Preliminary Study of the Prevalence of Intestinal Parasites among Diarrheic Inhabitants in Makkah Al-Mukarramah

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Abstract

Diarrheic disease is one of the greatest causes of morbidity and mortality worldwide. Intestinal parasites contribute to the disease and the well being of humans. The current study aims to determine the prevalence of intestinal parasites among patients suffering from diarrhoea and to determine the etiological agents responsible. The study evaluates the prevalence rate in relation to residential localities.

This study was undertaken in the holly city of Makkah Al-Mukarramah where total population is about 1,496,000. A total of 166 diarrheic stool samples were collected. A wet smear from each specimen in normal saline and Lugol's iodine solution was examined microscopically for the presence of trophozoites and cysts of protozoan parasites. Stools were also examined using ethyl acetate formalin concentration technique to confirm the presence or absence of intestinal parasites. All stool specimens were stained by Zeal Nelsen technique to detect the oocysts of *Cryptosporidium* spp. One way ANOVA was used to analyze data.

128 persons were found to be infected, with an overall prevalence of 77.1%. 46.99% of the studied samples were females, and 53.01% were males. The prevalence of infection in female population was 36.1%, while 40.9% in males. 16.9% of infected females were living near the Holy Masjid (city centre), while 19.3% were living away from the Holy Masjid. 18.7% of infected males were living near Holy Masjid, while 22.3% were living away from it. The majority of cases fall into the young age groups (< 30 years old). There is no significant difference between the prevalence of infection near and away from the Holy Masjid (P=0.22), whereas the prevalence of infection between over 30 years old under 30 years old was significance of (P=0.036). Rates of infection were higher in the areas away from the Holy Masjid than those living near the Holy Masjid. The prevalence of intestinal parasites was more or less in accordance with previous studies. The present work results were discussed with previous investigations.

Key words: Intestinal parasites, prevalence, intensity, Makkah Al-Mukarramah, Saudi Arabia.

الملخص العربى

يعتبر مرض الإسهال من الأمراض التي تتسبب في كثير من حالات الوفيات على مستوى العالم. تساهم الطفيليات المعوية في المرض وصحة الإنسان. تهدف الدراسة الحالية إلى تحديد انتشار الطفيليات المعوية بين المرضى الذين يعانون من الإسهال، وكذا تحديد الطفيل الممرض. تقيم الدراسة درجة الانتشار وعلاقتها بالبيئة المحلية.

تمت هذه الدراسة فى مكة المكرمة حيث تم تجميع 166 عينة براز إسهال. تم عمل مسحة رطبة من البراز فى محلول ملحى ومحلول يود (لوجلز) ثم فحصت مجهريا للكشف عن الحويصلات والأطوار المغتذية للطفيليات الأولية. تم فحص البراز أيضا بإستخدام طريقة التركيز (الفورمال إيثر) لتأكيد وجود الطفيليات من عدمه. تم صبغ كل العينات بطريقة زيل نيلسن للكشف عن حويصلات الكريبتوسبوريديوم. تم استخدام تحليل المتغايرات ذات الاتجاه الواحد لتحيل النتائج إحصائيا.

وجد 128 مصابا بنسبة إصابة عامة (77.1%). 78 فردا كانوا من الإناث (46.99%) و88 من الذكور (53.01%). كانت نسبة الإصابة فى الإناث 36.1% وفى الذكور 40.9%. 16.9% من الإناث المصابات من سكان المنطقة التي تحيط بالحرم المكي بينما 19.3% من المناطق البعيدة عن المسجد الحرام . 18.7% من الذكور المصابين من سكان المنطقة المحيطة بالحرام المكي بينما 22.3% من سكان المنطقة البعيدة عنه. تقع الغالبية العظمى من المصابين تحت عمر 30 سنة. لايوجد اختلاف جوهري بين نسب الإصابة بين سكان المنطقة المحيطة بالحرم المكي في المدينة عن أطرافها و المناطق البعيدة عنه (=0.22)، بينما يوجد اختلاف جوهري بين نسب الإصابة في الأعمار الصغيرة عنها في الكبيرة (=0.036). تتفق نسب الإصابة بالطفيليات المعوية مع نتائج الدراسات السابقة. كما تم مناقشة النتائج مع الدراسات السابقة.

