Sadaa Al-qalum Journal

Prevalence of intestinal Parasitic Infections Among Patients Attending Al-Salam Medical Laboratory-Al-Abyar City-Libyia

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ARTICLE INFO

Received: 18-*05*-2026
Accepted: 25-05-2026
Published: 02-06-2026

ABSTRACT

IPIs are a predominant health threat throughout the world; however, these infections are most prevalent in the tropics and sub-tropics. The objective of this research was to evaluate the prevalence of IPIs among patients receiving services at Al-Salam Medical Laboratory located in Al-Abyar. A retrospective study assessing records of 410 stool samples collected from a variety of patients during the period from 1/1/2024 until 31/12/2024 was carried out. Each stool specimen was evaluated both macroscopically and microscopically using the direct wet mount procedure with saline and Lugol's iodine as wetting solution.Of the 410 stool specimens,59(14.39%) contained helminthes ova/cysts. Three different species of parasites were identified: *Entamoeba histolytica, Entamoeba coli and Ascaris lumbricoides*. *Entamoeba histolytica* was the most common species overall (40.67%) followed closely by *Entamoeba coli* (30.50%) and *Ascaris lumbricoides* (28.81%).Infection rates were higher in females (59.32%) than their male counterparts (40.67%).The highest infection rate overall occurred during the summer season (35.59% of total samples).These results support the need for an increased focus on health promotion activities and enhancements in both water supply and waste disposal systems in order to decrease the incidence of intestinal parasitic infections in this area.

1. Introduction:-

Intestinal parasitic infections are among the most common infectious diseases. They affect people of all ages and socioeconomic groups around the world; however, they are disproportionately concentrated in low and middle-income countries located in the tropics or subtropics (Feleke, 2021; Holland *et al.*, 2022). The global prevalence of intestinal parasites is influenced by a combination of factors such as inadequate sanitation infrastructure,contaminated sources of drinking water,overcrowding, poor hygiene practices, and lack of access to health care (GBD 2021, NTD Collaborators, 2024).

According to Feleke (2021), around 3.5 billion people globally have intestinal parasites, for which approximately 200,000 deaths are reported annually. In sub-Saharan Africa, South Asia and parts of the Middle East and North Africa, the burden of intestinal parasites is excessively high, due to limited resources to enable adequate prevention and control (Alruwaili *et al.*, 2024). Clinical manifestations of intestinal parasites occur on a continuum with asymptomatic infection at one end of the continuum and severe complications like anemia, wasting, growth retardation, abdominal pain, pancreatitis, and cholecystitis on the other end of the continuum (Al-Malki, 2021; Al-Yousofi *et al.*, 2022).

Entamoeba histolytica, one of the most common protozoan parasites, causes high morbidity and mortality rates. It is the third leading cause of death from a parasitic disease globally, behind malaria and schistosomiasis(Hasan *et al.*, 2023). In fact, an estimated 50 million new clinical cases of amoebiasis will occur this year, leading to 75,000 deaths, particularly in children under five years old, in many endemic areas (Abate *et al.*, 2023). *Entamoeba coli*, while not pathogenic, is a valuable indicator of faecal contamination in food and water and when present can indicate that contamination with other pathogenic organisms has also occurred (Hasan *et al.*, 2023).

Another common soil-transmitted helminth, Ascaris lumbricoides, is the parasite which causes ascariasis (Holland *et al.*, 2022). The prevalence of A. lumbricoides is greatest in sub-Saharan Africa and South/Southeast Asia and has resulted in the systematic review and meta-analysis of over 400 studies published between 2010 and 2021 showing A. lumbricoides remains one of the most neglected tropical diseases (Holland *et al.*, 2022). Ascaris lumbricoides is transmitted via contaminated soil (due in part to the use of untreated human and animal waste as fertiliser, poor sanitation facilities and open defecation), particularly in rural and peri-urban settings (Holland *et al.*, 2022; Abate *et al.*, 2022).

