Universal anaemia preventive programme in Adolesents: usefulness in preventing anaemia in pre pregnant women

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SUMMARY

In 1996, it was found 36% of adolescents were anaemic in Sri Lanka. In an effort to break the vicious cycle of anaemia, adolescents was targeted and made a priority age group by the Ministry of Health. Hence a first study was conducted in 1998 to identify a cost effective preventive programme by using daily and weekly iron supplementation for adolescent schoolgirls. In 2002 the prevalence of anaemia among school going adolescents' aged 10-15 years were assessed as a baseline and it was 11.1%. Highest prevalence was recorded among grade 7 children and the prevalence was varied from 11% to 30% within districts. As a result, it was decided to address anaemia in school adolescents aged 10-15 years by giving a high priority through schools. In 2002 – 2003, a study was carried out in 5 districts to assess the impact of anaemia in schoolchildren with weekly iron supplementation for a period of 6 months. It revealed when the supplementation coverage is more than 30%, the reduction of anaemia was 50%. As a result weekly iron supplementation was initiated in all schools annually for a period of 6 months among adolescents aged 11-15 years of age since 2004.

This study was conducted in 2009 to assess the impact of iron supplemntation programme after 5 years of the implementation. A household survey was carried out in nine districts of Sri Lanka, one district randomly selected from each province. A multistage cluster sampling method based on the probability proportional to size technique was used to identify 30 clusters per district. A systematic random sampling technique was used within each cluster to identify 21 households. It was expected that the previously supplemented adolesents should presently fall into this age category.

The prevalence of anaemia was 23.5 percent among non-pregnant and non-lactating women aged 15-20 years.

It concluded that iron supplementation during the early adolescent period was not sufficient to maintain iron levels for a long period of time as a strategy to control anaemia in pre pregnanat women. It is recommended to initiate a sustainable cost effective solution to control anaemia in adolescents and pre pregnant women.

No intervention is fool proof; but with constant follow up and monitoring prevailing interventions can be further strenthgenth to serve an effective purpose.

INTRODUCTION

Iron deficiency is estimated to cause anaemia in two billion people worldwide, and another billion are iron deficient. Inadequate iron is the most prevalent nutritional deficiency. An iron-supplementation programme has the potential to prevent iron deficiency in substantial segments of the population, as demonstrated in other countries [1].

Adolescence has been defined by the World Health Organization (WHO) as the period between the ages of 10 and 19 years [2]. It is also a period of increased nutritional requirements. In addition to the increased iron needs of the expanding red cell mass and myoglobin in newly gained muscle tissue, adolescent girls require up to 15% more iron to compensate for menstrual blood losses [3]. The haemoglobin cut-offs used to define anaemia in adolescents over 12 years and less than 12 years of age living at sea level are 12 and 11.5 g/dl, respectively [4]. Study conducted in 1996 revealed that the prevalence of anaemia was 36% among adolescents in Sri Lanka [5].

Preventing and correcting iron-deficiency anaemia among adolescents is urgent because of its negative consequences, which include decreased immunity, increased morbidity, and impaired cognitive performance [6]. Adolescent girls are an important target group because they are future mothers, and they can often be reached relatively easily through schools. Although in principle prevention and treatment of nutritional iron deficiency is simple, i.e., increasing available iron through diet and preventing abnormal iron losses, achieving these goals is not easy. Regular provision of supplementary iron and folate tablets to adolescent girls from the onset of menses has proved to be effective [7]. However, the health infrastructure required for delivery of these supplements is often inadequate for the implementation of this approach.

RESEARCH -1

ADOLESCENT SCHOOLGIRLS: DAILY OR WEEKLY IRON SUPPLEMENTATION?

The daily administration of 60 mg of iron results in a rapid decline in percent of iron absorbed. It also loads the intestinal epithelium with iron and often causes adverse gastrointestinal symptoms. Since the renewal time of the intestinal mucosa is five to six days, a similar weekly dose of iron should be efficacious, given adequate time and compliance, and side effects would be minimized. Large-scale programmes to combat iron deficiency among adolescents have seldom been attempted because of the costs of daily supplementation and the extra managerial burden for the health sector [8]. To improve the iron status of adolescents, alternative approaches that are less costly and less burdensome to the health sector are needed.