Introduction

Diarrheic disease is one of the greatest causes of morbidity and mortality worldwide. It is a recognized problem in the developing world especially among children. Intestinal parasites are amongst the most common infections that contribute significantly to the enteric disease and the well being of human. Intestinal parasitic infection is generally of worldwide distribution; prevalence rates in the population correlate roughly with the level of sanitation. The higher rates of prevalence in communities may be attributed to inadequate hygiene or environmental contamination. High prevalence rates were reported from developing countries (Bolbol *et al.*, 1989; Araj *et al.*, 1996; Hashmey *et al.*, 1996; Fernandez *et al.*, 2002; Kaur *et al.*, 2002).

Intestinal parasitic infections have been previously investigated in Saudi Arabia. Studied reports revealed the significance of intestinal parasitic infection for general public health. Many studies confirmed a higher prevalence among certain populations including: communities' studies in Abha (13.2%) (Al-Madani *et al.*, 1989) and Riyadh (32.2%) (Al-Shammari *et al.*, 2001), food handlers (14%) (Khan *et al.*, 1987; Ali *et al.*, 1992), expatriates (55.7% - 31.4%) (Abdul-Hafez *et al.*, 1987; Al-Madani & Mahfouz, 1995; Abahussain, 2005), patients attending hospitals and health clinics (31.3%) (Al-Fayez & Khogheer, 1989), among school children in Riyadh (14.2%) (Ahmed & Bolbol, 1989) and in Makkah (13.24%) (Al-Harthi, 2004). Intestinal protozoa infection was higher than that of helminths in Makkah among school children (12.2%) (Al-Harthi, 2004). The most common protozoal infections in the Saudi Arabia were *Giardia lamblia* followed by *Entamoeba histolytica* (Omar *et al.*, 1991; Hassan, 1994; Al-Shammari *et al.*, 2001; Zakai, 2004). A low prevalence of *Cryptosporidium* spp. (1%) has been reported, a much higher prevalence (32%) was detected among symptomatic children in Jeddah (Khan *et al.*, 1987; Al-Braiken *et al.*, 2003). Among

helminths infection *Ascaris lumbricoides* and *Hymenolepis nana* were the most prevalent (Al-Shammari *et al.*, 2001).

As far as we are aware, there is no published data that have studied diarrheic disease among individuals living in Makkah Al-Mukarramah city. The current study aims to determine the prevalence of intestinal parasites among patients suffering from diarrhoea and to verify the etiological agents responsible. The study also evaluates the prevalence rate in relation to patients' age and residential localities.

MATERIAL & METHODS

This study was undertaken in the Holy city of Makkah Al-Mukarramah where total population is about 1,496,000 (70% are Saudi ~1,057,000 and 30% ~ 421,000 are foreign residents from different nationalities). As it's the Moslems holy city; thousands of peoples come to perform Umrah or Hajj all year round. The city is divided into several districts each have different social, economical, educational and health standards. Ten different general clinics either government primary health centres or private clinics where randomly chosen. Each clinic presented a different region and the distance of each clinic from the city centre (The Holy Masjid) was considered. Five clinics were selected from rural areas surrounding with a minimum distance of 10 kilometres from The Holy Masjid.

A total of 166 diarrheic stool samples were collected. The parasite analysis used in the study is a standard protocol (Garcia *et al.*, 1997). A wet smear from each specimen in normal saline and Lugol's iodine solution was examined microscopically for the presence of trophozoites and cysts of protozoan parasites. Stools were also examined using ethyl acetate formalin concentration technique to confirm the presence or absence of intestinal parasites. All stool specimens were stained by Zeal Nelsen technique to detect the oocysts of *Cryptosporidium*

spp (Henriksen & Pohlenz, 1981). The statistical analyses of data obtained were performed using one way ANOVA by using Microsoft Excel software.

