

Epidemiology of giardiasis in sulaimaniya and chamchamal with its effect on some biochemical parameters and pcv.

-Lazem H. K. Al-taie (Ph.D), Dept. Microbiology, College of Medicine, Alnahrin University, Iraq.

-Fatema M. Ali, Diplo, Dept. Public Health, Technical college Sulaimaniya, Iraq.

المخلص

هدفت الدراسة الحالية الى تحديد نسبة الاصابة بطفيلي الجارديا في الاعمار والاجناس المختلفة في منطقتي السليمانية وجمجمال اضافة الى تبيان تاثير الطفيلي على بعض التغيرات الكيموحيوية النسبية النووية لحجم الخلايا المرصوفة. تضمنت الدراسة فحص 1200 نموذج براز من المرضى الخارجين من منطقتين مختلفتين، أحدهما حضرية (سليمانية) والآخرى شبه ريفية (جمجمال) ومن كلا الجنسين ووزعوا الى فئتين عمرية، بالغين واطفال. فضلا عن 40 نموذج دم من المرضى المصابين بطفيلي الجارديا لغرض الفحوصات الكيموحيوية. أظهرت نتائج الدراسة أن أعلى نسبة للاصابة بالطفيلي كانت في منطقة جمجمال منه في السليمانية أما بالنسبة للعمر فقد كانت نسبة الاصابة في الاطفال اعلى (55%) منه في البالغين (45%) وكانت نسبة الاصابة في الاناث اكثر من الذكور. ومن ناحية اخرى فقد عانى الاطفال المصابين من انخفاض حجم الخلايا المرصوفة، نسبة الالبومين الى الكلوبولين، الكولستيرول و الكالسيوم وارتفاع في الكلوبولين. أما البالغين المصابين من الذكور فقد اظهروا ارتفاعا في نسبة الالبومين الى الكلوبولين وانخفاضا في حجم الخلايا المرصوفة و بروتين مصل الدم الكلي، الكولستيرول، والكلسيرينات الثلاثية، و الكالسيوم، أما الاناث البالغين فقد عانو من ارتفاعا في الالبومين ونسبة الالبومين الى الكلوبولين وانخفاضا في الكلوبولين والكولستيرول والكلسيرينات الثلاثية.

Abstract

The present study aimed to detect the percentage of infection with *Giardia lamblia* in different ages and sexes in Sulaimaniya and Chamchamal, and showing the effects of Giardiasis on some biochemical parameters and PCV% which related to the public health in society. The prevalence of Giardiasis and its relationship to age, and sex was studied randomly in 1200 out patients in two different areas, Sulaimani city (urban) and Chamchamal (semirural) during period from April to June 2007. Stool samples were examined microscopically by direct general stool examination (GSE). 40 blood samples were collected from patients whom found infected with *G. lamblia* for estimation of PCV, TSP, Alb, Glo, A/G, S.Chol. S.TG, and S. Cal. The results showed that the higher rate of infection was recorded in Chamchamal as semirural. Age factor had effect on the prevalence of infection; the rate in children (55%) was higher significantly than in adults (45%). The percentage of infection was higher in females than in males. Infected children suffered from reduction in PCV, S.chol. and S. Cal. and A/G ratio which attributed to elevation of Glob, infected adults suffered from

reduction in S.Chol., S. TG., S.Cal., and Glob, which cause the elevation of A/G. It can be concluded from the present study that Giardiasis was higher in semi rural area than urban, children than adults, and in females than males. PCV and serum Calcium were the most affected by the Giardiasis.

