ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2017; 3(10): 141-145
www.allresearchjournal.com
Received: 14-08-2017
Accepted: 20-09-2017

Dr. Kanak Kanti Mandal
Assistant Professor, Department of Biochemistry, Mayo Institute of Medical Sciences, Barabanki, Uttar Pradesh, India

Dr. Sandeep Tammareddy
Assistant Professor, Department of Paediatrics, GSL Medical College, Rajahmundry, Andhra Pradesh, India

Correspondence
Dr. Sandeep Tammareddy
Assistant Professor, Department of Paediatrics, GSL Medical College, Rajahmundry, Andhra Pradesh, India

To study effects of once-weekly iron supplementation with and without vitamin C on anaemia in teenage girls

Dr. Kanak Kanti Mandal and Dr. Sandeep Tammareddy

Abstract
Background and Objectives: One of India's most pressing public health issues is nutritional deficiency illnesses. Children and adults alike are more likely to contract a host of diseases when they are undernourished, which has serious consequences for health. This study set out to examine the effectiveness of two different treatment strategies for anaemia in schoolgirls, namely weekly oral iron/folic acid or weekly oral iron/folic acid with vitamin C. The participants in the study ranged in age from 10 to 14 years old.
Material and Methods: The paediatrics department of GSL Medical College, Rajahmundry, Andhra Pradesh, India, conducted this case-control study. From September 2016 to August 2017, the research was conducted. In this investigation, 50 cases of acute lower respiratory tract infection were included in the sample, along with 50 control children who were matched for sex, age, and nutritional status.
Results: Adolescent girls studying in schools face a severe problem of iron deficiency anaemia. A study conducted on teenagers found that 63.8% of females were diagnosed with anaemia. Another study conducted by Shaw NS40 demonstrated a higher incidence of iron deficiency in teenage girls, with a frequency of 61.8% for anaemia in adolescent girls. The findings of our study indicate that around 68.3% of young teenage girls exhibited anaemia, with a similar prevalence seen. Among the girls, 49.4% had mild anaemia, 18.9% had moderate anaemia, and 1.2% had severe anaemia.
Conclusion: Weekly administration of Fe/Folate supplemented with Vitamin C resulted in a more rapid increase in haemoglobin levels in children with anaemia. Proposed that implementing a public health strategy involving the weekly administration of iron/folate supplemented with Vitamin C through supervised schools may be a more effective approach compared to providing weekly iron/folate alone to address anaemia in adolescent girls.

Keywords: Iron, haemoglobin, deficiency, girls

Introduction
Nutritional deficiencies pose a significant health concern in the context of India. Furthermore, undernutrition not only has direct implications for morbidity and death, but it also increases the susceptibility of both children and adults to a range of diseases. Vitamin A, iron, and iodine are considered to be three crucial micronutrients that play a significant role in several physiological processes. These nutrients are essential for the development of proper learning and cognitive abilities, immunological defense mechanisms, work capacity, and reproductive health. The deficiency of these three micronutrients has been widely recognized to have profound and detrimental impacts on human health [1-3].
The most prevalent hematological disorder observed in infancy and childhood is anaemia, which arises due to inadequate iron levels for the production of haemoglobin. Iron deficiency anaemia affects around 30% of the world's population, with the majority of affected individuals residing in developing nations. Iron deficiency anaemia is a condition that arises when the absorption of iron is insufficient to offset the iron requirements and losses. Pregnant women, newborns, young children, and teenagers have more stringent requirements. Iron deficiency anaemia has numerous and significant ramifications, impacting not only the well-being of individuals but also the progress of society and nations. The incidence of anaemia among adolescent girls in India is significantly elevated [2-4].
Adolescent females represent a particularly susceptible demographic due to their elevated iron requirements and subsequent losses from the body. The largely cereal-based diets

