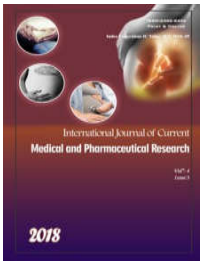
Research Article

INTERNATIONAL JOURNAL OF CURRENT MEDICAL AND PHARMACEUTICAL RESEARCH

ISSN: 2395-6429, Impact Factor: SJIF: 4.656
Available Online at www.journalcmpr.com
Volume 4; Issue 3(A); March 2018; Page No. 3124-3128
DOI: http://dx.doi.org/10.24327/23956429.ijcmpr20180409



PREVALENCE OF ANEMIA IN ADOLESCENT SCHOOL CHILDREN IN RURAL AREA IN THE STATE OF GOA

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ARTICLE INFO

Article History:
Received 18th December, 2017
Received in revised form 1st January, 2018
Accepted 16th February, 2018
Published online 28th March, 2018

Key words:
Adolescents, anemia, iron and folic acid tablets, weekly iron and folic acid supplementation

ABSTRACT

Introduction: Adolescents face a wide-range of health problems because of combination of biological, psychological and social factors. In developing countries, many children enter adolescence undernourished, making them more prone to anemia. In order to address the problem of anemia, Ministry of Health and Family Welfare, India launched Weekly Iron and Folic Acid Supplementation (WIFS) Programme for adolescents. There is a need to understand the burden of the problem and the utilization of the intervention.

Aims and objectives

1.To assess the prevalence of anemia and associated risk factors in adolescent school children in rural area in Goa
2.To study the utilization and impact of WIFS Programme.

Materials and methods: This cross-sectional study was conducted in 291 adolescent children from two schools situated in rural area in Goa. One School had implemented WIFS while the other one had not initiated WIFS at the time of the study. Data was collected using pretested semi-structured questionnaire. Hemoglobin testing was done using Hemocue Hb 301 photometer. Data was analyzed using SPSS software version 14.0.

Results: Prevalence of anemia in adolescent school children was found to be 12.4% in this study. Thirty one (86.1%) of children had mild anemia, 5 (13.9%) had moderate anemia and none of them had severe anemia. Prevalence of anemia was significantly higher in females 24 (16.1%) as compared to males 12 (8.5%) [p = 0.047]. Religion, socio-economic status, diet, history of worm infestation and Body Mass Index was not found to be statistically significantly associated with anemia in adolescents in the present study. Prevalence of anemia in the WIFS implemented school was 17 (12.1%) and in the non WIFS implemented school, it was 19 (12.6%). No statistically significant difference was found in two schools in relation to prevalence of anemia (p = 0.672).

Conclusion: The prevalence of anemia in Goa was found to be lower than most other States in India. However it was of mild public health importance in the region. There was no significant difference found in schools implementing and not implementing the WIFS programme with respect to the prevalence of anemia. Strengthening the existing programmes such as mid day meal programme, school health programme, Weekly Iron and Folic acid Supplementation programme together with health education about diet and consumption of iron rich foods is necessary to further decrease the prevalence of anemia.

INTRODUCTION

"Adolescence" as defined by the World Health Organization is the period between 10 – 19 years of age[1]. This is the transition period between childhood and adulthood. Iron requirement increases during adolescence as there is expansion of lean body mass, total blood volume and onset of menstruation. Anemia in adolescent girls and boys limits their development, learning ability, reduces concentration in daily tasks, increases their vulnerability to infection, reduces physical fitness and work productivity. Anemia symbolizes both poor nutrition and poor health.

According to National Family Health Survey III (2005 -2006), 55% of women and 24% of men in the age group of 15 – 49 years in India are anemic[2]. Out of these, 33% of women are mildly anemic, 16% are moderately anemic and 2% are severely anemic. In order to address the problem of anemia, 12-by-12 initiative[3] was launched with an aim to ensure that every child should have hemoglobin of 12 grams by the age of 12. Also there is National Iron + Initiative[3] which provide iron and folic acid supplementation to pregnant and lactating women and children along with adolescents both in and out of the school. Those in the school are reached through Weekly Iron and Folic Acid Supplementation (WIFS) programme

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while out of school adolescents are reached through anganwadi centres. Goa is ranked among the best performance states of India in sectors such as health, education and infrastructure[4]. Still as per District Level Health Survey – 4 (2012-1013) report, a total of 53.3% of adolescents (15 – 19 years) in rural area in Goa were anemic[5]. There is a need to systematically evaluate the current status of anemia in adolescents in Goa and risk factors associated with the same. In Goa, Weekly Iron and folic acid Supplementation Programme was introduced in 2013, the utilization and impact of the WIFS Programme also needs to be studied.