Keywords: Giardiasis, biochemical parameters, PCV, Prevalence , Sulaimaniya

Introduction

Giardia lamblia is a pathogenic protozoan parasite of medical and evolutionary importance 1. Human is the main reservoir of the parasite, but a variety of animals can *act as carrier of Giardia spp.* Similar to those infecting humans. It naturally infects humans, beavers, coyotes, cattles, cats , dogs and rats can experimentally infect certain other mammals 2.It causes giardiasis which is a major global cause of water borne parasitic diarrheal disease 3. The result of the relative resistance of *Giardia lamblia* cyst to chlorination 4 , is one of the most common protozoa which is world-wide in distribution ,in 1681, Antoni Van Leeuwenhock recovered *G.lamblia* from his own stool and it is considered as the first intestinal protozoan discovered in man 5. Infection of host is initiated when the cyst of *G. lamblia* is ingested indirectly by contaminated food and water or directly by person-to-person; especially among preschool children by fecal-oral contamination with cyst6. The majority of infections are probably asymptomatic but in some, especially children, are associated with sub acute or chronic diarrhea and intestinal irritation, symptomlogy differs from person to person, depending on such factors as inoculum's size, duration of infection, and individual host and perhaps parasite factors. The incubation period generally varies from 9 -15 days, for acute giardiasis is 1-2 weeks 7. Numerous reports indicate that diarrhea and malabsorption may accompany with *G. lamblia* infection in children 8Infants under one year are less likely infected than the older children 9. The prevalence of giardiasis is related to levels of sanitation and management of supplied water, 2-7%in western countries and of 20-60% in developing countries 10.Transmission routes include: water borne, person to person, food borne and zoonotic transmission 11. Evidence for animal-to-human transmission is limited, despite the wide distribution of *Giardia.* organisms between non-human mammalian hosts. Mice, gerbils ,beavers , sheep , dogs , cattle , cats and birds have been experimentally infected , or found to be infected with organisms similar to ,if not identical to human isolates12 .Studies in domestic pets and ruminants indicate that there are other potential sources and reservoirs of *Giardia.* close to man 13.It may cause acute or chronic diarrhea which contribute to nutritional deficiency ,in chronic disease there may be evidence for malabsorption of fat , vitamins A , B12 ,

protein, D-xylose, iron and lactose¹⁴. The trophozoites can be found in diarrheic stools and by duodenal aspiration or biopsy¹⁵.

Materials and Methods

Study area and population: Two different towns (Sulaimaniya as urban and Chamchamal as semirural) of the Kurdistan region in the province of located in the north of Iraq. 1200 out patients of different sex and ages were examined for general stool, 900 from Sulaimaniya Teaching Hospital, and 300 from Chamchamal General Hospital, during the period from April to June 2007.

Stool samples: were examined by general stool examination, samples which contain cysts and/or trophozoites of *G.lambli*a regarded as positive for giardiasis. 40 cases of positive giardiasis which were confirmed clinically and parasitologically. 10 healthy individuals, who had neither clinical signs nor any parasitic infection.

Blood samples: were collected from patients with positive giardiasis and divided into two portions, one for estimation of PCV(%), and the other allowed to clot at room temperature. The serum was separated and stored at -20C for further investigation.

Biochemical parameters: including total serum protein, S. Albumin, S. Globulin, S. Cholesterol, S. Triglycerides, S. Calcium, using commercial kits from Biomerio com.

Statistical analysis: Data of infection ratio expressed as %, other data are means \pm SD. t-test was done to show significant difference between groups of study subjects, P-value less than 0.05 were considered statistically significant. In case of children the comparison done with normal values cited 16.

Results

Out of 1200 examined patients, 40 were positive for giardiasis giving an infection rate of 3.3%. The blood were collected from the 40 positive cases and from 10 negative cases were considered as negative controls in both, center of Sulaimani and chamachamal, which is used for some biochemical parameter and PCV, from total 40 positive patients, 11 (27.5%) were from sulaimani and 29 (72.5%) were from chamchamal. According to age patients divided into children (primary school age and less) and adults, present results mentioned that number of infected children were higher 22(55%), than adults 18 (45%), divided in to Infected males 8 (20%) were less than females 10(25%), as shown in table 1.

