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Spirulina and Lipid Profile of the Obese Femal Adults

U Kavitha Devi PhD Scholar Mother Teresa Women's University Kodaikanal.

Dr. V Vasantha Kumari Former Research Officer, TANSCHE, Chennai.Tamil Nadu,

ABSTRACT

Aging, disease, decay or death is the natural phenomena in any biological system and are the basis of "Biological Turnover". Death being the final event of aging and disease is inevitable, inexorable and irreversible, but the rate of death can be delayed. Therefore, health of all is an enduring vision that recognizes the oneness of humanity. There is a need to promote health universally. According to World Health Organization, today's emphasis is on health expectancy rather than life expectancy. Cholesterol refers to lipids and fat like substances, which provide fuel for the body and is essential for cell structure. It is responsible to supply blood and oxygen to the myocardium. But, if mismanaged, cholesterol disorder acts as a timed bomb in the body. Awareness of the need to lower cholesterol levels in order to lower the risks of heart diseases is been well established. Besides dietary improvements, the research is underway to identify natural foods having a cholesterol reducing effect. Spirulina with its high concentration of functional is emerging as an important therapeutic food. Therefore it is suggested that spirulina would be an excellent agent to be considered to overcome the obesity.

KEYWORDS : TC-Total Cholesterol, TGL-Triglycerides, HDL- High Density LipoProtein LDL-Low Density LipoProtein

INTRODUCTION

Aging, disease, decay or death is the natural phenomena in any biological system and are the basis of "Biological Turnover". Death being the final event of aging and disease, is inevitable, inexorable and irreversible, but the rate of death can be delayed. Therefore, health of all is an enduring vision that recognizes the oneness of humanity. There is a need to promote health universally. According to World Health Organization, today's emphasis is on health expectancy rather than life expectancy.

Cardio vascular diseases (CVD) one of the major chronic diseases, which is the leading cause of death. In India, the death rate from CVD has increased at an alarming rate and is estimated currently as 52 per cent (Gupta, 2001). Indians all over the world have highest rates of mortality and morbidity from heart disease as compared to blacks, Hispanics and other Asians. Prevalence of CVD in urban India is about double that of rural India (5%)and about four fold higher than in US (2.5%). At present, at least 30 million people are suffering from heart disease in India, which is expected to become 100 million by year 2010(Gambhir, 2000).

One of the major risk factors for cardiovascular diseases is Hyperlipidemia – "The Walking Time Bomb". Cholesterol disorders or scientifically termed as dyslipidemia refers to the clinical conditions produced by lipid aberrations, thus rising the cholesterol and triglyceride levels in a variety of lipoprotein levels. The lipid fractions that are to be monitored in case of hyperlipidemia are total cholesterol (TC), triglycerides (TG), low density lipoprotein cholesterol(LDL-C), very low density lipoprotein cholesterol (VLDL-C) and high density lipoprotein cholesterol (HDL-C).Hyperlipidemia leads to the development of atherosclerosis (thickening, hardening and blocking of large and medium arteries resulting from lipid accumulation in the artery wall)and later to the progression of coronary cardiovascular morbidity and mortality.

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Awareness of the need to lower cholesterol levels in order to lower the risks of heart diseases is been well established. Besides dietary improvements, the research is underway to identify natural foods having a cholesterol reducing effect.

Vijayalakshmi and Rema (1994) determined the biochemical profile of 50 normal adult men and women volunteers (20-39 years) in Coimbatore city. Results revealed that, the mean levels of haemoglobin (men :14.8 g%, women :12.2g%), blood glucose (men : 98.5mg/dl, women : 95.0 mg/dl), serum cholesterol (men : 176.7 mg/dl, women 170.6 mg/dl),serum iron (men : 117 mcg/dl, women 107.8 mcg/dl), serum protein (men : 6.95 g/dl, women6.78 g/dl) serum retinol (men : 40-50 mcg/dl, women : 38.28 mcg/dl), serum calcium (men :10.36 mg/dl, women : 10.69 mg/dl) were comparable with the western standards.

