ORIGINAL ARTICLE

EFFECT OF DAILY VERSUS WEEKLY IRON FOLIC ACID SUPPLEMENTATION ON THE HAEMOGLOBIN LEVELS OF CHILDREN 6 TO 36 MONTHS OF URBAN SLUMS OF VADODARA

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ABSTRACT

Objective: To assess the effect of daily versus weekly iron folic acid (IFA) supplementation on the haemoglobin levels of children 6 to 36 months of urban slums of Vadodara

Design: Non Randomized control supervised trial

Setting: Five out of 40 anganwadi centres were randomly selected. The centres were randomly divided into 3 groups i.e., daily, weekly and control.

Participants: All children age 6 to 36 months were selected

Intervention: Subjects of daily group (n=31) received one IFA tablet (19.8 mg of elemental iron/tablet) daily for 60 days; weekly group (n=30) received one IFA tablet per week for 19 weeks; control group (n=31) did not receive any supplementation.

Main Outcome Measure(s) included impact on haemoglobin levels, anemia prevalence.

Results: A significant rise in the hemoglobin levels of 2.03g/dl and 1.75g/dl was observed in daily and weekly group respectively, with anaemic subjects showing a higher rise. Overall prevalence of anemia reduced significantly by 35% and 43% respectively in daily and weekly group. Weekly supplementation showed fewer side effects and more reduction in anemia compared to daily.

Conclusions: IFA supplementation significantly increased haemoglobin levels of underprivileged children below 3y of age, irrespective of dose and regimen (daily or weekly). Weekly supplementation with medicinal iron can be used as a strategy for improving haemoglobin levels and anemia reduction among children 6 to 36 months with fewer side effects.

Key words: Under 3, IFA supplementation, anaemia, weekly vs. daily supplementation, low socio economic group

INTRODUCTION

Iron deficiency anemia (IDA) is a public health problem of staggering proportions affecting 20-50% of world’s population 1. It is the most common nutritional disorder in the world affecting particularly pregnant and lactating women and preschool children 2.

Infants and young children are highly vulnerable to IDA because of depletion of iron stores due to rapid growth, low iron content of most infant diets and early initiation of top milk. According to WHO (1991), 48% of children <3years of age have IDA 3. In India nearly 60-70% of all children below 6 years suffer from varying degree of anemia 4.

The results of the National Family Health Survey III (NFHS-3) show almost 40% of all children below three are underweight and...
almost 80% of children in the age group of 6-35
months are anaemic.

In India, 57 of every 1000 children die before
they reach the age of one year. Iron deficiency
anaemia is associated with impaired motor
development, physiological and behavioural
effects, reduced physical activity and poor
scholastic performance in children.

Iron supplementation has successfully proved to
be a short term strategy to combat anaemia. But
daily iron-folic acid (IFA) supplementation has
shown to have certain limitations like rapid
decline in iron absorption due to high dose and
gastrointestinal side effects. On the other hand
weekly iron supplementation has advantage
over daily iron supplementation like - lower
side effects, cost effectiveness and improved
compliance.

The National anemia control program
recommends supplementation of 100 IFA tablets
every year for all children 6 to 36 months.
However, this has failed to make any dent in
anaemia control among under 3 with latest NFHS
III data showing increase in anaemia from 74.3%
to 78.9%, the reasons for this are many
predominantly poor compliance. Fewer then
one in ten children were given IFA
supplementation in last seven days (4.7 %) as
per NFHS III. The operational success of this
strategy needs to be examined and redefined.

While the effectiveness of weekly regimen of
iron supplementation in improving
haemoglobin levels has been established in older
children and adolescents, very few studies
have addressed this issue in infant and young
children (< 3 years)

Therefore, the present study was undertaken
with the major objective of assessing the
effectiveness of weekly versus daily iron
supplementation in improving the haemoglobin
levels of young children (6 months - 3 years)
and reducing the prevalence of anaemia.