Table (2) shows the changes in measures of PCV and biochemical parameters in patients infected with giardiasis according to age, and sex, in comparison with normal values obtained from Pagana & Pagana (2001) for children and control healthy for adults. PCV (%) was decreased clearly in infected children (35.73) compared with

normal(40.5), while it decreased but not significantly according to sex. The infection of giardiasis reduce TSP but not significantly in all groups of the study patients, in children was decreased (6.01 gm/dl) less than in normal children value (6.9 gm/dl). In infected females the level of total serum protein was (6.11±0.26) there was non-significant decrease as compared with male total protein (6.22±0.30).(Table2).In children infected patients Albumin (4.0±0.20) was decreased in comparison with normal (4.65), while it stayed constant in infected male (3.96±0.24) and females (4.04±0.16) . Globulin was sharply elevated in infected children (2.01±0.25),otherwise, there was non-significant difference between male and female Globulin . Albumin/Globulin ratio was reduced clearly in all patients infected with Giardiasis as shown in table (2). In children infected patients cholesterol (132.77±9.23) was reduced clearly in comparison with normal children values, in infected males & females the level of cholesterol was (135.58±10.64) (143.38±12.62), respectively there was non-significant decrease as compared with non infected patients. Triglyceride in infected children (122.09±24.71) was slightly decreased in comparison with normal children values (128.5) , adult infected patients, either males or females, triglycerides (102.21±25.98)(131.71±33.50), was decreased non significantly. Serum calcium in infected children (8.80±0.59) was decreased in comparison with normal children values. . In infected males & females the level of serum calcium was (8.91±0.65, 9.06±0.54) there was non-significant difference as compared with non infected male & females serum calcium

Discussion

The present study is a record of the infection rate of *G. lamblia* among infected patients of center of Sulaimani and Chamchamal in different age and sex. The infection rate with *G. lamblia* among the positive case was 55% in children and this is higher than the adult which was 45% in both Sulaimani and Chamchamal. This high rate of infection among children pointed out that there are many factors affecting the increase rate of infection such as misunderstanding or low education among children to the proper hygiene, poor toilet training, overcrowding, low socio-economic status and climatic conditions 17.

In Sulaimani city the rate of infection with *G. lamblia* among children was very high in comparison to children in Chamchamal; the reason of this may be due to using day care center in Sulaimani more than Chamchamal. The prevalence of *G. lamblia* in day care children was significantly higher than the 2% among age-matched children not in day care center 18. The high rate infection with *G. lamblia* among children in the present study was similar to the other studies in Iraq by 19 in Baghdad 20 in Mosul, in Erbil 21, and in Duhok city 22.

The rate of infection was high in females 10 than male 8, which was (25 %) this rate was higher than that in male which was (20 %), this

may be related with direct contact of females with children. In day care center 20-50% of children may be infected, often without symptoms, making it difficult to control giardiasis in the developing regions 23 .Although many of these children are asymptomatic, they can introduce *Giardia* to family members and contribute to high endemic rates in the community 24.

The above reasons improved by which the rate of infection in Chamchmal was low in females (48.28%) than males (51.72%) because females in this region approximately all home ladies and do not use day care center for their children therefore the rate of infection was low in them and there children also.

The present study revealed that the rate of infection in Chamchmal (72.5%) is higher than in center of Sulaimani city (27.5%). This was because of using water of wells for drinking in most regions and giardiasis in most cases is transmitted via contaminated drinking water (waterborne diseases).²⁵ Several factors contribute to the frequency of water-transmitted disease: *First, *Giardia*. is widely distributed in both humans and other mammalian species, allowing for frequent contamination of surface water supplies.²⁶ * Second, the cyst form of *G.* can survive for weeks in cold fresh water 27. *Third, *Giardia*. cysts are relatively resistant to chlorination alone 4,28. Therefore, when water supplies are only treated by chlorination, there is possibility that *G.* will escape inactivation. * Fourth, only a few parasites are necessary to establish an infection,also giardiasis is transmitted by fecal-oral and direct person-to-person spread 29 , and may be because of poor hygiene and health education in these regions.