Ingesting food or drink that has been contaminated with eggs, cysts, or larvae of parasites is one of the most common ways that intestinal parasite infections occur. Protozoan parasites such as Entamoeba histolytica transmit via the faecal-oral route, whereas soil-transmitted helmiths, such as the Ascaris roundworm infect via unwashed vegetables and the ground where they grow. Seasonal temperature changes and humidity have an important influence on how long parasites can survive and how easily they can be transmitted to hosts.

Hand washing is one of the most cost effective interventions to prevent intestinal parasitic infection. Adherence to handwashing practices has been shown to reduce the rate of infection among school children and other community members, especially in areas where intestinal parasite infections are endemic. Medications used to treat intestinal parasitic infections include antiparasitic medications; metronidazole is the drug of choice to treat amoebiasis because it kills both trophozoites and cysts; while albendazole and mebendazole are most often used to treat soil transmitted helminthes.

Although awareness of intestinal parasitic infections keeps increasing, many areas across Libya have insufficient characterization of them as will limit the planning of appropriate public health responses. The Al-Abyar area of north-eastern Libya has many of the same epidemiologic features found in other North African countries, including similar climates, sanitation availability, and economic conditions. There is also a need for local studies to assess the

prevalence of intestinal parasites and to determine which species are prevalent so that appropriate health policies can be developed, priority could be given to interventions and diagnostic and therapeutic resources allocated (Prevalence in Hun City, Libya, 2024).

2. Aims of the Study:-

The purpose of the current research was to:

•Determine the pathogenic/non-pathogenic intestinal parasite types and prevalence among people utilising Al-Salam Medical Laboratory located at Al-Abyar.

•Investigate the association between patient sex (male versus female) and the occurrence of an intestinal parasitic infection.

•Evaluate whether the month or season in which a sample was collected was associated with the occurrence of an intestinal parasitic infection.

•Provide evidence-based data to inform the local community on how to develop strategies for the prevention/control of intestinal parasitic infections.

3. Materials and Methods:

3.1 Study Design and Site:

This study was cross-sequential, retrospective, and involved a laboratory in Libya (Al-Salam Medical Lab). A total of 410 patients submitted stool samples for laboratory analysis from 1st of January to 31st December 2020 (2024). The study site's climate is semi-arid Mediterranean (hot summers & warm winters), both of which have been shown to play a role in the survival and spread of parasites (Workineh et al., 2022).

3.2 Study Population and Sample Size:

The study's population comprised 410 faecal samples: 215 from male patients and 195 from female patients across a wide age range.This sample represents about half of all patients that were seen at the laboratory during the study's time frame.

3.3 Laboratory Methods:

Analyses of faecal samples were performed first using a macroscopic and then microscopically. For macroscopic analyses, we measured the following parameters: appearance of colour, consistency, presence of blood or mucus, and presence of adult helminths. For microscopic examinations, two slides were prepared; one slide was made using the direct wet mount method where a small amount of stool was emulsified in 0.9% NaCl solution on a glass slide (not an industry standard) and then examined under a microscope for the presence of trophozoites (protozoa in their motile, feeding stage) and cysts (the dormant, resistant form of protozoa). The second slide was stained using Lugol's iodine solution; this procedure increases the detail of protozoan cysts and helminth eggs or larvae. This approach was chosen because it is widely used in resource-limited settings for the primary detection of intestinal parasites (WHO, 2021; Alruwaili et al., 2024).

3.4 Statistical Analysis:-

The SPSS program (25.0 edition) was used to enter &analyse data. Descriptive statistics were generated for all variables. Infection rates were calculated using percentages; associations between parasitic infection and categorical variables (sex, month of the sample, season) were determined using the Chi-Square test at a significance level of $P < 0.05$.

4. Results:

4.1 Overall Infection Rate:-

A total of 59 out of 410 stool samples (14.39%) gave a positive result for intestinal parasites and 351 (85.61%) gave a negative result. The results are shown in Table 1.

