

Prevalence and Predictors of Intestinal Parasitic Infections at King Abdulaziz University Hospital, Jeddah, Saudi Arabia, from 2019 to 2023: A Retrospective Study

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Purpose: Parasitic infections are a primary cause of illness worldwide and a public health problem. This study highlighted the prevalence of intestinal parasitic (IP) infections and their updated epidemiologic status from 2019 to 2023 at King Abdulaziz University Hospital, Jeddah, Saudi Arabia.

Patients and Methods: A retrospective study was conducted from 2019 to 2023 at King Abdulaziz University Hospital. The laboratory results, socio-demographic information, and the year of data collection were collected from the hospital's parasitology laboratory. The data were analyzed using SPSS version 26. Ethical approval was obtained from the National Committee of Bioethics (NCBE) - King Abdul Aziz City for Science and Technology, with an approval number of 258-22.

Results: During the study period, 7673 stool samples were requested for intestinal parasite examination. The prevalence of IP infection from 2019 to 2023 was 212/7673, with a percentage of 2.8%. Infected patients had a mean (SD) age of 37.68 (17.27) years. Most infected patients were females (61%) and from Saudi Arabia (37.1%). Most stool samples were brown (79.1%), and about half were soft (51.7%). 2019 had the highest number of infected cases (28.3%), while the number of cases decreased in 2023 (8.8%), the lowest during five years. The most predominant parasite among study subjects was *Blastocystis hominis* (48.11%).

Conclusion: The prevalence of IP infection is lower than in previous comparable surveys. Maintaining personal hygiene, conducting epidemiological surveillance, and enhancing environmental sanitation can prevent and control infections.

Keywords: intestinal parasites, infection, prevalence, Saudi Arabia

Introduction

Parasitic infections are a crucial public health condition globally caused by intestinal helminths and protozoan parasites, particularly in developed countries, and are considered a primary cause of illness and disease.¹⁻³ At least 30% of the worldwide population is infected with these parasites. For instance, 3.5 billion individuals worldwide are affected, and approximately 450 million patients are ill due to these infections.^{4,5} In developed countries, protozoan infections more commonly cause gastrointestinal infections than helminths.³

Helminths are worms with multiple cells and are classified into Nematodes (roundworms), trematodes (flatworms), and cestodes (tapeworms). In addition, the most common species of intestinal helminthic parasites are *Ascaris lumbricoides* (roundworm), *Ancylostoma duodenale*, *Trichuris trichiura* (whipworm), and *Necator americanus* (hookworms). Conversely, Protozoan parasites contain only one cell and can multiply inside the human body. Common intestinal protozoan parasites are *Entamoeba histolytica*, *Giardia intestinalis*, *Cryptosporidium spp*, and *Cyclospora cayetanensis*.³

Several intestinal protozoan parasites cause diarrhea-related diseases, such as giardiasis, cyclosporiasis, amoebiasis, and cryptosporidiosis.⁶

Intestinal parasitic (IP) infections are influenced by several factors, such as geography, socio-economic conditions, hygiene, and health status. These factors create ideal conditions for the growth and transmission of parasites, leading to a high risk of exposure to these infections.⁷

Stool examination is commonly used to screen parasites in diarrhea and gastrointestinal disorders.⁸ Traditional microscopy is still effective for diagnosing intestinal helminths, while new methods have been developed for protozoan parasites.³

As mentioned by WHO, there were approximately 4300 death cases of ascariasis, 45,000 death cases of hookworm infection, and 54,000 death cases of amoebiasis every year globally.⁹ A previous study in Saudi Arabia detected that the most common intestinal parasites were *Giardia lamblia* (21.9%), followed by *Entamoeba histolytica* or *Entamoeba coli* (17.8%), *Trichuris trichiura* (16.2%), *Ascaris lumbricoides* (15.8%), hookworm (13%), *Hymenolepis nana* (8.9%), *Strongyloides stercoralis* (3.5%), *Schistosoma mansoni* (2.2%), and *Enterobius vermicularis* (0.43%).¹⁰

It is well known that Saudi Arabia is considered one of the largest countries of expatriate workers, particularly the catering staff and food handlers from different countries worldwide, including Bangladesh, Sri Lanka, Philippines, Indonesia, India, and Pakistan. These countries are known to be endemic for several diseases, including those caused by intestinal parasites.¹¹ In Western India, 15.19% of participants had intestinal parasitic infections. Protozoa caused 70.71% of these infections, while helminth infections were detected in 25.71% of participants.¹² In the Philippines, the prevalence of helminth infections was 64.5%. The most common helminths were *Ascaris lumbricoides* (51.2%), *Trichuris trichiura* (27.6%), hookworm (8.0%), and *Enterobius vermicularis* (0.3%).¹³ Thus, the present study highlighted the prevalence and type of IP infections and their updated status from 2019 to 2023 at King Abdulaziz University Hospital, Jeddah, Saudi Arabia.

