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Sufficient Feed for Deficient Marrow: A Study on Dietary Factors Influencing Hemoglobin Levels

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ABSTRACT

According to WHO, the prevalence of anemia is highest in South Asia, and India has the maximum prevalence of anemia among the South Asian countries. Anemia is major concern in developing countries like India. Thus, the present study explored the dietary factors influencing hemoglobin levels among the college students. Adopting stratified and simple random sampling technique, this study was conducted at three Arts and Science Colleges situated in North Chennai. This study was conducted among 1000 students in the age group of 19 to 22 years. Interview schedule was used for collection of the details regarding the background information and eating habits of the participants. Biochemical tests are the most objective and sensitive measures of nutritional status. In the present study, hemoglobin is evaluated using Drabkin Method. The obtained details were coded and entered into Microsoft excel. The coded raw data were subjected to statistical analysis using Statistical Package for Social Science (SPSS) version 20.0. Hemoglobin levels of the participants were correlated with the dietary habits. The prevalence of anemia was more among 19 years (73.4%), followed by 65% in 20 years, 54.6% in 21 years and 46% in 22 years. Hostel dwellers were more prone to anemia than the students resided with the parents, friends and relatives. Students residing at hostel tend to have a poor eating habit leading to low hemoglobin levels. Vegetarians are more prone to anemia when compared to mixed diet consumers and ova-vegetarians. Spreading the Nutrition Education in this regard helps to increase the hemoglobin levels among the general population. Encouraging consumption of iron rich foods and vitamin C helps to increase the hemoglobin levels.

Keywords: Anemia, Hemoglobin, Iron, Dietary factors, Drabkin method, Junk foods

INTRODUCTION

Anemia is a ubiquitous but major public health issue that affects quality of life as well as work capacity of a large population throughout the world. According to WHO, the prevalence of anemia is highest in South Asia, and India has the maximum prevalence of anemia among the South Asian countries. [1] Studies conducted in different regions of India showed that 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, and 58.4% in Tamilnadu as well as in Kerala. [2]

In India, anemia is of major concern in almost 50% of the existing population. The issue at hand gains importance as the percentage of women affects is significantly higher than men. Statistics indicate that about 20 to 40% of maternal deaths in India are due to anemia and roughly about one out of every two women (56%) suffer from some form of anemia. [3] Studies have shown that a higher number of university level students, particularly females were anaemic who are further hard-pressed by wrong eating habits as well as lack of awareness. [4]

Anemia causes adverse consequences as the disease progress. It affects not only the growth of adolescent girls but also their attentiveness, memory and school performance which play a role in attendance retention in school. It also causes

delay in the onset of menarche and affects immune system leading to infections. If the anemic adolescent girl becomes pregnant, it may increase foetal morbidity as well as mortality, the perinatal risk, the incidence of Lower Birth Weight (LBW), and may induce an overall increase in Infant (IMR) and Maternal Mortality (MMR) Rates. As growing pregnant adolescents compete with the growing foetus for nutrients, anemia in pregnancy will be worse than that in older women. [5]

The major objective of nutrition plans is to achieve appropriate and essential nutrition to be physically prepares for a healthy life. To promote health at a society level, the multiple attitudes of the people it encompasses, must be taken into consideration. Selection of unhealthy foods, elevated costs of nutritionally healthy foods and cheaply priced, combined with easily available nature of fast foods may pose a negative impact on the eating habits of university students. [6]

According to health and diet survey by Food and Drug and Administration (FDA), 2014 almost 89% opted for high salt diet in India, namely that the majority of diets are vegetarian especially rich in fruits, vegetables and pulses with high consumption of sweets and snacks with few dishes also containing meat. The common snacks in India are usually high-fat, high-salt fried foods that may also be high in ***trans***-fats, and this may explain their relationship with a number of different health outcomes. [7]

In 2011, Gan showed the relationship between unhealthy eating behaviours and inadequate nutrient intake among university students. A study undertaken in Malaysia showed that only 19% of students studying in university consumed vegetables more than thrice every week. The study also concluded the immediate need for making healthy food choices. Vegetable plants and fruit trees though occupying about 65% of cultivable terrain are consumed less frequently in India's general population. [8] According to the report of International Food Information Council Foundation 2015, almost 61% opted for added sugar. [9]

