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Prevalence of *Giardia lamblia* among School Children in Brack Region, South Libya

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ABSTRACT

Giardia lamblia is one of the most prevalent protozoan parasites worldwide. Due to its potential impact in public health, especially among children and In Brack Al-Shati, studies exploring *Giardia lamblia* prevalence still in paucity. therefore the present work was performed to estimate the prevalence of *G. lamblia* among school children. A total of 1110 stool samples were collected from 548 boys and 562 girls and scrutinized for the presence of the parasite. The ages of the children were from 6 year to 15 years. All stool samples collected were subjected to microscopic examination using direct (wet mount) and concentration (formalin-ether) methods. The overall prevalence of the parasite was 1.80%. The prevalence rates among boys and girls were 2.19 % and 1.42% respectively. The infection was recorded in all ages except the youngest (6 years) and the oldest (15 years old). The age 8 years showed the highest rate (4.13%) and 13 years showed the lowest rate (0.61%). *Giardia lamblia* prevalence was also varies between child school, the highest was in Al-Majd school (5.69%), and the lowest was in Tamzawa school (0.55%). The present study was the first attempt to demonstrate the prevalence of *G. lamblia* among schoolchildren in the region and all children vulnerable to infection regardless their genders, age, school, and class grade.

انتشار الجيارديا لامبليا بين أطفال المدارس في منطقة براك ، جنوب ليبيا

محمد الشيباني محمد

الجيارديا لامبليا *Giardia lamblia* هي واحدة من أكثر الطفيليات الأولية المعوية شيوعاً في جميع أنحاء العالم. نظراً لتأثيرها المحتمل على الصحة العامة ، وخاصة بين الأطفال ، وعدم وجود أي دراسات سابقة في منطقة الدراسة ، بلدية براك ، وادي الشاطئ ، لذلك تم إجراء الدراسة الحالية لتقدير معدل انتشار الجيارديا لامبليا بين أطفال المدارس. تم جمع ما مجموعه 1110 عينة من البراز، من 548 تلميذ و 562 تلميذة، فحصت للتأكد من وجود الطفيل. تراوحت أعمار التلاميذ بين 6 سنوات و 15 سنة. فحصت العينات مباشرة باستخدام التحضيرات الرطبة المباشرة وطرق تركيز الفورمالين - الأثير. كان معدل انتشار الطفيل الكلي 1.80 %. حيث كانت معدلات الانتشار بين التلاميذ والتلميذات 2.19 % و 1.42 % على التوالي. سجلت الإصابة في جميع الأعمار باستثناء الأصغر (6 سنوات) والأكبر (15 سنة). سجل أعلى معدل انتشار عند العمر 8 سنوات (4.13 %) و 13 سنة أظهرت أدنى معدل (0.61 %). يختلف انتشار العدوى من مدرسة إلى أخرى وسجلت العدوى في جميع المدارس باستثناء مدرسة واحدة ، وكانت أعلى نسبة في مدرسة المجد (5.69 %) ، وكانت الأقل في مدرسة تامزاوة (0.55 %). هذه الدراسة هي الأولى من نوعها لإثبات انتشار الجيارديا لامبليا بين تلاميذ المدارس في المنطقة المدروس وأن الأطفال عرضة للإصابة بغض النظر عن جنسهم وأعمارهم ومدارسهم وفصولهم الدراسية.

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INTRODUCTION

Giardia lamblia is an intestinal protozoan parasite with worldwide distribution. Both human and animals are vulnerable to be infected with this parasitic infection. *G. lamblia*, also known as *G. intestinalis* or *G. duodenalis*, infecting human small intestine and it is the most frequent pathogenic intestinal protozoan causing severe diarrhea and related symptoms accompanied by malabsorption in children throughout the world (Ankarklev *et al.*, 2010). Water and food are the most common transmission vehicles (Savioli *et al.*, 2006). Attachment of the trophozoite to the mucosal surface causes shortening of the villi of small intestine, inflammation of the crypts and lamina propria, and lesions on mucosal cells resulting in inability of the small intestine to absorb such essential, fat-soluble substances as carotene, vitamin B₁₂, and folate, which may lead to reduce secretion of intestinal digestive enzymes, such as disaccharidase (Bogitsh & Cheng, 1998). It has been currently related to chronic fatigue post infectious irritable bowel syndrome, poor cognitive function and failure to thrive in childhood, all of these factors have lead to an increasing attention of *Giardia* protozoan infection in the recent years. Studies on the prevalence of intestinal parasites specially *G. lamblia* among school children are few and rarer specially in Brack municipality, therefore the focus of the present study is on exploring the parasite prevalence among school children and assess the association between these infections and child age, sex, class grade.

