To Determine Prevalence of Low Haemoglobin in Healthy Females and its Correlation with Diet, Weight and Body Mass Index.

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ABSTRACT

**Background:** More than a quarter of the total world population is anemic and half of them have iron deficiency anemia. Many studies done have shown that iron fortified legume staples are important source of proteins and non-heme iron in children; all infants treated with oral iron and visited weekly to record iron intake, feeding, and health showed improvement in cognitive, motor, and social-emotional development hand washing with soap and hand finger nail clipping reduced prevalence of anemia. So we designed this study to find out the cause of low hemoglobin in healthy females and its correlation with diet, weight and body mass index.

**Material and Methods:** This open-label, prospective, observational study was conducted in 90 healthy volunteers belonging to nearby areas. The following parameters were observed and recorded: height, weight, body mass index (BMI) and hemoglobin estimation and questionnaire was given to the participants to record dietary intake.

**Results:** All the volunteers completed the study were of an average age of 20.28±0.10 years and had average hemoglobin of 11.91 ± 0.11gm/dl and the average body mass index (BMI) was 21.73 ± 0.33 (kg/m²) respectively. It has been observed that haemoglobin has non-significant (p>0.05) correlation with age, weight, height and BMI. Majority of volunteers took more than three meals per day; eating food outside on one-two occasions per week and reported that their food was fried. Most of the participants reported consuming small proportions of food with fruits and milk being essential component.

**Conclusion:** To conclude our study found that the participants although were not anaemic they had haemoglobin on the lower side of normal values and there was no correlation between with age and BMI.

**Key words:** Anaemia, haemoglobin, diet, weight, body mass index.

INTRODUCTION

According to World Health Organization (WHO), LO: hemoglobin (Hb) level less 13g/dl in males and less than 12g/dl in females is considered as anaemic.[¹] Around 30% of the total world population is anemic and half of them about 600 million population have iron deficiency anemia.[²] Risk factors associated with anemia are diet low in iron, vitamins and minerals, blood loss from surgery, injury and heavy menses in females, alcohol intake, drug toxicity, family history of anemia and chronic illness. Clinical features associated with anemia are fatigue, rapid heartbeat, irritability, pale family history of anemia and chronic illness. Clinical features associated with anemia are fatigue, rapid heartbeat, irritability, pale skin, malaise, fever, weight loss, night sweats, shortness of breath on exertion, dizziness, headache, tinnitus, glossitis, mood disturbances, mental confusion, etc. So anemia is not a single disease but a condition like fever with many possible causes and many forms. To treat anemia first of all we have to treat the underlying cause, proper balanced diet (rich in iron, folic
acid and vitamins), hormones to treat heavy menstrual bleeding, manmade version of erythropoietin stimulate to make Red blood cells(RBCs) and antibiotics to treat infections. An interventional study titled “Improving iron status through consumption of iron fortified cowpea” done by Noguchi Memorial Institute for Medical research, University of Ghan Nestle foundation, concluded that iron fortified legume staples like cowpea have been identified to be important source of proteins and non-heme iron in children. In Another study titled, ‘The Anemia Control Program: Early Intervention’, done by Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHID) it was observed that all infants who were treated with oral iron and visited weekly to record iron intake, feeding, and health showed improvement in cognitive, motor, and social-emotional development. Another study titled “Impact of hand hygiene activities on the prevention of intestinal parasitic infections and anemia among school children” by University of Alcala, Maastricht University, concluded that the hand washing with soap and hand finger nail clipping reduce prevalence of anemia among the children with unhygienic activities. We thought it worth to design a study to find out the cause of low hemoglobin in healthy females and its correlation with diet, weight and body mass index.

MATERIALS AND METHODS

This open-label, prospective, observational study was conducted in collaboration of Department of Medicine and Community Medicine, Gian Sagar Medical College & Hospital, Patiala, India for 2 months between August 2014 to December, 2014. This study was conducted in 90 healthy volunteers belonging to nearby areas. All female participants between the age group of 18 to 25 years, with confirmation of anemia by Sahli’s Hemoglobinometer but without clinical symptoms and willing to give written informed consent were included in the study. Any participants with active medical disease, other than anemia; recent history of gastrointestinal bleeding; drug and alcohol abuse; using anticoagulant drugs, history of bleeding disorder, sickle cell anemia, thalassemia; or major surgery within the last three months were excluded from the study.

Procedure: All the participants after giving written informed consent were enrolled in the study and the following parameters were observed and recorded: height, weight, body mass index (BMI) and hemoglobin estimation. A questionnaire was given to the participants to record dietary intake. Hemoglobin estimation: was done by Sahli’s Hemoglobinometer which is based on the principle that Hemoglobin present in a sample of blood is converted into acid hematin by addition of N/10hydrochloric acid (HCl) to the blood and its hemoglobin content is determined by matching the solution against non-fading glass having a standard color. Anemia was classified as:

1. Blood loss: Acute blood loss, Chronic blood loss
2. Hemolysis: Inherited genetic defects, Acquired genetic defects, Mechanical trauma, Infections of red cell, Toxic or chemical injury, Membrane lipid abnormality, Sequestration
3. Decreased red cell production: Inherited genetic defects, Nutritional deficiencies, erythropoietin deficiency, Immune mediated injury of progenitors, Inflammation mediated iron sequestration, Primary hematopoietic neoplasm’s, Space occupying marrow lesion, Infection of red cell progenitors, unknown mechanism.

Statistical Analysis:
The data was tabulated as mean ± standard deviation (SD). Results were analyzed using non parametric tests (Chi-Square Test), parametric tests (two tailed student t-test) and correlation (Pearson correlation coefficients) analysis. A p<0.05 was considered statistically significant.

