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STUDY ON THE LATENT IRON DEFICIENCY IN PATIENTS WITH TRICHURIASIS

S.M. Sadjjadi [1], DVM, PhD; J. Massoud [2], DVM, PhD

Key words : *iron deficiency, anemia, trichuris trichiura, Iran*

Abstract

Trichuriasis is an intestinal parasitic disease which is caused by *Trichuris trichiura,* a soil transmitted helminth. In order to evaluate the iron status of trichuriasis patients, a total of 120 (49 males and 71 females) patients with *Trichuris trichiura* infection as well as 54 healthy individuals were evaluated. Blood samples were analyzed for serum iron, transferrin saturation percent, haemoglobin and other hematological indices. Anemia based on hemoglobin level less than 13 mg/dl in males and less than 12 mg/dl in females were found in 10 (7 males and 3 females) patients. Of remaining 110 non anemic patients 11% (14.3% of males and 8.8% in females) would be classified as iron deficient by serum iron and 6% by transferrin saturation percent. These findings suggest that serum iron and percent transferrin saturation are valid and sensitive tests for detecting iron deficiency in these patients; and *T.trichiura* infection is associated with high incidence of iron deficiency.

Introduction

Iron deficiency is a medical problem in about 500 million people throughout the wrold (3). There are many reasons for this high prevalence of iron deficiency, including poor availability of dietrary iron and pathological blood losses due to presence of parasitism (2). The poosible association between trichuriasis and reduced haemoglobin concentration has attracted less attention (13). Some evidence suggest that heavy *Trichuris trichiura* infections may cause sufficient blood loss to result in iron deficiency anemia, although whether this

1- Dept. of Parasitology and Mycology , School of Medicine, Shiraz University of Medical Sciences, Shiraz, P.O.Box 71343-1735, Iran.

2- Dept. of Parasitology and Mycology, School of Public Health, Tehran Univ. of Med. Sciences, P.O. Box 14155-6446, Tehran, Iran.

is due to lesions in the colon or hematophagous activity by the worm is still unclear (8). In the last few years, increasing attention has been paid to a new iron related analysis, the concentration of circulating ferritin , serum iron and transferrin saturation as an indicator of iron status of body (1,11). Etiological studies in Iran indicates that most common anemia due to parasitism is that which accompanies hookworm infection with iron deficiency as the primary cause (14); but no study has been so far carried out with *T.trichiura* infection. The current study was undertaken to evaluate the usefulness of serum iron concentration and transferrin saturation percent as a mean of assessing iron status and to determinine the prevalence of latent iron deficiency among patients with different intensity of *T.trichiura* infections. This study was carried out in the northern part of Iran as there is a high incidence of trichuriasis (15).

Materials and methods

The study was conducted in the rural areas in the Caspian littoral , northern parts of Iran. A total of 3067 individuals were selected by multi-stage cluster random sampling method of which 120 individuals who were infected only with *Trichuris trichiura* and 54 healthy subjects of comparable weight, age and sex of the same socio-economic class as the patients but with no evidence of infectious and parasitic diseases were selected as control. All patients and controls were subjected to laboratory investigations including stool examinations for ova and parasites and complete hemogram. Fresh faecal samples collected from the individuals were examined using formol ether concentration technique. The intensity was determined using Stoll's technique (12). Blood samples were drawn from all subjects and sera not immediately analyzed were stored at-20°C. Haemoglobin concentration was measured by Cyanmethmoglobin method within 3-10 h after blood collection (6). Serum iron (SI) and total iron binding capacity (TIBC) were determined using magnesium carbonate as the absorbent (5) and transferrin saturation percent was calculated from the above measurements.

Results and discussion

The prevalence of different helminthic infecions according to sex is shown in Table 1. As table shows, a total of 36.1% of the population under study were infected with *T.trichiura*, many of them had other intestinal infections. From *T.trichiura* infected indivduals a total of 120 individuals who had only

T.trichiura infection and no other infections, were selected as infected group. The mean concentration of haemoglobin in male and female *Trichuris* infected and control group according to age groups are shown in Tables 2 and 3. As tables show, a decrease in haemoglobin concentration have been observed in *Trchuirs* infected compared to the control group in most of age groups; although not significant. The relationship between the intensity of *Trichuris* infection and haemoglobin concentration in male and female individuals are shown in Tables 4 and 5. As tables show there were significant decreases in haemoglobin concentrations in male individuals who had higher intensity of *Trichuris* infection; using ANOVA test showed that in different intensities, mean hemoglobin concentration different ($P<0.05$). The mean serum iron concentration ± standard deviation the healthy control and infected groups in male and females are shown in Table 6. As table shows there is a decrease in serum iron concentration in infected group than in control group. Although there was a significant association between higher intensity and decrease in mean hemoglobin level, specially in male individuals; there was no significant difference between increasing intensity and serum iron or transferrin saturation percent. The percent distribution of normal and abnormal values of haemoglobin , serum iron and transferrin saturation percent in all infected and non infected subjects studied are presented in Fig 1. According to this distribution 10(8.3%) of the infected subjects had hemoglobin level below the accepted norms i.e<13 g/dl for men and <12 μg/dl for women (16). A total of 13(11%) of infected group had deficient serum iron level i.e. <80 g/dl for male and <50 g/dl for female (12) and 9(7.6%) had reduced transferrin saturation i.e<16% (9,17), and a higher level in control group. The highest incidence of deficiency was found in serum iron level with 11% of the patients having values below the acceptable level. From 120 patients with *T.trichiura* infection, 10 (8%) had hemoglobin concentration under normal value, so they were anemic (Fig.2). A total of 12 (11%) out of 110 infected individuals with normal hemoglobin had serum iron under normal value, so they had latent iron deficiency (Fig.2). In 110 patients with normal hemoglobin 7(6%) had transferrin saturation percent <16%. Using hemoglobin and serum iron concentration for determination of anemia in these patients, a total of 22 (18%) would be classified as iron deficient.