MATERIALS AND METHODS

The research design for the present study is of experimental type. In the present research, the samples are selected by means of stratified sampling and simple random sampling techniques. This study was conducted at three Arts and Science Colleges situated in North Chennai (two Government colleges and one government aided college). This study was conducted among 1000 students in the age group of 19 to 22 years. Willingness of the participants to participate in the undertaken study was confirmed. Ethical clearance was obtained from Universal Ethics Committee (UEC) before commencement of the study. UEC reviewed the study methodology, interview form, data collection sheet, participant informed consent form, and rendered 'Full Board Approval' to conduct the study. Written consent to participate in the study was got from all of them. The selected participants who have consented to be a part of the study were informed about the study and its importance by the researcher so that they would cooperate and make possible in collecting the necessary information for the study. After finishing the preliminary procedures including obtaining ethical clearance, permission from college authorities, and consent from selected study participants, data collection was started. Interview schedule was used for collection of the details regarding the background information and eating habits of the participants. Biochemical tests are the most objective and sensitive measures of nutritional status. In the present study, hemoglobin is evaluated using Drabkin Method. By following this method, 20 microliter of capillary blood was drawn from the participants in a sterile condition. To the 20 microliter of the whole blood sample, 5ml of Drabkin solution was added, and rinsed using the pipette 3-4 times with reagent. Further, it was mixed well and

allowed to stand for at least 15 minutes at room temperature (18–26° C). Reading and recording the absorbance of each test versus the blank as the reference at 530 nm in a spectrophotometer. [10] The obtained details were coded and entered into Microsoft excel. The coded raw data were subjected to statistical analysis using Statistical Package for Social Science (SPSS) version 20.0. Hemoglobin levels of the participants were correlated with the dietary habits.

RESULTS AND DISCUSSION

Table-1: ***Effect of type of Diet on Hemoglobin levels***

Type of Diet	Normal Hemoglobin	Low Hemoglobin	Total	Chi-square level	P value
Vegetarian	37 (28.9) [9.9]	91 (71) [14.6]	128 (100) [12.8]	13.378	<0.001*
Mixed vegetarian	330 (38.6) [88.2]	526 (61.4) [84.4]	856 (85.6) [100]		
Ova vegetarian	7 (43.8) [1.9]	9 (56.2) [1.4]	16 (100) [1.6]		
Total	374 (37.4)	626 (62.6)	1000 (100)		

Note: Values within ( ) denote row percentage; Values within [ ] denote column percentage; ** denote 1% level significance

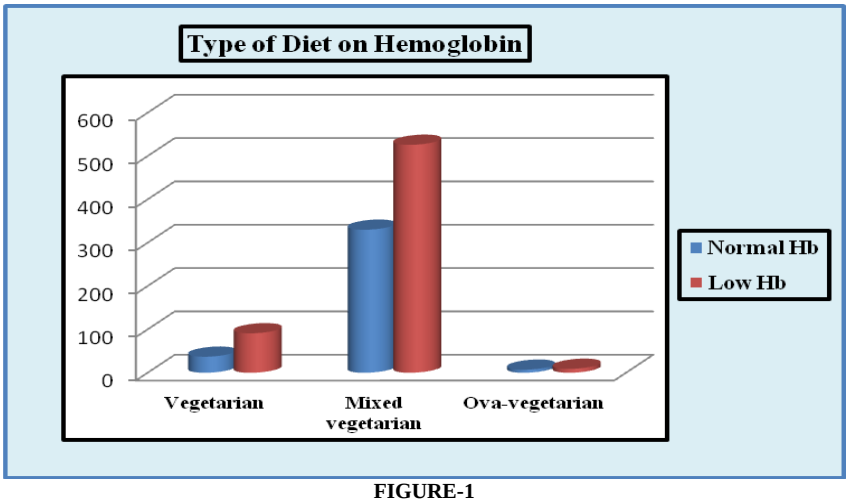

FIGURE-1

In the present study, vegetarians are more prone to anemia when compared to mixed diet consumers and ova vegetarians. A study conducted by *Babitha* showed that anemia was found more (82.5%) among vegetarians than the non-vegetarians [11]