Methods

Study Design

A retrospective study explored the trend of intestinal parasite prevalence over five years at King Abdulaziz University Hospital, Jeddah, Saudi Arabia. (2019–2023).

Study Subjects

The study subjects were all individuals of having IP infections who were referred to the hospital laboratory for a stool examination during the study period.

Data Collection

The data from 7673 patients were retrospectively collected from the parasitology laboratory at King Abdulaziz University Hospital. The laboratory results, such as species of the intestinal parasites, were collected; socio-demographic information of infected patients, such as sex, age, nationality of the study subjects, and the year of data collection, were also collected ([Appendix](#)).

Statistical Methods

Data were extracted into an Excel sheet and then revised. The statistical analysis was done using the computer program IBM SPSS (version 26.0, Armonk, NY, USA). Categorical variables were described in numbers and percentages. A normality test was done for continuous variables. Logistic regression analysis was conducted to determine associations between intestinal parasite classification and patients' characteristics. P-values less than 0.05 were considered statistically significant.

Ethical Considerations

The National Committee of Bioethics (NCBE)—King Abdul Aziz City for Science and Technology gave approval, with approval number 258–22, on 22 May 2022. Data protection measures were implemented to ensure confidentiality.

Considering the study's retrospective nature, the Institutional Review Board (IRB) did not require patients' consent to review their medical records. All methods were performed according to the relevant guidelines and regulations (the Declaration of Helsinki).

Results

During the study period (2019–2023), 7673 stool samples were requested for intestinal parasite examination at King Abdulaziz University Hospital. Out of them, 212 samples were confirmed with intestinal parasite infections. The mean (SD) age of patients infected by intestinal parasites was 37.68 (17.27) years. Most infected patients were females (61%). In terms of nationality, the majority of the infected patients (37.1%) were Saudi, followed by Indian (27.7%). In addition, most infected cases were reported in 2019 (28.3%). All details are shown in Table 1.

Regarding the stool samples with confirmed parasitic infection, most samples were brown (79.1%). Approximately half were soft (51.7%), while only 10.8% contained coinfection. All details are illustrated in Table 2.

In Figure 1, the overall prevalence of IP infection in the study area from 2019 to 2023 was 212/7673, with a percentage of 2.8%.

According to Table 3, out of 14 different intestinal parasites have been identified in this study. The most frequently detected intestinal parasite species was *Blastocystis hominis*, found in 102 cases, accounting for 48.11% of the total intestinal parasite cases detected. *Endolimax nana* cyst was the second most common intestinal parasite species, with 74 cases accounting for 34.91% of the total intestinal infection cases detected. *Entamoeba Coli* and *Giardia lamblia* cysts were detected in 21 and 20 cases, accounting for 9.91% and 9.43% of the total intestinal infection cases. *Enterobius vermicularis* adult, Hookworm egg,

Table 1 Demographic Characteristics of the Infected Participants

Demographic Characteristics of the Infected Participants			
Age	Mean (SD)	37.68 (17.27)	
	Median (IQR)	34.50 (20)	
	Min-Max	2–93	
Parameter	Category	Frequency (n=212)	Percentage
Gender (n=210)	Male	82	39
	Female	128	61.0
Nationality (n=202)	Saudi	75	37.1
	Indian	56	27.7
	Yemeni	16	7.9
	Philippine	14	6.9
	Pakistani	11	5.4
	Ugandan	5	2.5
	Sudanese	3	1.5
	Other	22	10.9
Year	2019	60	28.3
	2020	25	11.8
	2021	49	23.1
	2022	58	27.4
	2023	20	9.4

Table 2 Basic Characteristics of the Infected Sample (N=212)

