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PUBLIC HEALTH IMPORTANCE OF SOME COMMON INTESTINAL PROTOZOA IN FOOD HANDLER - IN BAGHDAD

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ABSTRACT
Intestinal protozoa parasitic infection remains an important public health problem, consumption of contaminated food and water with the infective form of the protozoa consider to be the main source of infections. Therefore, food handlers play an importance role in the transmission of these parasites to their customers. This study consider to be the first one on food handler class in Baghdad (capital of Iraq) in order to screen the prevalence rate of intestinal protozoa infections as a total of 7487 stool samples were collected from food handler aged 20-45 years old how attended Al-Yarmouk teaching hospital laboratory to get medical certificates during the period from the beginning of May/2013 to the end of May/2016. All samples were examined using saline wet mount and staining methods. The overall results indicated that the total positive number for protozoa infections was 106 (1.41%) including 82 (1.09%) case for *Giardia duodenalis* and 24(0.32%) for *Entamoeba histolytica*. highly significant differences ($p<0.01$)were recorded according to gender and climate, males showed higher prevalence rate for infections 1.48% (94/106) compared with females 1.05% (24/106). In hot weather, 69 (1.77%) cases were observed as positive for infections while 37 (1.06%) case was seen in cold weather. In conclusion, this study shows that there are intestinal pathogenic protozoa infections among food handlers and *G. duodenalis* infection was the common one that requiring the establishment of adequate, treatment and prevention.

KEYWORDS: Intestinal Protozoa, Diagnostic Method, *Giardia duodenalis*, *Entameoba histolytica*, Food Handler, Baghdad.

INTRODUCTION

Intestinal parasitic infections are of global public health concern (Thomas *et al*., 2015), as its affected the nutritional, immunological status of the person and their complications may be potentially fatal or cause malabsorption (Alyousefi *et al*., 2011). These diseases extract a large toll on populations, including lost ability to attend school or work, retardation of growth in children, impairment of cognitive skills, considerable gastrointestinal morbidity, malnutrition and mortality worldwide particularly in developing countries (Stanley, 2003, Feng and Xiao, 2011). Other impacts of these infections include the serious economic burden placed on entire countries such as reduced worker productivity, reduced commodity yields, effects on income and impacts on food security (Newell *et al*., 2011). The species of the parasite, the course and intensity of infection and numerous socioeconomic factors play a role in the amount of harm caused to the health of individuals and communities (Hyman *et al*., 2013).

The causative agent of gastrointestinal parasitic infections including parasitic worms and protozoa (Araujo *et al*., 2003). Protozoa are microscopic, one-celled eukaryotic organisms that can be found in nature as parasitic or free-living, classification of protozoa according to their morphology and movement includes flagellates, ciliates, amoeba, and sporozoa **.** Multiple factors have been proposed to account for the disease variability, such as the state of the host immune system, host age, nutritional status, strain genotype, infectious dose and possibly co-infection (Faubert, 2000, Alyousefi *et al*., 2011).

The most important intestinal protozoan pathogens are *Entamoeba histolytica* and *Giardia duodenalis* (Arora and Arora, 2009) while, *Cryptosporidium* spp. infection recorded as sporadic cases among the general population and particularly in those suffering from diarrhea (Agholi *et al*., 2013). Other protozoan such as *Balantidium coli*, *Isospora belli* infections have a restricted geographical distribution or some of them are widely distributed, but rare pathogenic such as *Sarcocystis* spp., *Dientamoeba fragilis*, *Trichomonas hominis* infections (Kenny and Kelly, 2009). In general exogenous source is the main way for Protozoan organisms infections, Intestinal protozoa are spread by the fecal-oral route which involves the ingestion of the infective stage (cyst) with contaminated food or water, so infections are widespread in areas with inadequate sanitation and water treatment, other rout of infections include person-to-person contact and animal to human transmissions which known as zoonotic infections (Mohammed *et al*., 2008) ,also Human-to-animal transmission of parasites is also becoming an emerging issue of public health and veterinary significance (Brent *et al*., 2011).

Usually, traditional methods used for detection of protozoa infections including saline wet mount and staining test for trophozoites and cysts observation in stool samples of patients (McHardy *et al*., 2014).Difficulty diagnosis lies in the need for a highly skilled personnel and sometimes

need to take more than one sample of the feces of an infected person for microscopical techniques (Godkar and Godkar, 2003). Therefore, studies showed that the use of molecular method based on nucleic acid such as Polymerase chain reaction (PCR) technique have begun to play an integral part in clinical laboratory diagnosis (Zarlenga and Higgins, 2001, Mens *et al*., 2007).

Epidemiology of giardiasis

Giardiasis, a gastrointestinal disease caused by protozoan parasites *Giardia duodenalis*, is the major species found in mammals and the only species known to cause illness in humans, Giardiasis characterized by acute or chronic diarrhea in symptomatic patients or without any clinical signs in asymptomatic (Ivanov, 2010). The Centers for Diseases Control (CDC) estimates that annually in the United States there are more than 2.5 million cases of giardiasis (Hunter and Thompson, 2005, Karanis *et al*., 2007). According to American Medical Association, approximately 200 million people in Asia, Africa, and Latin America have symptomatic giardiasis (Thompson *et al*., 2000) while about two-third of infected people have no symptoms (asymptomatic infections) which leads to difficulty in the eradication and control of disease (Furness *et al*., 2000, Davies *et al*., 2009).