Supplementation using intermittent dosing schedules may offer such an alternative for large-scale programmes targeted to children. Studies in pre-school children [9], adolescents [10], and pregnant women [11] showed that intermittent iron supplementation was as effective in improving iron status as daily supplementation. Supplementation on a weekly instead of a daily basis decreases programme cost and might increase compliance. For these reasons, we tested the hypothesis that weekly iron supplementation would be as effective as daily iron supplementation under real life community conditions in Sri Lanka when schools were used as the distribution channel.

Materials and methods

The study was designed as a double-blinded, placebo controlled clinical trial. It was conducted in girls' schools with classes up to year 10 in the district of Colombo, Sri Lanka. The girls were from 10 to 17 years of age. To achieve significant results at the 5% level with a 5% drop-out rate at a power of 90%, 231 girls were assigned to each group. Nine schools were selected randomly. The fieldwork was carried out from September to December 1997.

Placebos were manufactured by the State Pharmaceutical Manufacturing Cooperation (SPMC) and placebos had the same colour and shape and were not distinguishable by sight. Therefore, the girls, teachers, and interviewers were not aware of differences among the treatment regimes. All the girls who participated in the study were given the specified supplementation regime for each school as follows.

Daily treatment group (243 girls) were given a daily dose of ferrous sulphate (60 mg elemental iron) and 250 µg of folic acid in a combined tablet (iron/folate) and 100 mg of vitamin C five days per week, Monday through Friday. Weekly treatment group (230 girls) were given the same dose of iron/folate and vitamin C, but only once a week on Monday, and they were given a placebo replacement for the iron/folate and vitamin C during the other four days. Control group (217 girls) were given the placebo replacement for iron/folate and vitamin C five days per week, Monday through Friday.

To eliminate a major source of variation among subjects, anthelmintic therapy, consisting of a single 500-mg dose of mebendazole, was given to all the girls on the first day.

Fingerpricked samples of blood were collected to measure the haemoglobin level by the HemoCue method at the beginning and 8 weeks after completeing the supplementation regime. In a randomly selected sample, venous blood was collected to measure serum ferritin.

Results

The factors affecting the initial haemoglobin values were compared at the beginning of the study to detect any confounding effect of these factors on the supplementation (table 1). The girls were classified as anaemic or non-anaemic according to the age-specific cutoffs for initial haemoglobin values. The anaemic and non-anaemic groups did not differ in age, mother's years of education, number of siblings, birth order, nutritional status, and age of menarche.

TABLE 1. Characteristics of subjects according to initial anaemia status

Characteristics	Anaemic	Non anaemic
Age (yr)	13.6 (1.2)	13.4 (1.7)
Mother's education (yr)	11.0 (8.0-11.0)	11.0 (8.0-11.0)
Body mass index (kg/m2)	17.2 ± 2.7	17.3 ± 3.0
No. of siblings	2 (1.0-3.0)	2 (1.0-2.5)
Birth order	2 (1.0-2.0)	2 (1.0-2.0)
Age of menarche	12.3 ± 1.1	12.2 ± 1.2

