. histolytica*) are common that pose an important public health concern in Pakistan.

Key words: Gastrointestinal parasites; protozoa; helminth; human; Pakistan.

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Introduction

Intestinal parasitic (IP) infections are of special apprehension to public health around the world. IP infections affect all age groups, in general, but children are most commonly affected attributed to their fragile immune system and composite nutritional requirements. World population is affected with

intestinal parasites most-often in low income countries like Ethiopia and Sub Saharan Africa [1].

Intestinal parasites are two types, protozoans and helminths. Among protozoan, most common parasites prevalent generally in global population are *Entamoeba histolytica*, *Giardia lamblia*, and *Cryptosporidium spp.* The most popular helminth parasites that affect human intestinal tract are *Ascaris lumbricoides*, *Trichuris*

trichura, *Ancylostoma duodenale*, *Hymenolepis nana*, *Taenia saginata* and *Taenia solium* [2].

Gastrointestinal tract acts as a reservoir of intestinal parasites that are mostly localized in gastrointestinal tract of humans and animals with most of the infections observed in small intestine. Among IP's, *E. histolytica* infect gastrointestinal tract, they pierce small intestine wall moving down to digestive tract to colon (large intestine) forming cysts that are observed in stool, whereas *G. lamblia* infects small intestine, migrating from duodenum to proximal jejunum, where they attach to mucosal wall and damage it. Most intestinal protozoan infections prevalence is reported to be high, such as amoebiasis that affects 48 million individuals globally [3].

Intestinal helminths further prevail in tropical areas, where temperature is usually suitable for parasite growth. Parasitic infections are common in unhygienic environments [4]. Recent investigations conducted among 148 samples collected from cafeteria food handlers, 33% of them were positive for one or more intestinal parasites, of which the prevalence rate of *A. lumbricoides* was 16% while it was 4.3% by *E. histolytica* / *dispar*. Food handlers who did not practice hand washing after defecation or before serving food were positively associated. In Southern Ethiopia, 36% food handlers were infected with different intestinal parasites, where 14% were tested positive for *E. histolytica* / *dispar* and 9.27% for *A. lumbricoides* [5].

Keeping in view above facts present study was aimed to determine prevalence of intestinal parasites in different gender and age groups in patients visiting for treatment purpose to hospital and also to determine symptoms, associated risk factors and medication being recommended for intestinal parasite.

Methodology

Study Area and Design

The study was carried out at a clinical laboratory of pathology ward in Gujranwala hospital from January to June, 2017 on basis of patients visiting for treatment. Gujranwala is located 328°60.000"N and 7410'59.880"E according to geographical coordinates. It is 226 m (744 feet) above sea level, and its total area is about 3,198 km² with a total population of 1,384,471. The study population (patients) interviewed and sampled came from various urban and rural areas.

Data was initially collected through a questionnaire by interviewing patients, and experimental work was carried out by observing stool samples under light microscope (No. AD1978). Fecal samples of 318

patients were examined and diagnosed for gastrointestinal parasites in pathology laboratory.

The data was collected from patients included all closed-ended questions related to associated characteristics of patients including age, sex, family size, education, life skills, occupation, personal hygiene, awareness regarding parasitic infections, source of water, presence or absence of latrines in their houses, residence, economic status, food type and its handling, and habit of wearing shoes. The questionnaire was prepared in English, but for convenience and better understanding it was asked in local language, Urdu, spoken in the city. The responses were noted on a separate notebook, providing very useful information related to associated risk factors.

Stool Sample Collection and Examination

During stool sample collection, disposable plastic boxes and spoons were distributed to patients along with instructions on stool collection. They were told to fill up disposable plastic boxes about size of tip of thumb (approximately 5 gram of stool) of fresh stool by using disposable spoon [6]. The patient's serial number with date of diagnosis was mentioned on plastic box so that their diagnostic results were easily identified and recorded on register. The stool sample containing plastic boxes were placed in a large container and carried to pathology clinical lab on the same day of collection for parasitological examination under microscope.

Direct wet-mount method is simplest technique used for easy diagnosis of intestinal parasites in stool samples. This method specifically involves use of iodine to detect the presence of motile intestinal parasites, cyst, egg, larvae or trophozoite by using light microscope. In performing wet-mount technique, firstly 2 gram of stool sample was combined with 3-4 ml of normal saline, which was used to observe cyst and trophozoite in stool sample and for easy observation on the surface. After it, a drop of emulsified sample was added on a clean glass slide followed by adding few drops of iodine solution on glass slide that was then covered with a cover slip. The prepared glass slide was then placed on stage under microscope. The ova and cyst of intestinal parasites were observed by microscope and their identification was done based on size and morphological characteristics, which differed according to species of parasite diagnosed in each stool sample [7].

