Prevalence of Intestinal Parasitic Infestation Among Expatriate Workers

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Abstract

Background
Parasitic infestations of the gastrointestinal tract remain a common problem in third-world countries. Poverty, illiteracy, poor hygiene, scarcity of potable water, as well as the hot and humid tropical climate, are all contributing factors associated with intestinal parasitic infestation.

Objective
This cross-sectional study aims to evaluate the prevalence of intestinal parasitic infestation amongst expatriate workers in Benghazi City, Libya.

Patients and methods
A total of 250 stool samples (200 male and 50 female) were randomly collected between October 2017 to April 2018 from expatriate workers in Benghazi City, Libya. The samples examined were used to detect the presence of intestinal parasitic infestation while the study utilized a pre-tested structure. Cases were matched based on demographic parameters, such as age, gender, and nationality, while the history of diarrhea was recorded using direct smear microscopy for the detection of intestinal parasitic infestation.

Results
Of the 250 immigrants looking for work, 95 (38%) were found to be infested with two or more intestinal parasites. The protozoa included: Blastocystis hominis, Giardia lamblia, Entamoeba histolytica, Entamoeba dispar, and Cryptosporidium parvum (47.4%, 38.9%, 17.9%, 17.9%, and 4.2%, respectively); the non-pathogenic protozoa included the prevalence of Entamoeba coli (E. coli), which is 12.6%, and the helminth Ascaris lumbricoides is 1.1%.

Conclusion
The prevalence of parasitic infection was relatively high (38%) and was affected by individual hygiene. Therefore, comprehensive healthcare education aimed at reducing parasitic infestation is needed.

Introduction
Intestinal parasitic infestations are distributed throughout the world, with a high prevalence in the poor and socio-economically depressed communities in the tropics and subtropics. These infestations have a clear association with human malnutrition [1], and it is a serious public health threat globally [2]. The high frequency of intestinal parasites in the population of a region indicates low socio-economic developmental conditions, poor medical care, occupational exposure, and a low standard of hygiene [3-4]. Parasitic infections, particularly intestinal helminths, cause hundreds of thousands of avoidable deaths each year and are among the world’s common infectious diseases. Intestinal helminths are more prevalent throughout the tropics, especially among poor communities. Records show increasing trends in helminthiasis, particularly in developing nations [5]. This is a public health problem with an estimated 3.5 billion people being infected worldwide, as the majority affected are children [6-7]. Socio-economic factors, such as poor hygiene, shortage of safe water supply and sanitation facilities, and low socioeconomic status, are known to play a pivotal role in susceptibility to infection [8].
Aim of the study

This study was conducted to determine the prevalence of intestinal parasites and to identify the factors that contribute to the spread of intestinal parasites among expatriate workers in Benghazi, Libya.

Materials And Methods

Study area

Located in North Africa, along the Mediterranean Sea, Benghazi is the second largest city in Libya. It is seen neighboring Egypt, Sudan, Chad, Niger, Algeria, and Tunisia.

Study design and patients

A cross-sectional study was conducted in Benghazi city. The study included 250 stool samples (200 male and 50 female), including samples from the Anti-Illegal Immigration Agency of the Ministry of the Interior, during the period from October 2017 to April 2018. Cases were matched according to demographic parameters such as age, gender, and nationality. A history of diarrhea was recorded.

Collection of samples

A single stool sample of about 2-5 grams was obtained from each individual for the expected parasites; each sample was collected fresh in a sterile plastic vial, then properly identified, and immediately transferred to the medical laboratory department of the Institute of Benghazi. The stool samples were assessed by direct smear (± 2 mg of feces) in physiologic saline solution, direct smear in Lugol’s iodine solution, formaldehyde-ether sedimentation method, and by the modified acid-fast stain in order to identify oocysts of opportunistic coccidian intestinal parasite [9]. All the samples were then placed in 10% formalin as a fixative, and a questionnaire was distributed to the expatriate workers. The questionnaire was prepared to collect the sociodemographic and clinical data from each participant, including age, gender, and nationality.

Statistical analysis

Data entry and data analysis were done using Statistical Package for Social Science (SPSS), software version 17 (IBM Corp, Armonk, NY, US). A descriptive analysis was performed for demographic findings and categorical variables. The χ2-test was employed to find the significance or non-significance of the relationships between age, sex, and symptoms and the presence or absence of parasites. The accepted level of significance P < 0.05 was considered significant [10].

Results

As illustrated in Figure 1 and Table 1, the overall prevalence of infestation with intestinal parasites among various populations was 38% (95/250) of the patient population.

![Figure 1: Percentage distribution of parasitic infestations amongst various populations](image-url)
These results suggested that the patients, aged 58 and older (66.7%), were the most frequently infested, followed by the age range of 36-46 years (66.7%). There were no significant differences between age group and infestation (P > 581). Our results, as shown in Table 2 and Figure 2, revealed that the prevalence rate of infestation was higher in males (85/200 (42.5%)) as compared to females 10/50 (20%) in expatriate workers.