Epidemiology of amoebiasis

Amoebiasis (amebic dysentery) caused by the protozoan parasite *Entamoeba histolytica*. Amoebiasis remains an important health problem in tropical countries where sanitation infrastructure and health are often inadequate (Ximénez *et al*., 2009). Clinical features of amoebiasis range from asymptomatic colonization to amoebic colitis (dysentery or diarrhea) and invasive extraintestinal amoebiasis, which is manifested most commonly in the form of liver abscesses Global statistics on the prevalence of *E. histolytica* infection indicates that 90% of individuals remain asymptomatic while the other 10% develop clinically overt disease (Fotedar *et al*., 2007). The WHO reveled that approximately 500 million people worldwide are infected annually with *E. histolytica*, resulting in symptomatic illnesses and death in about 50 million and 100,000 persons, respectively (WHO,1997) it is believed that since 90% (450 million) of infections are due to *E. dispar*, while 10% (or 50 million) are infections with *E. histolytica*, the worldwide incidence of invasive disease is more likely to be 5 million cases annually, with global mortality still at 100,000 per annum(Jackson, 1998).

The aim of present, the first one in Baghdad, study was to measure and describe the epidemiological features and determine the prevalence rates of some main pathogenic intestinal protozoan infections in food handlers of public and private sector including *E. histolytica* and *G. duodenalis.* Detection was done using the conventional technique with deeper understanding of the public health significance of intestinal parasitic infection**.** This study was the first one conducted to answer the following question, what is the extent of change on the incidence of intestinal protozoa parasites infections recently? The results will reflect the level of health on both personally and generally.

MATERIALS & METHODS

Study Area

The study was conducted in the Al-Yarmouk teaching hospital located in Al-Karkh sector of Baghdad for food handlers including those responsible for the distribution, procurement and sale at food shops how attended laboratory twice per year to conduct routine examination to have valid medical certificates. The personal information of each food handler was in account, include sex and age. The study lasted from the fifth month /2013 till the end of the fifth month /2016. A total of 7487 stool samples were examined including 6345 from male and 1142 from female aged between 20-45 years old.

Identification of Pathogenic Intestinal Protozoan Parasites

Stool Samples

Macroscopic and microscopic examination of the stool sample forms an important part in the diagnosis of intestinal parasitic infections. Color, texture and presence of blood and mucus with either trophozoites during the active stage or cystic forms during the chronic stage were detected (Garcia, and Bruckner, 1997). Stool samples were collected in sterile plastic cups approximately 10 g examined microscopically for observation of *G. duodenalis* and *E. histolytica* (Ipek *et al*., 2006)].

Unpreserved stool samples were first diluted two folds using normal saline (1 ml liquid stool sample or 1gm of feces in 1 ml of normal saline). Diluted fecal samples were vigorously mixed by wood stick. One drop 50 µl of the diluted stool samples was placed on a slide and observed under a phase contrast microscope at magnifications 400x (Alam *et al*., 2011).

Staining Methods

Stained smears of stool samples were used for differentiation between pathogenic *E. histolytica* and non-pathogenic *E. dispar* through the observation of intracytoplasmic RBCs in trophozoites of *E histolytica* using trichrome stain according to the method recommended by WHO "after fixation, the smear was covered with iodine alcohol solution for one minute. It was washed and dipped in ethanol (70%) for one minute then placed in a Coplin jar containing trichrome stain for 5 minutes and destained with acid-alcohol destaining solution for a few seconds. It was then placed in ethanol (95%), absolute alcohol and xylene for one minute each respectively" (WHO, 1991).

Statistical Analysis

Statistical package for social science (SPSS) program, version 21 for windows, was used for data entry and data analysis. Chi-square test was used to verify the frequencies. P value less than 0.05 ($P< 0.05$), less than 0.001($P<0.001$) as considered as significant and highly significant respectively.

RESULTS

The results revealed that a total of 1769 stool samples were examined during the period from the beginning of May/2013 to the end of December/2013 including 1563 male and 206 female, only 37 patients recorded as infected with intestinal protozoa, the presences of *G. duodenalis* and *E. histolytica* were recorded in 22 (59.45%), 15 (40.54%) patients respectively. Significant differences ($P<0.05$) were observed according to gender and type of infected protozoa. The prevalence rate was higher in male 65.62% (21/32) than female 20% (1/5) for *G. duodenalis*. *E. histolytica* infection showed higher prevalence rate in females than males 80% (4/5), 34.37% (1/5) respectively.