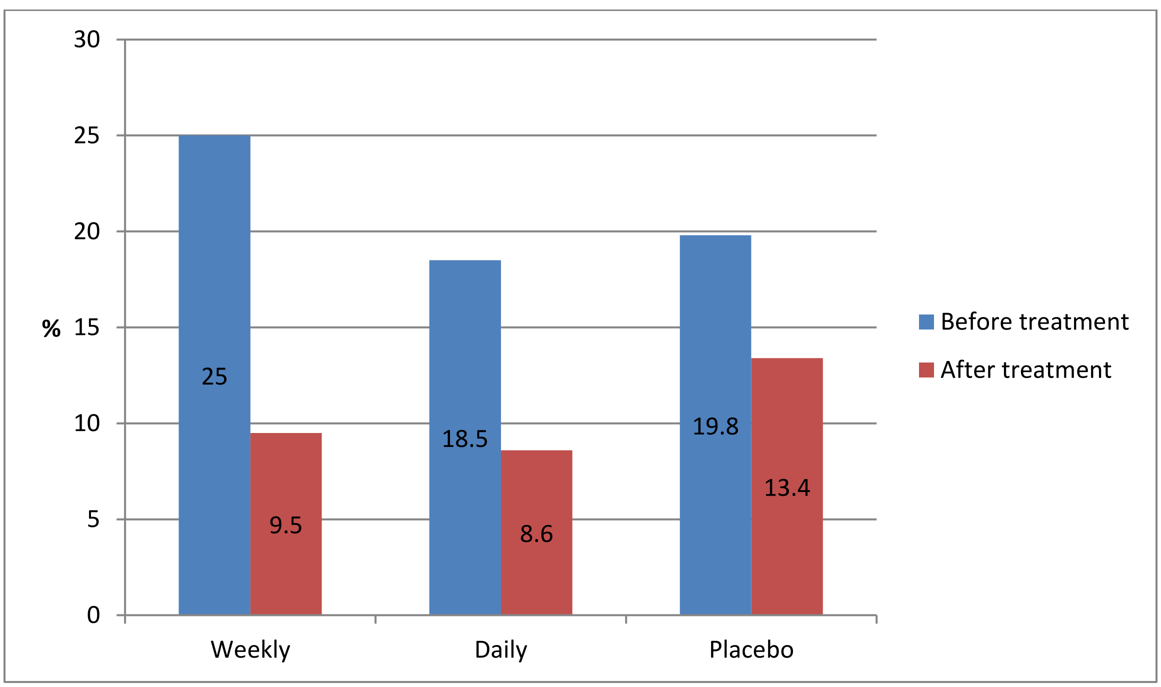
Initial haemoglobin (F = 0.46, p = .6), final haemoglobin (F = 1.6, p = .2), and the change in haemoglobin (F = 1.5, p = .2) did not siginificantly differ among the three treatment groups (table 2). Daily and weekly supplementation had a greater effect on haemoglobin levels than placebo.

TABLE 2. Mean ± SD haemoglobin concentration (g/dl) before and after eight weeks of treatment

Treatment group	Before treatment	After treatment	Change
Weekly (*n* = 220)	12.8 ± 1.3	13.1 ± 1.0	0.4 ± 1.2
Daily (*n* = 222)	12.9 ± 1.1	13.2 ± 0.9	0.4 ± 1.1
Placebo (*n* = 217)	12.9 ± 1.1	13.1 ± 1.1	0.2 ± 1.2

The overall prevalence of anaemia at the start of the study was 21.1%, and there were no significant differences among the treatment groups in the initial haemoglobin levels (Figure 1). The prevalence of anaemia was reduced from 25% to 9.5% by weekly supplementation and from 18.5% to 8.6% by daily supplementation. In the placebo group the prevalence decreased from 19.8% to 13.4%.

Figure 1: Prevalence of anaemia before and after eight weeks of treatment



The three treatment groups did not differ in initial ferritin levels ($F = 0.51$, $p = .6$), but there were significant differences among the groups in final ferritin levels ($F = 3.67$, $p = .03$) and the change of ferritin levels (*F* = 4.11, *p* = .02) after supplementation (table 3). Ferritin increased most in the daily treatment group, much less in the weekly treatment group, and not at all in the placebo group.

TABLE 3. Mean ± SD serum ferritin level (μg/L) in a subsample of subjects before and after eight weeks of treatment

Treatment group	Before treatment	After treatment	Change
Weekly (*n* = 9)	66.6 ± 32.9	82.7 ± 34.8	16.1 ± 21.3
Daily (*n* = 22)	54.1 ± 26.7	92.3 ± 39.9	38.2 ± 41.1
Placebo (*n* =11)	59.1 ± 34.9	56.3 ± 30.4	–2.8 ± 31.2

The unit cost of weekly supplementation, including anthelmintic treatment, was 3.24 SLR (Sri Lankan rupees), equal to $US.05. This was one-quarter the cost of daily iron supplementation.

The following conclusions were drawn. The effects of weekly and daily supplementation were not distinguishable. Weekly supplementation is an economically advantageous and simple intervention to improve the haemoglobin status of adolescent girls. Weekly supplementation generated fewer complaints of side effects, and compliance was high. A greater response of ferritin to daily than to weekly iron in the short period of eight weeks is to be expected. However, for a long-term preventive programme, the slower ferritin response is not disadvantageous, since iron stores will slowly raise to desirable levels with several months of weekly supplementation. With daily supplementation, there is a tendency to initially undesirable high serum ferritin levels that only gradually become normal. Administration of iron supplementation by teachers without close medical supervision is a viable possibility. A weekly iron supplementation programme aimed at controlling anaemia among adolescents should be encouraged. It is recommended that preventive iron supplementation be provided through schools on a long-term basis.

