Original Article

Assessment of Weekly Iron–Folic Acid Supplementation with and without Health Education on Anemia in Adolescent Girls: A Comparative Study

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Abstract

Background: Iron deficiency is the most common and widespread nutritional disorder in the world, affecting a large number of children and women in developing countries and constituting a public health condition of epidemic proportions. Weekly iron and folic acid supplementation (WIFS) with health education has been demonstrated to be effective in reducing anemia in adolescent school going girls. We assessed the impact of WIFS with and without health education on anemia in adolescent school girls of Delhi. **Methods:** This is a school-based intervention study conducted in two government senior secondary schools of Delhi. A total of 210 adolescent school girls from two schools were included in the study. In one school (intervention group), weekly ironfolic acid with health education once a month was given, and in the second school (control group), only WIFS was given for 6 months. Iron–folic acid supplementation containing 100 mg of elemental iron and 0.5 mg of folic acid was given on a weekly basis, and health education was provided once a month for 6 consecutive months. Hemoglobin (Hb) estimation was done at the beginning and the end of the study using the Hemocue method. Mean Hb change after intervention between the control and experimental groups was compared using a *t* test. Pre and post differences within the control and experimental groups were assessed using a paired-*t* test. **Results:** After intervention, there was a significant decline in prevalence of anemia in both the intervention (54.7 percentage points decline) and the control (26 percentage points decline) groups ($P < 0.001$). **Conclusions:** WIFS with once a month health education can be effective in reducing the prevalence of anemia in adolescent school girls.

Keywords: *Adolescent, anemia, health education, India, schools, weekly iron–folic acid supplementation*

Background

Iron-deficiency anemia is the most common form of malnutrition in the world, where the World Health Organization has estimated that around 2 billion people are affected by iron deficiency anemia.[1] In countries of the South East Asia region, at least 40% to 50% of pregnant and adolescent girls are anemic.[2] According to the Indian Council of Medical Research (ICMR), the prevalence of anemia in adolescent girls was 90.1% with 7.1% having severe anemia.[3] Anemia during adolescence reduces growth velocity and in turn increases pregnancy-related complications.[4,5]

The daily administration of iron loads the intestinal epithelium, and adverse gastrointestinal symptoms are frequent. Renewal time of the intestinal mucosa is 5 to 6 days; therefore, a weekly dose of iron should be efficacious.[6,7] Supplementation of iron folic acid (IFA) on a weekly basis will enhance compliance, and cost and side effects can be minimized. Supervised IFA supplementation at work sites and schools ensures proper utilization of IFA tablets.[8-12]

The literature shows that nutrition interventions are more likely to be effective, when educational strategies are focused on behavioral change.[4,13] We conducted a school-based study to investigate the impact of WIFS with and without health education in anemic adolescent school girls.

Methods

Sample selection

This study was conducted in the Northwest district of Delhi, which was selected by a simple random sampling method. Two schools were targeted in this district through use of a random number table. In both the schools, an XI (higher secondary) class was randomly selected by a lottery method. The

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classes from IX to XII were written on paper slips. These slips were placed in an envelope of same size and color. These envelopes were thoroughly mixed, and one envelope was picked. Students for the study were selected using a random number table.

The intervention group was given weekly iron folic acid supplementation (WIFS) with health education once a month, while a control group was given only WIFS. A lottery method, as mentioned above, was used for determining the intervention and control groups. This resulted in 106 students included in the intervention group and 104 in the control group.

Sample size was calculated using the free software G* Power Program, version 3.1.2. It was hypothesized that the combined intervention of WIFS and health education once a month should be able to improve hemoglobin (Hb) levels at 1 g or more as compared with the single intervention (WIFS only to examine statistical significance between groups).[8] This was converted into an effect size of 0.56. Using a confidence interval of 95%, with significance level (alpha) at 0.05, power of the study (1-beta) of 80%, and effect size of 0.56, the required sample size in each group was 64, for a total of 128. Considering a 50% dropout, a total of 210 students were included in the study.

