SUMMARY

AND

CONCLUSION

SUMMARY AND CONCLUSION

In view of the fact that underprivileged school girls have received relatively little attention, have poor iron status and related functional abberations and that there do not appear to be studies reported in literature on pre-adolescent and adolescent school girls, to study the effect of a prophylactic dose of Fe supplementation on the functional benefits, the present investigation was undertaken with the following general objectives :

I. To study the impact of prophylactic iron supplementation at 60 mg elemental Fe for 60 days at a stretch, twice in a school year on iron status.

II. To study the impact of this level and duration of prophylactic supplementation of Fe twice in a school year, on :

(i) selected areas of Cognitive Function, namely, concentration, memory, discrimination, perception and visual motor coordination in underprivileged school girls, 8 - 15 yrs of age.

(ii) selected parameters of Physical Work Capacity, namely, pulse rate and blood lactic acid, in underprivileged school girls, 8 - 15 yrs of age.

(iii) growth status

Sample and Experimental design

The sample of the present study consisted of 207 underprivileged 8 - 15 year old girls studying in four Municipal Primary Schools, exclusively for girls and living in the nearby slums.

The hemoglobin (Hb) and Red Cell Morphology (RCM) examination were performed on all the subjects. The subjects were stratified by age, using one year age interval and then, within each category, pair matched for Hb levels and baseline Cognitive Function (CF) test scores to fulfill objective II(i) and for Hb levels and body surface area to fulfill objective II(ii). The Experimental & Placebo groups were also matched for nutrient intake of calories, fats, proteins, iron and ascorbic acid. One subject from each pair was assigned to either of the groups, namely, the experimental group and the placebo group.

The study was conducted over one calender year. Iron supplementation (experimental group) at a dose level of 60 mg elemental Fe, in the form of ferrous sulfate ($FeSO_4$) and sugar tablets (placebo group) were administered twice, at the commencement of each school term for 60 days at a stretch (i.e. over one school year). Data were collected every four months i.e. baseline (0 month), at the commencement of the study; mid-evaluation (04th Month), at the end of the first school term; final evaluation

(08th month), at the end of the second school term; and final data (12th month), following a withdrawal of supplements.

The parameters studied at each evaluation were :

Parameters	Baseline	Mid	Final	Post final
Height (cm)	✓	—	✓	—
Weight (kg)	✓	—	✓	—
Hb (g/dl)	✓	✓	✓	✓
RCM	✓	—	—	—
SI (mcg/dl)	—	—	✓	—
TIBC (mcg/dl)	—	—	✓	—
TS (per cent)	—	—	✓	—
Tests of Cognitive Function.	✓	✓	✓	✓
Tests of Physical Work Capacity	✓	✓	✓	✓
Dietary Survey	✓	—	—	—

In light of the baseline survey data on RCM wherein a predominantly microcytic hypochromic red cell picture was obtained, it was decided to intervene the subjects with ferrous iron alone, in the form of $FeSO_4$. The prophylactic dosage was calculated from the WHO (1975) agreed dose of 3 mg elemental Fe / kg body weight/day, as 60 mg elemental Fe / day since the mean weight of the subjects was 21 kg at baseline.

From the above sample of 207, the final study sample was 166 due to attrition, attributed to non-cooperation of subjects due to various reasons including deletion of some subjects who attained menarche during the course of the study.

Parameters to fulfill Objective I

1. Hematological status

   (i) Red Cell Morphology (Dacie and Lewis, 1977).

   (ii) Blood Hb using the filter paper technique (NIN, 1974) of the cyanmethemoglobin method.

   (iii) Serum iron, Total iron binding capacity and Transferrin saturation were estimated using the method of Ramsay (Varley, 1969).

Parameters to fulfill Objective II (i).

