

Original Article

Association of anemia with BMI in paramedical students of the remote and rural high land of Mid-Western Nepal

Bishal Pokhrel¹, Kirti Parajuli², Ramesh Nayak³, Dharma Datta Subedi⁴

Author's Affiliations

¹Associate Professor, Dept. of Community Medicine, Janaki Medical College, Nepal

²Research Assistant, National Institute for development and research, Nepal

³Assistant Professor, Dept. of Physiology, Janaki medical College, Nepal

⁴Professor, General Practice and Emergency Medicine, Janaki Medical College, Nepal

Correspondence to:

Dr. Bishal Pokhrel

Department of Community Medicine,
Janaki Medical College, Nepal

Email: drbishalp@gmail.com

ABSTRACT

Background and Objectives: Anemia is a widespread public health issue. It impairs immune systems and is linked to an increase in morbidity. Additional factors linked to lower hemoglobin (Hb) levels in adolescents include lack of awareness, low educational status, poor dietary practices, and unhealthy eating habits, low iron bioavailability of the diet, decreased physical activity, malaria, and parasite infestations. Studies on the incidence and severity of anemia among Nepali college students are extremely rare. The significance of research on the prevalence of anemia among college students cannot be underestimated. The study's objective was to evaluate the relationship between anemia and BMI in paramedical students from the isolated, rural highlands of Midwestern Nepal.

Materials and Methods: A quantitative cross-sectional study was conducted among the paramedical students of KAHS. A total of 96 students from paramedical students were participated in this study. Before collecting the data, the consent was taken from

students. Data were collected from a semi-structured questionnaire and analyze by using SPSS software (20.0 Version). A chi square test was used to show the relationship between demographic variables and anemia.

Results: The prevalence of anemia was 20.8% (male=6.1% and female=53.3%) among the 96 students. There was no significant association between anemia and BMI ($P>0.05$).

Conclusion: The anemic status of students was significantly associated with gender but BMI and age where not the factors of anemic status in this Therefore, there should be adequate diet and nutritional status needs to be emphasized for paramedical students who are well educated and well oriented about nutrition and its ill effect on health.

Keywords- Anemia, BMI, KAHS

INTRODUCTION

'Anemia' refers to low hemoglobin level or less number of red blood cells [1]. It is one of the most common nutritional disorders and it has public health importance in developing countries like Nepal [2,3]. Globally, anemia is a public health problem affecting people in both developed and developing countries with bad consequences of human health as well as social and economic development [4,5].

Anemia is a critical health concern because it affects growth and energy levels adversely. It damages immune mechanisms and is also

associated with increased morbidity. It occurs at all age groups, but is more prevalent in pregnant women and children [4,6]. Especially, young children from low income families have a higher risk for developing anemia due to iron deficiency that occurs as a result of high demand for iron during the period of rapid growth [7]. Globally, anemia affects 1.62 billion (24.8%) of the population and an estimated 36% of developing world's population suffers from this disease. Anemia is known to be a significant global problem affecting 305 million (25.4%) school age children (SAC) [5].

In developing countries, the prevalence of anemia among school age children is 40%, and it is classified as severe public health problem [7]. Lack of awareness, low educational status, poor nutritional practices and unhealthy food habits, low iron bioavailability of the diet, decreased physical activities, malaria and parasitic infestations are additional factors associated with lower hemoglobin (Hb) level in children so, hemoglobin concentration is an important diagnostic indicator for the wellbeing of an individual [8,9,10].

Although anemia remains a widespread public health problem in most developing countries, and even developed countries, there are very few studies on the prevalence and severity of anemia among school age children as well as college students in Nepal. Because of its impact on cognitive development and physical growth, studies on the magnitude of anemia among college students have paramount importance. Therefore, the main aim of the present study

was to determine the prevalence and severity of anemia on college students.

MATERIAL AND METHODS

A purposively descriptive cross-sectional study and was conducted in paramedical students of KAHS. A total of 96 students of Batch 3, 4 and 5 were participated in the study. Those students who give us the permission to carry out this study were included. Data were collected from a semi-structured questionnaire and analyze by using SPSS software (20.0 Version). Chi square test was used to establish the association between the categorical variables. P value 0.05 was fixed as for statistical significance.

