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● *RESEARCH ARTICLE* ●

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Soybean – An effective therapeutic intervention in dyslipidemia

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ABSTRACT

Chronic-degenerative diseases are a growingly health problem all over the world. The confluence of dietary errors and improper lifestyle practices has aggravated the epidemic. It is well known that the modification on lipid concentration is a useful approach to decrease cardiovascular mortality. The study was undertaken to investigate therapeutic effect of 90 days oral administration of soya nuts on 100 dyslipidemic subjects above 40 years of age selected by purposive random sampling. The subjects were divided into two groups a control group and an experimental group. The baseline questionnaire requested information about the demographic profile and main known risk factors for dyslipidemia.Lipid profile of the subjects was estimated by using standard analytic techniques. It was observed that mean change in lipid profile value and BMI was significant at 0.05 level except HDL level in females and VLDL levels in males. Mean change in daily nutrient intake of calorie, total fats and saturated fats was reduced in experimental group as compared to control group. When the lipid profile values of sedentary and moderately active subjects in control and experimental group were compared, it was found that overall improvement in lipid profile was more marked in experimental groups. Thus it appears that soyabean may be an effective intervention in dyslipidemia.

Key words : Dyslipidemia, Therapeutic intervention, Soybean

INTRODUCTION

Cardiovascular disease (CVD) threatens to cripple India's workforce and stunt India's growth if timely and appropriate public health measures are not Instituted (Goenka et al., 2009). Blood Cholesterol levels are largely determined by the proportion of dietary energy derived from transfats, saturated fats, polyunsaturated fats and refined carbohydrates (Warenenjo *et al.*, 2006 and Pedersen *et al.*, 2005). The National Cholesterol Education Program's Therapeutic Lifestyle Changes diet includes unsaturated fats, fiber, and plant sterols/stanols. The whole foods approach incorporates increased consumption of fruits, vegetables, whole grains, and fish; and the American Heart Association guidelines emphasize functional foods like soy protein (Victoria *et al*., 2008). Cassidy *et al.* (2006) assessed the effect of soy isoflavones which reduced low density lipoprotein cholesterol. Soy lecithin lowers serum cholesterol levels (Hori, 2001). It also contains saponins. Soybeans, as a major source, have a saponin content of five to six per cent by weight. Saponins bind cholesterol and bile acids in the gut, lowers the cholesterol (Timothy, 1999). Soyabean has been reported to be able to lower total cholesterol levels by 30%. (Desroches *et al.*, 2004).The present investigation was planned and conducted to assess the effect of soyabean supplementation on dyslipidemia.

MATERIALS AND METHODS

The present study was conducted on 100 dyslipidemic subjects (50 males and 50 females) above 40 years of age who were selected from different clinics and hospitals of Gwalior city by purposive random sampling and divided into 2 groups a control and an experimental group(on soyabean supplementation),each group including 25 males and 25 females. All the necessary information (age, sex, activity, life style pattern, family history of disease, present complaints etc) was gathered through pretested interview schedule. A detailed dietary profile was computed using a combination of 24 hour recall technique and weighing method for consecutive seven days. Sensory evaluation or the organoleptic quality of soya nuts was judged by a panel of 6 faculty members from the Home Science department of KRG College on the basis of 9 point Hedonic scale(Shrilakshmi,2008). Quantity of Soya nuts to be given as supplementation were standardized (30 g/day). A variety of clinical trials have demonstrated that consuming 25 to 50 g/d of soy protein is both safe and effective in reducing LDL cholesterol by 4% to 8%. The beneficial effects of

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soy are proportionally greater in people with hypercholesterolemia (Erdman W. John, 2000). The period of supplementation was 3 months. Anthropometric parameters and blood lipid profile was estimated prior and after soya nuts supplementation and results were statistically analysed using appropriate methods. Triglycerides, and total and HDL cholesterol were estimated by spectrophotometric assays. The selected subjects were asked to devoid of food for 12 hrs or overnight and venous blood samples were withdrawn, the serum was separated and stored at -20^{o}C for the analysis of lipid profile. Total Cholesterol (CHOD-PAP method, Deeg *et al*., 1983), Triglycerides (GPO-POD method, Wood *et al.*, 1998),HDL-Cholesterol(Phosphotungstate method, Lopes-virella,1977).LDL-Cholesterol and VLDL-Cholesterol were calculated from total cholesterol, HDL-cholesterol and Triglyceride by Friedwald's formula