RESULTS

90 volunteers were enrolled in the study and all of them completed the study. The demographic characteristic is shown in Table 1. The average age of volunteers in the study was 20.28±0.10 years and had average hemoglobin of 11.91 ± 0.11gm/dl and the average body mass index (BMI) was 21.73 ± 0.33 (kg/m²) respectively. All the healthy volunteers gave a written informed consent and completed the study.

Table 1. Characteristic of volunteers in our study

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n=90 (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>20.28±0.10</td>
</tr>
<tr>
<td>Haemoglobin (gm/dl)</td>
<td>11.91±0.11</td>
</tr>
<tr>
<td>Height (Inches)</td>
<td>63.61±0.26</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>54.98±0.91</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>21.73±0.33</td>
</tr>
</tbody>
</table>

Correlation
Estimates of correlation for Haemoglobin with age, weight, height and BMI along with their significant levels among volunteers are presented in Table 2. It has been observed that haemoglobin has non-significant (p>0.05) correlation with age, weight, height and BMI.

Table 2. Correlation coefficients for haemoglobin with age, weight, height, and BMI among volunteers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age</th>
<th>Weight</th>
<th>Height</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemoglobin</td>
<td>0.47</td>
<td>0.65</td>
<td>0.24</td>
<td>0.48</td>
</tr>
<tr>
<td>p</td>
<td>0.64</td>
<td>0.52</td>
<td>0.81</td>
<td>0.64</td>
</tr>
</tbody>
</table>

The weight change observed in volunteers of shown in Fig 1. Around 65% of volunteers reported that they had no change in their weight. Out of the 35% that reported weight change two-third said that the weight change reported was unintentional. Fig 2 shows the other responses as answered by the volunteers on self-reporting in the questionnaire given to them Fig 2. 80% of volunteers reported that they took
more than three meals per day; majority of them (63%) reported eating food outside on one-two occasions per week. Most of them (100%) reported that their food was fried and refined oil (95%) was the major media for cooking food.

Majority of them (71%) were not taking any food supplements and 95% were free from any metabolic disorder. Most of the participants (82%) reported consuming small proportions of food with fruits and milk being essential components.

DISCUSSION
Anaemia is a global public health problem affecting both developing and developed countries with major consequences on human health as well as social and economic development with the most significant contributor to the onset of anaemia is iron deficiency. In India, adolescent girls face serious health problems due to socioeconomic conditions, nutrition and gender discrimination; in absence of proper and adequate nutrition, a person can develop several developmental malformations. [8] Haemoglobin concentration, body weight, stature and body mass index (BMI) are some of the most popular use parameters for the evaluation of human health. [9] Anaemia occurs in both undernourished and overnourished individuals has been associated with low body mass index. [10]

The results of our study suggest that the participants had a low haemoglobin level and a lower body mass index. There was no correlation between haemoglobin level with age, or body mass index. The dietary pattern was also studied and most of the individual were not following a balanced diet pattern.

The results of our study are similar to one study where a negative association of BMI to Hb concentration was observed, but at the same time this study found no correlation in overweight and obese groups which was different from our study. High prevalence of anaemia was found in both urban and rural girls in all BMI groups and was thought to be due to age, socioeconomic condition, low food intake, increase tendency to lose weight for zero size combined with menstrual loses which is like our study were the component of balanced diet was missing. [8]

Another study done to find Anaemia and body mass index (BMI) of fisherwomen inhabiting in Karang island of Loktak Lake, Manipur (India) demonstrated no correlation of BMI with haemoglobin level is similar to our study. [9]

One more study done to access Anaemia in relation to body mass index and waist circumference among Chinese women showed that women with overweight/obesity or central obesity were less likely to be anaemic as compared to normal weight women is slightly different from our study were we found that all the women had a lower BMI and were on the lower side of the haemoglobin level. [11]

Another study done to see Anaemia in Relation to Body Mass Index (BMI) and Socio-Demographic Characteristics in Adult Nigerians in Ebonyi State concluded that the Anaemia had no definite relationship with BMI and sociodemographic characteristics studied as shown by our study. [10]

One more study done to access prevalence of anaemia and its correlation to body mass index among scheduled caste school children in Fatehabad district of Haryana concluded that concluded that anaemia still constitutes a health problem among school children, with a negative correlation, is
different from our study as it enrolled school children whereas in our study we included females of more than 18 years of age.\textsuperscript{12}

There are certain limitations in our study, firstly, we had a small sample size and this was mainly due to short duration of the study. Secondly, an intervention in one of the groups would have been quite helpful. Thirdly long term follow-up could have given better results. To conclude our study found that the participants although were not anaemic they had haemoglobin on the lower side of normal values and there seemed to be negative correlation between with age and BMI. An irregular dietary habit could have been one of the reason for lower haemoglobin.

**What this study adds:**

1. **What is known about this subject?**  
It is already known that healthy females have haemoglobin on the lower side of normal. earlier studies have demonstrated that iron fortified diet and hygiene measures help to improve the hemoglobin level in these healthy females.

2. **What new information is offered in this study?**  
This study tried to correlate the various parameter such as diet, BMI and weight with low hemoglobin level as well as it tried to highlight some of the common myths associated with anemia.

**REFERENCES**


2. Craig JIO, Mc Clelland DBL, Ludlam CA. Blood disorders. In: Davidson’s Principles and Practice of Medicine, edited by Nicholas A. Boon, Nicki R. Colledge, Brian R. Walker; Ed. 20\textsuperscript{th}, p 999-1064.


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