

# Effect of *Salvia hispanica* (Chia seeds) and *Foeniculum vulgare* (Fennel seeds) against weight-loss and lipid profile in obese human subjects

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**Abstract:** Increased levels of bad cholesterol in the body result in increasing blood pressure and weight gain. The rate of mortality in people, especially who are obese, is increasing due to absence of organic sources of fiber in their diets. Chia and fennel seeds are rich sources of fiber. The objective of this study was to evaluate the combined effect of *Salvia hispanica* (Chia seeds) and *Foeniculum vulgare* (Fennel seeds) against weight-loss and lipid profile in obese human subjects. The research was conducted on obese people aged 25 to 40 years at the Jinnah Hospital Lahore. The study design was randomized control trial (RCT). The sample size was calculated and was divided in-to two groups. With the duration of study being 3 months, pre-testing of all the participants was done. Group 1 was control group, given placebo treatment and Group 2 was an intervention group and given chia and fennel seeds. Post-testing was done and data were analyzed. Results showed that chia and fennel seeds have significant effect ( $p < 0.05$ ) on BMI and lipid profile hence, both are beneficial for lowering body weight and improving LDL, HDL, serum triglycerides and total cholesterol levels.

**Keywords:** BMI, chia seeds, fennel seeds, lipid profile, LDL, HDL, serum triglycerides, total cholesterol, weight loss.

## INTRODUCTION

Hyperlipidemia is a condition that is identified by increased levels of lipids (fats, triglycerides and cholesterol) in the blood and it occurs due to lipid metabolism disorder in the human body and results in serum lipid concentration beyond normal levels (Naser *et al.*, 2021). It is a major precursor of lipid related diseases. It can be heredity and due to medicines, but major cause are poor diet with the intake of saturated fat greater than 10 percent of the total calories and fats more than 40 percent of total calories per day thus becoming more common in both developed and developing countries (Onwe *et al.*, 2015). There are two major types of hyperlipidemias; the first one is primary hyperlipidemia, which is a genetic abnormality, while the other is secondary hyperlipidemia that is due to predisposing factors like obesity, hypothyroidism and chronic renal failure (Naser *et al.*, 2021) Hyperlipidemia could be treated either by following a healthy diet pattern or suitable lifestyle along with proper medications (hypolipidemic agents) to reach therapeutic goal of controlled blood lipid levels (He & Ye, 2020). Now-a-days, people are more concerned over the usage of food items, diets and nutritional supplements that are promoting weight loss. It is because, usage of fiber in diet has positive influence on enhancing lipid profile, promoting weight loss, maintaining blood glucose levels and reducing blood pressure in the body. For this purpose, chia seeds and fennel seeds are targeted to be investigated properly for beneficial uses (Toscano *et al.*, 2015). The consumption of chia seeds has been increasing due to

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their beneficial effects. More investigations related to composition and beneficial effects of chia seeds on human health are being conducted. Recently, usage of chia seeds has been approved by European Parliament as a Novel food (Melo *et al.*, 2019). *Salvia hispanica* (Chia seed) is a plant that belongs to a family called Lamiaceae. Chia seeds have high content of dietary fiber in them. They contain 30 to 34 grams of fiber. Chia seeds consist of many beneficial compounds including  $\alpha$ -linolenic acid (ALA), accounting for almost 60% of all fatty acids. Chia seeds have a variety of vitamins and minerals (Kulczyński *et al.*, 2019). They include vitamins such as vitamin B1, B2 and B3, in addition to minerals such as potassium, phosphorus, calcium and magnesium in amounts that are very beneficial for health (Prathyusha *et al.*, 2019). Chia seeds have very nutritional properties as they contain carbohydrates (26-41%), fats (40%), proteins (15-25%) and almost 60% of omega 3 fatty acids that help in improving lipid profile, thus protecting against heart diseases (Felemban *et al.*, 2021). Due to the presence of alpha linolenic acid (ALA) in chia seeds our body can fight against high lipid levels in the blood thus reducing high blood pressure and treating heart diseases. As ALA is transformed in-to DHA (Docosa-hexaenoic acid) and EPA (Eicosa-pentaenoic acid) by our body, these seeds prove to be beneficial in maintaining heart and cognitive health (Franklin & Hongu, 2016).