Hb measurements

Hb estimation was done in the beginning and at the end of the study using the Hemocue method.[14] All aseptic precautions were followed while conducting blood draws. Anemia was defined as Hb <12.0 g/dL with severe anemia defined as Hb <7.0 g/dL, moderate anemia defined as Hb between 7.0 and 9.9 g/dL, and mild anemia defined as Hb between 10.0 and 11.9 g/dL.[15]

Interventions

The intervention group received health education and WIFS once a month. For the control group, only WIFS was provided. IFA supplementation containing 100 mg of elemental iron as ferrous sulphate and 0.5 mg of folic acid was given. Health education was provided once a month for 6 months. This education included causes of anemia, emphasis on an iron rich diet, and encouragement of three major and two minor meals. The health education package also included a power point presentation, pamphlets, and visual display of iron and vitamin-C rich foods.

Statistical analysis

Data analysis was conducted using SPSS Software Version 17.0. Mean Hb levels after intervention between the control and experimental groups were compared using a *t* test. Pre and post differences within the control and experimental groups were assessed using a paired-*t* test.

Ethical considerations

Written permission from the Director of the School Health Service, Delhi, was obtained prior to the study. Principals of the selected schools were contacted and informed about the purpose of the study, and their permission was obtained. Confidentiality was assured and written informed consent was obtained from parents of the students. Health education was provided to the girls in the control group after 6 months of data collection.

Results

Girls from both schools were comparable in socio-economic status according to the modified Kuppuswamy scale 2011.[16] In both schools, most of the girls were of upper lower socio-economic status. The mean age of the girls was 16.4 ± 0.8 years. Pre and post intervention dietary assessment was done and is presented in [Table 1]. History-related worm infestation and symptoms of anemia were assessed before and after intervention in both the groups; there was significant decrease in the symptoms after intervention in both the groups [Table 2].

Baseline Hb evaluation was done before carrying out the intervention. The overall prevalence of anemia among the school girls was 96.7%, with 4.3% suffering from severe anemia.[15] The percentage of girls with anemia decreased from 93.3% to 38.6% in the intervention group and from 100% to 74% in the control group. The decrease in prevalence of anemia in the intervention group was greater compared with the control group (P = 0.001). Mean Hb

Table 1: Dietary history before and after intervention in adolescent girls attending two schools in Delhi, India (*n*=210)

Diet	Intervention group (*n*=106)		Control group (*n*=104)	
	Baseline No. (%)	Post intervention No. (%)	Baseline No. (%)	Post intervention No. (%)
Non vegetarian	58 (54.7)	70 (66.0)	67 (64.4)	69 (66.3)
Green leafy[ab]	105 (99.1)	106 (100.0)	96 (92.3)	98 (94.2)
Eggs[c]	54 (50.9)	75 (70.7)	62 (59.6)	60 (57.6)
Tea/Coffee[bc]	102 (96.2)	30 (28.3)	97 (93.2)	90 (86.5)
Skipping of meals[abc]	51 (48.1)	15 (14.1)	92 (88.5)	94 (90.3)
Fasting	32 (30.2)	14 (13.2)	25 (24.0)	25 (24.0)

Pre and post differences of the dietary habits between the groups were analyzed by using the Chi-square test, and pre and post differences within the group were analyzed with the McNemar test. a=pre intervention differences of symptoms between the groups at P<0.05, b=post intervention differences of symptoms between the groups at P<0.05, c=post intervention comparison within the intervention groups at P<0.05, d=post intervention comparison within the control groups at P<0.05

Table 2: Symptoms of anemia before and after intervention in adolescent girls attending two schools in Delhi, India (*n*=210)

Symptoms of anemia	Intervention group (*n*=106)		Control group (*n*=104)	
	Baseline No. (%)	Post intervention No. (%)	Baseline No. (%)	Post intervention No. (%)
Pica[cd]	26 (24.5)	05 (4.7)	37 (35.6)	08 (7.7)
Passing of worms[cd]	26 (24.5)	03 (2.8)	28 (26.9)	05 (4.8)
Anal pruritis[cd]	25 (23.5)	02 (1.9)	37 (35.6)	03 (2.9)
Decreased appetite[abcd]	52 (49.1)	15 (14.1)	71 (68.3)	28 (26.9)
Fatigue[cd]	74 (69.8)	30 (28.3)	68 (65.4)	30 (28.8)
Irritability[cd]	67 (63.2)	18 (17.0)	60 (57.7)	20 (19.2)
Breathlessness[bcd]	59 (55.7)	20 (18.9)	71 (68.3)	35 (33.6)

