MANUSCRIPT

Title : Correction of anaemia in adolesence through schools by weekly iron supplementation – Experience in 5 districts.

R Jayatissa[1] MBBS, M.Sc, MD, N Rajaratna[2] MBBS, DCH, M.Sc.

[1] Nutrition Department, Medical Research Institute, Ministry of Health, Colombo 8.

[2] Family Health Bureau, Ministry of Health, Colombo 10, Sri Lanka.

Present address of the Author responsible for the correspondence about the manuscript:

Dr. Renuka Jayatissa

Department of Nutrition

Medical Research Institute

Baseline Road

Colombo 8.

Telephone No. - 2695999

Fax No. – 2691495

Email - amal@eureka.lk

ABSTRACT

Background: Adolescents are a high-risk group for iron deficiency due to increased nutritional requirements. The prevalence of anaemia among adolescence of 10-14 years in year 2002 varied from 7.4% to 25.2%.

Objectives: to reduce the anaemia prevalence among schoolchildren following the weekly iron supplementation for 6 months by 50%.

Methods: The study was carried out in Moneragala, Hambantota, Vavuniya, Ampara, and Rathnapura districts. All schoolchildren of grade 7 and 10 were given weekly dose of iron folate and Vitamin C for 6 months under supervision of teachers. On the first day Vitamin A megadose and mebandasole were given. 600 children were assessed for haemoglobin (Hb) before and after the supplementation.

Results: Highest coverage of the supplementation for 6 months was reported in Vavuniya district, i.e. 49.8%. Lowest coverage was from Ampara district (16.4%) due to non-starting of the supplementation and shortage of tablets. 40.3% of children had taken tablets even during the vacation. Anaemia prevalence was decreased in Vavuniya and Monaragala district by 47.1% and 23.2%. Anaemia was increased in Ratnapura, Ampara and Hambantota districts by 25%, 66.9% and 133% respectively. Supplementation cost per child was Rs.18. When more than 30% of schoolchildren had 6 months of supplementation the anaemia prevalence has significantly decreased.

Conclusions: The study shows that correct intervention can reduce the anaemia prevalence and without proper intervention anaemia prevalence increase in adolescence. It is recommended that properly conducted weekly iron supplementation should be initiated through schools as a long term intervention to control anaemia.

BACKGROUND

Iron and folate deficiency cause anaemia in 1000 million people world wide while iron deficiency alone causes anaemia in another 1000 million. A lack of iron is the most prevalent nutritional deficiency. An iron supplementation programme has the potential to prevent iron deficiency in substantial segments of the population. They have proven successful in other countries too[1].

Adolescence is the period of intense physiological, psychological and social change. The transition from childhood to adulthood may extend over variable periods of time, depending upon socio-cultural and economic factors[2]. The main nutritional problems among adolescences are micronutrient deficiencies, iron deficiency anaemia in particular. Anaemia is recognised as the greatest nutritional problem among adolescents and diet is likely the main factor. Dietary inadequacies are to be a threat to adolescents because of erratic eating patterns and specific psycho-social factors. In addition to these, adolescents have high nutritional requirements for rapid growth.

Preventing and controlling anaemia caused by iron deficiency is needed, particularly by girls, and as much ahead of pregnancy as much possible. Correcting it is an investment in adult productive and reproductive lives. Successful anaemia control programmes are recognised as highly cost effective. It is an urgent issue among schoolchildren because of the negative consequences it carries; e.g. poor cognitive development, lethargy, loss of work capacity, tiredness, poor school performance and ultimately leading to low productivity. Some of these consequences may be long lasting, if not permanent. Schoolchildren would be an important target group for the approach.

Therefore, to improve the iron status of schoolchildren, *alternative* oral iron supplementation *approaches* that are less costly and less burdensome to the health sector are tested in Sri Lanka and other countries[3,4]. Supplementation on a weekly, instead of a daily basis, has decreased the costs of programme and also increased subject compliance[4].

Sri Lanka consists of 9800 schools in 25 districts. Around 50,000 children attend grade 7and 10 classes in the country. The prevalence of anaemia among schoolchildren of grade 7 in year 2002 varied from 7.4% to 25.2% giving highest prevalence in Vavuniya district and lowest in Colombo district[5]. Therefore there is an urgent need to carry out a programme to combat anaemia caused by iron deficiency in Sri Lanka.

