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RESEARCH ARTICLE

NUTRITIONAL STATUS AND ANAEMIA IN MEDICAL STUDENTS OF SGRDIMSAR, AMRITSAR

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Background: Anaemia is a global public health problem. Adolescents are vulnerable to iron deficiency because of increased iron requirements related to rapid growth. Considerable changes in growth pattern, lifestyle, dietary habits, and behavior are likely to influence the haemoglobin levels among adolescents belonging to high-income group.
Aims & Objective: The objective of the study was to determine haemoglobin status and body mass index (BMI) in adolescents and study the correlation between them.
Materials and Methods: Three hundred medical students of Sri Guru Ram Das Institute of Medical Sciences and Research (SGRDIMSAR, Amritsar, Punjab, India) belonging to both the sexes were studied after taking consent on format for anthropometric parameters using standard protocol. BMI of ≥18.5 kg/m^2 was used to define undernutrition status. Haemoglobin level was estimated in g%. Statistical analyses were carried out using mean and standard deviation; Student's *t*-test was used for measuring the effect of gender on correlation of Anaemia with BMI.
Results: In our study, 86 (45.7%) girl students were found to have Anaemia (Hb <12 g%) with only 2 (1.7%) boys had haemoglobin levels <12 g%; 67 (60%) boys were overweight whereas 34 (18%) girls showed undernutrition. A positive correlation of haemoglobin with grades of BMI was found in both in boys and girls; however, none of the correlation showed significance to the levels of <0.05.
Conclusion: Nutritional Anaemia and undernutrition prevailed more among girl students rather than boys in spite of being literate and having healthy nutritive diet. We recommend that adolescents be screened periodically for Anaemia, and multisectorial community-based approach should be adopted to combat this serious public health issue.

INTRODUCTION

Anaemia is a serious public health and nutrition problem affecting both developing and developed countries, with major consequences on human health as well as social and economic development. Nutritional Anaemia is of more concern in the developing countries having high prevalence rate due to dietary iron deficiency. The other causes of Anaemia are heavy menstrual blood loss, parasitic infections, acute and chronic infections, micronutrient deficiency, and haemoglobinopathies.[1]

Adolescents are vulnerable to Anaemia because of increased iron requirements related to rapid growth. Among adolescent girls, menstruation increases the risk of iron-deficiency Anaemia throughout their adolescent and childbearing age.[2] Anaemia in adolescence severely impairs the physical and mental development, weakens behavioral and cognitive development, reduces physical fitness, decreases the work performance, and even contributes to the adverse outcomes in pregnancy.[3–6] Mild Anaemia can adversely affect the productivity and is also known to reduce the immune competence.[7]

Several studies across the country have shown that the prevalence of Anaemia in rural adolescents is more than the urban primarily due to ignorance, low socioeconomic status, and poor dietary habits.[8] Although prevalence of Anaemia is marginally higher in rural areas but some recent studies have highlighted the increasing prevalence of Anaemia among adolescents living in urban settlements.[9,10]

Measuring height, weight, and body mass index (BMI) gives significant information on the nutritional and health status of individuals. Many research studies have reported that malnutrition affects body growth and development, especially during the crucial period of adolescence.[11] Several studies on the prevalence of Anaemia have been published, but a few have looked for its association with BMI.

Keeping in view the increasing incidence of nutritional Anaemia in urban population, we conducted a study to estimate the prevalence of Anaemia among affluent educated class of young medical students and its correlation with BMI.

Aims and Objectives

The aim of this study was to determine the BMI and blood pressure in adolescents, and to investigate the correlation between the two. This study also aimed to highlight the benefits of lifestyle modifications such as aerobic exercises, diet management, and total abstinence from alcohol and smoking.

MATERIALS AND METHODS

Three hundred adolescent medical students aged between 17 and 19 years belonging to both the sexes, studying at Sri Guru Ram Das Institute of Medical Sciences and Research (SGRDIMSAR), Amritsar, volunteered for the study. This cross-sectional study was conducted at the Department of Physiology from April to July 2014. Informed written consent was obtained from all participants, and the study protocol was approved by the ethic committee. Anthropometric measurements were conducted using the standard protocol.