Statistical Analysis

Statistical analysis was performed by using SPSS software, version 21.0. Chi-square test was applied to find out level of significance, and to observe various associations between associated risk factors and prevalence of IPs, whereas two-way ANOVA was applied to find out the effect of independent variable on dependent variables. Values were considered to be statistically significant when values were less than 0.05.

Results

Among 318 stool samples examined, 249 (78.3%) had positive results containing intestinal parasites which showed presence of parasites responsible of intestinal diseases. Overall, prevalence of intestinal parasites in study population included four helminth and three protozoan parasites with single and mix infections. Total prevalence of IPs was 78.3% (n = 249 cases) which showed high distribution of parasites during study period. Among age groups, most infected group was 21-30 comprising more young male patients (n = 109, 34.3%) followed by 31 to 40 of age having adult male patients (n = 85, 26.7%) indicating exposure of male individuals to various working environments. Mostly these patients had occupation like food or drink handlers at shops or hotels. The least affected were children of 1-10 years old having frequency of 3.8%. Males were more affected as compared to females, however, this association was statistically non-significant ($p = 0.567 > 0.05$). Higher prevalent

helminth was *A. lumbricoides* (39.3%) followed by *H. nana* (3.1%), *S. stercoralis* and *T. saginata* had a similar frequency of 1.9%. Moreover, protozoan prevalence included *E. histolytica* (6.6%), *G. lamblia*

Table 2. Frequency distribution of socio-demographic characteristics of patients.

Characteristics	No. of Participants (n) = 318 (%)
Gender	
Male	277 (87.1)
Female	41 (12.9)
Marriage Status	
Married	167 (52.5)
Unmarried	151 (47.5)
Family Size	
5	45 (14.2)
6-7	117 (36.8)
> 8	156 (49.1)
Education Level	
Primary	69 (21.7)
Secondary	67 (21.1)
Matric	35 (11.0)
Intermediate	37 (11.6)
Graduate	18 (5.7)
Illiterate	52 (16.4)
Bachelor of arts	39 (12.3)
Diploma	1 (0.3)
Profession	
Teaching	18 (5.7)
Nursing	10 (3.1)
Food handler	103 (32.4)
Chef	56 (17.6)
Farmer	17 (5.3)
Any kind of stall	17 (5.3)
Servant in factory	29 (9.1)
None	68 (21.4)
Residence	
Urban area	282 (88.7)
Rural area	36 (11.3)
Economic status	
Poor	98 (30.8)
Middle class	220 (69.2)
Source of water	
Tape water	159 (50.0)
Filter water	153 (48.1)
Boil water	6 (1.9)
Type of Food	
Home made	236 (74.2)
Ready made	34 (10.7)
Fast food	48 (15.1)
Hygienic Conditions	
<i>Washes hand before meal and after toilet</i>	
Yes	173 (54.4)
No	58 (18.2)
Sometimes	87 (27.4)
<i>Kind of latrine</i>	
Open Field	4 (1.3)
Private	227 (71.4)
Open Field	4 (1.3)
<i>Surrounding area clean</i>	
Yes	141 (44.3)
No	177 (55.7)
Source of Drugs	
Hospital prescription	201 (63.2)
Pharmacy	42 (13.2)
Others	6 (1.9)
None	69 (21.7)

Figure 1. Prevalence percentage of various intestinal parasites.

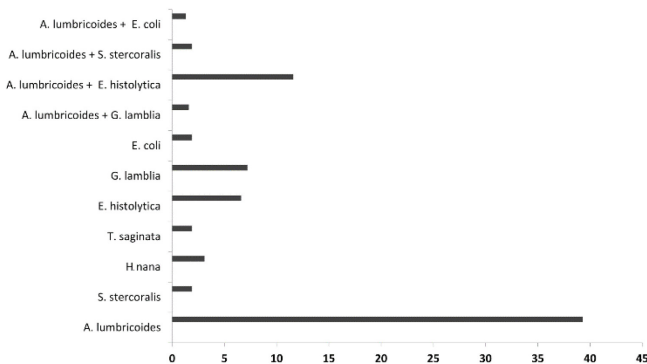


Table 1. Distribution of patients infected with intestinal parasites by age group.

Age group	No. of Patients (%)
1-10	12 (3.8)
11-20	44 (13.8)
21-30	109 (34.3)
31-40	85 (26.7)
41-50	42 (13.2)
51-60	26 (8.2)

(7.2%), and *E. coli* (1.9%), respectively (Table 1; Figure 1).