RESULTS AND DISCUSSION

It is evident from Table 1 that experimental group showed decrease in cholesterol ,triglycerides,LDL,VLDL cholesterol and an increase in HDL cholesterol concentration in contrast to control group. It indicates that consumption of soya nuts would be an effective intervention and also improve lipid profile as well as serve as a healthy diet if eaten in combination with nutritionally adequate diet. Similar findings have been reported by Siyan *et al.* (2005) that soya protein containing isoflavones significantly reduced serum total cholesterol, LDL cholesterol and triacylgycerol and significantly increased HDL cholesterol. To test the difference of mean change in lipid profile value and BMI (Table 2 and 3) of control group and experimental group t-test was applied. It was observed that difference was significant at 0.05 level except HDL level in females and VLDL level in males. Slight reduction was observed in the mean change in BMI in

Table 1 : Mean change in blood lipid profile

Blood lipid profile (mg/dl)	Experimental group(50)								Control group(50)							
	Male				Female				Male				Female			
	Initial	final	Mean change		Initial	final	Mean change		Initial	final	Mean change		Initial	final	Mean change	
			No	%			No	%			No	%			No	%
TC	254.2	213.84	40.36	15.8	256.8	215.32	41.48	16.1	269.48	264.6	4.88	1.8	248.08	238.4	9.68	3.9
TG	184.04	163.56	20.48	11.1	167.48	147.84	19.64	11.7	204.8	201.04	3.76	1.83	172.96	168.68	4.28	2.47
HDL	34.56	36.2	1.64	4.7	35	36.64	1.64	4.6	31.88	32.76	0.88	2.7	36.68	37.64	0.96	2.6
LDL	153.24	140.72	12.52	8.1	146.92	134.72	12.2	8.3	178.32	177.76	0.56	0.31	153.32	149.2	4.72	3.07
VLDL	58.32	49	9.32	15.9	46.88	40.68	6.2	13.2	46.32	43.84	2.48	5.35	53.72	50.2	3.52	6.55

Table 2 : Test of significance of lipid profile (experimental group)

Blood Lipids mg/dL	Experimental group		Control group		t- value	Level of significance
	Mean(S.E.)	S.D.	Mean (S.E.)	S.D.		
Cholesterol						
Male	40.36+3.93	19.66	4.88+0.43	2.17	8.9675	Significant at 0.05
Female	41.48+3.49	17.44	9.68+1.56	7.80	8.3216	Significant at 0.05
Triglycerides						
Male	20.48+1.31	6.57	3.76+0.39	1.94	12.2008	Significant at 0.05
Female	19.64+1.94	9.68	4.28+0.46	2.28	7.7239	Significant at 0.05
HDL						
Male	1.64+0.28	1.38	0.88+0.19	0.97	2.2509	Significant at 0.05
Female	1.64+0.22	1.11	0.96+0.25	1.27	2.0093	Not Significant
LDL						
Male	12.52+4.19	20.96	0.56+5.13	25.66	1.8050	Not Significant
Female	12.20+1.64	8.21	4.12+0.38	1.90	4.7937	Significant at 0.05
VLDL						
Male	9.32+0.84	4.22	2.48+0.24	1.19	7.7976	Significant at 0.05
Female	6.20+0.44	2.20	3.52+0.21	1.05	5.5043	Significant at 0.05

Table 3 : Test of significance in relation to BMI

Variable BMI (weight in kg/ht in m^2)	Experimental group		Control group		t- Value	Level of significance
	Mean (S.E.)	S.D.	Mean (S.E.)	S.D.		
Male (25)	0.8004+0.0709	0.3545	1.9120+0.1218	0.6092	7.8857	Significant at 0.05
Female (25	0.6680+0.0673	0.3363	1.780+0.165	0.824	6.2498	Significant at 0.05

