Impact of the supplemented dietary iron in the biological cycle among the adolescent girls

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IMPACT OF THE SUPPLEMENTED DIETARY IRON IN THE BIOLOGICAL CYCLE AMONG THE ADOLESCENT GIRLS

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Abstract

India has one of the fastest growing youth populations in the World. Adolescents are tomorrow’s adults and 80 per cent of them live in developing countries. Anemia is primarily a metabolic disorder marked by a progressive decline in the iron content in the blood. It is considered to be silent with no early warning signs. Iron-deficiency anemia is among the most common forms of health hazards in the world and is the eighth leading cause of disease in girls and women in developing countries. The negligence of dietary iron has ruined the biological cycle during the reproductive age groups and continues forever till their menopausal ages. It takes days together to replenish the lost iron during menstruation, by the time, the next biological cycle starts. Ultimately the body iron depots, gets diminished. The present study was therefore carried out as a baseline survey to find out the pervasiveness of anemia among 100 adolescent girls, who were supplemented with 50 g of dates (one of the richest source of iron), for a period of 1 month. Analysis of the Hemoglobin (Hb) in blood was estimated by Cyanomethemoglobin method on the 1, 2 and 3 day of menstruation. From our results, the Hb level were found to be 9.3 - 13. 2 g/dl in the control group. After supplementation the increasing levels of Hb (10.6 – 14.8 g/dl ) was found to be statistically significant (p < 0.05). In adolescents, anemia leads to a
fall in academic performance with a dip in memory and concentration levels, it is concluded that adequate nutrient intake in the dietary supplementation helps in reducing the prevalence of anemia in adolescents.

**Keywords:** Anaemia, Dates, Hemoglobin

**Introduction**

Anaemia is a major killer in India. Statistics reveal that every second Indian woman is anaemic and one in every five maternal deaths is directly due to anaemia. Anaemia spares none; it affects both adults and children of both sexes, although pregnant women and adolescent girls are most susceptible and most affected by this disease. Anemia refers to a condition in which the hemoglobin content of the blood is lower than normal as a result of deficiency of one or more essential nutrients, heavy blood loss, parasitic infections and congenital hemolytic diseases. Globally, anemia is a public health problem affecting people in both developed and developing countries with bad consequences of human health as well as social and economic development (Selomon Assefa et al., 2014). Nutritional anemia is one of India's major public health problems. Adolescence is a vulnerable period in the human life cycle for the development of nutritional anemia. Young children from low income families have a higher risk for developing anemia due to iron deficiency that occurs as a result of high demand for iron during the period of rapid growth (Selomon Assefa et al., 2014). Anemia in adolescent girls contributes to maternal and foetal mortality and morbidity in future. Most of the health care services in India are for mother and child group.

Iron is the most abundant element on earth and is an essential trace mineral for humans. The human body contains about 3.5 to 4.5 g of iron. Two thirds of this is present in blood and the rest is stored in the liver, spleen, bone marrow and muscles (Toteja et al., 2006). One of the main important source of iron is date fruit. The main chemical components of date fruit include carbohydrates, dietary fiber, enzymes, protein, fat, minerals, vitamins, phenolic acids and carotenoids. Many studies have shown that date fruit has antioxidant, antimutagenic, anti-inflammatory, gastroprotective, hepatoprotective, nephroprotective, anticancer and immunostimulant activities (Zhen-Xing Tang et al., 2013). In the present study, we have
evaluated the pervasiveness of anemia among 100 adolescent girls, who were supplemented with dates.

**Materials and Methods**
A study was conducted among girls aged 12 to 23 in KG Chavadi, Coimbatore-105. The sample size of 100 was determined using single population proportion formula. To maximize the sample size, prevalence of anemia (50%) was considered. Ninety five percent certainty and 5% margin of error was taken. A total of 100 girls in the age group of 12-23 were selected and hemoglobin levels were estimated before and after supplementation with 50g of dates for one month. Portable hemoglobinometer was used to determine hemoglobin concentration from a capillary blood sample collected from the fingertip of each aseptically, using sterile single-use disposable lancet. The cyanmethemoglobin method works on the principle of conversion of hemoglobin to cyanmethemoglobin by the addition of potassium cyanide and ferricyanide whose absorbance is measured at 540 nm in a photoelectric calorimeter against a standard solution (Nkrumah et al., 2011).