1. Cognitive Function (CF)

A battery of tests comprising of four subtests was selected. These selected tests were specific to functional abberations reported in anemia. The CF tests were :

1. Clerical task for attention, concentration and discrimination.
2. Visual memory test for intellectual deterioration, in which the ability to remember non verbal material is evaluated - for immediate visual memory.
3. Digit Span for immediate auditory memory.
4. Mazes for perception (planning capacity), foresight and visual motor coordination.

The first two tests were developed and standardised in our own laboratory as suggested by Dr Anandalakshmy, Director, Lady Irwin College, New Delhi. The latter two tests were taken from the Gujarati adaptation of the Weschler's Intelligence scale for Children (Bhatt, 1973) for the specific areas to be tested.

The CF tests were carried out individually in a separate room in privacy. This prevented any consultation between and distraction to the subject. The total time involved for all tests per subject was 25 minutes.

II (ii) Physical Work Capacity (PWC)

A modified Harvard step test was used. A step exercise at the rate of 20 steps per minute for a period of 5 minutes over a 12" high bench was performed.

Pulse rate and blood lactic acid were measured both before and after exercise. Blood lactate was estimated as per the method of Barker and Summerson (1941).

II (iii) Impact on growth

Weight for age - Jelliffe, 1966

Height for age - Jelliffe, 1966.

III. Dietary intake

The 24 hour recall method, modified by Pasricha (1959) was employed.

The matching criteria between the experimental and control groups were as under for :

1. Cognitive function tests :

   (a) age, (b) baseline Hb and (c) baseline CF test scores.

2. Physical Work Capacity

   (a) age (b) baseline Hb and (c) body surface area.

Body surface area was calculated as per the formula of Banerjee and Sen (1955).

Statistical analysis was conducted employing :

1. Independent 't' test
2. Paired 't' test and
3. Coefficient of correlation (r), depending upon the analysis in question. The level of significance were considered at 5%, 1% and 0.1% levels.

Results of the Study :

In line with the objectives stated earlier, results of the present study are presented under the following heads :

I. Iron status of the study population

II. Impact of supplementation of CF tests

III. Impact of supplementation on PWC

IV. Impact of supplementation on growth

I. Iron status of the study population

1. Prevalence of anemia

The mean hemoglobin (Hb) level of the subjects was 10.42 g/dl. The prevalence of anemia was universal using the WHO cut off point at 12 g/dl. No appreciable difference in the prevalence of anemia was observed between younger (age $\leq$ 11 yrs) and older (age $\geq$ 11 yrs) subjects.

Anemia was mainly due to Fe deficiency as indicated by the total absence of macrocytic megaloblastic cells in the red cell morphology examination.

Having established that iron deficiency was the chief cause of anemia, the effect of 60 mg elemental Fe/day for 60 days at a stretch, twice in the school year was evaluated.

(a) Response to supplementation on the prevalence of anemia

Hb estimates made every 4 months over a period of 1 year indicated a drastic reduction in the prevalence of anemia in the Fe treated group. At the end of the 2nd intervention (final evaluation), Hb values of nearly 70% of the subjects were above 12 g/dl. However, on considering the cut off point as 11 g/dl, the initial prevalence was 70% which dropped to a mere 1% at final evaluation. The Hb values of the placebo group remained virtually stationary.

(b) Prevalence based on response to Fe supplementation

A responder was a subject whose Hb increased by atleast 1 g/dl from baseline at mid and at final evaluation. Results indicated that nearly 60% subjects had a response of 1 g/dl or more at mid evaluation; nearly 90% responded at final evaluation in the Fe treated group.

These results substantiated the earlier contention that Fe deficiency anemia was near universal in this study population which could be effectively combated by the Fe dose level utilized in atleast 90% of the supplemented population.

2. Changes in mean Hb

The Hb values were compared over time within each group and at each point of time between the two treatment groups.