Results

A hundred and sixty six samples were collected from patients complaining of diarrhoea. Their age distribution was between 0.75 – 70 years. The mean age is around 30 years old. The sex distribution showed 78 (46.99%) were females and 88 (53.01%) were males (Fig. 1a & Fig. 1b). Around 87 (52.41%) reside within the vicinity of the Holy Masjid and 79 (47.60%) from localities of Makkah Al-Mukarramah, away from the Holy Masjid. A total of 128 persons were found to be infected (77.1%), 60 of them were females (36.14%) and 68 were males (40.96%) (Fig. 2). Infection with *Entamoeba histolytica/E. dispar* were (109, 65.7%), followed by *Giardia lamblia* (10, 6.0%), *Cryptosporidium* spp. (3, 1.8%) and other parasites (6, 3.6%) (Fig. 3). Two persons only have prevailed *Ascaris lumbricoides* eggs beside *E. histolytica/E. dispar* or *G. lamblia*. Some of the non-infected persons had yeast cell in their stools. The macroscopic examination of the collected stools shows brown colour and some with blood.

From the total infected females, 28(16.9%) were living near the Holy Masjid, while 32 (19.3%) were living away from Holy Masjid. Between the infected male group 31 (18.7%) were living near Holy Masjid, while 37 (22.3%) were living away from Holy Masjid (Fig. 4). The majority of positive cases were among the young age groups (< 30 years old). The infection rate according to age group is presented in table 1. Amongst positive female samples, 47 (28.3%) were under 30 years, and 43 (25.9%) of males under 30 (Fig. 5). Table 2 summarize all the parameters obtained.

The one way ANOVA statistical analysis showed that the differences between the prevalence of infection near Holy Masjid and away from it are not significance (P=0.22). On the other hands, the differences in prevalence in different age groups show significance of (P=0.036), in

which the prevalence were more in the age groups under 30. The significance between males and females cannot be tested for significance because the numbers of females and males samples were not identical.

Discussion

Diarrhoea can be caused by a variety of agents such as bacteria, viruses and parasites. This study investigates the prevalence of parasitic entero-pathogens among diarrhoeic patients of the city of Makkah Al-Mukarramah. The overall positive intestinal parasites detected in specimens were (77.1%). The highest protozoan parasite detected was *E. histolytica/E. dispar* (65.7%) followed by *Giardia lamblia* (6.0%), and *Cryptosporidium* spp. (1.8%). Perceptibly, the incidence rate of parasitic infection in current study is much higher than that previous reported in Makkah among asymptomatic male primary school children (13.24%) (Al-Harthi, 2004). A study conducted in Jeddah city (70 Km from Makkah) among diarrhoeic and asymptomatic children (<5 years of age) detected at least one species of parasite in (47.4%) of the children examined (Al-Braiken *et al.*, 2003). The study showed that the incidence of protozoan parasites among diarrhoeic children much higher than asymptomatic individuals. The study reported a high prevalence of *Cryptosporidium* spp. (32%) followed by *Giardia lamblia* (29%) and *Entamoeba histolytica/E.* dispar (14%) among diarrhoeic children. Most of reported studies from other geographical localities in Saudi Arabia indicated lower parasitic incidence rates as these investigating were mainly carried out on asymptomatic populations (Al-Faleh, 1982; Al-Madani *et al.*, 1989; Omar *et al.*, 1991; Al-Shammari *et al.*, 2001; Zakai, 2004).

The most common intestinal protozoan parasites reported in Saudi Arabia were *Giardia lamblia* and *Entamoeba histolytica/E. dispar*. Studies revealed high prevalence of giardiasis in Riyadh (37.7%) (Al-Shammari *et al.*, 2001); in Al-Asiah Qasim region (22.6%) (Al-Faleh,

1982); in Asir (10.9%) (Omar *et al.*, 1991); in Jeddah (9.5%) (Al-Braiken *et al.*, 2003) and (2.89%) were reported among school children in Makkah (Al-Harthi, 2004). Whereas, *E. histolytica/ dispar* is estimated to be infecting around (37.7%) in Riyadh; (5.2%) in Al-Asiah Qasim region; (4.1%), in Asir; (2.2%) in Jeddah; and a low prevalence of (1.01%) were detected among children in Makkah (Al-Faleh, 1982; Al-Shammari *et al.*, 2001; (Omar *et al.*, 1991; Al-Braiken *et al.*, 2003; Al-Harthi, 2004).

As it is well known that, among intestinal parasites, the two most common intestinal protozoan parasites world wide are *Giardia lamblia* and *Entamoeba histolytica. Giardia lamblia has* a reported global prevalence of approximately 30%. *Entamoeba histolytica* also has a world-wide distribution with infection rates up to 80% in some developing countries. Since both are transmitted faecal-orally by ingestion of contaminated water or food or by person-to-person contact, they have their highest prevalence in areas where sanitary conditions are poor (El-Sheikh & El-Assouli, 2001).