**Statistical Analysis**
The values were expressed as Mean ±SD. The statistical analysis was carried out by one-way analysis of variance using SPSS statistical analysis program. Statistical significance was considered at p<0.05

**Results**
Table 1 shows the levels of Hb on the first day of their biological cycles The minimum mean Hb was 9.3 g/dl and maximum levels observed in target group of girls was 13.2 g/dl

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Minimum Hb level (g/dl)</th>
<th>Maximum Hb level (g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal control values</td>
<td>9.3±3.20</td>
<td>13.2±2.31</td>
</tr>
<tr>
<td>(Before supplementation)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows the Hb levels and the % increase of Hb were estimated on the 1st, 2nd and 3rd of the menstruation after supplementation.
Table 2.

<table>
<thead>
<tr>
<th>Mean Hb levels</th>
<th>Minimum Hb level (g/dl)</th>
<th>% increase of Hb</th>
<th>Maximum Hb level (g/dl)</th>
<th>% increase of Hb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal control levels</td>
<td>9.3±1.21</td>
<td>--</td>
<td>13.2±4.20</td>
<td>--</td>
</tr>
<tr>
<td>On Day 1</td>
<td>9.9±2.43</td>
<td>6.46±3.41</td>
<td>14.1±3.24</td>
<td>6.82±3.65</td>
</tr>
<tr>
<td>On Day 2</td>
<td>9.7±3.43</td>
<td>4.30±3.54</td>
<td>14.0±3.54</td>
<td>6.06*±3.54</td>
</tr>
<tr>
<td>On Day 3</td>
<td>10.8±3.21</td>
<td>3.22±4.12</td>
<td>14.8±2.38</td>
<td>4.54*±3.24</td>
</tr>
</tbody>
</table>

*statistically significant p<0.05

Discussion

Hemoglobin forms an unstable, reversible bond with oxygen. In its oxygenated state it is called oxyhemoglobin and is bright red. In the reduced state it is called deoxyhemoglobin and is purple-blue. Hemoglobin molecule is made up of four heme groups surrounding a globin group. Heme contains iron and gives a red color to the molecule. Iron is also necessary for growth, development, normal cellular functioning, and synthesis of some hormones and connective tissue (Aggett, 2012). Iron is a mineral that is naturally present in many foods, added to some food products, and available as a dietary supplement. Iron is an essential component of hemoglobin, an erythrocyte protein that transfers oxygen from the lungs to the tissues (Wessling-Resnick, 2014). Iron helps make up many proteins and enzymes in our body, helps transport oxygen through your body and is used for regulating cell growth and differentiation. Without enough iron, you may feel tired, breathless, dizzy, weak and irritable. Measurement of hemoglobin level helps to diagnose the extent and severity of anemia, polycythemia as well as other diseases of red blood cells. The magnitude of anemia determined in this study (37.6%) is considered as a moderate public health problem according to WHO 2001. Teen girls ages 14 to 18 need 15 mg of iron a day. The iron needs are high in adolescent girls because of the increased requirements for expansion of blood volume associated with the adolescent growth spurt and the onset of menstruation. The minimum mean Hb was 9.3 g/dl and that of maximum levels observed in target group of girls was 13.2 g/dl. During adolescent period, the risk of iron deficiency and anemia among boys and girls appears to be more due to growth spurt and in girls it remains as such during their reproductive life (Kanani and Poojara, 2000). There was increase in the mean
Hb in the experimental period. A similar increasing trend in the levels of Hb was observed on the day 1, 2 and 3 of the menstruation. However, the increase was found to be statistically significant (p < 0.05) after the supplementation on the 2 and 3 day of menstruation. There were marginal differences in prevalence of anemia and mean Hb in relation to Day 1 which were not statistically significant. Anemia has a serious negative impact on growth and development during adolescent and decreases the ability to concentrate and learn. Iron deficiency was shown to be associated with impaired cognitive process in adolescents as suggested by improved performance following supplementation (Khanduri et al., 2007).

Conclusion

In spite of the fact that anemia is a preventable condition, it is highly prevalent among the adolescent in all over India, as from the last ten years much focus has been given on adolescent girls. In adolescents, anemia leads to a fall in academic performance with a dip in memory and concentration levels. From our results, it is concluded that adequate nutrient intake either in the dietary supplementation or the form of balanced diet and education will surely help in reducing the prevalence of anemia in adolescents. 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 anemia.

Acknowledgement

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estimation by the HemoCue® portable hemoglobin photometer in a resource poor setting. 


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