exhibit reduced bioavailability of iron due to their elevated phytate content. It is probable that anaemia will have a detrimental impact on the physical labor capacity and cognitive skills of adolescent females during the pubertal period of their development. Adolescent anaemia restricts growth and postpones the onset of menarche, perhaps resulting in cephalopelvic disproportion. Supplementation during pregnancy does not effectively repair the iron status, leading to higher maternal mortality and lower child survival rates [3-5]. In India, it is common for females to marry and conceive before the completion of their growth phase, which increases the risk of anaemia. Limited efforts have been made to specifically address anaemia control among adolescent females, resulting in a lack of prioritization of healthcare services for this demographic globally [4-6]. Anaemia is characterized by a decrease in the volume of red blood cells or the concentration of haemoglobin, falling below the range of values observed in individuals who are in good health. While a decrease in the quantity of haemoglobin in circulation leads to a decline in the blood's ability to carry oxygen, there are typically minimal clinical disruptions until the haemoglobin level drops below 7–8 g/dl. Pallor becomes apparent in the mucous membranes at levels below this threshold. When moderately severe anaemia progresses gradually, there may be a surprising lack of noticeable symptoms or objective observations. The progression of anaemia, irrespective of its etiology, leads to the manifestation of symptoms such as weakness, tachypnea, dyspnea upon physical exertion, tachycardia, ventricular dilatation, and congestive heart failure. Anaemia is not a singular categorization, but rather a consequence of numerous underlying pathological mechanisms [5-7]. The objective of the study was to assess the effectiveness of weekly oral iron/folate supplementation compared to weekly oral iron/folate supplementation with Vitamin C in 11- to 14-year-old anemic adolescent girls.

Materials and Methods

This study is prospective in nature. The objective of this study is to assess the effectiveness of weekly iron pill supplementation, with and without vitamin C, in enhancing the haemoglobin percentage (Hb %) levels among adolescent females with anaemia. A study design was chosen based on this idea. The present investigation was carried out at the Department of Pediatrics, GSL Medical College, Rajahmundry, Andhra Pradesh, India. The research was undertaken from September 2016 to August 2017. The participants for this study consisted of adolescent girls aged 10 to 14 years who were studying in the 6th to 9th grade. The researchers sought permission from the school officials.

Inclusion Criteria

- Children exhibiting deficiency
- Children diagnosed with anaemia

Exclusion Criteria

- Individuals diagnosed with chronic illnesses.
- Individuals who exhibit reluctance to engage in the experiment.

Results

This study involved a sample of 100 teenage girls aged 10-14 years who were attending corporation schools. Out of these, 92 girls provided consent for screening, and baseline data on height, weight, and haemoglobin status were collected. Out of the 100 participants, 98 individuals with haemoglobin levels exceeding 12gm/dl were eliminated from the study. Four adolescents with severe anaemia were referred to a tertiary care facility for additional treatment. A total of 100 female participants with a haemoglobin percentage of less than 12gm/dl were included in this study. These participants were randomly assigned to two groups, with 50 girls in each group. The baseline data for haemoglobin, height, and weight were recorded for each participant. The female participants in Group A received a weekly supplementation of iron folic acid tablets, while those in Group B received a weekly supplementation of iron folic acid together with Vitamin C at a dosage of 100mg for a duration of 24 consecutive weeks. In the final analysis, a total of 50 children from Group A and 50 children from Group B were included for statistical examination. Fifteen children in each group experienced a loss of follow-up and subsequently withdrew from the study. The research population has a prevalence rate of 69.6% for anaemia, with 1.2% of individuals classified as severely anemic.

Age distribution

Table 1: Age Distribution

Sr. No.	AGE	Group A	Group B
1.	10	5	3
2.	11	10	17
3.	12	15	8
4.	13	10	8
5.	14	10	4
	Total	50	50

The age range of 12 to 13 years encompassed the majority of the children. The age distribution exhibited a similar pattern in both groups.

Nutritional status

Table 2: Nutritional Status

Sr. No.	Nutritional Status	Group A	Group B
1.	Normal	39	78
2.	Undernutrition	10	25
3.	Overweight	1	7

A total of 39 children in Group A and 10 children in Group B had normal nutritional status. One kid in Group A and 25 children in Group B exhibited undernutrition.

Awareness about Anaemia

A survey was conducted to assess awareness regarding the causal factors, impact, and prevention of anaemia. The results indicated that, on average, only 7.3% of participants in Group A and 9.4% in Group B demonstrated awareness of the factors associated with anaemia.

Table 4: Factors Affecting Awareness of Anaemia

S. No	Factors regarding anaemia	Group A	Group B
1	Tea/coffee intake	5	6
2	Worm infestation	10	8
3	Cognitive factors	10	06
4	Delivery related complications	5	10
5	Iron rich foods	10	10
6	Affects adolescent girls	10	10

Height at enrollment

Table 5: Height at enrollment

Sr. No.	Group	Mean
1.	Group A	140.9
2.	Group B	143.3

In Group A, the average height of girls was 140.9 cm with a standard deviation of 8.3cm. In Group B, the average height of girls was 143.3cm with a standard deviation of 8.3cm, and both groups had similar measurements.