*Foeniculum vulgare* commonly called as fennel seed, is a plant that belongs to a family called Apiaceae. These seeds are aromatic and herbaceous. Fennel seeds also contain beneficial amounts of dietary fiber about (5.75 to 7.59 g/kg) in them (Bukhari *et al.*, 2014). Fennel seeds

are also rich in different vitamins and mineral such as Vitamin C, and minerals such as magnesium, potassium, calcium and sodium (Rafieian *et al.*, 2023). Fennel seeds are proving to be advantageous in lowering bad cholesterol, treating different heart diseases and cancers, due to the presence of antioxidants thus promoting human health (Motti, 2021). As phytochemicals in fennel seeds help remove toxins, maintain metabolism of hormones, have antioxidants and strengthen immune system, that is why treatments through natural plants are becoming more common these days (Nematalla *et al.*, 2024). Plasma lipid levels can be significantly reduced by fennel seeds as they have anti-atherogenic and cholesterol lowering actions. Fennel seeds also prevent accumulation of fat in fatty liver form (Elghazaly *et al.*, 2019). They also improve blood flow by decreasing levels of lipids from the blood. Thus, fennel seeds also help in maintaining heart health by reducing bad cholesterol and blood pressure without interfering with heart rate or breathing system (Noreen *et al.*, 2023). Due to beneficial role of chia and fennel seeds, the current study aims at evaluating the effect of *Salvia hispanica* (Chia seeds) and *Foeniculum vulgare* (Fennel Seeds) collectively against weight loss and lipid profile in obese individuals.

## MATERIALS AND METHODS

### *Study Area*

This study was conducted and performed in Jinnah hospital, Lahore from August 2023 to October 2023.

### *Sample size*

The sample size for the study was calculated from an online calculator Raosoft 2020. The sample size for the study was 60 participants. Two groups were made and each group had 30 participants.

### *Study groups*

Group 1 was the control group which received placebo treatment (placebo capsules). Group 2 was the intervention group that received 5g of chia seeds and 5g of fennel seeds each day.

### *Inclusion criteria*

Participants falling in following category were recruited into the study.

- Age group 25-40 years.
- All obese men and women.
- Who were willing to cooperate.

### *Exclusion criteria*

Participants failing to fall in the above category were excluded from the study.

- Pregnant, lactating, disabled, teen agers and young girls
- Having history of any physiological and psychological disorder.
- Having addiction of alcohol consumption.

**Tools:** Following tools were used for the 'Pre' & 'Post' assessment of obese human during the study.

### *Anthropometric measurements*

Measurements of height and weight were taken, and then BMI (Body Mass Index) of the participants was calculated by its formula  $BMI = \text{kg/m}^2$  (Zierle-Ghosh & Jan, 2018)

### *Lipid profile test*

Fasting of 12 hours is required for doing lipid chemistry test. Blood samples were taken from the participants and their total cholesterol, LDL, HDL and serum triglycerides were measured. Sample was determined using enzymatic colorimetric assays DYTONA plus kit.

### *Ethical approval*

The study was approved by the Research and Ethics committee of Riphah International University, Lahore (No. REC/RCR & AHS/22/0807).

## STATISTICAL ANALYSIS

Data were analyzed using SPSS software version 24. T-test was done on data. Data were presented as mean  $\pm$  SD and  $p < 0.05$  was considered as a level of significance.

## RESULTS

### *Baseline data of participants*

In the control group, 53.3% of participants were male and 46.7% of the participants were female whereas in the intervention group, 33.3% of the participants were male and 66.7% of the participants were female. Mean BMI of the participants was  $31 \text{kg/m}^2$  and mean TC, STGL, HDLC and LDLC levels of the participants were 196.61 to 204.77, 212.60 to 202.36, 37.56 to 38.26 and 133.81 to 156.69 mg/dl, respectively.

### *Effect of chia seeds and fennel seeds on BMI*

BMI of the participants was significantly reduced ( $p < 0.05$ ) by giving them combined treatment of chia seeds and fennel seeds. However, in the control group, there was no significant decrease in the BMI of the participants (table 2).

### *Effect of chia seeds and fennel seeds on lipid profile*

It was seen that total cholesterol, serum triglycerides, LDL cholesterol values were significantly decreased ( $p < 0.05$ ) and HDL cholesterol value was significantly improved ( $p < 0.05$ ) when combined treatment of chia seeds and fennel seeds was given to the participants. However, in the control group, there was no significant decrease in TC, STGL, LDL and no significant increase in HDL values (table 2).

**Table 1:** Characteristics of participants (n= 60) before intervention

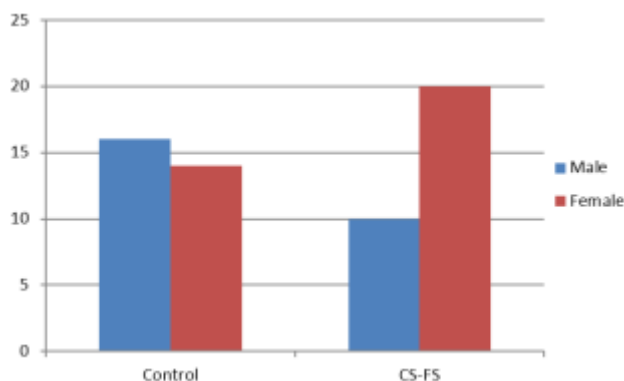
Parameter	Control group	CS-FS group
	Mean $\pm$ SD	Mean $\pm$ SD
Wt (kg)	87.98 $\pm$ 12.78	86.32 $\pm$ 11.77
BMI (kg/m <sup>2</sup> )	31.34 $\pm$ 1.35	31.51 $\pm$ 2.06
TC (mg/dl)	196.61 $\pm$ 33.19	204.77 $\pm$ 42.70
STGL (mg/dl)	212.60 $\pm$ 79.43	202.36 $\pm$ 79.75
HDLC (mg/dl)	37.56 $\pm$ 6.44	38.26 $\pm$ 6.23
LDLC (md/dl)	133.81 $\pm$ 35.07	156.69 $\pm$ 31.94

