Original Research Article

Correlation of Hemoglobin Level and Body Mass Index in Otherwise Healthy Young Adults

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Abstract: Nutritional anaemia is prevalent in the developing country like India especially among women. Adolescence is considered as a nutritionally critical period of life which is more susceptible for developing anaemia. To determine the association between haemoglobin (Hb) concentration and body mass index (BMI). Two hundred and fifty otherwise healthy young medical students of both sexes were taken as sample. Height was measured by portable stadiometer to nearest 0.1cm and weight was measured by digital weighing scale with 0.1kg sensitivity. Haemoglobin was estimated in gm% by Sahli's acid haematin method. Data was presented in mean and standard deviation. Unpaired t-test and Pearson correlation was carried out in Microsoft Excel. Thirty-two percent girls and no boys found anaemic. There was no correlation between Hb concentration and BMI in both male and female student. Anaemia is also prevalent in literate medical students who are aware about health and disease. BMI showed insignificant correlation with haemoglobin level.
Keywords: Anemia, Body mass index, Haemoglobin, Medical student

INTRODUCTION

Developing country like India is facing the problem of both under nutrition and obesities are major health. Nutritional anaemia is one of them and it is mainly prevalent in growing age group like children and adolescence [1]. Anaemia during adolescence severely impairs the physical and mental development [2]. It weakens behaviour and cognitive development of individual. Nutritional anaemia is not just a medical problem but has its effect on other aspect like education, socioeconomic, and demography [3]. In addition adolescent girls are more sufferers because they are future mothers, who have low pre-pregnancy iron reserve to meet the requirement of growing foetus resulting in pre-term babies and/or low birth weight babies. Most significant contributor to anaemia is iron deficiency and other causes are heavy blood loss, parasitic infection [4].

Obesity has also its effect on anaemia. Inappropriate food habits also can be related to the occurrence of iron deficiency anaemia among adolescents [5]. Habits frequently observed in this group, such as changing the principal meals for snacks, skipping breakfast, reducing the intake of fruits and vegetables, and the increasing consumption of high calorie foods not only can result in of iron deficiency due to insufficient consumption of its sources but can also increase the risk of chronic diseases such as obesity which has been reported as a risk factor for iron deficiency anaemia independently of food consumption [6]. With this background this study was planned to evaluate whether there is any correlation between BMI and haemoglobin concentration in otherwise healthy young adult.

MATERIALS AND METHODS

This cross-sectional study was conducted in the postgraduate research laboratory of Department of physiology, M.K.C.G. medical college, Berhampur, Odisha, during the period from Nov 2016 to May 2017 after due approval from the Institutional Ethics Committee. Two hundred and fifty otherwise healthy first year medical students in the age group of 18–25 years were taken as a convenience sample. Students with history of any chronic illness, on any medication and smokers were excluded from the study. The aim of

the study was explained to the participants and written consent was obtained from all participants.

Standing height of the subjects were recorded by stadiometer without shoes and wearing light clothing to the nearest of 0.1 centimetres. The weight was measured with shoes off and with light clothing by a digital weighing machine with 0.1 kg sensitivity. BMI was calculated using Quetelet's index [BMI = weight in kg/square of height in meter [7]. Depending on their BMI values, the subjects were classified into underweight (i.e. BMI<18.5), normal (i.e. BMI 18.5-25) and overweight (i.e. BMI >25) as per WHO classification [8].

Haemoglobin level was measured using the Sahli's acid hematin method. Anemia in this study was defined as haemoglobin level less than 12mg/dL for female considering the female participant was not pregnant at the time of the study. For male subjects, was defined as less than 13gm/dL according to WHO standard [9].

Statistical analysis

All data are expressed as means and standard deviation. The relationship between haemoglobin (Hb) concentration and BMI was examined by calculating the Pearson's correlation coefficient (*r*) and the significance of correlation (*p*). A two tailed p-value less than 0.05 was statistical significant.

