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Research Article

PREVALENCE OF ANEMIA AND ITS ASSOCIATION WITH BODY MASS INDEX AND PLASMA PROTEIN IN MEDICAL STUDENTS OF KOLHAN REGION OF JHARKHAND – A CROSS-SECTIONAL STUDY

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ABSTRACT

Objectives: Anemia is one of the major public health concerns affecting almost 30% of the global population. Past studies have indicated that anemia is linked to lower body mass index (BMI) and plasma protein levels. This study aims to determine the prevalence of anemia among medical students and also to investigate its association with BMI and plasma proteins.

Methods: A cross-sectional study of 177 medical and paramedical students aged 18–21 years was done at MGM Medical College in Jamshedpur from September 2018 to July 2019. A Transasia EM200 automated chemical analyzer was used to identify plasma protein using the biuret approach. HemoCOR-D (cyanmethemoglobin) was quantified by a colorimetric instrument. A colorimetric apparatus measured hemoglobin (Hb) with HemoCOR-D (cyanmethemoglobin).

Results: There are a total of 177 pupils. The study included 48% (n=85) females and 52% (n=92) males. Males had a mean age of 20.03± 0.99 years while females had a mean age of 20.16±0.937 years. Males had greater Hb levels and protein levels than females, with averages of 13.61 ± 1.43 and 7.77± 0.93, respectively. Males had a frequency of anemia of 15.4%, while females had a prevalence of 70.9%. The researchers discovered a statistically significant link between anemic and non-anemic girls' plasma protein levels (p=0.07), protein intake and plasma protein (p=0.048), and BMI and Hb (p=0.022).

Conclusions: A significant association was found between daily protein intakes with plasma protein. The association between BMI and hemoglobin was also found significant.

Keywords: Haemoglobin, Plasma Protein, public health, nutrition, Adolescent.

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INTRODUCTION

According to the recent data of the World Health Organization (WHO), anemia is a common medical condition affecting almost 30% of the world population [1]. The WHO has defined anemia as hemoglobin (Hb) levels below 12.0 and 13.0 g/dL among females and males, respectively [2]. Although the prevalence is high across the globe, it has become a public health concern among developing nations and vulnerable populations such as children, young adolescents, pregnant, and lactating women [3,4]. The prevalence can be as high as 36.5%, and 39.8% among pregnant women of reproductive age and children aged 6–59 months, respectively. Various complications such as maternal mortality, perinatal mortality, early delivery, fatigue, decreased physical activity [5], low birth weight of the fetus, and poorer cognitive function were found to be linked with anemia [6].

The relationship between body mass index (BMI), a standard indicator for establishing adult nutrition, health, and anemia has been controversial [1]. Anaemia has been connected to low BMI in an Iranian study [7], while other research has shown that it occurs in both undernourished and overnourished adults from low and high socioeconomic levels [4,6,8,9]. Plasma protein plays an important part in a variety of body systems, activities, and disorders, including heart disease, cancer, sideroblastic anemia, neurological diseases, inflammation, and hemophagocytic syndrome [10,11]. Several other studies have also found a relationship between plasma protein and obesity, albeit the results have been mixed [12-14]. A study in South Korean teens found an inverse relationship between teenage ferritin levels in serum and obesity; therefore, the relationship between serum proteins and obesity remains unknown [15].

Anemia has been linked to lower BMI and plasma protein levels, and research has shown that it is more common among college students from developing countries [16]. This could be because most students from developing countries consume less protein, iron, folate, and other micronutrients needed for Hb synthesis and red blood cell development. Furthermore, students from developing countries are often ignorant of the symptoms of anemia and may have limited access to healthcare, which further complicates investigations and diagnosis [8].

Since anemia is more prevalent in developing countries and has been linked to inadequate nutrition, it is important to raise awareness of anemia, encourage students to get tested for anemia, and provide access to healthcare and nutrition services to reduce the prevalence of anemia among students.

Hence, present study was conducted to determine the prevalence of anemia among medical students and also to investigate its association with BMI and plasma proteins.

Objectives
The aim of the study was to determine the prevalence of anemia among medical students and also to investigate its association with BMI and plasma proteins.

METHODS

Study design
A cross-sectional study was conducted at MGM Medical College located in the Kolhan region of the state of Jharkhand, India, between September 2018 and July 2019.

Study population
The study population included Medical and Paramedical students at MGM Medical College, Jamshedpur.

Sample size determination
The formula used for the determination of sample size: $4PQ/L^2$

P=Prevalence in the percentage of the population= 60%

Q=100–P=100–60=40,

L=Level of Permissible Error=10%

Thus, $4PQ/L^2$=4×60×40/6X6=267 samples were obtained. One hundred and seventy-seven subjects were participated in this study.

Sampling technique
A simple random sampling technique was used. It provides equal opportunities for every person to be selected.