### TABLE 1: Overall distribution of intestinal parasitic infestations amongst various populations

| Number examined | Infected | Non-infected |
|-----------------|----------|--------------|
| 250             | 95       | 155          |

### TABLE 2: Distribution of intestinal parasites according to age group amongst various populations

| Infection                      | Age 14-24 | Age 25-35 | Age 36-46 | Age 47-57 | Age 58 or older | Total |
|--------------------------------|------------|------------|------------|------------|-----------------|-------|
| Positive count % within parasitic infestation | 53         | 21         | 18         | 1          | 2               | 95    |
| Number examined                 | 137        | 65         | 41         | 4          | 3               | 250   |

### FIGURE 2: Percentage distribution of intestinal parasites amongst various age groups

A significant difference (P<0.000) was found between males and females. The relationship between the prevalence of intestinal parasitic infestation in expatriate workers and sex are presented in Table 3 and Figure 3.
Our study also included the assessment of infested people belonging to various regions. As depicted in Table 4 and Figure 4, the highest prevalence of intestinal parasites was recorded in people with Somali nationalities (66.7%), followed by Tunisian and Egyptian nationalities (50%) while fewer parasitic infestation presented among Bangladeshi nationalities (0.00%).

**TABLE 3: Relationship between the prevalence of intestinal parasitic infestation and sex among expatriate workers**

| Gender | Female | Male |
|--------|--------|------|
| Infested | 10     | 85   |
| Non-infested | 40     | 115  |
| Total    | 50     | 200  |

**TABLE 4: Distribution of parasites according to nationalities**

| Nationality | Eritrean | Chadian | Egyptian | Ethiopian | Bangladeshi | Sudanese | Somali | Tunisian | Algerian | Total |
|-------------|----------|---------|----------|-----------|-------------|----------|--------|----------|----------|-------|
| Infested    | 6        | 17      | 4        | 14        | 0           | 42       | 6      | 4        | 2        | 95    |
| Total number per Nationality | 14 | 41 | 8 | 52 | 1 | 111 | 9 | 8 | 6 | 250 |

P-value = 0.449
There are no significant differences between nationality and parasitic transmissibility ($P>0.449$). It was also observed, as shown in Table 5 and Figure 5, that of all the tested samples, the most common intestinal protozoan parasite was Blastocystis hominis (B. hominis) with the highest prevalence at 47.4% (45), followed by Giardia lamblia (G. lamblia) at 38.9% (37), Entamoeba histolytica (E. histolytica) and Entamoeba dispar (E. dispar) at 17.9% (17), Entamoeba coli (E.coli) at 12.6% (12), and Cryptosporidium parvum (C. parvum) at 4.2% (4). Only the helminth parasite, Ascaris lumbricoides (A. lumbricoides), was detected at a low prevalence rate of 1.1% (1). There were significant differences in prevalence among B. hominis ($P=0.00$), G. lamblia ($P=0.00$), E. histolytica and E. dispar ($P=0.00$), C. parvum ($P=0.036$), E. coli ($P=0.00$), and no significant differences among A. lumbricoides ($P=0.201$), as seen in Table 5 and Figure 5.

**TABLE 5: Prevalence of intestinal parasitic infestations amongst examined patients**

| Type of parasite                        | Infected (n=95) | p-value |
|-----------------------------------------|-----------------|---------|
| Blastocystis hominis                    | 45              | 0.000   |
| Entamoeba histolytica/ Entamoeba dispar | 17              | 0.000   |
| Giardia lamblia                         | 37              | 0.000   |
| Entamoeba coli                          | 12              | 0.000   |
| Ascaris lumbricoides                    | 1               | 0.201   |
| Cryptosporidium parvum                  | 4               | 0.036   |
Our data, as shown in Table 6 and Figure 5, 71.6% showed infestation by a single parasite. Twenty-two point one percent (22.1%) of expatriate workers were found to be infested by two species of parasites and only 6% of the workers showed infestation by three species of parasites. The results showed that there was a high significant difference between prevalence and types of parasitic infestation (P=0.000). We also attempted to find out the relationship between the prevalence of parasitic infestation and diarrhea.

| PATTERN OF INFECTION | INFECTED |
|----------------------|----------|
|                      | NUMBER   | %    |
| Single infection     | 68       | 71.6 |
| Double infection     | 21       | 22.1 |
| Triple infection     | 6        | 6.3  |
| Total                | 95       | 100  |

TABLE 6: Pattern of intestinal parasitic infection among the studied sample
It was observed that the prevalence of diarrhea with an infestation (83.9%) was greater than that of without diarrhea (31.5%), as seen in Table 7 and Figure 7. There was a highly significant difference, which was detected between the prevalence of parasitic infestation and diarrhea (P=0.000). Data were also analyzed based on the occupation.

| Diarrhea       | Total examined (n=250) | With parasitic infection (n=95) |
|----------------|------------------------|---------------------------------|
| With diarrhea  | 31                     | 26 (83.9%)                      |
| Without diarrhea | 219                   | 69 (31.5%)                      |
| Total          | 250                    | 95                              |