The study revealed decrease in PCV% in infected children and adults of both sexes from both Sulaimaniya and Chamchamal region. As noted before (table-1-) children were more infected with *G. lamblia* than the adults and most of them had chronic infection without symptoms. Intestinal parasites find in the human gastrointestinal tract a good environment for their development. Carbohydrate, lipids, amino acids, iron and the like are used by parasites to grow and developed and they also use macromolecules that they can breakdown using their own enzymes³⁰. Proteins are necessary for formation of globin part of heamoglobin and iron is necessary for formation of red blood cells because of its essential location in heamoglobin molecule. The essential vitamins for normally growing red blood cells are folic acid and B12 and their deficiency lead to slow growth of the RBCS. Abnormal fractional absorption of vitamin B12 and folic acid has been noted in children with chronic diarrhea due to giardiasis 31.

The study revealed relatively decreased serum total protein in infected patients with *G. lamblia* but without significant difference especially among children but in other infected patients the normal serum total protein was recorded. This may refer to approximately all patients (except children) had acute infection with *G. lamblia* and they

were under treatment that did not lead the parasite to take enough time to make malabsorption of protein. Whereas, most children suffered from chronic infection with *G. lamblia*, since *Giardia*. lacks synthesis of most amino acids and dependent on scavenging them from the intestinal milieu in which the trophozoite replicates 32.

The increased serum globulin in infected children (table-2-) could be explained by that ,the response of given patients to infection with *G. lamblia* appear to be variable, depending on the infecting dose and on such host-related factors as age, pervious surgery, presence of enteric bacterial infection, malnutrition, and the globulin abnormalities associated with altered immune mechanisms15.

The study revealed decreased serum cholesterol, the decrease occurred especially in children, that most infected patients were suffered from acute not chronic infection but children were suffered from chronic infection. The trophozoite of *G. lamblia* appear to satisfy their lipid requirement by obtaining cholesterol and phosphatidyl-choline from the external environment33.

Serum triglyceride in infected patients with *G. lamblia* decreased in infected patients with significant difference. This caused by malabsorption syndrome, malnutrition and hyperthyroidis16 .Duodenitis, perhaps choledochitis mucosal inflammation, possible mechanical and toxic interference with absorption of vitamin A and fat, resulting in diarrhea and steatorrhoea 34.

The study revealed decreased serum calcium especially in infected children with chronic infection and suffering from malabsorption according to the infection and most of these patients were suffered from decreased of albumin (hypoalbuminemia). Hypoalbuminemia is associated with decreased levels of total calcium. Also decreased valus of calcium (hypocalcemia) affected by malabsorption 16 . No further investigations have been documented.

Table-1: Relationships of Giardiasis with age and sex in Sulaimani (urban) and Chamchamal(semirural)

	Sulaimani. infected pat.No.(%)	Chamchamal infected pat.No.(%)	Total Infectedpat.No.(%)
Children	9(22.5)	13(32.5)	22(55)
Adult	2(5.0)	16(40.0)	18(45)
Male	0.0(0.0)	8(20.0)	8(20.0)
Female	2(5.0)	8(20.0)	10(25.0)
Total	11(27.5)	29(72.5)	40(100)

Table-2: Means \pm SD of PCV (%), TSP.(gm/dl), Alb.(gm/dl), Glob.(gm/dl), A/G ratio, Chol.(mg/dl), TG(mg/dl), and Cal.(mg/dl), in Children and adults infected with Giardiasis.