Table (1): Overall infection rate of intestinal parasites

Status	Number (N)	Percentage %
Infection cases	59	14.39%
Non-infection	351	85.61%
Total	410	100%

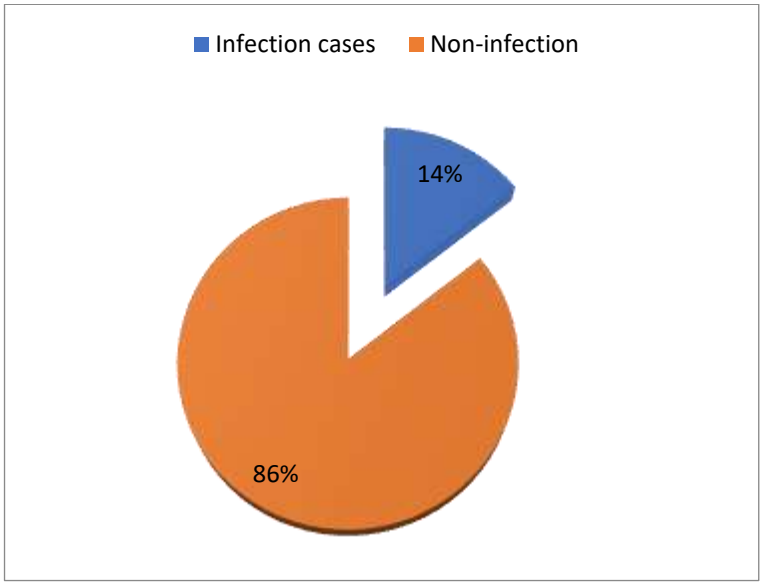


Figure (1): Overall infection rate of intestinal parasites

4.2 Infection Rate by Sex:-

Males 40.67% (24/59) had a lower percentage of infection than females 59.32% (35/59). Data are shown summarized in Table 2.

Table (2): Infection rate by sex

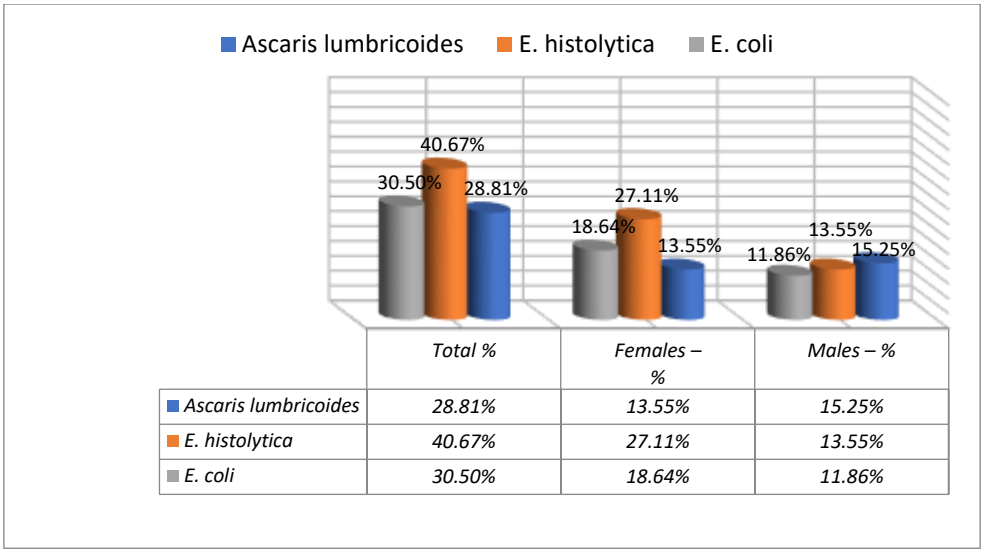
Sex	Samples examined (N)	Infected (N)	Percentage %
Male	215	24	40.67%
Female	195	35	59.32%
Total	410	59	100%

4.3 Infection Rate by Parasite Species and Sex:

Identified species included:*Entamoeba histolytica/dispar,Entamoeba coliand Ascaris lumbricoides.Entamoeba histolytica* was the most common species overall (40.67%) followed closely by *Entamoeba coli* (30.50%) and *Ascaris lumbricoides* (28.81%). Among males, the predominant species was *Ascaris lumbricoides* (15.25%), while *Entamoeba histolytica* predominated among females(%27.11) Further detail is provided in Table 3.