Information regarding demographic factors were collected by interviewing patients before their stool examination, includes gender, marital status, family size, level of education, profession, residence, economic status, source of food, water and drugs, and hygienic conditions as shown in Table 2. Among 318 samples, male patients had higher (87.1%) frequency of infection than female patients (12.9%). Married had a higher prevalence rate (n = 167, 52.5%) than unmarried (n = 151, 47.5%). Patients with family size (> 8 individuals) were more prone to infection (n = 156, 49.1%) followed by family size of 6-7 (n = 117, 36.8%) and 5 (n = 45, 14.2%) individuals, respectively. Current findings depicts the influence of various living factors including hygiene and status of individuals and their exposure to risk factors related to intestinal parasites. When infection frequency was compared with level of education, results showed that more infected individuals were having primary education (21.7%) followed by illiterate group (16.4%); patients having graduate level of education (n = 18, 5.7%) and diploma holders (0.3%). These findings showed awareness towards cleanliness and handling of food materials with precautions depends on education level. According to profession, the most examined patients were food handlers, including males (n = 103, 32.4%) followed by patients having no occupation, including mostly children and females (n = 68, 21.4%) followed by patients who were chef including males (n = 56, 17.6%). More patients were from urban areas of

Gujranwala and nearby towns and central areas (88.7%), but lowest number of patients was from rural areas (11.3%), because many patients had their employment source located in Gujranwala urban areas. Patients belonging to middle income (n = 220, 69.2%) group were more in number compared to lower income strata (n=98, 30.8%). A high number of patients used tap water as source of water supply (50%) followed by patients using filtered water (48.1%), and patients using boiled water (1.9%). Patients eating home-cooked food were more frequent (74.2%), followed by patients consuming fast food (15.1%), and patients eating ready-made food (10.7%). Patients using hospital prescription as source of drug were more in number (n = 201, 63.2%), followed by patients not using any kind of drug (n = 69, 21.7%) and patients using pharmaceutical store as source of drug (13.2%), respectively.

Information related to source of water, type of food eaten, hand washing habit before meal and after toilet usage, kind of latrine used, cleaning surrounding area, and personal hygiene was also collected. Patient washing hands before meals and after toilet were 54.4% followed by patients that occasionally wash hands with a frequency of 27.4% and patients who did not wash hands were 18.2%. Patients who used private latrine were more in number with a frequency of 71.4% (n = 227) followed by patients using public latrine (n = 87, 27.4%), and patients using open field were 1.3%. Patients having filthy residential surrounding areas were more frequent (55.7%) than patients having clean surrounding areas (44.3%). Patients who followed personal hygienic routine were more frequent (n = 172,

Table 3. Association of prevalence of intestinal protozoan and helminth parasites with personal characteristics of examined patients

Personal Characteristics	Frequency	Intestinal Protozoan (No of positive)			Intestinal Helminths (No of positive)				Protozoan and Helminths (No of positive)				χ ²
		Eh	Gl	Ec	Al	St	Hn	Ts	Eh	Gl	St	Ec	
Sex													
Male	277	18	19	6	106	6	9	6	29	5	6	4	9.594
Female	41	3	4	0	19	0	1	0	8	0	0	0	
Age Group													
1-10	12	0	1	1	4	0	2	0	0	0	0	0	64.07
11-20	44	4	2	1	16	0	0	1	9	2	0	1	
21-30	109	5	5	2	48	3	4	1	11	0	3	2	
31-40	85	5	9	2	32	1	3	2	10	2	0	0	
41-50	42	5	2	0	21	0	1	2	4	0	2	1	
51-60	26	2	4	0	4	2	0	0	3	1	1	0	
Marital Status													
Married	167	12	15	2	66	3	5	5	18	2	3	1	6.738
Unmarried	151	9	8	4	59	3	5	1	19	3	3	3	
Family size													
5	45	2	3	0	16	1	1	0	3	0	2	0	27.39
6-7	117	8	7	3	42	4	3	1	12	3	2	1	
>8	156	11	13	3	67	1	6	5	22	2	2	3	

Eh: *Entamoeba histolytica*; Gl: *Giardia lamblia*; Ec: *Entamoeba coli*; Al: *Ascaris lumbricoides*; Ss: *Strongyloides stercoralis*; Hn: *Hymenolepis nana*; Ts: *Taenia saginata*.

