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Research Article

HEMOGLOBIN STATUS OF FEMALE MEDICOS IN URBAN AREA AND FACTORS AFFECTING IT: AN OBSERVATIONAL CROSS-SECTIONAL STUDY

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ABSTRACT

Objectives: Estimating the hemoglobin (Hb) status in female medicos through prospective cross-sectional study and assessment of influencing of cofactors were objectives.

Methods: Women medicos who volunteered, consented and met selection criteria were enrolled. Hb level was estimated to diagnose anemia. Relationship with influencing factors was assessed statistically.

Result: A total of 100 eligible students were enrolled. Mean age±standard deviation (SD) age of the participants' was 20.9±3.1 years (17-25 years). Mean±SD Hb was 12.25±1.0189 g% (9.0-16.0 g%). 33 were anemic, and mild anemia (32%) was frequent. There was a history of worm infestation in three students (3%), who were treated adequately. Nine were on iron supplements of which five were still anemic and were continuing the treatment by the end of the study. 28 (84.84%) anemic students were not on any iron or hematinic treatment. There was no association between the anemia and nature of diet, consumption of green leafy vegetables, consumption of coffee/tea after food, smoking/tobacco or alcohol consumption, mother's education, socioeconomic status, menstrual factors, and physical exercise. The prevalence of anemia was found to be higher in underweight and overweight students in comparison to students with normal body mass index.Asymptomatic participants (n=78) outnumbered symptomatic ones (n=22), but without any statistical significance. Easy fatigability (14%), pallor (7%), breathlessness (6%), weakness (9%), and easy bruising (1%) were frequent complaints.

Conclusion: Anemia is frequent among women medicos, often underdiagnosed, under-reported, many remaining asymptomatic. Negligence of medical students toward their anemic status despite the awareness of consequences of low Hb level is a serious cause of concern.

Keywords: Awareness, Hemoglobin, Nutritional anemia, Women medical students.

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INTRODUCTION

The nutritional disturbance is one of the common health problems next to infectious diseases among the adolescents and young adults due to the increased demands during the growth period. It is estimated that 25% of world's population are anemic with more disease burden reported from developing countries (43%), particularly from Africa and Asia [1]. Developed countries are focused on another side of the coin, i.e., obesity and related comorbidities, while developing countries are still battling with malnourishment and infection having a huge impact on economic and social policies.

Available data indicate gender difference even globally with a high rate of anemia among young girls compared to boys. Female preponderance (73.5% nonpregnant women) is seen worldwide. Among Asians too female preponderance is observed with 34% of nonpregnant females being anemic and worst ratio is seen in South East Asia where 85.4% of nonpregnant females are anemic compared to men (4.1%) [1]. It is estimated that 56% of young girls aged 15-24 years are anemic India [2]. These statistics have made the governments to focus on improving the nutritional status. Younger children and school going children are covered under midday meal program, deworming, and iron supplements while adolescents and young adults are not covered under these programs which result in increased incidence of nutritional disturbance among this population. Due to socioeconomic and cultural reasons, in addition to poor diet and menorrhagia, girls and young women are affected the most [3]. Reports have revealed that even students among the educated, belonging to higher socioeconomic class have anemia (63-70.8%) [4,5]. Medical fraternity including medical students is considered to be part of well-informed society and perceived by the general public as authority on health-related knowledge; surprisingly, most of our students have anemia as revealed by various studies. Saratha *et al*. reported that 76% of young adult female medical and nursing students were anemic [6].

Most of the data available included both male and female medicos, while there is no study done primarily on female medicos. Although study by Saratha *et al*. [6] was on female students they included even nursing students. Hence, we planned this study on our female medicos. We estimated the hemoglobin (Hb) status and assessed its correlates in young female medical students to highlight the under-recognized and under-reported condition.

METHODS

A cross-sectional observational study was conducted after obtaining approval from the ethical committee. A written informed consent was taken from the participants, emphasizing the voluntary nature of participation. Our primary objective was to assess the Hb status in female medical students. Assessment of the influence of cofactors, i.e., age, academic year, sociodemographic variation, and diet, relation between nutritional status body mass index (BMI) and Hb and establishing correlation of vitals (pulse, BP, and temperature) with Hb concentration were the secondary objectives.

