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Nutritional Status of Preschool Children Infected with *Giardia intestinalis*

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Abstract

Giardia intestinalis is the most common intestinal parasite in human worldwide. It can produce a wide spectrum of clinical manifestations. In order to assess the nutritional status of preschool children infected with *Giardia intestinalis*, a cross sectional study was made in Marvdasht city, Fars Province, Southern Iran. A total of 337 preschool boys and girls aged 3-6 years were randomly selected for stool examination of intestinal parasites as well as measurement of height, weight, head and arm circumferences. A total of 77 individuals were infected with *G. intestinalis*. Seventy-one individuals who had only *G. intestinalis* and 229 with no parasitic infections were selected as infected and control groups, respectively. Z-Score of -2SD was used as cut off point of malnutrition. A total of 9 (12.7%) of infected children and 18 (7.9%) of non infected individuals had a height for age Z-score (HAZ) below -2SD. Eight (11.3%) of former group had a weight for age Z-score (WAZ) under-2SD. In control group 4.4% of preschool children had WAZ under-2SD. 4.2% of infected children had a weight for height Z-score (WHZ) under-2SD but none of the controls had it. Statistical analysis showed a significant difference in height, weight, head circumference, HAZ, and WAZ between infected and control children ($P<0.05$). Also, HAZ and WAZ, was significantly different between these two groups, but not for WHZ. A higher infection with *G. intestinalis* in the children with lower parents' education was observed. However the distribution of malnutrition was not significantly different between boys and girls. In conclusion the present study indicated that giardiasis retarded growth of preschool children in this region.

Keywords: Giardia intestinalis*, Nutritional status, Protozoa, Preschool children, Iran*

Introduction

Parasitic infections constitute a considerable public health problem especially in developing countries. *G. intestinalis,* a protozoan parasite, is a common intestinal protozoon all over the world. It is considered the most commonly detected intestinal parasite in humans in developed countries (1). However, the prevalence of *Giardia* has been reported 20–30% of the population in developing countries (2, 3).

About 200 million people have symptomatic giardiasis and about 500 000 new cases are reported annually (4, 5).

G.intestinalis, can produce a wide spectrum of clinical manifestations, from asymptomatic to acute or chronic diarrhoea with malabsorption syndrome and weight loss. The infection in children can interfere with growth and development (6, 7). *G .intestinalis* may cause acute or chronic diarrhoea and contribute to nutritional deficiency or remain asymptomatic (7).

There are contradictory results published about the effects of giardiasis on children nutritional status. Some authors found that giardiasis was related to growth retardation (8, 9) while others reported no relationship (7).

The impact of *Giardia* infection and diseases on nutritional status and growth of children in the developing countries needs further investigations and evaluation (10). This study was undertaken to obtain an insight in association between *Giardia* infection and nutritional status

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parameters among preschool children in an endemic area where the prevalence of *Giardia* infection in children is high (11).

Materials and Methods

The study was undertaken in Marvdasht City, Fars Province, and Southern Iran. A total of 337 preschool children (aged 3-6 years) were randomly selected from baby care centers and nurseries from six different regions of the city. Stool examination and anthropometry measuring were carried out for all children (12).

To investigate the nutritional status of this community, all 71 *Giardia* infected people as well as 229 individuals with no intestinal parasitic infection as control group were enrolled in the study. Other data were collected with respect to the age, sex and parents education of the children. Weight, height, head and arm circumferences were measured according to standard field techniques. All anthropometric measurements were made by the same observer. Student *t*-test was used for comparing the means.

The parents of the children involved in this study were asked to collect a fresh sample of their children stool on a prearranged day. They were provided with 3 pre-coded screw capped plastic containers one day before anthropometry. All samples were carried out to Parasitology laboratory of Shiraz Medical School where simple wet smears as well as formalin ether concentration technique were performed for each specimen (12).

Data were analysed with SPSS release 10. *Epi-Info*, version 6 was also used for anthropometric analyses (13). National Center Health Statistics (NCHS) and WHO standards were used for determination of malnutrition in children (14). Standard deviation of scores (z-scores) for height for age (HAZ), weight for age (WAZ) and weight for height (WHZ) were calculated as mentioned earlier (14). For each of the anthropometric indicators of malnutrition a cut off point of-2 standard deviation (SD) below the median of that of the NCHS/WHO reference population was used (14). Stunting, underweight and wasting were defined as HAZ<=- 2, WAZ<=- 2, and WHZ<= - 2, respectively. The Odds ratio with 0.95% confidence interval was also calculated with regard to HAZ and WAZ and WHZ (15).

