

# A Study on Prevalence of Anemia among Female Medical Students of Kerala

A Sheena<sup>1</sup>, Riyaz Sheriff<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Physiology, Azeezia Institute of Medical Sciences and Research, Kollam, Kerala, India, <sup>2</sup>Professor, Department of Microbiology, Azeezia Institute of Medical Sciences and Research, Kollam, Kerala, India

## Abstract

**Introduction:** Iron deficiency anemia is one of the most common nutritional disorders in women and children. The prevalence of anemia in India ranges from 19.13% to 52.5%. The risk factors include low socioeconomic status, menstruation, nutritional status, hand hygiene, and worm infestations. Untreated anemia can lead to morbidities including delayed menarche, increase in infections, low birth weight, increase in infant mortality rate, and maternal mortality rate. This study aims at understanding the prevalence of anemia among female medical students of Kerala.

**Materials and Methods:** Participants were included following the inclusion and exclusion criteria. Body mass index (BMI) was calculated as the WHO guidelines after recording the height and weight of the candidates. The hemoglobin was estimated using Sahli's acid hematin method and correlated with the BMI of the students.

**Results:** Seventy-eight female students participated in the study out of which 19 were underweight, 51 had normal BMI, and eight were in obesity category. Forty-four students had hemoglobin above 13 g/dL. Among the 19 students who were underweight, six were found to be anemic and among the students with normal BMI, 26 were found to be anemic. The prevalence of anemia among the underweight category was 56.25% and in students with normal BMI, 51% were found to be anemic.

**Conclusion:** The reason for students developing anemia is related to improper knowledge, attitude, and practice toward dietary habits, menstrual irregularities, and possibly occult parasitic infestations. It is essential that appropriate preventive measures such as health education, lifestyle modification, education about nutrition, and nutritional supplementation be carried out to reduce short-term and long-term morbidities among female undergraduate medical students.

**Key words:** Anemia, Body mass index, Female gender, Hemoglobin, Iron deficiency anemia, Sahli's acid hematin method

## INTRODUCTION

Anemia is one of the most common nutritional disorders in women and children. As per the recent WHO estimates, 29.9% of women in the age group of 15–49 years are anemic world wide and 39.8% children until the age of 10 years is anemic.<sup>[1]</sup> The most common reason for anemia worldwide is the iron deficiency anemia. The normal hemoglobin percentage in males is 13 g/dL and females is 12 g/dL. The anemia is classified based on the hemoglobin percentage as mild (Males: 11.0–12.9 g/dL

and females: 11.0–11.9 g/dL), moderate (8.0–10.9 g/dL in both genders), and severe (<8.0 g/dL in both genders).<sup>[2,3]</sup> Studies have been conducted in different regions of India showing the prevalence of anemia was 52.5% in Madhya Pradesh, 37% in Gujarat, 41.1% in Karnataka, 85.4% in Maharashtra, 21.5% in Shimla, 56.3% in Uttar Pradesh, 77.33% in Andhra Pradesh, 58.4% in Tamil Nadu, and 19.13% among college students in Kerala.<sup>[4-12]</sup> The major risk factors identified from literature include low socioeconomic status, blood loss during menstruation, nutritional status, hand hygiene, and worm infestation. In India, helminthic infestation is very common which can lead to chronic blood loss which, in turn, results in anemia.<sup>[13]</sup> Anemia if left untreated can lead to various adverse effects. As per the documented literature physiologically it can cause delay in onset of menarche and increase in incidence of infections due to impairment in immune system. If the anemia is ignored on a long term and in the event of pregnancy may

Access this article online



www.ijss-sn.com

**Month of Submission :** 01-2023  
**Month of Peer Review :** 02-2023  
**Month of Acceptance :** 02-2023  
**Month of Publishing :** 03-2023

**Corresponding Author:** Dr. Riyaz Sheriff, Professor, Department of Microbiology, Azeezia Institute of Medical Sciences and Research, Kollam, Kerala, India.

lead to increased incidence of low birth weight, increase in infant mortality rate, and maternal mortality rate.<sup>[14]</sup>

Medical students on the other hand with better knowledge about nutrition and access to healthcare would be expected to have better health indices but in practice it is noticed that many students especially female students are seen to have varying grades of anemia. The studies done for detection of anemia exclusively in female medical students suggest that around 19.13–35.1% of them suffer from varying degrees of anemia. The reasons attributable to this include poor eating habits, meal skipping, snacking, increasing fast food consumption among medical students added to the long schedules of studying, and family adoption visits and early clinical exposure postings of the new curriculum-based medical education prescribed by the National Medical Commission.<sup>[12,15-17]</sup>