We included all healthy female medical students aged 17-25 years (both inclusive) who agreed to follow the study procedures and provided a written informed consent. We excluded those aged <17 and >25 years; diagnosed to have carcinoma, receiving frequent chemotherapy and radiotherapy, other systemic diseases which would affect the Hb status - bleeding tendency, thrombocytopenia, etc., those on antipsychotics, and recent blood transfusion in the last 3 months; married, pregnant, and lactating women were also excluded from the study.

Sociodemographic information of the participants was collected, which included: Age, physical exercise (nature and frequency of exercise), academic year and academic performance, rural or urban background, family income and socioeconomic status (classified using modified Kuppuswamy socioeconomic status) [7,8] literary status of mother, number of family members, and detailed menstrual history. A self-reported diet history (Vegetarian or nonvegetarian, any change in the food habit - increase or decrease in intake, and source of food), use of concomitant medication and history of any disease or major surgery in the last 6 months were collected. The presence of any clinical signs and symptoms of nutritional deficiency or anemia was noted. History of worm infestations, regular deworming, and treatment received was collected.

Height, weight, pulse, blood pressure (BP), and temperature were recorded using standard methods and BMI was computed. Individuals were categorized as per the World Health Organization (WHO) guidelines [9].

For Hb estimation, venous blood was collected from all participants by qualified technicians after taking aseptic precautions. Cyanmeth-Hb method was used to estimate Hb and graded as per WHO standards [9]. Hb was analyzed at our hospital laboratory, accredited with National Accreditation Board for Testing and Calibrating Laboratories.

Statistical analysis

Data were collected using Microsoft Excel worksheet 2013. The collected data were analyzed by SPSS to find descriptive statistics - mean±standard deviation (SD), frequency, percentage, and inferential statistics analyzed using Chi-square test.

RESULT

A total of 100 (n=100) eligible female medical students were enrolled. Mean±SD age of the participants' was 20.9±3.1 with a range of 17-25 years. And a median age of 21 years. Mean±SD Hb was 12.25±1.0189, with a range of 9.0-16.0 g%.

Of 100 participants, 33% (n=33) were anemic and 67% (n=67) were nonanemic. Among the anemic students had mild anemia (32%) was frequent, 1% had moderate anemia. However, 53% (n=53) had borderline values ranged from 12-13 mg/dl.

Incidence of anemia was marginally higher in >20 years age group (35.59%) as compared to ≤20 years (29.3%) (Table 1).

In comparison to first-year students (16.70%), the 2nd-4th-year students had a higher prevalence of anemia (Fig. 1) but were statistically insignificant (p=0.06).

No statistical significance was found between the occurrence of anemia and nature of diet. There was a narrow difference between prevalence of anemia among vegetarians (38.9%) and nonvegetarians (31.7%) (p=0.557) (Table 2).

Literary status of mother

There was a lower percentage of prevalence of anemia among students who's mother is graduate/post-graduate (29%) compared to those whose mothers' education was less than graduation. However, no statistical significance could be established (p=0.45) (Table 3).

Table 1: Age distribution among the study population

Age	Non-anemic	Anemic	Total
20 and below	29	12	41
Percentage of within age	70.7	29.3	100
Percentage of within Hb	43.3	36.4	
Above 20	38	21	59
Percentage of within age	64.41	35.59	100
Percentage of within Hb	56.7	63.6	
Total	67	33	100

Hb: Hemoglobin

Table 2: Distribution of anemia among vegetarians and nonvegetarians

Diet	n (%)		
	Non-anemic	Anemic	Total
Vegetarian	11 (61.1)	7 (38.9)	18 (100.0)
Percentage of within Hb	16.4	21.2	18.0
Nonvegetarian	56 (68.3)	26 (31.7)	82 (100.0)
Percentage of within Hb	83.6	78.8	82.0
Total	67	33	100

