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Original Article

Biochemistry Section

Prevalence of Nutritional Deficiency Anaemia and Its Impact on Scholastic Performance among Undergraduate Medical Students

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ABSTRACT

Introduction: Nutritional deficiency anaemia can lead to development of headache, fatigue, lethargy, apathy, exertional dyspnoea, palpitations and tinnitus and thereby decrease the quality of everyday life to a great extent. Such symptoms may pose a hindrance for students in their academic life and have a negative impact on their career.

Aim: To determine prevalence of nutritional deficiency anaemia and its correlation with academic performance among medical students.

Materials and Methods: A cross-sectional study was conducted at Adichunchanagiri Institute of Medical Sciences. Two hundred eighty nine healthy undergraduate medical students of both genders were included in this study. A predesigned and pre-structured questionnaire was used as a tool to obtain information regarding demographic profile, dietary habits and academic performance. Haemoglobin level was estimated. Student's t-test and Chi-square test were employed.

Results: Majority of the participants were within the age group of 17-20 years (84.4%). The overall prevalence of anaemia was 15.6% with high rates among female students (93.3%), this gender difference was statistically significant ($p<0.001$). There was statistically significant difference in Hb% ($p=0.009$) among high and low performers. There was no association between the anaemic status and students scholastic performance ($\chi^2=3.1533$, $p=0.368$).

Conclusion: The mean haemoglobin level was higher among low performer, indicating that nutritional anaemia may not \ play a major role in educational performance and intelligence in higher education.

Keywords: Academic performance, Haemoglobin levels, Rural area

INTRODUCTION

Considering the importance of nutrition on health, education and productivity, it has been argued that health is an important factor for academic achievement at school and at higher education [1,2]. Malnutrition is an important public health problem of children in developing countries. Persistent under nutrition is a major obstacle to human development and economic growth of the country. Additionally, it remains one of the major obstacles to human well being affecting all areas of a student or child health, growth and development including academic performance.

A recent study has revealed that chronic malnutrition inhibit growth, retards mental development and reduces motivation and energy level resulting in reduced educational attainments, health and survival of learners [3]. The potential for health to improve cognitive function, learning and academic achievement of students has received attention by researchers and policy makers [4]. It is widely accepted that health and well being are essential elements for effective learning [5].

Malnutrition is generally defined as chronic condition which is due to over or under consumption of any or several essential macro or micro nutrients. The relationship between micronutrient deficiency energy level and cognitive development has captured attention because micronutrients are related to specific physiological process [6-8]. The prevalence of anaemia in rural adolescents is more than the urban mainly due to low literacy rate, ignorance, low socioeconomic status and poor dietary habits [9,10]. However, a recent study has reported the increasing prevalence of anaemia among adolescence living in urban settlements [11].

Academic burden, parental and peer pressure and even psychological ailments affect medical students and their performance. Studies have explored psychological and social factors separately as predictors of poor performance [12]. However, there are lesser researches on the nutritional status of adolescence and the relationship between nutritional deficiency and scholastic performance. This study was an attempt to assess the prevalence of nutritional deficiency anaemia and its association with academic performance among undergraduate medical students.

MATERIALS AND METHODS

An analytical cross-sectional study was carried out between June to August 2015 at Adichunchanagiri Institute of Medical Sciences, Karnataka, India, with 289 medical students aged between 17 and 25 years. Convenient sampling was done to select the subjects.

A predesigned, pretested semi structured and validated questionnaire in English was administered to collect data on demographic profile, dietary habits, past or present history of any illness and academic performance of the previous university examination as percentage obtained.

Institutional Ethical Committee clearance was taken prior to the start of the study. A consent form along with an information sheet giving details of the study was provided to all the study participants. Subjects who gave consent and completed the questionnaire were included in the study and participants with history of hematological disorder (thalassaemia trait, sickle cell trait and malignant conditions) were excluded from the study.

The study used several variables to determine the proportions and contributing factors to anaemia among undergraduate medical students. A total volume of 5 ml of venous blood was collected in Ethylene Diamine Tetra Acetate (EDTA) coated vials from each participant under aseptic precautions for laboratory procedures.