The present study indicated that individuals aged <30 showed higher incidence rate than those > 30. This finding coincides with most of the previous studies in Saudi Arabia (Omar *et al.*, 1991; Al-Eissa *et al.*, 1995; Al-Shammari *et al.*, 2001). The prevalence of *G. lamblia* was usually high during childhood and begins to decline during early adolescence. Infection with *E. histolytica*, on the other hand were found to increase with age reaching its highest in early adult life (Al-Shammari *et al.*, 2001). As worldwide, the high incidence rate of parasitic infection among children and young individuals most likely attributed to lack personal hygiene and the habits of proper hand washing before eating.

Data obtained showed no significant rate of infection between the individuals living in areas away from the Holy Masjid than the central area of the city near Holy Masjid. These results differ from the finding reported in Abha where rural areas had higher rate of infection (Omar

et al., 1991), and the situation in Riyadh where urban areas showed higher prevalence of parasitic infection (Al-Shammari *et al.*, 2001). Also, the parasites detected where similar between those living close and away from the Holy Masjid. The protozoan parasites detected, include *Giardia lamblia, E. histolytica/ E. dispar* cysts and *Cryptosporidium* spp. oocysts. These parasites have been isolated from water resources in different parts of the world (Cook, 1995; Hachich *et al.*, 2004; Stanley, 2003). It is very likely that the high incidence of *E. histolytica/E. dispar* and *G. lamblia* in the present study could be attributed to the possible contamination of the water supply (wells). The water supply around the Holy Masjid area is provided by the municipality of Makkah, however, shortage of water do frequently occurs and water is provided by water tanks.

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References

Abahussain, N. (2005): Prevalence of intestinal parasites among expatriate workers in Al-Khobar, Saudi Arabia. *Middle East J Family Med.*, 3 (3): 17-21.

Abdul-Hafez M.A.; El-Kady, N.; Noah, M.; Bolbol, A.S., and Baknina, M.H. (1987): Parasitic infestation in expatriates in Riyadh, Saudi Arabia. *Ann Saudi Med.*, 7 (3): 202-206.

Ahmed, M.A. and Bolbol, A.H. (1989): The intestinal parasitic infections among children in Riyadh, Saudi Arabia. *J Egypt Soc Parasit.*, 19: 583-587.

Al-Braiken, F.A.; Amin, A.; Beeching, N.J.; Hommel, M. and Hart, C.A. (2003): Detection of Cryptosporidium amongst diarrhoeic and asymptomatic children in Jeddah, Saudi Arabia. *Ann Trop Med Parasitol.*, 97(5): 505-510.

Al-Faleh, F.Z. (1982): The prevalence of *Entamoeba histolytica* and other parasite in school children. *Comm Health in Saudi Arabia.*, 32-34.

Al-Fayez, S. and Khogheer, Y.A. (1989): A follow-up study on prevalence of parasitic infections among patients attending King Abdulaziz University Hospital, Jeddah. *Saudi Med J.*, 10 (3): 193-197.

Al-Harthi, S.A. (2004): Prevalence of intestinal parasites in schoolchildren in Makkah, Saudi Arabia. *The New Egypt J Med.*, 31 (4): 37-43.

Ali, S.I.; Jamal, K. and Qadri, S.M.H. (1992): Prevalence of intestinal parasites among food handlers in Al-Madinah. *Ann Saudi Med.*, 12: 63-66.

Al-Madani, A.A. and Mahfouz, A.A. (1995): Prevalence of intestinal parasitic infections among Asian female housekeepers in Abha District, Saudi Arabia. *South Asian J Tropl Med Public Health.*, 26 (1): 135-137.

Al-Madani, A.A.; Omar, M.S.; Abu Zeid, H.A. and Abdullah, S.A. (1989): Intestinal parasites in urban and rural communities of Abha, Saudi Arabia. *Ann Saudi Med.*, 9: 182-185.

Al-Shammari, S.; Khoja, T.; El-Khwasky, F. and Gad, A. (2001): Intestinal parasitic diseases in Riyadh, Saudi Arabia: prevalence, sociodemographic and environmental associates. *Trop Med Int Health.*, 6(3): 184-189.

