FEASIBILITY OF “DIRECTLY OBSERVED HOME-BASED TWICE-DAILY IRON THERAPY” (DOHBIT) FOR MANAGEMENT OF ANEMIA IN RURAL PATIENTS: A PILOT STUDY

SAHUL BHARTI

ABSTRACT

BACKGROUND: Iron deficiency anemia (IDA) is a significant public health challenge in resource-poor settings, despite strong evidence for efficacy of iron supplementation. We hypothesized, modeled on the successful initiatives in disorders like tuberculosis or HIV, that directly observed therapy is an effective and practical strategy for control of IDA in such settings. OBJECTIVE: To overcome practical constraints and optimize compliance and effectiveness of iron supplementation by “Directly Observed Home-Based twice daily Iron Therapy” (DOHBIT) through village youth volunteers. DESIGN: Prospective longitudinal evaluation of DOHBIT SETTING: A remote rural hilly hamlet with 25 families. METHODS AND MATERIAL: 100 mg elemental iron was administered twice daily under direct supervision to 33 anemic patients at home for 90 days. Outcome measures included hemoglobin rise, weight gain and side-effects. STATISTICS: Pre- and post-intervention weight and hemoglobin values were compared using paired t-test. RESULTS: 29 patients completed 3-months twice-daily iron therapy without interruption (compliance 87%). There was significant increase in mean weight (43.3 ± 6.8 kg vs. 45.1± 6.9 kg; P < 0.0001) as well mean hemoglobin concentration (9.5 ± 0.9 gm% vs. 11.7 ± 0.7gm%; P < 0.0001) and prevalence of anemia decreased by 40% from recruitment through the 3-months therapy. In terms of side effects, occasional constipation was stated by 3 patients, transient heartburn by two and diarrhea by none. Vomiting prompted withdrawal of iron therapy in one patient. CONCLUSIONS: Providing iron supplementation as directly observed home based therapy is feasible and successful in decreasing the prevalence of anemia in resource-poor settings.

KEY WORDS: Iron deficiency anemia, hemoglobin, iron therapy, community participation, directly observed therapy

INTRODUCTION

Based on rural population survey by National Institute of Nutrition, 58% of rural population in India develop anemia (defined by WHO criteria). The problem is exaggerated in women, adolescents and children. The wide ranging manifestations of anemia, both implicit as well as explicit, have always forced innocent patients to seek remedies (from unnecessary to hazardous) from qualified as well as unqualified practitioners at an enormous cost without much benefit. Indeed, correct diagnosis and initiation of appropriate therapy also fail to yield desirable results in view of poor compliance, frequent interruptions in regular availability of iron tablets at primary care level and other constraints. Recent studies undertaken in the community for tackling the problem of iron deficiency anemia have focused on dietary diversification, food fortification, and altered dosage or interval schedules. However, studies appraising community participation for control of anemia are scarce. Given the role of community participation in the field of health and nutrition, we hypothesized that “Directly Observed Home-Based twice daily Iron Therapy” (DOHBIT), by overcoming the aforementioned problems, would be a better option in lowering the disease burden due to this universal yet not an innocent bystander of rural people. There is no study reported on this issue from our country.

MATERIALS AND METHODS

Panyali is a hamlet 60 kilometers south of district headquarters Nahan in district Sirmour of Himachal Pradesh. There are around 25 closely spaced families with majority of them involved in farming. We started our Bharti Healthy India Movement (BHIM) in May 2003 in this hamlet. The results of our preliminary surveys suggest that anemia had not been studied intensively in this area before. Malaria is not endemic in this area. All the prominent residents were given detailed briefing on the study protocol. Fact sheets explaining the project were distributed to all educated people of the village. Local village youth were trained about the common illnesses including anemia. Two volunteers underwent further training for procedures like hemoglobin and ESR estimation in a nearby 50 bedded charitable hospital for next 6 weeks. The hemoglobin estimation (Sahli’s method) was carried out by the most experienced volunteer and author himself validated every 5th measurement. Out of 100 villagers investigated, 33 were confirmed anemic. Though many of them had been told to have deficiency of blood in the past, iron therapy had never been carried out in these affected patients appropriately for many reasons. Rather, patients had been seeking numerous unwanted and costly treatments from various government and private clinics for different symptoms arising from anemia. Our study was carried out from November 2003 to the end of February 2004.

Inclusion criterion was any patient older than 12 years of age with anemia. Anemia was defined using hemoglobin thresholds recommended by the WHO as follows: adolescent boys and adult men <13.0 g/dl; adolescent girls and non-pregnant women <12.0 g/dl; and pregnant women <11.0 g/dl.