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 supplementation of iron tablets among the adolescent children under the following objective, to reduce the anaemia prevalence among adolescence schoolchildren by 50% following by a weekly iron supplementation for 6 months.

METHODS

Baseline study was carried out before starting the supplementation. It was carried out in five selected districts, i.e. Moneragala, Hambantota, Vavuniya, Ampara, and Rathnapura as a pilot project. The study population was identified as all schoolchildren of grade 7 and 10 in these districts.

A sample size was estimated to ensure adequate power (90%) to detect a reduction in the prevalence of anaemia by 50% with 95% confidence interval, with design effect 2 and allowing a 10% dropout rate. It 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. Six schools from each district was identified using population proportion to sampling technique from a list of all the schools provided by the Department of Education in selected districts. One class from each grade 7 and 10 was randomly selected from each selected school. All the children in each selected class were included in the assessment of height and weight. 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.

Baseline assessment

Three teams each comprising 3 field investigators was responsible for data collection. Fieldwork was carried out district by district. All selected schools were informed about the study and the date of the visit. The consent forms were distributed to all children in the selected classes prior to the study with a letter from the investigator forwarded through the class teacher. All children who had obtained the consent of their parents and were present on the day of the study were identified as participants. A structured format was developed to obtain identification data, age and sex of children in the selected classes. The information was obtained from the attendance register and marked on the format by a member of the study team.

The height and weight of all the participants were measured. Measurements were taken by trained field investigators. Height was recorded to the nearest centimetre by using an anthropometric rod. The children were weighed with the use of an electronic balance to the nearest 0.5g after removing shoes and socks. Instruments were checked daily by using a standard weight. The observer variation was assessed by taking duplicate measurements of 10% of sub sample representing all districts, by one specially trained investigator.

Supplementation

After the baseline assessment iron supplementation programme was initiated by the peripheral staff (medical officer of health) of Ministry of Health. All children were given the supplementation regime as follows for 6 months: 200 mg of Ferrous sulphate (60 mg of Elemental iron), 250μg of Folic acid tablet 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 mebandasole 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.

End assessment

On the day after the last dose of drugs was administered, i.e., after 6 months, the same classes were reassessed. The following information was obtained during the end assessment: no. of days on which tablets were taken (iron, vitamin A and worm treatment), number of days absent before and during the supplementation (from attendance register last year and this year), side effects and other complaints. Finger pricked blood samples were collected to assess the haemoglobin levels from 10 randomly selected children from each class by Haemocue method. Weight and height of all the children in the class was measured.

Ethical clearance was obtained from the ethical committee of the Medical Research Institute and permission obtained from the relevant educational and health authorities.

Analysis

The following indices were used to assess the impact of the programme. Pre and post mean haemoglobin levels, pre and post anaemia prevalence and pre and post thinness of the children. WHO defined cut-off levels were taken to classify anaemia[7]. Under 12 years of age a haemoglobin concentration below 11.5g/dl, 12 -13 years of age is 12.0g/dl and from 14 years of age for males is 13.0g/dl and from 14 years of age for females is 12.0g/dl. BMI was calculated by using height and weight and cut-off points proposed by WHO (1995) for BMI-for-age table to assess thinness (less than 5th percentile) was used. Data were processed using the Statistical Package for Social Sciences (SPSS) was used for further analysis. All fieldwork was completed during, July – August 2002 and March-May 2003. The data analysis was carried out using the SPSS package.

RESULTS

A total of 1762 children were enrolled in the baseline assessment. All children had anthropometric measurements (Figure 1). There were 1667 in the end assessment. 92% of children were given tablets by the teacher when marking the register in the morning. Others were given the tablets after the interval. Education programmes were conducted in all schools at the beginning of the supplementation.

Coverage of the supplementation for specified period (6 months) varied from district to district. Highest coverage for supplementation was reported in Vavuniya district, i.e. 49.8%. Ampara district had the lowest coverage (16.4%) as shown in Table 1. Only one school out of six schools had completed the supplementation in both Ampara and Hambantota districts.