Araj, G.F.; Abdul-Baki, N.Y.; Hamze, M.M.; Alami, S.Y., Nassif, R.E. and Naboulsi, M.S. (1996): Prevalence and aetiology of intestinal parasites in Lebanon. *J. Med. Liban.*, 44(3): 129-133.

Bolbol, A. S.; Mostafa S. D.; al-Sekait, M. and al-Nasser, A.A. (1989): Pattern of intestinal parasitic infection in preschool children in Riyadh, Saudi Arabia. *J Hyg Epidemiol Microbiol Immunol.*, 33(3): 253-259.

Cook, G.C. (1995): *Entamoeba histolytica* and *Giardia Lamblia* infections: current diagnostic strategies. *Parasite.*, 2: 107-112.

El-Eissa, Y.A.; Assuhaimi, S.A.; Abdullah, A.M.; AboBakr, A.M.; al-Husain, M. A.; al-Nasser, M.N. and al Borno, M.K. (1995): Prevalence of intestinal parasites in Saudi children: a community-based study. *J Trop Pediatr.*, 41(1): 47-49.

El-Sheikh, S.M. and El-Assouli, S.M. (2001): Prevalence of viral, bacterial and parasitic enteropathogens among young children with acute diarrhoea in Jeddah, Saudi Arabia. *J Health Popul Nutr.*, 19(1): 25-30.

Fernandez, M.C.; Verghese, S.; Bhuvaneswari, R.; Elizabeth, S.J.; Mathew, T.; Anitha, A. and Chitra, A.K. (2002): A comparative study of the intestinal parasites prevalent among children living in rural and urban settings in and around Chennai. *J Commun Dis.*, 34(1): 35-39.

Garcia, L.; Bullock-Iacullo, S.; Fritsche, T.; Healy, G.; McAuley, J.; Neimeister, R.; Palmer, J.; Wilson, M. and Wong, J. (1997): *Procedures for Recovery and Identification of Parasites from the Intestinal Tract. Approved Guideline.* Wayne, PA: National Committee for Clinical and Laboratory Standards, 17: 8–10 and 25–27.

Hachich, E.M.; Sato, M.I.; Galvani, A.T.; Menegon, J.R. and Mucci, J.L. (2004): *Giardia* and *Cryptosporidium* in source waters of Sao Paulo State, Brazil. *Water Sci Technol.*, 50(1): 239-245.

Hashmey, R.; Genta, R.M. and White Jr.A.C. (1996): Parasites and diarrhoea. I: Protozoans and diarrhea., *J Travel Med.*, 4: 17-31.

Hassan, S.I. (1994): Parasitic infections in primary and secondary schools in Giza Governorate, *Egypt. J Egypt Soc Parasitol.*, 24(3): 597-601.

Henriksen, S.A. and Pohlenz, J.F. (1981): Staining of cryptosporidia by a modified Ziehl-Neelsen technique. *Acta Vet Scand.*, 22(3-4): 594-596.

Kaur, R.; Rawat, D.; Kakkar, M.; Uppal B. and Sharma V.K. (2002): Intestinal parasites in children with diarrhea in Delhi, India. Southeast Asian., *J Trop Med Public Health.*, 33(4): 725-729.

Khan, Z.A., Al-Jama, A.A. and Madan, I. (1987): Parasitic infections among food handlers in Dammam and Al-Khober, Saudi Arabia. *Annals of Saudi Medicine.*, 7: 48-50.

