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Effect of Spirulina Supplementation on Hemoglobin Level of Anaemic Young Women

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Abstract

The present study was undertaken to study the effect of spirulina supplementation on blood haemoglobin level of the selected young women. Sixty anaemic young women were selected for the study and they were divided into two groups, as experimental group (30) and control group (30). Nutritional status of the selected young women was assessed by recording anthropometric measurement and biochemical examination before and after supplementation. Spirulina capsules were prepared for the intervention Programme by filling 500 mg. of spirulina powder in each capsule. Total four capsules of spirulina of two g/d were provided as a supplementation to the selected anaemic young women, for a period of 90 days. Results showed that, body weight of the selected young women of experimental group was increased from 49.86 to 50.63 kg and Body Mass Index from 22.3 to 22.4 after supplementation of spirulina, however it was not statistically significant. It was found that blood haemoglobin level of the selected young women of experimental group was increased from 9.5±1.28 to 11.01±0.92g/dl after the spirulina supplementation, which was significant statistically. It indicates that consumption of spirulina is helpful in overcoming the prevalence of anaemia in the community especially vulnerable sections of population.

Keywords: Spirulina; Supplementation; Hemoglobin; Young Women.

Introduction

Anaemia is a major global problem affecting 20-70 per cent of the population in various countries. In India, it is an important public health problem affecting people from all walks of life particularly in preschool, school children and pregnant women because of high prevalence (50-70%) and the adverse functional consequences.

Spirulina is a simple one celled form of blue green algae that is widely produced and commercialized as dietary supplement for modulating immune functions, as well as ameliorating a variety of diseases. Spirulina is a rich source of micronutrients and antioxidants. It is one of the few non animal sources of vitamin B12 which makes it an excellent addition to the vegetarian diet. Spirulina has a higher percentage of protein (60%) than any other food. (Venkataraman, 1993).The total iron content of spirulina is 89 mg/100g. Apart from containing high bio-chelated iron, spirulina also contains appreciable amount of calcium, magnesium, copper, chromium and selenium and vitamins namely vitamin B12, folic acid and vitamin B6 which are essential for haemopoiesis. Chlorophyll provides the green pigment and is known as the 'blood of plants' because as it's similarity in structure to haemoglobin in human blood. Japanese research has shown positive results using spirulina to treat anaemia, partially attributed to the hypothesis that chlorophyll will convert to haemoglobin if ingested with sufficient iron(Carmel, 2008).

Anaemia has multiple adverse effects on human function. Severe anaemia during pregnancy is thought to increase the risk of maternal mortality. Pregnancy anaemia has been reported to be associated with preterm delivery and a subsequently LBW in many studies. Beside this, anaemia has long been known to impair work performance, endurance and productivity. As it has become increasingly apparent that it is difficult, if not impossible, to correct anaemia fully by iron treatment during pregnancy alone, more

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attention is being paid to the need to provide young women with either daily, or weekly, low dose iron supplements. This strategy may prevent them being anaemic and iron deficiency when they become pregnant. So the present investigation was undertaken to know the impact of supplementation of spirulina on haematological status of young women.

Methods

Preparation of Spirulina Capsules

Empty capsules capacity of 500 mg was purchase from market. Exact amount of 500 mg of spirulina powder was filled in the empty capsule in hygienic condition. Filled capsules were kept in Zip lock plastic bags till end of the experiment. Four spirulina capsules each containing 500 mg of spirulina powder was supplemented (2 g per day) to the selected young women of experimental group for a period of 90 days. They were advised to take these capsules four times a day, each at breakfast, lunch, snacks, and dinner.

Selection of Subjects and Collection of Data

A total of 100 young women of 20 to 25 years of age form different girls hostel of Vasantrao Naik Marathawada Krishi Vidyapith, Parbhani of Maharashtra state were randomly selected and screened for blood haemoglobin level. From these, 60 anaemic young women were selected. They were equally divided into two groups as experimental (30) and control (30). All the selected young women were personally interviewed by the investigator with the help of a pretested questionnaire to collect the information on socio-economic background, family size, education and occupation of parents.

Anthropometric Measurements

Nutritional status of all the selected young women was assessed by determining body weight (kg) and height (cm) and by calculating the values of body mass index. The measurements of body weight and height for each respondent were recorded by following the standard techniques given by Jelliffe (1966).

Estimation of Haemoglobin Level

Haemoglobin content in the blood of selected young women before and after supplementation was estimated by cyanomethaemoglobin method of (Crosby *et al*., 1954) using a filter paper technique. The data obtained from the experiment such as hemoglobin level was subjected to statistical analysis (Panse and Sukhatme, 1985).

Results and Discussion

The present investigation was undertaken to study the effect of spirulina supplementation on the blood haemoglobin level of the selected young women.

