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Supplementation Effect of Iron and Folic Acid Capsule With and Without *Thandai* on Anaemic Adolescent Girls

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ABSTRACT Nutritional problem of adolescent girls are common throughout the country. They encounter a series of serious nutritional challenges not only affecting their growth and development but also their livelihood as adults. Furthermore nutritional status of girls has important implication in terms of physical work capacity and adverse reproductive outcome. Therefore, the present investigation was undertaken to study the supplementation impact of iron and folic acid capsule with and without *thandai* on anemic adolescent girls. *Thandai* was prepared by grinding germinated groundnut seeds with jaggery and black pepper. Fifty-four anaemic girls (age, 15-18 yr) were selected and divided randomly into three groups; A , B and C. Each group contained 18 girls. *Thandai* along with Cofol-Z capsule (iron + folic) given to the subjects of group A whereas to the subjects of B group, only Cofol-Z capsule was given . The subjects of group C served as control. Supplementation was continued for six weeks. Questionnaire regarding general information was filled up. Hb content was measured at 0, 3rd and 6th week of supplementation. One way ANOVA was used for testing the variation among all groups by using computer software (SPSS-Version 8.0). All the subjects exhibited varied symptoms of anaemia. On supplementation, significant ($p<0.05$) improvement was found in mean Hb value of was three times higher in subjects of experimental group A (21.20%) than subjects of experimental group B (6.87 %). Thus iron and folic acid supplementation with *thandai* proved to be more efficacious in combating the problem of anaemia during adolescence.

INTRODUCTION

Adolescence is a transition stage in the life cycle linking childhood and adulthood. This phase is referred as period of stress and strain during which there are greatest physical, biological, emotional and social activities and adjustments. Nutritional problems of adolescent are common throughout the country. The nutritional requirements of adolescent are influenced primarily by the normal event of puberty and simultaneous spurt of growth. Puberty is an intensely anabolic period with increase in height and weight, alteration in the body composition resulting from increased lean body mass and change in the quantity and distribution of fat and enlargement of many organ systems. Adolescent are particularly susceptible to iron deficiency anaemia in view of the increased need for dietary iron for hemoglobin and myoglobin synthesis during this rapid period of growth when blood volume and muscle mass are increasing. Nutritional anaemia due to iron deficiency is the most prevalent nutritional problem in the world. More than 500 million people have iron deficiency anemia (ACC/SCN 1992; Craig 1994). Iron deficiency is not life-threatening but it can have detrimental effect on work capacity, learning ability and resistance to disease. Once anaemia results, there is also impairment in cognitive performance and behavior (Indjradinata and Pollitt 1993) and further cause pregnancy complications (Viteri 1994). A large number of adolescents in India particularly girls live under suboptimal conditions marked by poor nutritional status and high level of morbidity and mortality. The next generation of our country will be affected if adolescent girls who would be mothers have ill-health and nutritional status. Keeping in view the importance of adolescent period in human life and nutritional problems of adolescent girls, the present study was conducted to investigate the effect of supplementation of iron and folic acid capsule with and without *thandai* on anaemic adolescent girls.

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MATERIAL AND METHODS

***Supplements**: Thandai* was prepared by grinding the fresh 24 hour germinated groundnut seeds (20g raw seeds soaked in water overnight and kept for germination for 24 hours at 30^0 C in BOD incubator) along with jaggery (25g) and black pepper(1g) into fine paste. Water was added to make the total volume upto 200ml. The nutritive value of per serving (200ml) of *thandai* in terms of protein, fat, carbohydrates, fibre, iron and vitamin C was calculated. For this, content of protein, fat and fibre in germinated groundnut seeds was determined by standard mathod (AOAC 1995, 1985). Iron content was determined by Wong's spectrophotometer method (1928). For the estimation of carbohydrate protocol of Sadasivam and Manickan (1996) was followed. Dye binding technique used by Sawhney and Singh (2000) has been adopted for determination of vitamin C in germinated groundnut seeds. Thereafter, the presently determined nutritive value of germinated groundnut seeds was taken and sumed up with the nutritive value of jaggery and black pepper which was calculated with help of the book "Nutritive value of Indian Foods" by Gopalan et al. (2002).

