Iron deficiency anemia among the female students of Dolatpur town Sindh, Pakistan

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ABSTRACT

Objective: To assess pervasiveness of Iron deficiency anemia in teenage (10-16 years) female students.
Study Design: A descriptive cross sectional study.
Place and Duration: The female students from Government High Schools, belonged to Dolatpur town, District Shaheed Benazirabad Sindh, Pakistan during period of 15th December 2016 to 26th March 2017.
Methodology: A Total 150 teenage female students were randomly chosen from different Government Schools. Data like socio-demographic, socioeconomic, education, social status, age, sex, and dietary intake lifestyle were gathered along with 150 blood samples. The evaluation of Body Mass Index (BMI), hemoglobin (Hb) and serum ferritin (SF) levels by using BMI standard formula Hemo-Cue Hb 120+ analyzer and ELISA method respectively.
Results: The mean of Body Mass Index (BMI), Hemoglobin (Hb) and Serum ferritin levels were observed at 17.21±0.71, 10.93±0.91 and 36.86±23.11 respectively from all female students. Iron Deficiency Anemia was observed in 67.3% of students.
Conclusion: Nutritious deficiency is the common cause of Iron Deficiency Anemia in female students.
Keywords: Female students, Body mass index, Hemoglobin, Iron deficiency anemia, Serum ferritin

How to Cite This:
Jamali NH, Jamali AA, Ahmer A, Jamali AA, Shah K, Shaikh SU, Kazi HA. Iron deficiency anemia among the female students of Dolatpur town Sindh, Pakistan. Isra Med J. 2019; 11(4): 242-246.

INTRODUCTION

Worldwide, around 30 % to 55% youthful people suffer from anemia. Youthful people are mostly at the risk of developing anemia because of increased requirement of energy, vitamins and minerals at the time of puberty to cope with the physical changes teenage people experience at this age[1,2]. Iron deficiency anemia is the main nutritional deficiency disorder prevailing all over the world, accounting for about 75% to 80% of the total burden of anemia[3]. Iron deficiency anemia is caused by blood loss, insufficient dietary intake or poor absorption of iron from food. In Ghana Anemia in children is a public health issue. Health Service of National anemia control strategy in Ghana, reported that 76% of Ghanaian children less than five years of age, 73% of children aged 2 to 10 years and 63% of school children aged 5 to12 years suffer from anemia[4,5]. Globally, more than 50% of the world's population around 3.5 billion people were encounter anemia. Occurrence of iron deficiency in developing countries was outrageous, 33% of men, 44% of women, 42% of children not yet old enough for school, and 53% of school going children, countries like Asia and Africa having the highest occurrence amongst all[6]. Different laboratory tests for the diagnosis of iron inadequacy anemia in babies different are suggested such as Hemoglobin, mean cell volume and serum ferritin test[7]. However, in many developing countries low ferritin level is considered as main cause behind iron deficiency anemia and its value (<12ng/ml) is a powerful symbol in the analysis of iron deficiency anemia[8]. Men having higher values of serum ferritin than women, i.e. men age between 30-39 years found to have high value of serum ferritin and it gets constant until 70 years of age. However women have relatively low serum ferritin level until menopause and then a rise is shown in serum ferritin level[9]. Serum ferritin level may vary due to Hemoglobin value which is influenced by residential

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Received for Publication: January 24, 2018
1st Revision of Manuscript: April 26, 2018
2nd Revision of Manuscript: July 30, 2018
3rd Revision of Manuscript: August 09, 2018
4th Revision of Manuscript: September 04, 18
5th Revision of Manuscript: June 10, 2019
Accepted for Publication: July 11, 2019