Table- 2: ***Frequency of Junk foods consumption on Hemoglobin level***

Frequency of Junk foods	Normal Hemoglobin	Low Hemoglobin	Total	Chi- square level	P value
Daily	63 (39.4) [16.8]	97 (60.6) [15.5]	160 (100) [16]		
4-6 times per week	83 (35.3) [22.1]	152 (64.6) [24.3]	235 (100) [23.5]		
1-3 times per week	131` (32.3) [35]	274 (67.6) [43.7]	405 (100) [40.5]	13.378	0.037*
Rarely	74 (46.3) [19.7]	86 (53.7) [13.8]	160 (100) [16]		
Never	23 (57.5) [6.1]	17 (42.5) [2.7]	40 (100) [4]		
Total	374 (37.4)	626 (62.6)	1000 (100)		

Note: Values within ( ) denote row percentage; Values within [ ] denote column percentage; * denote 5% level significance

In the current study, prevalence of anemia was reported more among subjects who consumed junk foods one to three times per week (67.6%), followed by those who consumed four to six times per week (64.6%) and 60.6% among daily consumers. It is interesting to note that prevalence of anemia among rare and never consumers of junk foods is reported to be lower, that is 13% and 2.7% respectively.

The poor dietary pattern followed by higher socioeconomic group with more of snacks and junk foods, which lack micro nutrients explaining the higher prevalence of anemia among them [2]

Table- 3: ***Effect of Food Frequency on Hemoglobin level***

Food items	Correlation coefficient	P value
Bajra	.338	<0.001**
Dhal	.193	<0.001**
Whole grams	.421	<0.001**
Roasted Bengal gram	.301	<0.001**
Greens	.456	<0.001**
Fruits	.301	<0.001**
Dry fish	-362	<0.001**
Jaggery	.392	<0.001**
Packet foods	.251	<0.001**
Biscuits	-076	<0.017**
Carbonated beverages	.291	<0.001**
Pickles	-519	<0.001**
Coffee	-225	<0.001**

** denote 1% significance level

The above table illustrated the correlations of hemoglobin with the selected iron rich foods. It is very well understood from the above tables that iron rich foods intake is found to be lower among the study group, which in turn has an effect on lower hemoglobin level.

Greens are inexpensive food and richest source of iron. But unfortunately, the frequency of greens consumption seems to be very less in the study, which has a strong impact on lower hemoglobin level, it is also statistically significant at (p<0.001). Our study is also supported with the study conducted by *Gurram Sudha Rani.* [12] In that study, the respondents who never took green leafy vegetables had more prevalence of anemia in both rural and urban areas than who consumed thrice or more per week.

Dhal, wholegrams, and roasted bengal gram are loaded with protein. Dhals and wholegrams contain around 3 to 5 milligrams per 100 gram and roasted bengal gram has 9.5 milligrams of iron. Globin is a protein present in hemoglobin, thus it is necessary to take protein rich foods to improve the iron status. As per this view, the protein-rich food intake is also found to be lesser, which is also a reason for lower hemoglobin status. It is also statistically significant (p<0.001).

The millet bajra is loaded with iron (8 milligrams per 100 grams). Inspite of the inexpensiveness and abundant nutritional property of bajra, it is not consumed frequently by the study group. The awareness among millet consumption needs to be improved to prevent micronutrient deficiencies. Bajra consumption is positively correlated with hemoglobin status (p<0.001). Pickles and dry fish are traditional preserved foods. They are reported to be preserved using salts. The higher salt intake reduces the iron absorption thereby reducing the hemoglobin which is also significant in our study with the correlation value of -519 and -362 respectively.