***Selection of Subjects and Experimental Plan**:* Fifty-four adolescent girls aged 15-18 yrs studying in between 8^{th} to 11^{th} standards were selected from government schools of district Kurukshetra, Haryana Pradesh. They were divided randomly into three groups of 18 girls each and given diet and supplementation as per the following plan.

Group A: Daily diet plus *thandai* plus capsule Cofol-Z

Group B: Daily diet plus capsule Cofol-Z

Group C: Only daily diet (served as control)

Cofol-Z capsule contained elemental iron (50mg); Zinc Sulphate Monohydrate USP (61.8 mg) and Folic acid I.P. (0.5 mg). *Thandai* drink contained 1.37 mg iron and 7.21 mg vitamin C

General information and socio-economic status of each subject was collected through questionnaire cum interview method on pre tested and structured questionnaire. Supplementation was continued for six weeks and spot-feeding was done by the investigator herself . The impact of supplementation on the adolescent girls was assessed by measuring Hb level of each subject in mid-period(after three weeks) and at completion (after six weeks) of feeding trial.The Hb content of these subjects was estimated by Sahli's method (Sood 1981).

RESULTS AND DISCUSSION

Per serving (200ml) of *thandai* contained 5.19 g protein, 28.47g carbohydrate, 8.42g fat, 0.59 g fiber and 1.372 mg iron (Table 1). The amount of vitamin C was 7.21 mg/serving which is approximately 20 per cent of daily requirement according to recommended dietary allowances as given by ICMR (2002). Therefore, the nutritive value of *thandai* supposed to be as a healthy and nutritionally superior beverage.

Table 2 reveals that half of the studied subjects (50%) were between 16-17 years of age. Maximum subjects (33.33%) were studying in 11^{th} standard followed by 9^{th} (29.63%), 10^{th} (24.07%) standard and minimum (12.96%) were in 8th class. Information on age and education depicts that some of the studied subjects were not in appropriate class according to their age. The reasons included repeating of session, lack of interest in studies thus leaving the studies in between or admission to school at late ages. Size

Table 1: Nutritive value of "*thandai*", per serving (200ml)

Nutrients	*Content of nutrients in thandai*
Carbohydrate (g)	28.47
Protein (g)	5.19
Fat (g)	8.42
Iron (mg)	1.372
Fiber (g)	0.59
Vitamin C (mg)	7.21

Table 2: General information of the studied subjects

Characteristics detail	*Number of subjects(n=)*	*Percentage (%)*
Age of Respondents (years)		
15-16	11	20.37
16-17	27	50.00
17-18	16	29.63
Education		
8^{th}	7	12.96
9^{th}	16	29.63
10^{th}	13	24.07
11^{th}	18	33.33
Family Members		
5-Mar	3	5.55
7-May	25	46.29
9-Jul	17	31.48
>9	9	16.66
Family Income (Rs)		
<5000	21	38.89
>5000	33	61.11

of family members ranged from 5-7 (46.29%) to 3-5 (5.55%).More than half of the families (61.11 %) had their monthly earning above rupees 5000.

The symptoms of anemia were observed among all the subjects of the present study with wide range of variation varied (Table 3). Paleness of eyes was in maximum number of the subjects (62.96 per cent). However, the paleness of skin and flat nails were found in 66.66 and 33.33 per cent of subjects respectively. More than half of the subjects were harang complaint of headache (55.55%). In few subjects, pigmented skin (16.66%), fissured tongue (14.8 %) and spoon shaped nails (18.52%) also floated up. A majority of subjects complained for lethargy (72.22%) and breath-lessness on exertion (64.81 %). Problem of anorexia was faced by about 35.18 per cent of the subjects .