METHODOLOGY

The prospective study was undertaken in the
areas of anganwadi centres managed by a
children’s hospital of Baroda, in 2004. Five out of
40 anganwadi centres were randomly selected
and a total of 158 subjects (6-36 months of age)
were enrolled for the study. The anganwadi
centres were randomly divided into three
groups, with a minimum of 50 subjects in each.

The three groups were – daily group (n=55) and
weekly group (n=51), each of which served as
experimental groups and a control group (n=52).
Daily group received one iron folic acid (IFA)
tablet/day for 60 days, whereas weekly group
received one IFA tablet/week for 19 weeks.
Control group did not receive any
supplementation. It was a supervised trial.
Chemical analysis of the IFA tablets was done
using Wong’s method.

Baseline data were collected on socio-economic
status, dietary intake, hemoglobin levels, red cell
morphology and morbidity profile. Hemoglobin
levels and red cell morphology were again
measured at the end of the intervention period.

Socio-economic status: Information on socio-
economic profile of the subjects was collected
using a pre-tested structured questionnaire.
Dietary intake: Data on dietary intakes was
collected using 24 hour dietary recall method
and food frequency questionnaire.
Haemoglobin estimations: Haemoglobin levels
were measured using standard
cyanmethemoglobin method.
Red cell morphology: The red cell morphology of
all the subjects was studied using peripheral
blood smear.

Morbidity Profile: Data on morbidity profile was
collected using a reference period of two weeks,
both at baseline and after intervention.
Ethics: Before starting the study, consent was
taken from the social welfare officer of the
hospital, supervisor of the anganwadi centres
and the parents of all the subjects.

Statistical analysis: Data was analysed using the
SPSS package. Frequency distribution and
percentages were calculated for all parameters
while means and standard errors were
calculated for all numerically expressed
parameters. Independent’t’ test were used to
compare the difference between the means in
different groups. Paired’t’ test were used to
assess the differences between the means of
same group before and after the study period.
Chi-square test was used to test difference
between the frequency distribution.

RESULTS

Out of the 158 enrolled children, 92 children – 31
each in daily and control groups and 30 in
weekly group, completed the study, for analysis
the subjects were classified into two categories.
The subjects in the two categories were not
mutually exclusive.
All subjects – Total 92 (daily =31, weekly=30 and control =31) subjects who participated and completed the study, including both anaemic and non-anaemic subjects.

Anemic subjects – Total 80 subject with initial Hemoglobin levels below 11g/dl including 28 from daily, 25 from weekly and 27 in control group.

Table 1: Mean Dietary Iron Intake of the Subject in Three Groups

<table>
<thead>
<tr>
<th>Age group</th>
<th>Daily (A) Mean ± SE</th>
<th>Weekly (B) Mean ± SE</th>
<th>Control (C) Mean ± SE</th>
<th>A v/s B 't' value</th>
<th>B v/s C 't' value</th>
<th>A v/s C 't' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 to 12 m</td>
<td>7.42 ± 1.33</td>
<td>5.85 ± 1.47</td>
<td>6.61 ± 0.99</td>
<td>0.78</td>
<td>0.43</td>
<td>0.47</td>
</tr>
<tr>
<td>12 to 24 m</td>
<td>5.9 ± 0.8 9</td>
<td>5.11 ± 0.38</td>
<td>5.38 ± 0.44</td>
<td>0.82</td>
<td>0.464</td>
<td>0.529</td>
</tr>
</tbody>
</table>

The results of chemical analysis showed that the IFA tablets contained 19.8 mg of elemental iron/tablet. The daily group was supplemented 1 tablet/day for 2 months (60 days) thus consuming a total of 1188 mg of iron through supplements, while the weekly group was supplemented 1 tablet/week for 19 weeks thus consuming a total of 376.2 mg iron.