Aims and objectives

1. To assess the prevalence of anemia and associated risk factors in adolescent school children in rural area in Goa
2. To assess the utilization and impact of WIFS Programme on the prevalence of anemia

MATERIALS AND METHODS

This was a cross sectional study conducted in adolescent school children in rural area in Goa from January - June 2016. Care was taken to ensure representation from schools with and without WIFS implementation. The schools were selected by simple random method. The first school to meet the inclusion criteria and give consent was selected.

Two schools were selected from the rural areas of Goa for the purpose of the study. One school was from the field practice area of Rural Health Training Centre (RHTC), Mandur (school 1) which was Government aided school in which WIFS Programme was not initiated at the time of study. Other school was from the field practice area of PHC, Sanquelim (school 2) in which WIFS was implemented since 2013 from 6^{th} to 10^{th} standard students. Both these schools have other ongoing programmes such as mid day meal programme and school health checkup once in a year. Census method was used to select study participants from the selected schools. The WHO reference standard was used to define the grades of anemia[6]. Cut-off values were as follows

Mild anemia - 10 -12 gm/dl
Moderate anemia - 7 – 9.9 gm/dl
Severe anemia - less than 7 gm/dl

The period of adolescence were classified into three stages as follows[7]

Early adolescent period – 10 – 13 years
Mid adolescent period - 14 – 15 years
Late adolescent period- 16 – 19 years
For calculation of Body Mass Index (BMI)[8] following cut-off values were used:
Underweight – less than 15
Normal BMI – 15 - 22
Overweight – 22 – 25
Obese – more than 25

Inclusion criteria: Students in the age group of 10-19 yrs i.e. students from class 5 to class 10 were included in the study.

Exclusion criteria: Subjects whose parents didn't give consent & those children who were not willing for blood testing were excluded from the study. Also those who were absent on the day of examination and testing were excluded.

Sample size: $N = \frac{z^2 p q}{d^2}$

Confidence interval (z) – 95%
Sample error (d) – 10%
Prevalence[8] (p) – 58.6%
Sample size = 271

Data collection: Data was collected using pretested semi-structured questionnaire. Questionnaire included socio-demographic information, diet history, history of worm infestation, menstrual history in girls, history of consuming weekly iron & folic acid tablets followed by anthropometric examination and blood testing of study participants. All students from class 5 to class 10 were interviewed. Information regarding socio-economic status was obtained from their parents.

Hemoglobin testing was done by Hemocue Hb 301 photometer using finger prick blood. A child whose hemoglobin was done in the last 6 months using the same method, record based data was collected. There were total of 91 students whose hemoglobin was tested in the last 6 months as a part of WIFS Programme using the same technique. Hemoglobin of the rest of the 200 students was tested as a part of the study.

Hemocue method has been used extensively throughout the world for estimating the concentration of hemoglobin in capillary blood in field situations. This method is also used by National Family Health Survey in India to determine the prevalence of anemia. Sensitivity and specificity of this method for capillary blood estimation of hemoglobin is 70.6% and 95.2% respectively[9]. It consists of a portable, battery operated photometer and disposable cuvettes in which blood is collected.

Ethical consideration: Study was approved by Institutional Ethics Committee of Goa Medical College. Permission was taken from Directorate of Education Department to approach the schools. Principal's consent was taken to conduct the study. Informed consent was obtained from the parents.

Data analysis: Data was entered in Excel sheet and then analyzed using SPSS software version 14.0. Descriptive statistics (frequency, percentages, mean, and standard deviation) was used primarily to summarize and describe the data. Chi-square test and student's t test was used to test the association between two variables.

RESULTS

School 1 had a total of 155 students. Out of them, parents of 2 children did not give consent to participate in the study and 13 students were absent on the day of interview and testing, hence excluded. In school 2, there were total of 166 students enrolled. Out of which, parents of 3 children did not give consent, 10 students were absent and 2 children did not give assent for blood testing, hence excluded. So a total of 30 students were excluded after applying exclusion criteria. A total of 291 adolescent children i.e. 140 children from school 1 and 151 children from school 2 participated in the study.