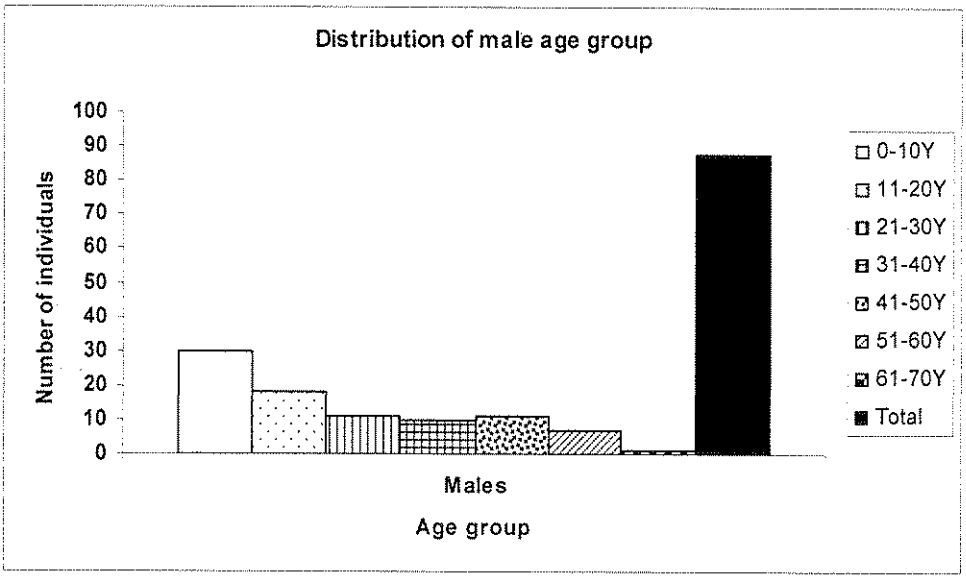
Omar, M.S.; Abu-Zeid, H.A. and Mahfouz, A.A. (1991): Intestinal parasitic infections in school children of Abha (Asir), Saudi Arabia. *Acta J Trop.*, 43: 195-202.

Stanley, S.L. (2003): Amoebiasis. *The Lancet*, 361: 1025-1034.

Zakai, A.H. (2004): Intestinal parasitic infections among primary school children in Jeddah, Saudi Arabia. *J Egypt Soc Parasitol.*, 34(3): 783-790.

Figure 1 (a, b): The distribution of male and female age range of the studied samples.

(a)



(b)