Table 2: Impact of IFA Supplementation on Haemoglobin levels of Children (6 to 36 months)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Haemoglobin Levels (g/dl) Mean ± SE</th>
<th>A v/s B 't' value</th>
<th>B v/s C 't' value</th>
<th>A v/s C 't' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily (A)</td>
<td>9.06 ±0.23</td>
<td>1.56</td>
<td>2.23</td>
<td>0.875</td>
</tr>
<tr>
<td>Weekly (B)</td>
<td>9.59 ±0.251</td>
<td>6.86 ±0.256</td>
<td>0.68</td>
<td>7.65***</td>
</tr>
<tr>
<td>Control (C)</td>
<td>8.73 ±0.284</td>
<td>-0.06 ±0.23</td>
<td>7.7***</td>
<td>0.316</td>
</tr>
<tr>
<td>All Subjects</td>
<td>9.06 ±0.23</td>
<td>1.56</td>
<td>2.23</td>
<td>0.875</td>
</tr>
<tr>
<td>Initial</td>
<td>8.81 ±0.205</td>
<td>1.24</td>
<td>3.08</td>
<td>1.91</td>
</tr>
<tr>
<td>Final</td>
<td>10.97 ±0.12</td>
<td>0.57</td>
<td>8.33***</td>
<td>10.09***</td>
</tr>
<tr>
<td>Difference</td>
<td>2.16 ±0.26</td>
<td>0.1 ±0.22</td>
<td>7.42***</td>
<td>0.48</td>
</tr>
<tr>
<td>Paired ‘t’ Value</td>
<td>8.13***</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Anaemic Subjects

<table>
<thead>
<tr>
<th>Groups</th>
<th>Haemoglobin Levels (g/dl) Mean ± SE</th>
<th>A v/s B 't' value</th>
<th>B v/s C 't' value</th>
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<td></td>
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</tr>
</tbody>
</table>

*** Significant at p<0.001, Figures in parenthesis indicates no of subjects

The effect of iron supplementation on the mean haemoglobin levels of the subjects is shown in Table 2. The initial hemoglobin level of the three groups was not different significantly. However, the mean final hemoglobin level of “All subjects” of the daily and weekly groups was significantly higher than the control group.

Table 3: Effect of IFA Supplementation on Change in the Percent Prevalence of Red cell Morphology among Children (6 to 36 months)

<table>
<thead>
<tr>
<th></th>
<th>Normocytic Normochromia</th>
<th>Microcytic Hypochromia</th>
<th>Macrocytic Hypochromia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial (%)</td>
<td>Final (%)</td>
<td>Initial (%)</td>
</tr>
<tr>
<td>Daily</td>
<td>9 (29)</td>
<td>28 (90)</td>
<td>17 (54.8)</td>
</tr>
<tr>
<td>Weekly</td>
<td>10 (32.2)</td>
<td>22 (70.9)</td>
<td>16 (53.3)</td>
</tr>
<tr>
<td>Control</td>
<td>7 (22.5)</td>
<td>7 (22.5)</td>
<td>15 (50)</td>
</tr>
</tbody>
</table>

When the different levels of change in hemoglobin levels was seen for all subjects, 39% of subjects from daily group and 33% of subjects from weekly group showed an increase in hemoglobin levels between 1.51g/dl to 2.5g/dl. A total of 29% and 20% subjects from daily and
weekly group respectively showed an increase greater than 2.51 g/dl (Figure 1). Sixty one percent subjects in the control group showed a drop in hemoglobin levels. The data when analysed for anemic subjects showed a similar trend.

The impact of supplementation on the final haemoglobin levels of all subjects in relation to initial hemoglobin levels is shown in Figure 2. A higher increase in hemoglobin levels was observed in the subjects with hemoglobin level below 10 g/dl in both daily (2.43 g/dl) and weekly (2.03 g/dl) groups.

With respect to the impact of supplements on the percent prevalence of anemia, the results showed that the overall percent prevalence of anemic subjects reduced from an initial 89% to 55% in the daily and 83% to 40% in the weekly group, whereas it increased from initial 87% to 93% in the control group.