Study Area: The study was conducted in PCL General Medicine (HA) students of KAHS, Jumla.

Study Design: Descriptive cross-sectional study was adopted.

Study Population: Study populations were General Medicine (HA) students of KAHS, Jumla.

Sample Size: A total of 96 students from KAHS were participated in the study. Those students who give us the permission to carry out this study were included only.

Sampling Technique: General Medicine (HA) was chosen purposively. Numbers of the participants were chosen purposively through college attendance register.

Inclusion Criteria: Students who study in paramedical students during research period.

Exclusion Criteria: Those who do not give informed consent.

Experimental procedure:

For Anemia:

Method: Sahli's (Acid Haematin) Method

Principle: Blood was added to 0.1 N hydrochloric acid hemoglobin is converted to brown color acid hematin. The resulting color after dilution is compared with standard brown reference blocks of Sahli's haemoglobinometer.

Specimen: Capillary blood thoroughly mixed with anti-coagulated (EDTA or double oxalated) venous blood.

Requirements: Standard brown glass mounted on comparator, Graduated tube, Hb% pipe He (0.02ml), 0.1 N hydrochloric acid, Distilled water and Pasteur pipette.

Procedure:

- a. Using a pasture pipette add 0.1 N hydrochloric acid in the tube up to lowest mark (20% mark).
- b. Draw blood up to 20 ml mark in HD pipette. Adjust the colour, carefully without bubbles wipe excess of the blood on the slide of the pipette by using a dry piece of cotton.
- c. Transferring blood to acid in the graduated tube, use the pipette well, mix the reaction mixture and allow the tube to stand for at least 10 minutes.
- d. Dilute the solution with distilled water by adding few drops at time carefully and by mixing the reaction

mixture, until the color matches with the glass plate in comparator.

- e. The matching should be done only against natural light. The level of fluid noted its lower meniscus and the reading corresponding to level on the scale is recorded in g/dl.

Anemia was defined as Hb < 12 g/dl. Severe anemia < 7 g/dl, Moderate anemia 7-9.9 g/dl and mild anemia 10-11.9 g/dl respectively. Normal values Men 13-18g/dl, Women 12-16.5 g/dl, Children (up to 1 years) 11-13 g/dl, Children (up to 12 years) 11.5-14.5 g/dl and Infants (full term cord blood) 13-19.5 g/dl [11].

For BMI:

Height was taken with the help of measuring tape to the nearest 0.1 cm. The weight was recorded to the nearest 0.5 kg using portable weighing machine and wearing minimum clothing. Body mass index (BMI) was calculated by using the standard formula $BMI = \text{weight (in kg)} / \text{height}^2 \text{ (in meters)}$.

BMI is age and sex independent and a known epidemiology marker of nutritional status of adolescents. International obesity task force (IOTF-2000) has proposed the standard for adult's obesity in Asia and India as follows: A cut off point of less than 18.5 kg/m² is used to define underweight, 18.50 to 24.99 normal, more 25.00 to 29.99 pre-obese and more than 30.00 obese [12].

RESULTS

Out of 96 students participated most of the study students fall less than 21 years in which male student were high. Out of 96 students,

20 students were anemic, among these anemic students 6.1% were males and 53.3% were females. The proportion of anemia among the gender was significantly different ($p < 0.05$).