Table 2 illustrates the period of coverage in details by district. About 52.6% of children were not given supplementation at all in Ampara district. The reason for the poor coverage of the supplementation programme in Ampara district was due to not initiating the programme in some schools during the last year. The programme was initiated in the current year. Therefore the children who were already assessed last year for the basement assessment were not given the supplementation.

Other reasons for not completing the programme were, that there were no tablets after school vacation. The Ministry of Health had not supplied the tablets to teachers. This was a logistic problem at the level of the Provincial Health sector and the poor co-ordination of the education and health sector. Therefore 35% of schools have not had tablets continuously to distribute among children except in the Vavuniya district. One school had a fear of distributing tablets due to the colour change which had occurred in iron tablets which has happened 3 months after the pogramme. A single health officer had not visited that school to get that fact clarified.

In some schools tablets were given only for 3 months only till the school vacation and basically they have forgotten to continue the programme. A single officer from the health ministry had not visited them to remind. In another school, vitamin C tablets were not available throughout. One of the positive factors identified was some teachers had taken the trouble to give tablets even during the vacation (40.3% of children had taken tablets even during the vacation).

Figure 2 shows that the supplementation of Vitamin A megadose and mebandasole in the districts during the supplementation. Vavuniya district had a low coverage during the programme due to distribution of these 2 drugs during the school medical inspections. Therefore the worm treatmnet and Vitamin A megadose were not repeated during this programme. Ampara had the low coverage due to non commencement of the programme. All the other districts had a good coverage of Vitamin A megadose and mebandasole.

Sample of children were assessed for haemoglobin i.e., 579 (32.9% of the total sample) were in the baseline assessment and 558 (33.5% of the total sample) were in the end assessment.

Figure 3 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 4 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 5 show that the prevalence of thinness in districts pre and post supplementation, i.e., Vavuniya (39.4% & 38.6%), Monaragala (42.9% & 42.1%), Ratnapura (41.6% & 32.7%), Ampara (54.5% & 51.2%) and Hambantota (41.8% & 49.1%). It shows that the minimum positive impact on the under nutrition with iron supplementation.

Figure 5 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%.

The following side effects were reported:

- Vomiting 1.1%
- Abdominal pain 8.3%
- Gastritis 0.3%
- Other 2.0%

Problems encountered by the school teachers and children were:

- No problem 76.2%
- No time to do additional work 3.3%
- Parents do not like 3.8%
- Children do not like 3.9%
- Sometimes forget 0.0%
- Other 12.7%

The cost of the supplementation per child for 6 month period was Rs. 18.

CONCLUSIONS AND RECOMMENDATIONS

Weekly supplementation is an economically advantageous and simple intervention to improve the Hb status of adolescents. Weekly supplementation generated fewer complaints of side effects and compliance was high. Administration of iron supplementation by teachers is a good strategy with the close monitoring of the health staff. Ampara and Hambantota district had shown increased prevalence of anaemia, it showed that the iron requirement had not been met during this stage and showed the necessity of high iron intake during this growing period. Therefore it indicates this as an ideal age group to intervene to combat iron deficiency. A weekly iron supplementation programme aimed at controlling anaemia among adolescents should be encouraged with the full participation of the health and the education sector. 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.

ACKNOWLEDGEMENTS

We sincerely thank principals, teachers and students of the schools and all the health staff of Ampara, Vavuniya, Hambantota, Monaragala, Ratnapura DPDHS areas and the staff of the Department of Nutrition, Medical Research Institute. Our gratitude goes to the Director Family Health Bureau and UNICEF representative, Dr. H. Wijemanna, Dr. H. Yakandawa.

REFERENCES

1. ACC/SCN. Controlling of iron deficiency. Nutrition policy paper. No.4. Geneva, ACC/SCN:1997.

2. Delisle H, Chandra-Mauli V, De Benosit B. *Should Adolesents be specifically targetted for nutrition in developing countries? To address which problem and how?,* 2003. Available at http;//www.who.org/adolesents.

3. Kianfar H, Kimiagar M, Ghaffarpour M. Daily and weekly iron supplementation in iron deficienct girls. Nut.Res. Dept. of Nutrition and Food Technology Research Institute. Iran. INACG Symposium:2003.