CS-FS: Chia seeds-Fennel seeds, Wt: Weight, BMI: Body Mass Index, TC: Total Cholesterol, STGL: Serum Triglycerides, HDLC: High Density Lipo-protein, LDLC: Low Density Lipo-protein

**Table 2:** After effects of Chia seeds and Fennel seeds on Weight, BMI and Lipid profile

Parameter	Groups	Before intervention	After intervention
		Mean $\pm$ SD	Mean $\pm$ SD
Wt (kg)	Control	87.98 $\pm$ 12.78	88.47 $\pm$ 12.57* *
	CS-FS	86.32 $\pm$ 11.77	84.27 $\pm$ 11.81*
BMI (kg/m <sup>2</sup> )	Control	31.34 $\pm$ 1.35	31.52 $\pm$ 1.17* *
	CS-FS	31.51 $\pm$ 2.06	30.72 $\pm$ 2.09*
TC (mg/dl)	Control	196.61 $\pm$ 33.19	197.23 $\pm$ 34.59* *
	CS-FS	204.77 $\pm$ 42.70	199.77 $\pm$ 41.30*
STGL (mg/dl)	Control	212.60 $\pm$ 79.43	209.11 $\pm$ 68.72* *
	CS-FS	202.36 $\pm$ 79.75	195.99 $\pm$ 76.45*
HDLC (mg/dl)	Control	37.56 $\pm$ 6.44	37.25 $\pm$ 6.48* *
	CS-FS	38.26 $\pm$ 6.23	46.27 $\pm$ 6.30*
LDLC (md/dl)	Control	133.81 $\pm$ 35.07	134.25 $\pm$ 34.38* *
	CS-FS	156.69 $\pm$ 31.94	147.07 $\pm$ 31.86*

Note: \* p < 0.05 is significant, \*\* p > 0.05 is not significant

**Fig. 1:** Gender distribution of participants.

## DISCUSSION

The current study showed positive effects of chia seeds and fennel seeds on human subjects without harming them. For this purpose, the intervention group was given 5g of chia seeds and 5g of fennel seeds. The result showed that combined treatment of both seeds was significant in promoting weight loss by 86kg to 84kg and maintaining lipid profile. Similarly, a study was conducted in 2022 for 9 weeks also showed positive

impact of chia seeds in controlling obesity due to their anti-adipogenic effect and also reduced LDL and triglycerides in them (Grancieri *et al.*, 2022)

Another study with the aim of observing the effect of fennel seeds on females with obesity was done for 4 weeks in December 2021 and the levels of HDL, LDL, triglycerides and cholesterol were evaluated before and after the study. Results showed that fennel seeds increased HDL and reduced BMI and weight of obese females (AbdEl wahab *et al.*, 2021). The present study also proved to be significant and effective in decreasing mean LDL from 156.69mg/dl to 147.07 and mean cholesterol from 204.77mg/dl to 199.77mg/dl. Being rich in fiber, they worked well in reducing increased weight of the participants.

An RCT was conducted in 2020 on chia seeds and showed positive results by decreasing total cholesterol, LDL, free fatty acids levels and triglycerides and increased HDL levels (de Abreu Silva *et al.*, 2021). The current study also aimed to assess the role of chia and fennel seeds together on reducing weight and improving lipid profile of the participants and increasing mean HDL from 38.26mg/dl to 46.27mg/dl. The control group did

not show any positive result while the participants in the intervention group reduced weight and improved lipid profile.

The results of the current study were consistent with a previous study in which extracts of fennel seeds were used to evaluate the changes in weight and lipid profile of the rats. Results showed that fennel seed extract reduced weight and improved lipid profile while orlistat did not show positive results on triglycerides (Dina *et al.*, 2019). Previously, there is no such study in which synergistic effects of chia and fennel seeds were evaluated. Chia seeds and fennel seeds given together for 3 months daily in a dosage of 5g respectively proved to be beneficial in weight reduction and improving lipid profile of participants in the intervention group.

## CONCLUSION

A condition that is identified by increased levels of lipids (Triglycerides, fats and cholesterol) in the blood occurring due to disorder in lipid metabolism and decreased HDL levels is termed as hyperlipidemia. The major cause is poor diet with increased saturated fat intake beyond normal values causing obesity, CVD's and strokes. This issue requires proper attention to be addressed. Based on previous studies and current research, chia seeds and fennel seeds together have significant effects in weight reduction and improving lipid profile thus preventing from certain diseases.

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