RESEARCH ARTICLE

Correlation of anemia to body mass index among adult population in a rural region of Malwa in Madhya Pradesh

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ABSTRACT

Background: Anemia and obesity are the markers of imminent health issues in adults because malnutrition shows two extreme ends, decreased hemoglobin (Hb) and increased body mass index (BMI), caused due to undernutrition and overnutrition, respectively. Aims and Objectives: This study was done to compare the effect of a BMI on anemia in India as very few of these studies have been done in rural India and none in the rural Malwa region of Central India. Materials and Methods: The study was conducted at a rural mission hospital in a remote village Hatpipliya of district Dewas, Madhya Pradesh, beginning from September 2020 to November 2020 with a sample size of 152 subjects. Hb was assessed on the basis of the World Health Organization standards and BMI was calculated as per Quetelet’s index. The collected data were tabulated and analyzed. Results: A total of 152 people in the age group of >20 years were included in the study. Seventy-one (47%) were male and 81 (53%) were female. The prevalence of anemia among underweight population was 38.8%, which was almost closed to those with normal BMI (38.5%). The overweight category showed 21% to be anemic and interestingly, 50% of obese individuals were anemic. Conclusion: No significant difference (P > 0.05) was found in the prevalence of anemia among all BMI groups. Frequent screening for the prevalence of anemia and its association with BMI should be done among the target group.

KEYWORDS: Adults; Anemia; Body Mass Index; Hemoglobin; Indians

INTRODUCTION

Health, which is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity,[1] is one of the most important assets of a nation. It is dependent not only on economic and financial status of a country but also on specificities such as medical care and education. Human health can be assessed by a number of biochemical and anthropometric measurements, BMI and hemoglobin (Hb) levels being one of them as both obesity and anemia are the markers of imminent health issues in adults.

Anemia, not a disease in itself but only a symptom, is a condition that affects an estimated 2.36 billion individuals globally.[2] It is classically defined as a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet the body’s physiological requirements, which vary by age, sex, altitude, smoking habits, and during pregnancy.[3]

Anemia has been found to affect individuals of all ages and both genders although it has shown a higher prevalence in women.[4] Surprisingly, its occurrence has been uniformly found in all genre, strata, and socioeconomic status. Although a variety of isolated conditions cause anemia,
yet their occurrence may coexist. Anemia, even when mild to moderate, affects the sense of well-being resulting in fatigue, stress, and reduced work productivity along with an increased mortality rate.\cite{6}

Body mass index (BMI) is a very useful anthropometric indicator of measuring the nutritional status of a population.\cite{7} In fact, a BMI of <18.5 kg/m² can be used to predict poor demographic, economic, social, and environmental conditions of a population.\cite{8}

India is one of the world’s more populous nations and anemia is one of those conditions which have been constantly prevalent in the nation primarily due to under nutrition as an effect of poverty in the past and possibly related obesity now in today’s times as reported in some countries.\cite{9,10}

Malnutrition shows two extreme ends, anemia, and obesity, caused due to undernutrition and overnutrition respectively. Interestingly and less commonly known, hepcidin connects the contrasting poles of obesity and anemia. Hepcidin is a 25-amino acid antimicrobial peptide majorly expressed in human liver and synthesized in small quantity in the subcutaneous and visceral adipose tissues.\cite{11,12} It is reported to inhibit iron absorption in enterocytes.\cite{13} Thus, this study was done keeping in mind that only a few\cite{14-16} studies have been done to compare the effect of a BMI on anemia in India and very few of these studies have been done in rural India and none in the rural Malwa region of central India. Moreover, some of the studies\cite{17,18} that have examined the relationship between BMI and anemia have reported contradictory results.

MATERIALS AND METHODS

The study was conducted at a rural mission hospital in a remote village Hatpipliya of district Dewas, Madhya Pradesh, beginning from September 2020 to November 2020. It was a cross-sectional study which was done as per the Declaration of Helsinki. Permission for the study was obtained from the concerned officials of the institution. The rural mission hospital is a 100-bed hospital in Hatpipliya, a rural village in Dewas district catering to mostly rural population.

The study had a sample size of 152. The subjects chosen for the study were >20 years in age, healthy with no known illnesses. Subjects with a history of asthma, hereditary cardiac, or blood diseases, any ailment for which long-term medication was taken were excluded from the study.

Informed consent was taken before the initiation of the study. On receiving the consent, the basic vital data which included age, gender, education, and occupation were collected. A digital weighing scale that could measure to the nearest 0.1 kg was used to record weight, and height was measured to the nearest centimeter, in the Frankfurt plane position.