### Hemoglobin and its Methods of Estimation

The hemoglobin molecule is a tetramer consisting of two pairs of similar polypeptide chains called globin chains. To each of the four chains is attached heme which is a complex of iron in ferrous form and protoporphyrin. The major (96%) type of hemoglobin present in adults is called HbA and it has 2 alpha-globin chains and two beta-globin chains ( $\alpha_2\beta_2$ ). The gene that codes for the formation of  $\alpha$ -globin chains is located on chromosome 16 and that which codes for the formation of  $\beta$ -globin chains is on chromosome 11. In adults, a minor amount of HbA2 ( $\alpha_2\beta_2$ ) is also present and constitutes <3.5%. Various methods are available for estimation of hemoglobin in the laboratory. Most commonly used methods are based on development of color. These include Sahli's acid hematin method, cyanmethemoglobin method, oxyhaemoglobin method, and alkaline hematin method. Among these methods, the common ones are Sahli's acid hematin method and cyanmethemoglobin method. Sahli's acid hematin method uses the simple principle wherein blood is mixed with N/10 HCl resulting in the conversion of Hb to acid hematin which is brown in color. The solution is diluted until its color matches with the brown colored glass of the comparator box and concentration of Hb is read directly.<sup>[18]</sup> Cyanmethemoglobin method is the internationally recommended method for determining hemoglobin. Here, the blood is diluted in a solution containing potassium cyanide and potassium ferricyanide. Potassium ferricyanide converts Hb to methaemoglobin which is converted to cyanmethemoglobin (HiCN) by potassium cyanide. The absorbance of the solution is, then, measured in a spectrophotometer at a wavelength of 540 nm or in a colorimeter using a yellow green filter.<sup>[19]</sup> Oxyhaemoglobin method converts Hb to oxyhaemoglobin by reaction with ammonia and the color of the solution is measured in a photocolormeter. Finally, the Alkaline

hematin method where blood is converted to alkaline hematin by addition of alkali such as sodium hydroxide and the color measured in a colorimeter at 540 nm.<sup>[20]</sup> Among these methods, we selected the Sahli's acid hematin method as it is easy to perform, quick, and inexpensive, can be used as a bedside procedure and can be done by students under supervision as it does not require technical expertise.

## MATERIALS AND METHODS

The study was conducted in Azeezia Institute of Medical Sciences and Research, Kollam district of Kerala state between March 2022 and September 2022 among the female undergraduate Medical students belonging to 2021 batch all above the age of 18 years. Candidates with history of anemia and other comorbid diseases such as hypothyroidism, chronic renal diseases, bleeding disorders, known cardiac ailments, hypertension, hyperthyroidism, and surgery in the recent past were excluded from the study. The weight in kg was measured using a standard digital weighing scale with Krups weighing machine wearing light clothes and without shoes. The machine was calibrated to nearest 0.1 kg. The height in centimeters using stadiometer was recorded. Subjects were asked to stand in Frankfurt plane position. Body mass index (BMI) was calculated as weight in kilogram divided by the square of the height in meters. BMI <18.5 kg/m<sup>2</sup> is categorized as underweight, between 18.5 and 24.9 kg/m<sup>2</sup> as normal, 25.0–29.9 kg/m<sup>2</sup> as pre-obesity, 30.0–34.9 kg/m<sup>2</sup> as obesity class I, 35.0–39.9 kg/m<sup>2</sup> as obesity class II, and more than 40 kg/m<sup>2</sup> as obesity class III or morbid obesity. The students were demonstrated on the method of hemoglobin estimation using Sahli's acid hematin method and were allowed to perform the test under supervision. Blood was collected using aseptic finger prick method. N/10 HCl was taken into the graduated hemoglobin tube up to mark 2 g%. 20  $\mu$ L blood was collected in hemoglobin pipette under aseptic precautions without air bubbles. Tip of pipette was wiped off to avoid blood adhering to it. Blood was transferred immediately to N/10 HCl in hemoglobinometer tube. Pipette was rinsed several times by drawing N/10 HCl without foaming. After mixing the contents were left undisturbed for 10 min. The maximum conversion of hemoglobin to acid hematin occurs now and gives a brown color to the mixture. Then, distilled water was added to dilute the acid hematin and continuously mixed with stirrer until the color matched the standards in the comparator. Reading was taken at eye level under natural day light after lifting the stirrer up and the reading was recorded in g/dL. The anemia is classified based on the hemoglobin percentage as mild in males with hemoglobin of 11.0–12.9 g/dL and in females when the reading is between 11.0 and 11.9 g/dL. Moderate anemia

was when the hemoglobin levels were between 8.0 and 10.9 g/dL and severe anemia when the hemoglobin was <8.0 g/dL. The results were analyzed on Microsoft Excel and Chi-square tests. Students with mild anemia were given dietary counseling after getting a detailed history on socioeconomic status, dietary habits, menstrual history, and history of passing worms. Students with moderate and severe anemia were counseled and advised medicine consultation for work up and pharmacotherapy of anemia.

