Effects of sesame oil and olive oil on the plasma total cholesterol, low density lipoprotein and high density lipoprotein cholesterol of guineapig

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Abstract: High cholesterol poses a threat to our heart. The levels of cholesterol are highly dependent on what and how much of fatty food we eat. It is a well-known fact that some dietary component increase cholesterol levels in our blood, while others help to decrease cholesterol levels when we eat them with our diet. Propose study was to examine the effects of combined sesame and olive oil as a dietary supplement on hypercholesterolemia Guinea pig for a period of 60 days. When cholesterol elevating food was given to normal Guinea pig first resulted in an increase of plasma total cholesterol by 33.63%, plasma high density lipoprotein cholesterol by 76.76% and plasma low density lipoprotein cholesterol by 61.68%. Administration of sesame and olive oil to hypercholesterolemia Guinea pigs, total plasma cholesterol levels were declined by 19.55%, plasma high density lipoprotein cholesterol levels by 17.79% and plasma low density lipoprotein cholesterol by 32.93%. These beneficial effects of sesame and olive oil on hypercholesterolemia of Guinea pigs appeared to be due to its oleic acid, palmitic acid, linoleic acid, sesamol, sesaminol, fiber, flavonoid content which enhancing the cholesterol excretion, bile acid production and inhibit oxidation of low density lipoprotein cholesterol. The sesame and olive oil are especially rich in mono-unsaturated fatty acids like linoleic acid; oleic acid and palmitic acid which are absorbed in the blood stream and liberated out un-wanted cholesterol. On the other hand, Sesamol and sesaminol are phenolic antioxidants. Antioxidants are known to reduce oxidation of low density lipoprotein cholesterol. Thus the combination of sesame and olive oils are thought to be helpful in maintaining good health or strong heart.

Keywords: Sesame oil, Olive oil, Hypercholesterolemia, Guinea pig.

I. INTRODUCTION

Cholesterol is one of the principal building blocks of the plasma membrane, synthesizes bile acids, vitamin-D and hormones like estrogen, testosterone and progesterone. The cholserols are low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), very low density lipoprotein cholesterol (VLDL-C) and triglycerides. Triglycerides are used to produce energy while LDL-C, HDL-C are the lipoproteins, a combination of fats and proteins that transport fats throughout the blood. Though, it is not found in vegetable oils, is present in animal fats [18]. The fundamental risk factor for the development of coronary artery diseases is an increase of the plasma cholesterol level [30, 16]. High cholesterol levels can slowly clog arteries resulting in stroke although this clogging of arteries takes years to become life threatening. Coronary artery disease is among the major mortality causes in all countries of the world.

Certain nutritional factors appeared to cause elevation of cholesterol level. High cholesterol containing food like pork or beef also appears as cholesterol elevating factor. Literatures show that blood cholesterol decreases following consumption of some plant extracts or plant products. Different investigations carried out on Garlic [13,5,9,27,28,1,6,31], on Sesame [25,21,19,26,23,12,24,20,22,11] and on Olea [17,18,30,7,15,24,10].

Use of plant extract for the treatment of different diseases is an old day practice. There are many plants, which have been successfully administered for different diseases to human and animal. Amazing fact is that, although the plant extracts are in use for treatment of diseases the proper scientific investigations of the folk medicines are still not completed. Most of the folk medicines remain only in believe rather than practical pharmacological application while they surely have specific role in disease treatment. Despite the progress in conventional chemistry and pharmacology in producing effective drugs, the plant kingdom might yet provide useful sources of new medicines. The present investigation is aimed at finding an effective combination of oils produced from...
certain medicinal plants, *Sesamum indicum* and *Olea europea* which could supplement as a therapeutic agent for hypercholesterolemia.

II. MATERIALS AND METHODS

**Collection of animals, olive oil and sesame oil:** Olive and Sesame oil were collected from the local Ayurvedic based pharmacy of Morigaon District, Morigaon, Assam. Nine Guinea pigs of both sexes weighing between 750 -1000 g were collected from the animal house of Morigaon College and used in the experiments which lasted for 60 days. They were housed in plastic cages in the laboratory, Department of Zoology, Morigaon College, Morigaon, Assam. They were given normal food and water and allowed to acclimatize for 10 days before the experiment. After 10-days of adaptation period, Guinea pigs were divided into 3 groups of 3 Guinea pigs each.

**Cholesterol elevating food formula:** Cholesterol elevating food was prepared by mixing 1 g cholesterol and 0.2 g cholic acid with 98.2 g of standard pellet diet. Cholesterol and cholic acid (approximately 95% and 99% purity respectively) were obtained from Sigma-Aldrich (Germany). The high cholesterol diet was prepared daily by dissolving cholesterol in diethyl and cholic acid in methanol and thoroughly coating with these solutions with the pellets.

**Group I** - This group of animals without cholesterol elevating food formula and oil was considered as the control group (they were given normal food).

**Group II** - This group was given cholesterol elevating food formula but no oils as supplement (kept for first 30 days).

**Group III** - Group III was given cholesterol elevating food formula with simultaneous supplement of oils (Guinea pigs received high cholesterol diet + combination of olive and sesame oil). Oils and cholesterol elevating food was given every day at 24 hour intervals (kept for another 30 days).