The chance of having anemia is more in female than the male. Out of 20 anemic students both male and female were equally suffering from mildly anemic and moderately anemic 75% and 25% respectively ($p = 1$). (Table 1, 2, 3 and 4)

Table 1: Age wise distribution of the students

Age	Number	Percentage (%)
19	14	14.6%
20	25	26.0%
21	31	32.3%
22	20	20.8%
23	05	5.3%
24	01	1.0%
Total	96	100 %

Table 2: Gender wise distribution of the students

Gender	Number	Percentage (%)
Male	66	68.75%
Female	30	31.25%
Total	96	100%

Table 3: Gender wise distribution of anemia

Anemia	Male (%)	Female (%)	Total (%)	P Value
Present	04 (6.1%)	16 (53.3%)	20 (20.9%)	<0.01
Absent	62 (93.9%)	14 (46.7%)	76 (79.16%)	
Total	66 (100%)	30 (100%)	96 (100%)	

Table: 4 Severity of anemia among the students (n=20)

Severity of anemia	Male (%)	Female (%)	Total (%)	P Value
Mild	03 (75%)	12 (75%)	15 (75%)	1
Moderate	01 (25%)	04 (25%)	05 (25%)	
Severe	00 (0%)	00 (0%)	00 (0%)	
Total	04 (100%)	16 (100%)	20 (100%)	

Table: 5 Distribution of BMI among the students.

BMI	Number	Percentage (%)
Under weight	19	19.8%
Normal weight	69	71.9%
Pre-obese	08	8.3%
Obese	00	0.0%
Total	96	100%

Among the 96 students, one fifth of the students (19.8%) were under weight and a very few (8.3%) were pre obese. A chi square test was applied to show the relationship between BMI and gender of the students, it was found that there was no significant relationship ($P > 0.05$).

Similarly the age and anemic status of the students were found to be insignificant association with BMI ($P > 0.05$) (Table 5, 6, 7 and 8).

Table: 6 Relationship of BMI with gender of the students.

BMI	Male	Female	Frequency	P-value
Under weight	13 (19.7%)	6 (20.0%)	19 (19.8%)	0.478
Normal weight	49 (74.2%)	20 (66.7%)	69 (71.9%)	
Pre-obese	04 (6.1%)	04 (13.3%)	08 (8.3%)	
Obese	00 (0.0%)	00 (0.0%)	00 (0.0%)	
Total	66 (100%)	30 (100%)	96 (100%)	

DISCUSSION

Anemia though global, is more of concerned in the developing countries due to high prevalence. Unfortunately, it is not restricted to rural and low socio economic status adolescents which shows increase prevalence which affluent societies [13].

In the present study anemia was found in 20% of students out of which prevalence of anemia was higher among female 53.3% than male 6.1%. Similarly Gargade et al. found prevalence of anemia (29%) among medical students of whom more common among females (45%) than in males (5%) [14].

Pandey et al found prevalence of anemia

Table: 7 Relationship of BMI with age of the students.

Age	BMI					P-value
	Under weight	Normal weight	Pre-obese	Obese	Total	
<20 years	02 (14.3%)	12 (85.7%)	00 (0.0%)	00 (0.0%)	14 (100%)	0.358
>20 years	17 (20.7%)	57 (69.5%)	08 (9.8%)	00 (0.0%)	82 (100%)	

Table: 8 Relationship of anemia with BMI of the students.

Anemia	BMI					P-value
	Under weight	Normal weight	Pre-obese	Obese	Total	
Present	03 (15%)	15 (75%)	02 (10%)	00 (0.0%)	20 (100%)	0.862
Absent	18 (23.0%)	53 (70%)	05 (7%)	00 (0.0%)	76 (100%)	

30.20% among medical students out of which

prevalence of anemia was higher among female medical students (47.37%) than males (18.96%) [15]. Bano et al found 32% prevalence among medical students while prevalence of anemia among female was 44% while in males 20% [16]. Kalyanshetti et al found it to be 25.5% [17]. Kaur found prevalence of anemia among undergraduate students was 35%, more prevalent among girls (44.8%) than the boys (17.6%) and was statistically significant ($p=0.000$) [18]. Pal et al found prevalence of anemia among adults 57.23% more prevalent among females (66.87%) than males (46.62%) [19].