Table (3): Infection rate by parasite species and sex

Parasite	Males (N)	Males %	Females (N)	Females %	Total	Total %
Ascaris lumbricoides	9	15.25%	8	13.55%	17	%28.81
E. histolytica	8	13.55%	16	27.11%	24	%40.67
E. coli	7	11.86%	11	18.64%	18	%30.50
Total	24	40.67%	35	59.32%	59	%100



	Total %	Females – %	Males – %
Ascaris lumbricoides	28.81%	13.55%	15.25%
E. histolytica	40.67%	27.11%	13.55%
E. coli	30.50%	18.64%	11.86%

Figure ()Infection rate by parasite species and sex

4.4 Monthly Distribution of Infections:

The number of infected male patients(16.66%) peaked in September, November, and May with none reported in January and October,whereas the number of infected female patients (20.00%) peaked in December and June.The total for both sexes was highest in December (16.94%),June (15.25%), and September (13.55%). Detailed data can be found in Table 4.

Table (4): Monthly distribution of intestinal parasitic infections by sex

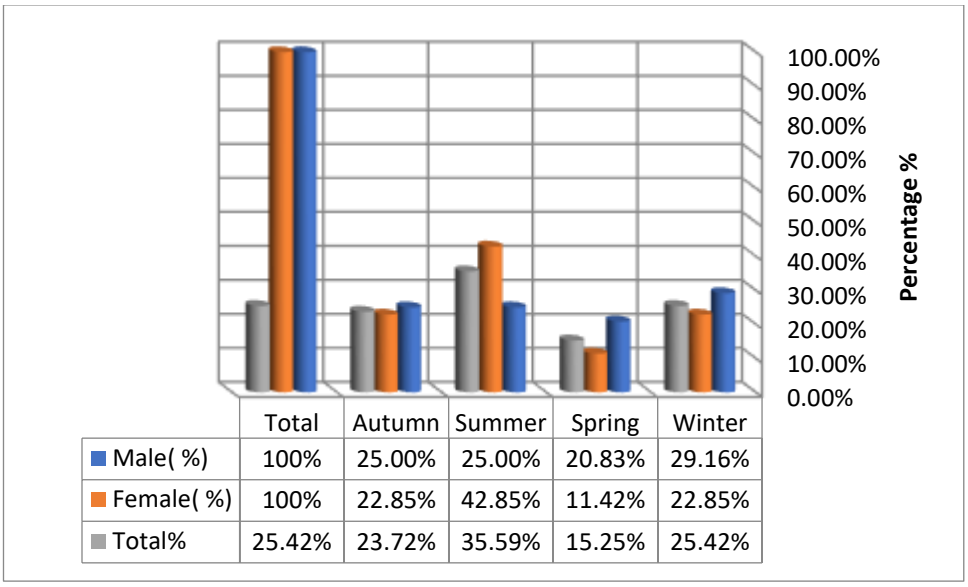
Month	Male (N)	Male (%)	Female (N)	Female (%)	Total	Total%
January	0	0.00%	1	2.85%	1	%1.69%
February	2	8.33%	1	2.85%	3	%5.08%
March	2	8.33%	1	2.85%	3	%5.08%
April	1	4.16%	2	5.71%	3	%5.08%
May	4	16.66%	4	11.42%	8	13.55%
June	2	8.33%	7	20.00%	9	15.25%
July	0	0.00%	4	11.42%	4	6.77%
August	2	8.33%	2	5.71%	4	6.7%
September	4	16.66%	4	11.42%	8	13.55%
October	0	0.00%	2	5.71%	2	3.38%
November	4	16.66%	0	0.00%	4	6.77%
December	3	12.5%	7	20.00%	10	16.94%
Total	24	100%	35	100%	59	100%

4.5 Seasonal Distribution of Infections:

The summer season had the highest overall rate of infection (35.59%) compared to winter (25.42%), autumn (23.72%), and spring (15.25%). The seasonal pattern was the same for both sexes (Table 5).

