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EFFECT OF CHIA SEED SUPPLEMENTATION ON THE ANTHROPOMETRIC MEASUREMENTS AND SERUM LIPID PROFILE IN WOMEN WITH HYPERCHOLESTEROLEMIA

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ABSTRACT

Background: Elevated levels of total cholesterol (TC), especially low density lipoprotein (LDL), serum triglyceride (TG) and low levels of high density lipoprotein (HDL) have been documented as leading risk factors for the development of coronary heart disease (CHD) in Indian women. **Objective:** To determine the effect of Chia seed supplementation on the anthropometric measurements and serum lipid profile (SLP) in women with hypercholesterolemia. **Method:** This study included 30 women (30–45 yrs) with hypercholesterolemia (200mg/dl- 239mg/dl), of which, an equal number (n=15) belonged to Group I (Control group without supplementation but with diet counseling) and Group II (Test group with Chia seed supplementation and diet counseling).The study was conducted for a period of 60 days. The subjects in the test group were asked to consume 12.5g of Chia seeds, twice (before lunch and dinner) every day followed by 200ml of water. **Results:** Statistically significant reductions were seen in the anthropometric measurements and SLP of women in the test group when compared to that of the control group. Significant reductions were seen in the BMI and waist circumference of the subjects in Group II by 2.4% and 3.1% respectively compared to a mild increment by 0.6% in both the parameters in Group I. Regarding the SLP - TC, LDL, Very low density lipoprotein (VLDL), serum TG, TC:HDL ratio and TG:HDL ratio reduced by 14.7%, 10.2%, 20.7%, 20.7%, 10.6% and 17.1% respectively in Group II compared to increments by 1.1%, 4.7%, 23.1%, 23.1%, 4.7% and 29.1% respectively in Group I. **Conclusion:** Chia seeds can be advocated as an effective hypolipidemic agent inorder to prevent cardiovascular disease complications.

KEYWORDS: Chia seeds, Coronary Heart Disease, Dyslipidemia.

INTRODUCTION

The global burden of disease is shifting from infectious diseases to non-communicable diseases, with cardiovascular disease (CVD) as a ubiquitous cause of morbidity and leading cause of approximately 17 million deaths every year.[1,2] Of these deaths, 7.3 million were due to Coronary Heart Disease and 6.2 million were due to stroke.[2] CVD is the biggest killer of women globally, killing more women than all cancers, tuberculosis, HIV/AIDS and malaria combined.[3] Half of all deaths in the developed world and a quarter of deaths in the developing world are due to CVD which are comprised of hypertension and the diseases caused by atherosclerosis.[4]

Dyslipidemia which is characterized by elevated serum total cholesterol, LDL-C and lowered HDL-C is recognized as a prominent risk factor for CVD.[5] Studies of NCD biomarkers in Asian Indians have long raised the possibility of an "Asian Indian Phenotype" that produces a high-risk metabolic profile consisting of high serum triglycerides, decreased HDL cholesterol, glucose intolerance and metabolic syndrome. Other putative markers of NCD risk (Lipoprotein (a), C-reactive protein and homocysteine) are also elevated in Asian Indians.[6,7,8] The serum lipid parameters along with non-lipid risk factors increases the risk of developing atherogenesis at an early age in Indian women.[9] Since CVD is now becoming a major cause of death worldwide, there is renewed interest in determining an effective hypolipidemic agent in order to prevent cardiovascular disease complications.

Salvia hispanica L. commonly known as Chia is a species of flowering plant in the mint family, Lamiaceae. Chia seed is a natural source of omega-3 and omega-6 fatty acids, fiber, protein of high biological value and natural antioxidants.[10,11,12,13] As all these nutrients have been implicated in lowering CVD risks and as they occur naturally in Chia, addition of Chia to conventional treatment may reduce CVD risk factors when added to the diet.[14] Chia seeds also help in reducing blood pressure, stabilizing blood glucose levels and aid in weight loss.

The purpose of the present study is to determine the effect of Chia seed supplementation on the Body Mass Index (BMI), waist circumference and serum lipid profile in women with hypercholesterolemia and to compare the same with that of a control group without supplementation.

MATERIALS AND METHODS

The study was designed to investigate the effect of Chia seed supplementation on the Body Mass Index (BMI), waist circumference and serum lipid profile in women with hypercholesterolemia. It was a pre-test, post-test experimental design with a control group without any supplementation, whereas both the groups were given diet counseling. The subjects were selected based on simple random sampling technique. The sample size for the study was 30 hypercholesterolemic women, who were equally divided into 2 groups – Group I (control group, n=15) and Group II (test group, n=15). Women in the age group of 30-45 years with serum total cholesterol (TC) level above 200mg/dl and residing in Chennai were included in the study.