In the current study, 36 (12.4%) of the participants were found to be anemic (Hb < 12 gm/dl). Mean hemoglobin in the study population was 13.17 ± 1.18. Mean hemoglobin in males and females was 13.49 ± 1.03 and 12.86 ± 1.23 respectively. The difference in mean hemoglobin between males and females was tested using student's t test and was found to be statistically significant ($t = 4.702$, $df = 289$, $p < 0.001$) as seen in Fig. 1

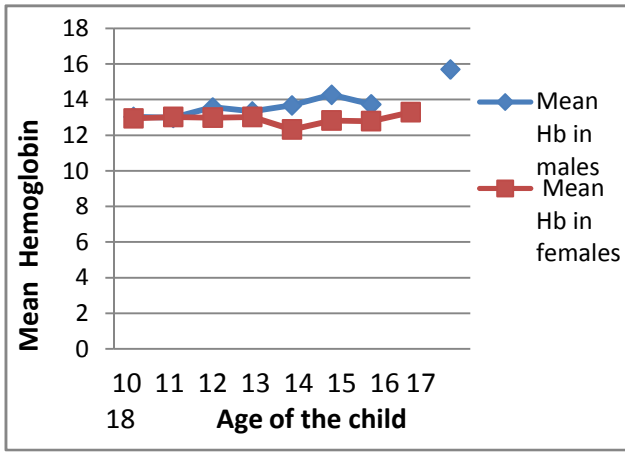

Fig 1 Mean Hemoglobin in males & females according to age

In the present study, 31 (86.1%) were found to have mild anemia, 5 (13.9%) were moderately anemic and none of the participants had severe anemia.

Table 1 Grading of anemia in adolescents according to sex

Grades of anemia	No. of adolescents		Total (%)
	No. of Male (%)	No. of female (%)	
Mild anemia (10 – 12 gm %)	12 (100%)	19 (79.2%)	31 (86.1%)
Moderate anemia (7 – 9.9 gm %)	0	5 (20.8%)	5 (13.9%)
Severe anemia (Less than 7 gm %)	0	0	0
Total	12 (100%)	24 (100%)	36 (100%)

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seen that out of 12 boys who were anemic, all were mildly anemic. In girls, majority 19 (79.2%) of them were having mild anemia and 5 (20.8%) had moderate anemia.

Table 2 Association between socio-demographic factors and anemia

Variable	No. of adolescents (N = 291)	Adolescents with anemia	Test of significance
Sex			χ^2= 3.932, p= 0.047, OR = 2 (0.997-4.339)
Male	142 (48.8%)	12 (8.5%)	
Female	149 (51.2%)	24 (16.1%)	
Age group (years)	199 (68.4%)	23 (13.6%)	χ^2= 0.832, p= 0.362
Early adolescence (10 – 13 yrs)			
Mid adolescence (14 – 15 yrs)	78 (26.8%)	7 (9.0%)	
Late adolescence (16 – 19 yrs)	14 (4.8%)	2 (14.3%)	
Religion			χ^2= 0.187, p= 0.666
Hindu	268 (92.1%)	32 (11.9%)	
Christian	17 (5.8%)	2 (11.8%)	
Muslim	6 (2.1%)	2 (33.3%)	
Socio-economic status*	20 (6.9%)	2 (10%)	χ^2= 1.001, p= 0.801
I			
II	39 (13.4%)	4 (10.3%)	
III	68 (23.4%)	10 (14.7%)	
IV	93 (32.0%)	10 (10.8%)	
V	49 (16.8%)	7 (14.3%)	

As seen in table 2, prevalence of anemia in females was higher 24 (16.1%) as compared to 12 (8.5%) in males. This difference in males and females in relation to prevalence of anemia was found to be statistically significant. In the present study, 2 (14.3%) of adolescents in the late adolescent period were anemic followed by early adolescent age group 27 (13.6%) and mid adolescence 7 (9.0%). This difference was not found to be statistically significant. Religion and socio-economic status was also not found to be significantly associated with anemia in adolescents in the present study.