Basic Characteristics of the Infected Sample			
Parameter	Category	Frequency	Percentage
Presence of coinfection	Yes	23	10.8
	No	189	89.2
Stool color (n=211)	Brown	167	79.1
	Green/ Greenish brown	20	9.5
	Yellow/ Yellowish-brown	12	5.7
	Dark brown	6	2.8
	Red/ Reddish brown	4	1.9
	Yellowish green	1	0.5
	Black	1	0.5
Consistency of stool (n=211)	Soft	109	51.7
	Formed	51	24.2
	Watery	22	10.4
	Loose	21	10
	Hard	4	1.9
	Mucoid	4	1.9

and *Strongyloides stercoralis* were detected in 4 cases, each with a percentage of 1.89% for each species. *Trichomonas Hominis* and *Hymenolepis nana* were seen in only 2 cases each (0.94% for each species).

Entamoeba histolytica, adult worms, *Ascaris*, *Hymenolepis nana*, *Echinococcus*, and *Chilomastix mesnili* were less common, and each has been detected in 1 case (0.47%). Table 3 provides information on the percentage of each intestinal parasite species among infected cases and in the screened samples.

Concerning the IP trend (Table 4), The highest distribution of intestinal parasites was in 2022 (71 parasites, 29.3%), followed by 2019 (66 parasites, 27.3%), and the year with the lowest intestinal parasites distribution was 2023 (21 parasites, 8.7%).

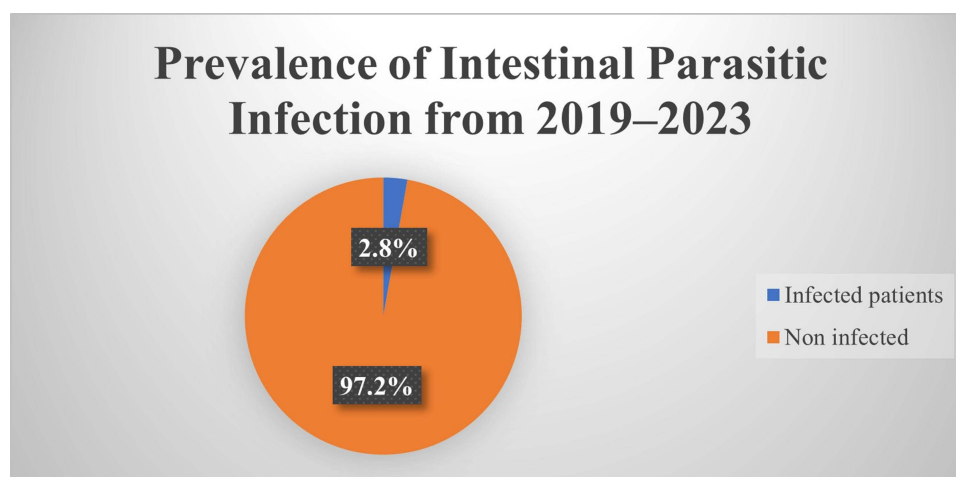
**Figure 1** Prevalence of intestinal parasitic (IP) Infections from 2019–2023.

Table 3 Distribution of Intestinal Parasitic (IP) Species

IP* Species	Frequency	Percentage of IP* Species Among Infected Cases	Percentage of IP* Species in the Screened Samples
Blastocystis hominis	102	48.11	1.33
Endolimax nana cyst	74	34.91	0.96
Entamoeba Coli	21	9.91	0.27
Giardia lamblia cyst	20	9.43	0.26
Enterobius vermicularis adult	4	1.89	0.05
Hookworm egg	4	1.89	0.05
Strongyloides stercoralis	4	1.89	0.05
Trichomonas Hominis	2	0.94	0.03
Hymenolepis nana	2	0.94	0.03
Entamoeba histolytica	1	0.47	0.01
Adult worm	1	0.47	0.01
Ascaris	1	0.47	0.01
Echinococcus	1	0.47	0.01
Chilomastix mesnili	1	0.47	0.01

Abbreviation: *IP, Intestinal parasite. **Abbreviation:** *IP, Intestinal parasite.