The investigations done were as follows:

The Hb estimation was done with a finger prick sample of capillary blood using the Sahli’s hemoglobinometer using the standard protocol. Anemia is defined as a Hb concentration below 12 g/dl for the diagnosis of anemia and assessment of severity according to the World Health Organization (WHO).\cite{19}

BMI was derived as weight (kg)/height (m) as per the Quetelet’s index.\cite{20} Using this, the patients were categorized as underweight (<18.5 kg/m²), normal or lean BMI (18.5–22.9 kg/m²), overweight (23.0–24.9 kg/m²), and obese (>25 kg/m²) based on the revised consensus guidelines for India. The collected data were tabulated and analyzed.

RESULTS

A total of 152 people in the age group of >20 years were included in the study. Seventy-one (47%) were male and 81 (53%) were female [Table 1]. Fifty-seven (37.5%) people were anemic based on the WHO criteria, of them 47 (82.5%) were female and 10 (17.5%) were male. Mild anemia was observed to be higher as compared to its moderate and severe types [Figure 1]. Undernutrition was identified among 36 (23.6%) people, with females (63.8%) being more undernourished than their male counterparts (36.2%). The number of overweight/obese individuals was 33 (21.7%) with more males being overweight/obese as compared to females. Those with adequate nutritional status were 83 (54.6%) with 45 (54.2%) females and 38 (45.8%) males [Table 2].

Table 1: Grades of anemia in the study population

<table>
<thead>
<tr>
<th>Hb level</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb&lt;12 g/dl</td>
<td>61</td>
<td>34</td>
<td>95</td>
</tr>
<tr>
<td>Hb 11–11.9 g/dl mild</td>
<td>4</td>
<td>32</td>
<td>36</td>
</tr>
<tr>
<td>Hb 8–10.9 g/dl moderate</td>
<td>5</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Hb&lt;8 g/dl severe</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td>81</td>
<td>152</td>
</tr>
</tbody>
</table>

Hb: Hemoglobin

Table 2: BMI in the study population

<table>
<thead>
<tr>
<th>BMI</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI&lt;18.5 – underweight</td>
<td>13</td>
<td>23</td>
<td>36</td>
</tr>
<tr>
<td>BMI&gt;18.5–22.9 – normal</td>
<td>38</td>
<td>45</td>
<td>83</td>
</tr>
<tr>
<td>BMI&gt;23–24.9 – overweight</td>
<td>11</td>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>BMI&gt;25 – obese</td>
<td>9</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td>81</td>
<td>152</td>
</tr>
</tbody>
</table>

BMI: Body mass index
On comparing Hb levels to BMI, it was seen that of all the underweight study population, 14 (38.8%) were found to be anemic (95% confidence interval [CI] 24.7–55.13). Among the people with normal BMI, 32 (38.5%) were anemic, (95% CI 28.81–49.31). In the overweight category, 4 (21%) were anemic (95% CI 8.5–43). Finally, the obese category with BMI >25 showed 7 (50%) to be anemic (95% CI 26.8–73.2) [Table 3].

DISCUSSION

The present study shows that the prevalence of anemia was 37.5% among rural society of Central India. About 23.6% were underweight and 21.7% were either overweight or obese. Interestingly, a little over half of the study population had normal BMI and 63% reported normal Hb levels. No significant difference ($P > 0.05$) was found in the prevalence of anemia among all BMI groups.

On comparing the results of the present study with other similar studies done in the past, it was seen that anemia had a prevalence of 37.5% observed in the present study which is lower than 70.1% and 53.2%, respectively, among adult females and males, aged 20–50 years reported by Pratima et al.\footnote{21} in North Indian population. In addition, Kaur et al.\footnote{22} observed anemia prevalence rate as 59.8% in rural Wardha in Maharashtra. In another study done in the rural slums of Kanpur,\footnote{23} the prevalence of anemia was found to be 78.5% which is much higher than as found in our study. Furthermore, Siddharam et al.\footnote{24} reported 45.2% of females to be anemic which is closer to this present study. Furthermore, Debbarma et al.\footnote{25} reported a prevalence of 26.62%. Although the prevalence of anemia in the present study was lower than in other studies done in the Indian subcontinent, this fact cannot be ignored that most of the studies were not done in the rural population where healthy eating habits are still a norm. The lack of association between BMI and anemia is in accordance with many a study done in the past which came up with similar results.\footnote{26-29} However, a study\footnote{15} conducted at the Himalayan Institute of Medical Sciences showed a negative correlation between anemia and BMI. Negative correlation was also seen by Peter et al.\footnote{30} Another study\footnote{31} done on medical students in Amritsar has shown a positive correlation between the two but none of the results were statistically significant. The major reason of the dissimilarities could be because most studies where the association between BMI and anemia has been done in India were done on medical college going female students.

CONCLUSION

It can be said that the present study shows that 37.5% of the study population were found to be anemic. About 23.6% were underweight and 21.7% were either overweight or obese. Interestingly, a little over half of the study population had normal BMI and 63% reported normal Hb levels. No significant difference ($P > 0.05$) was found in the prevalence of anemia among all BMI groups. Frequent screening for the prevalence of anemia and its association with BMI should be done among the target group.

REFERENCES


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