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Health Status of Adolescent Girls

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ABSTRACT

Food is very essential part of life. It provides essential nutrients to the body for growth and to regulate the normal functioning. Less consumption of food may lead to deficiency diseases of various nutrients. Adolescence, a transitional period, from child to an adult, undergoes various physical, biochemical as well as emotional changes. Therefore, it has been considered a low risk group for poor health resulted in deprived of health care resources and scant attention, hence resulted in various nutritional deficiencies. The present study deals with 200 adolescent girls in the age group of 13-15 years from two Govt. Schools of Yamunanagar belonging to low income group. The subjects were equally divided into Experimental (E) and Control groups (C). The respondents of group E were supplemented with 2 capsules (1g) of spirulina after mixing with one serving (40g) of wheat besan ladoo daily for six days a week for a period of two months while the group C was given a placebo for the same period. The dietary survey was conducted for three consecutive days by 24 hour recall method before and after supplementation. The results of the study showed that the mean daily intake of cereals, pulses, green leafy vegetables, sugar and jaggery was inadequate in both the groups. The intake of roots and tubers, visible fat exceeded the recommended allowances. Paleness of skin and conjunctiva, dental caries, fatigue were most prevalent among the clinical signs. The prevalence of common ailments was more marked in group C when compared with group E after introducing spirulina in the ladoos. Thus, better nutritional status and health could be attributed to spirulina supplementation. The adolescent girls were encouraged to eat a balanced diet.

Key Words : Spirulina, Diet, Adolescents, Health, Supplementation, Morbidity

INTRODUCTION

Adolescence, a transitional period, from child to an adult, undergoes various physical, biochemical as well as emotional changes. Fat phobia is one of the major causes for nutritional deficiency observed in adolescents resulting in skipping of one or more meals. Many of the adolescents are more inclined towards junk foods ignoring its ill effects, most common in high income group making them deprive of nutritious food stuffs.

Malnutrition is a serious problem in India as millions of children die with it every year (Yojana, 1999). The Govt. of India has identified chronic protein energy malnutrition (National Nutrition Policy, 2005) in children as a major nutritional problem of public health importance and micronutrient deficiencies of iron, iodine and vitamin A (Govt. of India, Financial Express, 1999). The discovery of spirulina marked an important breakthrough in tackling the problem of malnutrition. It is a blue green micro algae, which is considered as food for the future because of its amazing ability to synthesise high quality concentrated food than any other algae (Muratee, 1993). Spirulna has a unique blend of nutrients that no single plant source can provide. It provides 65-70 per cent proteins, 8-14 per cent of carbohydrates, vitamins such as β-carotene, thiamine, riboflavin, niacin, vitamin B_6, folic acid, biotin, vitamin C, vitamin E, iron, calcium, phosphorus. The objective of the present study is to find out the impact of spirulina supplementation on dietary, clinical and morbidity status of adolescent girls.

METHODOLOGY

Selection of subjects :

A sample of 200 adolescent girls of age between 13-15 years belonging to urban areas of Yamunanagar

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were selected by random sampling technique and equally divided into two groups Experimental (E) and control group (C).

Dietary Survey :

A complete record of the food intake of each subject was kept by 24 hour recall method for three consecutive days using both before and after the supplementation. Nutritive value of the diets was calculated with the help of the Nutritive value book. The Nutriguide software programme (Song *et al.,* 1992) was also consulted. The amount of nutrients supplied by Spirulina were added to the total nutrient intake of the subjects of Group E.

Clinical examination :

The respondents were clinically examined for the nutrient deficiency symptoms with the help of a doctor. Nutrient deficiency symptoms of the respondents were assessed as per the method described by Jelliffe (Jeliffe, 1966) both at T_1 and T_2.

Morbidity status :

Morbidity status was assessed through medical history and clinical examination. The respondents were asked if they were suffering from common illnesses like viral fever, malaria, diarrhoea, common cold and cough etc. during past six months both at T_1 and T_2.

Supplementation :

Spirulina powder in the form of 'Dabur Sunova' capsules were bought from the market for supplementation. Two capsules (1g) were opened and thoroughly mixed with 35 g. of wheat besan ladoo and supplied daily to the subjects if Group E for six days a week for a period of two months.

Statistical analysis :

The results obtained were statistically analysed using student t-test, coefficient of correlation and chi-square (χ^2) test to see the effect of spirulina supplementation on dietary and health status of the adolescent girls.

RESULTS AND DISCUSSION

The demographic information of the adolescent girls in the present study revealed that the majority of the subjects (78.5%) in both the groups belonged to nuclear families and had 3-5 family members. It was observed that more than half the subjects in both the groups had both parents educated. 68% of the subjects were vegetarian in both the groups.

