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A R T I C L E   I N F O

The presence of Giardia lamblia Infestation among healthy and undernourished Children under 5 years of age.

ABSTRACT

Background Worldwide, malnutrition is common and is responsible directly or indirectly for about a third of all deaths of children under 5 years of age. Restrictive diets may be iatrogenic as a result of exclusion diets or parental food fads, or may be due to parasitic infection like Giardia lamblia which is a zoonotic parasitic disease caused by the flagellate protozoan Giardia lamblia (also sometimes called Giardia intestinalis and Giardia duodenalis). This study aims to evaluate the occurrence of infection by Giardia lamblia among the malnourished children under five years.

Patients & Methods: A descriptive cross sectional study was done on children attending the pediatric department, and nutrition department in General Pediatrics Hospital in Kirkuk from 15th of March to the last of August 2015. The study included 101 children, their age from (2 months -5 years). Each child included in the study was assessed by a prepared questionnaire. Screening done by measuring weight for age, height for age, then diagnostic test done by depending on weight for height to confirm diagnosis or exclude malnutrition. Each malnourished case was sent for general stool examination.

The Results: The males were 56.4 % while female were 43.6% most of the cases were of 2-12 month for both females (47.4%) and males (54.5%) respectively.. Other findings for this study showed that all the cases were wasted (100%) followed by abdominal distention (60.4%) and finally most of the study cases were below 3rd percentile 73.3%.Regarding the general stool examination , the laboratory examination showed that positive test for Giardia lamblia were 12 cases, (11.9%) most of the study cases had normal Middle Arm Circumference   (88.1%) and most pateints with Giardia lamblia had weight for age less than 3rd percentile (83.3%) and most Giardia lamblia positive patients had height for age less than 3rd percentile while negative Giardia lamblia infection had normal height for age (100%). Finally the present study concluded that Giardia lamblia is still prevalent among malnourished cases.

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Introduction

Malnutrition remains one of the most common causes of morbidity and mortality among children through the world. Approximately 9% of children below 5years of age suffer from wasting (weight for height below -2 standard deviations (<-2SD) of the national center for health statistics (NCHS)/WHO reference values) and are at risk of death or sever impairment of growth and physiological development (1,2,3)

Parasitic infections in children (below 5 years of age) are problematic because of negative lifelong health consequences and can contribute to malnutrition resulting in growth retardation (4) . Giardia lamblia is a common cause of endemic and epidemic water borne diarrhea throughout the world affecting almost every individual. The interactions of the parasite with the surface mucosa of small intestine have been proposed to be responsible for pathogenesis leading to malabsorption, maldigestion, and diarrhea . However, scarce information is available pertaining to the consequences of Giardia infection in malnourished and re-nourished children. Thus, it is pertinent to investigate the effect of Giardia lamblia in malnourished and re nourished animals(4).

Poor environmental conditions may increase insect and protozoal infections and also contribute to environmental deficiencies in micronutrients (5) . Overpopulation, more commonly seen in developing countries, can reduce food production, leading to inadequate food intake or intake of foods of poor nutritional quality. Conversely, the effects of malnutrition on individuals can create and maintain poverty, which can further hamper economic and social development(1) . The aim of this study was to decrease mortality and morbidity among children with malnutrition by early detection of Giardia lamblia infection.

Patients and methods:

The study cases (malnourished cases) was taken from the general Pediatric ward and Rehabilitation ward for malnutrition cases.

A case control hospital based selective study were done on patients with malnutrition attending General Pediatric Hospital in Kirkuk during the period from 15th of March to the last of August 2015 aged from 2 months_5 years.

A comparable group of malnourished cases without Giardia lamblia were taken as a control group.

Before the study acceptance was taken from the parents and from the director of General Pediatric Hospital in Kirkuk. Each case (malnourished cases) was assessed by a prepared questionnaire . The anthropometric

measurements were measured for each case included in the study (malnourished cases).These included Wt/age and Ht/age.

□ Wt/age:

Each case was assessed for weight using unicef weight scale for children who cannot stand and digital scale for older children who can stand. The measurement then put on growth chart in regard to age and sex (6).

□ Wt/Ht age:

The Wt and Ht/Length for each malnourished patient and control were put on special chart for Wt/Ht/Length according to sex(7).

- .Inclusion criteria for malnourished cases:

1 .Patient aged 2month _ 5years.

2 .Patient with Wt/Ht _1SD and less.

-Exclusion criteria for malnourished cases:

.Age <2 month as these ages not included in the definition of malnutrition by the WHO even there weight is less than normal as this decrease in the weight may be due to failure to thrive because of immaturity (8) .

.Age >5 years as this age also not included in the WHO program for malnutrition due to fact that malnutrition after 5 years of age unlikely to be nutritional and usually it is a secondary malnutrition (8).