Hb: Hemoglobin

Table 3: Literary status of mother and prevalence of anemia

Literary status of mother	n (%)		
	Non-anemic	Anemic	Total
≤12th standard	14 (56)	11 (44)	25 (100)
Graduate/post-graduate	53 (71)	22 (29)	75 (100)
Total	67	33	100 (100)

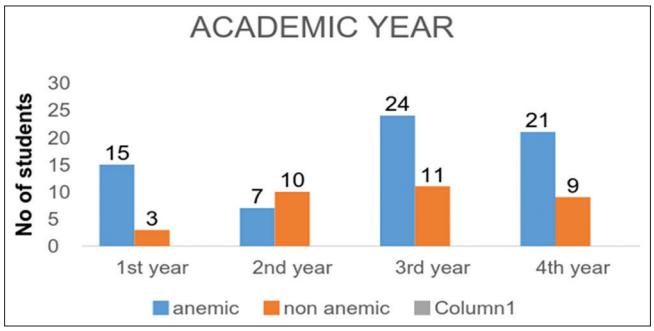

Fig. 1: Prevalence of anemia among the study population

There was no statistically significant relationship between anemic status of students and the socioeconomic status of family (p=0.169).

There was a history of worm infestation in three students (3%), who were treated adequately. Nine students were on iron supplements of which five (55.55%) were still anemic and were continuing the treatment by the end of the study. 28 (84.84%) anemic students were not on any iron or hematinic treatment.

Association of anemia with age of menarche (p=0.37), history of heavy bleed (p=0.982), duration of cycle (p=0.419), and irregular cycles (p=0.668) was statistically insignificant.

Similarly, physical exercises and anemia also did not show statistically significant relationship (p=0.884).

The prevalence of anemia among young female medical students was not found to be significantly associated with tea/coffee (p=0.62), smoking/tobacco (p=0.39), or alcohol consumption (p=0.98). The

relation between consumption of green leafy vegetables and Hb levels were not found to be statistically significant (p=0.37).

Asymptomatic participants (n=78) outnumbered symptomatic ones (n=22) with complaints of easy fatigability (n=14, 14%), pallor (n=7, 7%), breathlessness (n=06, 6%), weakness (n=09, 9%), and easy bruising (n=01, 1%). However, there was no statistical significance between symptomatic and asymptomatic patients (p=0.219) (Table 4).

The study showed no correlation between height, weight or BMI of students. BMI was within the normal range in 52 (52%) participants while 24 (24%) were underweight, 21% were overweight (n=21), and 23% obese (n=23) (Table 5).

The prevalence of anemia was found to be higher in underweight and overweight students in comparison to students with normal BMI (Table 5).

Mean±SD height of the participants was 161±5.812 cm, with a range of 149-178 cm. Mean±SD weight of the participants was 54.52±8.785 kg, with a range of 38-80 kg, and median weight of 53 kg.

Mean BMI±SD BMI of the participants was 20.99±3.1, with a range of 14.84-29.6 and median BMI of 18.69.

Mean±SD temperature was 37.005°±0.005°, with a range of 36-38°C. Association between temperature and Hb was statistically insignificant (p=0.031).

Mean±SD pulse rate of the participants was 73.08±6.824 beats/minute, with a range of 45-100 beats/minutes. Association between pulse rate and Hb was statistically significant (p=0.013).

Association between systolic BP and Hb was statistically significant (p=0.031), but there was no statistically significant association was found with diastolic BP (p=0.451) (Table 6).

Table 4: Symptoms reported by anemic population

Symptoms	n
No symptoms	78
Breathlessness	1
Breathlessness, easy fatigability, weakness	3
Breathlessness, easy fatigability, weakness, pallor	1
Easy fatigability	4
Easy fatigability, pallor	1
Fatigability, breathlessness, weakness	1
Fatigability, weakness	2
Pallor	5
Weakness	2
Weakness, fatigability	1
Weakness, fatigability, bruising	1
Total	100

BMI: Body mass index

Table 5: BMI and anemic status of study population

BMI	n (%)		
	Anemic	Non-anemic	Total
Underweight<18.5	11 (45.83)	13 (54.16)	24 (24)
Normal 18.5-22.9	14 (26.92)	28 (53.85)	52 (52)
Overweight 23-24.99	5 (45.45)	06 (54.54)	11 (11)
Obese>25	3 (23.07)	10 (76.92)	13 (13)
Total	33 (33)	67 (67)	100 (100)

