

## IMPACT OF IRON SUPPLEMENTATION ON ANAEMIC YOUNG ADULTS

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### ABSTRACT

The study was carried out to compare the effect of different supplements on the iron status of anaemic young adults (18-25 yrs) residing at ladies hostel, Yamunanagar. Supplementation study involved 36 girls divided into three groups of 12 each and were supplemented with iron capsules and iron fortified beverages. Group A was supplemented with fortified lime juice Group B with fortified grape juice and Group C with iron capsules. The supplementation period was for 90 days. The effect of supplementation was assessed by estimating the blood haemoglobin, serum ferritin and total iron binding capacity (TIBC) before and after supplementation. An increase in all the parameters was noted. The increase in all the three groups was statistically significant ( $P < 0.01$ ). Haemoglobin increased from  $8.24 \pm 1.06$  to  $10.35 \pm 1.07$  g/dl in group A,  $8.43 \pm 0.89$  to  $10.33 \pm 0.76$  g/dl in group B and  $8.15 \pm 0.79$  to  $10.65 \pm 0.80$  g/dl group C. Serum ferritin increased from  $3.90 \pm 4.99$  to  $23.25 \pm 21.16$  ng/ml in group A  $3.9 \pm 3.59$  to  $23.55 \pm 17.25$  ng/ml in group B and  $7.1 \pm 11.04$  to  $38.58 \pm 27.42$  ng/ml in group C. The TIBC decreased significantly from  $390.41 \pm 25.29$  to  $325.41 \pm 26.48$  mg/dl in group A,  $383.83 \pm 41.22$  to  $308.00 \pm 24.77$  mg/dl in Group B and  $408.66 \pm 36.15$  to  $342.75 \pm 26.97$  mg/dl in Group C. Between the three supplements there was no significant difference in haemoglobin and serum ferritin. A significant difference existed between grape juice and capsule ( $P < 0.05$ ). TIBC in Group B decreased to 308.00 mg/dl and in Group C, it was 342.75 mg/dl in group C. Between the three supplements there was no significant difference in haemoglobin and serum ferritin. A significant difference existed between grape juice and capsule ( $P < 0.05$ ). This difference was observed at initial level and the same continued after intervention. No significant difference was observed between the three supplement groups and all were found to be equally effective in improving the iron status among the anaemic individuals. Hence, the iron-fortified beverages may be recommended as a substitute for capsules.

**Key words:** Anaemia, supplementation, haemoglobin, ferritin, iron binding capacity

### INTRODUCTION

Most of the government programmes of health and nutrition are being made for children, adolescents (11 to 18 years), pregnant and nursing mothers, where as young adult girls (18-25 years) still remain a largely neglected and difficult to measure population. Hence, it is time to look for a long-term strategy to combat IDA. Looking through the various strategies available, the most suitable strategy may be to encourage the consumption of iron fortified foods. **Thus, the proposed study is focussed on the bio-accessibility of iron-fortified foods through intervention program in terms of supplementation.**

### MATERIAL AND METHODS

The girls who volunteered to participate willingly ( $n=36$ ) were selected for the intervention study. They were divided into 3 groups, namely first group were given fortified grape juice, second group fortified lime juice and third group ferrous sulphate capsules. The intervention was carried out for a period of 90 days and the juices were prepared freshly and administered to the subjects on daily basis. The fortified juices were administered immediately after snacks instead of tea in the evening. A common meal pattern was followed for all the subjects, as it was a hostel diet. These

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subjects were assessed for their haemoglobin status by Cyanomethemoglobin method, serum ferritin by direct immunoenzymatic determination and total iron binding capacity by Ferrozine method. All the parameters were assessed at three stages -Initial, 45<sup>th</sup> day and 90<sup>th</sup> day of the intervention period.

The fortified products namely grape juice and lime juice were fortified with 50 mg FeSO<sub>4</sub>/ serving (200 ml) which provided 15 mg of ferrous iron (equivalent to 50% of the RDA). Iron capsules were also formulated using 50 mg FeSO<sub>4</sub>. The selected subjects were de-wormed using the Albendazole tablet (400 mg dosage) before the beginning of the intervention program.