Table 4 : Mean change in nutrient in intake

Nutrient intake	Experimental group (50)								Control group (50)							
	Male				Female				Male				Female			
	Initial	Final	Mean change		Initial	Final	Mean change		Initial	Final	Mean change		Initial	Final	Mean change	
			No	%			No	%			No	%			No	%
Calorie (kcal)	2600	2200	400	15.38	2200	1722	478	21.72	2326.8	2235.6	91.2	3.91	1938	1890	48	2.5
Protein (g)	50	57	7	14	48.48	55	6.52	13.33	49.12	50.92	1.8	3.66	49	51	2	4.0
Carbohydrate (g)	465	381	84	18.06	380	279	101	26.57	423	388.16	34.84	8.23	314	297	17	5.4
Fat (g)	60	48	12	20	55	40	15	27.27	52	50	2	3.84	56.96	55.1	1.96	3.4
Saturated fat (g)	40	20	20	50	34.2	15	19.2	56.1	24	23	1	4.1	27	24.96	2.04	7.5
Unsaturated fat (g)	20	28	8	40	20.88	25	4.12	19.73	28.08	29	0.92	3.2	29.88	31.44	1.56	5.2
Fibre (g)	16	21	5	31.25	12.64	20	7.36	58.22	14.84	15.2	0.36	2.42	10.72	11.88	1.16	10.8

experimental group. It was revealed that the difference of mean change in BMI of control and experimental group was statistically significant at 0.05 level. This finding is supported by a cross sectional study (Gertraud *et al.*, 2008) which reports higher soy consumption in adulthood was related to a lower BMI (P = 0.02).These findings suggested a protective role of dietary soya intake against CVD risk factors. Table 4 depicts value for mean change in daily nutrient intake of calorie, total fats and saturated fats was reduced in experimental group as compared to control group .The considerable decrease in calorie intake in experimental group may be associated with soyabean supplemented diet which perhaps reduced the calorie content with simultaneously increase in fiber .The mean change of protein increased after supplementation which can also be attributed to incorporation of soyabean in the diet. In the present study majority of the subject were living sedentary life with lesser number living in moderate category (Table 5). As far as the activity is concerned the subjects who were moderately active exhibited better lipid profile status in both groups. When the lipid profile values of sedentary and moderately active subjects in control and experimental group were compared, it was found that overall improvement in lipid profile was more marked in

Table 5 : Mean change in blood lipid profile in relation to activity pattern

Activity	Blood lipid profile (mg/dl)	Control group (50)						Experimental group (Soybean) (50)					
		Male (17)			Female (19)			Male (17)			Female (16)		
		Initial	Final	Mean Change	Initial	Final	Mean Change	Initial	Final	Mean Change	Initial	Final	Mean Change
Sedentary	TC	270	268	2	250	249	1	250	222	28	248	232	16
(69)	TG	200	198	2	170	168	2	180	167	21	168	152	16
	HDL	32	32	0	38	39	-1	36	37	-1	36	37	-1
	LDL	170	169	1	150	148	2	158	149	9	148	138	10
	VLDL	44	42	2	52	50	2	60	49	11	48	46	2
		Male (08)			Female (06)			Male (08)			Female (09)		
Moderate	TC	268	264	4	248	244	4	256	214	42	252	215	37
(31)	TG	198	194	4	174	176	4	186	163	23	172	146	26
	HDL	34	34	0	36	37	-1	32	34	-2	38	42	-4
	LDL	178	176	2	152	149	3	154	140	14	150	134	16
	VLDL	48	46	2	51	50	1	58	46	12	42	38	4

experimental groups. A study (Hanachi *et al.*, 2008) also drew same conclusion that the soy milk treatment with exercise produced a decrease in total cholesterol and triglycerides level compared with control group. This suggests that physical activity has an impact on lipid status but it is more effective with soya supplementation.

Conclusion:

The population that was targeted in this study mostly belonged to service class and more importantly those who lead a sedentary life style. Such subjects are much more prone to CVD risk factors and dyslipidemia and constitute a large chunk of Indian population. Due to the hectic life styles of people from such classes, a daily dose of exercise and a healthy balanced meal become low priority, plus the time constraint does not allow an adequate amount of time to be spent on exercise. This is where supplementation and nutritional awareness can play a vital role in prevention of most likely disorders such as obesity, diabetes, dyslipidemia and CVD. Awareness should be spread among people specially those who lead or are bound to sedentary life style, about this neutraceutical. Also if possible supplementation coupled with at least moderate physical activity can guarantee effective prevention and improvement in the now epidemic cardiovascular disease.

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