مجلة العلوم البحتة والتطبيقية
Journal of Pure & Applied Sciences
www.Suj.sebhau.edu.ly ISSN 2521-9200
Received 10/02/2020 Revised 20/07/2020 Published online 10/08/2020

Prevalence of Intestinal Parasitic Infections Among People in Sebha City, Libya

*Hasan M. S. Ibrahim [1] & Abubaker H. A. Salem [2]
[1]University of Sebha, Faculty of Science, Department of Zoology. Sebha, Libya
[2]University of Sebha, Faculty of Science, Department of Biotechnology. Sebha, Libya
*Corresponding author: has.elhajali@sebhau.edu.ly

Abstract Intestinal parasitic infection remains the public health problem in many areas in the world, especially in developing countries. The aim of the study was to assess the prevalence of intestinal parasitic infections in Sebha city. A total of 955 human stool samples were collected from January to December 2015. All samples were examined by microscopy methods in Al-Yamam and Sebha Central laboratories. Data were analyzed by SPSS software, and the statistical significant differences were measured at level $p<0.05$. The overall prevalence of intestinal parasite was 14.9% (142/955). The rate in females (17.2%, 76/443) was higher than in males (12.9%, 66/512), with no significant differences in the prevalence between them ($p>0.05$). About 99.3% (141/142) of infected samples were protozoa infections, and 0.7% was a helminth infection (1/142). Furthermore, 137 out of 142 (96.5%) of the infected samples were singly infected with five species of parasites. *Blastocystis hominis* was the most common detected parasite with 8.3% of infection rate, followed by *Entamoeba histolytica/Entamoeba dispar* (4.4%), *Giardia lamblia* (1.4%), *Entamoeba coli* (0.2%), and *Enterobius vermicularis* (0.1%). Whereas**,** five samples out of 142 (3.5%) had mixed infections. According to the age groups, the highest prevalence of infection was found in the group aged 30-39 years (23.5%), and the lowest rate was in the age group 0-9 years (9.3%) with no significant relationship between the infection and ages ($p>0.05$). The results also showed that the highest infection rate was in February (22.8%), and the lowest rate was in June by 8.0%, with significant differences in the prevalence of infection between the year months ($p<0.05$).
Keywords: Intestinal, Parasites, Prevalence, Sebha.

دراسة مدى انتشار العدوى بالطفيليات المعوية بين سكان مدينة سبها– ليبيا

*حسن محمد صالح ابراهيم,[1]، أبوبكر حامد علي سالم[2]
[1]قسم علم الحيوان–كلية العلوم–جامعة سبها، ليبيا
[2]قسم التقنيات الحيوية–كلية العلوم–جامعة سبها، ليبيا
*المراسلة: has.elhajali@sebhau.edu.ly

الملخص تعتبر الإصابة بالطفيليات المعوية من أهم المشاكل الصحية العامة ولا سيما في البلدان النامية. تهدف هذه الدراسة إلى قياس معدل انتشار الإصابة بالطفيليات المعوية في سكان مدينة سبها. تم تجميع 955 عينة براز خلال الفترة من يناير الى ديسمبر 2015، وقد أجريت عملية فحص العينات في كل من مختبر سبها المركزي ومختبر اليمامة، وتمت دراسة العلاقة بين نسبة انتشار الإصابة مع كلا من الجنس، الفئات العمرية، وأشهر السنة باستخدام البرنامج الإحصائي SPSS، الإصدار رقم 20، واعتبرت قيمة الفروقات الإحصائية التي أقل من 0.05 ذات دلالة إحصائية.أظهرت النتائج أيضا أن حوالي 99.3% (141/142) من العينات الموجبة كانت أوليات طفيلية، وأن إصابة واحدة فقط بنسبة 0.7% كانت من الديدان الطفيلية. أيضا أظهرت النتائج أن حوالي 137 عينة من واقع 142 (96.5%) كانت مصابة بشكل منفرد بواحد من خمسة طفيليات. طفيل البلاستوسيستس هومينس *Blastocystis hominis* من أكثر الطفيليات شيوعا في هذه الدراسة وبنسبة انتشار 8.3%، يليه طفيل الزحار الأميبي *Entamoeba histolytica/Entamoeba dispar* وبنسبة 4.4%، ثم طفيل الجيارديا لامبليا *Giardia lamblia* بمعدل 1.4%، ثم طفيل الأميبا القولونية *Entamoeba coli* (0.2%)، وأخيرا الدودة الدبوسية *Enterobius vermicularis* (0.1%). وسجلت الإصابة المختلطة بنوعين من الطفيليات فقط في خمسة عينات من أصل 142 (3.5%).وفقا للفئات العمرية، تم الحصول على أعلى معدل انتشار للإصابة في في الفئة العمرية بين 30–39 سنة (23.5%)، وأقل معدل في الفئة العمرية 0–9 سنوات (9.3%) مع عدم وجود أي فارق إحصائي في معدل الانتشار بين الفئات المختلفة ($p>0.05$). كما أظهرت النتائج أيضا أن أعلى معدل للإصابة كان في شهر فبراير (22.8%)، و أدنى معدل في شهر يونيو بنسبة 8.0%، مع وجود فروقات إحصائية بين معدل انتشار الإصابة و أشهر السنة ($P<0.05$).
الكلمات المفتاحية: انتشار، الطفيليات، المعوية، سبها.