.Patient who did not complete the questionnaire and the parameter assessment (9) .

.Children on tonics and anabolic steroid (9).

Materials:

Each malnourished case was sent for general stool examination. The stool was taken immediately into a clean container and sent for the lab and examined immediately (within 20 minutes) under light microscopy by experience lab person looking for Giardia lamblia trophozoite or cyst .

The method of preparation of the sample for examination and process of the test were done according to: zinc sulfate concentration method.

We mixed one gram feces in 10ml of 33% zinc sulfate solution and let it during 10 minutes before the observation of 10 microscopic fields with X40 objective.

Ideally we should taken three consequence samples on three consequence days to prove or exclude Giardia lamblia infection.

.**Statistical analysis:**

The result were presented in tables and figures and statistical significances were assessed by the SSPS version 11 using p_ value <0.05 considered significant.

Results

The total No. of cases was 101 cases, males were 56.4 % while female were   43.6% as shown in Figure 1.
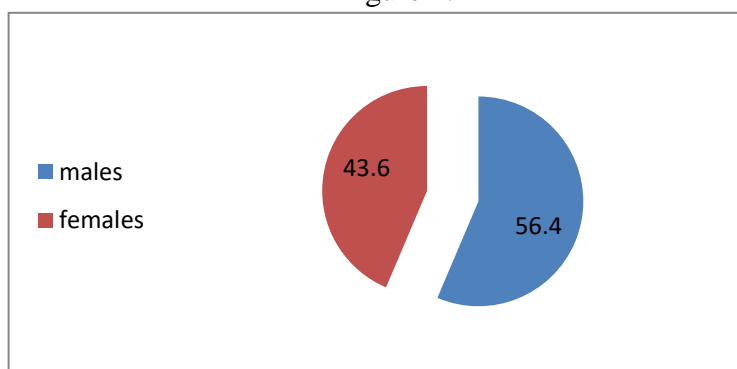
(male=56.4, female=43.6)

Figure 1 :Sex distribution of study cases

Table 1 shows the distribution of study cases according to age. Most f the cases were of 2-12 months . For both females (47.4%)and males (54.5%)) respectively.
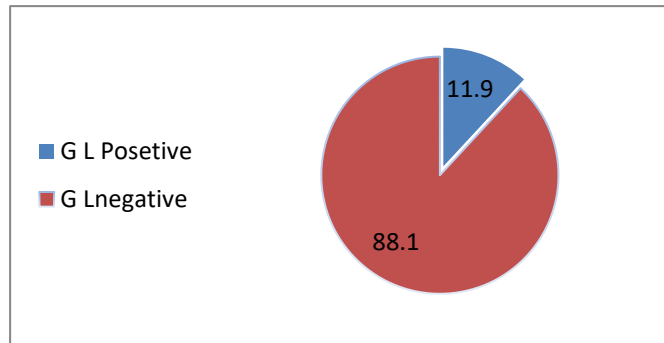
Table 1 distribution of study cases according to age.

Age (months)	Male	Female	Total
2-12	27 (47.4%)	24 (54.5%)	**51 (50.5%)**
13-24	14 (24.6%)	9 (20.5%)	**23 (22.8%)**
25-36	7 (12.3%)	9 (20.5%)	**16 (15.8%)**
37-48	8 (14%)	0 (0%)	**8 (7.9%)**
49-60	1 (1.8%)	2 (4.5%)	**3 (2.9%)**
Total	57 (56.4%)	44 (43.6%)	**101 (100%)**

P-value > 0.05 (not significant)

Table 2 : Distribution of cases according to type of malnutrition

Type of Malnutrition	Number	%
Normal	13	12.9
-1SD	67	66.3
-2SD	12	11.8
-3SD	8	7.9
-4SD	0	0%
Total	101	100%

Figure 2 show, the rate of infection with *Giardia lamblia* in the malnutrition cases. The No. of cases positive for *Giardia lamblia*. was 12 cases, (11.9%) (all the cases were cyst).

(*Giardia lamblia* **+=11.9,** *Giardia lamblia* **=88.1)**
Figure 2: the prevalence of *Giardia lamblia***. among the study cases.**

Table 4 Most cases were between 25 – 36 months (66.7%)

Table 4 Distribution of cases according to age in regard to *Giardia lamblia* **infection.**

Age (months)	*Giardia lamblia* infection		Total
	+ve	-ve	
2-12	0 (0%)	51 (50.5%)	51 (50.5%)
13-24	4 (33.3%)	19 (18.8%)	23 (22.8%)
25-36	8 (66.7%)	8 (7.9%)	16 (15.8%)
37-48	0 (0%)	8 (7.9%)	8 (7.9%)
49-60	0 (0%)	3 (2.9%)	3 (2.9%)
Total	12 (100%)	89 (100%)	101 (100%)

p-value>0.05(Not significant)

Table 5 shows the distribution of study cases according to *Giardia lamblia* infection in regard to WT/Age. Most of *Giardia lamblia*positive patient had WT for age less than 3rd percentile (83.3%).

