AJHS.
Asian Journal of Home Science
Volume **8** | Issue 2 | December, 2013 | 514-517

Research Paper

Efficacy of iron rich biscuit on the haemoglobin status of school going girls

■ SWATI YADAV **AND** VIMLA DUNKWAL

Received: 28.05.2013; **Revised:** 03.09.2013; **Accepted:** 01.10.2013

See end of the paper for authors' affiliations

Correspondence to **:**
SWATI YADAV
Department of Foods and Nutrition, College of Home Science, S.K. Rajasthan Agricultural University, BIKANER (RAJASTHAN) INDIA

■ **ABSTRACT :** The present study was carried out to develop an iron rich premix and its impact on haemoglobin (Hb) level of school going girls (n=50) of government Maharani Sr. Sec. School, Bikaner (Raj). Mean Hb of subjects were appeared to be 7.78 g/dl. Clinical investigation observed that 100 per cent subjects were suffering from anemia out of which 35 per cent of subjects were showing the signs of iron deficiency anemia like pale conjunctiva (46%) and pale nails (24%). The processed pearl millet flour, soybean flour, roasted Bengal gram flour, rice flakes powder, niger seed and lotus stem powder were incorporated to develop an iron rich premix. Later the biscuits were developed using these premix. An intervention was done for the subject in two groups *i.e.* experimental and control. Experimental group received iron rich biscuit with anola candy for 45 days and control group did not receive such supplementation. Intervention programme brought out the significant ($P<0.05$) mean increment in haemoglobin levels as 1.63g/dl in experimental group and non-significant increment noted for control group. Hence, the intervention was significantly effective for correcting iron deficiency anemia.

■ **KEY WORDS :** Anemia, Premix, Iron, Haemoglobin

■ **HOW TO CITE THIS PAPER :** Yadav, Swati and Dunkwal, Vimla (2013). Efficacy of iron rich biscuit on the haemoglobin status of school going girls. *Asian J. Home Sci.*, **8** (2): 514-517.

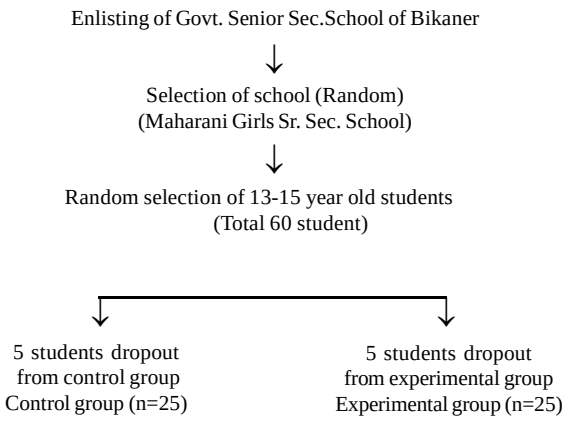
Iron is an important constituent of hemoglobin and its deficiency is the main etiological factor responsible for nutritional anemia in the community. Inadequate intake of other haemopoetic factors like vitamin C, folate, vitamin B_2, vitamin B_6 and protein have also been reported to be a cause in about 20 per cent of the anemic cases (WHO, 1975). Iron deficiency anemia, the most common type of anemia (also called IDA) is the state of being a person having insufficient amount of iron to fulfill the body demand. Iron deficiency anemia is generally caused by very poor intake of iron in normal diet. School going children who are our future citizen form an important segment of the Indian population. They contribute to the vital human potential and impart strength to our national economy and development. The better nutritional status of children will help to build the healthy society and nation. Therefore, their nutritional status is of great significance. At school age certain specific biological, psychological and nutritional needs must be met to ensure the healthy survival and welfare of this age group as they are the future of our country and working hands of tomorrow. During the first stages of puberty when growth spurt occurs in both sex but girls are at higher risk than boys for IDA because of smaller iron stores due to loss of iron in the blood in their monthly menstrual flow. On the other side, muscle mass and blood volume also increase at this age which increase the need of iron for haemoglobin formation. If the diet of adolescents does not contain sufficient amount of absorable iron or they do not consume adequate quality of food, they become anemic. A recent survey by the State Department of Medical Health and Family (Rajasthan) revealed that 1.84 lakhs students are anemic and about 70,000 are under weight (TOI, 2008).The best strategy to correct the nutritional deficiencies is the food-based approach where nutrient-rich food supplements are formulated with nutrient-rich familiar foods. Premix is finite mixture of nutritional supplements such as minerals and vitamins, usually combined

with a carrier and ready to mix in a fixed ratio. These premixes vary in method of preparation and processing. In this way, these foods have become popular with time because of less cost, time and energy saving, convenience in preparation (Rao, 2002). In the beam of above scientific proceedings, research has been propelled towards correcting iron deficiency anemia via combination of cereals (pearl millet and pulses- soybean and Bengal gram) with other iron rich foods like rice flakes, niger seeds, lotus stem had been planned to supplement the diet of iron deficient subjects, along with anola candy, which essentially enhance the absorption of non-haeme iron and later impact analysis was exercised with the objective to evaluate the effect of iron rich biscuit intervention on the school going girls.