Table (5): Seasonal distribution of intestinal parasitic infections by sex

Season	Male (N)	Male (%)	Female (N)	Female (%)	Total	Total%
Winter	7	29.16%	8	22.85%	15	25.42%
Spring	5	20.83%	4	11.42%	9	15.25%
Summer	6	25.00%	15	42.85%	21	35.59%
Autumn	6	25.00%	8	22.85%	14	23.72%
Total	24	100%	35	100%	59	25.42%



	Total	Autumn	Summer	Spring	Winter
Male(%)	100%	25.00%	25.00%	20.83%	29.16%
Female(%)	100%	22.85%	42.85%	11.42%	22.85%
Total%	25.42%	23.72%	35.59%	15.25%	25.42%

Figure ()Seasonal distribution of intestinal parasitic infections by sex

5. Discussion:-

5.1 Overall Infection Rate:

The IPI rate of 14.39%, reported using a laboratory-based methodology, corresponds to other laboratory-based, retrospective studies conducted in Libya and elsewhere in North Africa; however, a study from Hun City (Libya) (2024) observed a higher IPI rate (7.4% to 11.6%) within the period 2021-2023, and attributed the decline to improved sanitation and healthcare access at a local level. The IPI rate in Saudi Arabia for the same period was very low(approximately 2.76%) according to Alruwaili *et al.* (2024), but is more reflective of the higher development index of this country compared to Libya. By contrast, in Ethiopia, Feleke (2021) and Workineh *et al.* (2022) reported extremely high rates (30-60%) in some communities due to extreme poverty and sanitation deficits endured by most of sub-Saharan Africa. Based upon semi-urban characteristics of Al-Abyar, moderate levels of IPI incidence reported in this current study, and reasonable healthcare seeking behavior of the sample population, it is most likely that the relative poverty and sanitation deficits experienced in the area compared to other regions of the world were the main contributors to the differences in reported rates of IPI across the regions referenced above.

5.2 Infection Rate by Sex:

Recent studies have reported an increased female frequency of infection (59.32%) in comparison with male(40.67%) infection rates, as per the findings of this study. As reported by Alruwaili *et al.*, (2024) females made up 61% of infected individuals visiting King Abdulaziz University Hospital in Jeddah. The higher female prevalence in these locations has been attributed to women's domestic duties (e.g., food prep, household cleaning), which may lead to increased exposure/contact with soil, water and food that have been contaminated (Alruwaili *et al.,* 2024). Al-Malki (2021) observed that gender differences in health knowledge and hygiene practices exists within the Arabian Peninsula, with women sometimes exhibiting lower levels of handwashing compliance than men despite being perceived as caregivers. Other reports show males to have higher frequencies of infection (Workineh *et al.,* 2022), than females; specifically, Workineh *et al.*(2022)attributed this finding to increased instances of male

outdoor activity and contact with contaminated environments in northwest Ethiopia. So the relationship between sex and infection appears to be affected by local context.

5.3 *Entamoeba histolytica*:

Entamoeba histolytica/dispar was found to be the most commonly detected organism overall in this study of protozoan infections in the MENA. This finding confirms E. histolytica's well-established position as a major pathogenic protozoan in the region (Hasan *et al.,* 2023). Hasan *et al.* (2023) reported an Entamoeba spp. prevalence of 21.68% from their Duhok, Iraq-based cross-sectional investigation. Abate *et al.* (2023), however, documented that 13.17% of Ethiopian schoolchildren were infected with E. histolytica. It is possible that some of the overall high proportion of individuals infected with the amoeba are due to a limitation of the current study's methodology; specifically, the direct wet mount cannot differentiate between the pathogenic E. histolytica and the morphologically identical, non-pathogenic species *E. dispar*. To accurately determine the true burden of E. histolytica, the authors recommend that molecular diagnostic testing (e.g., PCR) or immunoassays (i.e., antigen detection), as per Abate *et al.* (2023) and Al-Yousofi *et al.* (2022), be made available to allow for definitive E. histolytica species identification.