Results

Distribution of intestinal parasites in the children under study has been shown in Table 1. The most prevalent parasite was *G. intestinalis*. The analysis of data on parents' education in children under study showed a higher infection with *G. intestinalis* in the children with lower parents' education (Table 2).

Comparison of different values and measurements between children with and without giardiasis are shown in the Table 3.

Statistical analysis showed a significant difference in height, weight, head circumference, HAZ, and WAZ between infected and non-infected children ($P<0.05$).

The HAZ, WAZ and WHZ for the *Giardia* infected and non-infected according to sex showed that the distribution of malnutrition is not significantly different between boys and girls. Z-score height for age (HAZ), weight for age (WAZ) and weight for height (WHZ) for the *Giardia intestinalis* infected and non infected group were compared with NCHS data. (Figs. 1-3).The status of malnutrition according to degrees of malnutrition is shown in Table 4. Cut off point of –2SD of the median for HAZ, WAZ and WHZ was calculated for determination of malnutrition. A significantly higher degree of malnutrition was observed in stunting and underweight *Giardia* infected than non-infected group. The risk of malnutrition in *Giardia* infected group was higher than non-infected with Odds ratio of 1.7 for HAZ and 2.7 for WAZ (Table 4).

Table 1: Distribution of intestinal parasites in 337 preschool children

Organism	Number	Percentage
Giardia intestinalis	77	22.8
Entamoeba sp.	19	5.6
Blastocystis hominis	6	1.8
Hymenolepis nana	1	0.3
Chilomastix mesnili	6	1.8
Ascaris lumbricoides	3	0.9
Trichuris trichiura	1	0.3
Iodamoeba buetschlii	1	0.3
Enterobius vermicularis	1	0.3

Table 2: Distribution of *Giardia* infected and non infected preschool children according to parents' education

Education	Father				Mother			
	Giardia infected		Control		Giardia infected		Control	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Illiterate	17	23.9	16	6.99	32	45	19	08.3
Poor reading	18	25.6	68	29.7	01	1.41	07	03.1
Primary school	01	1.41	02	0.9	08	11.3	69	30
High school	12	16.9	32	14	12	16.9	65	28.4
High school Diploma	15	21.1	79	34.5	16	22.5	60	26.2
University educated	08	11.3	32	14	02	2.8	09	3.9
Total	71		229		71			229

Table 3: Comparison of different values and measurements of children with and without *Giardia* infection

	Giardia infected (No.=71)		Non-infected (No.=229)		
Parameter value	Mean	S.D.	Mean	S.D.	*P*
Age	5.41	0.65	05.47	0.60	0.481
Height	109.98	5.13	112.20	5.83	0.004*
HAZ	-0.57	1.12	-0.22	1.15	0.025*
Weight	17.96	2.32	18.79	2.37	0.010*
WAZ	-0.56	.98	-0.29	0 .93	0.033*
WHZ	-0.12	.96	-0.10	0 .80	0.881
Head circumference	.51.09	1.26	51.50	1.45	0.032*
Arm circumference	16.37	1.09	16.38	1.14	0.947

* Significantly different between infected and non infected ($P<0.05$)

Table 4: The status of malnutrition in *Giardia* infected and non-infected children according to the cut off point of -2SD Z-scores

		Giardia infected		Non-infected	
		No.	**%**	**No.**	**%**
HAZ	Z-Score<=-2SD	9	12.7*	018	7.9*
	Z-Score> -2SD	62	87.3	211	92.1
Total		71	100	229	100
WAZ	Z-Score<=-2SD	8	11.3*	010	4.4*
	Z-Score> -2SD	63	88.7	219	95.6
Total		71	100	229	100
WHZ	Z-Score<=-2SD	3	4.2	0	0
	Z-Score> -2SD	68	95.8	229	100
Total		71	100	229	100

*Significantly different between infected and non-infected (P<0.05)
HAZ: z-scores height for age
WAZ: z-scores weight for age
WHZ: z-scores weight for height