Parameters	Children Infected (n=22)	Children* Normal values	Infected adult males (n=8)	Non infected adult males (n=5)	Infected adult females (n=10)	Non infected adult females (n=5)
PCV (%)	35.73 \pm 1.63	40.5	38.42 \pm 2.16	40.1 \pm 5.61	36.95 \pm 1.72	37.32 \pm 4.02
TSP (gm/dl)	6.01 \pm 0.18	6.90	6.22 \pm 0.30	6.6 \pm 0.73	6.11 \pm 0.26	6.5 \pm 0.65
Alb (gm/dl)	4.0 \pm 0.20	4.65	3.96 \pm 0.24	4.2 \pm 0.42	4.04 \pm 0.16	4.5 \pm 0.45
Glob.(gm/dl)	2.01 \pm 0.25	1.25	2.27 \pm 0.37	2.43 \pm 0.48	2.08 \pm 0.28	2.58 \pm 0.26
A/G ratio	2.26 \pm 0.54	3.72	2.08 \pm 0.65	1.72 \pm 0.37	2.58 \pm 1.44	1.74 \pm 0.41
Chol.(mg/dl)	132.77 \pm 9.23	151	135.58 \pm 10.64	157.2 \pm 30.66	143.38 \pm 12.62	159.32 \pm 27.04
TG.(mg/dl)	122.09 \pm 24.71	128.5	102.21 \pm 25.98	123 \pm 34.83	131.71 \pm 33.50	143.7 \pm 34.6
Cal.(mg/dl)	8.80 \pm 0.59	9.75	8.91 \pm 0.65	9.57 \pm 0.74	9.06 \pm 0.54	9.57 \pm 0.21

*These normal values obtained from Pagana & Pagana(2001).

References

1. Thompson, R.C., Reynoldson, J.A., Mendis, A.H. (1993). Giardia and giardiasis. *Adv Parasitol* 32: 71-160.
2. Smith, P.D., Gillin, F.D., Kaushal, N.A., and Nash, T. E. (1982). Antigenic analysis of Giardia lamblia from Afghanistan, Puerto Rico, Ecuador, and Oregon. *Infect. Immun.* 36: 714-719.
3. Hill, R.D. (2001), Giardia lamblia .J. Prince. And Pract. Of Clinic. Parasitol. ; Edited by G Stephen and Pearson, D. R. 219- 241.
4. Jarroll, E.L., Bingham, A.K., Meryer, E.A. (1981). Effect of chlorine on Giardia lamblia cyst viability. *Appl Environ Microbiol* 41:483-7.
5. Yaeger, G.R., (2000). Protozoa: Structures classifications growth and development. Society of protozoologists.

6. Keyston, J.S., Kraiden S., and Warren M. R., (1978). Person-to-Person transmission of *Giardia lamblia* in day-care nurseries. *Can. Med. Assoc. J.* 119:241-248.
7. Reitmeyer, M., and Roberison, S., (1997). Giardiasis. Clinical medicine conferences, Chief Medical Resident, s University of Virginia.
8. Nunez, F.A.; Hernandez, M. And Finaly, C. M., (1999). Longitudinal study of giardiasis in three-day care centers of Havana City. *Acta trop.*; 73(3): 237-242.
9. Blake, R.T. and Overend, D.J., (1982). The prevalence of *Dirofilaria immitis* and other parasite in urban pound dogs in north-eastern victoria. *Aust. Vet.J.*; 58: 111-114.
10. Muller, N. and Gottstein, B., (1998). Antigenic variation and the murine immune response to *Giardia lamblia*. *Int. J. Parasitol.*: 28: 1829-1839.
11. Ford, B.J. (2005). The Discovery of *Giardia* 1. *J Microscope*; Vol53: pp 147- 153.
12. Monis, P.T., Andrews, R.H., Mayrhofer G., (1998). Novel lineages of *Giardia intestinalis* identified by genetic analysis of organisms isolated from dogs in Australia. *Parasitology* 6:7-19.
13. Buret, A., den Hollander, N. Wallis, P.M.(1991) Zoonotic potential of giardiasis in domestic ruminants. *J Infect Dis* 162: 231-237
14. Sutton, D.L., Kamath, K.R. (1985) Giardiasis with protein losing enteropathy. *J Pediat. Gastroenterol Nutrit* 4: 56-9.
15. Mehlhorn, H. (Ed). , (2000). Encyclopedic reference of Parasitology. 2th edition P: 234-235.
16. Pagana, K.D., Pagana, T.J., (2001). Moby, s Diagnositic and laboratory test Reference. 5th edition. P. 859.
17. Hellard M.E., Sinclair M.I., Hogg G.C., Fairley C.K.(2000): Prevalence of enteric pathogens among community based asymptomatic individuals. *J Gastroenterol Hepatol* 15:290–293.
18. Black, R.E., Dykes, A.C., Sinclair, S.P. and Wells, J.G., (1977). Giardiasis in day care centers: Evidence of Person-to-Person transmission. *Pediatrics*; 60:486-491.
19. Al-Dabagh, M.A.; Shaheen, A.S.; Zeki, L.A. and Abudullah, M., (1967). Giardiasis in a group of rescool age children in Iraq. *Journal of the faculty of Medicine Baghdad*; 9: 73-83.
20. Al-Rahaley, I.M., (1998). Some aspects anteropathogenic *Escherichia coli* from diarrhea in children in Hospitals and normal children in Nurseries. M.Sc. thesis. University of Mousl.
21. Molan, A .L. and Farag, A.M.(1989). Prevalence of Intestinal Parasite in Scool children of Arbil North of Iraq, *Med.J.*10:107-110.
22. Issa, S.H., (2003). The prevalence of *Giardia lamblia* among children in Duhok city-north of Iraq. M.Sc./ college of Medicine, Duhok University, Medical parasitology.