Table 1 : Type of family of the adolescent girls

Group	Nuclear family	Joint family
Experimental	86	14
Control	71	29
Total	157	43

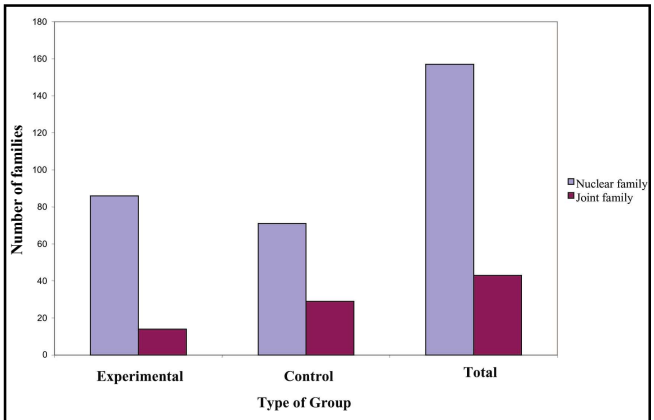


Fig. 1 : Type of family of the adolescent girls

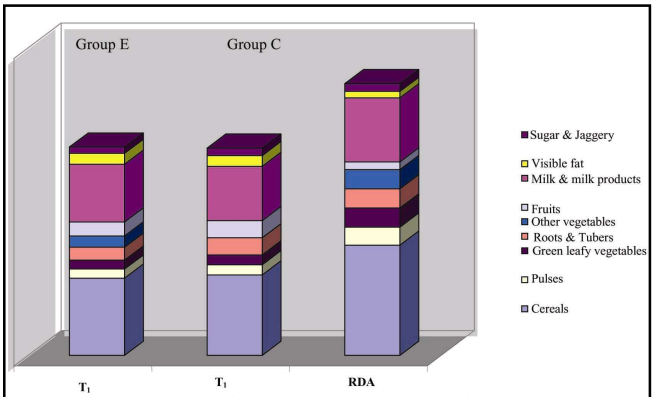
Dietary intake by the adolescent girls :

The data in Table 2 showed that mean intake of cereals by the respondents of E and C group before supplementation (T_1) was 301±30.4 and 314±29.6 gm. and after supplementation (T_2) was 310±21.3 and 323±16.8 g, respectively. There was an increase in cereal consumption due to supplementation because of increased intake of wheat in the form of ladoo, used for supplementing spirulina. The average daily intake of pulses by respondents of E and C group at T_1 was 36±21.3 and 40±26.4 g and T_2 was 41±18.7 and 39±23.2 g, respectively. The average intake of pulses increased due to the presence of gram flour in the ladoo. The intake of pulses was much below the RDA (Indian Council of Medical Research, 2004). The diet was deficient in the intake of green leafy vegetables in both the groups. The consumption of T_1 being 35±28.1 and 38±19.2 in group E and C, respectively. A significant (p=0.01) increase in the consumption of green leafy vegetables was found in both the groups as they were easily available at low price during the months of March-April. The subjects did not meet the suggested intake of 100 g. as per ICMR recommendations as most adolescent girls disliked green vegetables. A higher intake of roots and tubers, other vegetables, fruits and visible fat was observed in both

Table 2 : Average daily food intake of the Adolescent girls

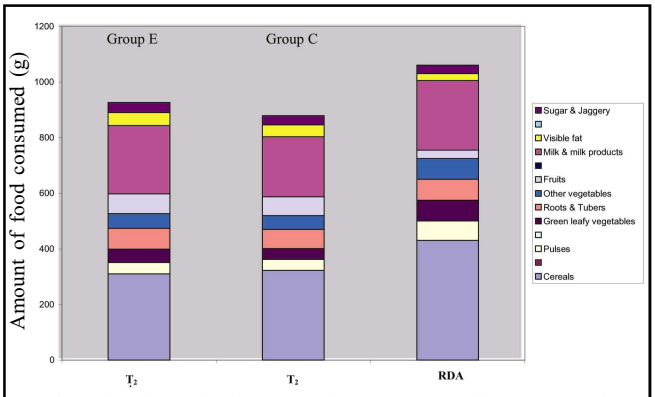
Foods (g)	Experimental group		Control group		RDA	t-value
	T_1	T_2	T_1	T_2		
Cereals	301±30.4	310±21.3	314±29.6	323±16.8	430	1.71
Pulses	36±21.3	41±18.7	40±26.4	39±23.2	70	1.12
Green leafy vegetables	35±28.1	48±13.8	38±19.2	39±20.1	75	2.97*
Roots and Tubers	50±15.2	75±21.2	67±23.4	69±27.4	75	0.21
Other vegetables	44±26.4	53±19.2	46±22.5	49±24.9	75	1.28
Fruits	55±22.6	71±21.6	67±21.9	68±26.5	30	1.31
Milk and milk products	225±41.1	245±39.2	212±42.8	216±32.6	250	0.03
Visible fat	42±4.6	46.8±3.5	42±7.5	43±7.3	25	2.76**
Sugar and Jaggery	25±7.9	36±6.2	29±8.2	33±6.4	30	4.32**