This study was published in Food and Nutrition Bulletin in 1999 and the original data was used with the data of other countries to provide the global recommendation of iron supplementation regime for adolesents.

I decided to find out the magnitude of the problem of anaemia among adolesents in Sri Lanka.

RESEARCH – 2

ANAEMIA AMONG SCHOOL GOING ADOLESCENT IN SRI LANKA; 10-15YEARS OF AGE

This study was carried out to assess the prevalence of anaemia among adolescent's schoolchildren aged 10-15 years in Sri Lanka.

METHODS

The 2002 school-based study was carried out and a three-stage cluster sample design was adopted to draw a nationally representative sample of students of 10-15 years of age in public schools. Calculated sample size for each district (PSU) was 372 students. From the 25 districts, 12 were selected randomly with the probability proportional to district population size. At the second sampling stage, twelve schools from each district were selected with probability proportionate to school enrolment size. A total of 144 schools were included. The third stage of sampling consisted of randomly selecting one or two class from each grade 5-10 at each chosen school and 11 children were randomly selected to assess the haemoglobin (Hb) level to detect anaemia by Haemocue method. Finger pricked blood samples were taken from 1521 students and age dependent haemoglobin levels were taken to detect anaemia by adjusting the altitude [6].

RESULTS

Prevalence of anaemia increased with the age except at the age of 11 years (Table 4). In general, boys were more anaemic than girls except among 14 years of age group. Overall prevalence of anaemia was 11.1%. Highest prevalence of anaemia was observed at the age of 14 years (37.7%) among girls.

Table 4

Prevalence of anaemia, in relation to the age and sex

Age years			**Anaemia (%) (CI)** g/dL		
	No.	**Mean Hb**	**Male**	**Female**	**Total**

		(SD)			
10	378	12.6 (1.4)	10.5 (8.7-12.3)	9.6 (7.6-11.7)	10.1 (8.5-11.6)
11	395	12.8 (1.0)	8.7 (5.3-12.1)	6.9 (3.7-10.1)	7.8 (5.1-10.5)
12	421	13.2 (1.1)	15.1 (7.1-23.1)	11.5 (7.4-15.7)	11.2 (8.3-14.0)
13	85	13.1 (1.2)	12.9 (3.9-21.9)	6.3 (2.4-14.9)	11.8 (5.8-17.7)
14	131	13.6 (1.4)	22.9 (9.0-36.8)	37.7 (27.6-47.8)	25.9 (18.6-33.3)
15	111	13.9 (1.3)	11.0 (9.6-12.4)	12.7 (5.1-20.3)	17.1 (9.7-24.6)
Total	**1521**	**12.9 (1.2)**	**11.0 (9.6-12.4)**	**11.2 (9.4-13.1)**	**11.1 (9.9-12.4)**

The prevalence of anaemia among schoolchildren of grade 7 varied from 7.4% to 25.2% giving highest prevalence in Vavuniya district and lowest in Colombo district.

In conclusions, this study documented a persistence of anaemia and the need of suitable intervention through the school health programme.

This issue was taken up at the Nutrition co-ordinating committee at the Ministry of Health which was chaired by the Deputy Minister of Health, Nutrition and Welfare. At that meeting it was decided to carry out a pilot iron supplementation programme among the adolescent children. As a result third research was conducted.

RESEARCH – 3

IRON SUPPLEMENTATION FOR SCHOOLCHILDREN OF GRADE 7 AND 10 IN SRI LANKA

(Pilot project in Ampara, Hambantota, Ratnapura, Monaragala and Vavuniya districts)

This study was conducted to reduce the anaemia prevalence among adolescence schoolchildren by 50% following by a weekly iron supplementation for 6 months from July 2002 to May 2003.

Method

The sample size was 120 children from each district giving a total sample size of 600 for all 5 districts.

A multi-stage stratified sampling technique was used to identify the sample. It was decided to study 6 schools from each district. One class from grade 7 and 10 was randomly selected from each selected school. Only 10 randomly selected children using the attendance register from each selected class was included in the assessment of haemoglobin using Haemocue method by taking finger pricked blood sample.