The subjects in the test group were instructed to consume 12.5g of Chia seed, twice daily, that is, before breakfast and lunch with 200ml of water. The supplement was provided in sachets. The subjects in the control group did not receive any supplementation. An interview schedule was used to elicit personal and dietary information/habits of the subjects. The serum lipid profile comprising of total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), very low density lipoprotein cholesterol (VLDL-C), triglyceride (TG), TC: HDL and TG: HDL ratios were analyzed on the 1st day and on the 61st day of the study /supplementation period in both the groups. The BMI and waist circumference of the subjects were recorded before and after the study/supplementation period. The details obtained from the interview schedule were subjected to descriptive analysis and information regarding the BMI, waist circumference and serum lipid profile were subjected to inferential statistical analysis.

RESULTS AND DISCUSSION

A major proportion of the subjects in Group I (38.5%) and Group II (46.1%) were graduates, whereas, an equal percentage of subjects (40%) in the test group belonged to the undergraduate and professional categories. All the subjects in both the groups had sedentary lifestyle. It has been reported that sedentary behaviour is prospectively associated with increased risk of all-cause and cardiovascular disease mortality.[15] All the subjects in both the groups belonged to high income category. Majority of the subjects in Group I (61.5%) were not involved in any kind of physical activity, whereas, a similar percentage of subjects in Group II (61.5%) were involved in regular physical activity. An equal distribution of subjects in Group I and Group II (76.9%) had a family history of hypercholesterolemia and hypertension respectively, which are independent risk factors for CHD. Regarding their dietary habits, all the subjects in Group I were lacto-vegetarians and an appreciable percentage of subjects in Group II (7.7%) were found to be non-vegetarians; others were lacto-vegetarians. Sunflower oil was consumed by majority of the subjects in both the groups, whereas, ghee was consumed by all the subjects in Group I and by majority of the

subjects in Group II (92.3%) on a daily basis. High calorie foods like chocolate, cakes, biscuits, bonda, bajji, samosa, burgers, french fries and pizzas were consumed by an appreciable proportion of subjects frequently in both the groups.

BMI of the control and test groups

The mean BMI of the hypercholesterolemic women in the control and test groups is presented in **table 1** and represented graphically in **fig.1**.

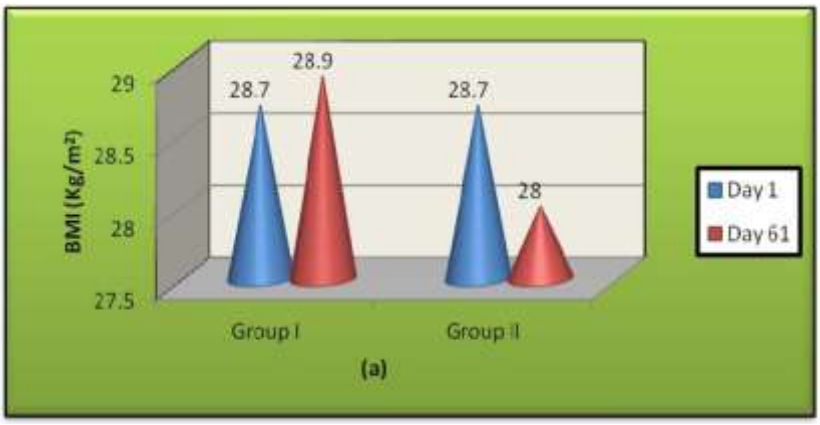
Table 1: Mean BMI and waist circumference of the hypercholesterolemic women in the control and test groups before and after the study/supplementation period

Parameter	Group I (n=15) Mean ± S.D		Level of significance
	1st day	61st day	
BMI (kg/m²)	28.7 ± 3.1	28.9 ± 3.1	NS
Waist circumference (cms)	96.1 ± 11.3	96.7 ± 10.2	NS
Group II (n=15)			
BMI (kg/m²)	28.7 ± 3.8	28.0 ± 4.1	p<0.001
Waist circumference (cms)	94.6 ± 11.4	91.6 ± 7.8	p<0.01

NS- Not Significant

It can be inferred that the mean BMI (28.9 ± 3.1 kg/m²) and the mean waist circumference (96.7 ± 10.2 cms) of the subjects in Group I at the end of the study period were slightly higher than the baseline value of 28.7 ± 3.1 kg/m² (BMI) and 96.1± 11.3 cms (waist circumference), but it was not statistically significant.