## RESULTS AND DISCUSSION

**Haemoglobin status** - Haemoglobin level is the most commonly used indicator to detect anaemia at the field level. Thus, a preliminary screening of the study population (n=200) for haemoglobin status was carried out and the same has been presented in Table-1.

**Table-1**  
**Distribution of subjects by haemoglobin status(n=200)**

| Haemoglobin Status | n   | Percent | Mean ± SD (G/dl) | Range (g/dl)  |
|--------------------|-----|---------|------------------|---------------|
| <7 (Severe)        | 6   | 02.89   | 06.34 ± 0.62     | 05.24 - 06.92 |
| 7-9.9 (Moderate)   | 110 | 53.14   | 08.87 ± 0.88     | 07.00 - 09.98 |
| 10-11.9 (Mild)     | 88  | 42.51   | 10.63 ± 0.43     | 10.00 - 11.70 |
| >12 (Normal)       | 10  | 01.44   | 12.08 ± 0.10     | 12.01 - 12.20 |
| Total              | 200 | 100     | 09.59 ± 1.28     | 05.24 - 12.20 |

<sup>1</sup>ICMR,2001

**Table-2**  
**Impact of intervention on haemoglobin status of the subjects (n=36)**

| Group               | Initial (g/dl) | Mid (g/dl)     | Final (g/dl)   | Between initial & mid | T value Between mid & final | Between initial & final |
|---------------------|----------------|----------------|----------------|-----------------------|-----------------------------|-------------------------|
| <b>Lime Juice</b>   |                |                |                |                       |                             |                         |
| Mean                | 8.24           | 10.00          | 10.35          | 0.001**               | 0.02**                      | 0.0002**                |
| SD                  | 1.06           | 01.15          | 01.07          |                       |                             |                         |
| Range               | 7.00-10.40     | 8.06-11.83     | 8.92-12.10     |                       |                             |                         |
| <b>Grape Juice</b>  |                |                |                |                       |                             |                         |
| Mean                | 8.43           | 9.76           | 10.33          | 0.004**               | 0.0002**                    | 0.0002**                |
| SD                  | 0.89           | 0.95           | 00.76          |                       |                             |                         |
| Range               | 7.22-10.07     | 8.22-11.29     | 8.79-11.48     |                       |                             |                         |
| <b>Iron Capsule</b> |                |                |                |                       |                             |                         |
| Mean                | 8.15           | 9.83           | 10.65          | 1.5E05**              | 0.0005**                    | 1.7E06**                |
| SD                  | 0.79           | 0.88           | 00.80          |                       |                             |                         |
| Range               | 7.0<br>0-9.20  | 8.4<br>4-11.14 | 8.<br>97-11.98 |                       |                             |                         |

\*\* Significant @ 1% level

**Table-3**  
**Impact of intervention on serum ferritin status of the subjects**  
**(n=36)**

| Group               | Initial (g/dl) | Mid (g/dl) | Final (g/dl) | Between initial & mid | t value Between mid & final | Between initial & final |
|---------------------|----------------|------------|--------------|-----------------------|-----------------------------|-------------------------|
| <b>Lime Juice</b>   |                |            |              |                       |                             |                         |
| Mean                | 3.90           | 20.14      | 23.25        | 0.009**               | 0.54 <sup>NS</sup>          | 0.004**                 |
| SD                  | 4.99           | 19.96      | 21.16        |                       |                             |                         |
| Range               | 1.1-18.0       | 1.25-52.0  | 3.5-66.0     |                       |                             |                         |
| <b>Grape Juice</b>  |                |            |              |                       |                             |                         |
| Mean                | 3.90           | 18.35      | 23.55        | 0.006**               | 0.21 <sup>NS</sup>          | 0.0007**                |
| SD                  | 3.59           | 17.93      | 17.26        |                       |                             |                         |
| Range               | 1.1-10.00      | 1.1-60.0   | 1.3-44.0     |                       |                             |                         |
| <b>Iron Capsule</b> |                |            |              |                       |                             |                         |
| Mean                | 07.15          | 23.68      | 38.58        | 0.003**               | 0.01**                      | 0.0009**                |
| SD                  | 11.04          | 17.82      | 27.42        |                       |                             |                         |
| Range               | 1.1-36.0       | 4.0-49.0   | 4.0-90.0     |                       |                             |                         |