BMI: Body mass index

Table 6: Relationship of BMI, vitals, and Hb among study population

Correlation of Hb (g/dl)	Pearson correlation coefficient r	p
BMI	0.066	0.516
Temperature	0.216	0.031*
Pulse rate (bpm)	0.248	0.013*
SBP	0.216	0.031*
DBP	0.076	0.451

*Statistically significant, BMI: Body mass index, Hb: Hemoglobin

DISCUSSION

Nutritional anemia is the most frequent cause of anemia worldwide. Despite increased awareness and availability of better nutrition, this clinical condition is still a major health issue in many developing countries including India. Its occurrence in women particularly in younger women not only affects her but also future generation. Thus, identifying and treating this common condition becomes important. The prevalence of anemia in South Asians is reported to be the highest in the world indicating the disease burden in this region, while in India, it is reported to be as high as 56% in young girls [2]. Bhanushali *et al*. reported that anemia is frequent among adolescent girls 26.87% were anemic [10].

Efforts from the medical fraternity along with government agencies have resulted in increased awareness about the disease and its common causes. Frequent medical examination, food fortification, and deworming have yielded improvement but not satisfactory as still a major percentage (79.2%) of Indian population has anemia as indicated by a survey done in 2005-2006. Interestingly, girls were affected the most of 72.6% with nutritional anemia [11].

Physiological changes, peer pressure that influence the dietary habits have made young women more vulnerable to anemia. It is observed that the prevalence of anemia in young girls aged between 15 and 24 years is as high as 56%[2]. However, this report does not indicate the actual burden, as many remain asymptomatic, unnoticed and unreported.

It's a common belief that the magnitude of the problem is inversely proportional to the level of awareness. This has been proved even for anemia but in young adolescent girls [12], but not in young women. Chathuranga *et al*. reported 25% of women students were anemic among the university students [13]. We expect the medical students who study human health from the first year of their academic year to take care of their nutritional needs and health better than their counterparts. It is perplexing that the reports available state a high rate of anemia among this population (76%) [6] which is unexpected that gave us the imitative to take up this study.

Available reports state the occurrence of anemia in India varies between 25% and 80% [14-24]. There is a higher prevalence (22-96.50%) among adolescent girls [18,23-25]. Women medicos in this age group are no exception as 76% of Indian women medicos have overt nutritional anemia [6]. The low rate of anemia (8.0%) has been reported from a hilly state of Northern India [26] while prevalence as high as 47.4% was seen in women medicos in central India, most of them were of mild in severity none had severe form [27]. In a study by Bano *et al*., which included all medical students, 44% (n=22) women medicos were anemic [28]. Among first and second year medicos, 38.46% of women students were anemic [29]. Union Territory Pondicherry located in Southern India reported 76% women medicos having anemia [6]. Our institution is located in the west coastal region of South India, and 33% of our women medicos were anemic. This variation could be explained by demographic variations of the regions and the predominance of students from urban background (82%) among the study population in our study.

Mild anemia is frequent among medicos, while no report of severe anemia in this population has been reported [13,27,30]. Bano *et al*.

have reported mild anemia in 36%, moderate anemia in 8.0% of women medicos [28], and there was no severe anemia among these students. Our result too is in agreement with this fact as only 32% had mild anemia. However, a concerning observation that 52% of our participants had Hb of 12-13 mg/dl indicating the vulnerability of students to anemia in the near future, if not intervened. None of our participants had severe anemia similar to the previous studies.

List of contributing factors for anemia is endless; hence, we focused only on few major factors. Age and academic year has been an influencing factor; Incidence of anemia increase with age and academic year of the students. This trend has been observed by other researchers too and higher rate of anemia [26]. This could be attributed to the increased academic stress, work schedule during the last years of education and extracurricular activities.