Table 5 the distribution of study cases according to *Giardia lamblia* **infection in regard to WT/Age.**

WT/Age	*Giardia lamblia* INFECTION		TOTAL
	+Ve	-Ve	
<3rd percentile	10 (83.3)	78 (87.6)	88 (87.1%)
Normal	2 (16.6)	11 (12.4)	13 (12.9%)
>97th percentile	0 (0%)	0 (0%)	0 (0%)
TOTAL	12 (11.9%)	89 (88.1%)	101 (100%)

P- VALUE <0.05 (significant).

Table 6 shows, the distribution of study cases according to *Giardia lamblia* infection in regard to HT/Age. Most of the *Giardia lamblia* positive patients had less than 3rd percentile while negative *Giardia lamblia* infection had normal Ht for age (100%).

Table 6 the distribution of study cases according to GL infection in regard to HT/Age.

HT/Age	*Giardia lamblia* INFECTION		Total
	+ve	-ve	
<3rd percentile	9 (75)	0 (0%)	9 (8.9)
Normal	3 (25%)	89 (100%)	92 (91.1)
>97th percentile	0 (0%)	0 (0%)	0 (0%)
Total	12 (11.9)	89 (88%)	101 (100%)

P- VALUE <0.05 (significant).

Table 7 shows the distribution of study cases according to *Giardia lamblia* infection in regard to other symptoms and signs. There was no significant result regard to all associated symptoms and signs.

Table 7 the distribution of study cases according to *Giardia lamblia* infection in regard to other symptoms and signs.

ASSOCIATED SYMPTOMS and SIGNS	*Giardia lamblia* INFECTION		Total	P-VALUE
	+Ve	-Ve		
chest infection	7 (21.2)	26 (78.8)	33 (100%)	>0.05
Pallor	9 (14.8)	52 (85.2)	61 (100%)	>0.05
Abdominal distention	12 (16.7)	60 (8.33)	72 (100%)	>0.05
Wasting	12 (11.9)	89 (88.1)	101 (100)	>0.05
Hair changes	12 (70.6)	5 (29.4)	17 (100%)	>0.05
Lethargy	12 (23.1)	40 (76.9)	52 (100)	>0.05
dehydration	3 (4.7)	61 (95.3%)	64 (100%)	>0.05
Fever	0 (0%)	13 (100%)	13 (100%)	>0,05

P-value<0.05(significant)

Table 8 Show the distribution of *Giardia lamblia* infection according to type of malnutrition. Most of the cases is (-3SD).

Table 8 The distribution of *Giardia lamblia* infection according to type of malnutrition.

Type of Malnutrition	Giardia lamblia		Total
	Positive	Negative	
No.	2	11	13
-1SD	0	68	68
-2SD	4	8	12
-3SD	6	2	8
-4SD	0	0	0
Total	12	89	101

P-value >0.05 (Not significant)

Worldwide, malnutrition is a common and is responsible directly or indirectly for about one third of all deaths of children under 5 years of age. Primary malnutrition also continues to occur in developed countries as a result of poverty, parental neglect or poor education. (10)

The preset study revealed that Most of the malnourished cases were males. This is goes with several other studies. The reason why the rate of infection in males were more than that in females is that most of the families worry about males more than females.(10)

So that they attend doctors for health quickly and more frequently in males then females.

Most of the study cases aged less than 1 year of age. This is goes with the study done in Iraq by Ghazi, Mustafa . This is due to the fact that malnutrition was more prevalent among patient under 1 year of age as this group was depended on their family in their feeding and due to some wrong habit that most of the families begin feed their children after 1 year of age (11) .

All the study cases have wasting followed by abdominal distention and the dehydration. The reason why of with malnutrition presented with different signs and symptoms affecting different part of the body is that malnutrition is one of the most common acquired immune deficiency disorder that make the patient vulnerable to different types of infections affecting many systems in the body so present with different signs and symptoms(12).

Most of the study cases have weight less then 3rd percentile with normal height and Occipitofrontal circumference (OFC) for age this goes with several other studies in UK by Burden, Stoppard, In which the

weight of the patients is the first parameter affected by acute or chronic malnutrition (12) . The reason why the height and OFC is not affected in this study is that most of the cases have acute malnutrition that affect the weight only and on prolonged peril of malnutrition the height will be affected (chronic malnutrition). The OFC is only affected in malnutrition occurring very early in life or malnutrition due to congenital malformation or chromosomal abnormalities. Most of the study cases have wt/ht (the diagnostic test for malnutrition) <3rd percentile this is due to the same reason mentioned above in which only the weight affected and the height is normal. So the wt/ht is decreased for age and sex. Most of the study cases have normal Mid Arm Circumference (MAC) (the screening test) this is doesn't goes with other studies study Viana. in which MAC is first affected by malnutrition so that it is consider as the screening test for malnutrition the reason why this difference in the result is that may be due to that most our cases have mild malnutrition in which the MAC still not affected or it may be due to difference in the sample sizes(13).