Table 3 Association between personal characteristics and anemia

Variable	No. of adolescents (N = 291)	Adolescents with anemia	Test of significance
Type of diet	5 (1.7%)	1 (20%)	F = 0.486 (Fischer's Exact test)
Vegetarian			
mixed	286 (98.2%)	35 (12.2%)	
History of worms in stool	49 (16.8%)	8 (16.3%)	χ^2=0.850, p= 0.356
Yes			
No	242 (83.1%)	28 (11.6%)	
Menarche (only in girls)	88 (30.2%)	18 (20.5%)	χ^2=3.006, p= 0.085
Attained			
Not attained	61 (20.9%)	6 (9.8%)	
Body Mass Index	66 (22.6%)	8 (12.1%)	χ^2=1.373, p= 0.503
Underweight			
Normal	193 (66.3%)	22 (11.4%)	
Overweight	19 (6.5%)	5 (26.3%)	
Obese	13 (4.5%)	1 (7.7%)	

In the present study, 5 (1.7%) of adolescents were vegetarians, of those 1 (20%) had anemia. Forty nine (16.8%) participants reported history of passing worms in stool in the last one year. Anemia was seen more in children who gave history of passing worms in stool 8 (16.3%) as compared to adolescents with no history of worm in stool 28 (11.6%).

Among the adolescent girls, girls who had attained menarche were more likely to have anemia 18 (20.5%) as compared to 6 (9.8%) in those who had not attained menarche. Anemia was seen more in overweight children 5 (26.3%). However diet, history of worm infestation, menstrual status and Body Mass Index was not found to be statistically significantly associated with prevalence of anemia in the present study as seen in table 3.

Total number of children in WIFS implemented school was 140. As WIFS is implemented from 6th standard onwards, 5th class students were included as WIFS non beneficiary. So out of 140 children, 113 were eligible under WIFS Programme. Ninety eight (86.7%) were taking the benefit of WIFS and rest of the children opted out. Most common reasons for opting out of the programme was side effects of the tablets reported by 18 (11.5%) and 2 (1.8%) reported that they don't like to take tablets.

The common side effects reported by the subjects were epigastric pain 15 (13.3%); Nausea 1(0.9%); Vomiting 1 (0.9%); Nausea, epigastric pain & constipation 1(0.9%).

When we studied the prevalence of anemia according to WIFS implementation in schools we found that the prevalence in school 1 (WIFS implemented) was 17 (12.1%) as compared to 19 (12.6%) in school 2 (WIFS not implemented). The difference in prevalence of anemia was not found to be statistically significant (p = 0.909). This may be due to facilities provided in both the schools apart from WIFS Programme such as mid day meal programme and school health programme.

Table 4 Prevalence of anemia in WIFS Beneficiary

WIFS Beneficiary	Anemia		Total (%)
	Present (%)	Absent (%)	
Yes	11 (11.2%)	87 (88.8%)	98 (100%)
No	25 (13.0%)	168 (87.0%)	193 (100%)
Total	36 (12.4%)	255 (87.6%)	291 (100%)

(Chi-square = 0.179, df = 1, p = 0.672)

As seen in table 4, the prevalence of anemia was high 25 (13%) in WIFS non beneficiary as compared to beneficiaries 11 (11.2%). However this difference was not statistically significant (p = 0.672). Mean hemoglobin in WIFS beneficiaries was 13.29 ± 1.17 and in non beneficiaries it was 13.11 ± 1.18. No statistically significant difference was found in WIFS beneficiaries and non beneficiaries in relation to mean hemoglobin levels using student's t test (t = 1.349, df = 289, p = 0.179).

DISCUSSION

Prevalence of anemia in adolescent school children was found to be 12.4% in this study, indicating that it is of mild public health importance according to the World Health Organization. The prevalence of anemia was estimated to be 31.4% by Rakesh *et al*[10] in school children from Southern Kerala of class V to IX. Studies done in other states of India also revealed high prevalence of anemia in adolescents[11,12,13,14]. This variation in the prevalence might be due to the difference in the study population studied with respect to age group and different methods used for hemoglobin estimation. Though the prevalence of anemia in this study was lower than most of the other studies in India, it was still higher compared to prevalence reported in high income countries [15,16].

In this study, 31 (86.1%) of children had mild anemia, 5 (13.9%) had moderate anemia and none of them had severe anemia. Study done in adolescents by Rakesh *et al*[10] in Kerala reported that 18.5% had mild anemia, 11.9% had moderate and 1% with severe anemia. Verma *et al*[11] study in Rohtak observed that the prevalence of mild, moderate and severe grade of anemia was 40.2%, 27.3% and 0.20% respectively.

