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Efficacy of iron rich biscuits on the hemoglobin status of the patients in Allahabad

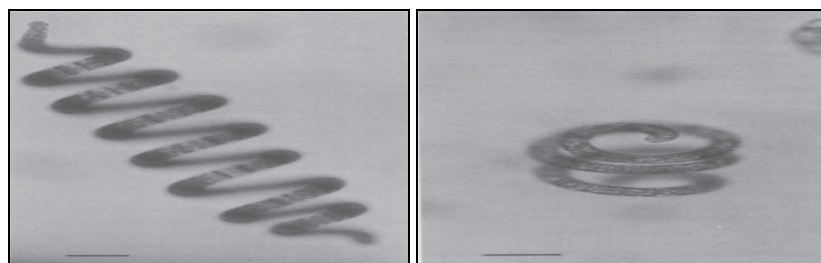## Ammatul Fatima and Dr. Sangita Srivastava

Abstract
The present study was carried out to develop an iron rich biscuits and its impact on hemoglobin level of the patients in Allahabad. Mean Hb of subjects were appeared to be 7.7 gm/dl. Clinical investigation observed that 100% subjects were suffering from anemia, out of which 45% of subjects were showing the signs of iron deficiency anemia like pale conjunctiva (48%) and pale nails (34%). The biscuits were assessed in a food laboratory. After analysis, it was found that biscuits fortified with spirulina were significantly high in various nutrients. The spirulina fortified biscuits contained 2.55 percent moisture, 6.25 percent proteins, 20.43 percent fat, 1.18 percent crude fibre, 4.07 percent ash, 288.98 percent calcium, 115.92 percent phosphorus and 3.94 percent iron whereas control samples contained 2.77 percent moisture, 4.49 percent proteins, 17.59 percent fat, 0.68 percent crude fibre, 3.08 percent ash, 214.15 percent calcium, 54.34 percent phosphorus, 1.87 percent iron respectively. An intervention was done for the subjects in two group i.e. experimental and control. Experimental group received iron rich biscuits for 45 days and control group did not receive such supplementation. Intervention program brought out the significant ($P<0.05$) increment in hemoglobin level as 1.66 gm/dl in experimental group and not significant increment noted for control group. Hence the intervention was significantly effective for correcting iron deficiency anemia.

Keywords: Iron, anemia, hemoglobin

Introduction
Iron plays an important in physical and cognitive development of growing children and adolescents [1]. Anemia is the most common nutritional deficiency disorder in the world. About one third of the global populations (over 2 billion) are anemic. Prevalence of anemia in all the age group is higher in Indian as compared to other developing countries [2]. Studies indicate that iron supplementation has positive effect on hemoglobin level and growth [3]. Since iron supplementation programmes have had little reported success in reducing anemia, interest is turning to food based approaches that have higher potential for achieving far reaching and long lasting benefits for the control of iron deficiency. Food based approaches aim at improving nutrition by increasing the availability and consumption of a nutritionally adequate and micro-nutrient rich diet made up from a variety of available food. Food based approaches are recognized as an essential part of an urgently needed more comprehensive strategy to combat iron and other micronutrient deficiencies [4]. Spirulina has a special form of protein that may be helpful for anemia and many other deficiency diseases [4].

Fig 1: Light micrograph of *Arthrospira maxima.* B. Light micrograph of *Arthrospira platensis.* Bar represents 20μm.

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Objectives
➢ The fortified food product has a higher nutritional value compared to control sample.
➢ The fortified food product has the significant increment in hemoglobin level in experimental group.

Materials and Methods
The present study was interventional in nature and was conducted in the urban area in Allahabad with the help of an especially designed questionnaire cum interview schedule information was gathered on socio-demographic profile.

Identification of the anemic subjects for intervention
Hemoglobin level of all the subjects (100) was estimated (at the starting of the study) by using Sahli's method, before supplementation and after 15th day during the intervention period of 45 days. On the basis of hemoglobin levels, the subjects were classified as normal, mild, moderate or severe anemic [7]. According to the hemoglobin levels, 100 anemic subjects, fell in the range of hemoglobin level 7.0 to 8 gm/dl were identified for the intervention.

Development of spirulina fortified cookies sample
Take 500 gm wheat flour + add 50 gm Spirulina powder and mix it well, add 200 gm grinded sugar + 50 gm butter into it. Prepare the soft dough and add 1 tsp of baking powder. Add 10 gm elaichi and cinnamon powder into it and kneaded again. Cut the dough into round shape. Bake the cookies at 180[0] F until turns it turns golden brown

Fig 2: Showing the picture of control and fortified sample

Organoleptic evaluation of the product
Standardization of the developed product was carried out through organoleptic evaluation, developed product evaluated for the sensory characteristics like color, flavor, texture, appearance, taste, & overall acceptability by selected 10 panel members [6].