Weight at enrollment

Table 6: Weight at enrollment

Sr. No.		Mean
1.	Group A	34.1
2.	Group B	34.2

The average weight in Group A was 34.1 kg, with a standard deviation of 8.6 kg. In Group B, the average weight was 34.2 kg, with a standard deviation of 7.8 kg. The weights in both groups were similar.

Severity of Anaemia

Table 7: Severity of anaemia

Grades	Group A	Group B
Moderate	20	31
Mild	30	19

According to the WHO standards for the severity of anaemia, 37.5% of individuals in Group A had moderate anaemia, 39.4% in Group B had moderate anaemia, and 62.5% in Group A and 60.6% in Group B had mild anaemia. Both groups exhibited similar levels of anaemia severity at admission.

Side effects

Table 8: Side effects

Side effects	Group A	Group B
Vomiting	6	6
Pain abdomen	3	4
Loose stool	0	1

A total of six children in Group A and six children in Group B experienced episodes of vomiting. Each group consisted of 3 youngsters who experienced stomach pain. In group B, one kid experienced loose stools. However, the observed adverse effects were of a modest nature and did not significantly impede the administration of the medication. The side effects were similar across all groups.

Discussion

One major issue among school-aged females is iron deficiency anaemia. Among teenage girls, 63.8% were anemic, according to one study; 61.8% were anemic, according to another; and iron deficiency was more common in teenage girls, according to Shaw NS40. The prevalence is similar to what our study found, which is that approximately 68.3% of young teenage girls were anemic. Out of the total number of girls, 49.4% had mild anaemia, 18.9% moderate, and 1.2% severe [7-9].

Schedules giving hematinics less frequently than once daily have been investigated for the purpose of improving compliance and reducing intestinal oxidative stress. This approach is predicated on the rate of mucosal turnover in the intestines. One possible rate-limiting stage in iron absorption is when the mucosal cells reach saturation of the iron binding protein, apoferritin. Many researchers have advocated for weekly iron supplementation as a strategy, and our study is no exception, due to the fact that the mucosal clearance period in humans is 5-6 days [10-12].

As Shoba S. and Sharda D.44 found in their study of teenage schoolgirls in India, supplementing with iron twice weekly resulted in improved compliance and fewer side effects. There were no significant adverse effects and both groups demonstrated improved compliance in our study. A fair increase in haemoglobin content was observed in teenage girls who took iron supplements regularly, according to several research. Following 25 weeks of weekly iron and folic acid treatment, which was equivalent to daily supplementation, the mean haemoglobin level increased from 10.45±1.21 g/dl to 11.99±1.19 g/dl, and the prevalence of anaemia was reduced from 63.8% [11-13].

Adolescent females' haemoglobin concentration was enhanced by weekly iron supplementation. Haemoglobin and serum ferritin levels were found to improve in teenage girls who took iron supplements weekly. After 24 weeks of supplementation with IFA once weekly, our study found similar results, with an average increase in haemoglobin percentage from 10.29±1.14 to 11.8±0.93 g/dl [12-14].

Vitamin C, when consumed with iron-rich foods, greatly improves iron absorption. The iron absorption rate was 7.7 percent when 50 milligrams of vitamin C and iron folate were taken together, compared to 1.6 percent when iron was taken alone. Our study found that adding 100 mg of vitamin C to the weekly regimen produced similar outcomes [15-17].

Vitamin C supplementation with iron and folate was associated with a much higher mean rise in haemoglobin percentage response than iron and folate alone. After three months of supplementation, it was shown that teenage girls from low-income communities whose haemoglobin concentrations were much higher when they took vitamin C supplements weekly in addition to iron and folate. Our study found that taking iron supplements with vitamin C every week resulted in a significantly higher haemoglobin concentration (2.30±0.69g/dl) compared to the group that took iron supplements alone at the end of the 24-week period. This difference was also observed at the end of the 12-week period, with the weekly IFA+ Vitamin C supplementation group still showing a significant increase in haemoglobin concentration. The supplemented vitamin C group likewise had a markedly lower incidence and severity [17-19].