Coffee and tea consumption is reported to be in higher side in the present study. Tea and coffee contain antinutritional factors namely phytates/ tannins and polyphenols which could inhibit iron absorption. It is evident that coffee/tea intake reduces the iron absorption, thereby reducing the hemoglobin level among coffee/tea consumers. Frequent tea consumption was significantly associated with an increased risk of iron deficiency anemia. [13] Important iron absorption inhibitors are polyphenols (Glloyl groups), present in tea, coffee, and cocoa. [14]

Jaggery is a rich source of iron and potassium. But it is evident from the present study that only 0.7% consumes it daily. The overall jaggery consumption is less in our study. Low jaggery consumption has a positive correlation with low hemoglobin level which is statistically significant (p <0.001). Fruits are rich source of vitamin A, vitamin C and micro minerals. Vitamin C is

essential for iron absorption. Fruits namely amla, guava, orange, lemon and pineapple are rich in vitamin C. In our study fruits consumption is lower among all the participants (0.3 % and 1.1% consume fruits daily and alternate days), which shows vitamin C deficiency is one of the reasons for low hemoglobin.

Junk foods such as packet foods and biscuits are loaded with calories, carbohydrates, and fat. It is deficient in protein and micro minerals especially iron. Our study also witnessed the higher and frequent consumption of junk foods and biscuits. When the students prefer to consume more junk foods then they reduce to eat iron rich healthy food. Thus, high junk food and biscuits consumption has a positive correlation and statistically significant at <0.001 level.

Table-4: ***Effect of Nutrients on Hemoglobin***

Nutrients	Correlation Coefficient	p value
Calories	.523	<0.001**
Protein	.439	<0.001**
Iron	.721	<0.001**
Zinc	.717	<0.001**
Vitamin B1	.781	<0.001**
Vitamin B2	.757	<0.001**
Vitamin B12	.465	<0.001**
Folic acid	.612	<0.001**
Vitamin C	.222	<0.001**
Vitamin B3	.808	<0.001**
Vitamin B6	.469	<0.001**

The correlation coefficient of energy, protein, and vitamin C is found to be .523, .439 and .222, respectively, which is statistically significant. B complex vitamins such as B6, B12, and folic acid involved in hemoglobin production. These vitamins activate the enzymes to form haem. When these vitamins are deficient, hemoglobin levels reduce in the blood leading to anemia. In the current research, there was an inverse relationship between folic acid and vitamin B12 with hemoglobin concentration. Our study participants did not meet the RDA for folic acid and vitamin B12 and were deficient in both the vitamins. This clearly states that deficiency of folic acid and vitamin B12 leads to low hemoglobin level with the correlation coefficient value of .612 and .465 respectively. This is also statistically significant (p<0.001). A deficiency of vitamin B12 or folic acid results in immature red blood cells and a condition called pernicious anemia. A study conducted by *Joanne Arsenault* reported inverse association between serum folate and hemoglobin concentration. [15]

There was also a positive correlation between vitamin B1, B2, B3, and B6 with the hemoglobin levels. The correlation coefficient of Vitamins B1, B2, B3 and B6 were found to be .781, .757, .808, and .469 respectively. We also noted a statistically significant association between iron uptake and hemoglobin levels with the correlation value of 0.721. Deficit of iron leads to a low level of hemoglobin. Inadequate dietary iron intake and inadequate intake of factors that facilitate iron absorption can be considered decisive for the occurrence of Iron-Deficiency Anemia (IDA).

Zinc is a well known co-factor of several enzymes in humans and plays a major role in the metabolism of iron. Therefore zinc deficiency is found to be associated with IDA. According to a study conducted by *Conrad* low serum zinc concentration (<10.7 μmol/L) was present in 34 (12%) children, and 37 (13%) were anemic (hemoglobin < 110 g/L). Serum zinc is correlated with hemoglobin ($\boldsymbol{r}$ = 0.24, $\boldsymbol{P}$ < 0.001). [16]

CONCLUSION

The prevalence of anemia was more among 19 years (73.4%), followed by 65% in 20 years, 54.6% in 21 years and 46% in 22 years. Hostel dwellers were more prone to anemia than the students resided with the parents, friends and relatives. Students residing at hostel tend to have a poor eating habit leading to low hemoglobin levels. Vegetarians are more prone to anemia when compared to mixed diet consumers and ova-vegetarians. Lower consumption of greens, bajra, and roasted bengal gram and high intake of dry fish, pickles, and coffee showed low hemoglobin scores. Thus it is necessary for the college students to modify

their eating habits accordingly to increase the hemoglobin levels. Food sources such as citrus fruits must be consumed along with iron food sources to increase the hemoglobin. Whereas caffeinated beverages, salty foods must be restricted which hinders the iron absorption. Spreading the Nutrition Education in this regard helps to increase the hemoglobin levels among the general population.

