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EVALUATION OF IRON-DEFICIENCY ANEMIA BY SERUM FERRITIN ASSAY IN SEVEN-YEAR-OLD CHILDREN

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ABSTRACT

Serum Ferritin (SF) levels in 73 seven-year-old children was measured by a radioimmuno assay method, and its possible relationship with hemoglobin, hematocrit and MCHC was investigated. The results showed there was positive correlation between SF with hemoglobin, hematocrit and MCHC values.

INTRODUCTION

Ferritin is an iron-containing compound with high moleculer weight. It is consisted of a protein layer with 450,000 molecular weight and variable amounts of hydrated ferric phosphate. The ratio of iron to the total molecule might be as high as 20% and the molecular weight of the compound may reach 900,000.

Ferritin in the body is mainly present in the reticuloendothelial cells of the liver, spleen and bone marrow. A small amount of ferritin is present in the circulating blood, the amount of which varies between 10 to 200 micrograms per litre (1).

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The results of serum ferritin (SF) determination in the iron-deficient patients point to the fact that SF is indicative of the total iron stores in the body, which amounts to only 10 percent that of normal people[2]

The average SF value in males is twice as much as that of females. This finding further supports the fact that the SF concentration is representative of the total body iron stores. In patients with iron-deficiency anemia, the amount of SF is less than 10 ug/1 and in patients with iron overload it is much higher than that of normal people[1].

No SF measurement in Iranians has been reported in the available literature. In nearly all of the surveys in the area of nutritional anemias in Iran, hemoglobin and hematocrit assays have been employed. The purpose of this study has been to measure SF in seven-year-old children and examine the manner with which it might relate to the hemoglobin, hematocrit and MCHC levels. This would enable one to determine whether or not the SF determination could be used as a better index of body iron stores and/or the etiology of anemia.

Methods

In this survey 548 seven-year-old children from three different parts of the country, namely Systan-Baluchestan, Northern Teheran and Southern Teheran, who had been chosen for a comprehensive nutritional assessment were considered for SF determination. Since the purpose of this study was to compare SF values in individuals with high MCHC levels against those with low MCHC levels, 48 samples with high and 17 samples with low MCHC's (above 31 and below 30, respectively) were selected for SF determination. Eight samples were also selected with normal MCHC values (between 30 and 31) to be used as a control group for the SF determination. Hemoglobin was determined by cyanomethemoglobin method (3) hematocrit was determined centrifugally, MCHC (Mean corpuscular Hemoglobin concentration) was calculated from hemoglobin and hematocrit

$$\left(\frac{\text{Hemoglobin}}{\text{Hematocrit}} \times 100 \right)$$

Ferritin was measured by a radio-immuno assay method using travenol kit (4).

Table 1
Hemoglobin, hematocrit, MCHC and serum feritin (SF) Values

n	±SD	Mean	
73	1.50	13.4	HB
73	2.94	39.93	HCT
73	2.33	32.73	MCHC
73	15.53	38.38	SF

Table 2

Correlation coefficient (r) and significance of correlations between serum ferritin (SF) with hemoglobin, hemotocrit, and MCHC

T	P	N	r	
7.39	P 0.001	73	0.68	SF/HB
3.94	P 0.001	73	0.42	SF/HCT
7.93	P 0.001	73	0.68	SF/MCHC

Table 3 MCHC levels in children with serum Ferritin Values of below 20 ug/1

MCHC	Serum Ferriting Mg/litr
30	18
29.6	10
30.5	20
30	14
30	20
30.6	18
30.2	20
29	10
29.3	18
29.1	18
30	18
30.6	18