Introduction

Intestinal parasitic infection remains the public health problem in many areas in the world, especially in developing countries [1]. These infections affect more than 3.5 billion people, with a morbidity of 450 million cases in the world [2]. Human intestinal parasites are responsible for 200000 deaths per year [3]. They are also responsible for the most gastrointestinal disorders found both in developed and developing countries such as abdominal pain, acute or chronic diarrhea, dysentery, weight loss, nausea, vomiting, anemia and delayed growth in children [3,5]. The transmission of the most intestinal parasitic infections occurs either indirectly via eating or drinking contaminated food or water, or directly by fecal- oral route [6]. *E. histolytica* and *G. lamblia* are the most two protozoa parasites causing amebiasis and giardiasis, respectively [8].

Many studies have been done on the intestinal parasitic infections in Libya. Some of these studies were on protozoan parasites, and others were on both protozoan and helminth parasites. These studies were in different cities including: Benghazi, [8-15]. In Tripoli, about five studies were done, [16-20]. Three studies were studied in Sirt [21-23]. In Zawia [24] , in Derna [25], in Al-Khoms [26], in Zliten [27], in Wadi Al-Shati [28], and in Nalout [32].

The aim of the study was to assess the prevalence of intestinal parasitic infections in Sebha city.

Materials and Methods

Study area:

This study was conducted in Sebha city and carried out at the Sebha Central Laboratory and Al-Yamama Laboratory. Sebha is located in the South-east of Libya (26, 28 North, and 14,16 East). The temperature in this city rapidly changes from the scorching-hot days (45°C) to the cooler nights (4°C).

Study populations and collection:

A total of 955 fresh stool specimen (512 males and 433 females) were collected in clean, numbered plastic containers during the period from January to December, 2015. The date of collection and personal details such as name, sex and age were recorded for each sample. The ages of these cases ranged between one month to 91 years, and divided into 7 age groups.

Examination of the samples:

Stool samples were diagnosed on the same day of collection. Each sample was checked for serial number and macroscopically examined for color, consistency, and occurrence of blood and/or mucus. Furthermore, the microscopic methods by both normal saline solution and Lugol's iodine were used for the examination of intestinal parasites. The identification of parasites cysts and/or trophozoites found in the samples was done as described by Neva and Brown [30], and WHO [31].

Statistical analysis:

Collected data were analyzed using Statistical Package for Social Sciences (SPSS, version 20, Inc, Chicago, IL, USA). *P*-values were calculated using the Chi-square (X^2) test. when *P* values were less than 0.05 ($p<0.05$) they considered to be statistically significant.

Results

This study was conducted to find out the prevalence of intestinal parasitic infection among people in Sebha city, Libya, from January to December, 2015. A total of 955 stool specimens, 512 (53.6%) were males and 443 (46.4%) were females, were collected and screened in two laboratories in Sebha: Al-Yamam and Sebha Central. The age of study population ranges from one month to ninety one years, and more than the third of them (354/955; 37.1%) were children under the age of 10 years. Moreover, the majority of this population (611/955; 64.0%) was under the age of 30 years.

The overall prevalence of intestinal parasitic infection was 14.9% (142/955). The infection prevalence in females (17.2%; 76/443) was higher than in males (12.9%; 66/512). The results in Table 2 showed that the prevalence of infection in males and in females, with no significant differences between the prevalence of infection and sex ($p>0.05$).

The majority of the positive samples were singly infected (96.5%; 137/142) with five species of parasites as indicated in Table 1. *B.hominis* was the most common detected parasite with 8.3% of infection rate, followed by *E.histolytica/E.dispar* (4.4%), *G.lamblia* (1.4%), *E.coli* (0.2%), and *E.vermicularis* (0.1%). Whereas, only five samples out of 142 (3.5%) were infected by mixed infection with two species of parasites. Three samples were by *B.hominis* and *E.histolytica/E. dispar*, and two samples were by *B.hominis* and *G.lamblia*. Moreover, a significant association ($p<0.05$) was observed between the infection prevalence of these parasites. Also, the protozoan infections (99.3%) were significantly higher than the helminth infections (0.7%). The distribution of the positive samples showed in Figure 1.