REFERENCES

1. Subramaniyam, K., Melvin George., Deepika Seshadri., Amrita Jeva., Chandraprabha, N., (2016). Prevalence of anemia among health science students of university in South India. International Journal of Research in Medical Sciences, 4(10): 4598-4601.
2. Siva, PM., Sobha, A., Manjula, VD., (2016). Prevalence of anemia and its associated risk factors among adolescent girls of Central Kerala. Journal of Clinical and Diagnostic Research, 10(11):19-23.
3. Siva, PM., Sobha, A., Manjula, VD., (2016). Prevalence of anemia and its associated risk factors among adolescent girls of Central Kerala. Journal of Clinical and Diagnostic Research, 10(11):19-23.
4. Kumar B, Shill., Palash Karmakar., Mel G, Kibria., Mohammed A, Rahman., Mohammed S, Hussain, Mohammed M, Sattar. Prevalence of Iron deficiency anemia among university students in Noakhail Region, Bangladesh. J Health Popul Nutr. 2014 Mar; 32(1):103-10.
5. Balwinder Kaur, GS., Aulakh and Bharsti., (2017) . Anemia management through Diet. Rashitriya Krishi, 12 (2): 41-43.
6. Gan,WY., Mohid, NM., Zalilah MS., Hazizi, AS., (2011). Differences in eating behaviours dietary intake and body weight status between male and female Malaysian University students. Malaysian Journal of Nutrition, 17(2): 213-228.
7. Misra, A., Singhal, N., Sivakumar. (2011). Nutrition transition in India: Secular trends in dietary intake and their relationship to diet-related non-communicable diseases. J Diabetes, 3: 278-292.
8. Aberoumand, A., (2009). Nutritional evaluation of edible *portulace oleracia* as plant food. Food analytical Methods, 2: 204-207.
9. Krishna Prabha, V., Mahaboob, MA., (2015). Formulation and nutrients analysis of stevial incorporated value added products. International Journal of Curr Pharmacy, 7:30-2.
10. Balasubramaniam, P., Malathi, A., (1992).Comparative study of hemoglobin estimated by Drapkin's method and Sahli's methods. Journal of Postgraduate Medicine, 38(1):8-9.
11. Babitha., (2014). Estimate the prevalence of anemia among unmarried female college students attending nursing college and influence of socioeconomic demographic factors. IOSR Journal of Nursing and Health Science, 3(1), version-2: 5-8.
12. Gurram Sudha Rani., Bollampalli Baburao., (2017). A study on prevalence of anemia and various factors influencing anemia among adolescent girls in urban and rural field practices areas of Osmania Medical College. International Journal of Community Medicine and Public health, 4(9):3319-3323.
13. Riyadh, A., Alzaheh., Osama., Al-Amer ., (2017). The Prevalence of Iron deficiency anemia and its associated risk factors among a sample of female university students in Taburt. Saudi Arabia Clinical Medicine women Health, 10:1-8.
14. Nora Nasir Al Hassan., (2015). The Prevalence of Iron deficiency anemia in a Saudi University female students. Journal of Microscopy and ultra structure, 3(1):25-28.
15. Joanne Arsenault., Mercedus Mora Plazas., Forrero, Y., Sandra Lilana Lopez Arara., (2008). Hemoglobin concentration is inversely associated with erythrocyte folate concentration in Colombian school-age children, especially among children with low vitamin B12 states. European Journal of Clinical Nutrition 63(7): 842-9.
16. Conrad R, Cole., Frederick K, Grant., Dawn, Swaby-Ellis., Joyc-Smith., Anne Jacques., Christine A, Northrop-Clewes., Kathleen L., Caldwell., Christina M, Pfeiffer., Thomas R, Ziegler., (2010). Zinc and iron deficiency and their interrelationship in low income African American and Hispanic children on Atlanta. The American Journal of Clinical Nutrition, 91(4): 1027-1034.

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