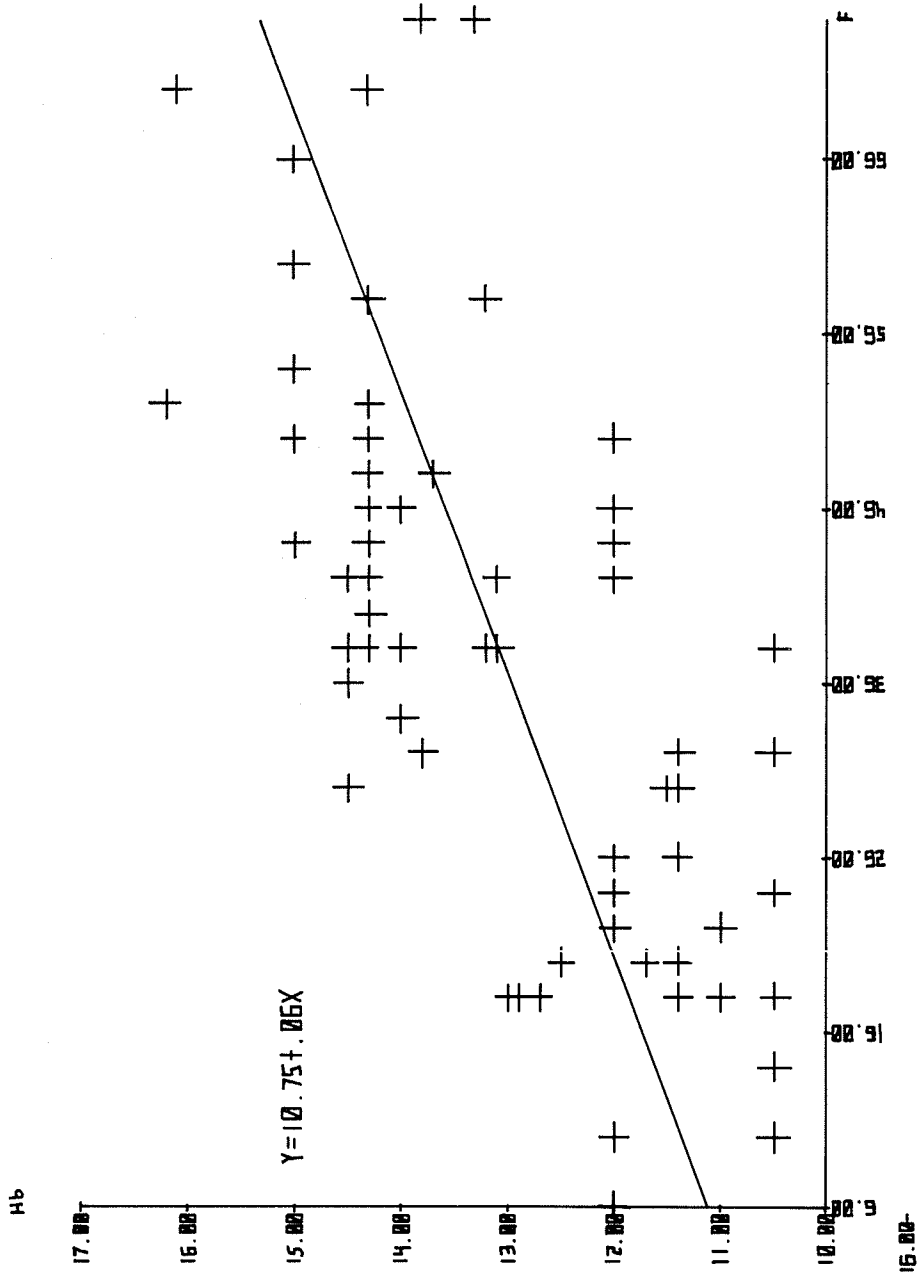
Table 4. Serum ferritin levels in children with MCHC values of below 31.

Serum Ferritin ug/1	MCHC
18	30
10	29.6
46	30.1
38	30
20	30.5
14	30
20	30
18	30.6
20	30.2
30	29.2
36	30
10	29
22	29.3
24	30
30	20.7
18	29.3
18	29.1
22	28.9
26	30
42	30.4
18	30
18	30.6

Results and Comments

The results of hemoglobin, hematocrit, MCHC and SF determinations are shown in Table 1. The relationship between SF on one hand and hemoglobin, hematocrit and MCHC on the other, are shown in Figures 1,2 and 3. The correlation co-efficient and significance of the correlations are presented in Table 2. There was good correlation between SF with hemoglobin and MCHC. From Table 2 it can be observed that the test of significance of correlation was positive in all three cases. MCHC had a better correlation than the other two parameters. The least correlation was between SF and hematocrit. Thus it is suggested that SF is somehow indicative of hemoglobin concentration, but less correlation existed between red cell volume and SF. Although Walters et al (5) could not prove a good correlation between SF levels and total body iron stores in healthy human subjects, our study shows that in the seven year-olds surveyed, such correlation did in fact exist.

