Prevalence of Iron Deficiency Anaemia Among School Children in Kenitra, Northwest of Morocco

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ABSTRACT
Iron deficiency anaemia is an important health problem in Morocco. This study was conducted to estimate the prevalence of anaemia among school children in Kenitra. The sample represents school children of all educational levels and age ranged between 6-15 years. The level of hemoglobin, haematocrit, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration was measured in a group of 271 school children. The seric iron was assessed and anaemia was defined when hemoglobin < 11.5 g dL$^{-1}$. A questionnaire was developed to obtain information about the daily food consumption and socio-economic conditions. The prevalence of anaemia was 16.2%. The mean hemoglobin concentration was 12.53 g dL$^{-1}$ in boys and 12.52 g dL$^{-1}$ in girls.

The results suggest that iron deficiency is an important determinant of anaemia in this population. There was a significant relationship between education of the mother and anaemia in children (p = 0.004) but not with the family income. It is concluded that improving the economic status of the family, women education and health education about balanced animal and plant food consumption are recommended strategies to reduce the burden of anaemia.

Key words: Iron deficiency, anaemia, school children, Morocco

INTRODUCTION
Iron Deficiency (ID) and Iron Deficiency Anaemia (IDA) are considered the major public health problems and the most common nutritional deficiency around the world (DeMaeyer et al., 1989). The prevalence of anaemia in the world is 24.8% (WHO., 2008). Furthermore, it is estimated that iron deficiency contributes towards 50% of the approximated 600 million global anaemia cases in preschool and school-aged children (WHO., 2011). The population groups which are most affected are pregnant women, infants and young children (Dillon et al., 2000; Chhabra et al., 2012). This high prevalence of IDA in developing countries is associated with poor sanitation conditions, low socio-economic conditions, restricted access to food and lack of knowledge for good dietary practices (Finch, 1977). Anaemia has multiple consequences which can be extremely severe (Goudarzi et al., 2008; Ahmadi et al., 2010). It affects the physical and mental development of an individual leading to decreased working capacity, which in turn affects the development of the country (WHO., 2001).

The objective of the present study was to determine the prevalence of iron deficiency anaemia on school children in Kenitra, Northwest of Morocco.

MATERIALS AND METHODS
Place and the sample study: This study was conducted among school-age children aged 6-15 years old in Kenitra city, located in the Northwest of Morocco.

Study setting: The survey took place in Kenitra, located in the Northwest of Morocco.
Type of study: A cross sectional descriptive survey was conducted using a structured questionnaire covering the following parameters:

- Demographic and anthropometric indicators including age, sex, weight and height
- Socioeconomic indicators including the educational level, family income and food consumption

Anthropometric measurements: The children’s height and weight were measured according to the WHO’s guideline (WHO., 2007). Weight, height and age data were used to calculate z-scores of the three different nutritional indicators in comparison to the newly published World Health Organization/National Center for Health Statistics (WHO/NCHS) reference population (WHO. and UNICEF., 2009) using the WHO AnthroPlus Software (Version 10.4, 2010). Underweight, stunting and wasting were defined as WAZ<-2.0, HAZ<-2.0 and WHZ<-2.0 Standard Deviation (SD) below the 2006 WHO reference, respectively. Body Mass Index (BMI) was used to diagnose the degree of thinness and overweight in children as prescribed by WHO (2007).

Weight-for-age reference data are not available beyond age 10 because this indicator does not distinguish between height and body mass in an age period where many children are experiencing the pubertal growth spurt and may appear as having excess weight (by weight-for-age) when in fact they are just tall (Blossner et al., 2010, 2009).

Blood test: Blood was collected by antecubital venipuncture and drawn into a container with EDTA for Red Blood Cell (RBC), Haemoglobin (Hb), Haematocrit (Hct), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) analyses. All these blood analysis were done by trained and experienced laboratory technicians in private laboratory of medical analysis under suitable conditions.

Anaemia was defined as hemoglobin level below 12 g dL\(^{-1}\) in children of 12-14 years and below 11.5 g dL\(^{-1}\) in children aged 6-11 years. The severity of anaemia was classified as mild (Hb>10.5 g dL\(^{-1}\)), moderate (Hb<10.5 g dL\(^{-1}\)) and severe (Hb<7.5 g dL\(^{-1}\)) (WHO., 2001).

Statistical analysis: The statistical analysis was carried out using the SPSS 21.0 statistical software package for Windows. Descriptive statistics of continuous variables were expressed using the mean±Standard Deviation (SD). Chi-square test was used to assess the association between independent and outcome variables. p<0.05 was taken as a minimum level of significance.

RESULTS

Sociodemographic and anthropometric characteristics of the study participants: A total of 340 children were selected, among whom complete response of the anthropometric measurements and blood samples were obtained from 271 children. The Mean±SD was 10.75±1.40 years ranged between 6 and 15 years.

From the total of 271 respondents, 142 (52.4%) children were male and 129 (47.6%) were female and 226 (83.4%) were younger than 12 years old. To the income, 182 (82.7%) of the parents have a temporary income. The prevalence of anaemia among children whose parents had a temporary income were 16.5%. Regarding the educational status of the parents of the sampled children, 139 (63.2%) of the fathers had formal education; 19.1% had attended secondary school; 143 (65%) mothers of the children were illiterate. The prevalence of anaemia in children whose father’s are illiterate was 19.8% and that of children whose mothers are illiterate was 16.2% (Table 1).