The total positive percentage rate for male was recorded 86.48%, while females showed 13.51% (Table 1**).**

TABLE 1: Prevalence rate for *G.duodenalis* and *E.histolytica* according to gender/2013

	No. of male sample	Positive Prevalence Rate %	No. of female sample	Positive Prevalence Rate %	No. of total sample	Overall prevalence rate %
Negative	1531		201		1732	
G.duodenalis	21	65.62 (21/32)	1	20 (1/5)	22	59.45 (22/37)
E.histolytica	11	34.37 (11/32)	4	80 (4/5)	15	40.54 (15/37)
Positive	32	86.48 (32/37)	5	13.51 (5/37)	37	2.09 (37/1769)
Total	1563		206		1769	

*Chi-square=3.125 p=0.024 P<0.05 Significant

In table two, a total of 2936 stool samples were collected and examined during the year 2014. The results showed that 2896 samples were negative while the positive samples included 32(80%) for *G. duodenalis* and 8(20%) for *E. histolytica* presences. Highly significant differences (P<0.01) was seen according to gender and type of infected protozoa, higher prevalence rate was shown in male 91.42% (32/35) for *G. duodenales* and the lower prevalence rate for *E. histolytica* 8.75% (3/35) Compared with females who showed a prevalence rate 100% (5/5) for *E. histolytica* and Without any proportion of infection for *G. duodenalis*. The total percentage rate recorded 1.36(40/2936).

TABLE 2: Prevalence rate for *G. duodenalis* and *E. histolytica* according to gender/2014

	No. of male sample	Positive Prevalence Rate %	No. of female sample	Positive Prevalence Rate %	No. of total sample	Overall Prevalence Rate %
Negative	2404		492		2896	
G.duodenalis	32	91.42 (32/35)	0	0%	32	80 (32/40)
E.histolytica	3	8.57 (3/35)	5	100 (5/5)	8	20 (8/40)
Positive	35		5		40	1.36 (40/2936)
Total	2439		497		2936	

*Chi-square=7.625 P<0.01 High Significant

TABLE 3: Prevalence rate for *G. duodenalis* and *E. histolytica* according to gender/2015

	No. of male sample	Positive prevalence %	No. of female sample	Positive prevalence %	No. of total sample	Overall Prevalence Rate%
Negative	1311		238		1549	
G.duodenalis	15	100 (15/15)	2	100 (2/2)	17	100
E.histolytica	0	0	0	0	0	0
Positive	15	-	2	-	17	1.08 (17/1566)
Total	1326		240		1566	

*Chi-square=6.258 p=0.002 P<0.05 Significant

For the year 2015**,** the results indicated that significant differences (P<0.05) were recorded in the prevalence rate according to protozoa species and gender as the male showed the largest number of infection than females with the same prevalence rate 100% (15/15) 100% (2/2) for *G. duodenalis* while no infection was observed for *E. histolytica* in both male and females samples. The total prevalence rate was 1.08% (17/1566) (Table 3).

Highly significant differences (P<0.01) were documented during the period from the beginning of 2016 till the end of May for the same year as shown in Table 4. A total of 1216 stool samples were examined. *G. duodenalis* was found only in 11(91.66%) samples of males while, *E. histolytica* found in one (8.33%) sample male. The total prevalence rate was 0.98% (12/1216).

TABLE 4: Prevalence rate for *G.duodenalis* and *E.histolytica* according to gender /2016

	No. of male sample	Positive prevalence %	No. of female sample	Positive Prevalence %	No. of total sample	Overall Prevalence Rate %
Negative	1005		199		1204	
G.duodenalis	11	91.66 (11/12)	0	0	11	91.66 (11/12)
E.histolytica	1	8.33 (1/12)	0	0	1	8.33 (1/12)
Positive	12		0	0	12	0.98 (12/1216)
Total	1017		199		1216	

*Chi-square=23.25 P<0.01 High Significant

When a comparison done for positive samples and the total prevalence rate during the whole years of the study, we found that there is a decrease in the number of cases registered, as well as in the prevalence rate between 2013-2014 and 2015-2016. The higher prevalence rates for positive samples and for total samples were recorded for the years 2013 and 2014 (34.9%, 0.49% and 37.73%, 0.53%) respectively while, 2015 and 2016 showed 16.03%, 0.22% and 11.32%, 0.16% respectively. *G. duodenalis* was found in 82 samples with the higher incidence of the total positive samples 77.35% (82/106) on the other hand, *E. histolyticain* observed in 24 samples with 22.64% (24/106) as a percentage of positive samples. Also *G. duodenalis* showed the higher prevalence of total samples 1.09 % (82/7487) compared with what recorded by *E. histolytica* 0.32% (24/7487) (Table 5).