Out of 60 selected young women, 56.66 per cent were belonging to 18 to 20 years of age group and the remaining 40 per cent were from 21 to 24 years of age group, only 3.33 per cent were belonging to > 24 years of age. A relatively very high per cent (86.66) of young women were belonging to nuclear families and only 13.33 per cent young women were belonging to joint families. Fifty five per cent of young women had monthly family income of Rs. ≤ 10,000 and 28.33 per cent found to have monthly family income of Rs. ≥ 10,000 to 20,000 and the remaining 16.66 per cent were belonging to monthly family income of Rs. > 20,000.

It was found that 15, 35 and 50 per cent fathers of the selected subjects were middle school educated, high school and graduate respectively. Majority (43.33 %) of subject's mother had education up to high school and the remaining 40 per cent were completed the middle school education. Fathers of the selected young women had occupation as farming (28.3%), service (55%), farming and business (3.3%) and business (10%). A relatively very high (95) per cent mothers were homemaker while only five per cent were doing service (Table 1).

Anthropometric measurements of young women of experimental and control group before and after supplementation of spirulina are given in Table 2. The mean value of the body weight (kg) of young women belonging to experimental group before supplementation was 49.86 ± 4.42 kg and it was ranged from 40.5 to 58.5 kg whereas after supplementation of spirulina capsule for 90 days it was 50.63 ± 4.03 kg. It was found that body weight of the selected young women of experimental group was increased by ¾ kg and 200 g increase in control group but the increment in the weight was not significant. The mean value of Body Mass Index (BMI) of experimental group before supplementation was 22.30 ± 2.22 and it was ranged from 18 to 26 whereas after supplementation for 90 days it was 22.48 ± 2.16. The results indicated that Body Mass Index (BMI) value of the selected subjects of experimental group

was slightly increased but it was not significant statistically. A slight increase (0.06) in BMI of the young women of control group was also noticed. In conclusion, it can be said that though the slight increase was noticed in the body weight and BMI value of the selected young women, it was not significant statistically.

The categorization of the selected young women of experimental and control group into different grades of under nutrition on the basis of BMI is presented in Table 3. Initially maximum (83.33) per cent of young women belonging to experimental group found to be normal followed by (16.66) mild under nourished and moderate under nourished (13.33) whereas, after supplementation of spirulina for 90 days, there was increase in per cent of normal (86.66) and decrease in mild under nutrition. On the other hand,76.66 per cent young women of control group were normal, 23.33 per cent were mild undernourished and only one young woman found to be moderate under nourished. None of the young women of experimental group was under the category of moderate and severe under nutrition.

Mean value of haemoglobin content in the blood of the selected young women is given in the Table 4. Wide variation was noticed in haemoglobin content of the blood of the selected young women belonging to experimental group. It ranged from 7 to 11 g/dl with an average value of 9.5±1.28 g/dl before the supplementation of spirulina which was found to be increased significantly after 90 days of spirulina supplementation (11.01±0.92 g/dl). On the other hand, mean value of haemoglobin content in the blood of control group of young women was 9.74 ±1.39 g/dl initially, but at the end of the experiment it was decreased (9.72±1.31 g/dl). From the above findings it can be inferred that supplementation of spirulina for 90 days to the selected young women of experimental group resulted in significant improvement in the haemoglobin level. The results of the present study are in line with the findings of Mani *et al.,* (2000), Thirumani and Uma (2005), Judhiastuty *et al.,* (2002). They reported that supplementation of spirulina to the anaemic adolescent girls resulted in significant improvement of haemoglobin level. Even the study conducted by Mahalakshmi (2000) and Mane (2011) on supplementation of spirulina to the elderly indicated that significant elevation in blood haemoglobin level of elderly.

Prevalence of anaemia among the selected young

Table 1: Socio-economic status of the selected young women

S. No.	Particulars	Selected young women	
		Number	Per cent
1	**Age (years)**		
	18 to 20	34	56.66
	21 to 24	24	40
	> 24	2	3.33
2	**Type of family**		
	Nuclear	52	86.66
	Joint	8	13.33
3	**Monthly family income**		
	≤10000	33	55
	>10000 to 20000	17	28.33
	≥20000	10	16.66
4	**Educational level of Father**		
	Illiterate	-	-
	Middle school	9	15
	High school	21	35
	Graduate	30	5
5	**Educational level of Mother**		
	Illiterate	6	10
	Middle school	24	40
	High school	26	43.33
	Graduate	4	6.66
6	**Occupation of Father**		
	Farming	17	28.33
	Service	33	55
	Farming and business	2	3.33
	Business	6	10
	Labor	2	3.33
7	**Occupation of mother**		
	Farming	-	-
	Service	3	5
	Business	-	-
	Homemaker	57	95