After the baseline assessment iron supplementation programme was initiated by the medical officer of health in the area in colloboration with the school health unit of Family Health Bureau. All children in grade 7 and 10 in selected classes were given the supplementation regime for 6 months: Iron folic acid combined tablet (60 mg of Elemental iron and 250µg of Folic acid) and 100 mg of vitamin C, only once a week, every seventh day only on Monday. If Monday was a holiday it was given on the following working day. On the first day, 500mg of mebandazole and Vitamin A megadose was also given.

Teachers were trained and briefed about this programme. Class teachers were asked to administer the tablets in the morning under direct supervision, to make sure that the child swallowed the tablets. The teachers were provided with the daily record sheets of the students and were asked to record whether the students were present or absent, whether the drugs were administered, and any subsequent complaints. Guidelines were issued to teachers by the Ministry of Health. Children were also given a pocket card to mark the dates of taking the supplementation.

Starting from the 1st day of the programme at least once in 3 months the Public Health Inspector or any other officer designated by the Medical Officer of Health was asked to visit the schools to check the shortage or requirement of drugs or other problems, if there were any other problems they were asked to attend to them.

On the day after the last dose of drugs was administered, i.e., after 6 months, the schools in the study programme were reassessed. Finger pricked blood samples were collected to assess the haemoglobin levels from 10 randomly selected children from each class by Haemocue method.

Results

Figure 2

Comparisons of mean haemoglobin levels in districts

pre and post supplementation

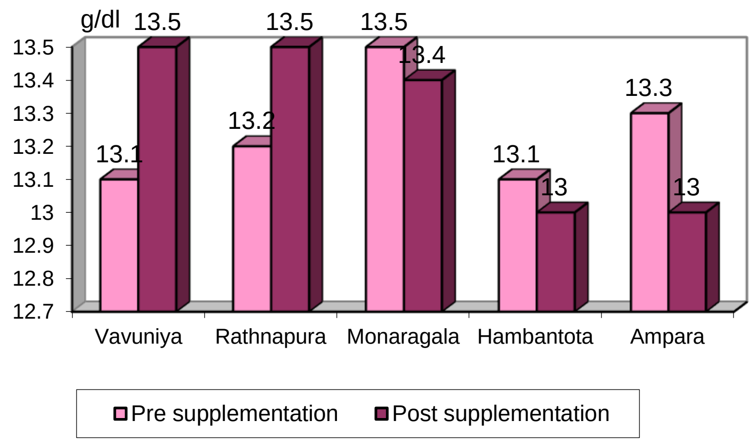


Figure 2 presents the mean haemoglobin (Hb) values among children before and after supplementation. Vavuniya and Ratnapura district had shown a marked increase of mean Hb levels among children. There is a decreased mean Hb level in Monaragala, Hambantota and Ampara district. This may be due to high requirement during the peak growth of these children and the intake of iron was not sufficient to meet the demand.

Figure 3 shows that the pre and post prevalence of anaemia levels respectively in the areas, i.e., Vavuniya (22.7% & 12.9%), Monaragala (17.2% & 13.2%), Ratnapura (12% & 15%), Ampara (14.2% & 23.7%) and Hambantota (12% & 28%). Vavuniya district had shown the reduction of anaemia by 50%. Ampara and Hambantota districts had increased prevalence of anaemia.

Figure 3

Comparisons of change of prevalence of anaemia after the supplementation and coverage of supplementation at 6 months

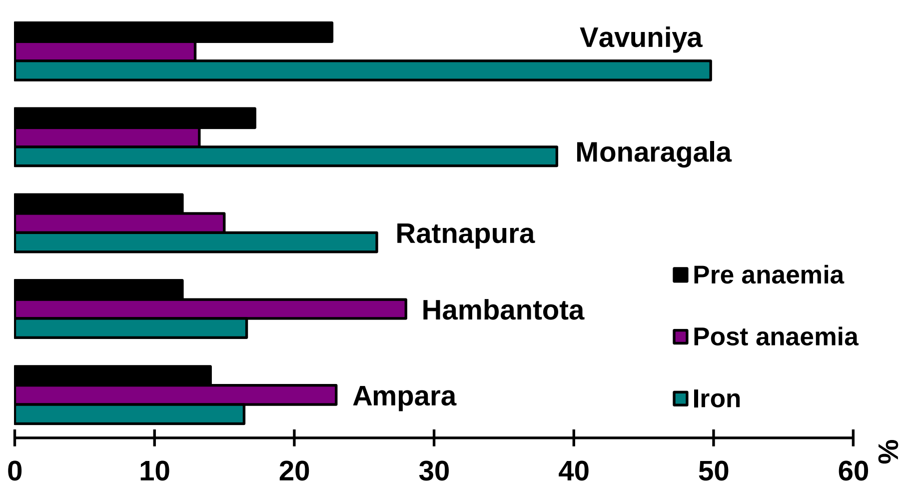


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Figure 3 shows when the coverage for 6 months in a population is over 30% the reduction of anaemia has occurred. 50% of schoolchildren of year 7 and 10 in Vavuniya district had taken the supplementation for 5-6 months period caused the reduction of anaemia by 50%.