Pre and post differences of the symptoms of anemia between the groups were analyzed by using the Chi-square test, and pre and post differences within the group were analyzed with the McNemar test. a=pre intervention differences of symptoms between the groups at $P<0.05$, b=post intervention differences of symptoms between the groups at $P<0.05$, c=post intervention comparison within the intervention groups at $P<0.05$, d=post intervention comparison within the control groups at $P<0.05$

rise in the intervention group was 2.3 g/dL after adjusting diet, socio-economic status, and personal hygiene history as compared with 1.9 g/dL in the control group. No girl had Hb status less than 7.0 g/dL after intervention.

Discussion

The overall prevalence of anemia was 96.7% (mild anemia 44.3%, moderate anemia 48.1%, and 4.3% severe anemia). This reinforced the increased requirement for iron in girls, which is not met by their regular diet. A study by the ICMR in India has shown a similar prevalence of anemia among adolescent school girls: 90.1%, with severe anemia at 7.1%.[3] Serial cross-sectional or prospective studies have also shown a similar prevalence of anemia.[17-19]

WIFS

Supplementation of iron has been recommended in the adolescent years mainly due to three factors: 16% to 55% of girls are already anemic by the time they become pregnant; pregnancy is too short a period of time in which to reduce preexisting anemia; and intervention channels already exist which can be used for targeting adolescent girls for iron intake.[4] The effectiveness of daily iron-supplementation programs has been questioned because of low efficiency of health services and lack of compliance with guidelines.[20] The use of intermittent supplementation schedules has been suggested as a way to improve compliance by reducing side-effects. Several studies conducted among adolescent girls and school-age children have shown that the efficacy of an intermittent iron-supplementation schedule is similar to that of daily dosing.[21,22]

In this study, both groups showed significant fall in the prevalence of anemia. However, the mean rise in Hb and fall in prevalence was higher in the intervention group and this. Similarly, other studies concluded that weekly iron dose was as effective as daily supplementation in treating anemia.[23-25] Weekly administration has the advantage of fewer side effects and lower costs. This approach, therefore, seems to be more efficient than daily supplementation.[26,27]

Experience and compliance with IFA intervention

Compliance was defined as the proportion of distributed pills that were consumed regularly by the study participants. The reduction in prevalence of anemia strongly supports the usefulness of IFA supplementation in school girls. In the early phase of the study, students complained about stomachache and heartburn after ingestion of the IFA pills. The frequency of gastrointestinal side effects is known to relate to the iron dose. However, symptoms were most common in girls who had a history of skipping meals. A history of skipping meals was high in both the study groups. Therefore, IFA tablets were given after consuming lunch, and students were advised not to skip meals. In both schools, compliance was almost 100%, as consumption of the IFA tablet was directly supervised by the investigator. Other studies have shown compliance at 70% to 90%.[28,29]

Health education

Our findings show that WIFS coupled with health education can overcome anemia. Health education has motivated girls to eat an iron rich diet. Nutrition education at school and in the community is essential in encouraging dietary practices for improving iron absorption from meals. Promising results using nutrition education as a strategy to improve iron levels and reduce anemia have been observed.[11,13] Studies have documented that administration of iron supplements with adequate information and motivation can be made an essential part of nutrition supplementation programs.[5,13,27] In a developing country like India with a large adolescent population, WIFS with health education can be viewed as an important nutrition intervention. WIFS increases compliance, decreases side effects, and is cost effective as compared with a daily regime.

There are limitations to the study. While study schools were randomly selected, only two schools were targeted for the research. In addition, in this study, only Hb measurement was carried out. Other markers like hematocrit and serum ferritin were not assessed. Despite these limitations, we demonstrated that WIFS with once a month health

education is effective in reducing the prevalence of anemia in adolescent school girls.

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Conflicts of interest

There are no conflicts of interest.

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