ABSTRACT

In schoolgirls entering adolescence, iron deficiency anemia not only compromises pubertal growth spurt but also may reduce physical work capacity (PWC) and cognitive function. Compromised height and BMI gains with high prevalence of anemia puts the girl at higher risk of morbidity and complications when she enters the reproductive phase of her life. Poor PWC and cognition compromises school learning and quality of life. While impact of daily and once weekly IFA supplementation to combat adolescent anemia has been studied, other dose regimens like twice weekly IFA (which may show better impact than once weekly IFA) are not adequately researched, especially in early adolescence.

Thus, the present research was undertaken with the *broad objective* to study the impact of daily and intermittent (once and twice weekly) iron folic acid supplementation on hemoglobin levels, pubertal growth, food and nutrient intake, cognitive function and physical work capacity among underprivileged primary school going girls in early adolescence (9 –13 years) of Vadodara.

Methodology

In four randomly selected Vadodara Municipal Primary Girl's Schools, hemoglobin (Hb) (n=334), height and weight (n=358) of girls willing and available in standard V and VI were assessed using standard methods; food and nutrient intake using 24 hour dietary recall and food frequency questionnaire (n=160), physical work capacity using Modified Harvard's Step test (n=240) and cognitive functions using selected tests from the modified Wechsler Intelligence Scale for Children (WISC), suitably adapted for this group (n=240). One HIG school was additionally selected to compare the LIG girls profile with affluent girls. In three randomly selected experimental schools (ES) IFA tablets in a dose of 100 mg Fe + 0.5 mg folic acid was given either once weekly (E1) or twice weekly (E2) or daily (ED) for one year. The fourth school (control: CS) did not receive any intervention.

Major Findings

Baseline Survey

The mean hemoglobin was 11.32 g/dl, and anemia prevalence: 68.3%. The prevalence of stunting (34.6% according to height-for-age <5th percentile CDC) and undernitrition (57.3%, BMI <5th percentile Must et al Std.) were high. Cereal intake was just about 50% RDA. Intake of green leafy vegetables (GLVs) and milk was very low (<10% RDA). Overall the girls did not frequently consume iron and vitamin C rich foods and those who did, consumed inadequate amounts. The mean intake of important nutrients was low: calories and proteins: 50% of RDA and iron: 30% of RDA. Many girls (45%) had dietary iron intake below 25% RDA.

In all the cognitive function tests, the mean scores were significantly lower ($p<0.001$) in LIG girls compared to HIG girls. Anemic girls had lower cognitive function test scores compared to non-anemic girls. The LIG girls climbed fewer steps than HIG girls. However, the recovery time (RT), was similar in both the groups. A higher number of steps were climbed and a shorter time was taken to revert to the basal pulse rate (recovery time) by non-anemic girls compared to anemic girls ($p<0.001$).

Process Evaluation and Impact of IFA supplementations

Satisfactory compliance (≥70% of expected dose of tablets) was seen in 59.6% intervened girls, with compliance being relatively better in twice weekly group. Differences in compliance between the three groups were not significant. More benefits were experienced by the girls compared to a few girls reporting side effects. There were many who spontaneously reported benefits in terms of improvement in appetite, perceived better weight gain, better concentration and stamina.

Impact of IFA supplementation was studied after one year of intervention. As regards impact, compared to control group, a significant improvement in all the three experimental groups was seen as regards increase in hemoglobin levels, height gain, PWC (mean increase in number of steps climbed) and cognition scores (Visual

memory test and Maze test). Significant improvement in scores of other two tests of cognition (Digit Span and clerical task) and BMI gains were seen only in twice weekly and daily groups (vs. CS). However, improvement in recovery time, i.e. shorter time taken to revert back to basal pulse rate, was significantly better only in daily group. Improvement in food and nutrient intake did not show consistent differences.

Within the intervened groups, twice weekly IFA consistently showed better impact than once weekly IFA for most indicators of anemia, growth, PWC and cognition. Considering only girls with good compliance a similar trend was seen. Initially anemic girls benefited more compared to non-anemic girls, with twice weekly and daily IFA supplementation showing better impact than once weekly IFA supplementation.

Conclusion and Recommendations

Overall, twice-weekly IFA supplementation was comparable to daily IFA supplementation in terms of impact on Hb, growth, cognitive functions and physical work capacity. Primary school girls undergoing pubertal development, thus appear to need IFA supplements for hematinic as well as non-hematinic benefits. Twice weekly IFA at less cost compared to daily IFA is likely to show much better impact especially in school situation when supervised supplementation is possible.

Further research is recommended on larger number of schools in different regions to study impact, feasibility and cost in various settings (rural, urban and tribal). Also non-school going girls should be included through community based interventions. Finally, adolescent boys also need to be beneficiaries of Anemia control programs and should be included in future studies.