

## Frequency of iron deficiency anaemia and beta thalassemia minor among adolescent school girls in Ahvaz, Iran

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### ABSTRACT

**Objectives:** To investigate the frequency of causes of anaemia among adolescent school girls in Ahvaz in 2009.

**Methodology:** A cross-sectional study was conducted on 208 Adolescent girls aged 15-19 years from high schools in Ahvaz. Blood samples were taken from all patients and were sent to laboratory for determination of complete blood count (CBC) test, serum ferritin (SF), hemoglobin electrophoresis (Hb F, Hb A2) was done for all of the anaemic cases. Iron deficiency anaemia was defined as a situation where Hb is less than 12 g/dl and ferritin is less than 12 ng/ml. Beta-thalassemia were identified by high performance liquid chromatography (HPLC) analysis of hemoglobin and Hb A2>3.4.

**Result:** Of the 208 patients, 37 cases (17.8%) were anemic and Iron deficiency anaemia was found in only 11 from 208 children (5.3%), minor beta thalassemia was found in only five of 208 children (2.4%), mixed beta thalassemia and iron deficiency anaemia was found in four of 208 (1.9%) and other patient with anaemia 19 patient (9.1%) minor alpha thalassemia was considered. anybody of students were macrocytic anaemia.

**Conclusion:** The results suggest that thalassemia and iron deficiency anaemia may be major contributing factors to the occurrence of anaemia in this area among schoolgirl population.

**KEY WORD:** Iron deficiency, Iron Deficiency Anaemia, Minor Thalassemia, School girls.

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### INTRODUCTION

Anaemia is generally defined as a reduction in red cell mass or blood hemoglobin concentration. The two most common causes of microcytic anaemia are iron deficiency anaemia and thalassemia trait.<sup>1,2</sup>

Anaemia affects more than a billion people in the world.<sup>3</sup> It is generally believed that at least half of anaemia worldwide is due to nutritional iron deficiency.<sup>4</sup> Iron deficiency (ID) and iron deficiency anaemia (IDA) are considered the major public health problems and the most common nutritional deficiency around the world due to their high prevalence.<sup>5</sup> Iron deficiency anaemia has serious health consequences especially for young children and women. More insidious social costs of iron deficiency are limitation in intellectual development in children<sup>6</sup> and impaired

work performance in adults, which together affects social and economic development.<sup>7</sup> ID usually develops in a sequential manner over a period of negative iron balance, such as periods of blood loss and/or prolonged iron-deficient diet, accelerated growth in children and adolescents as well as during pregnancy and lactation.<sup>8,9</sup> Thalassemia trait is also frequently misdiagnosed as iron deficiency in children because the two are similar hematologically and iron deficiency is much more prevalent.<sup>10</sup>

Alpha-Thalassemia trait is characterized by marked microcytosis and hypochromia of red cells in conjunction with mild anaemia and erythrocytosis. Levels of HbA<sub>2</sub> and HbF are generally normal or low. Diagnosis of this condition is typically made by family studies or by exclusion of iron deficiency and beta thalassemia trait. The incidence is particularly high in Asian populations.<sup>11</sup> This study was conducted to find out causes of anaemia among adolescent school girls.

## METHODOLOGY

This survey was a cross-sectional study conducted among 208 girls aged 15-19 years who were students of grades IX -XII in high school of one districts of Ahvaz. Hemoglobin concentration and other hematological parameters were determined using an automated blood cell counter and electrophoresis with High-performance liquid chromatography (HPLC) technic. The lower limit of the normal range was set at two standard deviations below the mean for the normal population. This definition resulted in 2.5% of the normal population being classified as anemic and Lower limit of normal for hemoglobin 12-18 years (female) is 12 g/dL.<sup>12</sup>

The mean corpuscular volume (MCV) and hemoglobin (Hb), serum ferritin, levels were measured and for anemic girls electrophoresis was done again. Iron deficiency anemia was defined as a situation where Hb is less than 12 g/dL, MCV is less than 78  $\mu$ m<sup>3</sup>, ferritin is less than 12 ng/mL.<sup>13</sup> minor beta-thalassemia was defined as a Hb A<sub>2</sub>>3.4%.<sup>14</sup>

The statistical analysis was performed using the Statistical Package for the Social Sciences version 15. (SPSS Inc, Chicago, IL, USA).

## RESULTS

Of the 208 patients, 37 cases (17.8%) were anemic with mean age 16.76 $\pm$ 0.98 and mean Hb 11.34 $\pm$ 0.79 (8.3-11.9) and mean RBC 4.77 $\pm$ 0.63 (3.38-6.3) and mean MCV 75.92 $\pm$ 8.64 (60.10-90.30) and mean MCH 24.19 $\pm$ 3.77 (17.9-30.5) and RDW 14.41 $\pm$ 1.7 (12.1-17.9) mean ferritin at anemic patient were 13.72 $\pm$ 5.23 (10.0-28.0)

Iron deficiency anaemia was found in only 11 from 208 children (5.3%), minor beta thalassemia was found in only five of 208 children (2.4%), mixed beta thalassemia and iron deficiency anaemia was found in four of 208 (1.9%) and other patient with anaemia 19 patient (9.1%) minor alpha thalassemia was considered. anybody of students were macrocytic anaemia.

In the present study, about 5.4% of the girls were thin based on BMI for age and 2.8% overweight (weight for height >120%). 11% of the girls showed evidence of stunting on the basis of height-for-age below the third percentile.