Standard procedures were followed during blood collections transportation, storage and disposal to protect the participants as well as the researchers. Complete blood count was done using automatic analyzer Sysmex KX- 21 (3 part cell Counter) to rule out of non-nutritional causes of anaemia. Peripheral blood smear was prepared using Leishmann's stain and studied under oil immersion objective of compound light microscope to ascertain the morphology of RBCs. Information on independent variable such as dietary habits, consumption of fast food, aerated beverages, coffee, tea and alcohol were collected.

The subjects were dichotomized into anaemic and non anaemic groups and further the anaemic group was grouped into mild, moderate and severe anaemic as per WHO guidelines [13]. Academic performance of the students was assessed by the percentage of marks scored by the students in their previous university examination. The percentage of the total marks scored by the students was taken into consideration to rule out bias. The students were categorized into two groups, who scored 60% were grouped as high performers and who scored <60% were considered as low performers.

STATISTICAL ANALYSIS

Data collected were entered into the excel sheet and analysis was done using SPSS software version 18.0. Continuous variables were expressed as mean±SD and categorical variables were expressed as frequency and proportion. Student's t-test was used to check the difference in mean. Chi-square test was employed to test the association between anaemia and academic performance.

RESULTS

A total of 289 undergraduate medical students participated in the study. Majority of the participants were within the age group of 17-20 years (84.4%). Nearly 74.5% of students consumed mixed diet and 17.5% of them were pure vegetarians. The overall prevalence rate of anaemia according to WHO criteria was 15.6% with high prevalence rate among female students (93.3%) [Table/Fig-1] which was statistically significant (p<0.001). [Table/Fig-2] is depicting the peripheral smear of the study participants and [Table/Fig-3] is showing RBCs levels for anaemia. The mean Hb% was high among low performer (14.64±1.93) than high performers (13.86±2.04) and it was statistically significant (p=0.009) [Table/Fig-4]. Additionally the difference in mean Hb% between female high and low performers was found to be statistically significant (p=0.02). There was no association between the anaemic status and students scholastic performance (χ^2 =3.1533, p=0.368) [Table/Fig-5].

Gender	Participants		Total
	Without anaemia	With anaemia	
Female	123(50.2%)	42(93.3%)	165(57.1%)
Male	121(49.6%)	3(6.7%)	124(42.9%)
Total	244(100%)	45(100%)	289(100%)

[Table/Fig-1]: Gender distribution of participants studied in relation to anaemia. p<0.001**, Significant, Chi-square test applied.

Peripheral Smear	Participants		Total
	Without anaemia	With anaemia	
Normocytic normochromic	239(98%)	28(62.2%)	267(92.4%)
Microcytic hypochromic	3(1.2%)	16(35.6%)	19(6.6%)
Dimorphic	2(0.8%)	1(2.2%)	3(1%)
Total	244(100%)	45(100%)	289(100%)

[Table/Fig-2]: Peripheral smear of study participants in relation to anaemia.

RBC (In million/cumm)	Participants		Total
	Without anaemia	With anaemia	
<4.3	20(8.2%)	9(20%)	29(10%)
4.3-5.9	213(87.3%)	34(75.6%)	247(85.5%)
>5.9	11(4.5%)	2(4.4%)	13(4.5%)
Total	244(100%)	45(100%)	289(100%)

[Table/Fig-3]: Red Blood Corpuscle (RBC) levels in relation to anaemia.

		High Performers ≥ 60% (N=231)	Low Performers < 60% (N=58)	p-value
Hb%	Both gender	13.86±2.04	14.64±1.93	0.009*
	Male	15.76±.98	15.92±1.06	0.44
	Female	12.55±1.47	13.26±1.70	0.02*

[Table/Fig-4]: Mean Hb% among the study participants in high and low performer groups.
* Statistically significant; Hb %: Haemoglobin %

Anaemic Status	Academic Performance				
	Low Performers	High Performers	Row Totals	Chi-square value	p-value
No Anaemia	53 (48.97) [0.33]	191 (195.03) [0.08]	244	3.1533	0.368
Mild Anaemia	2 (5.02) [1.81]	23 (19.98) [0.46]	25		
Moderate Anaemia	3 (3.81) [0.17]	16 (15.19) [0.04]	19		
Severe Anaemia	0 (0.20) [0.20]	1 (0.80) [0.05]	1		
Column Total	58	231	289		

[Table/Fig-5]: Showing the association between anaemic status and academic performance.

