Nutritional anemia is one of the major public health problems in India affecting almost 90% poor children, adolescent girls and women.\(^1\) There is convincing evidence that iron deficiency and anemia causes impaired growth, developmental delay, decreased physical activity, behavioral abnormalities, and impairs cognitive function and school performance.\(^1,4\) Childhood, an important phase of life for acquisition of different empowering knowledge and skills through socialization, can badly be affected by compromised iron status of body which can be addressed by reaching them through the existing settings such as schools and health facilities for integrating nutrition education and actual services to reduce anemia.\(^2\) Primary school can be the most important strategic place to foster healthy life styles and valuable second front in war against ill health and malnutrition (Gopalan, 1974). The School Health Committee (1965) also appreciated this. Unfortunately, health education in rural primary schools is either limited to some routine touching of the syllabus or nonexistent.\(^7\) There is dearth of information about the impact of school-based health-nutrition education on nutritional anemia among primary school children. The present study was contemplated to estimate clinically, the magnitude of anemia among the primary school children and to assess the impact, if any, of intervention with health-nutrition education.

A quasi-experimental intervention study was carried out from June 2008–Jan 2009 in two Free Primary Schools (FPS) namely Kantatria and Beldanga within Bhatar Gram Panchayat of Bhatar community development (CD) block of Burdwan District where Field practice area of ‘Rural Training Centre (RTC)’ of the department of Community Medicine, Burdwan Medical College (BMC), West Bengal (WB), is situated.

The Block was purposively selected to utilize the conveniences available from RTC. Out of fourteen gram Panchayats of the block, Bhatar Gram panchayat was selected by simple random sampling. Subsequently, out of fifteen FPS present in that Panchayat area, two were selected by simple random sampling. The selected schools were 2.5km apart with their students living under similar sociocultural background.

Based on the existing literatures,\(^1,7\) overall prevalence of anemia (in this age group) was presumed to be 85% (\(\pi_1\)) and a minimum 25% reduction (\(d\)) was assumed to be required to detect the change clinically. The sample size for study participants was calculated based on the formula:

\[
N = 2 \left( Z_{\alpha} + Z_{\beta} \right)^2 \left\{ \pi \left( 1 - \pi \right) \right\} / d^2
\]

(one sided \(Z_{\alpha} = 1.65\) and \(Z_{\beta} = 1.28\) at 95% confidence limit and 90% power). Assuming 5% dropout, total 58 participants were required for study group.

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At first necessary permission from the school, Panchayat, local health authorities and the parents were obtained. Initially a thorough clinical examination of students was done to assess the magnitude of anemia clinically by observing pallor at multiple sites and to exclude any participant with chronic illness, severe pallor/anemia and or undergoing treatment for anemia. Assessment of clinical anemia was done independently by two clinicians (Kappa ratio= 0.84). Students having inter-observer disagreement were also considered anemic and provided with treatment but not included in study.

The clinically anemic students were school-wise randomly allocated into experimental (students of Kantaria F.P.School) and control (students of Beldanga FPS) group. Thus, all 58 anemic students from the study school were enrolled as study subjects and all 80 anemic students from control school were included in control group.

Teachers were re-orientated through friendly-interesting-interactive discussions in three sessions. The parents of the students of study group were sensitized by doctors, health and ICDS workers with the help of Panchayat and motivated to guide their children in transforming the knowledge acquired in school into practice.

Both groups were given single dose of Tab. Albendazole (400) [repeated after 14 days] and Pediatric IFA (containing 20mg elemental iron and 100µgm folic acid). @ 1 tab. twice daily after meals for 50 days. The medicines were procured from the store of RTC, Bhatar. Health-nutrition education was provided to the study group through interesting and interactive sessions conducted regularly (at least thrice weekly if not daily) by the school teachers. Regular intake of iron rich foods, addition of pieces of lemon with meals and avoidance of tea or coffee within one hour before and after meal etc. were emphasized. Discussions were persuaded by the investigators during each school visit scheduled fortnightly. Changes in Mid-Day Meal (MDM) menu and development of kitchen garden in school campuses were promoted.

Information on parents’ education and occupation, consumption of MDM at school and IFA tablets and dietary pattern of the participants of the experimental group were collected by predesigned proforma sent to their parents.

First evaluation was done after a fortnight after disbursement of last round of IFA therapy and 2nd after six months since the beginning of project. One boy of study group discontinued IFA tablet due to vomiting caused by intentional overdose of three tablets at a time, one boy of study group and two girls of control group reported side effects of nausea and abdominal discomfort and declined to continue IFA. Two boys of control group were absentees at first and one boys of control group was absentee at final evaluation. Altogether 6 (4.3%) and 5 (3.6%) participants excluded from analysis of first and final evaluation. Other calculations were done based on the number of participants available for final evaluation. Simple proportion, \( \chi^2 \) and ‘unpaired t’ tests, 95% Confidence Interval (C.I.) around the difference between two proportions, Relative Risk (RR) with 95% CI and Absolute Risk (AR) were calculated. Epi info 3.4.3 version was used.