5.4 *Entamoeba col:i*

According to the findings of this study, Entamoeba coli showed up in 30.50% of positive specimens. Although it is a non-pathogenic species, the presence of E. coli indicates that there is a high level of faecal contamination in the surrounding environment with a subsequent risk of zoonotic diseases from coming into contact with pathogenic organisms. Alruwaili *et al.* (2024) demonstrated that E. coli was one of the most prevalent parasites identified at a tertiary care hospital in Saudi Arabia, and similar studies throughout the Middle East and North Africa have been published (Hasan *et al.*, 2023). The high incidence of E. coli found in this study reinforces the need for improved environmental sanitation measures to control the overall burden of intestinal parasites.

5.5 *Ascaris lumbricoides*:

Ascaris lumbricoides was found to be the 3rd most prevalent of positive parasites in this research study, making up 28.81% of the positive population. A recent global review and meta-analysis performed by Holland *et al.* (2022) documenting the prevalence of Ascaris from 2010-2021 illustrated that hundreds of millions of people are affected by ascariasis globally, especially in sub-Saharan Africa and southern Asia. Agricultural practices in Libya and Northern African are thought to increase the risk of ascaris infection by relying on the use of untreated human waste as fertilizer, having insufficient sanitary facilities and having the sufficient time for Ascaris eggs to survive in soil (Holland *et al.,* 2022; Abate *et al.,* 2022). The reporting of points (28.81% of positives or approximately 4.1%) is consistent with the lower end of the published prevalence for comparable environments.

5.6 Seasonal and Monthly Patterns:-

Seasonal prevalence of infections is well-documented within the literature regarding seasonal variations in Mediterranean and semi-arid climates for the IPI. According to Workineh *et al* (2022), the pattern seen in Ethiopia over a five year retrospective study was very similar to that noted in the Al-Abyar region, with a link to summertime

peaks of infections and the ambient temperature that encourages both the survival and the development of infective stages of the microorganism, the abundance of houseflies which act as mechanical vectors, and the increased consumption of potentially contaminated cold beverages, fresh fruit juices, and street food during hot weather (Al-Yousofi *et al.,* 2022). Consistent with this finding, Derso *et al.* (2021) charted the same seasonal peaks in northwest Ethiopia, with peaks in infection being observed during warmer months. The second peak recorded in the Al-Abyar region in December likely reflects unique environmental and behavioral characteristics endemic to the area, such as increased public gatherings, communal sharing of food, and decreased personal hygiene awareness during holidays.

6. Conclusions and Recommendations

6.1 Conclusions

Year 2024: Overall Intestinal Parasitic Infection Rate of Patients Attending Al-Salam Medical Laboratory in the Al-Abyar Region(14.39%). Three Parasite Species Identified: *Entamoeba histolytica/dispar, Entamoeba coli, Ascaris lumbricoides* (More Infection seen in females and Summer). The Results Confirmed the Continued Public Health Importance of Intestinal Parasitic Infections in This Area and are Consistent with Population-Based Studies from Northern Africa and Middle Eastern Countries (Alruwaili et al., 2024; Hasan *et al*, 2023; Prevalence in Hun City Libya, 2024).

6.2 Recommendations

1) Conduct tests for parasites in labs routinely within the primary healthcare facilities throughout the Al-Abyar area.
2) Provide community awareness programs regarding proper food handling, personal hygiene, drinking water treatment (especially prior to summertime).
3) Assist with lack of wastewater management and provide funds for rehabilitation of sufficient sanitation.
4) Develop new molecular diagnostic tests (PCR) and other antigen-based testing methods so we can accurately identify Entamoeba species for targeted therapy.
5) Encourage multisectoral collaboration between public health, education, demography and municipality officials to develop programs addressing the factors related to parasite transmission.
6) Develop prospective, community-level epidemiologic investigations with stratified sampling in the different regions of Libya in order to obtain more accurate national prevalence rates.

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