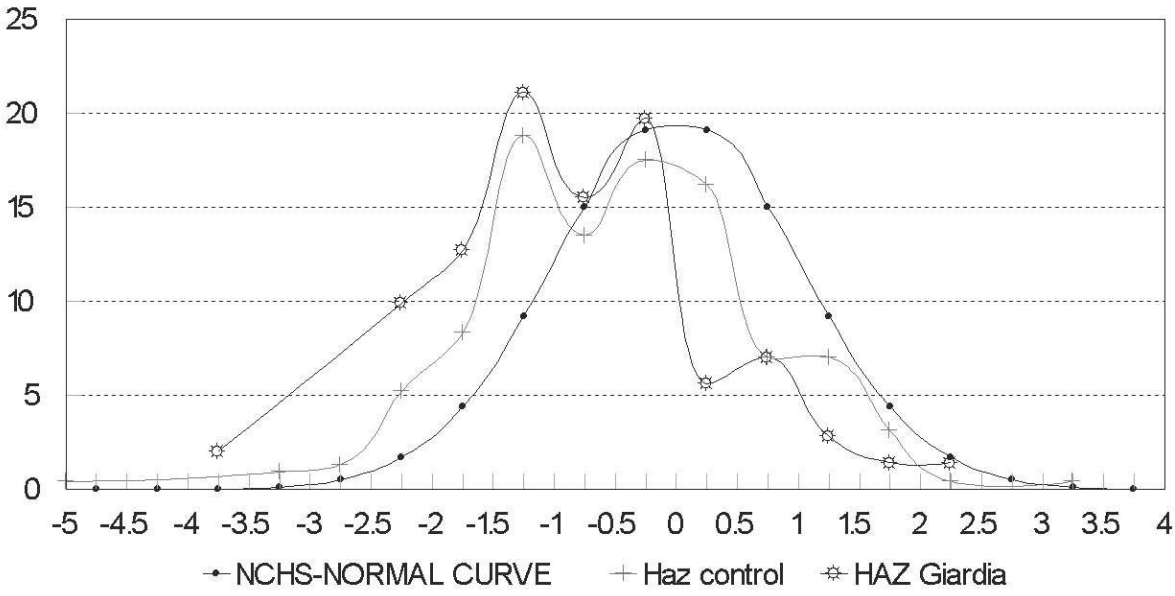

Fig. 1: Non commulative curve of height for age in reference (NCHS), *Giardia* infected and control group

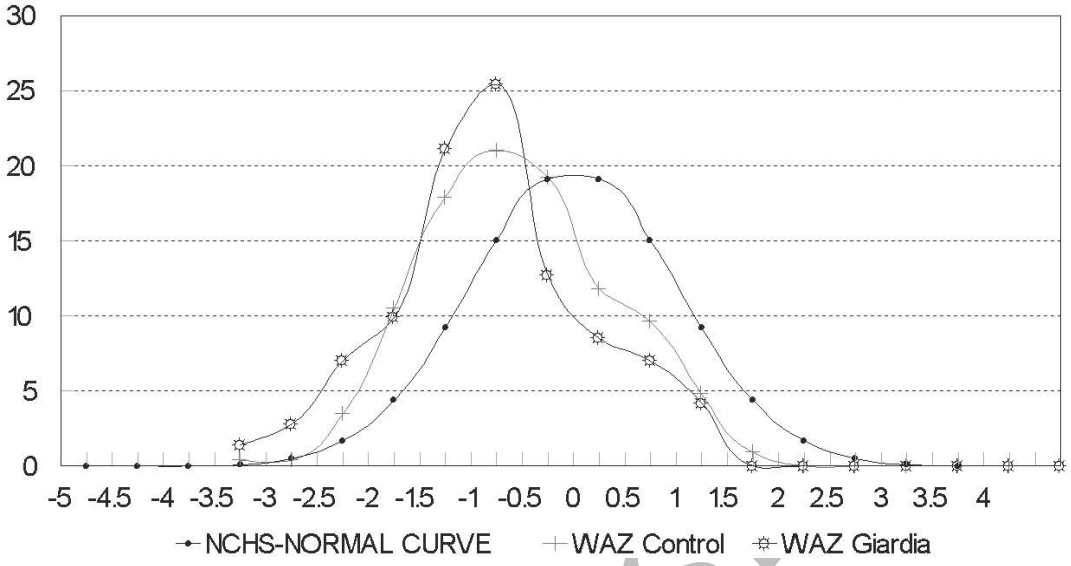

Fig. 2: Non commulative curve of weight for age in reference (NCHS), *Giardia* infected and control group