TABLE 5: A comparison between the number of infection and prevalence rate for both *G.duodenalis* and *E .histolytica* during the years of the study

		G. duodenalis	*E. histolytica*			
Year	Total number	Positive number	Positive number	Total Positive number	% of Positive samples	% of Total samples
2013	1769	22	15	37	34.9 (37/106)	0.49 (37/7487)
2014	2936	32	8	40	37.73 (40/106)	0.53 (40/7487)
2015	1566	17	0	17	16.03 (17/106)	0.22 (17/7487)
2016	1216	11	1	12	11.32 (12/106)	0.16 (12/7487)
Total	7487	82	24	106		
% of Positive samples		77.35 (82/106)	22.64 (24/106)	100 (106/106)		
% of Total samples		1.09 (82/7487)	0.32 (24/7487)	1.41 (106/7487)		

*P<0.05 significant, **P<0.01highly significant

According to gender, a total of 6345 and 1142 stool samples were taken from males and females respectively during the period of the study. As seen in Table 6 highly significant differences were observed, the total positive samples for males infection were 94(1.48%) including 79 (84.04%) of positive and 1.24% of total samples for *G. duodenalis* and 15 (15.95% of positive and 0.23% of total samples) for *E. histolytica.* Females recorded least number of infections 12(1.05%) including 3 samples for *G. duodenalis* (25% of positive and 0.04% of total samples) and 9 samples for *E. histolytica* (75% of positive and 0.14% of total samples).

TABLE 6: A comparison between the number of infection and prevalence rate according to gender for both *G. duodenalis* and *E . histolytica* during the years of the study

	No. of male sample	% of Positive samples	% of total samples	No. of female sample	% of Positive samples	% of total samples	Total
Negative	6251			1130			7381
G.duodenalis	79	84.04 (79/94)	1.24 (79/6345)	3	25 (3/12)	0.04 (3/6345)	82
E.histolytica	15	15.95 (15/94)	0.23 (15/6345)	9	75 (9/12)	0.14 (9/6345)	24
Total positive	94	100 (94/94)	1.48 (94/6345)	12	100 (12/12)	1.05 (12/1142)	106
Total samples	6345			1142			7487

*Chi-square=27.33, P<0.01 High Significant

According to climate, the collected stool samples were divided into two groups: the first one includes samples collected in hot season and the second one includes samples collected in cold season.

During the period of the study the results showed that among 3899 samples collected in hot weather only 69 samples were recorded as positive for the presences of protozoa. *G. duodenalis* was observed in 52 (75.36%) patients, while, only 17 (24.63%) positive samples were recorded for *E. histolytica*, highly significant (P<0.001) was seen (Table 7).

TABLE 7: Prevalence of *G.duodenalis* and *E. histolytica* in hot weather of all four years

	No.of samples	% of Positive samples	% of Total samples
Negative	3830		
G.duodenalis	52	75.36 (52/69)	1.33 (52/3899)
E.histolytica	17	24.6 (17/69)	0.43 (17/3899)
positive	69	100 (69/69)	1.77 (69/3899)
Total	3899		

*Chi-square=14.26 P<0.01 High Significant

In cold weather a total of 3588 stool samples were examined, the positive number for infections was 37 (1.06%). Results in Table 8 indicates that highly significant differences were observed as the higher prevalence rate was recorded for *G. duodenalis* 78.94% of positive and 0.83 of total samples while, *E. histolytica* showed 21.05% of positive and 0.22% of total samples.

TABLE 8: Prevalence of *G.duodenalis* and *E. histolytica* in cold weather of all four years

	No.of samples	% of Positive samples	% of Total samples
Negative	3551		
G.duodenalis	30	78.94 (30/37)	0.83 (30/3588)
E.histolytica	7	21.05 (7/37)	0.2 (7/3588)
positive	37	100 (37/37)	1.06 (37/3588)
Total	3588		

Chi-square=16.33 P<0.01 High Significant

DISCUSSION

One of the major health problems in the world is the parasitic infections (Steketee, 2003, Malakotian *et al*., 2009), the World Health Organization (WHO) estimated that two-thirds of the world is infected with one kind of intestinal parasite and that the highest rate was for protozoa parasites especially for *Giardia* infections (WHO, 2008, Vojdaani, ET AL., 2002). Another study, in Jeddeh- Saudi Arabia, conducted to investigate intestinal parasites among food handlers reported 50.15% was the rate of intestinal parasitic infections with 17 different species (Wakid, 2006). The results of a study done by (Nihar *et al*., 2010) found that the protozoan infections were higher 92.2% than the helminthes infections 7.8%. Also in Cameroon a study showed the overall intestinal helminthes prevalence rate was lower 5.8% than protozoan infection prevalence 10.9% (Thomas *et al*., 2015).

Food handler class at the public and private sectors considered of the most important classes of society because of their impact on the large number of people through their work as they facilitate the transmission of pathogens especially intestinal protozoa parasites to their customers through the preparation of unsafe and hazardous foods therefore attention to health aspect for workers and determine the size of the implications of the existence of parasitic infections is necessary (Ayeh-Kumi *et al*., 2009, Zarezadeh, and Malakotian, 2009).

Because of the lack of previous studies on the prevalence of pathogenic intestinal protozoa in Baghdad for food handler we will compare our results with studies done in other neighboring Arab states and foreign countries.