(a) Within group comparison

Comparing the changes in the Hb values from baseline to mid, to final, to post final, the paired 't' test revealed a highly significant ($p < 0.001$) improvement in the mean Hb values of the Fe treated group following each intervention. Withdrawal of supplements resulted in a significant ($p < 0.001$) drop in the mean Hb values from those at mid and final evaluation. This value, however, remained significantly ($p < 0.01$) higher than that at baseline. The mean Hb values at baseline, mid, final and post final evaluation were 10.28, 11.61, 12.33 and 10.6 g/dl respectively.

A marginal change observed in the Hb values (10.39, 10.71, 10.68 and 10.37 g/dl at baseline, mid, final and post-final evaluation respectively) of the placebo group over the study period was statistically significant; explainable only on the basis of variation in dietary intake due to seasonal availability of certain foods.

(b) Between group comparison

To compare the iron treated versus the placebo group, the independent 't' test was employed. Comparisons were made at baseline, mid, final and post-final evaluations.

Results indicated that the two groups did not differ in their baseline values; however, on treatment, the Fe treated group had significantly higher Hb values than the placebo group at mid (11.61 vs 10.71 g/dl) and at final (12.33 vs 10.68 g/dl) evaluations. No difference between the two groups was observed at post final evaluation due to a drop in Hb in the Fe treated group.

3. Changes in SI, TIBC and TS

Since the placebo group was not given any Fe treatment (it was simply carried over time with a sugar tablet intervention) the set of values obtained for this group would represent those for the normal population, functioning as a control group for the experimental (Fe treated) group. Thus, a comparison between the two groups would elicit the impact of Fe supplementation on the study population.

Intergroup comparison

Iron supplementation at 60 mg elemental Fe as $FeSO_4$/day for 60 days at a stretch, twice in the school year helped in filling up the Fe stores of these subjects.

Results of the independent 't' test, used to compare the two treatment groups, indicated significantly higher SI (87.93 vs 59.18 mcg/dl) and TS (23.36 vs 14.47 percent) values; significantly lower TIBC (388.03 vs 435.33 mcg/dl) values in the Fe treated against the placebo group.

No significant difference in values was observed between the younger (age $<$ 11 yrs) and the older (age $\geq$ 11 yrs) subjects in either treatment groups.

Significant difference were observed in the SI ($p < 0.001$), TIBC ($p < 0.001$) and TS ($p < 0.001$) values between the anemics (Hb $\leq$ 10.5 g/dl) and the non-anemics (Hb $\geq$ 11.5 g/dl) in either treatment groups.

A further comparison of the anemics between the two treatment groups revealed that the Fe treated anemics had significantly higher SI (76.45 vs 45.19 mcg/dl) and TS (19.0 vs 9.93 %) values and significantly lower TIBC (408.01 vs 470.82 mcg / dl) values than the anemics in the placebo group. For the non-anemics, only the SI values were significantly higher in the Fe treated versus the placebo group (112.76 vs 93.85 mcg/dl).

II. Impact of supplementation on Cognitive Function (CF) tests :

1. Impact of supplementation on the CF test scores of the total study population

(a) Within group comparison.

The paired 't' test was employed to compare the CF test scores of either treatment groups over the entire study period.

In the Fe treated group a highly significant ($p < 0.001$) enhancement from baseline in the Clerical Task (4.0 to 4.65 to 5.83), Mazes (4.36 to 5.72 to 7.54) and Total Score (20.11 to 22.6 to 26.54) were obtained at mid evaluation, which increased further at final evaluation. The enhancement in Digit Span (3.88 to 4.12 to 4.75) and Visual Memory (7.89 to 8.09 to 8.43) were significant only at final evaluation. On withdrawal of supplements (post final evaluation) a non-significant drop in Digit Span, Visual Memory and Clerical Task were observed. However, the drop in Mazes and Total Score were significant ($p < 0.001$). The scores for each test however were significantly higher at post final than those at baseline.

A similar analysis for the placebo group indicated significant improvement in Clerical Task, Visual Memory, Mazes and Total Score at mid evaluation. The Digit Span score increased only at final evaluation; the scores for the other tests had also increased further at final evaluation. A non-significant decrease in scores from final to post final evaluation was noticed.