**Treatment of animals with oil and collection of blood samples:** Guinea pigs had free access to eat and drink throughout the study. During the 60 days period, food and water consumption was monitored daily. Guinea pigs which received the high cholesterol diet enriched with 10% sesame and olive oil for the same period. At the end of 30th and 60th day, one Guineapig from each group was picked up at random and blood samples were collected from ear vein under light ether anesthesia without sacrifice.

**Statistical analysis:** Data obtained from the studies were statistically analyzed. Results were presented as mean, standard error and their differences (in percent) between the means with coefficient of variance (CV, in percent).

**Plasma TC, HDL-C and LDL-C:** Blood samples of Guinea pigs were collected at the beginning (for control) and at the end of the experimental period after 30th and 60th day (for analysis of cholesterol). A quantity of about 10-15 ml. of blood was collected from each Guineapig at the beginning and at the end of the experiment. Serum was separated by centrifugation at 3000 rpm for 10 min. and was stored at -80°C until analysis. Collected blood was used to study the total cholesterol (TC), HDL and LDL cholesterol. TC, HDL-C and LDL-C were assayed using enzymatic end point method by using test kits (collected from Eve’s Inn Diagnostics).

III. RESULTS

A considerable change has been noticed in plasma cholesterol level due to cholesterol administration. The total cholesterol level ranged between 49.23-52.46 mg/dl at normal, 63.34-72.25 mg/dl after 30 days. The HDL-C ranged from 10.75-12.66 mg/dl at normal and it was ranged from 17.56-22.37 mg/dl with an average value of 20.01 mg/dl after 30 days of treatment. LDL-C ranged from 22.05-25.14 mg/dl at normal. LDL-C ranged between 36.71-42.25 mg/dl with an average of 38.74 mg/dl after 30 days of treatment. When treatment was done with high cholesterol diet, plasma TC level was increased by 33.63%, HDL-C increased by 76.76% and LDL-C increased by 61.68% as compared to the control group (Table-1).
High cholesterol content was used in the high cholesterol diet in order to obtain hypercholesterolemia after a short follow-up period. The TC found to range between 52.95-56.08 mg/dl with an average of 54.27 mg/dl, HDL-C ranged between 15.16-18.0 with an average value of 16.45 mg/dl and LDL-C value ranged between 23.25-28.07 mg/dl with an average of 25.98 mg/dl after 60 days of treatment. When the treatment was done with high cholesterol diet enriched with 10% olive and sesame oil, the level of plasma TC was decreased by 19.55%, plasma HDL-C decreased by 17.79% and plasma LDL-C decreased by 32.93% after 60 days of treatment when compared with 30 days. CV is useful when there is a need to test the consistency of several sets of data. The low CV of different sets (2.31%, 5.04%, 2.01%, 6.12%, 7.92%, 5.82%, 2.73%, 5.11% and 4.46%) indicates that the set of data is more consistent (Table-1).

Table-I: Impact of Sesame and olive oils on cholesterol levels of Guineapig. Figures in parentheses indicate percent increase (+) or decrease (−). Table shows range, mean, standard error, differences (%) and coefficient of variance (CV) in percent. Comparisons for the percentage were made between group-I and group-II, between group-II and group-III.

IV. DISCUSSION

LDL-C is considered as bad cholesterol. LDL-C transports the majority of fat throughout the blood. LDL transports cholesterol from the liver to the tissues where it is combined into the cell membranes. HDL-C helps in bile formation, metabolism and the normal functioning of hormones and cells. High levels of LDL-C cause atherosclerosis, a build-up of plaque narrowing the walls of the arteries to the heart and increasing the risk of heart diseases. HDL-C is known as good cholesterol. Good cholesterol works hard to scavenge free radicals and prevent plaque buildup in the arterial walls. It takes old discarded cholesterol away from the arteries to the liver to be processed and eliminated, may also reduce the risk of heart attack or stroke. Low levels of HDL cholesterol may not adequately perform these functions.

This experiment showed that combination of oils aided in the reduction of TC and LDL-C but HDL-C was not affected significantly by the administration of combined oils and cholesterol elevating food. Plants produce an amazing variety of metabolites which have aroused much interest for their role in lipid and antioxidant metabolism. The sesame and olive oil are especially rich in mono-unsaturated fatty acids which help to reduced LDL-C and increase HDL-C in the blood. Present investigation is in conformity with the previous works.

This study on combined effects of sesame oil and olive oil on TC, HDL-C and LDL-C was able to conclude that it is potentially effective in the oxidation of fatty acids and lowering of cholesterol level. Sesame seeds contain two unique substances, sesamin and sesamolin, during refinement the two phenolic antioxidants, sesamol and sesaminol are formed. Both of these substances belong to lignans and have been shown to possess cholesterol-lowering effect in humans. Presumably, the oil contains chemical agents which help in maintaining the blood cholesterol at low level. The oils might be having antilipolytic effects in the body and prevent LDL-C...
from being oxidized. In this study, the observed cholesterol-lowering effects of combinations of sesame oil and olive oil administered to hypercholesterolemic Guineapigs could be related to an increased excretion of cholesterol, neutral sterols and bile acid. Yet these combinations significantly reduced the lipid profiles and improved the body antioxidant capacity of hypercholesterolemic Guineapigs.

REFERENCES