4. Jayatissa R, Piyasena CL. *Daily versus weekly iron supplementation*. Food and Nutrition Buletin.

5. Medical Research Institute. *The Challenging Nutritional problems in Schoolchildren:2003.*

6. World Health Organisation. *Physical Status: The use and interpretation of anthropometry*. WHO Technical report 854:1995.

7. Stoltzfus RJ, Dreyfuss ML. *Guidelines for the use of iron supplements to prevent and treat iron deficiency anaemia.* International Nutritional Anaemia Consultative Group, World Health Organisation and United Nations Children's Fund 1998:1-2.

Figure 1

Flow chart of sample design

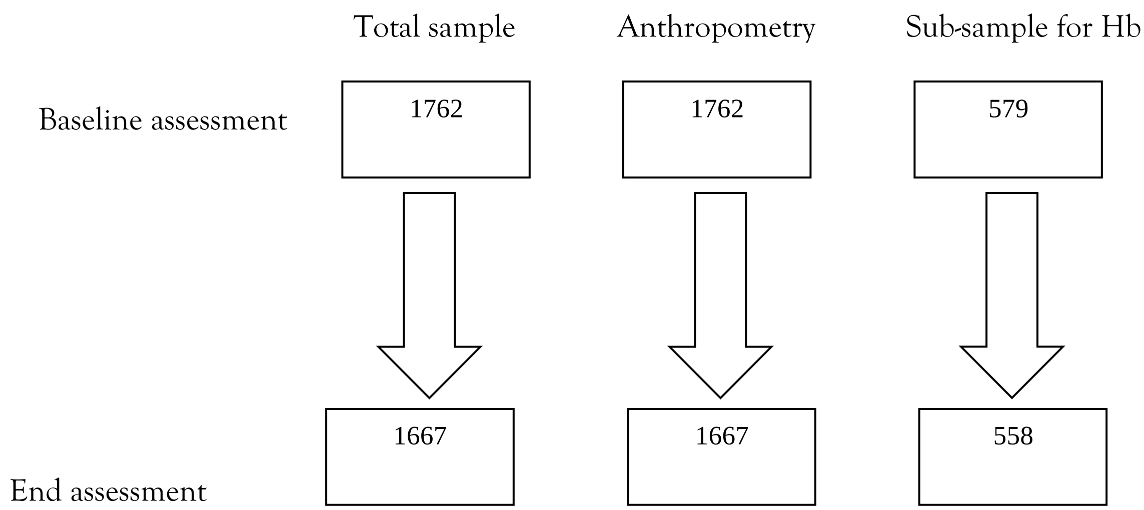

Table 1

Coverage of supplementation in the study population

District	No. of schools studied	No. of schools completed the supplementation	No. of children studied	No. of children completed the supplementation
Hambantota	6	1 (16.7%)	439	73 (16.6%)
Vavuniya	6	6 (100%)	223	111 (49.8%)
Ampara	6	1 ((16.7%)	293	48 (16.4%)
Monaragala	6	6 (100%)	335	130 (38.8%)
Ratnapura	6	3* (50%)	147	38 (25.9%)
Overall	**30**	**17 (56.7%)**	**1437**	**400 (28.2%)**

*3 schools were not included in the end assessment due to floods

Table 2

Period of iron supplementation in districts (No. %)

District	Not given	<3 months	3-4 months	4-5 months	5-6 months
Hambantota (n=439)	8 (1.8)	107 (24.4)	135 (30.8)	94 (21.4)	73 (16.6)
Vavuniya (n=223)	37 (16.6)	9 (4.0)	55 (24.7)	9 (4.0)	111 (49.8)
Ampara (n=293)	154 (52.6)	39 (13.3)	16 (5.5)	35 (11.9)	48 (16.4)
Monaragala (n=335)	0	51 (15.2)	39 (11.6)	48 (14.3)	130 (38.8)
Ratnapura (n=147)	0	1 (0.7)	57 (38.8)	49 (33.3)	38 (25.9)
Overall (n=1363)	199 (14.6)	207 (15.2)	302 (22.2)	235 (17.2)	400 (29.3)