A community based epidemiological survey of a total of 906 adults from 489 families in urban population and 275 from 196 families in the rural area (25-64 years of age) was carried out in Delhi urban population and rural areas in Gurgaon for prevalence of coronary heart disease (CHD). Results revealed that overall urban incidence rate of CHD was19.7/1000 compared to 8.3/1000 in rural area. The higher daily average intake of butter/oils, vanaspati, sodium and alcohol and high Polyunsaturated to Saturated fat ratio and lower intake of fibre and antioxidants were contributory factors for high incidence of CHD in urban population (Chadha*et al.*, 1996).

Misra*et al.* (2001) conducted a cross sectional epidemiological descriptive study to assess the nutrient profile, anthropometry and blood lipids of 227 (52 males and 175 females)urban slum dwellers in northern India. Results revealed that there was lower intake of fibre, vitamin E and MUFA, a low ratio of n-6/n-3 fatty acids, a high ratio of PUFA and SFA. There was high prevalence of hypercholesterolemia, hypertriglyceridemia and low levels of HDL-C.Mehta (2004) in Mumbai determined the dietary profile, anthropometric parameters and lipid profile of 200 individuals (of both gender) with age between 15 and 65 years. Results indicated that there was increase in the values of waist to hip ratio and mid arm circumference with the elderly subjects. This was due to decrease in their activity and higher intake of dietary fat. The mean total cholesterol levels were higher in females (206.4 mg/dl) compared tamales (203.4 mg/dl). Dietary saturated fat elicited a significant positive correlation with total and LDL cholesterol and triglyceride levels among the subjects.

Hyperlipidaemia refers to either increased serum total cholesterol level or serum triglyceride level or both. Hyperlipidaemia or hypercholesterolemia leads to the development of atherosclerosis and later leads to the progression of CHD, which will cause cardiovascular morbidity and mortality. The incidence of CHD thus can be minimised by maintaining the blood lipid levels, which can be accomplished by practicing proper dietary habits and life style. Itoh*et al.* (1999) determined the relationship between serum total cholesterol and nutritional status in 796 Japanese young females. Results revealed higher than

normal levels of total cholesterol (>200 mg/dl) and lipoprotein-a (>30 mg/dl) in 22.1 per cent and 19.3per cent of the subjects respectively.

Basu and Datta (2001) assessed the lipid profile and atherogenic factors in 75 adult males (31 to 60 years) in Calcutta and reported that out of 75 subjects, 41 had elevated total cholesterol and triglyceride levels. Also, the elevated blood lipid profile vs. body weight values, age-group wise indicated that number of subjects with normal body weight and elevated blood lipid gradually decreased as the age decreased. 55 per cent of the adult subjects in the study were at risk of CVD with hyperlipidaemia. Mishra *et al.* (2002) studied the association of anthropometric profile with hyperlipidaemia in 50 non-obese

Asian Indian males (BMI <25 kg/m2) and compared with that of normal Lipid emic males (n=50; BMI < 25 kg/m2). Results revealed that BMI, waist circumference, WHR, skinfolds and percentage of body fat were significantly higher in hyperlipidemic subjects as compared to normolipidemic controls. Hence Asian Indian males, defined as "non-obese" based on BMI, had adverse profile of anthropometric parameters compared to normolipidemic males. Sachan and Mogra (2004) assessed the prevalence of various nutritional and nonnutritional predisposing risk factors of CVD among 150 young males aged 18-25 years frompost-graduate colleges of Udaipur city. The nutritional risk factors i.e., increased body weight, high BMI, high WHR, unhealthy dietary habits increased the risk of CVD and the nonutritional risk factors like high blood pressure, faster pulse rate, positive family history of CVD, lack of exercise and stress were present in high risk group subjects.