RESULTS

Total 250 students studying in first year and second year MBBS were participated in the study. Table 1 shows anthropometric parameters and haemoglobin concentration of subjects. Table 2 describes gender distribution of students participated in the study according to BMI categorization. Out of 250 students, 30% were females and 70% were of male. The average haemoglobin level in female gender was 12.12±1.11 g/dL whereas in male it was 13.97±0.62g/dL. The average BMI among male and female gender was 23.01±3.34 kg/m^2 and 20.82±3.18 kg/m^2 respectively. In the present study 32% female students and no male students were anemic. Among 75 girls, 15 were underweight, 50 were in normal range, 10 were overweight and/or obese. Among boys, 15 were underweight, 125 were in normal range, 35 were overweight and/or obese. There was no association between hemoglobin and BMI in both genders, which was evaluated by Pearson's correlation coefficient [Table 3].

Table−1: Anthropometric parameters and haemoglobin level in sample (n=250).

Parameters	Male (n=175)	Female (n=75)
Age (years)	20.17 ± 1.38	19.58 ± 1.04
Weight(kg)	64.42 ± 9.82	54.35 ± 8.94
Height (cm)	167.57 ± 6.35	156.07 ± 5.86
BMI (kg/m^2)	23.01 ± 3.34	20.82 ± 3.18
Hb (mg/dl)	13.97 ± 0.62	12.12 ± 1.11

Table−2: Distribution of male and female according to BMI

	Total (n=250) Number (%)	Male (n=175) Number (%)	Female (n=75) Number (%)
Underweight	30 (12)	15 (8.5)	15 (20)
Normal	175 (70)	125 (71.4)	50 (66.6)
Overweight	35 (14)	35 (20)	10 (13.3)

Table−3: Correlation between haemoglobin concentration and BMI in sample (n=250)

	Boys (n=175)	Girls (n=75)
Pearson correlation (*r*) value	0.118	-0.154
P value	0.503	0.59

DISCUSSION

According to our study, 32% girls were anemic but none of the boys suffered from anemia. In India, prevalence of anemia among adolescent girls is 90%

[10]. Rati *et al.* and Patnaik *et al.* found the prevalence as 80% and 78.8% in their studies in rural areas of Karnataka and Odisha respectively [11,12]. Study by ICMR in sixteen districts of eleven states reported a

prevalence rate of 90.1% among the adolescent girls of 11-18 years age groups [10]. In addition, Kaur *et al.* observed anemia prevalence rate as 59.8% in rural Wardha in Maharashtra [13]. However, a very high prevalence of anemia (90.1%) was noted by Kulkarni *et al.* in adolescent girls of a urban slum in Nagpur [14]. No correlation of Hb concentration with BMI was observed in our study among both male and female [Table 3].

A negative association of BMI with Hb concentration was observed in study of Peter *et al.* among girls who were overweight & obese [15]. Similar results were observed by Bully *et al.* and Shatha *et al* [16-18]. In a study done by Sabena *et al.* with sample of medical student in Dehradun found 8% prevalence of anaemia. No boys were suffering from anaemia and correlation of BMI with haemoglobin was negative only in overweight and obese student.

Limitations:
We measured only haemoglobin as an indicator of anaemia status. Other parameters like mean corpuscular volume, serum iron, total iron binding capacity, serum ferritin, and serum transferrin were not included. Some variables that influence iron status such as physical activity, common infections and other micronutrient deficiencies were not assessed. There are newer technologies which can be used to assess haemoglobin concentration instead of Ashli's acid haematin method.

CONCLUSION
Anaemia is prevalent even in medical students who are well educated and well oriented about the nutrition and its effect on health. We found no association between BMI and haemoglobin concentration. Frequent screening for the prevalence of anaemia should be done among the target group. The students should be motivated and educated to take a balanced diet rich in green leafy vegetables and fruits. We suggest a further evaluation with large sample size to find out the association between BMI, iron status and inflammatory marker.

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