## RESULTS

A total of 78 female students participated in this study. As per our protocol, height and weight of all students were measured as described earlier. Out of the 78 students, 19 students were found to be underweight. Fifty-one students were having normal BMI and eight students were found to be in the pre-obesity category as per the recent WHO criteria. Out of the 78 students, 44 were having a hemoglobin of more than 13 g/dL. Thirty-four students were observed to have anemia of varying degrees. Among the 19 students who were underweight, six students were found to be anemic. Four students had mild anemia with hemoglobin values ranging from 11.0 to 11.9 g/dL and two students had moderate anemia ranging between 8.0 and 10.9 g/dL. Among the students with normal BMI, 26 students were found to be anemic. Twenty students had mild anemia, followed by five students having moderate anemia and one student having severe anemia. Among the pre-obesity students, two students who were found to be anemic had severe anemia. The prevalence of anemia in this group of undergraduate female medical students was 43.5%. Among the underweight students the prevalence of anaemia was found to be 56.25%. Among the students with normal BMI, 51% were anemic and in the students with pre-obesity, 25% were severely anemic.

## DISCUSSION

Anemia is one of the most common nutritional deficiencies found in developing countries. Iron deficiency anemia is the most common type of anemia in India. This anemia is more among the female gender especially in the reproductive age group. The incidence of anemia among the female undergraduate medical students in this study was 43.5% and about 70% of students had mild anemia. Most of the students belong to the middle class and upper middle class socioeconomic class as per the modified Kuppaswamy socioeconomic status scale for the year 2022<sup>[21]</sup> and, hence, poverty cannot be ascertained as a cause for anemia in these students. The mean hemoglobin percentage was 11.9 g/dL and the mean BMI was 20.8.

In this study, Sahli's acid hematin method was used as it is easy to perform, quick, and inexpensive, can be used as a bedside procedure, and does not require technical expertise and even students can be easily trained. This method has certain disadvantages as well. It is less accurate compared to cyanmethemoglobin method. All hemoglobins (oxyhaemoglobin and sulfhemoglobin) are not converted to acid-hematin, and hence, the value of hemoglobin obtained is less than the actual value. The color of acid hematin develops slowly. Color of acid hematin fades with time and dilution must be done exactly after 10 min when the color development is maximum. Individual variation in matching of color is seen. If the matching point is passed, the whole procedure has to be repeated. Color of glass in the comparator box tends to fade with time.

The medical students of the current generation are following the new Competency Based Medical Education introduced by the erstwhile Medical Council of India. As the socioeconomic status does not play a considerable role in causation of anemia, we started looking at other factors leading to anemia. Few students had given history of menstrual irregularities in the discussion after performing the hemoglobin estimation. On further discussions on the dietary intake, it was seen that many students were skipping breakfast, increased snacking, and fast-food consumption. The present study showed that the prevalence of anemia among undergraduate female medical students was 43.5%. It is essential that appropriate preventive interventions such as health education, lifestyle modification, and nutrition supplementation be carried out in this population so as to reduce the morbidity of anemia and its complications in high-risk settings.

## CONCLUSION

Female Students in the medical Profession are not exempt from suffering nutritional disorders like anaemia. This is attributable to change in dietary pattern, lifestyle and increase in intake of fast foods among college going children. Adding to the woes is the prevalence of menstrual irregularities among students in this age group. The need of the hour for prevention of anaemia is regular counselling on good dietary habits and menstrual health. These simple steps will go a long way in preventing short term and long-term complications related with iron deficiency anaemia.

### Limitations

The sample size was limited and the exact estimate can be obtained using a larger sample size.