Trichuris trichiura consume iron reserve of body and make some lesions on large intestine. Iron deficiency which is a medical problem throughout theworld (3), is caused by many factors including poor availability of dietary iron, physilological , genetical conditions and pathological blood losses such as hookworm and other parasitological infections (2). Anemia due to iron deficiency has been associated with severe *Trichuris trichiura* infection. One worm consumes 0.005 ml of blood every day (10). There are controversial reports on decrease of serum iron in trichuriasis (7,10). Among 110 infected individuals with normal hemoglobin 12(11%) had serum iron less than normal and 8(6%) with normal hemoglobin had transferrin saturation <16%. By determination of hemoglobin, serum iron and transferrin saturation 14%-19% of the people were classified as anemic. This is more evident in male individuals because of higher intensity of infection to. *T.trichiura* in male than female individuals. This method was also applied for finding latent iron deficiency in schistosomiasis (11). These finding have also been confirmed by other investigators (4,7,10,16). Figure 1 shows that hemoglobin , serum iron and transferrin saturation percent detect varying prevalence of iron deficiency. It is evident that a large number of people with trichuriasis have depleted iron stores. It would therefore seem that in patients with chronic *Trichuris trichiura* infetion determination of serum iron and transferrin saturation percent are valid methods for assessing iron status. Furthermore, this study demonstrates that patients with *T.trichiura* infection have higher incidence of latent iron deficiency than is commonly believed and might therefore benefit from iron supplementation. The findings show that , although the prevalence of *T.trichiura* is high in the north of Iran but the intensity is not so high to promote anemia in this region. The major problem caused by *T.trichiura* with this intensity, is latent iron deficiency in this region. The findings suggest that serum iron and percent transferrin saturation is a valid and sensitive method for determining iron deficiency in these patient; and trichuriasis was associated with latent iron deficiency in the region.

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Table 1- Prevalence of different helminthic infection according to sex in north of Iran.

Parasite	Male n=1462		Female n=1605		Total n=3067		Z Value
	No.	%	No.	%	No.	%	
Positive	906	62.0	958	59.7	1864	60.8	[illegible]
Hookworm	223	15.3	214	13.3	437	14.2	1.58
Trichuris	524	35.8	584	36.4	1108	36.1	.34
Ascaris	271	18.5	336	20.9	607	19.8	1.67
Strongyloides	182	12.4	142	8.8	324	10.6	3.20**
Trichostrongylus	39	2.7	57	3.6	96	3.1	1.43
Hymenolepis nana	69	4.7	39	2.4	108	3.5	3.45**

No astrisk indicates not significantly different

* P<.05

** P<.01

Table 2- Haemoglobin concentration in male individuals infected with Trichuris and control group according to age group.

Variable		No.	Haemoglobin g/dl	
			Mean	Std Dev
For entire population		77	14.55	1.63
Age group "year"	<10	25	13.77	1.21
	Control	6	14.30	1.55
	Infected	19	13.60	1.07
Age group "year"	11-20	18	13.90	.94
	Control	4	14.50	.58
	Infected	14	13.73	.97
Age group "year"	21-30	8	14.93	1.61
	Control	2	16.15	.91
	Infected	6	14.53	1.64
Age group "year"	31-40	10	15.32	1.66
	Control	7	15.01	1.69
	Infected	3	16.03	1.65
Age group "year"	>40	16	15.83	1.90
	Control	9	16.26	1.91
	Infected	7	15.27	1.87

Table 3- Haemoglobin concentration in female individuals infected with Trichuris and control group according to age group.

Variable	Value label	No.	Haemoglobin g/dL	
			Mean	Std Dev
For Entire population		97	13.76	1.32
Age group "year"	<10	31	13.53	1.08
	Control	5	13.94	1.43
	Infected	26	13.46	1.02
Age group "year"	11-20	18	13.91	1.34
	Control	3	14.56	1.76
	Infected	15	13.78	1.28
Age group "year"	21-30	17	13.57	1.27
	Control	8	13.37	1.54
	Infected	9	13.75	1.02
Age group "year"	31-40	15	13.70	1.40
	Control	6	13.63	1.11
	Infected	9	13.75	1.63
Age group "year"	>40	16	14.26	1.67
	Control	4	13.35	1.27
	Infected	12	14.57	1.72

Table 4- Relationship between Trichuris infection and haemoglobin levels of male indivduals in the North of Iran.