Table 1: Prevalence of intestinal parasitic infections in collected stool samples at different months.

Month	No.	Single infection					Mixed infection		infected	Non-infected	Total
		B.h	E.h/d	G.l	E.c	E.v	B.h&E.h/d	B.h&G,l			
January	No.	11	3	3	0	1	0	o	18	78	96
	%	11.5	3.1	3.1	0.0	1.1	0.0	0.0	18.8	81.2	100
February	No.	12	4	1	1	0	2	1	21	71	92
	%	13.0	4.3	1.1	1.1	0.0	2.2	1.1	22.8	77.2	100
March	No.	7	3	5	0	0	0	0	15	89	104
	%	6.7	2.9	4.8	0.0	0.0	0.0	0.0	14.4	85.6	100
April	No.	14	4	2	0	0	1	1	22	118	140
	%	10.0	2.9	1.4	0.0	0.0	0.7	0.7	15.7	84.3	100
May	No.	14	8	1	0	0	0	0	23	79	102
	%	13.7	7.8	1.0	0.0	0.0	0.0	0.0	22.5	77.5	100

June	No.	3	5	0	0	0	0	0	92	8	100
	%	3.0	5.0	0.0	0.0	0.0	0.0	0.0	92.0	8.0	100
July	No.	1	1	1	1	0	0	0	4	23	27
	%	3.7	3.7	3.7	3.7	0.0	0.0	0.0	14.8	85.2	100
August	No.	1	1	0	0	0	0	0	2	19	21
	%	4.8	4.8	0.0	0.0	0.0	0.0	0.0	9.6	90.4	100
September	No.	1	1	0	0	0	0	0	2	9	11
	%	9.1	9.1	0.0	0.0	0.0	0.0	0.0	18.2	81.8	100
October	No.	2	3	0	0	0	0	0	5	56	61
	%	3.3	4.9	0.0	0.0	0.0	0.0	0.0	8.2	91.8	100
November	No.	5	4	0	0	0	0	0	9	108	117
	%	4.3	3.4	0.0	0.0	0.0	0.0	0.0	7.7	92.3	100
December	No.	8	5	0	0	0	0	0	13	71	84
	%	9.5	6.0	0.0	0.0	0.0	0.0	0.0	15.5	84.5	100
Total	No.	79	42	23	2	1	3	2	142	813	955
	%	8.3	4.4	1.4	0.2	0.1	0.3	0.2	14.9	85.1	100

B.h = B.hominis; *E.h/d = E.histolytica/dispar*; *G.l = G.lamblia*; *E.c=E.coli*; E.v= *Enterobius vermicularis.*

The majority of the positive samples were singly infected (96.5%; 137/142) with five species of parasites as indicated in Table 1. *B.hominis* was the most common detected parasite with 8.3% of infection rate, followed by *E.histolytica/E.dispar* (4.4%), *G.lamblia* (1.4%), *E.coli* (0.2%), and *E.vermicularis* (0.1%). Whereas, only five samples out of 142 (3.5%) were infected by mixed infection with two species of parasites. Three samples were by *B.hominis* and *E.histolytica/E. dispar*, and two samples were by *B.hominis* and *G.lamblia*. Moreover, a significant association ($p<0.05$) was observed between the infection prevalence of these parasites. Also, the protozoan infections (99.3%) were significantly higher than the helminth infections (0.7%). The distribution of the positive samples showed in Figure 1.

The results also showed that the highest infection rate was in February (22.8%), followed by 22.5% in May (Table 1, Figure 2), and the lowest rate was in June by 8.0%. Significant differences were observed between the prevalence of infection and year months ($p<0.05$).

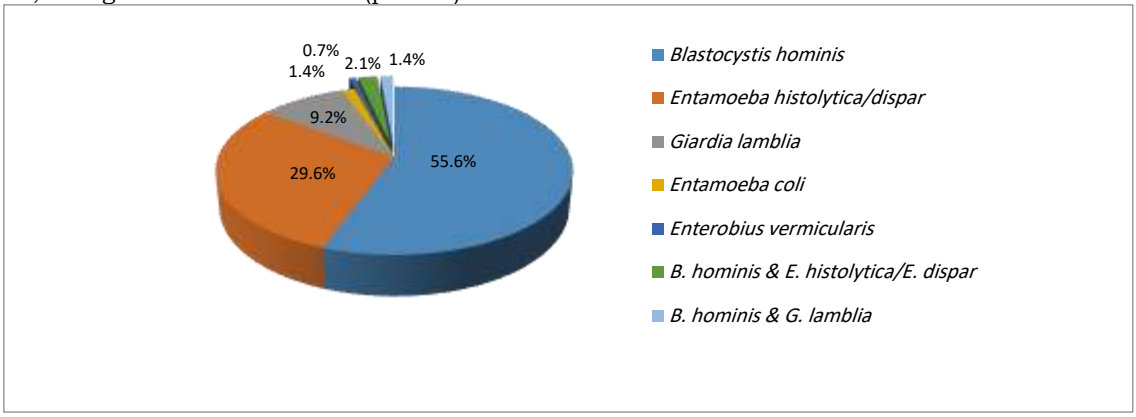

Figure 1: The distribution of the positive samples with the detected parasites.