Parameters

Standard height of students was recorded without shoes and wearing light clothes. The measuring tape was mounted on the wall to the nearest of centimeters (<5 and >5 mm). The weight was recorded with shoes off and with light clothes on a weighing machine (Krups) with at least count of 500 g. BMI was calculated by the formula: Weight (kg)/Height (m^2).

Body Mass Index (BMI)

BMI is independent of age and sex and is a known epidemiological marker of nutritional status in adolescents. International Obesity Task Force (IOTF-2000) has proposed the standards for adult obesity in Asia and India as follows:

- BMI: > 23 kg/m^2**:** Overnutrition
- BMI: 18.5–23 kg/m^2**:** Adequate nutrition
- BMI: < 18.5 kg/m^2**:** Undernutrition

A cutoff point of 18.5 kg/m^2 is used to define thinness or acute undernutrition state and a BMI of 23 kg/m^2 indicates overweight. A BMI of over 25 kg/m^2 indicates obesity.[12]

Physiological Parameters

Haemoglobin level was assessed using the Sahli Haemoglobinometer using standard protocol.[13] The measured haemoglobin values were tabulated according to the gender difference and compared with the standard values of grading of Anaemia according to WHO guidelines with haemoglobin <12 g% considered as anemic.[14]

Statistical Analysis

The data analysis was carried out using the Statistical Package for Social Science (SPSS). Statistical significance of difference (in mean values) between groups was assessed using Student's *t*-test. The relationship between haemoglobin (Hb) concentration and BMI was examined by calculating Pearson's correlation coefficient and the significance of correlation (*p*).

RESULTS

In our study of 300 medical students, there were 112 (37.3%) boys and 188 (62.6%) girls. Most of the subjects were within the age group of 17–19 years pursuing their MBBS course. Table 1 shows a statistically significant difference between the anthropomorphic parameters of girls and boys. The mean value of haemoglobin concentration among girl students was (11.73 ± 1.22 g%) and was less than that observed in boys (14.11 ± 1.27 g%), which was physiologically expected. Among 188 girl students, 86 (45.7%) were found to have Anaemia with haemoglobin <12 g%; of 112 boy students, 2 (1.7%) were found to have Anaemia as per WHO guidelines (Table 2).

Among girl students, 100 (53%) were having BMI between 18.5 and 23 kg/m^2 (adequate nutrition), 34 (18%) were underweight, and 54 (29%) were overweight. Among boys, 40 (36%) were having normal BMI between 18.5 and 23 kg/m^2, 5 (4%) were found to be underweight, and 67 (60%) were overweight (Table 3). Undernutrition was observed in 34 (18%) girls as compared to the 5 (4%) boys with BMI <18.5 kg/m^2. Overweight was seen in 67 (60%) boys in comparison to 54 (29%) girls with BMI >23 kg/m^2.

Table 4 shows the correlation of haemoglobin with different grades of BMI, with positive correlation in both boys and girls. However, none of the correlation achieves significance to the levels of <0.05. It is seen more clearly through scatter diagram (Figures 1 & 2).

Table 1: Anthropomorphic and blood parameters in medical students (n = 300)

Parameters	Boys (*n* = 112)	Girls (*n* = 188)
Height	1.75 ± 0.069	1.62 ± 0.051*
Weight	73.93 ± 14.28	56.91 ± 9.68*
BMI	24.03 ± 4.08	21.62 ± 3.39*
Haemoglobin	14.11 ± 1.27	11.73 ± 1.22*

*BMI: body mass index. * p<0.001; highly significant (Boys vs. Girls; unpaired t-test)*

Table 2: Distribution of students according to category of anaemia (WHO classification)