**- significant ($p \leq 0.01$)



Intake of various food groups in Group E and Group C before supplementation with Spirulina

Fig. 2 : Average daily intake of foods of Adolescent girls



Intake of various food groups in Group E and Group C after supplementation with Spirulina

Fig. 3 : Average daily intake of foods of Adolescent girls

the groups. The consumption of milk and milk products was marginally adequate in both the groups at T_1, the values being 225±41.1 and 212±42.8 g in group E and C, respectively. The average intake of sugar and jaggery among respondents of E and C group at T_1 was 25±7.9 and 29±8.2 g and at T_2 was 36±6.2 and 33±6.4 g, respectively.

Clinical signs of nutrient deficiencies:

The adolescent girls were observed for various clinical symptoms of diseases due to nutritional deficiencies as shown in Table 3 and Fig. 4 and 5. Paleness of skin was more pronounced in most of the respondents in both the groups. Pale conjunctiva was also observed in 46 per cent of the subjects in group E at

Table 3 : Clinical symptoms of nutritional deficiencies in Adolescent girls

Clinical signs	Experimental group				Control group			
	T_1		T_2		T_1		T_2	
	Number of subjects	%	Number of subjects	%	Number of subjects	%	Number of subjects	%
Eyes: Pale conjunctiva	46	46	21	21	30	30	28	28
Skin: Pale	15	15	6	6	18	18	16	16
Lips: Angular stomatitis	10	10	-	-	6	6	6	6
Gums: bleeding	5	5	-	-	3	3	3	3
Teeth: Mottled Enamel	28	28	7	7	12	12	12	12
:Dental caries	58	58	10	10	45	45	43	43
Fatigue	40	40	3	3	15	15	15	15
Anorexia	17	17	4	4	8	8	8	8

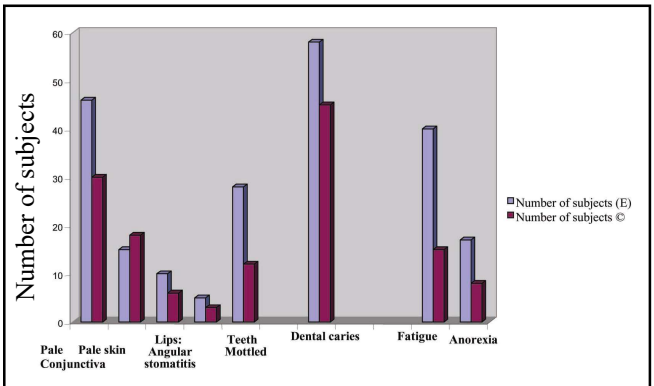


Fig. 4 : Clinical Symptoms of nutritional deficiency diseases in Adolescent girls before supplementation with Spirulina (T_1)

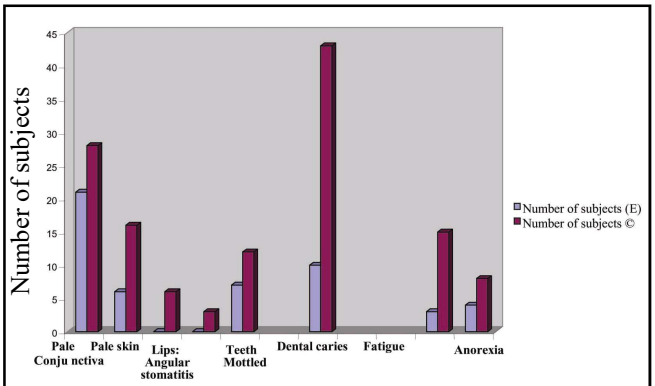


Fig. 5 : Clinical symptoms of nutritional deficiency in Adolescent girls after supplementation with Spirulina (T_2)

T_1 which decreased to 21 per cent at T_2. Angular stomatitis, which is a sign of B-complex deficiency, was observed in only 10 per cent and 6 per cent respondents in E and C groups, respectively. The condition remained the same for group C during the entire study period but none of the respondents in group E showed these signs at T_2. Dental caries were observed in 58 and 45 per cent of subjects in E and C groups, respectively. Irregular brushing of teeth, poor oral hygiene and excessive eating of sweets were the possible reasons for high incidence of dental caries in both E and C groups. But the carious lesions decreased to 10 per cent in group E at T_2 though the rate of formation of caries remained the same in the case of group C at T_2. The data collected showed that the clinical signs of nutritional deficiency diseases were more marked in group C as compared to Group E at T_2 showing positive and supplementing effect of spirulina. It has also been reported by Sheshadri and Jayam (Sheshadri and Jayam, 1993) that as a result of supplementing the diet with 1 gm./day of spirulina of preschool children, there was a decrease in the B-complex deficiency symptoms.