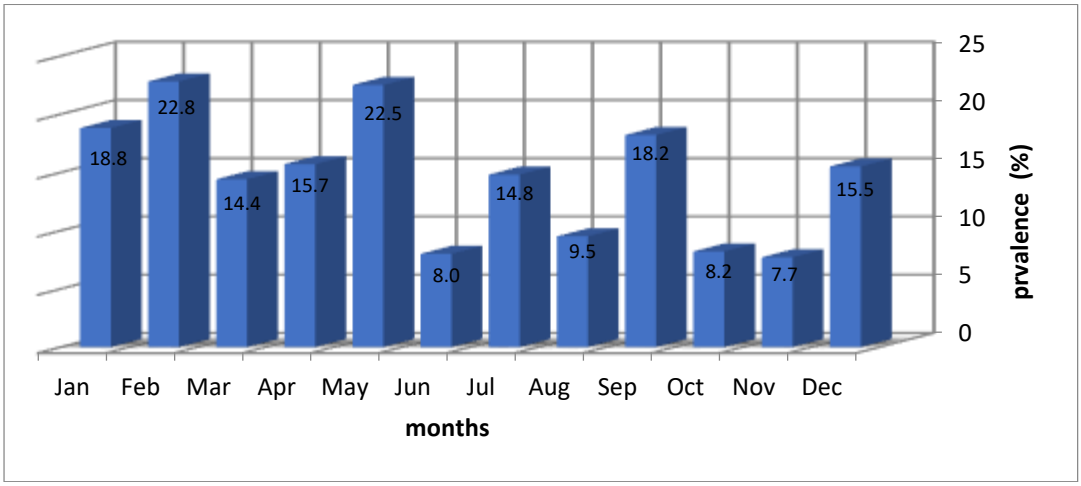

Figure 2: Prevalence of the intestinal parasitic infections according to months.

According to the age groups, the highest prevalence of intestinal parasitic infections in the collected stool samples was 23.5%, and it found in the group aged 30-39 years. Whereas, the lowest rate (9.3%) was in the age group 0-9 years (Table

2). No significant relationship were observed between the rate of infections and ages (p>0.05).

Table 2: Prevalence of intestinal parasitic infections according to age group and gender.

The result	age group								gender		
	0-9	10-19	20-29	39–30	49–40	59–50	≥ 60	Total	male	female	Total
Infected	33	26	24	23	10	11	15	142	66	76	142
	9.3%	19.1%	19.8%	23.5%	10.5%	14.9%	19.5%	14.9%	12.9%	17.2%	14.9%
Non-infected	321	110	97	75	85	63	62	813	446	367	813
	90.7%	80.9%	80.2%	76.5%	89.5%	85.1%	80.5%	85.1%	87.1%	82.8%	85.1%
Total	354	136	121	98	95	74	77	955	512	443	955
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Discussion

Limited studies have been done on the prevalence of intestinal parasites in Libya south. In this study the overall rate of intestinal parasitic infection was 14.9% (142/955). This result is convenient with some studies in Libya such as 15.7% in Tripoli [20], 15.4% in Al-Khoms [26], and 14.8% Sebha [42]. As well as in other countries**:** 16.6% in Ethiopia [56], and 13.4% in Khuzestan [29]. Different values of infection prevalence have been reported in different places. This finding is lower than other studies in some cities in Libya and other areas, 29.6% in Nalout [32], 31.0% in Derna [25], 38.0% and 75.6% in Benghazi [9, 15]**,** 27.8% in Saudi Arabia [33], 53% in Yemen [34], 62.4 in Ethiopia [35], 34.2% in Iran [36], 21.0 in Mozambique [37], 62.4% in and 52% in Pakistan [38]. In contrast, this finding (14.8%) appear to be higher than other previous studies ,7.4% in Zawia [24], 10.5% in Sebha [39], 12.9% in Benghazi [40], and 7.7% in Sharjah [41].

