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Epidemiological Study of *Giardia lamblia* in Tikrit city, Iraq

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ABSTRACT
This study was conducted during the period from December 2018 to November of 2019, and (615) stool samples were collected from patients attended Tikrit Teaching Hospital, Parasitology Laboratory, and from private laboratories, for both sexes, and for age groups ranged (1-16) years to investigate the prevalence of the parasite *Giardia lamblia* in Tikrit city. All samples were examined microscopically by the wet swab method and by the flotation method using zinc sulfate. The total infection rate was (14.30%), and the highest rate of infection was among the children of rural areas, the infection rate was (20.87%), while the rate of infection in urban area children was (11.54%). Some factors that affect the rate of infection such as age, gender, educational level, and months of the year also studied. The highest rates of infection were recorded within the age group (4-6) years was (17.61%). Where the highest rate of infection recorded in males (17.30%) and the lowest rate of infection was in females (11.22%). As well as the difference in the rate of infection among months of the year studied. The highest rate of infection was in April (28%), followed by June and May respectively at a rate of (25.49% and 23.7%), and the lowest infection rate was in January (6%). also, the educational level of the father and the mother affected the rate of infection. The lowest level of infection was 24.62% of the children whose parents are educated, as it reached (10.66%, 4.84%).

Keywords: epidemiology, *Giardia Lamblia*, direct wet smear method and zinc sulfate flushing method, Tikrit.

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INTRODUCTION
Giardia Lamblia is one of the most widespread intestinal protozoa that infects humans all over the world causing Giardiasis (Escobedo et al, 2018), diagnosed in the Duodenum and Ileum in humans where its effect is primarily on children (Halliez, 2013). Giardiasis affects more than 280 million people annually worldwide transmitted by the fecal-oral route to maintain the life cycle (Thompson, 2016). The clinical signs of infection with the parasite *G. lamblia* vary between the absences of pathological symptoms until the appearance of these symptoms, diarrhea, abdominal cramping, flatulence, weight loss, vomiting and nausea are among the most obvious symptoms. Many methods used in the diagnosis of giardiasis, including direct microscopic examination of wet swab or using Lugol's iodine solution, but the microscopic examination makes it difficult to diagnose *Giardia lamblia* because the giardia cysts are sporadically excreted or what is suspected with other organisms (Kuick, 2004).

Aims of the study
The aims of the study are; the prevalence of *Giardia lamblia* in Tikrit city, and the relationship of several factors (gender, age, area of residence, months of study, education level of father and mother) with the infection rate.

Materials and methods
During the period of December 2018 to November of 2019, (615) stool samples were collected from patients returning to Tikrit Teaching Hospital, from both sexes, and age groups ranged between (1-16) years, and stool samples were placed in clean and tight plastic containers. The samples were examined within a period not exceeding half an hour of obtaining them in Parasitology Laboratory/ Tikrit Teaching Hospital and private laboratories by light microscopy using the direct wet smear and the flotation method with zinc sulfate used to detection of cysts and trophozoites stages of *G. lamblia* parasite.
Macroscopic examination: stool samples were examined macroscopically for faecal consistency (wet or loose stool or diarrhea) and Color, (LukJetal 2002).
Microscopic examination of stool-wet mount: All specimens initially subjected to direct saline preparation. It was performed by suspending 2 mg to 5 mg of stool in few drops of 0.9% sodium chloride solution and then 1-2 drops of 1% eosin solution were added to the suspension, if the consistency of the stool specimen was fluid. Logol's iodine was added, then covered with cover slip and examined under the microscope using 10x objective for screening and then 40x objective for identification of parasite (A wasthi , S , at al , 1997).
Flotation Method by Zinc Sulfate Solution
1 g of feces was mixed with 10 ml of normal saline, and then it is filtered by gauze and the liquid put in test tube and centrifuged with speed 2300 rpm for five minutes, then the clear supernatant removed and the sediment again washed centrifuged 2300 rpm for five minutes, the supernatant removed. 2 ml of Zinc Sulfate Solution where was the specific gravity of this solution (1.28) was added to the sediment, cover slip was put on the tube and centrifuged by 2300 rpm for 5 minutes. Then cover slide was pull and placed on clean slide, 1 drop of Logol's iodine was added and examined using microscope at 40x then 100x magnification. (WHO,2003)

Statistical analysis

Chi-Square test used to show the rates of infection with the *G. lamblia* parasite in regarding to gender, age group, place, months of the year, and the educational level of the parents.

Results and discussion

Regarding to residence, the results of the study showed significant differences (P <0.01) in the infection rates of *Giardia lambila* in urban and rural areas, the rate of infection was higher in rural area (20.87 %) than urban area (11.54%).

The results of this study agreed with study done by (Al-Jubouri, 2010), and with Al-Ftali that recorded in Diwaniyah the highest rate of infection in rural areas at (18.65%), which is higher than the infection in urban areas, which was (10.11%). High infection rates in rural areas may due to several factors including; lack of clean drinking water and dependence on river water as a direct source of water, dealing with the contaminated soils of gardens and farms with parasite cysts, breeding and contact with animals that are reservoir of the parasite, using animal waste as organic fertilizer, and the low health and cultural levels of the rural population (AL-Jubouri ,2010).

Table 1: Prevalence of *G. lamblia* among patients, according to residence area.