Table 4 Annual Trends in Distribution of Intestinal Parasite Species at King Abdulaziz University Hospital (2019–2023)

IP Species	Years					Total
	2019	2020	2021	2022	2023	
Blastocystis hominis	26 (39.4)	12 (44.4)	28 (49.1)	29 (43.3)	7 (33.3)	102 (42.1)
Endolimax nana cyst	23 (34.8)	9 (33.3)	15 (26.3)	18 (26.9)	9 (42.9)	74 (31.6)
Entamoeba Coli	5 (7.6)	3 (11.1)	6 (10.5)	5 (7.5)	2 (9.5)	21 (8.7)
Giardia lamblia cyst	4 (6.1)	2 (7.4)	5 (8.8)	7 (10.4)	2 (9.5)	20 (8.3)
Enterobius vermicularis adult	3 (4.5)	0 (0)	1 (1.8)	0 (0)	0 (0)	6 (2.5)
Hookworm egg	0 (0)	0 (0)	0 (0)	4 (6)	0 (0)	4 (1.7)
Strongyloides stercoralis	0 (0)	0 (0)	0 (0)	4 (6)	0 (0)	4 (1.7)
Trichomonas Hominis	2 (3)	0 (0)	0 (0)	4 (6)	0 (0)	4 (1.7)
Hymenolepis nana	1 (1.5)	0 (0)	0 (0)	0 (0)	1 (1.5)	2 (0.8)
Entamoeba histolytica	0 (0)	0 (0)	1 (1.8)	0 (0)	0 (0)	1 (0.4)

(Continued)

Table 4 (Continued).

IP Species	Years					Total
	2019	2020	2021	2022	2023	
Adult worm	0 (0)	0 (0)	1 (1.8)	0 (0)	0 (0)	1 (0.4)
Ascaris	1 (1.5)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.4)
Echinococcus	1 (1.5)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.4)
Chilomastix mesnili	0 (0)	1 (3.7)	0 (0)	0 (0)	0 (0)	1 (0.4)
Total	66 (27.3)	27 (11.1)	57 (23.6)	71 (29.3)	21 (8.7)	242 (100)

Note: Each patient has more than one IP infection, and the percentage here was calculated based on the total number of infections.

Blastocystis hominis was the most commonly detected species in all four years, with 26 cases in 2019, 12 cases in 2020, 28 cases in 2021, 29 cases in 2022, and 7 cases in 2023. *Endolimax nana* cyst was the second most commonly detected species, with 23 cases in 2019, 9 cases in 2020, 15 in 2021, 18 in 2022, and 9 in 2023.

Entamoeba Coli and *Giardia lamblia* cysts were detected around a similar number of cases, with 21 and 20 cases, respectively, from 2019 to 2023. *Trichomonas Hominis* was detected in 6 cases over five years. *Enterobius vermicularis* adult, Hookworm egg, and *Strongyloides stercoralis* were detected in very few cases, with 4 cases each over the five years. Furthermore, *Hymenolepis nana* was seen in only 2 cases during the five years. In addition, *Entamoeba histolytica*, Adult worm, *Ascaris*, *Echinococcus*, and *Chilomastix mesnili* were each detected in only one case for each species over the five years.

Table 5 assesses the risk factors associated with IP. There were no significant factors related to IP classification.

Table 5 Binary Logistic Regression Analysis of Intestinal Parasite Classification with Infected Patients' Characteristics at King Abdulaziz University Hospital (2019 to 2023)

Categories	Intestinal Parasite Classification Reference= Protozoa		
	Odds Ratio	Confidence Interval (95%)	P-value
Helminthes			
Age (Above 40 years=ref)			
≤ 40 years	0.648	0.144–2.909	0.571
Gender (male=ref)			
Female	0.610	0.132–2.828	0.528
Nationality (non-Saudi=ref)			
Saudi	3.605	0.815–15.942	0.091
Color (Normal=ref)			
Abnormal	0.833	0.142–4.86	0.839
Consistency (Normal=ref)			
Abnormal	0.769	0.173–3.420	0.730
Coinfection (Yes=ref)			
No	0.175	0.030–1.016	0.052

Discussion

Parasitic infections are a significant public health problem and are considered a major cause of several diseases.¹¹ IP infections are associated with poor sanitary habits and improper hygiene. The association between these factors and the prevalence of parasitic infection differs globally and in different regions of Saudi Arabia.¹⁴