## DISCUSSION

In the present study among school age girl 15 to 19 years 17.8% of the girls were anemic (Hb<12 g/dL), none with severe anaemia (Hb<7).<sup>15</sup> and no one had macrocytic anaemia. of total student 37 cases (17.8%) were anemic, 11 of 208 children (5.3%) had pure iron deficiency anaemia, minor beta thalassemia were five of 208 children (2.4%). Mixed betathalassemia and iron deficiency anaemia was found in two of 208 (1%) and other patient with anaemia 19 patient (9.1%) minor alpha thalassemia was considered. Fifteen anemic patient equivalent 7.2% of total student and 40.5% of anemic patient had depleted iron stores (Ferritin<12 ng/L).

Numerous studies have demonstrated prevalence of anaemias and iron deficiency anemia for example in

Table-I: Mean $\pm$ SD (min-max) of age, weight, length, BMI, and average in anemic and non-anemic groups.

Group (No.)	Age (yr)	Weight (Kg)	Length (cm)	BMI (Kg/m <sup>2</sup> )	Average
Anemic (37)	16.76 $\pm$ 0.98	56.47 $\pm$ 11.20	158.58 $\pm$ 11.20	22.44 $\pm$ 4.20	14.81 $\pm$ 2.45
	(15-19)	(38-89)	(147-171)	(15.43-33.28)	(10.6-19.96)
Non-anemic (171)	16.81 $\pm$ 0.96	55.50 $\pm$ 10.66	158.56 $\pm$ 6.82	22.13 $\pm$ 4.05	15.04 $\pm$ 2.37
	(15-20)	(36-100)	(115-171)	(15.58-36.73)	(10.54-20)
All (208)	16.79 $\pm$ 0.96	55.61 $\pm$ 10.75	158.54 $\pm$ 6.66	22.17 $\pm$ 4.07	14.99 $\pm$ 2.38
	(15-20)	(36-100)	(115-171)	(15.43-36.73)	(10.54-20)

Table-II: Mean±SD (min-max) of hematological indices in anemic and non-anemic groups.

Group (No.)	RBC	Hb (g/dl)	Hct (%)	MCV (fl)	MCH (pg)	MCHC	RDW(%)	Ferritin (ng/dl)	Electrophoresis A1	A2	F
Anemic (37)	4.77±0.63 (3.38-6.31)	11.34±0.79 (8.3-11.9)	35.90±1.88 (29.8-38.3)	75.92±8.64 (60.10-90.30)	24.19±3.77 (17.9-30.5)	31.63±1.71 (27.9-37.0)	14.41±1.7 (12.1-17.9)	13.72±5.23 (10.0-28.0)	95.76±2.02 (91.5-97.9)	3.45±1.31 (2.1-5.6)	0.79±0.81 (0.0-2.9)
Non- anemic (171)	4.62±0.30 (3.88-5.34)	13.16±0.30 (12.0-15.0)	39.09±1.84 (33.9-43.1)	84.99±3.79 (74.4-96.6)	28.64±1.84 (23.1-38.4)	33.66±0.97 (31.0-36.2)	12.80±0.63 (11.6-14.8)	---	---	---	---
All (208)	4.64±0.38 (3.83-6.31)	12.83±0.97 (8.3-15.0)	38.52±2.21 (29.8-43.1)	83.37±6.08 (60.10-96.6)	27.85±2.86 (17.9-38.4)	33.29±1.38 (27.9-37.0)	13.09±1.10 (11.6-17.9)	13.72±5.23 (10.0-28.0)	95.76±2.02 (91.5-97.9)	3.45±1.31 (2.1-5.6)	0.79±0.81 (0.0-2.9)

study in Western Iran, anaemia was found 21.7 % and ID was found in 23.7% of girls aged 14–20 years old.<sup>16</sup> Oelofse et al found the prevalence of ID among preschoolers in rural KwaZulu-Natal to be 19.8%, and that 18.9% of mothers were iron deficient but not necessarily anaemic.<sup>17</sup> Sherste k et al found That prevalence of iron deficiency anemia is 9 to 12 percent in non-Hispanic white women.<sup>18</sup> The prevalence of anemia in study of Leenstra T et al was 21.1% and iron deficiency was 19.8%.<sup>19</sup> A study by Thankachan et al showed that the prevalence rates of anaemia was 39%, in young women of low socioeconomic status in Bangalore, India The majority of these anaemic women were iron deficient, and the primary factors responsible for this high prevalence rate in this population were inadequate intake of dietary iron, poor bioavailability and a concurrent inadequate intake of dietary micronutrients.<sup>20</sup> In a study conducted by Gholamreza in the south-eastern part of the Caspian Sea in Iran also the prevalence rates of IDA was 13.5%, respectively, in village women aged 18–35 years old.<sup>21</sup>

National health objectives for 2010 is to reduce iron deficiency in vulnerable populations female (16-19y) since 16% at 2000 by 3-4 percentage at 2000.<sup>22</sup> The present study indicates that iron deficiency anaemia is a public health problem among adolescent school-girls of Ahvaz, but constituted about 40% of all anemic girls. This differences in prevalence of anaemia may be due to the differences in nutritional habits in that area and for example consumption and non consumption of supplementary iron.

In conclusion, the results suggest that anaemia among Ahvaz adolescent schoolgirls cannot be solely explained by iron deficiency although it consist about half of patient and other causes like alpha thalassemia and beta thalassemia may play significant role in anemic students. Iron deficiency anaemia was very low than other studies. The findings of the present

study have important implications on the iron supplementation programmes.

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