Significant reductions were seen in the mean BMI (28.0 ± 4.1kg/m^2) and mean waist circumference of the subjects in Group II (91.6 ± 7.8 cms) after the supplementation period. Though there was a significant reduction in the mean BMI and waist circumference of the subjects, it still remained higher than the normal cut-off value which indicated the need for a longer supplementation period.



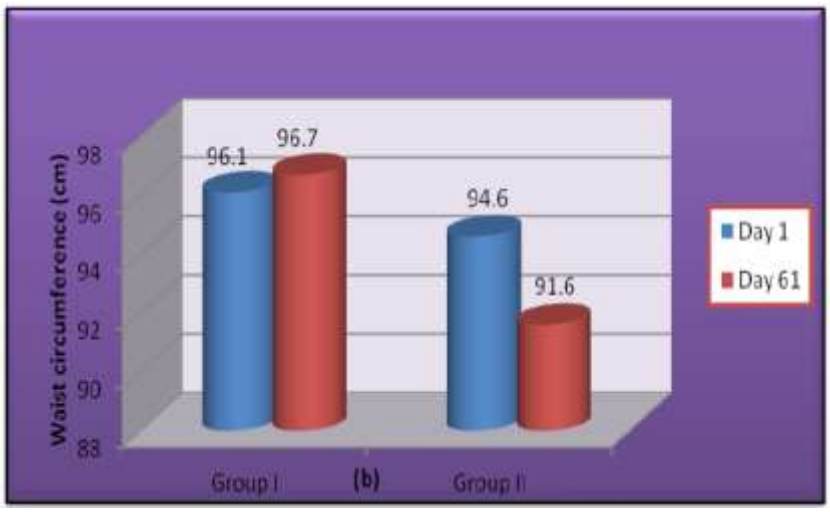


Fig 1: Anthropometric measurements of the hypercholesterolemic women a) BMI b) Waist circumference

Serum lipid profile of the control group

The mean serum lipid profile of the hypercholesterolemic women in the control group before and after the study period is presented in **table 2** and graphically represented in **fig.2.**

Table 2: Mean serum lipid profile of the hypercholesterolemic women in Group I before and after the study period

Parameter (mg/dl)	1st day Mean ± S.D	61st day Mean ± S.D	Level of significance
Total cholesterol	208.2 ± 10.7	210.6 ± 18.6	NS
HDL-C	51.4 ± 11.7	49.3 ± 12.5	NS
LDL-C	137.9 ± 12.7	144.5 ± 21.7	NS
VLDL-C	22.8 ± 9.6	28.1 ± 12.8	NS
TG	114.3 ± 48.1	140.8 ±64.3	NS
TC: HDL-C ratio	4.2 ± 0.8	4.4 ± 1.2	NS
TG: HDL-C ratio	2.4 ± 1.4	3.1 ± 1.8	NS

NS- Not Significant

The percentage increments in the parameters after 60 days of the study period were as follows: Serum TC increased by 1.1%, LDL-C by 4.7%, TG and VLDL-C by 23.1%, TC: HDL ratio by 4.7% and TG: HDL ratio by 29.1%. The HDL-C decreased by 4.0% after the study period. Increments were seen in all the lipid parameters (except HDL-C) after 60 days of the study period, but it was not significant. Since all these parameters can increase the likelihood of developing CHD in these women, it is therefore essential to control these risk factors with immediate intervention in order to prevent or delay the onset of cardiovascular diseases. Metabolic dyslipidemia which is a combination of increased TG levels and low HDL-C levels is associated with an increased risk of CHD.[16] For every 1 per cent increase in the total serum cholesterol level; a 2 per cent increase in the incidence of CHD is found.[17]