Barnard (1991) studied the effect of life style modification on serum lipids in 4587adults, aged 20-92 years, who attended a three week residential, lifestyle modification Programme consisting of a high complex carbohydrate, high fibre, low fat and low cholesterol diet combined with daily aerobic exercise, primarily walking. Results showed that total cholesterol value was reduced by 23 per cent (234 to 189 mg/100 mg), LDL-C by 23 per cent(151 to 116 mg/100 ml) and triglycerides by 33 per cent (200 to 135 mg/100 ml) and ratio ofTC/ HDL-C reduced by 11 per cent.

Spiralling (Arthrospira), a filamentous unicellular alga is a cyanobacteria grown in certain countries as food for human and animal consumption. This alga is a rich source of proteins, vitamins, amino acids, minerals and other nutrients. Its main use, therefore, is a food supplement. Over the last few years, however, it has been found to have many additional pharmacological properties. Thus, it has been experimentally proven, in vivo and in vitro that it is effective to treat certain allergies, anaemia, cancer, hepatotoxicity, viral and cardiovascular disease, hyperglycaemia, hyperlipidaemia and immunodeficiency. Several of these activities are attributed to spiralling itself or to some of its components including fatty acid; omega-3 andomega-6, alpha-to copherol, beta-carotene, phycocyanin, phenol compounds and a recently isolated complex, Ca- spirulina (Ca-SP) (Chamorro *et al.*, 2002).

MATERIAL AND METHODS

An experimental study entitled "Spirulina on Lipid Profile of obese female adults. "was carried out in Sivaganga city. The details of the materials used and methods adopted for the study are described here under;

The investigator had selected 60 adult obese women by purposive sampling techniques. The subjects were in the age group of 35-60 years. The adult obese women were divided in to two groups like experimental group and control group. Each group contained 30 respondents. The experimental group was given 600 mg of spirulina capsule per day. The subjects in the experimental group were instructed to consume 4 capsules/day throughout the intervention period. General information, Dietary habits, Anthropometric measurements and lipid profile of the subjects was collected by self structured questionnaire through personal interview method. The responses of subjects were expressed in frequency and percentages. The paired't' test was used to test the significance of mean difference between the initial and final values of biochemical parameters. The student 't' test was used to test the significance of mean difference between two groups with respect to nutrient adequacy and biochemical parameters.

RESULTS AND DISCUSSION

The present study titled a".**Spirulina on Lipid Profile of obese female adults.".** The study has attempted to find out the effect of spirulina supplement on weight management among obese women. The demographic profile, anthropometry, dietary history, nutrient adequacy, dietary modifications and bio-chemical assessment are discussed in this chapter.

TABLE - 1
Identification of obesity using Body Mass Index (N=60)

BMI*	Parameters	30 to 45 Years (n=37)		46 to 60 Years (n=23)	
		Frequency	Percent	Frequency	Percent
<18.5	Underweight	-		-	
18.5 to 22.9	Normal	-		-	-
23.0 to 24.9	At risk of Obesity	7	18.92	4	17.39
25 to 29.9	Obese Grade I	21	56.76	12	52.17
>30.00	Obese Grade II	9	24.32	7	30.44

*International Obesity Task Force (2002) Proposed Classification of Body Mass Index**.**

The data collected from 60 adult obese women is presented in Table-1. The selected women were grouped as 30 to 45 years of age group consisting of 37 respondents and 23 respondents from 46 to 60 years of age group. 18.92% of the women from the age group of 30 to 45 years and 17.39% of the women from the age group of 46 to 60 years were classified as at risk of obesity groups, 56.76% of the women from the age group of 30 to 45 years and 52.17% from 46 to 60 years were classified as obese Grade-I. 24.32% of the women from the age group of 30 to 45 years and 30.44% of the women from the age group of 46 to 60 years were classified as obese Grade-II.