**Figure 1:** Percent of All Subjects Showing Different Level of Change in Hemoglobin Levels – After Supplementation

Analysis of hemoglobin levels of the subjects according to the initial red cell morphology showed that irrespective of the type of red cells, significant increase in hemoglobin levels from initial to final was seen in all the three categories i.e. Microcytic, Hypochromic, Normocytic, Normochromic and Macrocytic Hypochromic in the daily and weekly groups. Normocytic Normochromic subjects showed rise in hemoglobin levels but lower in comparison to the other two deficient cell morphologies.

**Figure 2:** Effect of Supplementation on Change in Hemoglobin Levels of Subjects in Relation to Initial Hemoglobin Levels
Moreover the impact of supplementation brought about a drastic shift in the red cell morphology of the experimental group subjects with majority of subjects having normal red cell morphology in these groups after the intervention as shown in Table 3. An assessment of the physiological effects experienced on consumption of the supplements as reported by the subjects showed that majority of the subjects (90.3%) in daily group reported to have side effects as against only 9.6% in the weekly group.

**DISCUSSION**

Supplementation with medicinal iron in the present study led to a significant rise in the haemoglobin levels of the subjects in both the daily (2.03 g/dl) and weekly (1.75 g/dl) groups. The anemic subjects showed a higher increase in hemoglobin levels as compared to the normal subjects, in both supplementation groups.

A rise of 2.43 g/dl and 0.6 g/dl respectively was observed in daily group among subjects with hemoglobin levels <10g/dl and 10-10.9g/dl, and 2.03 g/dl and 1.39 g/dl in the weekly group. On the other hand no change in the mean hemoglobin levels was observed in the control group.

Studies in literature have shown a significant increase in haemoglobin levels on weekly supplementation to different age group thus showing it to have a comparable effect on hemoglobin levels. While studies have been carried out to assess the effect of daily supplementation of iron on hemoglobin levels of children, the effect of daily versus weekly iron supplementation on hemoglobin levels have been studied in few.

In a study by Sunghanget al (2002) in Thailand, 397 primary (6-13yr) school children were supplemented 60 mg of elemental iron, either on daily or weekly basis for 16 weeks. An increase in hemoglobin levels of 0.65 g/dl in daily group and 0.57 g/dl in weekly group was observed 9.

A study in North-East Delhi on 2210 girls aged 10-17 years assessed the effect of supplementing 100mg elemental iron and 500 mg folic acid for 100 days to the daily group and for 230 days to the weekly group. The haemoglobin levels significantly increased from pre to post, 11.7 to 12.2 g/dl in daily group and 11.7 to 12.1 g/dl in weekly group 10.

In the present study, overall 91% and 93% subjects from daily and weekly group showed improvement in haemoglobin levels. Further 39% and 33% of subjects respectively from daily and weekly group showed an increase in hemoglobin levels between 1.51 g/dl to 2.5 g/dl, while 29% subjects from daily and 20% subjects from weekly group showed an increase greater than 2.51 g/dl. As against this, 61% of control group subjects showed a drop in hemoglobin levels with 29% showing drop of over 0.5 g/dl.

A study conducted in Andhra Pradesh 8, to assess the effect of daily versus weekly iron supplementation on 244 girls (13-15 yrs) with different degrees of anemia, showed that rise in hemoglobin levels observed increased with the severity of anemia in both the groups. The results in the present study also showed a similar trend. The highest rise in hemoglobin levels of 2.43 g/dl and 2.03 g/dl was observed in severely anemic subjects from daily and weekly group respectively. Over all there was 35% and 43 % reduction in anemia among the daily and weekly group respectively.

To conclude, the results of the present study have shown that supplementation with IFA (19.8 mg elemental iron) brought about a significant rise in the haemoglobin levels in different age groups. Further research needs to be carried out to test the long-term effect of IFA supplementation on hemoglobin levels, anemia prevention, compliance and growth of young children.

**What is already Known**

IFA supplementation can cause a significant rise in the haemoglobin levels in different age groups.

**What this Study Adds**

Irrespective of dose and regimen (daily or weekly) IFA supplementation significantly
increases haemoglobin levels in young children (6 to 36 months).

Weekly supplementation shows fewer side effects.

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