Exclusion criteria were:

- Any active disease (acute or chronic) at the time of enrolment in the study that could affect iron metabolism or cause anemia through mechanisms other than nutritional deficiencies
- Recent hospitalization in past 6 weeks
To eliminate a major source of variation, all patients were dewormed with a stat dose of Albendazole (400 mg) at the beginning of study. Every anemic patient in the village had an accompagnateur (trained volunteer from the same village) who not only offered and observed the ingestion of pills, but also documented it on his entry register simultaneously. Any reported symptoms (abdominal discomfort, bloating, nausea, heartburn, diarrhea, or constipation) in previous week that may have been related to the iron supplement were also recorded. Supplementation was timed in such a way that majority of patients are available at home or near home. Patients were instructed to take the iron supplement with a glass full of water (mostly one hour before meal) and not to drink tea or coffee at that time so as to optimize iron absorption. If any patient reported any symptoms during the 24 hours after taking the supplement, he or she was encouraged to take the supplement with a snack. Author accompanied the team of volunteers, once a week, to enquire about any side effects of iron supplements had any effect on their sense of nutritionally rich food items. Only 3 patients gave history of worm infestation. None of the female patients had active gynecological problem at the time of initial evaluation. However, a female patient, who was underweight and had functional amennorhea for more than one year, resumed her normal menses after two months of iron therapy.

RESULTS

The study village had a total population of 144, out of which 34 were children aged 12 years or less. Among 110 adults, males were 48 and females numbered 62. Out of them, there were 2 pregnant and 3 lactating women and adolescents constituted 13.6% (3 boys and 12 girls; age range 13-18 years). Children (12 years or below) were excluded from current study as majority of them were already receiving iron supplements in a school-based and Anganwari based interventions. Out of 110 adults, 8 persons met the exclusion criteria and 2 persons could not be included because of some social or occupational assignments. Out of remaining 100 adults, 33 were confirmed anemic on hemoglobin testing at the start of study. However, 4 patients were considered protocol violators as they failed to complete 3-months iron therapy for the following reasons: (a) Two of them were pregnant women with one delivering after six weeks of iron therapy and other one (in mid trimester of gestation) had recurrent vomiting necessitating premature withdrawal of iron therapy (b) one girl got married and left in the middle of our programme, (c) another patient failed to carry on with iron supplementation and had frequent interruptions in his treatment due to some unanticipated social assignments. Compliance, therefore, was 87.8% in our study participants i.e. 87.8% completely adhered to 3-months supplementation protocol.

The mean age of anemic patients who completed the therapy was 34 years (range 14 to 60 yrs) with female to male sex ratio of 8.6:1 (26 females and 3 males). Mild anemia (hemoglobin concentration above 10 gm/dl but below the cut-off value) was observed in 37.9% (11/29), moderate anemia (hemoglobin level between 7-10 gm/dl) in 62.1% (18/29) patients whereas none had severe anemia (hemoglobin less than 7 gm/dl). Dietary histories showed poor intake of green leafy vegetables (which are only available during winter months) and there was a gender bias against women in intake of nutritionally rich food items. Only three patients gave history of worm infestation.

Statistical Analysis

On-treatment analysis was carried out for 29 patients who completed 90 days of iron therapy. Their mean values for hemoglobin concentration and weight (pre- and post-iron supplementation) were compared using paired t-test. The change in prevalence of anemia was, however, calculated after including the 4 protocol violators. Compliance (%) was defined as (total number of patients who completed the therapy/total number of patients enrolled) * 100. Mann-Whitney U test was used to compare hemoglobin values and weight of the males and females participants separately (both before and after intervention). Pearson correlation coefficient was calculated between baseline hemoglobin values and subsequent rise of hemoglobin after intervention.
The results of therapy are summarized in the Table 1.

The mean hemoglobin values were significantly higher in males as compared to females, both before (10.6±0.5 vs. 9.3±0.8 gm/dl, Mann-Whitney U test; \( P=0.02 \)) as well as after the intervention (12.7±0.5 vs. 11.6±0.6 gm/dl, Mann-Whitney U test; \( P=0.001 \)). Mean hemoglobin rise at completion of the 3-months iron therapy was 2.2±0.5 gm/dl (range; 1.2-3.1 gm/dl). Only 66.7% of males and 42.3% of female patients had restoration of their initial hemoglobin values to normal after 3-months of iron therapy. Patients with normal hemoglobin values after intervention (n=13) had significantly higher baseline hemoglobin values (10.2±0.5 gm/dl) than those who failed to normalize after intervention (n=16; 8.9± 0.7 gm/dl) \( (P<0.0001) \). However the rise in hemoglobin level was significantly but inversely correlated with the baseline hemoglobin values [Pearson correlation coefficient -0.605; \( P \) Value (2-tailed) = 0.001].