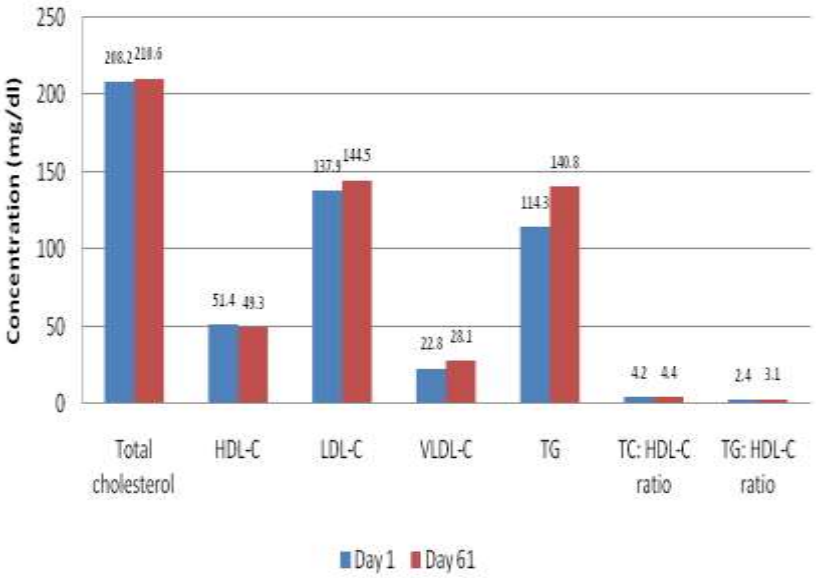


Fig 2: Mean serum lipid profile of the hypercholesterolemic women in the control group before and after the study period

Serum lipid profile of the test group

The mean serum lipid profile of the hypercholesterolemic women in the test group before and after 60 days of the supplementation period is presented in **table 3** and graphically represented in **fig.3.**

Table: 3 Mean serum lipid profile of the hypercholesterolemic women in Group II before and after the supplementation period.

Parameter (mg/dl)	1st day Mean ± S.D	61st day Mean ± S.D	Level of significance
Total cholesterol	217.2 ± 15.4	185.1 ± 13.3	p<0.001
HDL-C	46.5 ± 6.8	45.0 ± 8.8	NS
LDL-C	144.8 ± 15.7	129.9 ± 14.3	P<0.001
VLDL-C	31.8 ± 13.7	25.2 ± 9.9	p<0.01
TG	159.1 ± 68.8	126.1 ± 49.9	p<0.01
TC: HDL-C ratio	4.7 ± 0.7	4.2 ± 0.2	p<0.01
TG: HDL-C ratio	3.5 ± 1.9	2.9 ± 1.4	p<0.05

NS- Not Significant

Statistically significant percentage reductions in the lipid parameters after the supplementation period were as follows: Serum TC by 14.7 %, LDL-C by 3.2 %, TG and VLDL by 20.7%, TC: HDL ratio by 10.6 % and TG: HDL ratio by 17.1%. There was also a mild reduction in the HDL-C levels by 3.2% after the supplementation period, but the reduction was not statistically significant. HDL-C is a protective parameter for reducing the occurrence of CHD events. It can be inferred from these findings that Chia seeds which contains omega 3 fats and fibre has brought

about a significant hypolipidemic effect in these hypercholesterolemic women, thereby reducing their risk of developing CHD.

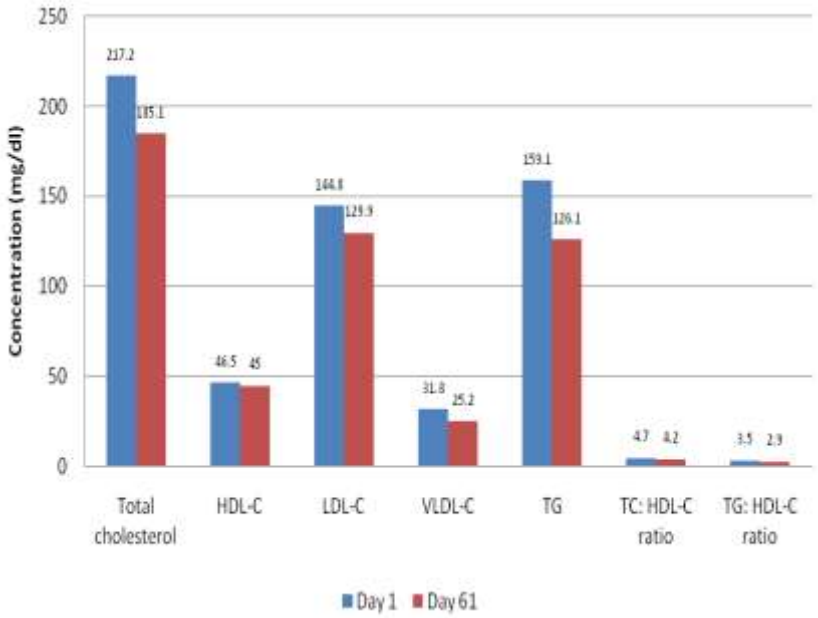


Fig 3: Mean serum lipid profile of the hypercholesterolemic women in the test group before and after the supplementation period

CONCLUSION

The results of the present study have significantly brought to light the hypolipidemic effect of Chia seed supplementation in women with hypercholesterolemia. Thus, it can be concluded that Chia seed can be advocated as an effective hypolipidemic agent for controlling dyslipidemia, which is independently responsible for the increased incidence of CHD - a major killer among Indian women.

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