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Effect of Some Seeds On Hypercholesterolemic Rats

Thesis

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LIST OF FIGURE

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ABSTRACT

The main targest of the present investigation is to study the effect of flaxseed sesame seed ,combination of them and its oils on hypercholesterolemic rats .The rats (n=48) were divided into two main groups. The first main group were fed on basal diet as a control negative.The second main group (42)rats were fed on basal diet containing 1% cholesterol and 0.2% bile salts to induce hypercholesterolemia .The hyperchlesterolemic rats were divided into seven subgroups as followes

(1)Fed on basal diet+1% cholesterol+0.2%bile salts (Positive control),

(2)Fed on hypercholesterolemic diet containing flaxseeds which provide with flax oil (50% from the oil which was added to the diet),.(3) fed on hypercholesterolemic diet containing flax oil (50% from the oil which was added to the diet),(4) fed on hypercholesterolemic diet containing sesame seeds, that provide with 50% from the oil added to the diet. (5) fed on hypercholesterolemic diet containing sesame oil (50% from the oil added to the diet) (6) fed on hypercholesterolemic diet containing combination of (sesame seeds and flaxseeds) provideing with 50% from the oil which added to the diet.**(7)** fed on hypercholesterolemic diet containing 25% sesame oil and 25% flax oil from the oil added to the diet.

Improvement occured in lipid fraction on total cholesterol, triglycerides, high density lipoprotein cholesterol, low density lipoprotein cholesterol, very low density lipoprotein cholesterol,kidney function (uric acid, urea nitrogen),liver function (alanine transferase, aspartate. transferase) when using flaxseed,flaxseed oil , sesame seedsa and sesame seeds oils. The lowest values resulted by using combination of seeds (flax and sesame) and its oils.

Key words: flaxseed, flaxseed oils ,sesame seeds ,sesame seeds oils ,combination of (flax and sesame) seeds and its oils , serum analysis,biological studies,experimental rats.

List of Abbreviation

AA	Arachidonic acid
ALA	Alphalinolenic acid
ALT	Alanine amino transferase
AST	Aspartate amino transferase
BO	Soya bean oil
BWG	Body weight gain
CD	Cadmium
CLA	Conjugated linoleic acid
CO	Canola oil
DHA	Docosahexaenoic acid
dl	Deciliter
DSF	Defatted sesame flour
DSS-ISO	Decorticated sesame seed extracted with isopropanol
EAI	Emulsion activity index
EPA	Eicosapentaenoic acid
ESI	Emulsion stability index
FA	Fatty acids
FC	Foam capacity
FER	Food efficiency ratio
FFA	Free fatty acids
FI	Food intake
Fig	Figure
FLM	Flax seeds meal
FO	Flax oil
FS	Flax seeds
GLC	Gas liquid chromatography
g	Gram
GOT	Glutamic oxalate transaminase
GPT	Glutamic pyruvate transaminase
HDL-C	High density lipoprotein cholesterol
LDL-C	Low density lipoprotien cholesterol
LI	Liter
LN	Linolenic acid
LO	Linseed oil
LSD	Least significant differences
MG	Milligram
MI	Milliliter
MT	Metric tons

PAF	Platelet activating factor
PGE2	Prostaglandin
PL	Phospholipid
PUFA	Polyunsaturated fatty acids
RTR	Renal transplant rejection
SC-CO2	Supercritical carbon dioxide
SD	Standard deviation
SFA	Saturated fatty acids
SLE	Systemic lupus erythematosus
SPI	Sesame protein isolate
SSO	Sesame seed oil
TG	Triglycerides
TNF	Tumor necrosis factor
VLDL-C	Very low density lipoprotein cholesterol
VO	Virgin olive oil
V/V	Volume to Volume
W/V	Weight to Volume

INTRODUCTION

Cholesterol is a soft, waxy substance found among the lipids (fats) in the bloodstream and in all your body's cells. It's an important part of a healthy body because it's used to form cell membranes, some hormones and is needed for other functions. A high level of cholesterol in the blood hypercholesterolemia is a major risk factor for coronary heart disease, which leads to heart attack..**(Garretti and Grisham, 1999).**