Weight is more affected in patients with Giardia lamblia infection with malnutrition as patients with malnutrition and Giardia lamblia have more severe degree of malnutrition than the malnutrition with negative Giardia lamblia this is goes with several other studies done in Mexico by Moya-Camarena. this is due to the same reason mentioned above that Giardia lamblia infection is one of the important causes of secondary malnutrition as result of malabsorption (14).

Most of the study cases have mild malnutrition (-1SD) this may be due to that most of the patients admitted for other reasons like diarrhea or chest infection actually so that the weight is mildly affected.

The Giardia lamblia infection is still prevalent among patients with malnutrition this is goes with other studies done in italia by Schoonees which consider Giardia lamblia as one of the important causes of malnutrition.(15) This is due to the fact that Giardia lamblia infection affect the small intestine and causes total and subtotal villous atrophy and this will lead to malabsorption of several nutrients which is manifested as malnutrition signs and abdominal distention and stool features of malabsorption all the study cases were of Giardia lamblia is small intestine disease by which the trophozoite become cyst as it pass from the small intestine to the large intestine so Giardia lamblia cyst will appear by general stoolexamination and

considered significant and symptomatic the trophozoite rarely seen in general stool examination and only in cases of very sever diarrhea by which no time for trophozoite to change in to cyst (16).

The study concluded that Giardia lamblia infection is still prevalent among children with malnutrition which may be a cause for the malnutrition among these children.

References:
1. Kliegman: Food Insecurity, Hunger, and Undernutrition. In: Robert M.kliegman, Richard E.Behrman, Hal B.Jenson, Bonita F.Stanton. Nelson Text Book of Pediatrics. 19th edition. United States of America, 2011;43:225-226.
2. Victora CG :Nutrition in early life .aglobal priority .lancet 2009; 347: 1123-1125.
3. De Onis M, Blossner M, Borghi E. Estimates of global prevalence of childhood underweight in 1990 and 2015. JAMA. Jun 2 2004;291(21):2600-6.
4. Young, E.M. Food and development. Abingdon, Oxon Routledge;(2012): pp. 36–38.
5. World Health Organization: WHO child growth standards (websites).Accessed June 5 ,2012 www.who.int /childgrowth/en/.
6. De Onis M, Garaza C, Onyango AW. comparison of the WHO child growth standards and the CDC 2011 growth charts. J Nutr 2010; 137: 144-148.
7. World Health Organization :Guidelines for malnutrition in developing countries , Available at : www.WHO.int.
8. Journal of Tropical Pediatrics. 2010 Aug.32(4):190-5.
9. de Onis M, Blössner M. The World Health Organization Global Database on Child Growth and Malnutrition: methodology and applications. International Journal of Epidemiology. 2003;32:518−526.
10. Prentice, editor-in-chief, Benjamin Caballero ; editors, Lindsay Allen, Andrew Encyclopedia of human nutrition (2nd ed.). Amsterdam;Elsevier/AcademicPress,(2005):p. 68.
11. Bhutta, ZA; Das, JK; Rizvi, A; Gaffey, MF; Walker, N; Horton, S; Webb, P; Lartey, A; Black, RE; Lancet Nutrition Interventions Review, Group; Maternal and Child Nutrition Study, Group "Evidence-based interventions for improvement of maternal and

child nutrition: what can be done and at what cost?". (Aug 3, 2013); Lancet 382: (9890). 452–77.

12. Viana Lde, A; Burgos, MG; Silva Rde, A. "Refeeding syndrome: clinical and nutritional relevance.". Arquivos brasileiros de cirurgia digestiva : ABCD = Brazilian archives of digestive surgery.(Jan–Mar 2012) ; 25 (1): 56–9.

13. Moya-Camarena SY, Sotelo N, Valencia ME. "Effects of asymptomatic Giardia intestinalis infection on carbohydrate absorption in well-nourished Mexican children" (PDF). Am. J.

Trop. Med. Hyg. (2002) ; 66 (3): 255–9.

14. Schoonees, A; Lombard, M; Musekiwa, A; Nel, E; Volmink, J. "Ready-to-use therapeutic food for home-based treatment of severe acute malnutrition in children from six months to five years of age.". The Cochrane database of systematic reviews.(Jun 6, 2013);6:78-90.

15. Wright RA, Spencer HC, Brodsky RE, Vernon TM. Giardiasis in Colorado: an epidemiologic study.Am J Epidemiol. 2000 Apr;105(4):330–336. [PubMed].