Category	Hb (g%)	Boys (*n* = 122)	Girls (*n* = 188)
Anaemic	<12	2 (1.7%)	86 (45.7%)
Nonanaemic	>12	110 (98.3%)	102 (54.3%)

Hb: Haemoglobin

Table 3: Distribution of students as per criteria of BMI (IOTF-2000)

BMI (kg/m^2)	Nutritional Status	Boys (*n* = 112)	Girls (*n* = 188)
<18.5	Undernutrition	5 (4%)	34 (18%)
18.5–23	Adequate	40 (36%)	100 (53%)
>23	Overnutrition	67 (60%)	54 (29%)

BMI: body mass index; IOTF: International Obesity Task Force

Table 4: Correlation of haemoglobin with BMI grades in boys and girls

BMI	Boys (*n* = 112)		Girls (*n* = 188)	
(kg/m^2)	r	Significance (*p*)	r	Significance (*p*)
<18.5	0.816	0.092	0.030	0.867
18.5–23	0.207	0.200	0.087	0.390
>23	0.208	0.092	0.087	0.531

*BMI: body mass index; r: correlation coefficient; * p <0.05.*

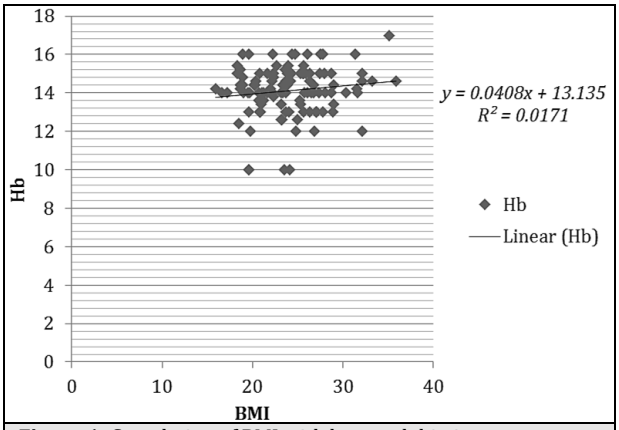

Figure 1: Correlation of BMI with haemoglobin in men

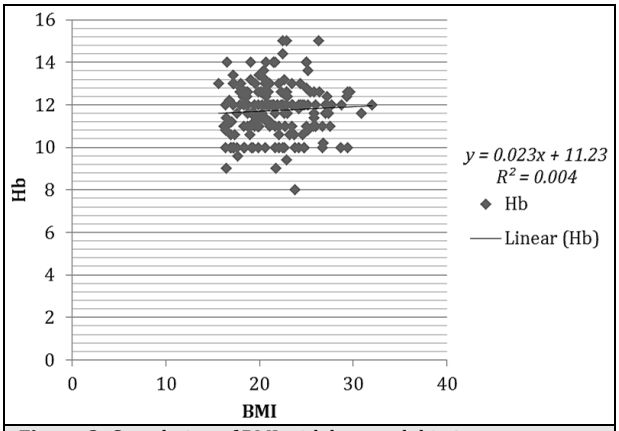

Figure 2: Correlation of BMI with haemoglobin in women

DISCUSSION

Adolescence is characterized by a spurt in physical growth and acquisition of adult phenotypes and biological rhythms. During this period, there is increase in iron requirements related to rapid growth and increase in lean body mass in both boys and girls as a result of the expansion in total blood volume. The consequences of iron deficiency are more serious in young females due to onset of menses. However, along with iron-deficiency anemia, reduced physical endurance, impaired immune response, difficulty in temperature regulation, changes in energy metabolism, and a decrease in cognitive performance have also been observed.[5] Although malabsorption and bleeding are regarded as two main causes of iron-deficiency anemia, the overwhelming cause is dietary.