There is a negative association between BMI and anemia among women medicos [31], but the statistical significance was not established. We too observed negative association of BMI to Hb concentration among girls who were overweight and obese, but failed to demonstrate statistical significance. Similar result was observed among nonschool going [25] and school going [10] adolescent girls wherein BMI was statistically significant. Verma *et al*. have reported significant lower level of Hb among girls (82.4%) having BMI ≤18.5 as compared to higher BMI (>21.5 kg^2) in the slums of Ahmadabad city [32]. Negative association in this study could be related to the reduction in levels of estrogen binding protein levels with increasing adiposity (BMI) with concomitant increase in insulin. Therefore, levels of free estrogen may rise up which may cause suppression of erythropoiesis in females [33].

There are contradicting reports about the influence of socioeconomic status of the students on anemia. Bhanushali *et al*. reported a positive impact of socioeconomic status on the anemic status of young adolescent girls [10]. Socioeconomic status of our medical students did not have any significant association on anemia similar to the reports by Thomsen *et al*. [31] while Chaudhary and Dhage have shown a positive association with anemia [23].

Dietary habits of the individual determine the nutritional status. Our study revealed that there was no statistical significance between the occurrence of anemia in vegetarians (38.9%) and nonvegetarians that were contradicting the observations of Saratha *et al*. [6] who reported less incidence of anemia in those who consumed nonvegetarian diet. consumption of tea immediately after food too did not have any significant effect. Bhanushali *et al*. reported that 26.92% of anemic students had a habit of post-meal consumption of coffee/tea [10]. Unlike Saratha *et al*. [6] who reported higher rate of anemia among those who consumed less of green leafy vegetables, our participants did not show any significant change. We attribute this to preliminary diet questionnaire or lack of efficient recall method.

The literacy rate of mother has shown definite impact on the prevalence of anemia in this population in terms of positive association [10,23,31] and our study support this observation.

Menstruation does play an important role in the development of anemia; any irregularity associated with it, i.e., menorrhagia can deteriorate the condition. We could not demonstrate any significant relation between anemia and factors associated with menstruation, i.e., age of menarche, duration of cycle, history of heavy bleeding, and irregular cycle could not be established; in contrast, Saratha *et al*. [6] noted a positive association between anemia and menstrual factors.

Worm infestation is a well-established cause of nutritional anemia in our country, hence deworming is the first step in the management. We expected none of participants to have worm infestation; unexpected observation was that 3% of our participants had a history of worm infestation, and all had been treated adequately. Awareness of deworming among medical students could be one of the reasons for 67% of the subjects to be non-anemic in our study. Saratha *et al*. [6] reported higher prevalence of worm infestation among their study population with a majority of them (96.91%) reported to have anemia. An interesting observation by Bhanushali *et al*. was that 92.31% of their study population was free from intestinal parasites [10].

Many of our women medicos were asymptomatic (78%). We observed a significant association between Hb, body temperature (p=0.031), pulse rate (0.013), and systolic BP (0.031). All these could be attributed to the hemodynamic changes caused by low Hb. Height did not have any influence on anemia in our medicos.

Anemia has significant effects on a student's health, endurance capacity, work productivity, and cognitive functioning and thereby affects academic performance. Therefore, there is a need of regular screening for anemia in female medical students.

Increasing reports of tiredness and lethargy among female adolescents and young adults requires immediate attention. Early detection and health intervention by necessary corrective measures will substantially prevent anemia. Hence, considerable effort is required to increase the awareness and provide better health facility to our future female doctors to tackle this simple, common and easy to treat condition.

Ours are the first study on women medicos while other studies have included male medicos, nursing students; hence, we did not have study to compare our results *vis*-a-*vis*. Our study highlights the under-reported condition having long-term effect not only on the participants but also may have implications on future generation. Thus, it is imperative that appropriate diagnostic methods and early intervention to be considered in women medicos.

CONCLUSION

There is an increasing need of analysis of anemic status among the professional students including medical students as latter are not exempt from vulnerability. Asymptomatic nature disease may be a contributing factor for under diagnosis and under reporting. Negligence of medical students toward their anemic status despite the awareness of consequences of low Hb level is a serious cause of concern.

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