DISCUSSION

Nutritional deficiency results in anaemia, reduced physical endurance, impaired immune response, difficulty in temperature regulation, changes in energy metabolism, leading to stress and anxiety, headache, fatigue, lethargy, dyspnoea, palpitations and decreased in cognitive performance. Nutritional anaemia thought to be more of concern in developing countries (including rural and urban) but nowadays there is increased prevalence in developed affluent society [14].

The overall prevalence of anaemia in the study group was 15.6% with high prevalence of anaemia among female students (93.3%) when compared to males. Globally, 24.8% of population is affected by anaemia; with highest prevalence among adolescent girls as compared to boys [15]. The prevalence of iron deficiency anaemia varies greatly according to a host of factors such as age, gender, physiological, nutritional and environmental factors and also socioeconomic conditions. The present study was conducted at a rural private medical college in South India with adolescents having better health, high socioeconomic status and good healthy atmosphere. Anaemia seen in girls may be attributed to less food intake in tendency to lose weight for achieving zero figures, accompanied with menstrual loses [16]. The present study data shows significant difference in mean Hb% among overall study group (p=0.009) and also among female students (p=0.02) in high and low performer category. Study by Sungthong R et al., reported that children with iron deficiency anaemia consistently had poor cognitive scores [17]. Non anaemic children with iron deficiency had high intelligent coefficient. National Health and Nutrition Survey III in United States of America, showed iron is essential trace element required for several neurological metabolic processes including neurotransmitters synthesis, myelin formation and brain growth [18]. Iron deficient individuals show selective decrease in dopamine neurotransmission which is involved in motor control. Thus, iron deficiency alone can potentially affect multiple cognitive functions. These neurological changes get reflected in certain motor tasks, scholastic performance and/or problem solving skills [19].

Studies on the relationship between nutritional status and academic performance showed that the children with iron deficiency and with or without anaemia had lower scores than the children with normal

iron status. Thus iron deficiency even without anaemia may place children at risk for cognitive delay [20]. Stoltzfus RJ et al., studied the relationship between haemoglobin and IQ and showed for even 1 g/dl decrease in haemoglobin [21], IQ to be lowered by 1.73 points. Most correlational studies found associations between iron deficiency anemia and poor cognitive and lower motor development and behavioral problems. However, confounding factors like poor socioeconomic background might hinder a specific inference to be made. Black MM found that short term trials of iron treatment among anaemic children younger than two years failed to show benefit to brain development, indicating that early treatment with iron is warranted especially in young children [22]. Aboussaleh Y et al., showed the negative correlation of IDA with cognitive function and school performance [23]. Socioeconomic factors also appeared to be significantly related to academic performance. The Egyptian study by Pollitt E showed no significant difference between the iron deficiency anaemia and the control group on continuous performance test and the peabody picture vocabulary test [24]. The Thailand study assessed the effect of iron treatment on psychoeducational performance which showed negative correlation in IQ scores and educational achievement, which did not improve even after treatment. Dissanayake DS et al., showed that iron status does not a play a major role in educational performance and intelligence of adolescence and that other factors affect educational performance and intelligence [25]. In this study all the nutritional status indicators were better and no significant association with educational performance were observed by students with anaemia and without anaemia which is in accordance with other workers [24,25]. Besides nutrition, other factors affecting academic performance are; social and study environment, learning ability, hereditary factors, gender etc.

LIMITATION

The study adopted a qualitative phenomenological study design in order to explore and present the effect of nutritional deficiency on the academic performance. The present study focused on the association between anaemic status and academic performance. Furthermore, though we found no association between medical students' anaemic status and academic performance, it might not be generalized due to limited sample size and as the study was confined to single college. Another limitation is that more reliable marker for iron deficiency state; serum ferritin level was not estimated due to its cost effectiveness.

CONCLUSION

The study throws light on the nutritional status on the adolescents studying in a rural medical college. It is not clear that whether nutritional status of medical student has any influence on career success. Hence, we conclude that nutritional anaemia may not play a major role in educational performance and intelligence in higher education.

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