Figure 2

Coverage of Vitamin A and mebandasole in districts

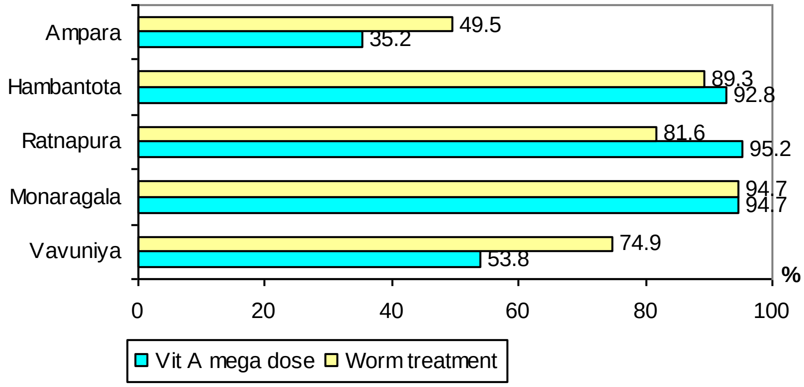

Figure 3

Comparisons of mean haemoglobin levels in districts

pre and post supplementation

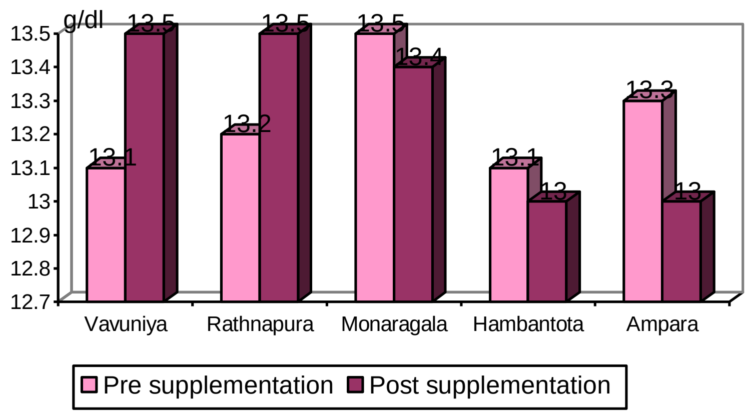

Figure 4

Comparisons of anaemia prevalence in districts - pre and post supplementation

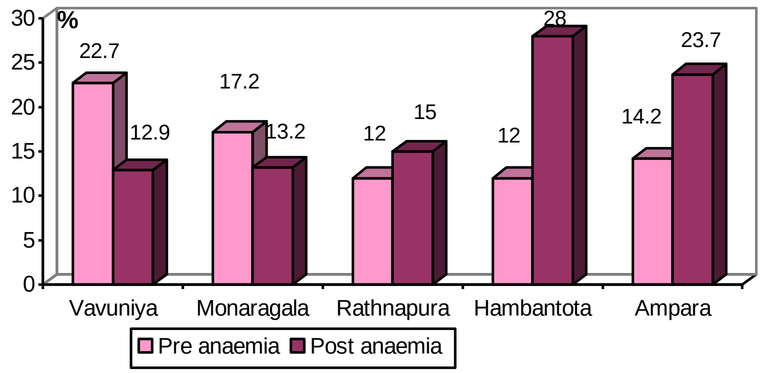

Figure 5

Comparisons of prevalence of thinness (BMI-for-age) in districts pre and post supplementation

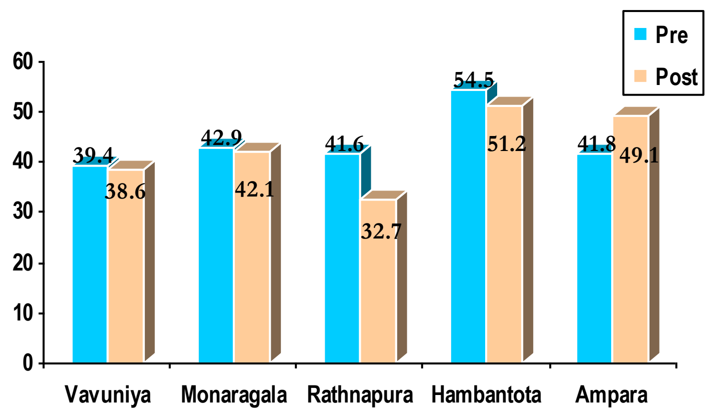

Figure 6

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