MATERIALS AND METHODS

The study area Brack municipality is situated in the zone of Wadi Al-Shati municipal branch one of the valleys of Fezzan region (Fig.1). The study was design as cross-section study. Stool samples were collected from children attending nine schools (Table 3), include primary and preparatory. The demographic data, gender, age, and the school, school grade (class) (class stage) were also accompanied every sample collected. A total of 1110 faecal samples were collected, in the period from September 2014 to May 2016 (548 boys and 562 girls). Their ages were from 6 year to 15 years old. The collected faecal samples were submitted for parasitological analysis in the laboratory of Medical Technology Department, Faculty of Engineering and Technology, Brack. Each sample was processed and examined immediately after collection using direct fecal smears (Normal saline, lugols iodine, and Eosin). Soon after direct smear microscopy, the samples were concentrated by formalin-ether sedimentation technique as described by Cook (1909) and Cheesbrough (2004). The detected parasite was identified according to Aboutable (2012) and the prevalence of infection was calculated according to the concepts described by Bush *et al.* (1997). The collected data, prevalence of *G. lamblia* infection according to the gender, age of child, schools and

school grades, were analyzed using computer program Minitab statistics 15.0 software and the Chi-square test was applied to evaluate the association between the prevalence of *G. lamblia* infection and the gender, age of child, schools and school grades.

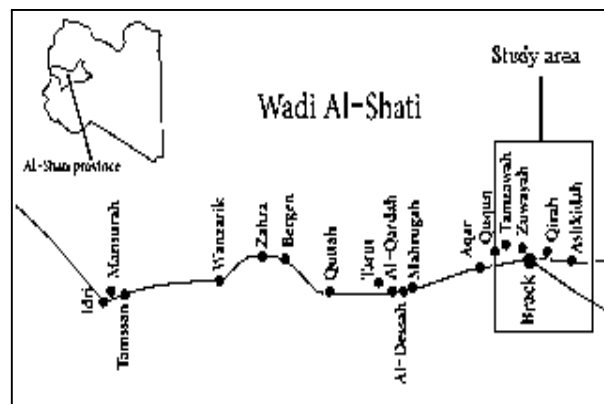


Fig.1 Geographic location of Wadi Al-Shati in Libya and the study area.

RESULTS AND DISCUSSION

Results

The overall prevalence of the parasite was 1.80% (1110 examined, 20 infected). The prevalence rates among boys and girls were 2.19 % (12/548) and 1.42% (8/562) respectively, the infection was little higher among boy, but statistically there was no significance difference (Table 1).

The infection was recorded in all ages except the youngest, 6 years, and the oldest, 15 years old. Schoolchildren aged 8 years showed the highest rate (4.13%) and 13 years showed the lowest rate (0.61%) (Table 2) although these differences were not statistically significant ($P=0.429$).

Table 1: Prevalence of the *G. lamblia* according to the child gender.

Gender	Examined	Infected	Prevalence (%)
Girl	562	8	1.42
Boy	548	12	2.19
Overall	1110	20	1.8

($P=0.337$)

Table 2: Prevalence of the *G. lamblia* according to the child age .

Age (Year)	Examined	Infected	Prevalence (%)
6	28	0	0.00
7	121	1	0.83

8	121	5	4.13
9	124	3	2.42
10	145	4	2.76
11	119	3	2.52
12	150	2	1.33
13	164	1	0.61
14	96	1	1.04
15	42	0	0.00

(P=0.429)

The prevalence of infection vary from one school to another, the highest was 5.69% in Al-Majd school, and the lowest was 0.55% in Tamzawa school. There were differences in the number of infected individuals but these differences were not statistically significant. (P=0.063) (Table 3).

Table 3: Prevalence of the *G. lamblia* according to the child school.

School	Examined	Infected	Prevalence (%)
24 December	119	0	0.00
Al-kolod	148	5	3.38
Al-Majd	123	7	5.69
Al-Mstagbal	51	1	1.96
Al-Yarmok	87	1	1.15
Abider Alffair	200	3	1.50
Tamzawa	182	1	0.55
Shohda Alshab	93	1	1.08

(P=0.063)

Upon analyzing the association between the parasite infection and a child school class, infection was recorded in all school grades (classes) except grade 8, the highest was 3.70% in school grade 2, and the lowest was 0.81% in grade 1. There were differences in the number of infected individuals according to their school grades but these differences were not statistically significant (P=0.362) (Table 4).