■ RESEARCH METHODS

Study was conducted on school going girls residing in Rajasthan. One of school among the all government senior secondary school was selected randomly by using lottery system. Thus, Maharani Girls Sr. Sec. School, Bikaner was selected for the present study. List of students belonging to age group 13-15 years was prepared and out of them 50 students were selected randomly to be considered as control (n=30) and experimental (n=30) subjects. Out of this ten students were not regular and not cooperative were excluded from the group. A total number of 50 students were included as subjects of the study. The following process was adopted during the study:

Selection of the subjects :



Identification of anemic subjects for intervention:

Haemoglobin level of all the subjects (50) was estimated (at the starting of study) by using Sahli's method, before supplementation and after every 15th day during the intervention period of 45 days. On the basis of haemoglobin levels, the subjects were classified as normal, mild, moderate or severe anemic (WHO, 1993). According to the haemoglobin levels, 50 anemic subjects, fell in the range of Hb level 7.0 to 8g/dl were identified for the intervention.

Procurement of material:

For the present investigation, raw material like pearl millet, rice flakes, roasted Bengal gram, lotus stem, soybean, niger seed were purchased from the local market of Bikaner in bulk to avoid the varietal differences. The ingredients incorporated in the premix and anola candy were on the basis of their local availability, cost effective, high energy and their iron and vitamin C contents (Gopalan *et al.*, 1989).

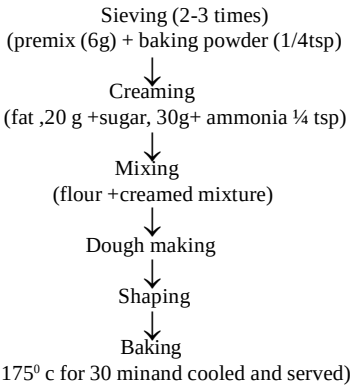
Processing of raw material:

The processing techniques like cleaning, washing, soaking, blanching (Srilakhsmi, 2008) under controlled condition and drying were carried out for the development of premix on the raw material *i.e.* pearl millet, rice flakes, roasted Bengal gram, lotus stem, soybean, and niger seed.

Development and standardization of premix and its product:

In view of the facts regarding nutritional quality of cereal, pulse combination, various trials in different ratios of various ingredients were made to develop an acceptable iron rich premix suitable for school going girls (13-15 years). Hence, along with processed pearl millet, roasted Bengal gram, soybean, rice flakes, niger seed, lotus stem and sugar were also added in order to supplement almost 1/3 of the dietary requirement of the school going girl. Apart of this, anola candy was also intervened to improve iron absorption. The premix was prepared in different ratios using flour of pearl millet: roasted Bengal gram: rice flakes: soybean: niger seed: lotus stem in the following. ratio *i.e.* 6:3:1:1:1:1 (P1), 5:2:2:2:1:1 (P2) and 5:2:2:1:1:1 (P3) was prepared. Among these ratios 5:2:2:1:1:1 was selected best by panel member. The premix so developed was used for product development like biscuits.

Development of iron rich biscuit:



Flow diagram of biscuit

Organoleptic evaluation of the product (biscuit) :

Standardization of the developed product was carried out through organoleptic evaluation. Developed products evaluated for their sensory characteristics like colour, flavour, texture, appearance, taste and overall acceptability by selected 10 panel members (Swaminathan, 1987).

Nutritional analysis of premix :

The premix and biscuit were then analyzed for their proximate composition by use in methods described in (AOAC, 1995). *i.e.* moisture, crude protein, crude fat, crude fibre, ash, micronutrients like- iron and antinutrient like phytic acid and oxalic acid.

Statistical analysis:

The statistical analyses were carried out as arithmetic mean, standard deviation, critical difference, standard error of mean and t-test.

■ RESEARCH FINDINGS AND DISCUSSION

Data of clinical assessment given in Table 1 showed that out of 50 subjects, 15 (30%) subjects did not show any sign of iron deficiency of anemia. The remaining 35 (70%) subjects displayed clinical sign like pale conjunctiva 23 (46%) and pale nails 12 (24%). Other symptoms regarding anemia like breathlessness, easy tiredness and headache were noted from almost all the subjects. It is evident from the results that mean haemoglobin level of the subjects was 7.78 g/dl, which was lower than the normal (> 12g/dl) levels. The overall prevalence of anemia among adolescent subjects was about 100 per cent, having the haemoglobin level below the cut-off level recommended by the WHO (1993). It was observed that out of 50 subjects examined for iron deficiency anemia, all the students were suffering from moderate anemia, not only single subjects reported to have normal haemoglobin levels.