elevation above sea level or smoking behavior. Iron is significant nutritional element for normal neurodevelopment and yet, it is the main general nutrient insufficiency among young children and infants worldwide[10]. WHO reported that about 818 million children below the age of five and women were affected by anemia, mostly in up warding countries[11]. Every year about one million die of them. Children with age of up to 4 years and pregnant woman are mainly affected with an evaluation global occurrence of 43 and 51 percent respectively[12]. In Pakistan most common type of malnutrition disorder present in children is iron deficiency anemia. According to a National Nutritional assessment, 65% of the Pakistani children ages between 7-60 months were found to endure anemia[13]. (WHO) Recommends cut off points for the diagnosis of iron deficiency anemia of less than 12µg/l for serum ferritin and less than 110g/l for Hemoglobin and determination of Hemoglobin was used to assess anemia[14]. The information provided estimation about Iron deficiency and made presumptions about the values of hemoglobin in the diagnosis of iron deficiency anemia. This study was conducted to assess the prevalence of Iron deficiency anemia in female students (10 to 16 years) of Dolatpur town of District Shaheed Benazirabad Sindh.

METHODOLOGY

This descriptive cross sectional study was conducted during the period of 15th December 2016 to 26th March 2017 on the female students of Government High Schools, belonged to rural and urban areas of Dolatpur town, District Shaheed Benazirabad, Pakistan. Total of 150 female students (10-16 years) were selected by visiting different High schools. Socio-demographic, Socioeconomic and other relevant data were collected by questionnaire and consent was obtained from participants.

Female students of age between 10-16 years from Govt. High Schools were included in the study who were belonged to rural and urban areas of Dolatpur town.

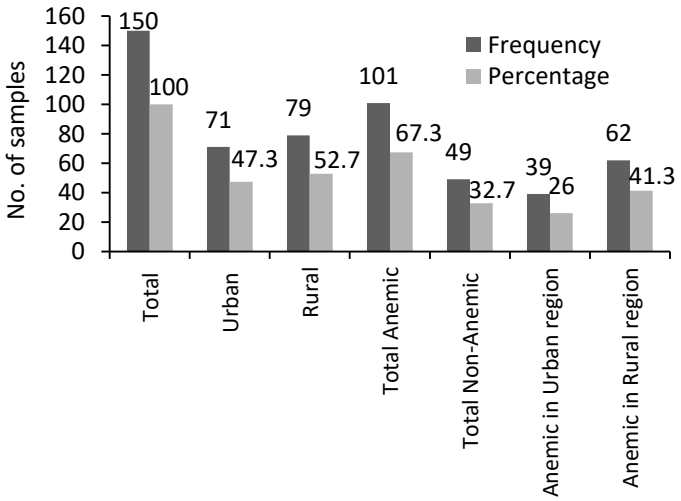
Participants with psychological, severe illness and disorders, deafness or those who were unable to communicate properly were excluded from the study.

The questionnaire included education, social status, age, sex, and dietary intake lifestyle. All students were divided into three classes on the basis of their monthly income sources of their parents. The parents whose income were less than Rs: 16,000/month (lower income class), Rs: 18,000- 25,000/month (middle income class) and were more than Rs: 28,000/month (upper middle income class). After collection of personal, anthropological and dietary intake data by questionnaire, the baseline levels were set for female students fulfilled all criteria which were taken for the determination of Body Mass Index, hemoglobin and serum ferritin levels. Body Mass Index was calculated by dividing the weight in kg by the square of height in meters. 5ml of blood sample was taken from each of the female students and was poured into the tube containing Ethylene Diamine Tetra Acetic acid (EDTA). For the assessment of serum Ferritin, 3ml of blood was transferred into a test tube and was centrifuged for 15 minutes at 3500 r.p.m by keeping it at room temperature for about half an hour, while Hemoglobin was estimated from remaining 2ml of blood sample in Diagnostic & Research Laboratory Liaquat University of Medical & Health Sciences, Hyderabad and simultaneously remaining serum samples were stored at 20 degree ℃ for future use. Hemoglobin concentration was determined by Hemo Cue HB 201+ analyzer and Serum Ferritin concentration was estimated by using ELISA method (Enzyme linked immunosorbent assay). According to WHO Recommendation, the cut off points for the diagnosis of iron deficiency anemia Serum Ferritin is less than 12 µg/l and Hemoglobin less than 110g/l.