Through a general view for the results of this study, we found that the total prevalence rate for both intestinal protozoa that observed in examined stool samples was between 0.98%-2.09% during the period of the study with a higher prevalence rate for *G. duodenali*s than *E. histolytica* for each year of the study 59.45% /2013, 80% /2014, 100% /2015, 91.42% /2016 and 40.54%/ 2013, 20%/2014, 0%/ 2015, 8.33% /2016 respectively. In general, many factors are associated with the infection rate such as socioeconomic status, climate, poverty, safe water supplies, lack of proper disposal of waste, personal and community hygiene , population density and the mode of transmission (no need for intermediate host) (Rosenfield *et al*.,1984, Marothi and Singh, 2011).

Also in Table 5 the results indicate that *Giardia* infections was the higher as seen in 82 of a total positive number 106 (77.35%) and of the total examined number 7487(1.09%) while, *E. histolytica* was shown in 24/106 (22.64%) and 24/7487 (0.32%), It is also noticeable that there was a decrease in the proportion of total infection during the

years of the study between 2013 and 2016. These findings suggest that despite the poor conditions in Iraq and the lack of maintenance of the water which is piped up to the citizen , we found that there was a decrease in the incidence of infections for both *G. duodenalis* and *E. histolytica* when a comparison done between the years 2013 and 2016, this could be due to increase cultural and health awareness among employees through educational seminars and attention to cleanliness on both personal and public level .These results were compatible with many studies such as the study which conducted in Egypt that revealed the higher prevalence rate for *G. duodenalis* (16.76%) in compared with *E. histolytica* that recorded (9.76%) (Sadek, 1997). In Sudan, 29.4% of food handler was infected as a result for a study with a prevalence rate for *G. duodenalis* 9.7% and for *E. histolytica* 4.3% (Babiker *et al*., 2009). Similar result documented in Jordan on food handler in which the total prevalence rate was 3.7% and *G. duodenalis* was the most prevalent one 2.44% (Abdel-Dayem *et al*., 2014). Similar results of a study in Iran showed 15.1% as total rate of protozoa infections of 1041 examined samples with 59.9% and 5.5% for *G. duodenalis* and *E. histolytica* respectively (Mehdi *et al*., 2015)

According to gender, Overall, males presented higher positive result rates for infections 1.48% than females 1.05% with a statistically significant difference ($P<0.01$). These finding may be due to that male and female did not have the same chance to be exposed to intestinal protozoa, some high risk habits such as male do not look for medical assistance, do not care about the disease, have worse hygiene practices than females and are less informed about safe eating (Miranda *et al*., 2000, Patil *et al*., 2005).

Agreement was observed with the results of several studies (Capuano *et al*., 2002, Ekdahl and Andersson, 2005, Nasiri *et al.,* 2006), while disagreement showed with studies revealed that females most common for infections (Quadros *et al*., 2004, Sharif *et al*., 2010). In Argentina a total of 350 human stool samples were examined, results indicated the total prevalence rate was 3.7% and in males it showed 6.1% while in females was 1.6% (Minvielle *et al*., 2004). A study done by Amjed, 2012 showed males were recorded high prevalence 2.18% than females 1.51%. In Italy, Calderaro *et al*. (2014) assessed more than 15,000 stool samples and observed higher prevalence in men of infection caused protozoa (21.7 vs. 18.8%; $p<0.001$). Men also protozoa (21.7 vs. 18.8%; $p<0.001$). Men also presented 1.9 times more infection caused by *G. duodenalis* than women. Santos & Merlini, 2010 did not observe any difference in parasite prevalence between male and female when 431 individuals were examine in Brazil

The epidemiology of intestinal protozoa infections is associated with climate, the present study revealed the higher prevalence 1.77% (69/3899) was found in hot months than in cold months 1.06% (37/3588), with highly significant differences between the prevalence of each type of protozoa as *G. duodenalis* showed 1.33% while *E. histolytica* showed 0.43% which may be due to the fact that Iraq is one of the countries that have long hot dry summer and short moderately cold winter, hot and dry weather encourages parasitic infection (Berenson, 1995) Also the population characteristics play a role , such as swimming in rivers and lakes in hot weather increases the susceptibility for infections (Stuart *et al*., 2003) Consumption of fresh vegetables which are an important part of Iraqi diet such as Lettuce, Leek and Celery, without good washing can be a major rout of infections. A study showed that among 303 samples of different vegetables were randomly selected from wholesale markets distributed through different regions in Baghdad, 161 were contaminated with different parasites 53.1% and 53 samples were contaminated with *Giardia* 17.5% which is the higher rate in comparison with other parasitic contamination rates of vegetables (Wasan *et al*., 2013). The high consumption of drinking water in hot weather mainly in water system using inadequately treated consider to be one of the major reason for infection rate, as the transmission of intestinal protozoa through drinking water was well documented (Egorov *et al*., 2002, Karais *et al*., 2007). The centers for diseases control and prevention (CDC) in 2004 reported that many cases of giardiasis occur in U.S.A. in summer because of the ideal environmental conditions (CDC, 2004). In Alaska, the effect of season on the prevalence rate of intestinal protozoa infection showed that most cases were reported during the fall 36%, followed by summer 29%, spring 19% and winter 16% (Joe and Louisa, 2011).