**TABLE 7:** Relationship between the intestinal parasitic infection and diarrhea amongst various populations

P-value = 0.000
As depicted in Figure 8 and Table 8, our results revealed that drivers and security officers showed a 100% prevalence of infestation while traders, farmers, artisan, unemployed, cleaners, and students showed 80%, 66.7%, 44%, 33.7%, 14.3%, and 0.00%, respectively. There was a significant difference between occupation and parasitic infestation (p>0.049).
### TABLE 8: Relationship between the intestinal parasitic infestation and occupation amongst various populations

| Occupation          | Unemployed | Student | Security officer | Trader | Farmer | Artisan | Driver | Cleaner | Total |
|---------------------|------------|---------|------------------|--------|--------|---------|--------|---------|-------|
| Infested            | 64         | 0       | 2                | 4      | 12     | 11      | 1      | 1       | 95    |
| Total number for each occupation | 190 | 2 | 2 | 5 | 18 | 25 | 1 | 7 | 250 |

P-value = 0.049

Data from Table 9 show the length of parasitic infestation and employment length. The data suggest a higher percentage of parasite infestation when the length of employment was less than one year (41%) in comparison to when the parasitic infestation was greater than one year (36%). Furthermore, the non-parasitic infection had a greater risk in cases where employment length was more than one year.

### TABLE 9: Relationship between the infestation of intestinal parasites and employment length

| Years of residence | Number examined | Parasitic infestation | Non-parasitic infection |
|--------------------|-----------------|-----------------------|-------------------------|
| Less than 1 year   | 100             | 41 (41%)              | 59 (59%)                |
| More than 1 year   | 150             | 54 (36%)              | 96 (64.0%)              |
| Total              | 250             | 95 (38.0%)            | 155 (62.0%)             |

P-value =0.425

Table 10 illustrates infected patients in combinations with other disorders. Of the 193 patients that were infested with parasites, 72 patients were non-infected with other disorders, two patients were infected with hepatitis C virus (HCV), seven with human immunodeficiency virus (HIV), two with atopic dermatitis, four with abdominal pain, and eight with hepatitis B surface antigen (HBsAg).

### TABLE 10: Infected patients in combination with other disorders

| Risk Factors                  | Non-infected | HCV (100%) | HIV (87.5%) | Allergic cutaneous (atopic dermatitis) (50.0%) | Abdominal pain (19.0%) | HBsAg (36.4%) | Total (38%) |
|------------------------------|--------------|------------|-------------|-------------------------------------------------|------------------------|--------------|-------------|
| Parasitic Infestation        | 72 (37.3%)   | 2          | 7           | 2 (50.0%)                                       | 4                      | 8            | 95          |
| Total Number per participant | 193          | 2          | 8           | 4                                               | 21                     | 22           | 250         |

Discussion

Intestinal parasitic infestations and the associated diseases are still prominent in the tropical and subtropical areas of the world and are more common in developing nations. This high rate of infestation might be attributed to poor hygiene standards in developing countries. The prevalence of intestinal parasites is largely due to poor personal hygiene practices and environmental sanitation, inadequate supply of safe water, and ignorance of health-promoting practices. The prevalence of intestinal parasitic diseases is higher among expatriate workers due to poor sanitation. The current study showed that the prevalence of total intestinal parasites reached 38%. In one of the previous studies in the district of Derna, Libya, the prevalence of infestation was found to be 31% [11]. This prevalence rate was found to be higher as compared to the other studies in Zawia, Libya, with 10.6% [12], and 12.88% in Benghazi, Libya [13]. Another study...
Conducted among school children by Ben Musa in 2007, reported a prevalence of 14.6% [14]. This prevalence is also higher than the study done in other countries, such as in Saudi Arabia, where the prevalence was 29.4% [15], Nepal, with a prevalence of 18.4% [16], and Brazil, with a prevalence of 22.3% [17].

Different studies conducted in Alhag Yousif Area, Khartoum, Sudan [18] and southern Sudan [19] showed a higher prevalence of 64.4% and 66%, respectively. The present study showed that intestinal protozoan parasitic infestations were more prevalent than helminthic infestations, in corroboration with the previous studies [20-23]. The present study revealed that the highest proportion of parasitic infestation was in age groups ranging above 45 years [21,23]. Furthermore, the present study found that there is no statistical significance (P=0.581) between age groups and the rate of infestation. Our data agrees with the findings of Okyay P et al., 2004 [24], Sadaga, 2007 [11], and Chandrashekhar et al., 2005 [25]. In this study, the prevalence of an intestinal parasitic infestation of expatriate workers in males was higher than in females. The percentage was 42.5% and 20% in females and males, respectively [24-25].

Conclusions

The prevalence of parasitic infestation was relatively high (38%) and was affected by individual hygiene. Therefore, comprehensive healthcare education aimed at reducing parasitic infestation is needed. Social awareness through media and other avenues provides an appropriate gateway for ensuring all individuals, including expatriate workers, are educated. It is recommended that all expatriate workers should be checked and treated, if necessary, upon arrival to Libya. The combination of adequate hygiene practices and preventative measures in expatriate workers could enable a decrease in the prevalence of parasitic infestations.

Additional Information

Disclosures

Human subjects: Consent was obtained by all participants in this study. Ethical Board of Benghazi Medical Center issued approval 136519. Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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