In this study, the rates of infections in male and females were 12.9% and 17.2%, respectively, therefore, gender did not present any significant association with the prevalence of intestinal parasitic infections (p>0.05). Similar results were found by Ibrahim [42], Okyay et al.,[43], and Akinbo et al., [44]. On the other hand, Elsaid et al.,[24] found the insignificant higher rate in males (11.3%) than in females (10.1%), whereas, similar rates between them were obtained by Ngui et al., [45] and Sah et al.; [46]. The higher prevalence in females may attributed to the eating unwashed fruits and vegetables by women before or during washing which may be contaminated with the infective stages of parasites.

The majority of infected people have a singly infection with intestinal parasites (96.5%), and only five samples (3.5%) were infected by two parasites, three samples by *B. hominis* and *E. histolytica/E. dispar*, and two samples were by *B. hominis* and *G. lamblia*. This finding is consistent with previous study by Elsaid et al in Zawia, Libya [24] who indicated the single and mixed infections were 95.3% and 4.7%, respectively.

Five intestinal parasites were recovered in this study namely: *B. hominis*, *E. histolytica/E. dispar*, *G. lamblia*, *E. coli*, and *E. vermicularis*. The most common parasite detected in this study was *B. hominis* with an infection rate of 8.3% (79/955). It is not clear whether this parasite is a pathogenic or commensal parasite [47,48]. This parasite represented 59.2% from the infected people. The higher levels of infection with this parasite was 17.7 (14/79) in both April and May months.

Entamoeba histolytica/E. dispar was the second most frequently identified intestinal parasite obtained in this study. The prevalence of infection with this parasite was 4.4% (42/955), and it represented 31.7% from the infected people. This result (4.4%) was exactly equal to that was obtained 4.4% by Kubti et al., in Benghazi [14]. Different rates were recorded in Libya, 11.8% in Zliten [27]; 3.0% in Tripoli [16]; 16.3% in Sirt [22]; 21% in Nalout [32]; 6.6% in Derna [25]; 1.2% in Wadi-Alshati [28]; and 12.1% in Alkhoms [26].

E. histolytica is a pathogenic protozoan parasite causing amoebiasis, and responsible for the mortality in the world, whereas, *E. dispar* is non pathogenic parasite. Therefore, the use of putting these two parasites together as *E. histolytica/E. dispar* because it cannot distinguish between them microscopically. Two studies were done in previous to confirm the microscopic method by molecular techniques. The first in Italy by Masucci et al., [49] who found 33 infections by microscopy, and only 11 of them were infected with this parasite by molecular techniques. The second in Saudi Arabia by Al-Harthi and Jamjoom [50] who found microscopically the presence of *E. histolytica/* or *E. dispar* in 65% of the samples and in only 2.5% by second generation *E. histolytica*-specific EIAs. In this study, the level of infection by *E. histolytica/E. dispar* was higher in May with rate of infection of 19.0% (8/42) from the infected people, and the lowest rates were 2.4% (1/42) in July, August, and September months.

The third most common species in the current study was *G. lamblia*. This pathogenic protozoan parasite causing giardiasis, and infects more than 200 million person in the world. It also has been recognized as one of the most significant causes of diarrhea in children and early infancy [51].

The prevalence of *G. lamblia* infection was 1.4% (13/955), which similar to previous results in different cities in Libya:1.3% in Tripoli [19] and Brack [52]; 1.2% in Zliten [27]; 1.8% in Zawia [24] and Wadi-Alshati [28]. On the other hand, this finding is lower than other studies carried out in Tripoli (17% [16]); in Sirt (28.8% [22]); and in Derna (12.7% [25]). The level of infection by *G. lamblia* was higher in March with infection rate of 38.5% from the infected people with this parasite (5/13).

Entamoeba coli is the fourth common species in this study, which was found only in two males (0.2%), one in February and the other in July. This finding is inconsistent with previous report in Sebha by Ibrahim [42], and lower in those

reported in Zawia 3.8% [24] and Benghazi 6.2% [10]. Some reasons my contribute to increase the rate of infection such as: limitations of health education, missing of pure drinking water and lack of proper sanitary disposal.

In this study, the prevalence of helminthes infections was significantly very low (0.1%) and it was only seen in one male sample in January. Similar observations have been found in studies performed in different countries [53,54].

The results also showed that the highest infection rate was in February (22.8%), followed by 22.5% in May (Table 1, Figure 2), and the lowest rate was in June by 8.0%. Significant differences were observed between the prevalence of infection and year months ($p<0.05$). This result may attributed to the high temperature (>45 ° C) in Summer months, which may affect on the infective stages of parasites, or to the small number of examined samples in these months.