The prevalence of anemia was calculated before and after administration of iron therapy as shown below:

\[
\text{Prevalence} = \frac{\text{Number of existing cases of anemia}}{\text{Total population at risk}}
\]

To make our analysis more realistic, 4 dropouts were also included for estimation of change of prevalence of anemia after iron supplementation. By excluding non-compliant patients, our estimate of prevalence of anemia after intervention might have produced a study population that is healthier than real and it would also have ignored the influence of feasibility problems on the efficacy of a treatment.

Anemia prevalence before start of iron therapy: 33/100*100=33%

Anemia prevalence after completion of therapy (Only 13 had normal hemoglobin values): 20/100*100=20%

So 40% reduction (55% if protocol violators are excluded) in prevalence of anemia was achieved by our intervention in the study population.

**DISCUSSION**

The availability of effective therapy for a widely prevalent disorder with high morbidity and mortality is an oxymoron that is explicitly perceptible in iron deficiency anemia, particularly in developing countries.11,12 Though the therapy of iron deficiency anemia is available through public health system in India, yet the incidence of anemia is still high and its impact on patient's physical condition, quality of life and socioeconomic status is enormous.1,3,13 The short term iron supplementation, despite its efficacy and cost effectiveness, has not been successful mainly due to problems with the delivery and compliance.15-17 Hence, DOHBIT seems a better and effective alternative.

The directly observed home based iron therapy through local village youth in the present study overcome many of the practical constraints frequently observed in iron supplementation programs for remote areas. Accessibility of therapy was instant, supply of iron tablets was uninterrupted, compliance was virtually complete, user provider relationship was excellent and culturally optimal counseling strategies were maximized. The significant rise in baseline hemoglobin levels and fall in anemia prevalence demonstrated in present study are consistent with the results of previous supervised efficacy trials of iron supplementation.13,15,16,17 Though, the role for direct supervision of iron intake in optimizing hemoglobin response has been emphasized in literature,16,18 yet the directly observed adherence did not show any additional benefit in few studies.19,20 As far as compliance is concerned, the acceptance of high dose iron therapy in our study was almost universal with only one patient developing persistent vomiting to necessitate withdrawal of iron therapy and none of the other side effects were significant to consider any change in therapy. Consistent with some studies, we also found that noncompliance due to intolerance of oral iron therapy is more highlighted than real.12,21 The utilization of village youth club volunteers was most crucial and our programme was successfully completed without offering any monetary incentive to the volunteers. Rather, the enthusiasm of community can be gauged from the fact that the supply of iron tablets was continuously sustained with the collective efforts of the villagers who gathered the tablets from all the near and far-off health centers as well as PHCs in advance. In the last month of therapy, volunteers were specifically instructed to emphasize and highlight the need for regular intake of green leafy vegetables as well as use of iron pot for cooking through out the year so as to further sustain the short term advantages of our 3-month home based iron therapy. Various studies had already underscored the decisive role of village health volunteers, schoolgirls and traditional birth attendants as effective supplement distributors in control of iron deficiency anemia.14,22,23

Table 1: On-treatment analysis of 29 anemic patients who completed 3 months of Directly Observed Home-Based twice-daily Iron Therapy*

<table>
<thead>
<tr>
<th></th>
<th>Before intervention</th>
<th>After intervention</th>
<th>Paired t test (P-Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg); mean ±SD</td>
<td>43.37 ± 6.82</td>
<td>45.17 ± 6.90</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Hemoglobin (gm/dl); mean ± SD</td>
<td>9.5 ± .91</td>
<td>11.7 ± .73</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

* Dose used was 100 mg elemental iron twice daily.
supplementation coupled with dietary diversification and nutritional education may be more effective strategy.13,14,20 Other possible reasons for only 40% reduction in prevalence of anemia despite very high compliance and adequate dose of iron therapy are small sample size,24 lack of severely anemic patients (rise in hemoglobin is inversely proportional to the baseline hemoglobin level),25 role of dietary inhibitors of iron absorption and the fact that only half of the anemia is wholly due to iron deficiency.26 As far as side effects are concerned, failure to tolerate iron therapy by one of the pregnant women in our study is a matter of some concern, yet a large trial in pregnant women is warranted to assess the efficacy and tolerability of DOHBIT. Finally, whether efficacy of our results can be deciphered in routine clinical practice programmes, awaits further confirmation.

On the basis of results of this pilot study, we conclude that directly observed iron supplementation approach such as one tested here offers a possible strategy to be used in concert with, not in place of, other long-term measures to control anemia in resource poor settings. Furthermore, our innovative approach has demonstrated the efficacy and feasibility of community participation, by empowering villagers and providing them an intervention to use, in eradicating iron deficiency anemia.

ACKNOWLEDGEMENTS

The author acknowledges the useful contributions made by village youth club volunteers Padam Singh and Ved Prakash, musicians Madan and Manoj, and village elderly Ranbir Singh for the successful completion of our programme.

REFERENCES