Table 4: Prevalence of the *G. lamblia* according to the child school grade (class) (class stage).

School grade (class stage)	Examined	Infected	Prevalence (%)
1	124	1	0.81
2	135	5	3.70
3	125	3	2.40
4	141	5	3.55
5	131	2	1.53
6	139	2	1.44
7	156	1	0.64
8	116	0	0.00
9	43	1	2.33

(P=0.362)

Discussion

The parasitic infestation is a common cause of morbidity and mortality in paediatric population in tropical countries (Al-Ballaa, 1993). Intestinal parasites are responsible for morbidity and mortality worldwide, especially in low-income countries (Nyarango *et al.*, 2008) and in the tropical and subtropical regions (Damen, *et al.*, 2011). It is estimated that some 3.5 billion people are affected, and that 450 million are ill as a result of these infections, the majority being children (Okayay *et al.*, 2004). Intestinal parasite infestations are more frequent among school age children, and they tend to occur in high intensity in this age group (Sehgal *et al.*, 2010), especially in the developing countries (Albonico *et al.* 1999). The prevalence of intestinal parasites in children varies in different regions of the world (Hussain *et al.*, 1997). It is particularly high in poor and developing countries due to use of contaminated drinking water, inadequate sanitary conditions and poor personal hygiene (Hussain *et al.*, 1997).

The present study result showed the lowest prevalence (1.80%) of *G. lamblia* compared with some other previous studies results in Libya and in different parts of the world (Table 5). A prevalence of 3.1% was reported among children in general from Wadi Al -Shati, Libya (Al -Mubrook *et al.* 2013) the same province of the valley where the present study area was. Study in Sebha city, Libya, the nearest town to the present study area cared out by Algazoui *et al.* (2016) showed 5% of the children were infected with *G. lamblia* also Bernawi *et al.* (2013) indicated the overall prevalence of *G. lamblia* infection among humans visited Sebha laboratory centre in Sebha province South Libya was 3.19% . *G. lamblia* was the most common parasite in Benghazi, Libya with prevalence of 11.4% (Dar *et al.* 1979). In Houn city, Libya a prevalence of 3.5% was reported by Abd-Alsalam (2018). A prevalence of 7% was reported by El Ammari and Nair (2015) in Libyan residents of Al-Khoms, Libya. A few earlier studies on the parasitic infections in Libya were mainly confined on school children (Table 5) confirm presence of *G. lamblia* infection. Abougrain *et al.* (2009) confirmed the contamination of raw salad vegetables sold in wholesale and retail markets in Tripoli by cysts of *Giardia* spp. may pose a health risk to consumers. These clear evidences obviously suggests without any doubt the presence of infection in the county. Comparing the present study result with previous studies it was obvious that the infection differs considerably from country to another and from place to another and community to another. In primary school children in Elengaz area, Khartoum, Sudan *G. lamblia* was the commonest intestinal parasite with prevalence of 33.4% Gabbad and Elawad (2014). Nxasana *et al.*(2013) also reported that *G. lamblia* was one of the most common parasites in primary school children of mthatha, Eastern Cape Province, South Africa with prevalence of 9.9%. In Iran the prevalence of *G. lamblia* was estimated to be 14.7% (Abasian *et al.*, 2013). The prevalence of *G. lamblia* infection among children

in Dohuk, northern Iraq was 38.5% (Al-Saeed and Issa 2006). Prevalence of *G. lamblia* among school children in Kaski District of Western Nepal was 13.2% Chandrashekhar *et al.* (2005). In Kalaiya Municipality in Bara District (Nepal), Pooja *et al.* (2014) reported the prevalence of *G. lamblia* 45.7% in private school children. In Kathmandu valley, Nepal Tandukar *et al.* (2015) reported prevalence of 58.7% *G. lamblia* School Going Children. In different parts of Ghana *G. lamblia* was the most prevalent (89.0%) intestinal parasite among school children (Nkrumah and Nguah, 2011). In Kumasi, Ghana Williams *et al.* (2014) revealed that the highest protozoan infection was *G. lamblia* (12.2%). Park *et al.* (2004). In Almadinah Almunawarh, KSA Abbas *et al.* (2011) detected giardiasis in 1.9% from diarrheic children. In Orang Asli children in Selangor, Malaysia, 24.9% of the children were infected with *G. duodenalis* Wongjindanon *et al.* (2005). The occurrence of gastrointestinal parasites among pre-school children, Gaza, Palestine was 10.3% Al-Hindi AI, and El-Kichaoi A. (2008).