The highest prevalence of intestinal parasitic infections in the collected stool samples was 23.5%, in the group aged 30-39 years. Whereas, the lowest rate (9.3%) was in the age group 0-9 years. No significant relationship were observed between the rate of infections and ages ($p>0.05$). This result agrees with studies by Nwaneri and Omuemu [55], Dar et al, [8], Sadaga and Kassem [25], and Elsaid et al.[24] who found no statistical differences between the infection rate and age groups.

Conclusion: the current study showed low prevalence of intestinal parasitic infections especially by *E. histolytica*/*E. dispar* and *G. lamblia* in comparison with the previous studies in Libya. There are many factors that responsible for increasing the rate of parasitic infections including contaminated food and water, poor environmental sanitation, personal hygiene and poverty. On the other hand, in addition to the microscopic examinations, further methods like molecular techniques or *E. histolytica*-specific EIAs are required to distinguish between the pathogenic *E. histolytica* and the non-pathogenic *E. dispar*.

Acknowledgment

We would like to thank all the staff of Sebha Central Laboratory, and Al-Yamama Laboratory for their kind assistance.

References

[1]- Norhayati M., Fatmah M., Yusof S., Edariah A. (2003). Intestinal parasitic infections in man: a review. Medical Journal of Malaysia. 58 (2): 296–305.

[2]- World Health Organization (1997). World health report 1997: conquering suffering, enriching humanity.: World Health Organization.

[3]- Garcia, L.S. (2004). Diagnostic Medical Parasitology, 4th edition, ASM Press.

[4]- Masucci L; Graffeo R; Bani S; Bugli F; Boccia S; Nicolotti N; Fiori B; Fadda G; Spanu T. (2011). Intestinal parasites isolated in a large teaching hospital, Italy, 1 May 2006 to 31 December 2008. Euro Surveillance. 16(24).

[5]- Ashtiani, M., Monajemzadeh, M., Saghi, B.; Shams, S., Mortazavi, S., Khaki, S., Mohseni, N., Kashi, L., Nikmanesh, B. (2011). "Prevalence of intestinal parasites among children referred to Children's Medical Center during 18 years (1991–2008), Tehran, Iran". Annals of Tropical Medicine & Parasitology. 105 (7): 507–513.

[6]- Niyyati M; Rezaeian M; zahabion F; Hajarzadeh R; Kia E. (2009). A survey on intestinal parasitic infections in patients referred to a hospital in Tehran. Pakistan Journal of Medical Sciences. 25(1): 90-97.

[7]- Fletcher S; Stark D; Harkness J; Ellis J. (2012). Enteric protozoa in the developed world: a public health perspective. Clinical Microbiology Reviews. 25: 420–449.

[8]- Dar F; Elkhouly S; EL-Boulaqi H; Munir R; and EI-Maghrebi S. (1979). Intestinal Parasites in Benghazi School Children. Garyounis medical journal. 2(1): 3-7.

[9]- Boulaqi H; Dar F; and Medini M. (1980). Prevalence Intestinal Parasites in Primary School Children in Benghazi city. Journal of the Egyptian Society of Parasitology. 10 (1): 77-82.

[10]- EL-Buni A. and Khan A. (1998). Intestinal Protozoan Infections in Benghazi. Sebha Medical Journal. 1(2): 106-108.

[11]- EI-Ammari N. and Nair G. (2003). Occurrence and prevalence of intestinal protozoan parasites in male and female Libyan nationals residing in Benghazi, Libya. Revista iberica de parasitologia. 63: 47-54.

[12]- Nowara E. and Nair G. (2005). Intestinal protozoan parasites among Libyan, non-Libyan African and non-African residents of Benghazi, Libya. Revista iberica de parasitologia. 65: 15-20.

[13]- El-Ammari N; Nair G; Kassem H. (2004). Intestinal protozoan and helminth parasites among Libyans, non-Libyan Arabs and non-Arabs living in Benghazi, Libya. Jordan Journal of Applied Science. 6: 72-81.

[14]- Kubti Y; Ali M; Khan A; Daw A. (2011). Prevalence of intestinal parasites among food handlers in Benghazi, Libya. Sebha Medical Journal. 10: 22-24.

[15]- A.Hussain, E. Younis, A. Elamami, M. Jelodar, T. Mishra, and G. Shivaramaiah (2019, June 13). Prevalence of Intestinal Parasitic Infestation Among Expatriate Workers. Cureus, 11(6): e4894. DOI 10.7759/cureus.4894

[16]- Ben-Rashed M; Abulhassan M; Tabit A; Hawas A. (2006). Demographic features of intestinal parasitic infection among Libyan children. Jamahiriya Medical Journal. 6: 138-140.

[17]- Ben-Musa N. and Ibrahim R.(2007). Long term formalin preserved stool specimens for detection of intestinal parasites from school aged children in Tripoli, Libya. Journal of the Egyptian Society of Parasitology. 37: 1049-1054.