Initially, out of 209 students screened, 138 were anemic with overall prevalence of 66.0 % (95% CI = 59.6% - 72.4 %) being 69.6% among girls and 62.6 % among boys. Mean age of the participants was 7.8 ± 1.3 years with a significant difference between the lower (I and II) and upper (III and IV) classes (t\(_{df=54} = 3.58, P < 0.01\)) and among children of illiterate or low literate mothers and or undergoing treatment for anemia. Assessment after first evaluation revealed that 23.2% and 28.9% from study and control group were clinically anemic (Overall 26.5%), with no significant difference. 95% CI around the difference between two proportions was -20.73 to 9.6. AR and RR were reduced by 5.7%, and 19.7% [Table 1]. Final evaluation revealed that 48.2% and 72.7% participants from study and control group were clinically anemic with significant difference between groups. The overall prevalence of anemia was 62.4%, the RR was 0.66 (95% CI = 0.49-0.90). AR and RR were reduced by 24.5% and 33.7%, respectively [Table 1]. Prevalence of anemia among lower classes (class I and II) and among children of illiterate or low literate mothers was significantly higher than their counterparts [Table 2]. Mean age of the subjects remained anemic was revealed to be significantly lower than that of their counter group who were found free from anemia (t = 3.58, P < 0.001, df = 54). However, no significant influence of gender was revealed.

High compliance of IFA consumption (97.1%) could be due to good rapport with students making them keen to consume. IFA therapy with 40 mg elemental iron daily increased the Hb level so that the suboptimal organs’ functions caused by inadequate O, supply and iron deficiency was improved and the child’s activities might be hastened, his/her appetite might be boosted along with upliftment of psychological wellbeing as well. After the correction of clinical anemia by 6-7 weeks of IFA therapy, the medication was stopped, not fully replenishing the exhausted iron store of the anemic
Table 1: Distribution of participants according to the results of first and final evaluations

| Category                  | Study group no. (%) | Control group no. (%) | Total no. (%) | \( \chi^2, \text{df}, p; \text{RR (95\% CI)} \) |
|---------------------------|---------------------|-----------------------|---------------|---------------------------------|
| 1st evaluation (n = 132)  |                     |                       |               |                                 |
| Anemia present            | 13 (23.2)           | 22 (28.9)             | 35 (26.5)     | 0.54, 1, 0.46;                  |
| Anemia absent             | 43 (76.8)           | 54 (71.1)             | 97 (73.5)     | 0.8 (0.44-1.45)                 |
| Total                     | 56 (100.0)          | 76 (100.0)            | 132 (100.0)   |                                 |
| RR = 0.80 (95\% CI = 0.44-1.45), AR reduction = 28.9\%-23.2\%= 5.7\%, RR reduction = 5.7/28.9 x 100 = 19.7\%, 95\% CI around the difference between two proportions = 20.73 to 9.6 |
| 2nd evaluation (n = 133)  |                     |                       |               |                                 |
| Anemia present            | 27 (48.2)           | 56 (72.7)             | 83 (62.4)     | 8.30, 0.0039;                   |
| Anemia absent             | 29 (51.8)           | 21 (27.3)             | 50 (37.6)     | 0.66 (0.49-0.90)                |
| Total                     | 56 (100.0)          | 77 (100.0)            | 133 (100.0)   |                                 |
| RR = 0.66 (95\% CI = 0.49-0.90), AR reduction = 72.7\%-48.2\%= 24.5\%, RR reduction = 24.5/72.7 x 100 = 33.7\%, 95\% CI around the difference between two proportions = -41.0 to -8.0. *df = degree of freedom |

Table 2: Distribution of participants of study group according to sex, class of reading and mothers’ education (N = 56)

| Parameter                  | Pallor +ve No. (%) | Pallor -ve No. (%) | Total No. (%) | \( \chi^2, \text{df}, p; \text{RR (95\% CI)} \) |
|---------------------------|--------------------|--------------------|---------------|---------------------------------|
| Sex                       |                    |                    |               |                                 |
| Male                      | 11 (52.4)          | 10 (47.6)          | 21 (100.0)    | 0.23, 1, 0.623;                 |
| Female                    | 16 (45.7)          | 19 (54.3)          | 35 (100.0)    | 1.15 (0.66-1.98)                |
| Class of study            |                    |                    |               |                                 |
| I and II                  | 19 (63.3)          | 11 (36.7)          | 30 (100.0)    | 5.92, 1, 0.015;                 |
| Ill and IV                | 8 (30.8)           | 18 (69.2)          | 26 (100.0)    | 3.06 (1.09-3.89)                |
| Mothers’ education        |                    |                    |               |                                 |
| Illiterate                | 12 (70.6)          | 5 (29.4)           | 17 (100.0)    | 8.24, 2, 0.0162; NA*            |
| Primary                   | 10 (47.6)          | 11 (52.4)          | 21 (100.0)    |                                 |
| ≥ Secondary               | 4 (22.2)           | 14 (77.8)          | 18 (100.0)    |                                 |

*RR not applicable (NA)

Ongoing instillation of nutrients at government’s cost should not be a permanent solution. Inculcating healthy life styles and dietary patterns conducive for prevention of anemia is the most cost-effective way to make a real dent in the problem. A well-concerted effort supervised by other stakeholders can be carried out by grass root health workers and School teachers.

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