Majority of the subjects 61.67 percent were in the age group of 30 to 45 years whereas 38.33 percent of the obese subjects belonged to 46 to 60 years of age group. Data indicated that majority of the subjects (91.8 and 78.2) from both age groups (30 to 45 years and 46 to 60 years) belonged to nuclear family whereas 8.1 percent and 21.7 percent of them were lived in joint family. Majority of the respondents i.e. 86.5 per cent and 73.9 per cent were consumed non-vegetarian food items. Myths of Religious factors, income level, physical inactivity and type of diet of the respondents are closely associated with high BMI and WHR of the selected obese subjects.

TABLE – 2
Mean nutrient intake of selected obese adult women (N=60)

Nutrients	RDA$	30 to 45 Years	46 to 60 years	't' Value
Energy (Kcals/d)	2230	2856.79 ±129.89	2816.82 ± 393.17	3.76**
Carbohydrates (g/d)	-	383.19 ±145.8	391.013 ± 21.19	2.357***
Proteins (g/d)	55	49.62 ± 2.93	47.91 ± 3.87	2.2*
Fat (g/d)	25	60.36 ± 3.97	60.09 ±3.87	0.238^{ns}
Iron (mg/d)	21	10.89 ± 1.34	10.18 ±0.98	0.85^{ns}
Fiber (g/d)	25	21 ±3.487	21.65 ± 4.72	0.60^{ns}

* Significant at one percent level,
** Significant at two percent level, Significant at five percent level.

The mean intake of nutrients by the obese subjects is presented in Table-6. The mean daily energy intake of 30 to 45 years and 46 to 60 years of age group was 2856.79 ± 129.89 and 2816.82 ± 393.17 calories, protein intake was 49.6± 2.93 and 47.9 ± 3.87g, fat intake was 60.36 ± 3.97 and 60.09± 3.87g, Iron intake was 10.89 ± 1.34 and 10.18± 0.98 mg, Fibre intake was 21± 3.487 and 21.65± 4.72g, other nutrients intake were greater than Recommended Dietary Allowances. The mean energy intake was found to be significant at (P<0.02) two percent level, carbohydrate intake was significant at (P<0.05) five percent level, protein intake was significant at (P< 0.01) percent level. Iron intake was found to be not significant. High intake of energy and starch dense foods promotes weight gain. These energy dense foods

are not only highly processed but also poor in micronutrient. Energy dense foods tend to be high in fat and sugars (WHO Report 2003).

TABLE - 3
Serum Lipid Profile (mg/dl) of Selected Obese female Adults (N=60)

Lipid Profile(mg/dl)	Normal Level $	30 to 45 years	46 to 60 years	't' value
TGL	<150	217.74 ±2.42	212.41± 5.14	5.3369*
TC	<200	216.51±9.25	214.469±.78	0.8057^{ns}
HDL-C	>40	44.3±2.77	43.9 ±2.7	0.5418^{ns}
VLDLC	<40	47.44 ±1.25	45.51± 1.01	6.1712*
LDL-C	<100	156.07 ±5.47	155.91 ±5.13	0.1193 ^{ns}
#TC/HDL-C	<5	4.68 ±1.09	4.91 ±1.07	0.7856^{ns}
#LDL/HDL-C	<2.66	3.54 ±0.25	3.56 ±0.24	0.5448^{ns}

*Significant at one per cent level .ns – Non Significant# - Risk factors$ - Anon 2001