Concerning the results of the anthropometric measurements among anemic children 11 (4.1%) were thin, that is BMI for age <-2 Z-score and the prevalence of stunting that is height for age<-2 Z-score was 17 (6.3%) (Table 1).

Prevalence of anaemia: The distribution of haemoglobin concentration shown in Fig. 1 and global results of Hb in Table 2. The mean hemoglobin concentration was 12.52 g dL\(^{-1}\) in boys and 12.41 g dL\(^{-1}\) in girls. The prevalence of anaemia among children was 16.2%. The Mean±SD value of Hb, Hct, MCV, MCH, MCHC and serum Iron,
Fig. 1: Distribution of haemoglobin concentration in school children

Table 2: Global results haemoglobin of the studied population

<table>
<thead>
<tr>
<th>Haemoglobin (g dL⁻¹)</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>12.45</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.90</td>
</tr>
<tr>
<td>Minimum</td>
<td>8.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>14.00</td>
</tr>
<tr>
<td>All the cases</td>
<td>271.00</td>
</tr>
</tbody>
</table>

Table 3: Stepwise multiple regression for haemoglobin concentration of school-aged children in Kenitra

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>T</th>
<th>p</th>
<th>95% CI for B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hct (%)</td>
<td>0.324</td>
<td>0.005</td>
<td>0.759</td>
<td>63.16</td>
<td>0.000</td>
<td>(0.313, 0.334)</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>-0.058</td>
<td>0.009</td>
<td>-0.309</td>
<td>-6.05</td>
<td>0.000</td>
<td>(-0.076, -0.039)</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>0.180</td>
<td>0.027</td>
<td>0.449</td>
<td>6.454</td>
<td>0.000</td>
<td>(0.125, 0.236)</td>
</tr>
<tr>
<td>MCHC (g dL⁻¹)</td>
<td>0.201</td>
<td>0.024</td>
<td>0.247</td>
<td>8.232</td>
<td>0.000</td>
<td>(0.152, 0.249)</td>
</tr>
<tr>
<td>Serum iron (µg dL⁻¹)</td>
<td>0.033</td>
<td>0.011</td>
<td>0.011</td>
<td>0.930</td>
<td>0.354</td>
<td>(-0.038, 0.104)</td>
</tr>
</tbody>
</table>

Table 4: Hematological parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Boys (n = 58)</th>
<th>Girls (n = 53)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (g dL⁻¹)</td>
<td>12.52±0.78</td>
<td>12.41±1.00</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Hct (%)</td>
<td>38.58±1.82</td>
<td>38.30±2.37</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>82.34±4.19</td>
<td>81.75±5.39</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>26.75±2.00</td>
<td>26.58±2.46</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>MCHC (g dL⁻¹)</td>
<td>32.44±1.04</td>
<td>32.39±1.16</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Serum iron (µg dL⁻¹)</td>
<td>0.81±0.30</td>
<td>0.76±0.27</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

DISCUSSION

Iron deficiency is the most widespread and common nutritional disorder in the world. In spite of the efforts to decrease the frequency, the prevalence varies in different parts of the world with higher rates in the developing countries (Lerner and Sills, 2011; WHO., 1989).

The objective of this study was to investigate the frequency of iron deficiency anaemia in school children (6-15 years) in Kenitra and its association with sociodemographic parameters.

We found that boys are more affected than girls. Similar findings have been documented in a previous studies which revealed that the prevalence of anaemia increased among male children (Nicklas et al., 1998; Ayoya et al., 2013; Leite et al., 2013). These differences can be attributed to genetics or an increased incidence of iron deficiency in boys (Siegel et al., 2006). Hassan and Khalique (2002) found anaemia in 24.8% of children. Similarly, a study by Gomber et al. (2003), stated that the prevalence of anaemia in school children from urban slums, aged 5-10.9 years was 41.8%. Srivastava et al. (2012) found anaemia in 37.5% of

Diet: About 64.9% of the study samples reported that they consume animal food at least once a week. The occurrence rate of anaemia was higher in children who take foods of both plant and animal sources less frequently (Table 1).
Iron deficiency anaemia, as a serious health problem affecting mostly infant, children and women of reproductive age and requires urgent attention. It was established that occurrence of anaemia is directly correlated with maternal literacy status. Participants who consumed animal and plant foods less frequently were more likely to develop anaemia than that of more frequent users of these foods. This shows that the problem of anaemia is linked with food insecurity.

Our findings suggest that current public-health strategies such as food fortification are necessary but not sufficient to reduce childhood anaemia. Instead, combining iron fortification and iron supplementation programs with efforts to reduce maternal anaemia, family poverty and food insecurity may yield optimal improvement of children’s hemoglobin levels.

Additional studies are needed on micronutrients deficiency, parasite infections, hereditary disorders and environmental pollutants.

ACKNOWLEDGMENTS

We would like to thank all school children and their parents in Kenitra province for their participation in the study.

REFERENCES