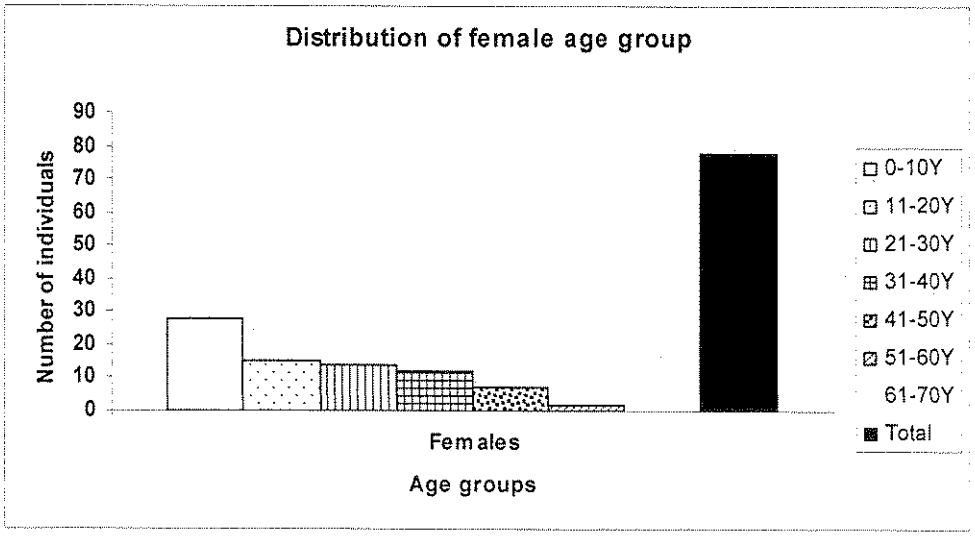


Figure 2: Prevalence of parasitic infections among males and females

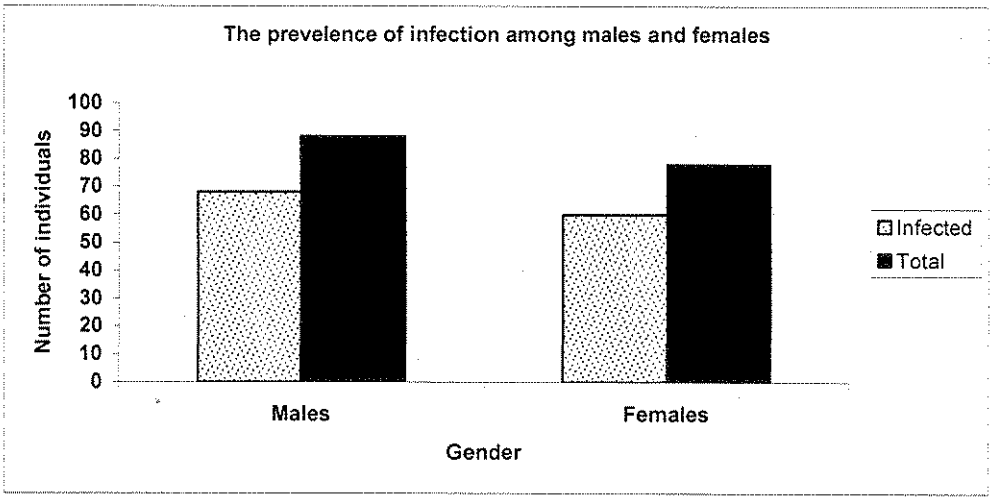


Figure 3: The different intestinal parasites identified and their prevalence among males and females

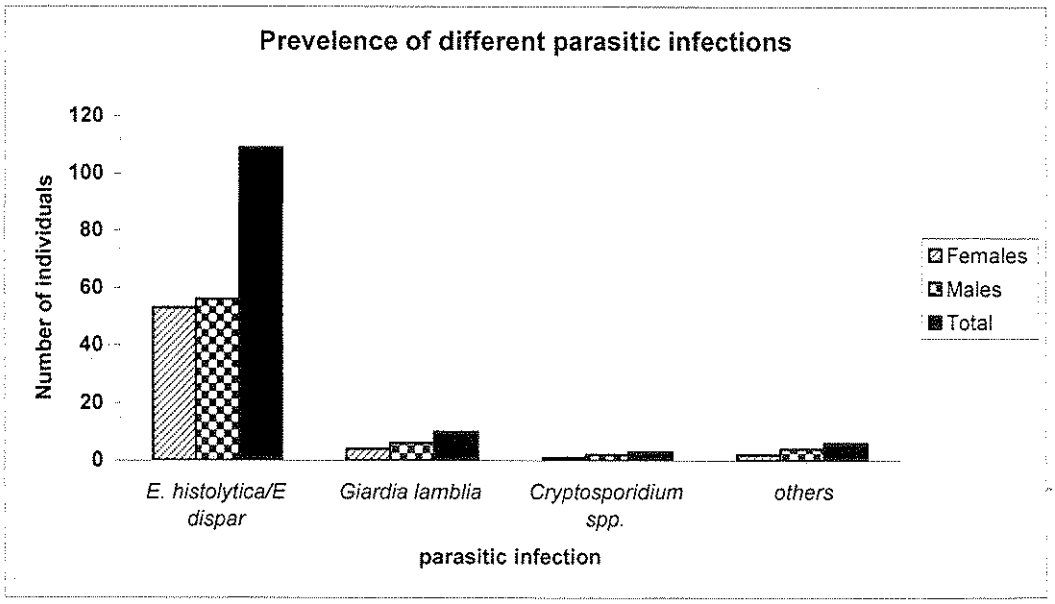


Figure 4: Prevalence of infection among males and females according to resident location near and away from Holy Masjid (H M)