23. Thompson, S.C., (1994) *Giardia lamblia* in children and the child care setting: A review of the literature. *J Paediatr Child Health*; 30: 202-209.
24. Overturf G.D.,(1994) Endemic giardiasis in the United States:Role of the daycare center (Editorial).*Clin Infect Dis.*; 18: 764-765.
25. Thompson, R.C., (2001). The Future impacts of social and culture factors on parasitic disease-some emerging issues.*International Journal for*
26. *parasitology*; 31: 949-959. Upcroft, J.A., Chen N., Upcroft, P. (1996) Mapping variation in chromosome homologues of different *Giardia* strains. *Mol Biochem Parasitol* 76: 135-43.
27. Centers for Disease Control (1980). Water borne giardiasis – California, Colorado, Oregon, Pennsylvania. *Morbid Mortal Wkly Rep* 29:121-3
28. DeRegnier, D.P., Cole, L., Schupp, D.G., Erlandes, S.L. (1989). Viability of *Giardia* cysts suspended in lake, river, and tap water *Appl Environ Microbiol* 55:1223-9.
- Flanagan, P. A. (1992). *Giardia*—diagnosis, clinical course and epidemiology: a review. *Epidemiol. Infect.* 109:1–22.
29. Backer, H., (2002) Water disinfection for international and wilderness travelers. *Clin Infect Dis*; 34: 355-364.
30. Gillin, F.D., Reiner, D.S. and McCaffery, J.K., (1996). Cell biology of the primitive eukaryote *Giardia lamblia*. *Annu. Rev. Microbiol.*; 50: 679-705.
31. Olivares, J.L., Fernandez, R., Feta, J., Ruiz, M.Y., Clavel, A. (2002) Vitamin B12 and Folic Acid in Children with Intestinal Parasitic Infection *J. of the American College of Nutritional*, Vol.21., 109-113.
32. Hjelt, K., Paerregaard, A., Krasilnikoff, P.A. (1992): Giardiasis: haematological status and the absorption of vitamin B12 and folic acid. *Acta Paediatr* 81:29–34.
33. Adam, R.D., (2001) Biology of *Giardia lamblia*. *J. clinic. Micro.Rev*; Vol.14 (3): PP: 447-475.
34. Lujan, H. D., Mowatt M. R., and Nash T.E., (1996). Lipid requirements and lipid uptake by *Giardia lamblia* trophozoites in culture. *J. Eukaryot. Microbiol.* 43:237–242.
35. Sood Dr.Ramnik M.D.(1987)*Medical laboratory Technology,Methods and interpretations medical parasitology*3th edition P: 49.