Increments in the placebo group could be attributed to their familiarisation with the tasks on subsequent testing, which could also be expected in the Fe treated group. Thus, making a comparison between the two groups is necessary in order to establish the true effect of Fe supplementation on CF test scores. This could only be established if the increment in the scores in the Fe treated group was substantially and significantly larger than that in the placebo group.

(b) Between group comparison

No significant difference (independent 't' test) could be observed between the two treatment groups in any of the CF test score at baseline or at mid evaluation.

However, at final evaluation significantly higher scores than placebo group for Clerical Task (5.83 vs 4.93), Digit Span (4.75 vs 4.33), Mazes (7.54 vs 6.20) and Total Score (26.54 vs 23. 78) were observed in the Fe treated group. Although, a similar trend was observed for Visual Memory test, the difference between the two groups was non-significant. At post-final evaluation, no difference between the two treatement groups was observed, except for Mazes ($p < 0.05$) which continued to remain higher in the Fe treated group.

To conclude Fe supplementation at the dose level used in the present study, brought about an improvement in attention,

concentration, discrimination, perception and visual motor coordination as measured by Clerical Task and Mazes tests. The beneficial effects on perception and visual-motor coordination were sustained for atleast four months after withdrawal of Fe supplements.

2. Impact of Fe supplementation on Anemic Versus Non-Anemic subjects, in CF test scores.

To avoid overlap problems and also have clarity between the two groups, anemics were classified as those subjects with Hb $\leq$ 10.5 g/dl and the non-anemics were those with Hb $\geq$ 11.5 g/dl.

(a) Within group comparison.

The Fe treated anemic subjects improved significantly in Clerical Task (3.93 to 4.52 to 5.86), Mazes (4.21 to 5.71 to 7.40) and Total Score (19.79 to 21.84 to 25.79) at both mid and final evaluations from their baseline values. However, the increase in Digit Span (3.84 to 4.13 to 4.72) and Visual Memory (7.8 to 8.02 to 8.36) scores were significant only at final evaluation. On withdrawal of supplements a significant drop from scores at final, were observed for the Clerical Task (5.86 to 5.55), Mazes (7.4 to 6.33) and Total Score (25.79 to 24.62). The scores for each test remained significantly higher than those at baseline.

The scores for the Fe treated non-anemics were significantly higher for Clerical Task (4.36 to 5.49 to 6.33) and Total Score (21.14 to 23.56 to 26.84) at mid evaluation; a further increase in these scores was observed at final evaluation. A significant benefit in Mazes score (4.81 to 5.62 to 7.66) was observed only at final evaluation. These scores did not change significantly at post final evaluation.

(b) Between group comparison

A comparison between the anemics and non-anemics for each treatment group, using the independent 't' test revealed no extra benefit to either group on Fe supplementation. Although, a trend for higher scores of non-anemics was indicated throughout the study period.

A further comparison of the anemics (Fe treated versus placebo) at final evaluation revealed a benefit on Clerical Task (5.86 vs 4.69), Mazes (7.40 vs 5.99) and Total Score (25.79 vs 23.34) and only in the Mazes (7.66 vs 6.19) score in the non-anemics. Thereby, illustrating that the benefit of Fe supplementation was greater in anemics than in non-anemics, and the areas in which this benefit was observed were attention, discrimination, concentration, perception and visual motor coordination as tested by Clerical Task and Mazes tests.

3. Impact of supplementation on younger (age $\leq$ 11 yrs) versus older (age $\geq$ 11 yrs) school girls, in CF test scores

The subjects were classified into 2 age categories :

i) Younger, age $\angle$ 11 yrs and (ii) older age $\geq$ 11 yrs.

(a) Within group comparison.