Table 3 reveals that the mean serum lipid profile of the obese female adults at the baseline study. The mean Triglyceride level was higher among 30 to 45 years of age group (217.74 mg/dl) compared to 46 to 60 years of age group (212.41 mg/dl). It was significant at one per cent level. The mean Total cholesterol level was 216.51 mg/dl and 214.46 mg/dl for 30 to 45 years and 46 to 60 years of age group. It was revealed that there was no significant difference between the 30 to 45 years and 46 to 60 years of age group. The mean HDL- Cholesterol was slightly higher in 30 to 45 years (44.3 mg/dl) compared to 46 to 60 years of age group (43.9 mg/dl). However the difference was not statistically significant. The mean VLDL Cholesterol level was (47.44 mg/dl) higher in 30 to 45 years of age group lower than the 46 to 60 years of age group (45.51 mg/dl) and the difference was statistically significant. The mean LDL cholesterol was in selected obese female adults 156.07 mg/dl for 30 to 45 years of age group and 155.91 mg/dl for 46 to 60 years of age group. The difference was not statistically significant. The risk ratio of TC/HDL-C was not significant among 30 to 45 years (4.68) and (4.91) 46 to 60 years of age group. The risk ratio of LDL/HDL-C was not significant in 30 to 45 years of age group (3.54) and 46 to 60 years of age group (3.56).

In the present study, higher concentrations of triglyceride, Total cholesterol, LDL-Cholesterol and VLDL – Cholesterol levels in the selected obese female adults was observed which may be due to lower intake of pulses, vegetables, fruits and green leafy vegetables. Hence, adverse dietary factors are responsible for early and accelerated heart disease.

TABLE – 4
Impact of spirulinas Supplementation on lipid profile (mg/dl) of obese female adults

Lipid Profile	Experimental (n=30)				Control (n=30)			
	Initial	Final	t-value	Difference	Initial	Final	t-value	Difference
TGL	216.06±4.16	170.79± 7.55	2.7605*	-45.27	215.32 ± 4.86	209.88±4.23	4.86**	-6.32
TC	214.75 ±07.83	192.3 ±4.08	1.336 ^{ns}	-22.45	211.78±6.72	199.62 ±1.09	0.7250 ^{ns}	-12.16
LDL-C	156.07± 05.37	143.16 ± 6.30	0.8196^{ns}	-12.91	155.93 ±26.86	153.16 ±5.07	0.5325 ^{ns}	-2.77
VLDL-C	42.30±2.27	30.16 ±3.31	1.5886^{ns}	-12.14	43.195 ±2.19	41.977 ±1.61	2.1668***	-1.218
HDL-C	43.459 ±3.34	50.99± 3.46	1.7932^{ns}	+38.36	39.897 ±1.66	38.15 ±1.63	55.755*	-1.747
#TC/HDL-C	4.985±0.40	4.47 ±0.37	4.8598^{ns}	-0.515	5.39 ±0.28	4.72±0.18	1.0606 ^{ns}	-.67
#LDL/HDL-C	3.636 ±0.33	3.194±0.29	5.3290^{ns}	-0.442	3.91 ±0.22	3.62±0.20	4.9564*	-.29

*Significant at one percent level **Significant at two percent level
*** - Significant at five percent level**#** - Risk factors **ns** – non Significant

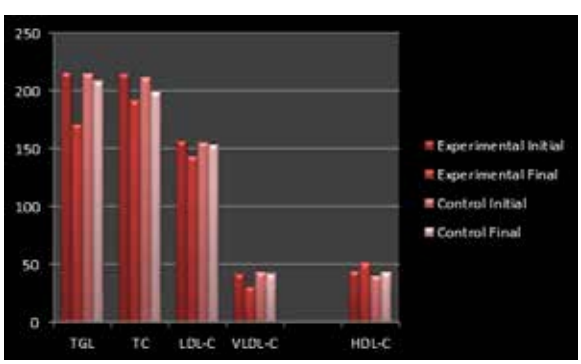

Figure-1 Impact of spirulina Supplementation on lipid profile (mg/dl) of obese female adults