Girls in our study who had lower haemoglobin levels before supplementation with vitamin C in the weekly IFA group showed a greater rate of haemoglobin rise. Supplementing school-aged children once a week is more effective than once a day when it comes to promoting growth in their stature. Over the course of the 12 weeks, participants in the Fe/folic acid with vitamin C group did have a little bit more growth in height than the control group, but by the conclusion of the trial, there was no statistically significant difference in the two groups' mean growth rates. Schoolgirls

between the ages of 10 and 14 have been found to have put on some extra pounds. Both groups gained weight during the course of our trial (12 weeks and 24 weeks), but we did not find a statistically significant difference [20-22].

Research on the effects of iron, folic acid, and vitamin C supplementation on haemoglobin levels a 2008 study on the health of teenage girls in an ICDS block found that the greatest increase in haemoglobin was seen when the individuals received iron and vitamin C supplements biweekly rather than once a week or every day. After three months of supplementation, the average height increased by 1.0 cm, and after six months, it increased by 0.2 cm. Subjects' mean body weights rose. After three months of supplementation, the haemoglobin level rose 2.5%, and after six months, it rose 0.2%. We found that supplementing once a week yielded significantly superior benefits in our study [21-23].

Results from the midterm survey clearly showed that school-going girls who took an iron-folate supplement weekly for six months under the supervision of a teacher had significantly higher haemoglobin levels than those who did not, suggesting that this approach was feasible. Our research also demonstrated that, with proper supervision, it is possible to increase haemoglobin levels by adding vitamin C to the weekly IFA program. Following the intervention, both groups shown notable improvements in memory, physical activity, hunger, and other related areas, according to the qualitative study. There are a lot of other variables that might affect the result, and this is just subjective [23-25].

Conclusion

Anaemia children's mean haemoglobin levels rose in both the weekly Fe/Folate and Fe/Folate with Vitamin C groups. Supplementing patients' iron and folate levels weekly with vitamin C had a greater impact on Hb level increment at 12 and 24 weeks than iron and folate alone. Mild and moderate anaemia rates fell in both groups, but the response was much stronger in the Fe/Folate with Vitamin C group. While both groups experience some growth in stature over the course of 12 weeks, the additional vitamin C group shows somewhat more improvement. The two groups did not differ with respect to weight increase. There are fewer adverse effects and higher compliance in both groups. Effective strategies to prevent anaemia must include school-based nutrition teaching and information and education campaigns (IEC) on the topic. The anemic youngsters had a greater haemoglobin increase in a short period of time when they were supplemented with vitamin C and iron once weekly. Adolescent girls who suffer from anaemia may benefit more from a public health plan that involves the supervised distribution of iron/folic acid and vitamin C to schools once weekly rather than only receiving iron/folic acid.