In the Fe treated younger group, highly significant increase in Clerical Task (3.59 to 4.14 to 5.47), Mazes (4.0 to 5.52 to 7.44) and Total Score (19.19 to 21.86 to 26.33) were observed at mid and final evaluations. At final evaluation the Digit Span (4.01 to 4.89) and Visual Memory (7.62 to 8.55) test scores had increased significantly from baseline. Except for Mazes, there was no significant change in any test score on withdrawal of supplements.

The results for older girls were similar to those of the younger girls, with the exception of Visual Memory scores which showed no significant change throughout the study period.

(b) Between group comparison

Results indicated that the younger Fe treated subjects had significantly lower scores at baseline for all tests, except Digit Span, than the older counterparts. However, on supplementation the scores had caught up with those of the older subjects at final evaluation.

These results indicate that it is the younger group (age $\leq$ 11 yrs) that contributes to the benefit of Fe supplementation on CF test scores in a mixed population of both younger and older subjects.

III. Impact of supplementation on Physical Work Capacity (PWC)

1. Impact of Fe supplementation on selected parameters of PWC in underprivileged school girls

Strict matching of subjects was observed for the study of this function. The subjects were matched for age, initial Hb and body surface area. As a result, the baseline data on pre and post exercise pulse rates and blood lactic acid, did not differ significantly in the two treatment groups.

(a) Within group comparison.

The paired 't' test for the analysis of the Fe treated groups over time revealed a significant drop in the post exercise pulse rate (175.25 to 167.59 beats per minute), pre and post exercise blood lactic acid (11.67 to 9.77 mg/dl; 26.03 to 19.52 mg/dl) values at mid evaluation, with corresponding increases in Hb values. The values remained significantly lower at final evaluation for pre and post exercise pulse rate (91.81 and 168.86 beats/minutes) and blood lactic acid values (8.66 and 16.81 mg/dl). On withdrawal of Fe supplements a highly significant increase in the pre and post

exercise pulse rate ($p < 0.001$) values were observed, although the post exercise pulse rate remained significantly ($p < 0.01$) lower than that at baseline. However, the post exercise blood lactic acid values had increased to those at baseline.

A similar comparison for the placebo group, revealed no significant changes in either pulse rate or blood lactic acid, pre or post exercise, at mid evaluation. However, an unexplained drop, only in the post exercise pulse rate (178.91 to 175.11 bests/minute) was observed at final evaluation. On withdrawal of intervention, no significant change either from final or baseline values was observed for any parameter.

(b) Between group comparison

A comparison of the two treatment groups (independent 't' test) at all four points of time revealed significantly lower post exercise pulse rate ($p < 0.001$) and pre and post exercise blood lactic acid ($p < 0.001$) values in the Fe treated group, at mid and final evaluations. At post final evaluation, no difference was observed between the two groups for any parameters except in the post exercise pulse rate which in the Fe treated group was significantly lower than that in the placebo group.

2. Relationship between Fe status and PWC

Results of the correlation coefficient (r) indicated that the post exercise blood lactate values highly correlated at baseline ($r = -0.2805$), at mid ($r = -0.2037$), at final ($r = -0.4582$) and at

post final evaluation (n = -0.8661) with the respective Hb values. An interesting relationship between the initial Hb and final blood lactate values, both pre and post exercise (r = -0.3855 and r = -0.5017 respectively) emerged. A significant correlation between mid (r = -0.2205) and final evaluation (r = -0.3831) pre exercise blood lactate values was also observed with the respective Hb values.

Also, the pre exercise blood lactate values correlated with TIBC, (r = 0.3578) and TS (r = -0.3227), the post exercise blood lactate values correlated with SI (r = -0.2866), TIBC (r = -0.3710) and TS (r = -0.3569) at final evaluation.

The relationship for pulse rate was similar to that observed for blood lactate values. To conclude, iron status has an important bearing on the ability of an individual to perform physical work. On supplementation with Fe, a beneficial effect on the Hb status and concomitant lowering of pulse rate and blood lactic acid, at rest and in response to exercise was observed. This would enable the subjects to perform an exercise or do any physical work with greater ease and less exhaustion.