Metha found prevalence of anemia among students was 70.83% more prevalent among females (74.47%) than males (35.71%) [20]. Debbarma et al found prevalence of anemia among medical students (26.62%) more prevalent among females (50.00%) than males (6.67%) [21]. Saxena et al found prevalence of anemia among medical students was 8% more prevalent among females (17%) than males (00%) [10]. Sah et al found higher prevalence of anemia among females (11.1%) as compared to males (3.1%) [22]. Agrawal et al found higher prevalence of anemia among females (65.11%) [23]. Kalyanshetti et al found prevalence of anemia among females was 59% while in contrast Verma et al find prevalence of anemia among young females 29.32% and in males it was 19.53% in 20-29 years age group [17,24]. Sah et al found prevalence of anemia among females to be 21.77% [15].

In the present study, prevalence of anemia among normal weight (75%) followed by underweight (15%) in pre-obese (10%) while non among obese (0.0%). Gargade et al found similar finding of higher prevalence of anemia among normal weight (55.2%), in underweight (27.6%), in overweight (13.6%) in obese (3.4%) [14]. While Metha found anemia more prevalent among underweight students (63.33%) and overweight students (0.83%) have less prevalence of anemia while in normal weight student's prevalence of anemia was 6.67%.²⁰ Pandey et al found prevalence of anemia among underweight (60%), normal weight (27.5%) overweight (12.5%) [15].

Gupta et al found higher prevalence of anemia among underweight (91.4%) in normal weight (83.6%) and in overweight (73.3%) [25]. Pal et al found higher prevalence among underweight males (62.5%), females (80.65%), among normal weight males (45.98%) females (62.67%) and overweight/obese males (19.05%) females (25.0%) [19]. Waseem et al found anemia in underweight (44.9%), in normal weight (23.67%) while in overweight it was (10%) [26]. Sinha et al found prevalence of anemia among undernourished women (76.06%) than normal weight (75.28%) in overweight women (66.67%) means negative correlation between anemia and BMI [27].

CONCLUSION

In our study, we have found that anemia is more common in female students as compared to male students as well as severity of anemia are also high among female students. The BMI of female students,

underweight is equal to male students but pre obese is high among the female students than male students. Therefore, the role of adequate diet and nutritional status needs to be emphasized for students particularly to reduce preexisting anemia. These recommendations would hold true in developing countries such as Nepal where poor mountain students generally do not seek nutritional care. The causes of anemia need to be study further. However, in the meantime, it is recommended that all students should receive basic nutrition education regarding food sources of iron and how food choices affect iron absorption.

ACKNOWLEDGEMENTS

I am grateful to the general medicine students and laboratory staff of KAHS.

Conflict of interest: None

Funding: None

Author's Contribution: All the Authors equally contributed.

REFERENCES

- Guyton AC, Hall JE. Red blood cells, anaemia and Polycythemia. In: Textbook of medical physiology. 11th ed. Philadelphia: Elsevier; 2006:426.
- Kalaivani K. Prevalence & consequences of anaemia in pregnancy. Indian J Med Res 2009;130(5):627-33.
- DeMaeyer E, Adiels-Tegman M. The prevalence of anaemia in the world. World Health Stat Quarterly 1985;38(3):302-16.
- World Health Organization: The World Health Report 2002: Reducing risks, promoting healthy life. Geneva: World Health Organization 2002; 49-93.
- Benoist B, McLean E, Cogswell M, Egli I, Wojdyla D: Worldwide prevalence of anemia 1993-2005. World Health Organization Global Database on Anemia. Geneva: World Health Organization; 2008;7-13.
- United Nations Children's Fund/United Nations University/WHO: Iron deficiency anaemia. Assessment, prevention and control. A guide for programme managers (WHO/NHD/01.3). Geneva: World Health Organization; 2001;15-31.
- United Nations, ACC/SCN: Controlling Iron Deficiency. Nutrition Policy Discussion. 9th edition. New York: United Nations; 1991;71.
- Alaofè H, Zee J, Dossa R, O'Brien HT: Education and improved iron intakes for treatment of mild iron-deficiency anemia in adolescent girls in southern Benin. Food Nutr Bull 2009; 30:24-36.
- Kikafunda JK, Lukwago FB, Turyashemerwa F: Anemia and associated factors among under-fives and their mothers in Bushenyi district, western Uganda. Public Health Nutr 2009; 12:2302-2308.
- Hashizume M, Shimoda T, Sasaki S, Kunii O, Caypil W, Dauletbaev D, et al: Anemia in relation to low bioavailability of dietary iron among schoolaged children in the Aral Sea region, Kazakhstan. Int J Food Sci Nutr 2004; 55:37-43.
- International Institute of Population Sciences and ORC Macro. National Family Health Survey - III. International Institute of Population Sciences, Mumbai, 2005-06.
- WHO / IASO/ IOTF. The Asia Pacific Perspective: Re defying Obesity and its treatment. Health Communications Australia Pvt. Ltd. 2000.
- Hallbrg L, Hulten L, Lindstedt G, Lundber PA, Mark A. Prevalence of iron deficiency in Sweden adolescents. Pediatr Res 1993;34:680.
- Gardage CB, Patil SN. Prevalence of Anaemia in First MBBS Students in a Rural Medical College. J Evolution Med Dent Sci 2016;5(25):1329-31.
- Pandey S. Singh A. A Cross Sectional Study of Nutritional Anaemia among medical Students