Morbidity status of the respondents :

Morbidity status of respondents is presented in Table 4 and Fig. 6 and 7. Measles had the maximum prevalence among subjects belonging to group E while Viral fever had highest prevalence in group C at T_1. Common cold was observed in 31% and 15% in subjects belonging to group E and group C, respectively. Diarrhoea was found in 19% and 28% in subjects belonging to group E and C, respectively. Typhoid was also present in a number of respondents. Prevalence of common diseases like common cold and cough, diarrhoea, measles, chicken pox, typhoid showed a marked decrease in respondents of group e at T_2 which was due to spirulina supplementation as it is a good source of phycocyanine which enhances body's immunity to fight against diseases. According to Venkataraman (Venkataraman, 1993), spirulina consumption results in improvement of general health and

Table 4 : Morbidity status of the Adolescent girls before and after supplementation with Spirulina

Diseases	Experimental group				Control group			
	T_1		T_2		T_1		T_2	
	Number of subjects	%	Number of subjects	%	Number of subjects	%	Number of subjects	%
Viral fever	20	20	19	19	31	31	30	30
Malaria	26	26	25	25	16	16	15	15
Diarrhoea	19	19	9	9	28	28	27	27
Common cold and cough	31	31	11	11	15	15	15	15
Measles	42	42	8	8	13	13	12	12
Chicken Pox	11	11	1	1	9	9	9	9
Typhoid	15	15	2	2	10	10	9	9

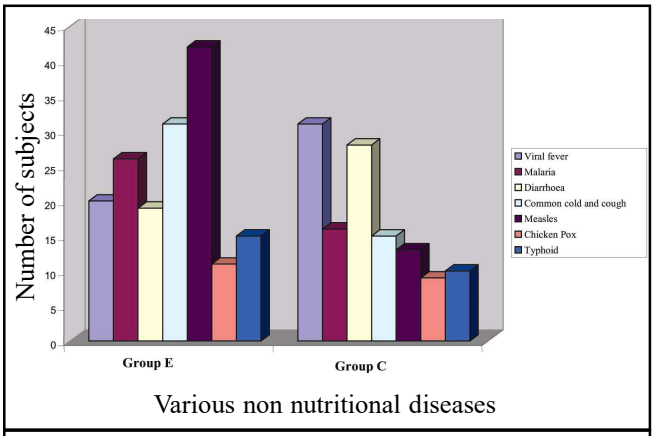


Fig. 6 : Morbidity status of the respondents before supplementation with Spirulina

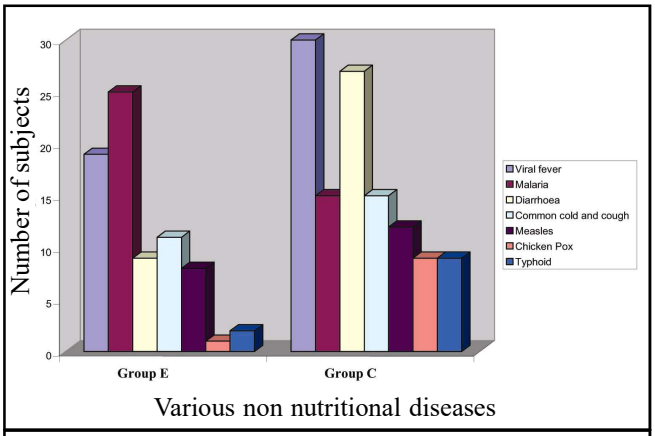


Fig. 7 : Morbidity of respondents after supplementation with Spirulina

protection against common ailments.

Conclusion :

It has further been perceived that intake of different food stuffs increased with the increase in income; even then intake was less than the RDA in all the subjects belonging to all income ranges. The variations in the consumption pattern were more in the subjects of low income range as compared to high income range. The result obtained from this study showed that the diets consumed by the subjects in both the experimental and control groups were deficient in cereals, pulses, green leafy vegetables but was high in fats and sugar and jaggery as compared to ICMR recommendations. The adolescent girls were not eating properly and there was also skipping of meals. An improvement in the health and nutritional status of the subjects in group E as compared to group C at the end of the study clearly shows the beneficial effect of including spirulina supplementation. Spirulina is a good source of β-carotene, vitamin E and pigments like phycocyanine, other carotenoids which enhance the immunity of the body against diseases. Hence, Spirulina can be taken as a health food safely for supplementing the diet of adolescent girls. It is important that together with supplementation with spirulina, nutrition education should be imparted to the mothers as well as the adolescent girls to emphasize on the consumption of cheap, nutritious foods like sprouted and fermented foods in their daily diet.

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