3. Impact of Fe supplementation on anemic and non anemic subjects

(a) Within group comparison.

Results of the paired 't' test for the anemic subjects indicated significant lowering of the pre and post exercise pulse rate and blood

lactic acid values, for the Fe treated group, at mid and final evaluations. On withdrawal of supplements, these values increased significantly ($p < 0.001$); the pre exercise pulse rate and post exercise lactic acid values did not differ significantly from those at baseline. However, the post exercise pulse rate remained significantly lower ($p < 0.001$) than that at baseline in this group.

Significant changes in the anemic placebo group were observed only for post exercise pulse rate at mid and final evaluation, and for pre exercise lactic acid values at mid evaluation. At post final evaluation, the values for both pre and post exercise pulse rate were significantly lower than those at baseline and no difference in the post exercise lactic acid was observed.

The non anemic subjects showed no significant changes in pre or post exercise pulse rate values on Fe treatment. However, significant changes in the post exercise lactic acid levels at mid (from 22.51 to 17.29 mg/dl) and at final (22.51 to 13.98 mg/dl) evaluations were observed. On withdrawal of supplements only the post exercise blood lactic acid level showed a significant increase (13.98 to 17.70 mg/dl) than the values at final; all values were similar to those at baseline.

For the placebo treated anemic and non anemic subjects none of the parameters changed significantly, except for the post exercise pulse rate, which increased significantly ($p < 0.05$) at mid evaluation.

(b) Between group comparison.

A comparison of the anemics versus non-anemics in both the treatment groups, using the independent 't' test, revealed that the anemics performed poorly in tests of physical work; and even on supplementation the post exercise pulse rate, pre and post exercise blood lactic acid values remained significantly ($p < 0.001$) higher in the anemics than in their non-anemic counterparts.

A further comparison between the anemics (Fe treated versus placebo group) at final evaluation revealed that Fe supplementation significantly lowered the pre and post exercise pulse rates (93.95 vs 98.13 beats/minutes and 174 vs 178.26 beats/minute) and blood lactic acid (9.48 vs 11.23 mg/dl and 18.26 vs 25.55 mg/dl respectively) values than their placebo counterparts. No difference had been observed between the two groups at baseline for any of these parameters.

A similar analysis for the non-anemics showed a significant benefit only for the pre and post exercise blood lactic acid values; these values did not differ significantly at baseline evaluation.

These results indicate that anemics performed poorly on tests of physical work and the belief that anemia affects work capacity is further strengthened.

4. Impact of Fe supplementation on PWC in younger (age $\leq$ 11 yrs) and older (age $\geq$ 11 yrs) school girls

(a) Within group comparison.

The Fe treated younger group showed a significant drop in post exercise pulse rate (94.47 to 93.73 beats/minute) and in pre and post exercise blood lactic acid (11.69 to 9.79 mg/dl and 27.16 to 19.53 mg/dl) values at mid evaluation. At final evaluation the benefit was observed in the pre exercise pulse rate ($p < 0.01$) values alongwith the benefit in the rest of the parameters. However, on withdrawal of supplements a significant increase in the pre and post exercise pulse rate and in post exercise blood lactic acid were observed.

A similar analysis for the younger, placebo treated subjects revealed a significant increase in the pre exercise pulse rate and blood lactic acid values at mid evaluation. A non significant drop in post exercise pulse rate and a similar increase in the post exercise blood lactic acid values were observed at this stage. The changes at final and post final evaluations, for none of the parameters was significant.

Changes in the older group were similar to those of the younger group both for pulse rate and blood lactic acid values in the Fe treated and placebo groups.

(b) Between group comparison

The younger iron treated subjects showed significantly lower post exercise pulse rate, and pre and post exercise blood lactic acid values at mid evaluation. At final evaluation the pre exercise pulse rate was also significantly lower in the Fe treated group than the placebo. The values at baseline for both the treatment groups were similar.