Prevalence of anemia was significantly higher in females 24 (16.1%) as compared to males 12 (8.5%) [$\chi 2 = 3.932$, df = 1, p = 0.047]. Also statistically significant difference was seen in mean hemoglobin of males and females (t = 4.702, df = 289, p<0.001). The result of the study corroborated the findings of other studies done in other States of India[8, 13]. Prevalence of anemia was more in girls who had attained menarche 18 (20.5%) as compared to those who had not attained menarche 6 (9.8%). This finding suggests that growth spurt and onset of menarche contribute to causation of anemia in adolescent girls.

Parasitic infestation is also one of the important causes of anemia because they cause bleeding from the gut, bladder and other internal organs. In the present study, 49 (16.8%) of children reported passage of worms in stool. Anemia was seen more in children who gave history of passing worms in stool 8 (16.3%). However it was not found to have statistically significant effect on status of anemia. Other studies also reported increased prevalence of anemia among adolescents with history of worm infestation[17,18].

There were total of 5 (1.7%) of vegetarians in the study population, out of those 1 (20%) had anemia as compared to children on mixed diet 35 (12.2%). Mehta *et al* study[19] done in Shimla found that prevalence of anemia was 1.2 times higher in vegetarians as compared to non vegetarians. Bioavailability of iron in vegetarian diet is low because of presence of iron absorption inhibitors such as tannates, phosphates, phytates. Such diet therefore contributes to high prevalence of anemia in those following a vegetarian diet.

This study showed high prevalence of anemia in overweight children 5 (26.3%). T. Jain *et al*[20] study in Meerut also found that the prevalence of anemia was high in overweight (50%) and obese children (50%). Pinhas- Hamiel *et al*[21] study in adolescents in Israel found greater prevalence of iron deficiency in overweight and obese children and adolescents. In contrast, Sudhagandhi *et al*[12] study in Tamil Nadu found high prevalence of anemia in underweight children (55.9%) followed by children with normal BMI (51.3%). High prevalence of anemia in overweight adolescents may be due to increased intake of junk foods and snacks which are deficient in iron in overweight children.

In Goa, Weekly Iron and folic acid Supplementation Programme was started in 2013[23]. Every child from 6th to 10th standard is given IFA tablets containing 100 mg of elemental iron and 500mcg of folic acid.

The difference in prevalence of anemia in two schools was not found to be statistically significant (p = 0.909). This may be due to facilities provided in both the schools apart from WIFS Programme such as mid day meal programme and school health programme. However, the present study was not designed to find out the effectiveness of WIFS Programme as baseline hemoglobin values were not available. Interventional study would be helpful for this purpose.

Most common reasons for opting out of the WIFS programme was side effects of the tablets reported by 18 (11.5%) and 2 (1.8%) reported that they don't like to take tablets. Side effects reported by the subjects were epigastric pain 15 (13.3%); Nausea 1(0.9%); Vomiting 1 (0.9%); Nausea, epigastric pain & constipation 1(0.9%). Predominant causes for IFA tablet refusal reported by Hema *et al*[24] in rural Pondicherry were stomach pain (24.2%), nausea and vomiting (14.2%), disliking of tablets (12.9%), bad taste and headache. The children opting out of the programme should be encouraged to participate in it. Side effects related to consumption of the tablet should be treated.

Limitation of the study

Hemocue method is recommended by the World Health Organiztion for field surveys, however direct Cyanmethemoglobin method remains the gold standard for hemoglobin estimation. The exact cause of anemia could not be evaluated as it was beyond the scope of the study. The risk factor such as worm infestation was assessed based on history from the child and was not confirmed by stool examination. Similarly data regarding other risk factors was obtained from participants and not confirmed with their parents.

CONCLUSION

In the current study, prevalence of anemia in adolescent school children was found to be 12.4%. According to the World Health Organization, this prevalence is classified as having mild public health problem. The current study did not find significant difference in anemia status in WIFS beneficiaries when compared to non beneficiaries. There is a need to further evaluate the impact of WIFS Programme. Strengthening the existing programmes such as mid day meal programme, school

health programme, Weekly Iron and Folic acid Supplementation programme together with health education about diet and consumption of iron rich foods is necessary to further decrease the prevalence of anemia. There is also a need to focus on adolescents who are at a higher risk of developing anemia such as females specially those who had attained menarche.

Conflict of interest: None

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How to cite this article:

Gaude Nilam and Dias Amit (2018) 'Prevalence of Anemia in Adolescent School Children in Rural Area in the State of Goa', *International Journal Of Current Medical And Pharmaceutical Research,* 04(3), pp. 3124-3128.

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