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Flax Seed: as an Independent Natural Agent for Lipid Profile Improvement

KEYWORDS: Hypercholesterolemia, α-Linolenic Acids, Linoleic Acid, Lignans

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ABSTRACT *We conducted a study to see the effect of grounded flaxseed, as part of the daily diet, on the lipid profile of 100 hypercholesterolemic individuals in the age group of 50-60 years. During the 6-wk periods, those were assigned to consume 2 tablespoons of grounded flaxseed seeds daily. Blood samples were collected at baseline before the intervention, and after 6 weeks of the study period. Flaxseed regimen was able to significantly reduce serum total cholesterol, triglycerides, and LDL-cholesterol and increase serum HDL-cholesterol. The cholesterol lowering effects of flaxseed was considered due to the activity of single or multiple components, including α-linolenic or linoleic acids, total and soluble fiber, and non-protein constituents present in these seeds.*

INTRODUCTION

Coronary artery disease (CAD) is a leading cause of death today and a major economic challenge for the health care system. There are now significant research data suggesting that CAD can be altered or prevented in large part by three major lifestyle changes. These three factors are nutritional modification, incorporating exercise into our daily lives and eliminating smoking. The implementation of only one of these three factors – nutritional modification – may generate significant effects on CAD. For example, increasing the consumption of omega(ω)-3-fatty-acids may be a particularly powerful dietary strategy to combat CAD.

Recently, flaxseed (linseed) was identified as a plant source of ω-3-fatty-acids. Flaxseed is one of the richest plant sources of the ω-3-fatty-acid, alpha-linolenic acid (ALA, C18:3, ω-3), but it is found in other foods as well. The ω-3-fatty-acid found in flaxseed differ from those in fish. Flax seeds has 800 times more lignans than any other food. Lignans may help protect against cancer by blocking enzymes that are involved in hormone metabolism and interfering with growth and spread of tumor cells. Other nutrients would include protein, magnesium, calcium, phosphorous and mucilage.

100 gm of ground flax seed supplies about 534 calories, 41 grams of fat, 28 grams of fiber, and 20 grams of protein. Whole flaxseeds are chemically stable, but ground flaxseed can go rancid at room temperature in as little as one week, Refrigeration and storage in sealed containers will keep ground flax from becoming rancid for a longer period.

Current dietary recommendations for adults suggest a daily intake of 2.22 g of ALA based on a 2000 kcal diet. Ingesting flax seed can provide ALA. ALA levels are increased as early as two weeks after the initiation of flax seed supplementation. The bioavailability of ALA is dependent on the type of flax ingested. ALA has greater bioavailability in oil than in milled seed, and has greater bioavailability in milled seed than in whole seed. Crushing and milling of flax seed substantially improve the bio-availability of entero-lignans, due to the improved accessibility of the colon bacteria to crushed and ground flax seed, the dose of flax seed ingested and the fat composition of the diet. The age of the subject does not appear to influence ALA bio-availability or its conversion to DHA (Docosahexaenoic acid). The relative bioavailability of entero-lignans from flax seed does not differ in men versus women. Approximately 4 gm of ALA appear to have biological effects similar to those of 0.3 gm of long-chain ω-3-PUFA. Comparatively, EPA (Eicosapentaenoic acid) and DHA more rapidly incorporated into plasma and membrane lipids, and produce more rapid effects than ALA. Therefore, the role of ALA in human nutrition may be more important in terms of long-term dietary intake.

Lignans are high in antioxidants and may support immune system, high in fiber and have anti-estrogenic effects which may help with menopausal symptoms. Lignans inhibit certain enzymes needed in the conversion of testosterone to di-hydroxy-testosterone which may improve prostate health. Thus it is important and beneficial to include lignan content in the diet.

AIMS AND OBJECTIVES

The study was conducted to estimate the amount of ω-3-fatty-acids and lignans in flax seeds and to study the effect of consumption of flax seeds in the form of grounded powder on serum lipid parameters viz. total cholesterol (CHO), triglycerides (TG), high-density-lipoproteins (HDL-CHO) and low-density-lipoproteins (LDL-CHO).

MATERIAL AND METHODS

Study Design:

The research protocol was approved by Institutional Ethics Committee. After taking written consent, 100 healthy individuals in the age group of 50-60 years were enrolled in this study. General health, medication use and lifestyle characteristics were assessed at baseline.

Intervention in Study Subjects:

From each study subject 5 mL of fasting venous blood was drawn by disposable syringe with full aseptic precautions

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and was taken in a properly cleaned & dried test tube without anticoagulant for lipid profile.

Complete serum biochemical analyses were done on Olympus AU-680 Clinical Chemistry Analyzer. Serum total cholesterol (CHOD-POD Method), serum HDL-CHO cholesterol (Direct Method), serum LDL-CHO cholesterol (Direct Method) and serum triglycerides (GPO-POD Method) were estimated. Internal and External Quality Control indicators of the analyzer were within acceptable range. After the analyses, these participants were asked to consume 2 tablespoons of grounded flaxseeds for 6 weeks. After 6 weeks, all these blood tests were repeated.

Biochemical Analysis of the Flax Seeds:
Omega-3-fatty-acids in flax seeds is estimated by modified Duncombe's colorimetric method. Estimation of lignans is estimated by a crude method.

Preparation of the Sample:
Heat the flax seeds for about 10-15 minutes. Take these seeds and crush them using mortar and pestle and make it into powder form. Use this powder for estimation of ω 3 fatty acids and lignans.