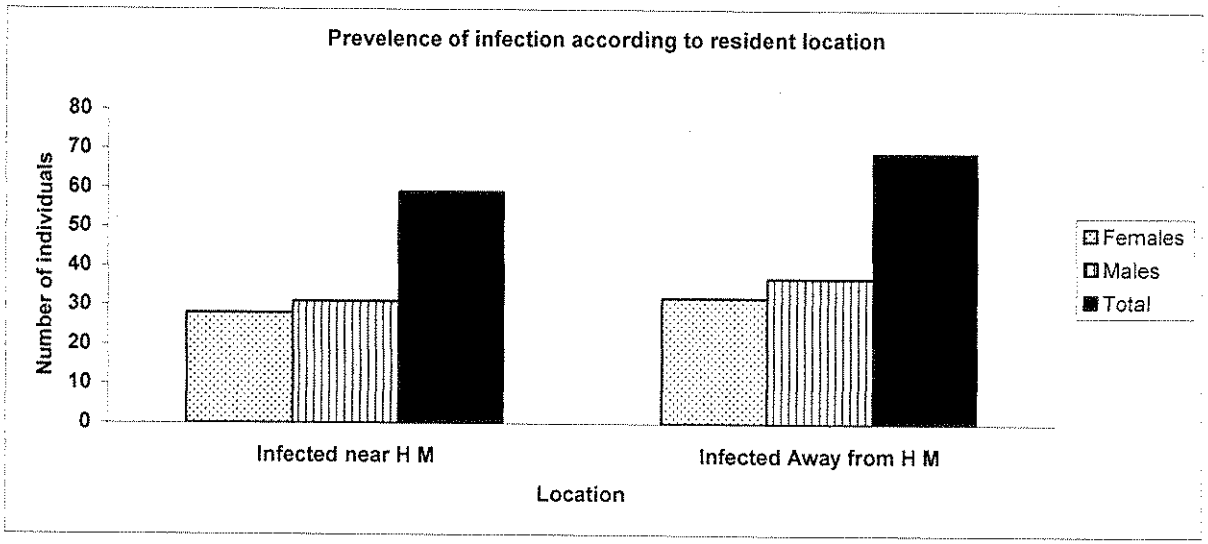


Figure 5: The distribution of infected males and females over and under 30.

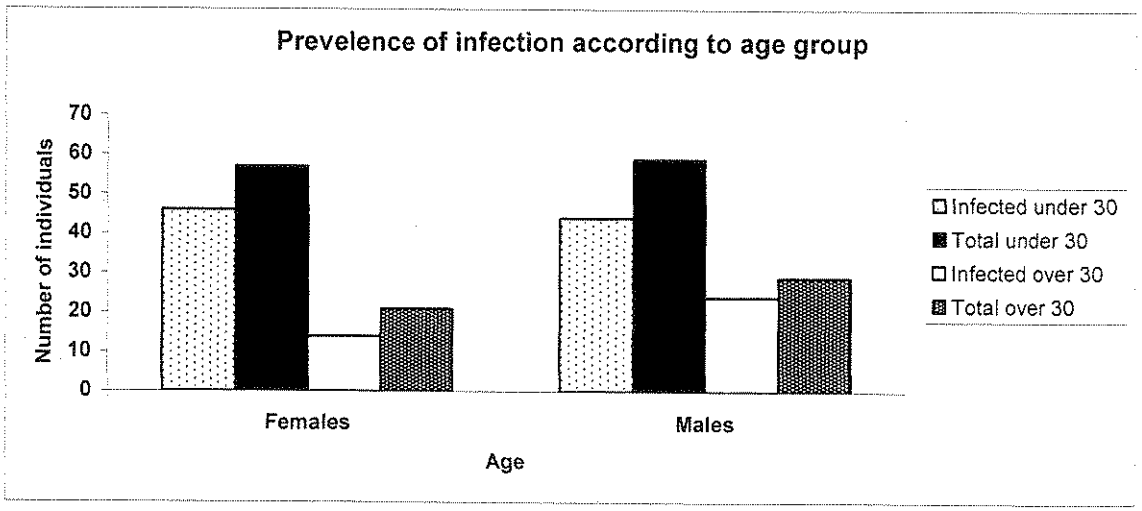


Table 1: Prevalence of infection among males and females in relation to age

Sex	Age groups	0-10Y	11-20Y	21-30Y	31-40Y	41-50Y	51-60Y	61-70Y	Total
Males	Total	30	18	11	10	11	7	1	88
	infected	20	16	7	9	9	6	1	68
	Percentage	66.70%	88.90%	63.60%	90.00%	81.80%	85.70%	100.00%	77.30%
Females	Total	28	15	14	12	7	2	0	78
	infected	23	13	11	5	7	1	0	60
	Percentage	82.14%	86.70%	78.57%	41.70%	100.00%	50.00%	0.00%	76.92%

Table 2: Summary of data collected showing the prevalence rates and different parameters

	Total	Infected			over 30 years old		Under 30 years old		Parasites			
		Total infected	Infected near H M	Infected Away from H M	Total over 30	Infected over 30	Total under 30	Infected under 30	*E. histolytica/ E. dispar*	*G. lamblia*	*Crypto.* spp.	Others
Females	78	60	28	32	21	14	57	46	53	4	1	2
Males	88	68	31	37	29	24	59	44	56	6	2	4
Total	166	128	59	69	50	38	116	90	109	10	3	6
percentage	100.0%	77.1%	35.5%	41.6%	30.1%	22.9%	69.9%	54.2%	65.7%	6.0%	1.8%	3.6%