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

Result and Discussion

Table 1: clinical sign of iron deficiency anemia among subjects (n=100)

Sr. no	Clinical signs	% respondent
A	No clinical signs	30.00 (30)
B	Clinical signs present	70.00 (70)
B_1	Pale conjunctiva	48.00 (48)
B_2	Pale nails	34.00 (34)
B_3	Flattering of nails	Nil
B_4	Koilonychias	Nil
B_5	Atrophic lingual papillae	Nil

Note: value in parenthesis indicate number of subjects

Data of clinical assessment given in table 1 showed that out of 100 subjects 30 (30%) subjects did not show any sign of iron deficiency of anemia. The remaining 70 (70%) subjects displayed. Clinical sign like pale conjunctiva 48 (48%) and pail nails 34 (34%). 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 hemoglobin level of the subjects was 7.78 gm/dl, which was lower than the normal (› 12 gm/dl) levels. The overall prevalence of anemia among the patients was about 100 percent, having the hemoglobin level below the cut off level recommended by the WHO [7]. It was observed that out of 100 subjects examined for iron deficiency anemia. All the subjects were suffering from moderate anemia, not only single subject reported to have normal hemoglobin level.

Nutrient analysis of biscuits
The biscuits were then analyzed for their proximate composition by use in methods described in [3] i.e. Moisture, Proteins, Fat, Fiber, Ash, Calcium, Phosphorus, Iron, Alcoholic acidity, Ph, Peroxide value.

Table 2: Results of Both the Samples

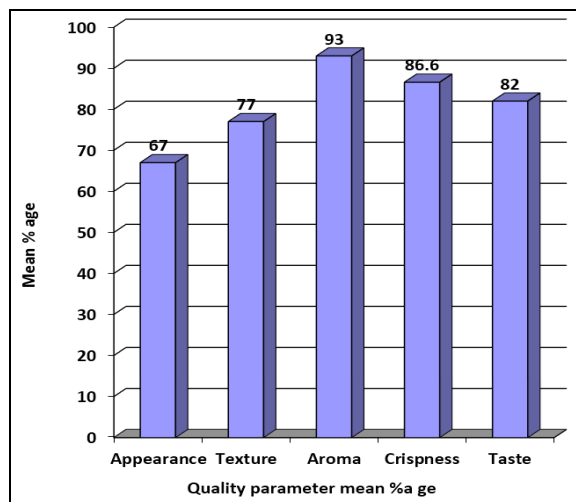| S.No	Test Parameter	Results(control sample)	Results (spirulina fortified cookies)	Unit
1.	Moisture	2.77	2.55	%
2.	Proteins	4.49	20.43	%
3.	Fat	17.59	16.25	%
4.	Fibre	0.68	1.18	%
5.	Ash	3.08	4.07	%
6.	Calcium	214.15	288.98	Mg/100 gm
7.	Phosphorus	54.34	115.92	Mg/100 gm
8.	Iron	1.87	3.94	Mg/100 gm
9.	Alcoholic acidity	0.24	0.30	%
10.	Ph	7.035	6.035	-
11	Peroxide value	0.987	0.755	Meq/Kg

Fig 3: Graph showing sensory evaluation of spirulina fortified cookies through composite scoring

Table 3: Acceptability of cookies.

Study spirulina fortified cookies	Patient	
	N	%
Liked	128	64%
Unlike	48	24%
neither	24	12%

All the results revealed that the samples were subjected to organoleptic evaluation by the experts and the results were noted, spirulina fortified biscuits were falling into the liked, disliked, or neither like nor dislike.

Shelf life study
The product was prepared, cooled and stored in glass jars at normal room temperature of 22 to 25 ^{0}C for three months. Then again it was subjected to organoleptic evaluation by a panel of 10 judges. The results showed no significant change in the appearance, aroma & taste of the cookies.

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Table 4: Mean gain levels among subjects during intervention

Group	Mean haemoglobin gm/dl levels of the subjects					
	15 Days		30 Days		45 Days	
	Mean	S.D	Mean	S.D	Mean	S.D
Experimental group	0.54	0.17	1.09	0.17	1.63	0.22
Control group	0.04	O.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	

CD = Critical Difference S.D = Standard Deviation

The present investigation revealed that the mean hemoglobin levels after 45 days of intervention in experimental group hiked to 9.42 gm/dl of mean hemoglobin status, while the mean hemoglobin status of control group rendered as 7.94 gm/dl. In terms of statistical analysis experimental group showed highly significant increase with level of ($p<0.05$) in hemoglobin levels while the control group possessed almost initial level of hemoglobin with non significant variation.

Conclusion
The present work reveals that fortified biscuits prepared from spirulina at 5% were well accepted on organoleptic parameters and the most acceptable product was found in satisfactory range during storage period. Intervention program brought out the significant ($p<0.05$) increment in hemoglobin level as 1.66 gm/dl in experimental group and not significant increment noted for control group, hence the intervention was significantly effective for correcting iron deficiency anemia. Food based approach of significantly improved the blood hemoglobin levels of the studied group within 45 days of intervention therefore, food based approach needs to be applied for eradicating nutritional deficiencies as it has a better rapport with the general masses.

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