Although nutritional anemia has global impact; it is of more concern in the developing countries. Unfortunately, it is not restricted to adolescents of rural and low socioeconomic status but also shows increased prevalence in developed opulent society.[15] Worldwide, about 24.8% of the population is affected by anemia, with highest prevalence of 47.4% in preschool children and the lowest prevalence of 12.7% in men. The regional estimates of WHO indicate that the highest proportion of population with nutritional anemia is in Africa (47.5%–67.6%) whereas the greatest number of individuals affected are in South East Asia.[16]

In the present study, 45.7% girls and 1.7% boys were found to have anemia with hemoglobin levels <12 g%. According to the National Family Health Survey 3, conducted in 2005–06, the national estimate of prevalence of anemia in adolescent girls was 56%, which is consistent with our study results. The prevalence of anemia among the adolescent girls aged 11–18 years was found to be 25%–80% in several previous studies conducted by the Indian Council of Medical Research in 16 districts of 11 states.[17] Higher prevalence of anemia in 32% was also reported among adolescent urban girls of Nagpur.[18] A study conducted in rural adolescent girls of Wardha, Maharashtra, India, found to have prevalence of anemia was found to be 59.8%.[19] Peter et al.[20] reported that 77.41% urban girls and 77.90% rural girls had hemoglobin level <10 g%. Higher prevalence of anemia was also found in 98% of rural girls and 56% of rural boys in Punjab.[21]

The study conducted by Saxena et al.[22] showed low prevalence of anemia to be 8% among adolescents, with none of the boys having hemoglobin levels less than 12 g%. In our present study, nutritional anemia was observed in only two (1.7%) boys, a finding that

is consistent with the above study.

It has been suggested that increased testosterone concentration in adult men is associated with an increase in the concentration of erythropoietin and hemoglobin.[23] In a study conducted in adolescent girls of Shimla hills, low prevalence of anemia was seen in 21.4%. It may be due to the higher altitude where chance of anemia is reported to be lesser.[24,25]

The prevalence of iron deficiency varies greatly according to a host of factors such as age, gender, physiological causes, pathological causes, nutritional factors, environmental factors, and socioeconomic conditions. The present study was conducted at an urban medical college in north India with adolescents having better health and environmental conditions. The reason for high prevalence of anemia the girls could be due to less food intake in tendency to lose weight for achieving zero figure, combined with menstrual loses.[22]

In this study, 67 (60%) boys were overweight as compared to 54 (29%) girls. However, undernutrition was more common in girls 34 (18%) compared to the boys 5 (4%). In the study conducted by Saxena et al.,[22] more than one third of the boys (42.4%) were overweight and 25.75% girls were underweight, which nearly coincides with our study results. In another study conducted by IP Kaur and S Kaur[21], undernutrition was found to be prevalent more in girls as compared to boys.

The coefficient of correlation (*r*) between anthropometric measurements and hemoglobin levels (Table 4) show that hemoglobin levels are positively correlated with anthropometric parameters of height, weight, and BMI but the correlation is not significant. Similar observation was seen in studies conducted others also.[19,21,24]

However, the study conducted by Al-Sharbatti et al. show negative correlation (statistically significant) between BMI and hemoglobin concentration in Iraqi adolescents girls.[26] Similar negative correlation was seen in adolescent girls in a study conducted by Saxena et al.[22] and Peter et al.[22]

Negative association in the above studies could have been related to the reduction in levels of estrogen-binding protein with increasing adiposity (BMI) resulting in rise of free estrogen levels, which may cause suppression of erythropoiesis in girls.[27] Obesity has been reported to be associated with anemia, which may be due to upregulated hepcidin expression, thereby hampering iron absorption.[28]

CONCLUSION

In this study, girl students showed poorer nutritional profile and higher prevalence of anemia as compared to the boys. Nutritional anemia was found to be prevalent even in medical students who were literate and had access to the nutritive diet in a good, healthy environment.

Hence, there is an urgent need for improving overall nutritional status of adolescents through nutrition education, community awareness, and various supplementation programs, especially for girls. The need for regular blood tests, especially hemoglobin levels, is emphasized and nutrition component needs to be included in the college curriculum.

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