Funding

None

Conflict of Interest

None

References

1. Chakravarthy I, Sinha R K. Prevalence of micronutrient deficiency based on results obtained from the national pilot programme on control of micronutrient malnutrition. Nutr Rev. 2002;60:S53-S58.
2. Chaturvedi S, Kapil U, Gnansekharan N, Sachdev HP S, Pandey RM, *et al*. Nutrient intake amongst adolescent girls belonging to poor socio-economic groups of rural Rajasthan. Indian Pediatr. 1996;33:197-201.
3. Shobha S, Sharada D. Efficacy of twice weekly iron supplementation in anemic adolescent girls. Indian pediatrics. 2003 Dec 15;40(12):1186-90.
4. Sharma A, Prasad K, Rao Vishweswara K. Identification of an appropriate strategy to control anaemia in adolescent girls of poor communities. Indian Pediatr. 2000;37:261-267.
5. Trivedi P, Palta A. Prevalence of Anaemia and impact of iron supplementation on anaemic adolescent school girls. Health Popul Perspect Issues. 2007;30:45-55.
6. Schultink W, Gross R, Gliwitzki M, Karyadi D, Matulassi P. Effect of daily versus twice weekly iron supplementation in Indonesian pre-school children with low iron status. Am J Clin Nutr. 1995;61:111-115.
7. Awasthi S, Verma T, Vir S. Effectiveness of Biweekly Versus Daily Iron–Folic Acid Administration on Anaemia Status in Preschool Children. Journal of tropical pediatrics. 2005 Apr 1;51(2):67-71.
8. Dacie JV, Lewis SM. Practical Hematology. Sixth edn Edinburg: Churchill Livingstone; c1984. p. 22-49.
9. Kapil U, Kaur S, Singh C, Suri S. The impact of a package of single mega dose of vitamin A and daily supplementation of iron, folic acid and vitamin C in improving haemoglobin levels. Journal of Tropical Pediatrics. 2005 Aug 1;51(4):257-8.
10. Rousham EK, Uzaman B, Abbott D, Lee SF, Mithani S, Roschnik N, *et al*. The effect of a school-based iron intervention on the haemoglobin concentration of school children in north-west Pakistan. European journal of clinical nutrition. 2013 Nov;67(11):1188-92.
11. Shah BK, Gupta P. Weekly vs daily iron and folic acid supplementation in adolescent Nepalese girls. Archives of pediatrics & adolescent medicine. 2002 Feb 1;156(2):131-5.
12. Perrin E, Rothman R, Coyne-Beasley T, Ford C, Bordley WC. Is weekly iron and folic acid supplementation as effective as daily supplementation for decreasing incidence of anaemia in adolescent girls?. Archives of pediatrics & adolescent medicine. 2002 Feb 1;156(2):128-30.
13. Shah SP, Shah P, Desai S, Modi D, Desai G, Arora H. Effectiveness and feasibility of weekly iron and folic acid supplementation to adolescent girls and boys through peer educators at community level in the tribal area of Gujarat. Indian J Community Med. 2016;41:158-61.
14. Vir SC, Singh N, Nigam AK, Jain R. Weekly iron and folic acid supplementation with counseling reduces anaemia in adolescent girls: a large-scale effectiveness study in Uttar Pradesh, India. Food Nutr Bull. 2008;29:186-94.
15. Bansal PG, Toteja GS, Bhatia N, Vikram NK, Siddhu A. Impact of weekly iron folic acid supplementation with and without vitamin B12 on anaemic adolescent girls: a randomized clinical trial. Eur J Clin Nutr. 2016;70:730-7.
16. Gera T, Sachdev HP, Nestel P, Sachdev SS. Effect of iron supplementation on haemoglobin response in

children: systematic review of randomised controlled trials. J Pediatr Gastroenterol Nutr. 2007;44:468-86.
17. Pankaj P Shah, Shrey A Desai, Dhiren K Modi, Shobha P Shah. Assessing Diagnostic Accuracy of Haemoglobin Colour Scale in Real-life Setting J Health Popul Nutr. 2014 Mar;32(1):51-57.
18. Sari M, De Pee S, Martini E, Herman S, Sugiatmi Bloem MW, *et al*. Estimating the prevalence of anaemia: a comparison of three methods. Bull World Health Organ. 2001;79:506-11.
19. Saxena R, Malik R. Comparison of HemoCue method with the cyanmethaemoglobin method for estimation of haemoglobin. Indian Pediatr. 2003;40:917.
20. Kapoor SK, Kapil U, Dwivedi SN, Anand K, Pathak P, Singh P. Comparison of HemoCue method with cyanmethaemoglobin method for estimation of haemoglobin. Indian Pediatr. 2002;39:743-6.
21. Sharma A, Prasad K, Rao KV. Identification of an appropriate strategy to control anaemia in adolescent girls of poor communities. Indian pediatrics. 2000 Mar 1;37(3):261-7.
22. Sukhdeep K, Sangha JK. Effect of weekly iron and vitamin C supplementation on the anaemic status of adolescent girls. Journal of Research, Punjab Agricultural University. 2010;47(1/2):92-7.
23. Joshi M, Gumashta R. Weekly iron folate supplementation in adolescent girls–an effective nutritional measure for the management of iron deficiency anaemia. Global journal of health science. 2013 May;5(3):188.
24. Kianfar H, Kimiagar M, Ghaffarpour M. Effect of daily and intermittent iron supplementation on iron status of high school girls. International Journal for Vitamin and Nutrition Research. 2000 Jul 1;70(4):172-7.
25. Ahmed F, Khan MR, Jackson AA. Concomitant supplemental vitamin A enhances the response to weekly supplemental iron and folic acid in anemic teenagers in urban Bangladesh. The American journal of clinical nutrition. 2001 Jul 1;74(1):108-15.