Table 3: Symptoms of anaemia observed in subjects

Clinical status and symptoms	*Number of subjects(n=)*	*Percentage (%)*
Eye		
pale	34	62.96
Slightly dry on exposure	19	35.18
Tongue Surface		
fissured	8	14.8
Skin		
pale	36	66.66
Pigmented	9	16.66
Nails		
flat	18	33.33
Spoon shaped	10	18.52
Anorexia	19	35.18
Headache	30	55.55
Breathless on exertion	35	64.81
Feeling of lethargy	39	72.22

Table 4 presents the Hemoglobin level of the subjects during the experimental period. Results showed that the mean hemoglobin level of subjects of experimental group A and B increased on giving iron supplementation alone in the form of capsule as well as alongwith nutritious *thandai* in compared to the subjects of control group C. At mid intervention, disparity in mean hemoglobin level was significant ($p \leq 0.05$) only between control and experimental group A. However, on continuation of supplementation for six weeks, the difference in mean Hb level was statistically significant for both experimental groups A and B. Further within the group analysis revealed that after 3 weeks of supplementation, the mean Hb level improved in both experimental groups but was statistically significant ($p \leq 0.05$) only in the subjects of experimental group A to whom *thandai* was given along with Cofol-Z capsule.Overall, the per cent increase in mean hemoglobin level was found three times higher in subjects of experimental group A compared to subjects of experimental group B. Improvement in Hb level with supplementation of iron either daily or weekly has been reported by a number of scientists (Vijyalakshmi and Jayanti 1986; Cook and Reddy 1995; Liu et al. 1995).But this positive effect on iron stores remained temporary if

Table 4: Hemoglobin content (gram %) of subjects before, during and after with and without supplementation

Hemoglobin content	*With dietetic intervention Experimental groups*		*Without dietetic intervention Control group (C)*	*Groups compared F-value*	*Diff. b/w control and each experimental group*	
	Thandai alongwith Cofol-Z capsule (A)	*Only Cofol-Z capsule (B)*			*A vs C*	*B vs C*
Before (at 0 day)	8.44 ± 1.12	8.88 ± 0.61	8.80 ± 0.58	NS	NS	NS
During (after 3 weeks)	9.35 ± 0.86	9.22 ± 0.65	8.83 ± 0.60	NS	0.5222*	NS
After (after 6 weeks)	10.29 ± 1.07	9.49 ± 0.68	8.83 ± 0.61	14.201**	1.450**	0.650*
Groups compared F-value	13.812**	3.912*	NS			
Diff. b/w the same group w.r.t. time						
0-3rd wk.	0.8611*	NS	NS			
3rd -6th wk.	0.9333*	NS	NS			
0-6th wk.	1.7944**	0.6056*	NS			
Per cent increase in Hb level within the same group w.r.t. time						
0-3rd wk.	10.13	3.83	0.34			
3rd -6th wk.	10.05	2.93	0.0			
0-6th wk.	21.20	6.87	0.34			

NS-Non Significant Value
**-Significant Value at 1% (P d" 0.01) Level of significance
*-Significant Value at 5% (P d" 0.05) Level of significance as tested by ANOVA
0-3rd wk./ 3rd -6th wk./ 0- 6th wk.-Difference within the group with respect to time, on the basis of post HOC test

diets did not contain adequate bioavailable iron (Sean 2000).The household process such as germination improved the amount of soluble iron and increased food iron bioavailability from low to the intermediate level (Cook1983). The present findings are in agreement with earlier reports (Anuradha and Sangeetha 2001; Tatala et al. 2007) who showed the impact of germinated food in improving the Hb status of anaemic children.

CONCLUSION

Our study showed that dietic intervention with any type of present supplements like *thandai* or cofol-2 capsule helped in significant improvement of hemoglobin level but maximum improvement in Hb level was observed in the subjects of group A ($p \leq 0.01$) to whom *thandai* was given alongwith Cofol-Z Capsule compared to the subjects of group B ($p \leq 0.05$) to whom only capsule of cofol-Z was given. The step-up in mean hemoglobin level was found three times higher in subjects of experimental group A (21.20 %) in comparison to subjects of experimental group B (6.87 %).

RECOMMENDATION

Unique nutritional profile of *thandai* made with germinated groundnuts, being rich in protein, folic acid, iron and vitamin C collectively make it as a good supplement for the anaemic patients. Thus, It is recommended that supplementation of iron along with *thandai* would be more helpful in managing anaemia among adolescent girls.

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