\*\* Significant @ 1% level

NS Non significant

The classification of different grades of anaemia as given by ICMR 2001 was used. It may be observed that majority of the subjects (53.14%) were found to be moderately anaemic (7-9.9 g/dl) with a mean of  $8.87 \pm 0.88$  g/dl. A slightly lower percentage (42.51%) of the subject was mildly anaemic (10-11.9 g/dl) with a mean of  $10.63 \pm 0.43$  g/dl. A very small percentage of the subjects (9.14%) were in the normal haemoglobin level of  $>12$  g/dl with a mean of  $12.08 \pm 0.10$  g/dl. Some subjects (2.89%) were severely anaemic ( $<7$  g/dl) with a mean of  $6.34 \pm 0.62$  g/dl.

Thus, the prevalence of anaemia in the study population was very high (98.56%) with a mean haemoglobin level of  $9.59 \pm 1.28$  g/dl. **Gawarikar et al., (2002)** reported the prevalence rate of 96.5 per cent among adolescent girls of Ujjain city **Malhotra and Passi (2004)** stated an incidence of 97.2 per cent anaemia among adolescent girls in rural blocks of Delhi, Rajasthan and Uttar Pradesh. Thus, prevalence rate mentioned in the present study is found to be similar with above mentioned studies.

**Nutrition Intervention** A sub sample (n=36) was selected for nutrition intervention program with haemoglobin ranging from 7.00 to 10.40 g/dl. Three groups of 12 subjects in each consumed either grape juice (200 ml) or lime juice (200 ml) or iron capsule (1) per day. All the three supplements contained 50 mg of  $\text{FeSO}_4$  providing 15 mg of ferrous iron (equivalent to 50% of the RDA).

The initial, mid and final levels of haemoglobin (measure of iron present in the haem in the whole blood), serum ferritin (stored form of iron in the serum) and total iron binding capacity (TIBC) (measure of receptors available for iron binding in the serum) were estimated which are assumed to be good indicators of anemia.

The impact of intervention on haemoglobin status of the subjects is presented in Table-2. The mean values for initial, mid and final haemoglobin levels of subjects of the group supplemented with lime juice was found to be  $8.24 \pm 1.06$  (7.0-10.4 g/dl),  $10.00 \pm 1.15$  (8.06-11.83 g/dl) and  $10.35 \pm 1.07$  g/dl (8.9-12.1 g/dl) respectively. Similarly in the groups supplemented with grape juice and iron capsule, the haemoglobin levels were  $8.43 \pm 0.89$  (7.22-10.07 g/dl),  $9.76 \pm 0.95$  (8.22-11.29 g/dl),  $10.33 \pm 0.76$  (8.79 - 11.48 g/dl) and  $8.15 \pm 0.79$  (7.02-9.2 g/dl),  $9.83 \pm 0.88$  (8.44

- 11.14 g/dl)  $10.65 \pm 0.80$  g/dl (8.97 - 11.98 g/dl for initial, mid and final levels for grape juice and iron capsule group respectively.