It was indicated in previous surveys of variable countries that the prevalence rate of intestinal infection was 13.3% in India,¹⁵ 8.8% in Iran,¹⁶ 10.2% in Qatar,¹⁷ ranging from 32.0 to 41.5% in Palestine,¹⁸ 64.4% in Sudan,¹⁹ 57.9% in Iraq,²⁰ 7.7% in UAE,²¹ and 58.7% in Yemen.²² In Saudi Arabia, the prevalence rate of intestinal infection was 27.2% in Al-Ahsa,²³ 6.2% in Makkah,¹⁴ 47.01% in Jeddah,²⁴ and ranging from 2.3 to 39.7% in Riyadh.¹¹ The current study revealed that only 2.8% of the examined patients were infected with one or more species of intestinal parasites between 2019 and 2023. This percentage is considered low compared to the previous results in Saudi Arabia. However, a previous Saudi study reported a slightly higher intestinal infection prevalence rate (6.98%).¹¹

According to the current study, the most frequently detected intestinal parasite species was *Blastocystis hominis* (42.1%), followed by *Endolimax nana* cyst (31.6%). This finding disagrees with the previous studies in Saudi Arabia, which reported that *Ascaris lumbricoides* and *Giardia lamblia* are the most common intestinal parasites.^{11,25} Another study in Saudi Arabia revealed that the most common parasite was *Entamoeba histolytica*.²⁶ Additionally, previous studies were inconsistent with our results and mentioned that *Entamoeba histolytica* was the most common protozoa seen among patients.^{14,21,23,27,28} The difference between our findings and others may result from the fact that the growth and transmission of these types of parasites depends on several factors, including geographic and socio-economic factors, poverty, malnutrition, relatively humid regions, personal and community hygiene, high population density, and health status.⁷

In terms of helminth infection, the present study reported that the prevalence of these parasites was lower than the protozoans' infection. These results are consistent with previous surveys in several regions inside the Saudi Kingdom.^{11,14,23,25,29} On the other hand, several studies outside the kingdom also reported that protozoan infections were the most common type of intestinal infection.^{30–32} However, a survey from the Dambia district indicated helminth infection more than protozoan infection.³³

In our survey, intestinal infection was more prevalent among female patients (61%). However, there was no statistical difference between females and males regarding the prevalence of infection. Our findings are similar to a Saudi survey that reported that the prevalence of IP infections among females was higher than among males, with no significant association.²⁶ The higher infection rate among females can be interpreted as being because females are more prone to the infective stages of parasitic infection due to the chores they do in the house and their lifestyle. In addition, another survey reported findings that agree with ours; females were more than males regarding parasitic infection.²⁹ On the other side, a previous Saudi study disagreed with our results and reported that the prevalence rate of infection was slightly higher in males than females.¹¹

Furthermore, age had no statistical impact on the prevalence of intestinal infection. This was similar to Amer et al²⁶ results, which reported a higher infection prevalence among patients younger than 40 with no significant difference among the different age groups.

IP infections varied over the years, with the highest annual prevalence in 2019 and 2022 and the lowest in 2023. This highlights the significance of IP infections as a public health concern. The lower prevalence in this study suggests an overall improvement in health services. Healthcare providers should recognize and address IP infections, consider these pathogens in diagnostics, and tailor treatments accordingly. By understanding the common etiologic agents, healthcare professionals can enhance diagnostic accuracy and guide management decisions.

Limitation

The validity of our findings is limited as the nature of the study design was a retrospective study conducted in a single place in Saudi. In addition, it is important to note that this study may not have considered all potential factors that could impact the prevalence of IP infections. As a result, it is highly recommended that future studies be conducted as generalized studies and a more comprehensive investigation of all possible variables that could affect the prevalence of IP infections.

Conclusion

IP infections are still a public health condition in several countries and Saudi Arabia as well. The current study's prevalence of IP infection is lower than that of previous comparable surveys. This reflects the general enhancement in health services in Saudi Arabia. Blastocystis hominis and Endolimax nana cysts were reported to be the most common etiologic agents of IP diseases among the study subjects. Enhancing environmental sanitation, maintaining periodical epidemiological surveillance, and promoting methods of maintaining personal hygiene could be good strategies to prevent and control IP infections.

Abbreviation

IP, intestinal parasitic.

Disclosure

The authors report no conflicts of interest in this work.

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