## REFERENCES

1. World Health Organization. Anaemia in Women and Children, WHO Global Estimates. Geneva: World Health Organization; 2021. Available from:

- <https://www.who.int/data/gho/data/themes/topics/anaemia-in-women-and-children> [Last accessed on 2022 Oct 24].
- World Health Organization. Nutritional Anaemias: Report of a WHO Scientific Group. Geneva: World Health Organization; 1968. Available from: <https://apps.who.int/iris/handle/10665/40707>
  - Preventing and Controlling Anaemia Through Primary Health Care: A Guide for Health Administrators and Programme Managers. Geneva: World Health Organization; 1989. Available from: <https://apps.who.int/iris/handle/10665/39849>
  - Raj A, Chopra AK. A study showing correlation between anaemia and common parasitological diseases among adolescent girls in villages of PHC Belkhera, Madhya Pradesh, India. *Int J Community Med Public Health* 2016;3:373-9.
  - Aishwarya MV, Gajjar DP, Raykundaliya RS, Patel VH, Neeta D. Prevalence of anaemia and epidemiological correlates among school going adolescent boys of Vallabh Vidyanagar (Gujarat). *Indian J Community Med* 2015;2:522-5.
  - Biradar SS, Biradar SP, Alalagi AC, Wantamutte AS, Malur PR. Prevalence of anaemia among adolescent girls: A one year cross-sectional study. *J Clin Diagn Res* 2012;6:372-77.
  - Patil SV, Durgawale PM, Kakade SV, Dighe S. An Assessment of Interventional Strategies for Control of Anemia among Adolescent Girls in an Urban Slum of Karad, Dist. Satara, Maharashtra. 2014. Available from: [https://www.trafficlight.bitdefender.com/info?url=http%3A//ajms.alameenmedical.org/ArticlePDFs/5%2520AJMS%2520V7.N3.2014%2520p%2520195-200.pdf&language=en\\_US](https://www.trafficlight.bitdefender.com/info?url=http%3A//ajms.alameenmedical.org/ArticlePDFs/5%2520AJMS%2520V7.N3.2014%2520p%2520195-200.pdf&language=en_US) [Last accessed on 2016 Jun 09].
  - Gupta A, Parashar A, Sharma D, Thakur A. Anemia among adolescent girls in Shimla hills of North India: Does BMI and onset of menarche have a role? *Indian J Med Sci* 2012;66:126-30.
  - Sachan B, Idris MZ, Singh A. Effect of socio-demographic characteristics on the prevalence of anaemia among school going adolescent girls in Lucknow district, India. *South East Asia J Public Health* 2013;2:8-12.
  - Koushik NK, Bollu M, Ramarao NV, Nirojini PS, Nadendla RR. Prevalence of anaemia among the adolescent girls: A three months cross-sectional study. *Women* 2014;14:12.
  - Devi R, Jaysree TM, Felix AJ, Ethirajan N. Prevalence of anaemia among children age 10 to 15 years in urban, Chidambaram. *J Drug Discov Ther* 2014;2:67-70.
  - Manjula VD, Parameshwari P, Pothen L, Sobha A. Prevalence of anemia among female undergraduate students of government medical college Kottayam, Kerala. *Int J Med Health Sci* 2014;3:133-8.
  - Siva PM, Sobha A, Manjula VD. Prevalence of anaemia and its associated risk factors among adolescent girls of central Kerala. *J Clin Diagn Res* 2016;10:LC19-23.
  - World Health Organization. Prevention of Iron Deficiency Anaemia in Adolescents: Role of Weekly Iron and Folic Acid Supplementation. Switzerland: World Health Organization, Regional Office for South-East Asia; 2011.
  - Chaudhary SM, Dhage VR. A study of anaemia among adolescent females in the Urban area of Nagpur. *Indian J Community Med* 2008;33:243-5.
  - Merline JA, Linu D, Swornila P, Kumari PL. Prevalence of anaemia among female medical students. *Int J Sci Res* 2017;6:174-6.
  - Kannan B, Ivan EA. Prevalence of anaemia among female medical students and its correlation with menstrual abnormalities and nutritional habits. *Int J Reprod Contracept Obstet Gynecol* 2017;6:2241-5.
  - Nasreen S, Syeda UN, Unnisa N. Estimation of hemoglobin for screening of anaemia in undergraduate students in Hyderabad city, India. *Int J Community Med Public Health* 2020;7:3137-41.
  - Nkrumah B, Nguah SB, Sarpong N, Dekker D, Idriss A, May J. Hemoglobin estimation by the HemoCue portable hemoglobin photometer in a resource poor setting. *BMC Clin Pathol* 2011;11:5.
  - Chakravarthy VK, Chandra DN, Prasanna BS, Rao TJ, Rao DR. Haemoglobin estimation by non-cyanide methods. *J Clin Diagn Res* 2012;6:955-8.
  - Gunjan K, Dash P, Patnaik J, Pany G. Socioeconomic status scale-modified Kuppusswamy Scale for the year 2022. *Int J Community Dent* 2022;10:1-6.

**How to cite this article:** Sheena A, Sheriff R. A Study on Prevalence of Anemia among Female Medical Students of Kerala. *Int J Sci Stud* 2023;10(12):26-29.

**Source of Support:** Nil, **Conflicts of Interest:** None declared.