Trichuris ova/g			Haemoglobin g/dL		P* all groups	signif.level between groups at.05 level (LSD)**
Group	faeces	N	Mean	Standard Deviation		
0	0	28	15.27	1.71	.0473	3,4
1	1-100	12	14.40	2.02		
2	101-500	14	14.50	1.31		
3	501-1000	12	13.82	1.19		
4	1001-2000	10	13.65	1.12		
5	2001-9000	1	14.60			
Total		77	14.55	1.63		

* One way analysis of variance testing a null hypothsis of no significant difference between means.

** Least significant different procedure.

Table 5- Relationship between Trichuris infection and haemoglobin levels of female indivduals in the North of Iran.

Trichuris ova/g			Haemoglobin g/dL		P* all groups	signif.level between groups at.05 level (LSD)**
Group	faeces	N	Mean	Standard Deviation		
0	0	26	13.67	1.35	.4520	No two groups are significantly different at the 0.050 level
1	1-100	29	13.51	1.26		
2	101-500	16	14.26	1.78		
3	501-1000	11	14.14	.84		
4	1001-2000	14	13.57	1.04		
5	2001-3600	1	13.30			
Total		97	13.76	1.32		

* One way analysis of variance testing a null hypothsis of no significant difference between means.

** Least significant different procedure.

Table 6- Serum iron level of individuals infected with *Trichuris trichiura* and non infected controls according to sex.

Variable	Trichuris trichiura			Control group		
	Mean	Std. Dev.	No.	Mean	Std. Dev.	No.
Males	128.38	44.11	49	130.43	58.27	28
Females	109.66	47.46	71	123.69	39.22	26
Total	117.12	46.88	120	127.18	49.66	54

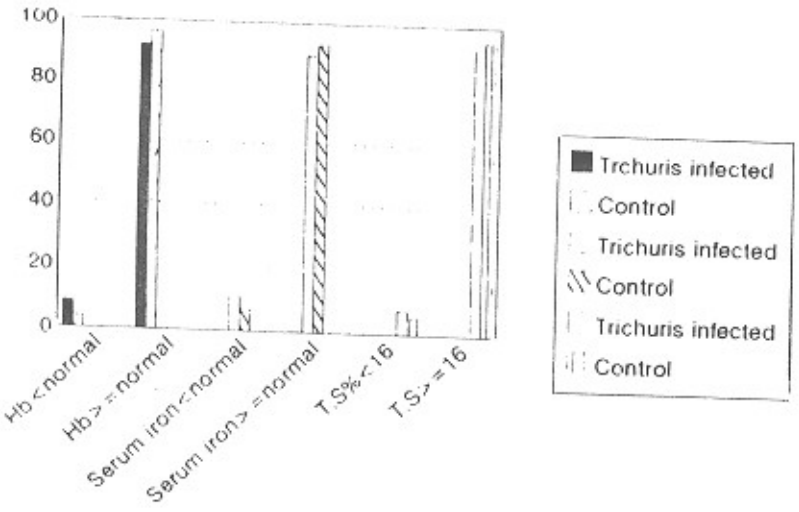

Fig. 1- Percent distribution of haemoglobin , serum iron and transferrin saturation (T.S) in Trichuris infected and control group.

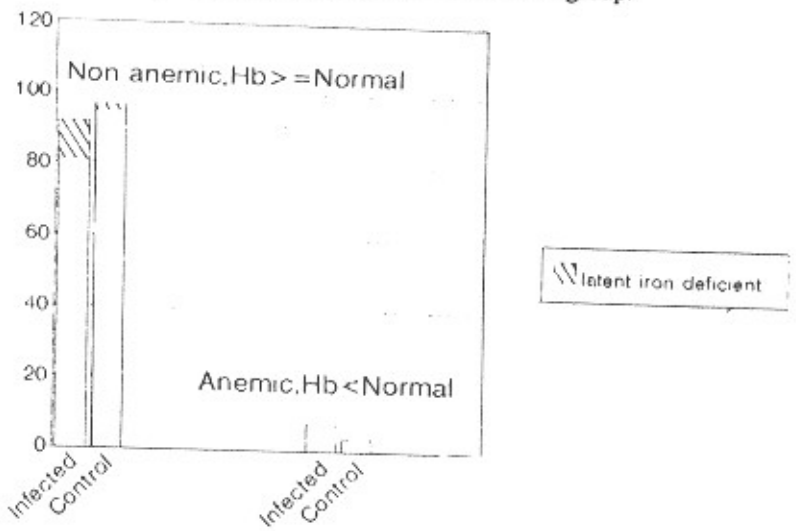

Fig. 2- Latent iron deficiency in Trichuris infected and control group.

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