**Table-4**  
**Impact of intervention on TIBC (total iron binding capacity) of subjects (n=36)**

| Group               | Initial (g/dl) | Mid (g/dl) | Final (g/dl) | Between initial & mid | t value Between mid & final | Between initial & final |
|---------------------|----------------|------------|--------------|-----------------------|-----------------------------|-------------------------|
| <b>Lime Juice</b>   |                |            |              |                       |                             |                         |
| Mean                | 390.41         | 350.33     | 325.41       | 2.43E-06**            | 1.99E-05**                  | 2.19E-07**              |
| SD                  | 25.29          | 21.83      | 26.48        |                       |                             |                         |
| Range               | 343-421        | 321-386    | 290-370      |                       |                             |                         |
| <b>Grape Juice</b>  |                |            |              |                       |                             |                         |
| Mean                | 383.83         | 333        | 308          | 7.23E-07**            | 0.000481**                  | 4.43E-07**              |
| SD                  | 41.22          | 30.52      | 24.77        |                       |                             |                         |
| Range               | 312-440        | 280-387    | 271-355      |                       |                             |                         |
| <b>Iron Capsule</b> |                |            |              |                       |                             |                         |
| Mean                | 408.66         | 373.33     | 342.75       | 7.23E-06**            | 1.61E-05**                  | 1.33E-07**              |
| SD                  | 36.15          | 28.75      | 26.97        |                       |                             |                         |
| Range               | 316-454        | 302-412    | 290-385      |                       |                             |                         |

\*\* Significant @ 1% level

**Jayatissa and Piyasena (1999)** showed that the daily administration of iron produced a greater increase in serum ferritin ( $59.1 \pm 34.9$  to  $92.3 \pm 39.9$   $\mu\text{g/L}$ ) than weekly administration ( $66.6 \pm 32.9$  to  $82.7 \pm 34.8$   $\mu\text{g/L}$ ). **Patterson et al., (2001)** showed that iron deficient women consuming either iron supplementation (9105 mg/d) or a high iron diet (2.25 mg/d absorbable iron) for 12 weeks increased serum ferritin levels from 9.0 to 24.8  $\mu\text{g/L}$  and from 8/9 to 11.0  $\mu\text{g/L}$  respectively after intervention. The present study though revealed an increase was however statistically non significant between the supplement groups.

Total Iron Binding Capacity (TIBC) estimated at initial, mid and finally after intervention has been presented in Table 4. The data indicated a significant decrease in TIBC for all the three supplemented groups at one percent level. The TIBC in lime juice supplemented group decreased from initial mean value of  $390.41 \pm 25.29$ , the range being 343-421  $\mu\text{g/dl}$  to mid  $350.33 \pm 21.83$ , the range being 321-386 mg/dl to final  $325.41 \pm 26.48$   $\mu\text{g/dl}$ , range being 290-370  $\mu\text{g/dl}$ . In grape juice supplemented group the TIBC decreased significantly showing  $383.83 \pm 41.22$  (312-440  $\mu\text{g/dl}$ ),  $333.0 \pm 30.52$  (280-387  $\mu\text{g/dl}$ ) and  $308.0 \pm 24.77$   $\mu\text{g/dl}$ , (271-355  $\mu\text{g/dl}$ ) for initial, mid and finally after intervention respectively. In the group supplemented with iron capsules the initial, mid and final TIBC were  $408.66 \pm 36.15$  (316-454  $\mu\text{g/dl}$ ),  $373.33 \pm 28.75$  (302-412  $\mu\text{g/dl}$ ) and  $342.75 \pm 26.97$   $\mu\text{g/dl}$  (290-385  $\mu\text{g/dl}$ ) respectively. The decrease in TIBC level in lime juice, grape juice and iron capsule supplement group were 65, 75.83 and 65.91  $\mu\text{g/dl}$  respectively indicating that the supplemented iron is utilized in the body in all the groups.

**Vijayalakshmi et al., (2004)** studied the impact of supplementation with traditionally prepared mungbean recipe (TPMP) and iron bioavailability improved mungbean recipe (IBIMR) for a period of one year in women aged 20-30 years. The TIBC levels decreased from  $554.5 \pm 21.3$  to

528.88±19.59 and 555±2.87 to 508.63±21.3 µg/dl respectively for TPMP and IBIMR group respectively.

### CONCLUSION

The results of the present study and that of others have demonstrated that prevalence of anaemia among the young adult girls was high as in other parts of the country. This emphasizes the need to include this group (Young adults) in the vulnerable group and the need for planning strategies to improve their iron status. The nutrition intervention revealed no significant difference among the three supplement groups and was equally effective in improving the iron status. Hence, iron fortified beverages may be recommended as a substitute for capsules. The need of the hour is providing nutrition education both to the parents and children so that they could take balanced meals, adopt desirable practices and improve their nutritional status.

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