Table 1 : Clinical signs of iron deficiency anemia among subjects (n=50)

Sr.No.	Clinical signs	% Respondents
A.	No clinical signs	30.00 (15)
B.	Clinical signs present	70.00 (35)
B-1	Pale conjunctiva	46.00 (23)
B-2	Pale nails	24.00 (12)
B-3	Flattening of nails	NIL
B-4	Koilonychias	NIL
B-5	Atrophic lingual papillae	NIL

Note- Values in parenthesis indicate number of subjects

Biscuit was prepared and subjected to organoleptic assessment on nine point hedonic rating scale in order to reach at most acceptable variation of the product to be served to the subjects under intervention. The mean acceptability scores obtained by the biscuit were noted to be ranging between "liked very much'' to "liked extremely". The results clearly revealed that mean scores for biscuit's colour was 9.00 while appearance and flavour secured similar score *i.e.* 8.70, similarly texture, taste and overall acceptability scored 8.50, 8.80 and 8.75, respectively (Table 2). The mean acceptability scores obtained by the aonla candy was noted to be ranging between "liked very much" to "liked extremely". The result clearly revealed that mean scores for aonla candy taste was 8.70 while colour, appearance, aroma and overall acceptability secured similar score *i.e.* 9.00. The present investigation revealed that the mean haemoglobin levels after 45 days of intervention in group A hiked to 9.42 g/dl of mean haemoglobin, whilst the mean Hb status of group B rendered

Table 2 : Organoleptic acceptability of Biscuit and anola candy

Sr.No.	Premix ratio	Mean score of sensory characteristics on nine point hedonic scale					
		Colour	Appearance	Texture	Aroma	Taste	Overall acceptability
1.	5:2:2:1:1:1 (P1)	9.00 ± 0.00	8.70 ± 0.46	8.50 ±0.50	8.70 ± 0.46	8.80 ± 0.40	8.75 ± 0.24
2.	5:2:2:1:1:1 (P2)	5.30 ± 0.46	5.60 ±0.49	5.30 ± 0.46	5.60 ± 0.49	5.50 ± 0.50	5.50 ± 0.50
3.	6:3:1:1:1:1 (P3)	4.50 ± 0.50	4.50 ± 0.50	4.40 ± 0.49	4.70 ± 0.49	4.40 ± 0.66	4.52 ± 0.20

Values are mean ± S.D. of 10 panelists

Table 3: Mean gain levels among subjects during intervention

Groups	Mean Hb (g/dl) levels of the subjects					
	15 days		30 days		45 days	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Group (A) experimental	0.54 ± 0.17		1.09 ± 0.17		1.63 ± 0.22	
Group (B) control	0.04 ± 0.07		0.12 ± 0.09		0.18 ± 0.14	
S.E.±	0.12		0.13		0.18	
C.D. p=0.05	0.34		0.28		0.38	

C.D.= Critical difference; S.D.= Standard deviation

as 7.94 g/dl. In terms of statistical analysis group A showed highly significant increase ($p<0.05$) in haemoglobin levels while the B-group possessed almost initial level of haemoglobin with non-significant variations. The followed study showed that nutritional profile of the school going girls was not appreciable and 100 per cent of all were anemic. Food based approach of significantly improved the blood haemoglobin levels of the studied groups within 45 days of intervention Table 3. Therefore, food-based approach needs to be applied for eradicating nutritional deficiencies as it has a better rapport with the general masses.

Authors' affiliations:
VIMLA DUNKWAL, Department of Foods and Nutrition, College of Home Science, S.K.Rajasthan Agricultural University, BIKANER (RAJASTHAN) INDIA

■ REFERENCES

AOAC (1995). Association of official analytical chemists. Official Method of Analysis (16 th Ed.). Arlington, V.A.

Gopalan, C., Rama Shastri, B.V. and Balasubramanian, S.C. (1989). Nutritive value of Indian foods. National Institute of Nutrition, ICMR, Hyderabad (A.P.) INDIA.

Rao, K. (2002). Approaches to intervention among children and adolescent. *Nutr. Rev.*, **60** (5): 118-125.

Srilakhsmi, B. (2008). *Food science.* New Age International Publishers, NEW DELHI, INDIA.

Swaminathan, M.S. (1987). *Food science chemistry and experimental food*. The Bangalore Printing and Publishing Co.Ltd., Mysore Road, Bengaluru (KARNATAKA) INDIA.

WHO (1975). Control of nutritional anemia with special reference to iron deficiency. Technical Report Series. No.580. GENEVA, SWITZERLAND.

W.H.O. (1993). Prevention and management of anemia in pregnancy. WHO/FHE/MSM/93.5, GENEVA, SWITZERLAND.