There are controversy and contradictory information concerning the prevalence of the *G. lamblia* according to the child gender. The present study results showed prevalence rates among boys and girls were 2.19 % and 1.42% respectively, the infection was little higher among Boy, but statistically there was no significance difference ($P=0.337$) (Table 1). Obaid (2014) found out no

significant differences recorded between the females (8%) and the males (6%). Chandrashekhar *et al.* (2005) reported no significant difference in the prevalence of *G. lamblia* according to children gender. In Hamadan, Iran Sedighi *et al.* (2015) found no significant relationship between infections and gender. In Sebha, Libya Algazoui *et al.* (2016) indicated that boys more infected (6.79%) than girls (3.06%) and the difference was not statistically significant. Contrary in Dohuk, northern Iraq Al-Saeed and Issa (2006) reported higher rate in boys than in girls.

Abbas *et al.* (2011) reported males had a higher rate than females (52.9%) and (47.1%), respectively. In Bat Dambang, Cambodia Park *et al.* (2004) reported prevalence of 4.4 and 1.1% in boys and in girls respectively. Park *et al.* (2004) revealed the infection rate of *G. lamblia* among boy 4.4 and 1.1 in girl. Shrestha *et al.* (2012) reported prevalence in males higher than in females among school Children. Bernawi *et al.* (2013) found no significant differences between infected males and females. In Kumasi, Ghana Williams *et al.* (2014) revealed *G. lamblia* with the prevalence of 16.8% and 7.8% in males and females respectively. Although the majority of the earlier studies found out that boys more vulnerable to this parasitic infection than girls and contrarily the minority found out that girls had more infection rates than boys but differences were not statistically significant, therefore no relationships between children gender and the presence of infection.

Table 5: Some of the reported studies of *G. lamblia* among school children in different parts of the world and the present study.

Prevalence (%)	Place	Reference
10.9	Palajunoy Valley of Guatemala	Cook <i>et al.</i> (2009)
2.9	Bat Dambang, Cambodia	Park <i>et al.</i> (2004)
9.9	Gorgan city, north of Iran	Masoumeh <i>et al.</i> (2012)
13.5	Loni in Ahmednagar, India	Aher and Kulkarni (2011)
45.7	Kalaiya in Bara District of Nepal	Pooja <i>et al.</i> (2014).
13.2	Kaski District of Western Nepal	Chandrashekhar <i>et al.</i> (2005)
5.8	Baglung District of Western Nepal	Shrestha <i>et al.</i> (2012)
58.7	Kathmandu valley, Nepal	Tandukar <i>et al.</i> (2015).
9.9	Mthatha, Eastern Cape Province, South Africa	Nxasana <i>et al.</i> (2013)
89.0	Ghana	Nkrumah and Nguah (2011)
12.2	Kumasi, Ghana	Williams <i>et al.</i> (2014)
38.5	Mansoura, Egypt	El-Tantawy <i>et al.</i> (2012)
33.4	Elengaz area, Khartoum, Sudan	Gabbad, and Elawad (2014)
53.5	Khartoum- Sudan	Tayrab <i>et al.</i> (2014)
12.7	Derna District, Libya	Sadaga and Kassem (2007)
3.5	Houn city, Libya	Abd-Alsalam (2018)
11.4	Benghazi, Libya	Dar <i>et al.</i> (1979)
1.8	Brack municipality Al-Shati, Libya	Present study

Abbas *et al.* (2011) reported males had a higher rate than females (52.9%) and (47.1%), respectively. In Bat Dambang, Cambodia Park *et al.* (2004) reported prevalence of 4.4 and 1.1% in boys and in girls respectively. Park *et al.* (2004) revealed the infection rate of *G. lamblia* among boy 4.4 and 1.1 in girl. Shrestha *et al.* (2012) reported prevalence in males higher than in females among school Children. Bernawi *et al.* (2013) found no significant differences between infected males and females. In Kumasi, Ghana Williams *et al.* (2014) revealed *G. lamblia* with the prevalence of 16.8% and 7.8% in males and females respectively. Although the majority of the earlier studies found out that boys more vulnerable to this parasitic infection than girls and contrarily the minority found out that girls had more infection rates than boys but differences were not statistically significant, therefore no relationships between children gender and the presence of infection.