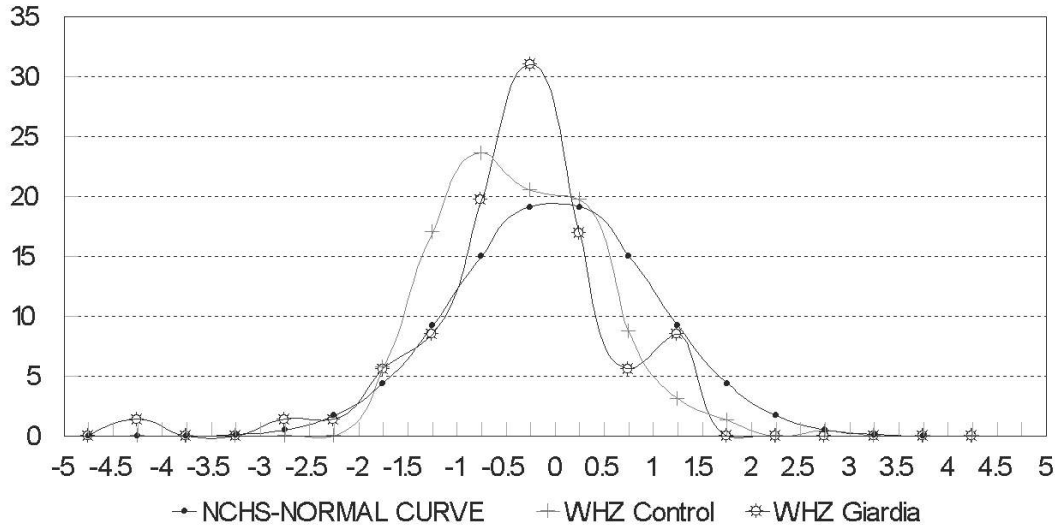

Fig. 3: Non commulative curve of weight for height in reference (NCHS), *Giardia* infected and control group

Discussion

There are contradictory results published about the effects of giardiasis on the nutritional status among children. It has been reported that children infected with *Giardia* showed no significant risk of malnutrition (15). On the other hand, a report showed that children infected by *G. intestinalis* had a significantly lower mean HAZ than non-infected children (16). The prevalence of *Giardia* in developing countries is estimated as 20-30% (17). The global malnutrition survey indicated a total of 32.5 % malnutrition in preschool children (18). Giardiasis could cause impairment of the protein digestion and by damaging the intestine lead to nutrient mal-absorption (16).

Our results agree with previous data (8, 19). Evaluation of patients with *Giardia* infection after treatment with anti-parasitic drugs showed that nutritional status of the population was im-

proved (19). A significant association between *Giardia* infection and deficit in growth has been shown in 45 children during the first three years of life without anti-parasitic treatment (18).

Protein energy malnutrition affects an unacceptably large proportion of the children under 5 years in developing countries: ~27% of under 5 years are considered underweight (<-2 S.d. weight-for-age), about 32% are stunted (height <-2 S.d. height-for-age), and about 9% are wasted (<-2 S.d. weight-for-height), although the prevalence varies greatly between areas and regions (18).

As *Giardia* is transmitted by water, some authors have argued that the amount of chloride in the water is not sufficient to destroy *Giardia* cysts (15). It could be assumed that the source of infection could be the tap water because normal chlorine levels used to kill bacteria in water supplies will not inactivate *Giardia* cysts (20). Marvdasht city population is consisted of different ethnic groups with different socioeconomic situations. On the other hand, WAZ and HAZ were significantly different between infected and non-infected groups. Environmental and socioeconomic factors may be effective on HAZ and WAZ changes (21). These differences have also been shown in Yemenis children (22).

A strong association between *Giardia* infection and under-nutrition,wasting and stunting but no evidence of an association between helminths infection and under-nutrition has been reported (23). Other authors noted a close association between intestinal parasitism and malnutrition, but observed that factors other than parasitism, such as social class and hygiene, were more important (24, 25).

The prevalence of stunting, underweight and wasting in preschool children varies by region and sub-region throughout low income countries (26). The prevalence of stunting in Asia (32.8-43.7%) is high, particularly in South Central Asia, although rates of stunting continue to improve throughout this region. For preschool children, the prevalence of underweight and wasting follow similar regional patterns to the prevalence of stunting. Estimates for prevalence of underweight pre-school children in different regions of a stunting, underweight and wasting refer to <-2 z-scores of the NCHS reference median for HAZ, WAZ, respectively unless otherwise indicated (27).

The present study demonstrated the practical implications of *Giardia* infection for growth and nutrition of children, and indicated that giardiasis significantly retarded growth in preschool children in this region.

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