In the older group at mid evaluation only the post exercise lactic acid value was lower in the Fe treated group than the placebo. At final evaluation the pre exercise blood lactic acid was lower than that of the placebo; no difference were observed in the pulse rate values. The values at baseline for both groups were similar.

At post final evaluation, in the younger group, the post exercise pulse rate remained significantly lower in the Fe treated group than the placebo. No difference was observed in the older group.

IV. Impact of iron supplementation on growth status

The parameters for the measurement of impact of Fe supplementation on growth were :

Height for age and weight for age.

Changes in the height-for-age and weight-for-age on intervention

(a) Within group comparison.

Results of the paired 't' test indicated highly significant ($p < 0.001$) improvement in the height of the subjects from baseline to final evaluation, in both the treatment groups.

Similar observations were made for weight gain in both the treatment groups.

(b) Between group comparison.

On comparing the Fe treated versus the placebo group, no significant difference was observed in either the mean height or the mean weight of the subjects at baseline or at final evaluation. However, on comparing the mean increase in height from baseline to final, in the Fe treated versus the placebo group, the values differed significantly (7.86 vs 6.19 cm). The difference between the mean increase in weight for the iron treated vs placebo group (2.31 vs 2.37 kg) was non-significant.

The subjects were divided further into two categories, based on their Hb status, anemics and non-anemics as done earlier. Results of the comparison between the anemics and non-anemics for the Fe treated and placebo groups indicated no significant differences in the height or weight of the two groups (anemics vs non-anemics) at baseline or at final evaluation.

To conclude, anemia at the level observed (mean Hb 10.42 g/dl) has no discernible effect on growth. Also, it may be possible that growth is affected in anemia only at a very young age, 6 months to 3 years, an interval during which the body weight normally more than doubles. Thus, the benefit of Fe supplementation on growth, in this study age group, may not be elucidated in a short span of 8 months when the growth is not so rapid as that in the infant or preschooler.

Conclusions of the present study

The present study has greatly contributed to the knowledge of functional alterations in anemia in school girls in several ways.

First, no other study to our knowledge has been conducted on underprivileged school girls (8 - 15 yrs) to study the impact of iron supplementation on functions, namely, iron status, cognitive function, physical work capacity and growth.

Secondly, the baseline survey revealed a very high prevalence of iron deficiency anemia, reducible on iron therapy. The benefit of Fe supplementation was observed in the iron status as well as in the functional areas studied.

An impact of Fe supplementation on cognitive function test scores, mainly on concentration, discrimination, perception and

visual motor coordination were observed. These benefits were not immediate, however, they were sustained for atleast 4 months after withdrawal of therapy.

This has an important bearing on the scholastic performance of the school children who are unable to concentrate, have poor discrimination, perception and visual motor coordination due to anemia. Although the benefits to the anemics were greater than those for non-anemics; and greater in younger than in older subjects, more studies with larger sample and longer intervention period need to be carried out.

The beneficial effect of Fe supplementation on physical work capacity as measured by a decrease in pre and post exercise pulse rate and blood lactic acid was observed. Inability of an individual to work for longer periods or to do heavy work for short duration may affect the physical development and will also have an effect on the family economy.

A child may not notice a number of objects around him, although they may seem interesting, simply because he feels tired and attempts to conserve his energy. The child thus loses an opportunity of learning by exploring.

Although, no clear cut beneficial effect on growth was observed in the study population, it may be due to the short interval of time between the two evaluations. The growth in this

age group (8 - 15 yrs) is not as fast as in pre-schoolers ('under fives'). Hence, it may be necessary to study the impact of Fe supplementation on growth over longer period of time.

To conclude the results of the present study indicated a reduction in the prevalence of anemia and improvement in iron status of underprivileged school girls (8 - 15 yrs of age) in response to a 60 mg elemental Fe prophylactic dose, twice in a school year. A beneficial effect of this regimen was also observed in the selected functional areas.