Data Analysis: The SPSS version-(22) was used to code check and analyze data required for statistical parameters which include simple mean, frequency distribution, standard deviation, Correlation and Co-efficient for the interpretation of observed results.

RESULTS

Comprehensively, 47.3% (n=71) of the female students who participated belonged to urban region and 52.7% (n=79) belonged to rural region out of total 100% (n=150) female students. Generally, the highest percentages, i-e 67.3% (n=101) of female students from Dolatpur town were found to be anemic as shown in Fig-1.



Quantity of anemic and non-anemic volunteers

Fig-1-: Frequency distribution of anameic and non-anameic female students (N=150).

Total 47.3% (n=71) volunteers belonged to urban areas and 52.7% (n=79) volunteers belong to rural areas. Our findings also revealed that mean of BMI=17.21±0.71, Hb=10.93±0.91 and S.f= 36.86±23.11 respectively was observed in all female students. For urban volunteers, means of BMI (17.40±0.63), Hb (11.52±0.53) and S.f (44.33±24.69) were found higher in analogizing with rural volunteers.

Table-I: Body mass index, hemoglobin and serum ferritin level of girls (N =150).

Variable	Frequency		BMI	Hb gram/dl	S.F µg/l	P value
	n	%	Mean±S.D	Mean±S.D	Mean±S.D	
Urban	71	47.3	17.40±0.63	11.52±0.53	44.33±24.69	0.491
Rural	79	52.7	17.04±0.73	10.04±0.86	30.15±19.42	
Total	150	100.0	17.21±0.71	10.93±0.91	36.86±23.11	

*P < 0.05 show the significant results, χ2 = 2.41

Hb=Hemoglobin, S.f=Serum Ferritin, BMI=Body mass index, S.D =Standard deviation

TABLE-II: FREQUENCY DISTRIBUTION OF FEMALE STUDENTS ACCORDING TO THE SEVERITY OF ANEMIA (N =150).

Variable (Age groups)	Normal (Hb>12 g/dl)		Mild (10-<11.9 g/dl)		Moderate (7-<9.9 g/dl)		S.f>12µg/l		S.f<12µg/l		P value
	n	%	n	%	n	%	n	%	n	%	
10-12 years	21	14.0	18	12.0	5	3.33	40	26.66	10	6.66	0.110
13-14 years	17	11.33	23	15.33	9	6.0	33	22.0	17	11.33	0.233
15-16 years	11	7.33	34	22.66	12	8.0	24	16.0	26	17.33	0.111
Urban	32	21.33	33	22.0	6	4.0	57	38.0	16	10.66	0.371
Rural	17	11.33	42	28.0	20	13.33	40	26.66	37	24.66	0.212
Total	49	32.7	75	50.0	26	17.33	97	64.66	53	35.33	0.491

*p< 0.05 show the significant results, χ2 = 0.638

This data draws important attention which is most of the volunteers who were anemic had BMI value less than normal. However, existing low iron status in girls has been established in multiple studies worldwide. Meanwhile in each age group, the mean of hemoglobin level was below the present cut-off level of 12g/dl. Majority of volunteers below the present cut-off level of 12g/dl belonged to rural areas (P-value 0.49). This is shown in Table-I.

The illustration made in this table clarifies that amongst all volunteers participated in present study 32.7% (n=49) had normal level of Hb, 50% (n=75) endure mild anemia (10-<11.9%g/dl) and 17.33% (n=26) endure moderate anemia (7- <9.9 g/dl). Thus, about 67.3% (n=101) endured mild and moderate iron deficiencies taking the Cut-off points of hemoglobin as less than 12g/dl. Comparatively, low percentage of volunteers found affected from mild and moderate anemia belonged to the younger aged group 10 to 12 years. Meanwhile high percentage of volunteers suffering from mild and moderate iron deficiency anemia belonged to the older age groups of 13 to 14 years and 15 to 16 years. Therefore, the mean of hemoglobin levels for the older age groups remained lowest amongst all. This might have associated with the onset of menstruation after reaching age of menarche, i.e. 14 years of the age. Blood test for serum ferritin is the preferred biochemical test and it shows significant correlation with total body iron stores. Keeping in view the established cut off level Serum ferritin <12µg/l, a number 35.3% (n=53) of the all volunteers had low and 64.6% (n=97) had normal range of Serum ferritin level respectively. Whereas, female students from rural areas reported with low percentage of serum ferritin level as compared to urban areas as shown in Table-II.