Data collection method
Research data were collected using questionnaires consisting of both open and close-ended questions. Questionnaires included personal history and dietary history of medical and paramedical students of MGM Medical College, Jamshedpur.

Batch, age, sex, weight, and height were taken for each student using the standard techniques of the WHO. Dietary history was included time of food intake (Breakfast, lunch, dinner, and any extra food taken).

Data collection procedure
Based on the inclusion criteria, participants were randomly selected and recruited for the study. On obtaining a signed consent from the participants, they were assigned a unique identification number and a structured questionnaire (11 items) was administered pertaining to the subject's demographic details, general health, and past 7 days' dietary history was recorded. On the 8th day, the questionnaire form filled out by the students was taken from them.

Laboratory investigations
On the 8th day, a 4-mL blood sample was collected in a sterile EDTA vial and it was centrifuged at 2000 rpm for 5 min to separate plasma. The plasma was separated in a separate vial under sterile conditions. The biuret method with an automated chemical analyzer (EM200 by Transasia) [17] was used to check for the presence of plasma protein. HemoCOR-D (cyanmethemoglobin) was used to quantify hemoglobin using a colorimetric measuring instrument.

Piloting the study
The structured questionnaire was pilot tested in 30 medical students and accordingly modified before final use. The data of pilot study were not included in the final study. The percentage prevalence of anemia in the pilot study was calculated as 60%. Following this, an estimate of the expected sample size 267 was obtained. The research questionnaire was approved by the local research advisory committee of ICMR, DHR, New Delhi with the proposal.

Quality control
The following metrics were used under quality control to ensure efficient, effective, and high-quality study findings.

Before conducting the study, the interviewers and all associated staffs received the proper training and orientation. In cases when the respondents had problems understanding the questions, the interviewer explained and clarified them for them. To improve the effectiveness of the study, the researcher additionally verified that the study tool was fully filled out. To prevent falsification of study results, the researcher also kept data in a safe and secure manner.

Inclusion criteria
All medial and paramedical students, aged between 18 and 21 years, were recruited.

Exclusion criteria
Those with any acute/chronic illness, pregnant participants, and not willing to give consent were excluded from the study.

Data analysis and presentation
Data were organized, cleaned up, and then entered into Epi-Info by CDC, Atlanta. Frequency, percentages, and figures and tables were used to analyze and show categorical variables.

Ethical consideration
The study was approved (IEC Approval No. MC/EC/02/18 dated June 04, 2018) by the Institutional Ethics Committee of MGM Medical College Jamshedpur, Jharkhand and Local Research Advisory Committee of DHR (ICMR) MoHFW, Government of India.

RESULTS

A total of 177 students participated in the study, of which 85(48%) were females and 92(52%) were males. The mean age of males and females was 20.03±0.99 and 20.16±0.937 years, respectively. Males were having higher Hb levels and protein with means of 13.61±1.43 and 7.77±0.93 as compared to females. The percentages of males and females having anemia were 15.4% and 70.9%, respectively. The mean BMI of males and females was 22.03±3.92 and 20.99±3.06, respectively. In the present study, the majority of the males and females were having normal BMI (Tables 1 and 2).

The association between anemic and non-anemic males with their BMI was found non-significant (p>0.05). Similarly, the relationship between

Table 1: Distribution of demographic variables of the patient

Variables	Males (Mean±SD)	Females (Mean±SD)
Age	20.03±0.99	20.16±0.937
Weight (Kg)	60.65±11.01	51.55±7.27
Height (cm)	166.07±9.11	156.89±6.78
BMI (Kg/m^2)	22.03±3.92	20.99±3.06
Hemoglobin (Male: 12–18 g/dL, Female: 12–16 g/dL)	13.61±1.43	11.32±1.67
Protein (6.0–8.0 g/dL)	7.77±0.93	7.68±0.62
Anemia	15.4%	70.9%

Table 2: Distribution of BMI as per sex

Variables	Males	Females
BMI (Kg/m^2)		
Underweight(<18.5)	16	18
Normal (18.5–22.9)	42	45
Overweight (23–24.9)	16	14
Pre-obese (25–29.9)	17	8
Obese (≥30) type 1	1	0

Table 3: Association between anemic males and females with their BMI

Gender	BMI				Chi-square p-value
	Under-weight (<18.5)	Normal (18.5–22.9)	Over-weight (23–24.9)	Pre-obese and obese (>25)	
Male					
Anemic (<13)	9	10	5	2	Normal BMI Vs. Others 0.524
Non-anemic(≥13)	7	32	11	16	
Female					
Anemic(<12)	13	32	9	7	Normal BMI Vs. Others 0.887
Non-anemic(≥12)	5	13	5	1	

Table 4: Association between anemic males and females with their plasma protein levels

Variables	Plasma protein		Chi-square p-value
	Normal (6–8)	Abnormal (<6 or>8)	
Gender			
Male			
Anemic (<13)	18	8	0.69
Non-anemic(> or=13)	41	25	
Female			
Anemic(<12)	49	12	0.07
Non-anemic(> or=12)	14	10	

Table 5: Association between protein intake with plasma protein level and BMI

Variables	Association	p-value
Protein intake versus Plasma Protein	0.149	0.048
Protein intake versus BMI	0.009	0.901
BMI versus Hemoglobin	0.172	0.022

anemic and non-anemic females with their BMI was also found non-significant (Table 3).