Flax (*Linum usitatissimum*) is a good source of alpha-linolenic acid, which is converted to long-chain omega-3 fatty acids. Like fish oils it may help to correct deficiency of these fatty acids and could be useful for those wishing to supplement their diets with a plant source of these nutrients

Many animal and human studies have looked at the role of flaxseed in prevention and treatment of disease, including heart disease, hypertension, inflammatory and autoimmune disease and cancer **(Cunnane *et al*, 1993).**

Flaxseed contains more than 50 per cent alpha-linolenic acid (ALA), one of the two essential fatty acids required by humans, which cannot be made by the body and must be ingested. In ALA there are 18 carbon atoms with three unsaturated bonds, starting at the third carbon atom, which is described by the notation 18:3w3, and ALA is sometimes referred to as an omega-3 (or n-3) polyunsaturated fatty acid (PUFA). The other essential fatty acid is linoleic acid, which is an omega-6 or n-6 fatty acid **(Erasmus, 1997and Simopoulos, 1999).**

The modern, western diet contains a much greater quantity of omega-6 than omega-3 fatty acids, in a ratio of 20–30 to one, although ideally the ratio should be almost equal. Recommendations to replace saturated with unsaturated fatty acids, to improve coronary health, have

contributed to this imbalance. Moreover, because of modern industrial and agricultural practice, the omega-3 content of many foods, including meat, fish, eggs and vegetables, is much lower than before. As a result many people are deficient in omega-3 ALA, which may lead to degenerative disease**(Makrides and Gibson, 2000)**.

In a crossover study, 12g ALA daily as flaxseed oil capsules (taken three times a day) were compared with flaxseed flour (added to foods) in a group of healthy young women. The bioavailability of the ALA was similar in each case and resulted in lowered blood lipids. In addition, although flaxseed is a high caloric food providing 280kcal/50g, over the four-week period, there was no weight gain in the subjects, indicating that other energy sources had been displaced from the diet **(Uauy and Hoffman, 2000).**

Flax *(Linum-usitatissimum)*,is an important annual oilseed crop.It has cultivated for centuries, particulary in Canada, which is the world leader in flax production, followed by India and China being the major producers of flaxseeds by contributing to approximately 60% of its total world production.

Table (a): The cultivated area (1000 HA) of flaxseeds and production of flax oil (1000 MT),in the world and some important countries during the period (2000-2003).

	Area(1000 HA)				**Production(1000 MT)**			
	2000	2001	2002	2003	2000	2001	2002	2003
World	2867	2621	2477	2456	2291	1925	2006	2091
Canada	653	662	633	728	781	715	679	754
India	641	580	536	459	236	204	209	173
China	484	402	400	390	333	253	420	466
Germany	112	33	10	16	159	48	10	10
Egypt	16	17	17	17	30	30	26	26

from:FAO (2003).

Sesame *(Sesmum indicum L)* is one of the first crops processed for oil as well as one of the earliest condiments. The addition of sesame seeds to baked goods can be traced back to ancient Egyptian times from an ancient tomb painting that depicts a baker adding the seeds to bread dough**(Hirata *et al*., 1996).**

According to several studies it could has a positive effect on cholesterol levels. Other studies claim that sesame seed could assist against the ageing of the human body due to the presence of niacin which, for example, cannot be found in soyabeans or rapeseed oil. As an example: In South America, sesame oil is called the "Queen of oils" due to its extraordinary cosmetic qualities, while Armenian turks eat a liquid sesame seed product called "Metahina" which makes reference to the rejuvenation of mental and physical capacities after drinking it. The seeds are also rich in linoleic acid, vitamin E and proteins, as well as calcium and, to some extent, vitamins A, B_1 and B_2. Since sesame oil has such a high level of unsaturated fatty acids (85%), it is assumed that it has a reducing effect on plasma cholesterol, as well having a reducing effect on coronary heart disease. In comparison, sesame seed has more calcium than milk, cheese or nuts**(Sirato *et al*., 2001).**

Sesame *(Sesamum indicum L.)* is one of the oldest cultivated plants in the world. It was a highly prized oil crop of Babylon and Assyria at least 4,000 years ago. Today,Sudan is the world largest producers of sesame, followed by India, China,Nigeria and Mexico .