Similar finding was proved with a study done in Baghdad by Shatha and Nada, (2011) in which results indicated that summer was the season during which highest. David *et al*., (2012) showed that the period from 2007 to 2010, the highest number of giardiasis occurred during the summer and autumn seasons, with an incidence of infection with *Giardia* 16.67% and the lowest was in winter 5.21%.

CONCLUSION

An intestinal pathogenic protozoon was detected among food handlers in Baghdad city how could be an important source of infection to general population. *G. duodenalis* was the most prevalent pathogenic parasite, males showed higher prevalence rate than females. Hot weather enhances the prevalence of parasitic infections.

RECOMMENDATION

Some main steps must be taken in order to control the infection such as treatment of the infected patients along with the improvement of personal hygiene and environmental sanitation are recommended. Additional studies require for Protozoa infection evaluated at the regional or local level

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REFERENCES

Abdel-Dayem,M., Al Zoubi, R. and Amr, Z.S. (2014) Microbiological and parasitological investigation among food handlers in hotels in the Dead Sea area, Jordan. *Journal of Microbiol. Immunol*. Infect, 47(5), 377-380.

Agholi, M., Hatam, G.R. and Motazedian, M.H. (2013) "HIV/ AIDS-associated opportunistic protozoal diarrhea," *AIDS Research and Human Retroviruses*; 29(1): 35–41.

Alam, M., Ilias, M., Siddique, A., Kabir, M., Nazib, F. and Khan, G. (2011) Genotype-specific detection of *Giardia lamblia* in stool samples of diarrhoeal and non- diarrhoeal patients in Dhaka, Bangladesh. Biol. Sci; 20(2): 183-189.

Alyousefi, N.A., Mahdy, M.A.K., Mahmud, R. and Lim, Y.A.L. (2011) Factors associated with high prevalence of intestinal protozoan infections among patients in Sana'a city Yemen. PLoS ONE; 6: 1-7.

Alyousefi, N.A., Mahdy, M.A., Mahmud, R. and Lim, Y.A. (2011) Factors associated with high Prevalence of intestinal protozoan infections among patient in Sana'a city, Plos; 6(7): e22044.

Amjed, Q.I. (2012) Prevalence of *Entameoba histolytica* and *Giardia lamblia* in children in Kadhmia hospital Iraq, J. vet. med; 36(1): 32-36.

Araujo, A., Jansen, A.M., Bouchet, F., Reinhard, K. and Ferreira, L.F. (2003) Parasites,the diversity of life, and paleoparasitology. Mem Inst Oswaldo ruz; 98(1):5-11.

Arora, D.R. and Arora, B. (2009) Medical Parasitology. 2nd edn. India, New Delhi: CBS publishers and Distributors, p.243.

Ayeh-Kumi, P., Quarcoo, S., Kwakye-Nuako, G., Kretchy, J., Osafo-Kantanka, A. and Mortu, S. (2009) Prevalence of intestinal parasitic infections among food vendors in Accra, Ghana, The Journal of Tropical Medicine and Parasitology, 32(1), 1–8.

Babiker, M.A., Ali, M.S. and Ahmed, E.S. (2009) Frequency of intestinal parasites among food-handlers in Khartoum, Sudan. East Mediterr Health Journal, 15(5), 1098-104.

Berenson, A.A. (1995) Control of Communicable disease Manual 16th edition An Official Report of the American Public Health Association.

Brent, D., Lorna, P., Angela, C., Katarina, P., Frank, P., David, K. and Jeffrey, F. (2011) The potential for zoonotic transmission of *Giardia duodenalis* and *Cryptosporidium* spp. from beef and dairy cattle in Ontario, Canada. Vet. Parasitol. 175:20–26.

Calderaro, A., Montecchini, S., Rossi, S., Gorrini, C., De Conto, F., Medici, M.C., Chezzi, C. and Arcangeletti, M.C.(2014) Intestinal parasitoses in a tertiary-care hospital located in a non-endemic setting during 2006-2010. BMC Infect Dis, 14, 264.

Capuano, D.M., Okino, M.H., Bettini, M.J., Takayanagui, O.M., Lazzarini, M.P., Castro Silva, A.A. (2002) Busca ativa de teníase e outras enteroparasitoses em manipuladores de alimentos no município de Ribeirão Preto, SP, Brasil. Rev Inst Adolfo Lutz.,61,33–38

Centers for Disease Control and Prevention (CDC), United States (2004) Parasites and health.www.cdc.gov

David, C., Guillermo,A. and Luisa, P. (2012) Current situation of *Giardia* infection in Spain: implications for public health world. J. Clin. Infect. Dis, 2(1):1-12 .

Davies, A.A., Campbell, B., Evans, M.R., Bone, A., Roche, A. and Chalmers, R.M. (2009) Asymptomatic carriage of protozoan parasites in children in day care centers in the United Kingdom. Pediatr. Infect. Dis. J; 28: 838- 840.

Egorov, A., Paulauskis, J. and Petroval, L. (2002) Contamination of water supplies with Cryptosporidium and *Giardia lamblia* and diarrheal illness in selected Russian cities. Int. Hyg. Environ. Health, 205, 281-289.