In the present study, a statistically significant relationship was found between anemic and non-anemic females with their plasma protein levels (p=0.07), whereas, the same relationship was found non-significant among males (Table 4).

This study found a statistically significant association between protein intake and plasma protein (p=0.048) and also for BMI and hemoglobin (p=0.022) (Table 5).

DISCUSSION

Anemia and under nutrition are the two global public health concerns affecting billions of people worldwide [18], but their prevalence is more among developing countries like India, Pakistan, and Bangladesh. According to the National Family Health report (NFHS-4) report (2017), the prevalence of anemia was 53% among Indian females and 23% among Indian males. They also discovered that 22.9% of females and 22.2% of males were malnourished. In the context of the country, Jharkhand has a high prevalence of both poor nutrition (31.5% of females and 23.8% of men) and anemia (65.2% of females and 29.9% of males) [19]. Jharkhand is more impacted by anemia and PEM than other states, due to cultural, social, and economic factors [20]. Jharkhand has also accepted the Government of India policy of "Anaemia Mukt Bharat" [20] to reduce the prevalence of anemia in the state. The present study was conducted among medical and paramedical students of Jharkhand to estimate the prevalence of anemia and its association with BMI and plasma protein.

This study discovered that a higher number of girls (70.9%) than males (15.4%) had anemia, which is consistent with practically all previous investigations. In prior research [21,22], the total prevalence of anaemia was determined to be 91.6% and 45.2%, respectively. Young girls are the most vulnerable to anemia, which increases with age and has an impact on the overall health of the female population. Anemia can decrease immunological function, increase infection risk, impair growth and intellectual development, and raise the risk of maternal and fetal mortality during pregnancy [23]. Anemia, according to one study [24], stops females from maturing physically, socially, and psychologically.

The current investigation discovered a statistically significant relationship between protein consumption and plasma protein (p=0.048). After absorption, dietary proteins are transformed into amino acids, which aid in the process of protein synthesis, which typically occurs in the liver. As a result, it is evident that the level of total plasma protein is affected by dietary protein intake. In a prior study, it was shown that daily protein intake and BMI were both positively connected with plasma protein (r=0.192) and Hb (p=0.05). Diet and health are inextricably linked in their impact on an individual's well-being. Previous research initially showed a link between obesity and iron insufficiency in 1962, discovering that the mean serum iron concentration in obese adolescents was considerably lower than in non-obese adolescents [25]. Since then, the relationship between these two entities has been a source of contention. A study conducted in Bangladesh discovered that 63.5% of girls had anemia and a decreased BMI [26]. Anemia and abnormal BMI are common in underdeveloped nations. This study found a statistically significant correlation between BMI and Hb (p=0.022).

A prior study found that 33% of students were underweight and 22.5% were anemic, indicating a positive relationship between anemia and BMI [21]. In another study of 619 women aged 20–49 years, iron deficiency was found in 23.5%, 41.9%, and 45.6% of women with normal weight, overweight, and obesity, respectively [27]. Another study discovered anemia in 53 pupils, 43.4% of whom were underweight, 22.6% of whom were normal weight, and 34.5% of whom were fat. In addition, they discovered a link between anemia and BMI [23].

Lower Hb levels in girls (82.4%) with a BMI of 18.5 or lower compared to greater BMI, and the difference was statistically significant [28]. In keeping with these findings, there was a significant connection between BMI and ferritin levels (p=0.001) [10,29,30]. A higher BMI has been linked to lower RBC counts as well as Hb levels. Erythropoietin, which promotes RBC production, has also been linked to weight loss [4,31-33]. Previous studies found a negative relationship between BMI and Hb (r=−1.24, p>0.05) [34]. Another study found no link between BMI and Hb level [7]. The current study discovered no statistically significant relationship between gender, BMI, and anemia. Ferritin levels in obese patients were not linked with gender in a similar study [29].

CONCLUSION

According to this survey, the prevalence of anemia is 15.4% for men and 70.9% for women. This study found a significant association between daily protein intake with plasma protein in medical students. The association between BMI and hemoglobin was also found significant.

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CONFLICTS OF INTEREST

In this study, the author reports no conflicts of interest. All procedures followed the Helsinki Declaration and its subsequent revisions.

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