DISCUSSION

Poor socioeconomic status and malnutrition are the chief causes behind the prevalence of anemia in Pakistan. Lack of health education, inappropriate health facilities particularly in remote and neglected areas of developing countries are of great significance behind anemia.

No such prevalence study has ever been conducted over iron deficiency anemia except this present study. It is recognized in a study that there are variations in stored levels of iron[15]. Though, we observed significant correlation between SF and Hb, suggesting iron status being significant determinants of hemoglobin and anemia. The serum ferritin concentration in healthy volunteers does not show relationship to the size iron stores of body, neither change in the serum ferritin value correlates with changes in the size of these stores normal adolescents[16]. The previously conducted studies on the iron status of adolescent girls were also not satisfactory, evaluated the iron status of 199 healthy males and females adolescents aged 12 to 19 years living in a fishing society in Sabah, Malaysia. The mean hemoglobin value for the females was (12.4±1.6g/dl) with (28.6) percent of adolescents having hemoglobin level <12 g/dl[17,18]. In present study our findings revealed that mean of BMI=17.21±0.71, Hb=10.93±0.91 and S.f= 36.86±23.11 were observed in all female students. While, mean of urban volunteers of BMI, Hb and S.f levels were 17.40±0.63, 11.52±0.53, 44.33±24.69 respectively. It was found higher in urban volunteers as compared to rural volunteers 17.04±0.73, 10.04±0.86 and 30.15±19.42 respectively.

Anemia in adolescent girls was reported 59.8% all belonged to rural Wardha, whereas those belonging to rural Amazonians had 15.8% and 27% out of all adolescent schoolgirls in periurban Bangladesh. A huge number of adolescent girls 29% in the urban slums of Vellore, south India are affected from anemia, in Western Kenya prevalence of anemia were 21.1% and iron deficiency was 19.8%[19-23]. In developing countries, prevalence of anemia in 27 years was reported by WHO comparing only 6% in industrialized ones[24]. About 61.9% of adolescent girls of truly poor community residing in urban

areas of Dehli and 85.4% of girls from same scenario residing in rural parts of Bharatpur (Rajhasthan) were anemic[25]. The prevalence of 43.1% in school and college students and 30.4% female students were anemic who belonged to District Shaheed Benazirabad[26]. In present comprehensive study, the prevalence of Iron deficiency anemia amongst female students was 67.3%, i-e quite high in female students of Dolatpur town. However, comparison between rural and urban areas indicates that mostly anemic students belonged to rural areas as shown in Figure-1.

Occurrence of anemia was in adolescent girls of 16 districts in India. Outcome reflected that among adolescent girls (n=4,337) from 16 districts, the Occurrence of anemia (defined as hemoglobin <12g/dl) was 90% with 7.1% had severe anemia (Hb<7g/dl)[27]. Iranian adolescents school girls, 5.8% had anemia (Hb<12) which were 21 in number and 31 girls comprising 8.5% of subjects had serum ferritin <12 and 6 cases, 1.7% were of Iron deficiency anemia (Hb<12) and serum ferritin <12µg/l. Plenty of 18 anemic girls, i-e. 85.7% were falling in mild anemia, whereas three of all had moderate anemia and none of them was reported having severe anemia[28]. In our study findings revealed that out of 100% subjects, about 32.7% female students had normal level of hemoglobin, 50% suffered from mild deficiency and 17.33% suffered from moderate deficiency and severe anemia was not seen. Thus, about 67.3% suffered from mild and moderate iron deficiencies taking the Cut-off point of hemoglobin as less than 12g/dl, majority of the students who endured mild degree anemia were (10-<11.9 g/dl) and 35.3% girls had serum ferritin <12µg/l. Considering the data with respect to age, low percentage of volunteers suffering from mild and moderate anemia were from the younger age group of 10 to 12 years. Meanwhile, high percentage of volunteers aged 13 to 14 years and 15 to 16 years suffer from mild to moderate iron deficiency anemia. Therefore, the mean value of hemoglobin levels was the lowest for the older age groups. This can be identified with the onset of menstruation after 14 years of the age. However, already existing low iron status in girls. Meanwhile, in each age group, the mean of hemoglobin level was the cut-off level of less than 12g/dl. Majority of volunteers below the cut-off level of 12g/dl belonged to rural areas as shown in Table-II.