The data on the impact of spirulina supplementation on lipid profile of obese female adults is shown in table – 4.Results revealed that mean Serum Triglyceride level of experimental group reduced significantly from 216.06 to 170.79 mg/dl after the supplementation period. It was significant at one per cent level. The mean triglyceride level reduced from 215.32 to 209.88 mg/dl in the control group; however it was significant at two per cent. The mean serum total cholesterollevel of the experimental group showed a significant reduction from 214.75 to 192.3 mg/dl whereas; it was slightly decreased from 211.78 to 199.62 mg/dl in the control group. However both the groups did not significant statistically. The LDL-Cholesterol level reduced from 156.07 to 143.16 mg/dl in the experimental group. Also, it reduced from 155.93 to 153.16 mg/dl in the control group. However, the difference was not significant in both the groups. Highly significant reduction from 42.30 to 30.16 mg/dl was observed in the VLDL cholesterol levels of the experimental obese female adults. The VLDL cholesterol levels of the control obese female adults reduced from 43.195 to 41.977 mg/dl and the decrease was significant at five percent level ($P<0.05$) of the control group of obese female adults. The HDL-Cholesterol level was slightly increased from 43.459 to 50.099 mg/dl of the experimental group. In the control group, it was decreased from 39.897 to 38.15 mg/dl. However the statistical difference was statistically significant at one percent level ($P<0.01$) for control group, but not found to be significant for experimental group of obese female adults. The risk of TC/HDL-C of the experimental obese female adults reduced from 4.985 to 4.47 whereas it reduced from 5.39 to 4.72 in the control obese female adults, however with no significant difference in both the groups. The risk ratio of LDL/HDL-C was 3.636 which were decreased to 3.194 in the experimental obese female adults. The risk ratio of LDL/HDL-C changed from 3.91 to 3.62 in the control obese female adults. However the difference in the risk ratios of LDL/HDL Cholesterol of control group significant at one percent level ($P<0.01$), but not found to be significant among the experimental group of obese female adults.

SUMMARY AND CONCLUSION

Majority of the subjects 61.67 percent were in the age group of 30 to 45 years whereas 38.33 percent of the obese subjects belonged to 46 to 60 years of age group. Data indicated that majority of the subjects (91.8 and 78.2) from both age groups (30 to 45 years and 46 to 60 years) belonged to nuclear family whereas 8.1 percent and 21.7 percent of them were lived in joint family. Majority of the respondents i.e. 86.5 per cent and 73.9 per cent were consumed non-vegetarian food items. Myths of Religious factors, income level, physical inactivity and type of diet of the respondents are closely associated with high BMI and WHR of the selected obese subjects. Results revealed that mean Serum Triglyceride level of experimental group reduced significantly from 216.06 to 170.79 mg/dl after the supplementation period. It was significant at one per cent level. The mean triglyceride level reduced from 215.32 to 209.88 mg/dl in the control group; however it was significant at two per cent. The mean serum total cholesterol level of the experimental group showed a significant reduction from 214.75 to 192.3 mg/dl whereas; it was slightly decreased from 211.78 to 199.62 mg/dl in the control group. However both the groups did not significant statistically. The LDL-Cholesterol level reduced from 156.07 to 143.16 mg/dl in the experimental group. Also, it reduced from 155.93 to 153.16 mg/dl in the control group. However, the difference was not significant in both the groups. Highly significant reduction from 42.30 to 30.16 mg/dl was observed in the VLDL cholesterol levels of the experimental obese female adults. The VLDL cholesterol levels of the control obese female adults reduced from 43.195 to 41.977 mg/dl and the decrease was significant at five percent level ($P<0.05$) of the control group of obese female adults. The HDL-Cholesterol level was slightly increased from 43.459 to 50.099 mg/dl of the experimental group. In the control group, it was decreased from 39.897 to 38.15 mg/dl. However the statistical difference was statistically significant at one percent level ($P<0.01$) for control group, but not found to be significant for experimental group of obese female adults. Spiralling supplementation for a period of 60 days showed a positive impact on lipid profile of obese female adults. It also improved the blood haemoglobin status of subjects.

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