[18]- Ben-Musa N; Sehari A; Hawas A. (2007). Intestinal parasitic infections among school

children in Tripoli, Libya. Journal of the Egyptian Society of Parasitology. 37: 1011-1016.

[19]- Rahouma A; Klena J; Krema Z; Abobker A; Treesh K; Franka E; et al. (2011). Enteric pathogens associated with childhood diarrhea in Tripoli-Libya. American Journal of Tropical Medicine and Hygiene. 84: 886-891.

[20]- Gashout A, Taweni F, Elmabrouk H. (2017). Pattern of intestinal parasites among hospital patients at Tripoli Central Hospital, Libya. Libyan Journal of Medical Sciences, 1:13-15.

[21]- Alsirieti S; Elahwel A; and Elamari A. (2006). Intestinal Protozoa in Libyan patients in Sirt. Jamahiriya Medical Journal. 6: 59-61.

[22]- Abdel-Magied A. and Elahwel A. (2006). Factors associated with intestinal parasitic infection among school children in Sirt, Libya. Benha Medical Journal. 23: 821-832.

[23]- Kasssem H; Zaed H; and Sadaga G. (2007). Intestinal parasitic infection among children and neonatus admitted to Ibn-Sina Hospital, Sirt, Libya. Journal of the Egyptian Society of Parasitology. 37: 371-380.

[24]- Elsaid M; Shaktur A; Elsaid S; EL-Alem M; Traish K; Kahbar F. (2014). Prevalence of intestinal protozoa in primary schools in Zawia City, Libya. Natural Sciences. 12: 67-71.

[25]- Sadaga G. and Kassem H. (2007). Prevalence of intestinal parasites among primary schoolchildren in Derna District, Libya. Journal of the Egyptian Society of Parasitology. 37: 205-214.

[26]- El-Ammari N. and Nair G. (2015). Critical evaluation of the intestinal Protozoan parasites among Libyan and other African residents of Al-Khoms, Libya. Journal of Entomology and Zoology Studies. 3:42-46.

[27]- Ali M; Ghenghesh K; Ben Aissa R; Abuhelfaia A; Dufani M. (2005). Etiology of childhood diarrhea in Zliten-Libya. Saudi Medical Journal. 26: 1759-1765.

[28]- Saad G; Khan A; Ajaili A; Abdulsalam A; Al-Shebani M; Kubti Y. (2009). A study of prevalence of human intestinal parasites in Wadi Al-Shati region. Sebha Medical Journal. 8: 51-58.

[29]- Khoshnood, S.; Saki, J.; Rafiei, A. and Alizadeh, K. (2015). Prevalence of Intestinal Parasitic Infections Among People in Baghmalek During 2013– 2014. Jentashapir Journal of Health Research. 6(2): 12-14.

[30]- Neva F. and Brown H. (1994). Basic Clinical Parasitology. Appleton and Lange, Connectient, USA, 1994.

[31]- WHO (1991). Basic Laboratory Methods in Medical Parasitology, World Health Organization, Geneva, Switzerland.

[32]- AlKilani M.; Dahesh S.; El Taweel H. (2008). Intestinal parasitosis in Nalout popularity, western Libya. Journal of the Egyptian Society of Parasitology. 38: 255-264.

[33]- Akhter J., Markley B, Hussain Q. (1994). Aetiology of gastroenteritis at a major referral centre in Saudi Arabia. Journal of International Medical Research. 22: 47-54.

[34]- Farag H. (1985). Intestinal parasitosis in the population of the Yemen Arab Republic. Tropical and geographical medicine. 37: 29-31

[35]- B. Sitotaw and W. Shiferaw (2020). Prevalence of Intestinal Parasitic Infections and Associated Risk Factors among the First-Cycle Primary Schoolchildren in Sasiga District, Southwest Ethiopia. Research Article, |Article ID 8681247 | 13 pages | https://doi.org/10.1155/2020/8681247

[36]- M.J. Afshar; M. B. Mehni; M. Rezaeian; M. Mohebali; V. Baigi, S. Amiri; M. B. Amirshekari; R. Hamidinia & M. Samimi et al. (2020). Prevalence and associated risk factors of human intestinal parasitic infections: a population-based study in the southeast of Kerman province, southeastern Iran. BMC Infectious Diseases, 20, 12 (2020). https://doi.org/10.1186/s12879-019-4730-8

[37]- Bauhofer, A., Cossa-Moiane, I., Marques, S., Guimaraes, E., Munlela B, Anapakala E, et al. (2020) Intestinal protozoan infections among children 0-168 months with diarrhea in Mozambique: June 2014 - January 2018. PLOS Neglected Tropical Diseases, 14(4): e0008195. https://doi.org/10.1371/journal.pntd.0008195

[38]- Mehraj V.; Hatcher J.; Akhtar S.; Rafique G.; Beg M. (2008). Prevalence and factors associated with intestinal parasitic infection among children in an urban slum of Karachi. Public Library of Science. 3: e3680.