Present study reveals that Hemoglobin level is quite low in female students of both urban and rural areas. In order to improve nutritional status, especially for iron of female students, necessary steps should be taken and youthful females should be encouraged for healthy eating and for the improvement of their lifestyle. Furthermore, abundant use of green leafy vegetables, meat, chicken, egg and pulses should be used in routine food intake to enhance nutritional stores and iron stores of body.

CONCLUSION

Nutritious deficiency is the common cause of Iron Deficiency Anemia in female students.

CONTRIBUTION OF AUTHORS

Jamali NH: Literature review, Study design, Questionnaire design, Data collection, Data analysis, Manuscript writing.
Jamali AA: Data collection, Data interpretation and sampling analysis.
Ahmer A: Data analysis, Critical review, Proof reading.
Jamali AA: Data collection, Data interpretation.
Shah K: English language, Data interpretation, Grammatically setting.
Shaikh SU: Proof reading.
Kazi HA: Proof reading.

Disclaimer: None.
Conflict of Interest: None.
Source of Funding: None.

REFERENCES

1. World Health Organization/Food and Agriculture Organization of the United Nations. Guidelines on food fortification with micronutrients. Geneva WHO. 2006. Website[www.who.int/nutrition/publications/guide_food_fortification_micronutrients]. Accessed on November 4, 2017.
2. World Health Organization. Vitamin and mineral requirements in human nutrition: report of a joint FAO/WHO expert consultation. 2nd ed. Bangkok, Thailand WHO. 2004. www.who.int/iris/bitstream/10665/42716/1/9241546123
3. Killip S, Bennett JM, Chambers MD. Iron deficiency anemia. Am Family Physic. 2007;75(5):671-678.
4. Egbi G. Prevalence of Vitamin A, Zinc, Iodine Deficiency and Anemia Among 2-10 Year-old Ghanaian children. African Journal of Food, Agriculture, Nutr & Develop. 2012;12(2):5946-5958.
5. Abdul-Razak A, Diego Moretti, Zimmermann MB, Armar-Klemesu M, Brouwer ID. Whole Cowpea Meal Fortified with NaFeEDTA Reduces Iron Deficiency among Ghanaian School Children in Malaria Endemic Area. J of Nutrit. 2012;142(10):1836-1842.
6. Stoltzfus RJ, Dreyfuss ML. Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia. Washington, D.C. 1998;20036-4810.
7. Vendt N, Talvik T, Kool P, Leedo S, Tomberg K, Tillmann V, et al. Reference and cut-off values for serum ferritin, mean cell volume, and hemoglobin to diagnose iron deficiency in infants aged 9 to 12 months. Medicina (Kunas). 2007;43(9):698-702.
8. Domell FM, Dewey KG, L.nnerdal B, Cohen RJ, Hernell O. The diagnostic criteria for iron deficiency in infants should be reevaluated. J of Nutrit. 2002;123(12):3680-3686.
9. Gibson R. Principles of nutritional assessment, 2nd ed. Oxford, UK, Oxford University Press, 2005:908.
10. Dawn Hartfield. Iron deficiency is a public health problem in Canadian infants and children. Public Child Health. 2010;15(6):347-350.
11. World Health Organization, WHO Global Database on Anemia. Worldwide prevalence of anemia (1993–2005). Website[www.int/iris/bitstream/10665/43894/1/9789241596