It has been suggested (6) that once the body becomes deficient of Iron, the signs appear in the following order. First the body stores of Iron are decreased and SF levels starts falling, with the subsequent decline in other parameters. This would suggest that the measurement of SF before the onset of other anemia signs, would be a good prognostic tool. This was not the case in our survey, as SF values of less than 20 ug/1 were always accompanied with below-average MCHC values, while all those children with below-average MCHC did not necessarily possess low ferritin value (Table 3 and 4) This means that in some of these children, MCHC shows some decline before a fall in SF value is observed. This might probably be due to the fact that these children did not suffer from anemia and thus had not entered the period of low iron stores. A more extensive study on a group of subjects with mild iron deficiency would clear this point and shed some light on the way these two factors may relate to each other.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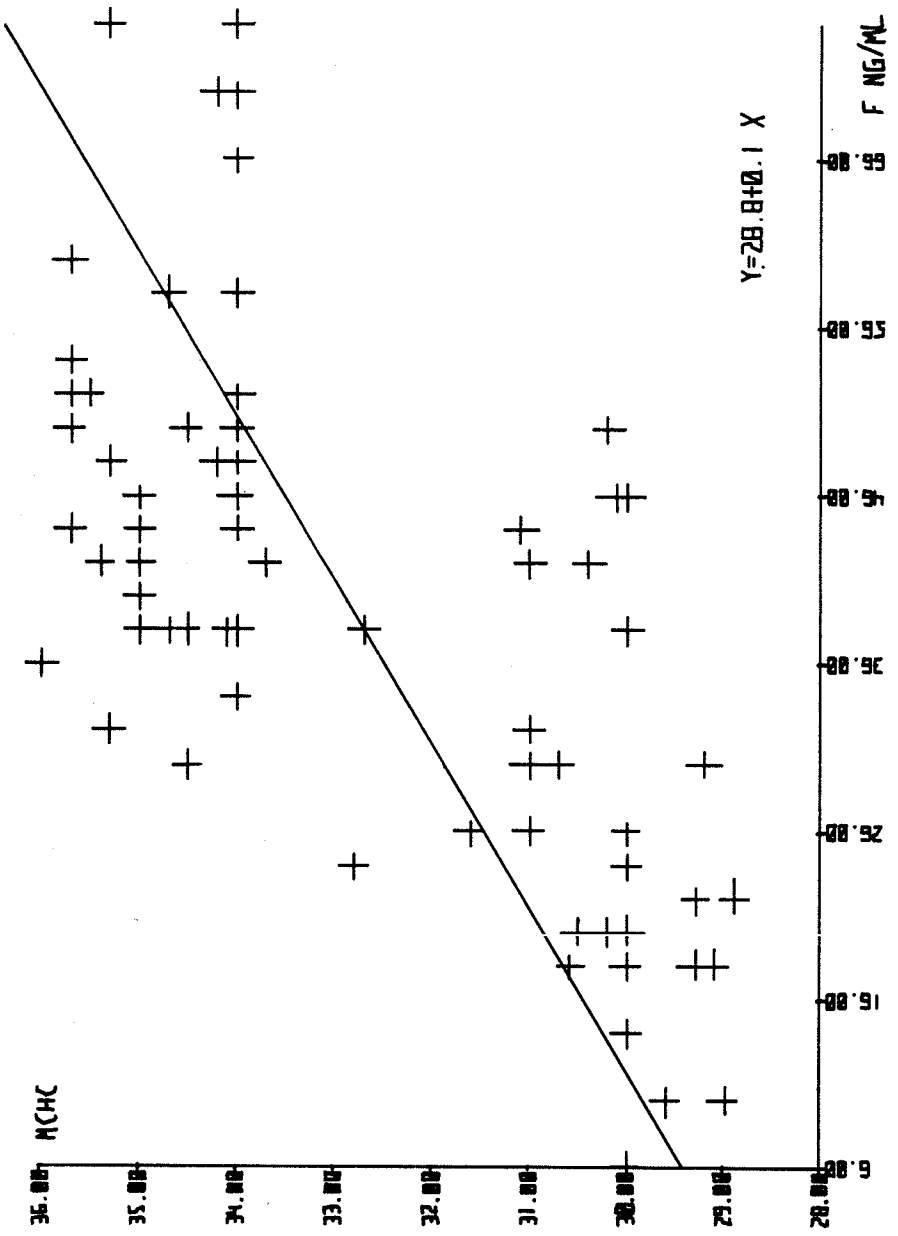
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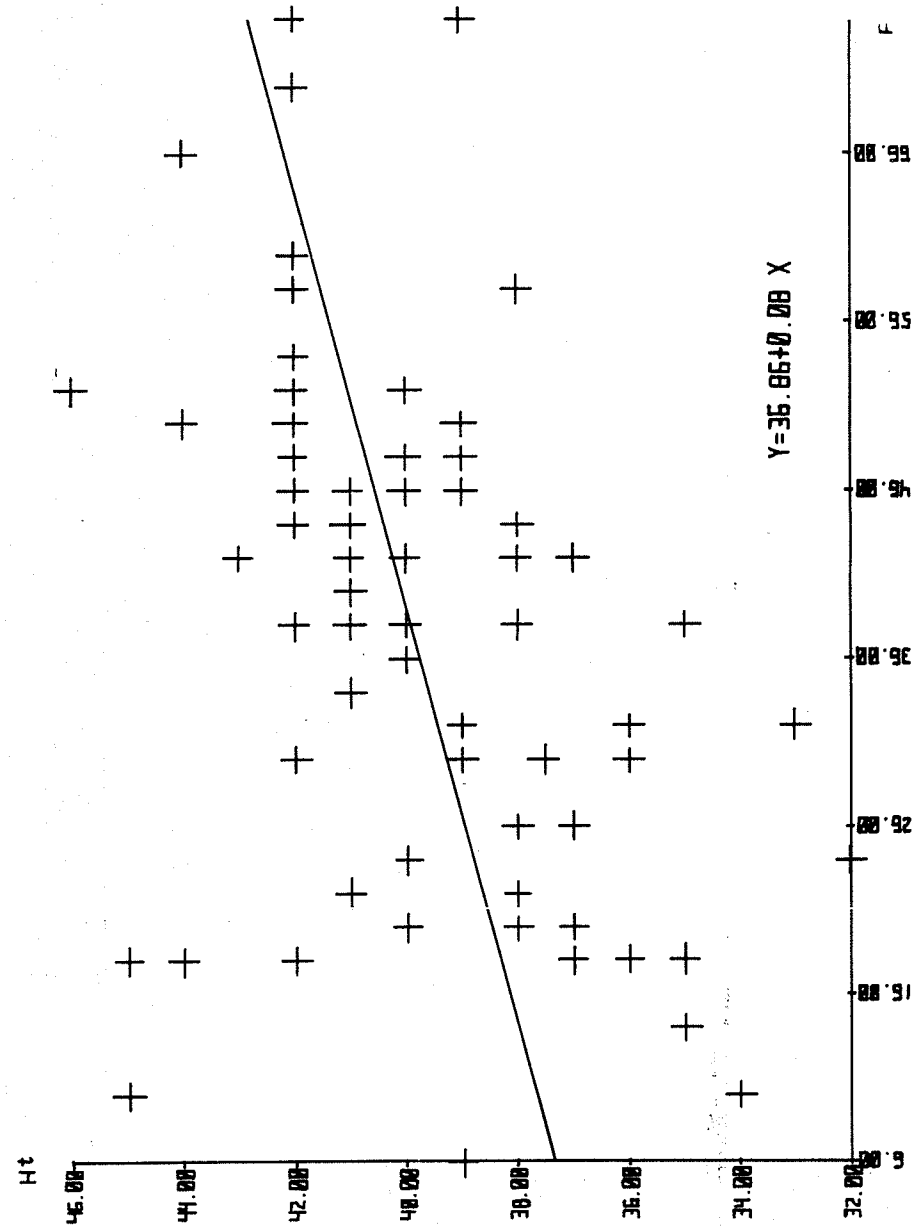
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