[39]- Ibrahim, Hasan M. S. and Baraka, Morad, A. S. (2019). Prevalence of intestinal protozoan parasitic infections among people attending Sebha Central Laboratory in Sebha, Libya: a retrospective study. EPH - International Journal of Applied Science, Special conference issue, 1(1): 374-385.

[40]- EL-Buni A. and Khan A. (1998). Intestinal Protozoan Infections in Benghazi. Sebha Medical Journal. 1(2): 106-108.

[41]- Dash, N.; Al-Zarouni, M.; Anwar, K. and Panigrahi, D. (2010). Prevalence of Intestinal Parasitic Infections in Sharjah, United Arab Emirates. Human Parasitic Diseases. 2: 21–24.

[42]- Ibrahim, Hasan M. S. (2017). A survey of the prevalence of intestinal protozoa in Sebha City, Libya. Journal of Pure & Applied Sciences, 16(2).

[43]- Okyay P.; Ertug S.; Gultekin B.; Onen O.; Beser E.(2004). Intestinal parasites prevalence and related factors in school children, a western city sample. Turkey, BioMed Central Public Health. 22: 4-64.

[44]- Akinbo F., Omoregie R., Eromwon R., Igbenimah I., Airueghiomon U. (2011). Prevalence of intestinal parasites among patients of a tertiary hospital in Benin city, Nigeria. North American journal of medicine & science. 3:462-464.

[45]- Ngui R.; Ishak S.; Chuen C.; Mahmud R.; Lim Y. (2011). Prevalence and Risk Factors of Intestinal Parasitism in Rural and Remote

West Malaysia. PLoS Neglected Tropical Diseases. 5(3): 974.

[46]- Sah R.; Paudel I.; Baral R.; Poudel P.; Jha N. and Pokharel P. (2013). A study of prevalence of intestinal protozoan infections and associated risk factors among the school children of Itahari, Eastern region of Nepal. Journal of Chitwan Medical College. 3(3): 32-36.

[47]- Tan K.S. (2008). New insights on classification, identification, and clinical relevance of Blastocystis spp. Clinical Microbiology Reviews. 21 (4): 639-665.

[48]- Shlim D.; Hoge C.; Rajah R.; Rabold J.; Echeverria P. (1995). Is Blastocystis hominis a cause of diarrhea in travelers? A prospective controlled study in Nepal. Clinical Infectious Diseases. 21(1):97–101.

[49]- Masucci L.; Graffeo R.; Bani S.; Bugli F.; Boccia S.; Nicolotti N.; Fiori B.; Fadda G.; Spanu T. (2011). Intestinal parasites isolated in a large teaching hospital, Italy, 1 May 2006 to 31 December 2008. Euro Surveillance. 16 (24).

[50]- Al-Harthi S. and Jamjoom M. (2007). Diagnosis and differentiation of Entamoeba infection in Makkah Al Mukarramah using microscopy and stool antigen detection kits. World Journal of Medical Sciences. 2: 15-20.

[51]- Muhsen K.; Levine M. (2012). A systematic review and meta-analysis of the association between Giardia lamblia and endemic pediatric diarrhea in developing countries. Clinical Infectious Diseases. 55 (4): 271-293.

[52]- Mergani M.; Mohammed M.; Khan N.; Bano M.; Khan A. (2014). Detection of intestinal protozoa by using different methods. Dentistry and Medical Research. 2: 28-32.

[53]- Al-Madani A., Omar M., Abu-Zeid H., Abdulla S. (1998). Intestinal parasites in urban and rural communities of Abha, Saudi Arabia. Annals of Saudi Medicine.9:182–185.

[54]- Korkes F., Kumagai F., Belfort R., Szejnfeld D., Abud T., Kleinman A. (2008). Relationship between Intestinal Parasitic Infection in Children and Soil Contamination in an Urban Slum. Journal of Tropical Pediatrics. 55: 42–45.

[55]- Nwaneri D. and Omuemu V. (2013). Intestinal helminthiasis and nutritional status of children living in orphanages in Benin City, Nigeria. Nigerian Journal of Clinical Practice. 16: 243-248.

[56]- Taye, S. and Abdulkerim, A. (2014). Prevalence of Intestinal Parasitic Infections among Patients with Diarrhea at Bereka Medical Center, Southeast Ethiopia: A Retrospective Study. Family Medicine & Medical Science Research. 3:3.