Table (b): The cultivated area (1000 HA) of sesame seeds and production of sesame oil (1000 MT),in the world and some important countries during the period (2000-2003)

	Area (1000 HA)				**Production(1000 MT)**			
	2000	2001	2002	2003	2000	2001	2002	2003
World	7190	7468	6771	6566	2892	3184	2966	2942
Sudan	2020	1880	1588	850	291	262	269	122
India	1650	1671	1385	1940	588	698	431	620
China	747	759	759	751	787	805	896	826
Nigeria	149	153	166	166	71	74	75	75
Mexico	65	71	37	44	38	43	20	23
Egypt	29	29	28	28	35	35	35	35

from:FAO (2003).

AIM OF STUDY

This study is carried out to investigate the following :

1- Determination of the chemical composition of two kinds of Egyptian oil seeds, sesame and flax .

2- Effect of diet containing flaxseeds and it's oil on food intake, body weight gain and food efficiency ratio, organs to body weight ratio, lipid fraction, liver and kidney functions in hypercholesterolemic rats.

3- Effect of diet containing sesame seeds and it's oil on food intake, body weight gain and food efficiency ratio, organs to body weight, lipid fraction, liver and kidney function in hypercholesterolemic rats.

4- Effect of diet containing a combination of (flaxseeds and sesame seeds) and it's oils on food intake, body weight gain and food efficiency ratio, organ to body weight ratio, lipid fraction, liver and kidney functions in hypercholesterolemic rats.

2-REVIEW OF LITERATURE

2.1CHOLESTEROL

Cholesterol is a wax-like substance. The liver makes it and links it to carry proteins called lipoproteins that let it dissolve in blood and be transported to all parts of the body. Cholesterol play essential roles in the formation of cell membranes, some hormones, and vitamin D **(Manson and Stampfer, 2001).**

Scanu (1992) cleared that the two main types of lipoproteins basically work in opposite directions :

Low-density lipoproteins (LDL) carry cholesterol from the liver to the rest of the body. When there is too much LDL cholesterol in the blood, it can be deposited on the walls of the coronary arteries. Accordingly LDL cholesterol is often referred to as the "bad"cholesterol.

High-density lipoproteins (HDL) carry cholesterol from the blood back to the liver, which processes the cholesterol for elimination from the body. HDL makes it less likely that excess cholesterol in the blood will be deposited in the coronary arteries, which is why HDL cholesterol is often referred to as the "good" cholesterol.

In general, the higher your LDL and the lower your HDL, the greater your risk for atherosclerosis and heart disease.

For adults age 20 years or over, the latest guidelines from the National Cholesterol Education Program recommend the following optimal levels:

- Total cholesterol less than 200 milligrams per deciliter mg/dl)
- HDL cholesterol levels greater than 40 mg/dl
- LDL cholesterol levels less than 100 mg/dl

Willett *et al* .,(1993) found that several factors affect blood cholesterol levels:

- Heredity--High cholesterol often runs in families. Even though specific genetic causes have been identified in only a minority of cases, genes still play a role in influencing blood cholesterol levels.
- Weight--Excess weight tends to increase blood cholesterol levels. Losing weight may help lower levels.
- Exercise--Regular physical activity may not only lower LDL cholesterol, but it may increase levels of desirable HDL.
- Age and gender--Before menopause, women tend to have total cholesterol levels lower than men at the same age. Cholesterol levels naturally rise as men and women age. Menopause is often associated with increases in LDL cholesterol in women.
- Stress--Studies have not shown stress to be directly linked to cholesterol levels. But experts say that because people sometimes eat fatty foods to console themselves when under stress, this can cause higher blood cholesterol.

2.2 Chemical composition of flaxseeds and sesame seeds :

Chemical composition of flaxseeds

Stitt (1988) demonstrated that flax is also a rich source of nutritionally complete protein, minerals and fiber; both soluble and insoluble. One of the drawbacks to flax is the low zinc content and the anti-b-6-factor. This situation can cause problems in feeding studies, because if not corrected, it can affect the utilization of the essential fatty acids. Adding 100 ppm of vitamin B-6 and 200 ppm of Zinc Sulfate will correct these deficiencies. Several feeding studies are underway using flax fortified at these levels, and good growth rates are being observed in chickens and pigs. We have observed very small increases over time in the peroxide level with the flax that is fortified with Zinc and B-6. Other