- in a Medical College at Bilaspur Chhattisgarh. National J Medical Res 2013;3(2):143-6.
16. Bano R, Ahmad N, Sharma BC, Agarwal A. Nutritional Anaemia in the Medical Students. Indian Med Gazette 2012; 16-18.
 17. Kalyanshetti SB, Kallur R. Association of anaemia with BMI in medical students, a cross sectional study. Indian J Basic Applied Med Res 2016;6(1):188-94.
 18. Kaur M. Relationship and Distribution of ABO, Rh Blood Groups and Haemoglobin concentration among the adolescents. J Phys Pharm Adv 2015;5(9):703-12.
 19. Pal A, De S, Sengupta P, Maity P, Dhara PC. An investigation on prevalence of Anaemia in relation to BMI and nutrient intake among adult rural population of West Bengal, India. Epidemiol Biostat Public Health 2014;11(2):8915-1-10.
 20. Metha K. Prevalence of Nutritional Anamia among College Students and its Correlation with their Body Mass Index. Int J Sci Res 2015;4(3):1882-6.
 21. Debbarma R, Paul P, Debbarma B, Sutnga T, Loukakpam B. Anaemia among Medical Students of Regional Institute of Medical Sciences (RIMS), Imphal. Sch J App Med Sci 2016;4(10):3744-8.
 22. Sah JP, Pant DR, Shrestha V, Tiwari BR, Jaiswal S. Distribution of ABO, Rhesus Blood Groups and Haemoglobin concentration. Among the School Students of Deurali V.D.C., Kaski, Nepal. Int J Pharmacy Biolog Sci 2013;3(4):10-16.
 23. Agarwal AK, Joshi HS, Mahmood SE, Singh A, Sharma M. epidemiological profile of anaemia among rural school going adolescent of district Bareilly, India. National J Community Med 2015;6(4):504-7.
 24. Verma P, Singh S, Ghildiyal A, Kumar A, Krishna A. Prevalence of Anaemia in adults with respect to socio-demographic status, blood groups and religion in north Indian population. Int J Biol Med Res 2012; 3(4):2422-8.
 25. Gupta VK, Maria AK, Kumar R, Bahia JS, Arora S. To Study the Prevalence of Anaemia in Young Males and Females with respect to Age, Body Mass Index (BMI), Activity Profile and the Socioeconomic Status in Rural Punjab. J Clin Diagnos Res 2011;5(5):1020-6.
 26. Waseem SMA, Bano R, Ahmad N, Kumar J, Khan A. Study of haematological profile and body mass index in undergraduate medical students in Lucknow, Uttar Pradesh, Int J Health Sci Res 2015;5(6):257-62.
 27. Sinha NK, Haldar JP. Correlation \Between Haemoglobin Level and Anthropometric Variables: A Study on Women of Reproductive Age Group, West Bengal. Anthropologist 2015;19(1):185-95.