Ekdahl, K. and Andersson, Y. (2005) Imported giardiasis: impact of international travel, immigration, and adoption. Am J Trop Med Hyg. ,72, 825–830.

Faubert, G. (2000) Immune response to *Giardia duodenalis*. Clin. Microbiol. Rev; 13:35-54.

Feng, Y. and Xiao, L. (2011) Zoonotic potential and molecular epidemiology of *Giardia* species and giardiasis. Clin Microbiol, 24:110–140.

Fotedar, R., Stark, D., Beebe, N., Marriott, D., Ellis, J. and Harkness, J. (2007) Laboratory diagnostic techniques for Entamoeba species. Clin Microbiol Rev. 20(3):511-32.

Furness, B.W., Beach, M.J. and Roberts, J.M. (2000) Giardiasis surveillance-United States, 1992-1997.MMWR; 49(7): 1-13.

Garcia, L.S. and Bruckner, D.A. (1997) Diagnostic Medical Parasitology. Washington, DC: American Society for Microbiology.

Godkar, P.B. and Godkar, D.P. (2003) Microscopic examination of stool specimen. Text Book of Medical LaboratoryTechnology. 2nd ed. Mumbai: Bhalani Publishing House; P. 937-952.

Hunter, P.R. and Thompson, R.C. (2005) The zoonotic transmission of *Giardia* and *Cryptosporidium*. Int. J. Parasitol; 35: 1181-1190.

Hyman, P., Atterbury, R. and Barrow, P. (2013) Fleas and smaller fleas: Virotherapy for parasite infections. Trends in Microbiology 21 (5): 215–220.

Ipek, Ö., Ali, A. K., Nogay, G., ler, B. C ., Jeffrey. B, Simon, B., Marco, A., Stefan, M.G., Alex, L., David, D. and Hotez, P. J. (2006) Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. Lancet., 367: 1521-1532.

Ivanov, A.I. (2010) *Giardia* and Giardiasis. Bulg. J. Vet. Med; 13(2) :65-80.

Jackson, T.F.HG. (1998) *Entamoeba histolytica* and *Entamoeba dispar* are distinct species; clinical, epidemiological and serological evidence. Int. J. Parasitol. 28:181–186.

Joe, M. and Louisa, C. (2011) A new strategy for understanding Giardiasis in Alaska. Epidemiology. Bulletin, 21.

Karanis, P., Kourenti, C. and Smith, H. (2007) waterborne transmission of protozoan parasites: a worldwide review of outbreaks and lessons learnt. J. Water Health; 5: 1-38.

Kenny, J.M. and Kelly, P. (2009) Protozoal gastrointestinal infections. Medicine 37:599–602.

Malakotian, M., Hosseini, M. and Bahrami, H. (2009) Survey of the parasites of vegetable in Kerman province. *Medical Journal of Hormozgan University*, 13(1), 55–62.

Marothi, Y. and Singh, B. (2011) Prevalence of intestinal parasites at Ujjain, Madhya Pradesh, India: Five-year study. Afr. J. Microbiol. Res., 5(18): 2711-2714.

McHardy, I.H., Wu, M., Shimizu-Cohen, R., Roger Couturier, M. and Humphries, R.M.(2014) Detection of intestinal protozoa in the clinical laboratory. Journal of Clinical Microbiology; 52(3):712–720.

Mehdi, S., Ahmad, D., Elham, K., Fatema, R., Mehrdad, N. and Mohtaram, N. (2015) Prevalence of intestinal parasites among food handlers of Sari, northern Iran. *Revista do Instituto de Medicina Tropical de Soa Paulo*, 57(2), 139–144.

Mens, P., Spieker, N., Omer, S., Heijnen, M., Schallig, H. and Kager, P.A. (2007) Is molecular biology the best alternative for diagnosis of *Giardia* microscopy? A comparison between microscopy, antigen detection and molecular tests in rural Kenya and urban Tanzania, Tropical Medicine and International Health; 12(2): 238-244.

Minvielle, M.; Pezzani, B.; Cordoba, M.; Deluca, M.; Apezteguia, M. and Basualdo, J.(2004). Epidemiological survey of *Giardia* spp. And *Blastocystic hominis* in an Argentinian rural community. Korean. J. Parasitol; 42: 61-66.

Miranda, L.V, Passos, A.D, Figueiredo, J.F, Gaspar, A.M. and Yoshida, C.F. (2000) Serological markers of hepatitis B in people submitted to blood testing in health care clinics. Rev Saude Publica, 3, 286-291.

Mohammed Mahdy, A.K., Lim, Y.A., Surin, J., Wan, K.L. and Al-Mekhlafi, M.S. (2008) Risk factors for endemic giardiasis: highlighting the possible association of contaminated water and food. Trans R Soc Trop Med Hyg.; 102: 465-70.

Nasiri, V., Esmailnia, K., Gholamreza, K., Nasiri, M. and Akhavan, O. (2006) Intestinal parasitic infections among inhabitants of Karaj city, Tehran province, Iran in 2006-2008. Korean J Parasitol., 47, 265–268.