54.1%) than patients with poor personal hygiene (n = 146, 45.9%). Mostly the recommended drug was Albendazole (n=117, 36.8%). Some patients were also prescribed metronidazole with different formulation. Association of prevalence of intestinal protozoan and helminth parasites with personal characteristics of examined patients is shown in Table 3.

Discussion

Diagnosis of intestinal parasitic infections in patients using a stool test (n = 318, 100%) was an easily accessible and useful immediate diagnostic tool for IP's similar to method used by Kidane *et al* [6] to diagnose IP's among primary school children of Wukro town. Similar observations were also reported in schoolchildren using stool samples to identify parasitic infections by Vincent *et al* [8]. Amer *et al* [9] analyzed the prevalence of intestinal infections among local patients in hospitals of Saudi Arabia.

The protozoan parasite prevalence included *G. lamblia* with highest prevalent rate of 7.2% (n = 23) followed by *E. histolytica* with 6.6% (n = 21) frequency. Similar findings were previously reported by Kadir and Salman [10], who documented the prevalence of intestinal parasites among primary school children of 6-12 years old in Al-Taameem province, Iraq, but prevalence rate of *A. lumbricoides* was less comparing to this study. Mix infections also occur with different prevalence rates and can be helminth parasites (HP's) with protozoan parasites (PP's) or HP's with HP's, but mostly double infection combinations were of HP's with PP's. Double infections of HP's with HP's included *A. lumbricoides* and *S. stercoralis* with a prevalence rate of 1.9% (n = 6 cases), and HP's with PP's double infections including *A. lumbricoides* and *E. histolytica* with a high prevalence rate of 11.6% (n = 37) followed by *A. lumbricoides* and *G. lamblia* with 1.6% and 1.3% (n = 4). Among single infections, the most prevalent parasite was *A. lumbricoides*, while the least prevalent parasites were *S. stercoralis*, *T. saginata* among HP's as previously reported by Ahmad *et al* [11] to evaluate prevalence of intestinal parasitic pathogens among gastroenteritis patients of Gilgit, Pakistan.

Considering gender, the most susceptible gender was males compared to females though was not statistically significant ($p = 0.567$). These findings were similar to previous findings reported by Cimerman *et al* [12] in Brazil.

In the current study, higher prevalence of intestinal parasites was observed in individuals with secondary education, food handlers, residents from urban areas, tap water users, consuming home-made food,

infrequent washed hands after toilet, using private kind of latrine, unhygienic environment (surrounding area which was not clean), poor personal hygiene and middle class status. Although higher prevalence of IP's was observed in 21-30 years age group, there was no statistically significant association between prevalence of IP's and age group ($p = 0.188$), but this finding was in contrast with a previous report stated by Kinade *et al* [6] in Ethiopia. Similarly in case of marital status, the most affected and prevalent rate of IP's was seen in married patients than unmarried, but there was no statistically significant association between prevalence of IP's and marital status ($p = 0.820$). Similarly in case of family size, prevalent rate of IP's was seen more in patients with family size greater than 8 and least affected patients with family size 5, but there was statistically non significant association between prevalence of IP's and family size ($p = 0.192$). Similar findings were observed by Mehraj *et al* [13] Karachi, Pakistan.

Mostly patients administered drug Albendazole (n = 117, 36.8%) as recommended by WHO [14] followed by patients not using any drug (n = 69, 21.7%), Albendazole and Metronidazol (n = 37, 11.6%), Metronidazol (n = 36, 11.3%), Mebendazole (n = 30, 9.4%) and Praziquantel (n = 3, 0.9%). The most effective drugs were Albendazole followed by Metronidazol and Mebendazole. These findings were similar to ones reported by WHO [15], which have already been recommended and suggested by various practitioners. The findings showed strong effect of some drugs on IP's among patients who had positive stool samples and use of some of these drugs resulted in great health improvement and reduction of intestinal parasitic symptoms among patients.

Conclusion

It was concluded that most prevalent intestinal parasites were *A. lumbricoides* among helminths, and *G. lamblia* among protozoans. These were spreading mainly through water and contaminated food and soil. While most infected people from intestinal parasites were those that used tap water source and consumed home-cooked food, having careless habit of not washing hands and with poor personal hygiene. Also the patients under study used tap water supplies which were contaminated with parasites and dust particles resulting in infections among the population. The frequent and effective drugs recommended by doctors were Albendazole and Metronidazol. In future, research work should be carried out in various rural areas of Pakistan because most of the population living in these

areas is unaware about main causes of intestinal parasites related diseases. Furthermore, medical treatment along with preventive measures can results in reduction of IP's from the society as well as from the rest of the world.

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