657]. Accessed on November 4, 2017.
12. Uberoi Is, De Sweemer C, Taylor CE. A study of anemia among rural preschool children. Indian Journal of Research. 1972;60(5):793-799.
13. National Nutrition Survey 1985-87. Nutrition Division, National Institute of Health. Government of Pakistan.1988;35.Website[www.aiou.edu.pk/foodsite/NationalHealth Survey of Pakistan]. Accessed on June 20, 2017.
14. World Health Organization/United Nations University/UNICEF. Iron deficiency anemia, assessment, prevention and control: a guide for programme managers. Geneva: WHO. 2001. Website[https://trove.nla.gov.au/version/31276429]. Accessed on June 20, 2017.
15. Pritchard JA, Mason RA. Iron stores of normal adults and replenishment with oral iron therapy. J Amer Med Assoc. 1964;190(10):897-890.
16. Foy H, Kondi A. A case of true red cell aplastic anemia successfully treated with riboflavin. J of Pathol & Bacteriol. 1953;65:559-564.
17. Foo LH, Khor GL, Tee ES, Dhanaraj P. Determinants of iron status in Malaysian adolescents from a rural community. International J of Food Sci & Nutrit.2004;55(6)517-525.
18. Foo LH, Khor GL, Tee E, Prabakaran D. Iron status and dietary iron intake of adolescents from a rural community in Sabah, Malaysia. Asia Pacific J of Clin Nutrit. 2004;13(1):48-55.
19. Kaur S, Deshmukh PR, Garg BS. Epidemiological Correlates of Nutritional Anemia in Adolescent Girls of Rural Wardha. Indian Journal of Community Medicine. 2006;31(4):255-258.
20. Ferreira MU, da Silva-Nunes M, Bertolino CN, Malafronte RS, Muniz PT, Cardoso MA. Anemia and iron deficiency in school children, adolescents, and adults: community based study in rural Amazonia. Am J of Public Health. 2007;97(2):237-239.
21. F Ahmed, MR Khan, M Islam, I Kabir, GJ Fuchs. Anemia and iron deficiency among adolescent schoolgirls in peri-urban Bangladesh. Eur J of Clin Nutrit. 2000;54(9):678-683.
22. Choudhary A, Moses PD, Mony P, Mathai M. Prevalence of anemia among adolescent girls in the urban slums of Vellore, south India. Tropical Doctor. 2006 36(3):167-169.
23. Leenstra T, Kariuki SK, Kurtis JD, Oloo AJ, Kager PA, ter Kuile FO. Prevalence and severity of anemia and iron deficiency: cross-sectional studies in adolescent schoolgirls in western Kenya. Eur J of Clin Nutrit. 2004;58(4):681-691.
24. World Health Organization. Nutrition in adolescence-Issues and Challenges for the Health Sector. Issues in Adolescents Health and Development. 2005. Website[www.who.int/iris/bitstream/handle/10665/43342/9241593660_eng.pdf%3bsequence=1]. Accessed on June 20, 2017.
25. Anshu Sharma, Kanti Prasad, K. Visweswara Rao. Identification of an appropriate strategy to control anemia in adolescent girls of poor communities. Indian Pediatrics. 2000;37(3):261-267.
26. Jamali NH, Mahesar H, Bhutto MA. Prevalence of Iron Deficiency Anemia in School and College Going Students of District Shaheed Benazirabad Sindh Province, Pakistan. Open J of Blood Dis. 2016;6:67-78.
27. Toteja GS, Singh P, Dillon BS, Saxena BN, Ahmed FU, Singh RP, et al. Prevalence of anemia among pregnant women and adolescent girls in 16 districts of India. Food Nutrition Bulletin. 2006; 27(4):311-315.
28. Ramzi M, Haghpanah S, Malekmakan L, Cohan N, Baseri1 A, Alamdari A, Zare N. Anemia and Iron Deficiency in Adolescent School Girls in Kavar Urban Area, Southern Iran. Iran Red Crescent Medical Journal. 2011;13(2):128-133.