Residence	No. of examined patients	No. of infected patients	Rate of infection %
Urban	433	50	11.54
Rural	182	38	20.87
Total	615	88	14.30

** There is a significant difference in the incidence rates between residential sites at a probability level (P <0.01).

According to age groups, a significant differences (P <0.05) were observed in the rates of infection with *G. lamblia* among age groups, as the highest infection rates is (17.61%) in the age group (4-6) years, and the lowest percentage of infection (6.81%) in the age group (1-3 years) as shown in Table (2). The results of this study consistent with what was found by (Tsuyouka, 1999) (Al-doury S.M ,2019), that the highest rate of infection recorded in the pre-primary age group. Also consistent with what was recorded by Hussein, T, K (2010) in Dhi Qar, that the highest rate of infection (33.3%), was recorded in the age group (24-48 months), and disagreed with what was recorded by Fattouhi and others (2008), the highest incidence rate was recorded at the age of (1-2) years. This may due to the fact that; the children at this age are more active and their lack of awareness of hygiene rules such as washing hands before eating and after using the toilet, in addition to children's habits of playing in polluted soil in Ponds or sewers with polluted stagnant water.(Hussein , T, K,2010)

Table 2: Prevalence of *G. lamblia* among patients, according to age groups.

Age group (years)	No. of examined patients	No. of infected patients	Rate of infection %
1-3	88	6	6.81
4-6	193	34	17.61
7-10	189	29	15.34
11-13	82	12	14.63
14-16	63	7	11-11
Total	615	88	14.30

* There is a significant difference among the age groups at a probability level (P <0.05).

According to the gender of patients, the results of the study showed a significant difference (P<0.05) in the rates of infection with *G. lamblia* according to the gender. The rate of infection in males (17.30%) was higher than that in females (11.22%), as showed in Table (3). Results of present study agreed with Al-Kiz (2011) and with what Al-Jubouri recorded in Salah Al-Din, where he recorded an infection rate in males (6.94) and in females (3.31%) and with what Al-Zaidi recorded (1999) for the rate of infection in males was (85.70%), while in females it was (72.90%). They are in public places and they are more mobile and active, and they are the working group in society, where they eat and drink from street vendors, and this increases their chances of exposure to infection (AL- Kiz , 2011).

Table 3: Prevalence of *G. lamblia* among patients, according to gender.

Gender	No. of examined patients	No. of infected patients	Rate of infection %
Male	312	45	17.30
Female	303	34	11.22
Total	615	88	14.30

* There is a significant difference between males and females at a probability level (P <0.05).

Regarding to distribution of infected patients with *G. lamblia* during months of the year, a significant difference (P <0.01) were observed in infection rate of *G. lamblia* according to the months of the year. The highest percentage of infection with *G. lamblia,* recorded in April (28%), followed by June (25.49%). The lowest incidence, was in January (6%), as in Table (4), which is consistent with the findings of Al-Kubaisi (2007), as it recorded the highest rate of infection in the month of June (10.95%) and the lowest rate of infection in January which was (92.1%). Also consistent with Al-Jubouri (2007) that recorded the lowest incidence was in January (1.52%), and the results of Salman (2012), and Al-Mousawi (2012) where the highest incidence was recorded in the summer. The high rate of giardiasis in summer may due to; the availability of suitability conditions for the growth of the parasite, an increase in drinking water and juices, the use of ice made from unsterilized water, and the presence of vector insects that are mechanical vectors of the parasite cysts. Where the reason for the decrease in the infection rate in winter is due to the cold climate, which can lead to killing of the parasites feeding stage (trophozoites), (Jhon & Petri, 2006),(Salman , 2012)
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Table 4: Distribution of *G. lamblia* among children, according to the months.

Months	No. of examined patients / month	No. of infected patients	Rate of infection %
December 2018	52	4	7.69
January 2019	50	3	6
February	51	5	9.80
March	53	6	11.32
April	50	14	28
May	52	12	23.07
June	51	13	25.49
July	52	8	15.38
August	50	6	12
September	51	6	11.76
October	52	7	13.46
November	51	4	7.84
Total	615	88	14.30

** There is a significant difference between the months of the year at a probability level (P <0.01).

The results of the study also showed that there are differences in the infection of *G. lamblia* according to the educational level of the fathers. The highest rates of infection among patients whose parents and mothers had the educational level (illiterate) were (24.62%) and (20.27%) respectively, and the lowest level of infection was among patients whose parents' have academic achievement (higher degrees) reached (4.84%) and (10.66%) respectively. Significant differences were observed in the incidence rates according to the educational level of the father at a probability level (P <0.01) and at (P <0.05) at the level of (P <0.05) respectively, As in Table (5) and (6). Results of this study consistent with other studies, done by Al-Abadi (2000) in Mosul, Al-Zorfi (2005) in Najaf, and AL-Bayati (2009) in Kirkuk, where they recorded the highest rate of infection

for children with illiterate parents. This may be due to; the lack of education and health knowledge, as well as the economic status may affect the rate of infection, and neglect of prevention methods.

Table 5: Incidence of infection with *G.lamblia* according to the educational level of the fathers.

The Father's educational level	No. of examined individuals	No. of infected patients	Rate of infection %
Higher degree	165	8	4,84
High school	211	28	13,27
Primary school	105	19	18,09
Illiterate	134	33	24,62
Total	615	88	14,30

** There is a significant difference in infection rates according to the father's educational level within the studied groups.

Table 6: Incidence of infection with *G. lamblia* according to the educational level of the mothers.

The Mother's educational level	No. of examined individuals	No. of infected patients	Rate of infection %
Higher degree	150	16	10.66
High school	197	24	12.18
Primary school	120	18	15
Illiterate	148	30	20.27
Total	615	88	14.30

** There is asignificant difference in infection rates according to the Mothers educational level within the studied groups.

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