Concerning *G. lamblia* infection and the child age the present study results indicated that the age group 8 years old showed the highest rate (4.13%) and 13 years showed the lowest rate (0.61%), although there were differences in the number of infected individuals according to their ages but statistically there was no significance difference ($P=0.429$) (Table 2). Most of the children enrolled were age of 8 years' higher parasites positive cases 4.13%. In this age most children are possibly fascinated outdoor food and drinks or Behavior of the children eating or drinking from each other's. The previous studies showed deferent data and contrary results and there were variations in *G. lamblia* infection with respect to children age. Hussain *et al.* (2004) in Muzaffarabad city Pakistan after 2 years of age, the prevalence of parasites continued to decrease as the age of children increased. Hussain *et al.* (2004) prevalence of *G. lamblia* among <15 years old children in Muzaffarabad city Pakistan, was 11.8%. In Sebha, Libya the nearest city to the present study area no significant difference was found among different age groups of children (Algazoui *et al.*, 2016). Obaid (2014) also recorded no significant differences appeared between the different age groups. In Sebha Province South Libya the age from 11-20 had the highest rate of infection (3.92%) and there was a significant differences between different age groups Bernawi *et al.* (2013). In Houn city, Libya A highest prevalence of 63% was reported in age group 12-14 years and lowest was 3.63 in age groups 6-8 with high significance by Abd-Alsalam (2018). In Wadi Al -Shati, Libya Al -Mubrook *et al.* (2013) reported the highest prevalence (7.4%) was among 12 to 14 years old age group and the lowest (0.9%) was among less than one year group. In Dohuk, northern Iraq Al-Saeed and Issa (2006) reported the age group 10-12 years had the highest rate (81.2%) and 7-9 years the lowest (22.9%). In Kathmandu valley, Nepal Tandukar *et al.* (2015) reported the highest prevalence in age between 5-10 years. Cook *et al.* (2009) reported prevalence of 10.9% *G. lamblia* among, Palajunoj Valley, Guatemalan school children aged 5-15. Abbas *et al.* (2011) reported age group 6 – 8 years had the highest rate (41.2%) and 4-6 years the lowest (29.4%). In

Hamadan, Iran Sedighi *et al.* (2015) observed the highest frequency of infections was in children of eight to nine years old (41.7%) and a significant relationship between infection and age. Tayrab *et al.* (2014) the highest prevalence with giardiasis in Sudanese schoolchildren, at Bashiar Teaching Hospital, in Khartoum- Sudan was 53.5% in age group 5-10 years. In Ghana, Nkrumah and Nguah, (2011) reported a significant rise in its presence with age. Aher and Kulkarni (2011) *G. lamblia* was the commonest parasite (13.5%) prevalent in school children 6-12 years. In Kaski District, Western Nepal prevalence was highest in the 6-10 years' age group (Chandrashekhar *et al.*, 2005) and no significant difference in the prevalence of *G. lamblia* according to children age. Masoumeh *et al.* (2012) *G. intestinalis* was the most common intestinal parasitic infections in primary school children, aged 8-12 years, living in Gorgan city, north of Iran. The prevalence of *G. lamblia* in Iran was estimated 14.7%. by age classification to be 15.1% amongst fewer than 10 years children, 19.2% amongst adolescents and youngest of fewer than 20 years, and 6.7% amongst adults of between 20-30 years old (Abasian *et al.* 2013). In Tertiary care hospital, Gujarat, India (Jethwa *et al.*, 2015) reported prevalence of giardia infection in paediatric age group (up to 12 years) was 5%. 6.4% of preschool children are most commonly affected with Giardia infection, the age group 6 to 9 year shoed the highest prevalence (7.7). In Egypt El-Tantawy, *et al.* (2012) 38.5% confirmed as true positives for *Giardia* the outpatient clinics at Mansoura University children hospital, recruited children were in the age of 6 months to 14 years. Wongjindanon *et al.* (2005) *G. lamblia* infection was 1.3 %, in people aged 0-15, years.

The infection was recorded in all the schools except one school and the rate of infection vary from one school to another, but there was no significance difference (Table 3), therefore all children vulnerable to infection regardless their school. In Benghazi, Libya there were marked differences in the incidence of *G. lamblia* in different schools. (Dar *et al.* 1979).

The present result showed the highest prevalence was 3.70% in school grade 2 and no significance difference in school grades (Table 4). In Bat Dambang, Cambodia Park *et al.* (2004) reported a highest rate (6.0%) among sixth school grade. In Baglung District of Western Nepal, Shrestha *et al.* (2012) reported the highest prevalence among School Children in class 5-8.

Finally it can be concluded that the present study was the first attempt revealed the prevalence of *G. lamblia* among school children in the region and all children vulnerable to infection regardless their genders, age, school and class grade. Because there are several factors associated with *G. lamblia* infections, therefore a farther studies is highly recommended to found the risk factors associated with *Giardia* infection study area.

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