Table 2: Anthropometric measurements of young women of experimental and control group before and after supplementation of spirulina

Anthropometric measurements	The mean value of different anthropometric measurements of the selected young women					
	Experimental group			Control group		
	Initial	Final (90 days)	't'value	Initial	Final (90 days)	't'value
Height (cm)	153.03 ±7.04 (141 - 165)	153.03 ± 7.04 (141 - 165)	-	150.83 ± 4.2 (141 - 165)	150.83 ± 4.2 (141 - 165)	-
Weight (kg)	49.86 ± 4.42 (40.5 – 58.5)	50.63 ± 4.03 (40 – 58.5)	0.70NS	45.4± 4.49 (38 - 51)	45.6 ±4.61 (39 - 53)	0.7N
BMI	22.3 ±2.22 (18-26)	22.48 ±2.16 (18- 26)	0.32 NS	20.39 ±1.49 (17- 22)	20.45 ±1.54 (17- 22)	0.15NS

NS – Non Significant
Figures in parenthesis indicate range

Table 3: Categorization of the selected young women of experimental and control group into different grades of under nutrition on the basis of BMI

S. No.	BMI Category	Control		Experimental	
		Initial	Final (90 days)	Initial	Final (90 days)
1	Normal	22(73.33)	23(76.66)	25(83.33)	26(86.66)
2	Mild under nutrition	7 (23.33)	6 (20)	5(16.66)	4(13.33)
3	Moderate under nutrition	1(3.33)	1(3.33)	-	-
4	Severe under nutrition	-	-	-	-

Figures in parenthesis indicate percentage

Table 4: Mean haemoglobin content in the blood of the selected young womenbefore and after supplementation of spirulina

Particulars	Haemoglobin content of blood (g/dl) of the selected young women					't' value
		Initial		Final (90 days)		
	Number	Range	Mean± SD	Range	Mean ± SD	E Vs C
Experimental group	30	7 - 11	9.5±1.12	9 - 12	11.01±0.92	4.39**
Control group	30	7 - 12	9.7±1.39	7 - 12	9.72±1.31	0.05 NS

** Significant at 1% level, NS- non significant

Table 5: Prevalence of anaemia among the selected young women before and after supplementation

S. No.	Degree of anaemia	Experimental (N=30)		Control (N=30)	
		Initial	Final 90 days	Initial	Final 90 days
1	Normal	-	3(10)	1(3.33)	2(6.66)
2	Mild	13(43.33)	21(70)	12(40)	11(36.66)
3	Moderate	17(56.66)	6(20)	17(56.66)	17(56.66)
4	Severe	-	-	-	-

Figures in parenthesis indicate percentage

women before and after supplementation is presented in Table 5.

Among the selected anaemic young women belonging to experimental group, maximum number (17) had moderate degree of anaemia while minimum number (13) were having mild degree of anaemia. None of them was found to be under the category of normal before supplementation.

On the other hand, the selected young women belonging to control group, 12 found to be having mild degree of anaemia, 17 had moderate degree of anaemia and one was normal before supplementation. After supplementation of spiruina for 90 days, 3 young women found to be normal, 21 were having mild degree of anaemia and 6 were having moderate degree anaemia while, in control group 2 young women found to be normal, 11and 17 were noticed to be under the category of mild and moderate degree of anaemia.

Spirulina has a blend of nutrient that no single plant source. It provides highest amount of protein (65-71%), high level of carotene and iron. These nutrients play a major role in formation of haemoglobin.

Beside this, iron in a spirulina is 60% better absorbed than ferrous sulphate and other

complements consequently.

On the whole, results indicated that supplementation of spirulina was beneficial in overcoming moderate degree to mild and mild to normal degree of anaemia among young women belonging to experimental group. In nutshell, it can be said that spirulina was helpful in reducing the prevalence of anaemia.

Similar observations were made by Uliayar*et al.,* (2000) and Jidhiastity*et al.,* (2002) that spirulina was effective in combat iron deficiency anaemia.

Conclusion

Results of the present study showed that body weight and Body Mass Index of the selected young women of experimental group was increased after supplementation of spirulina but it was not statistically significant.

After the supplementation of spirulina powder, more number of anaemic young women who were previously belonging to the mild under nutrition category, shifted to normal category thus there was per cent increase in the normal category of young women at the end of the experiment. Results inferred that the haemoglobin content of blood of the selected young women belonging to experimental group were significantly increased after supplementation of spirulina for 90 days.

Even prevalence of anaemia was decreased. In conclusion, supplementation of spirulina powder found to be helpful in reducing the prevalence of anaemia among the young women. Hence consumption of spirulina can be encouraged to overcome prevalence of anaemia among vulnerable sections of population.

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