Preparation of the Sample for Lignans:
Take about 10 grams of flax seed powder. Add it in boiling water for about 10-15 minutes. This dissolves the fats which is removed by filtration with help of muslin cloth. The fiber obtained in muslin cloth is then treated with alcohol and ether to remove moisture and fats completely.

Preparation of the Sample for Lignans:
The fats extracted during hot water filtration is used for estimation of ω-3-fatty-acids.

Statistical Analysis:
All statistical analyses were done on IBM SPSS Statistics Software v24.0. Student's paired t-test is used for comparison of means of the biochemical parameters before and after the consumption of grounded flax seeds. P<0.05 was considered as the level of significance.

RESULTS

The amount of lignans obtained from 100 gm of flax seeds was found to be 9.28 gm. The amount of ω-3-fatty-acids present in 1 gm of flax seed was found to be 0.25 gm.

Table I: Gender distribution in Study Population

Study Groups (N=100)	Males	Females
	54 (54%)	46 (46%)

Table II: Comparison of means of lipid parameters before and after the intervention

Lipid Parameter	Before		After	
	Mean	SEM	Mean	SEM
Total CHO*	260.73	3.19	243.42	3.01
TG*	145.81	2.60	138.88	2.58
HDL-CHO*	42.51	0.67	46.32	0.60
LDL-CHO*	218.22	3.23	197.10	3.05
*p-value = < 0.001				

Gender distribution of the study subjects is given in Table I. Table II represents the comparison of the means of lipid parameters before and after the consumption of powdered flax seeds.

Table III: Paired Sample t-test

Pair of Parameter (Before & After)	Paired Differences		p - value
	Mean	SEM	
Total CHO	17.31	1.35	< 0.001
TG	6.33	0.60	< 0.001
HDL-CHO	-3.80	0.34	< 0.001
LDL-CHO	21.12	1.34	< 0.001

Table IV: Paired Sample Correlations

Pair of Parameter (Before & After)	Correlation	Std. Error	p - value
Total CHO	0.906	0.031	< 0.001
TG	0.973	0.012	< 0.001
HDL-CHO	0.858	0.039	< 0.001
LDL-CHO	0.911	0.030	< 0.001

The change in values of lipid parameters before and after the intervention by paired sample 't' test showed to be statistically significant (p<0.001) (Table III). The average decrease in levels of serum total CHO, HDL-CHO and LDL-CHO as well as increase in serum HDL-CHO level was not due to chance variation, and can be attributed to the consumption of powdered flax seeds.

Paired sample correlations of each pairs of lipid parameter are statistically significant (p<0.001) (Table IV), signifies that all changes in each of the lipid parameters were consistent across the subjects, with almost perfect correlation.

DISCUSSION

The amount of lignans and ω-3-fatty-acids present in flax seeds was found to be 9.28 gm/100 gm and 2.5 gm/100 gm respectively. The results found were almost similar when compared with other researchers.(1) WHO recommends daily ALA intake of 0.8-1.1 grams, which can be easily obtained from flax seeds.

In the present study, the average decline in levels of serum total CHO, HDL-CHO and LDL-CHO and improvement in serum HDL-CHO level was not due to chance variation, and can be credited to the consumption of powdered flax seeds. Paired sample correlations of each pairs of lipid parameter are statistically significant (p<0.001), signifies that all changes in each of the lipid parameters were consistent across the subjects with almost perfect correlation.

The decrease in serum total CHO in the present study, is consistent with the observations in previous researches. One of the studies found that daily administration of 100 mg of flaxseed lignan, can be effective in reducing blood CHO levels, in men with a moderately high CHO level.(2)

A small study found that participants with high CHO who followed a low-fat diet and received 20 gm of ground flax seeds daily for 60 days which significantly lowered their levels of TG, total CHO and LDL-CHO, compared to those who followed the diet alone.(3) This study also is in accordance with our findings, but the study subjects in that study were fed low-fat diet. In our study, the similar changes are observed with regular diet.

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Male subjects in a small study experienced increases in TG levels after consuming 32.7 gm of flaxseed daily in muffins for four weeks.(4) This study with increase in TG levels contradicts our findings, where we found consistent decrease in TG levels. But our finding is partially supported by another small study in which consumption of 45 gm of whole flaxseeds daily for 12 weeks increased TG in some participants, lowered them in others and had no effect on a few subjects.(5) In that study, the changes in TG levels seem to be inconsistent across the subjects.

Flax seeds are a rich source of ALA. This is the plant-derived type of ω-3-fatty-acid, which has been shown to lower LDL-CHO, as well as TG levels.

Flax seeds also contain both insoluble and soluble fiber. Soluble fiber is thought to aid in lowering cholesterol, by preventing the absorption of cholesterol within the body. Flaxseed is rich in fiber and provides essential ω-3-fatty-acids, which may help lower cholesterol, make platelets less sticky, decrease the risk of thromboembolic episodes and improve cardiac health.

The soluble fiber and lignans, which are beneficial plant chemicals, in the flaxseeds are most likely responsible for any cholesterol-lowering benefits. But some studies analyzed found no benefit of taking flax seeds for lowering TG, although these seeds have the potential to lower total CHO and LDL-CHO.(6)

Further research needs to be done to unravel the myth surrounding the biological activities and properties of flax seeds.

CONCLUSION

Flax seeds were analyzed to be rich in lignans and ω-3-fatty-acids content. Consumption of grounded flax seeds reduced serum levels of total cholesterol, triglycerides and LDL-cholesterol and increased HDL-cholesterol in the study population.

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