Conclusions

Weekly supplementation is an economically advantageous and simple intervention to improve the Hb status of adolescents. It is recommended that properly conducted weekly iron supplementation for 6 months period which is cost effective should be initiated in schools without delay as a long term intervention to control anaemia among adolescents of grade 7- 10.

As a results of this recommendation Ministry of Health initiated the iron supplementation programme for adolesents in grade 7 and 10 throughout the country since 2004.

RESEARCH – 4

PREVALENCE OF ANAEMIA AMONG FEAMLE AGED 15-20 YEARS

This study was conducted as a component of a National study conducted in 2009 to assess the anaemia prevalence among women aged 15-20 years. This is 5 years after the supplementation programme expecting the adolesent who have participated in the iron supplementation programme may be within 15-20 years of age.

Method

A cross sectional household survey, representing all nine provinces, one district from each of the 9 provinces of Sri Lanka was carried out. Clusters were defined at the level of a Grama Niladhari (GN) division and 30 clusters per district, 21 households per cluster were selected. Measurement of haemoglobin levels was carried out using haemocue method, using capillary blood.

Results

Figure 4 shows 23.5% of non pregnant women were anaemic and it is higher among lactating women (26.7%). The low prevalence was observed among pregnant women, may be due to the iron supplementation during the antenatal period.

Figure 4: Prevalence of anaemia among women 15-20 years of age

One time supplementation regime is not sufficient to maintain the haemoglobin levels among adolesents for longer period of time. It may be needed to repeat the supplementataion regime every year for at least 5 years to sustain a higher haemoglobin levels to prevent anaemia.

DISCUSSION

Perhaps the reason you feel folic acid and NTDs are not a problem is because of the adolescent supplementation? If I understand correctly, Sri Lanka started nationwide supplementation of adolescent girls 11 and 14 years old in 2004. These girls received weekly iron and folic acid supplements for six months (plus one off vitamin A and deworming). So if I understand correctly an 11 year old girl gets six months of weekly supplements and then when she turns 14 she gets it again. However when you studied anaemia levels of girls/women 15-20 years old in 2009 (ie girls who were 11 and 14 in 2004 when the supplementation started would be 16 and 19 respectively in 2009 at the time of the survey), they were still found to be anaemic. So the conclusion was that the supplementation was not sufficient and the plan is thus to extend the weekly to cover all girls 11-17 years. (so by this I understand that all girls 11-17 years will get six months of supplementation per year?). I see from the DHS 2006/7 however that the average age of first birth in Sri Lanka is 25 years and only 0.5, 1.6 and 4.5% of girls 15 years, 16 years and 17 years respectively have begun childbearing. So I would suggest that no matter how successful the adolescent supplementation programme is at improving iron and folic acid status, the majority of women are unlikely to remain protected (adequate folic acid) by the time they start child bearing (since the supplementation will stop when they are 17 years old). And of course, as you know, even the successful iron folate supplementation programme during pregnancy will not benefit these women in the pre-pregnant, conception phase when it is essential to have adequate folic acid status.

CONCLUSIONS AND RECOMMENDATIONS

As a series of the work conducted by me and my research team, it was decided Sri Lanka should adopt a long term strategy to control anaemia among adolesents. It is a dire need for the country to even further prevent maternal anaemia and to enhance the productivity and the work out put.

Therefore it is recommended to identify the possibilities of iron fortification of a staple food item such as rice and bread. It is more cost-effective and sustainable than other strategies and it aims to supply amounts approximate to those of a good well-balanced diet. If properly regulated and monitored, it is a safe intervention. It can improve the nutritional status of a large proportion of the population not only adolesents without changing in eating habits. It is technically feasible to fortify with several micronutrients which will give us an opportunity to control more nutritional problems at the sametime.

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