Newell, D.G., Koopmans, M., Verhoef, L., Duizer, E., Aidara-Kane, E.,Sprong, H., Opsteegh, M., Langelaar ,M., Threfall, J., Scheutz, F., van der Giessen, J. and Kruse, H. (2011) The potential for zoonotic transmission of Giardia duodenalis and Cryptosporidium spp. from beef and dairy cattle in Ontario, Canada. Vet. Parasitol. 175:20–26.

Nihar, D., Mansour, A.Z., Khurshid, Anwar, L. and Debadatta, P. (2010) Prevalence of Intestinal Parasitic Infections in Sharjah, United Arab Emirates. Human Parasitic Diseases, 2, 21-24.

Quadros, R.M., Marques, S., Arruda, A.A., Delfes, P.S. and Medeiros, I.A. (2004) Intestinal parasites in nursery schools of Lages, southern Brazil Rev Soc Bras Med Trop., 37(5),422-3.

Patil, S.R., Cates, S. and Morales, R. (2005) Consumer food safety knowledge, practices, and demographic differences: findings from a meta-analysis. J Food Prot, 68, 1884-1894.

Rosenfield, P.I., Golladay, F.and Davidson, R.K. (1984) The Economics of Parasitic diseases: Research priorities. Soc Sci Med, 19, 1117–26.

Sadek, Y., el-Fakahany, A.F., Lashin, A.H. and el-Salam, F.A. (1997) Intestinal parasites among food-handlers in Qualyobia Governorate, with reference to the pathogenic parasites blastocystishominis. J. Egypt. Soc. Parasitol, 27(2), 471-478.

Santos, S.A. and Merlini, L.S. (2010) Prevalence of enteroparasitosis in the population of Maria Helena, Parana State. Cien Saude Colet, 15, 899-905.

Sharif, M., Daryani, A., Asgarian, F.and Nasrolahei, M.(2010) Intestinal parasitic infections among intellectual disability children in rehabilitation centers of northern Iran. Res Dev Disabil. ,31(4),924-8.

Shatha, A.W. and Nada, H.A.R. (2011) Prevalence of *Blastocystis hominis* and *Giardia Lamblia* parasites in patient of four regions in east-south Baghdad;The Iraqi. J. Vet. Med, 35 (2), 74 – 84.

Stanley, S.L. (2003) Amoebiasis. Lancet, 361:1025–1034.

Steketee, R.W. (2003) Pregnancy, nutrition and parasitic diseases. J. Nutr .,133: 1661S-1667S.

Stuart, J. M., Orr, H.J., Warbarton, F.G., Jeyakanth, S. and Nichols, G. (2003) Risk factor for sporpdic giardiasis :a case –control study in South Western England. Emerg. Infect. Dis, 9, 229-233.

Thomas, K., Fomefret, Y., Emmanuel, E ., Therese, N., Roger, M .and Albert, S. (2015) Prevalence and Risk Factors of Intestinal Helminth and Protozoa Infections in an Urban Setting of Cameroon: the Case of Douala. American Journal of Epidemiology and Infectious Disease, 3(2): 36-44.

Thompson, R.C., Palmer, C.S. and O; Handley, R. (2000) The public health and clinical Significance of *Giardia* and *Cryptosporidium* in domestic animals .Vet. J; 177 (1): 18-25.

Vojdaani,M., Barzegar, A. and Shamsiaan, A.(2002) Frequency of parasitic infections in patients referred to special clinic of Kermanshah University of Medical Sciences in years 1995–99 Journal of Kermanshah University of Medical Sciences , 6(2), 31–37.

Wakid, M.H. (2006) Distribution of intestinal parasites among food handlers in Jeddah, Saudi Arabia. J. Parasitic. Dis., 30(2), 146-152.

Wasan,A.M., Yahee,T.D. and Ban, N. (2013) Survey study of intestinal parasites on fresh Vegetables collected from some Baghdad sales and its role in human infection. Baghdad for Science Journal,10(1), 32-40.

World Health organization (1991) Laboratory methods in Medical Parasitology. Geneva: WHO,9-24.

WHO, PAHO, UNESCO (1997) Report: a consultation with experts on amoebiasis: Mexico City. Epidemiol. Bull. 18:13–14.

WHO (2008) The global burden of disease: 2004 update. WHO Press, Geneva, Switzerland.

Ximénez, C., Morn, P., Rojas, L., Valadez, A. and Gomez, A. (2009) Reassessment of the epidemiology of amebiasis: state of the art. Infect Genet Evol 9(6):1023-32.

Zarezadeh, M. and Malakotian, M. (2014) Prevalence of bacteria (Salmonella, Shigella) and intestinal parasites among food handlers in Kerman, Iran, in 1390, Pajoohandeh Journal, 19(1), 55–59.

Zarlenga, D.S. and Higgins, J. (2001) PCR as a diagnostic and quantitative technique in Veterinary parasitology.Vet. Parasitol; 101(3-4): 215-230.