# A comparative study between olive oil and *Nigella Sativa* oil in treatment of hyperlipidemia induced in male albino mice

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## Summary

This study was conducted on 20 adult mice divided randomly into 4 equal groups. The first group served as negative control (NC) that received the diluent (sun flower oil), while hyperlipidemia was induced in the other three groups; the second group received the diluent and was considered as positive control (PC), while groups three and four were treated with olive oil (OO) or *Nigella sativa* oil (NSO) at a dose of 0.4ml/kg BW given orally, respectively for two months. At the end of experiment and fasting overnight, lipid profile which included total cholesterol TC, triglyceride TG, high density lipoprotein cholesterol HDL-C, low density lipoprotein cholesterol LDL-C and very low density lipoprotein cholesterol VLDL-C) were measured. The results indicated significant ($P<0.05$) improvement in all these parameters as compared to the positive control, while the value of HDL-C was significantly higher in the olive oil treated group as compared with all groups including negative control group.

**Keywords: hyperlipidemia, olive oil, *Nigella sativa* oil, mice.**

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## Introduction

Substances derived from plants remain the basis for a large proportion of commercial medications used in the treatment of various ailments. Towards these, research is carried out on plant materials for their potential value (1) Hyperlipidemia or hyper lipoproteinemia involves abnormally elevated levels of any or all lipids and/or lipoproteins in the blood (2).

It is the most common form of dyslipidemia (which includes any abnormal lipid levels). Lipids (fat-soluble molecules) are transported in a protein capsule. The size of that capsule, or lipoprotein, determines its density. The lipoprotein density and type of apolipoproteins it contains determines the fate of the particle and its influence on metabolism. Hyperlipidemias are divided in primary and secondary subtypes. Primary hyperlipidemia is usually due to genetic causes (such as a mutation in a receptor protein), while secondary hyperlipidemia arises due to other underlying causes such as diabetes (3). Lipid and lipoprotein abnormalities are common in the general population, and regarded as a modifiable risk factor for cardiovascular disease due to their influence on atherosclerosis. In addition, some forms may predispose to acute pancreatitis. Olive oil is a fat obtained from the olive (the fruit of Olea europaea; family Oleaceae), a traOlive oil is composed mainly of the mixed triglyceride esters of oleic acid and palmitic acid and of other fatty acids, along with traces of squalene (up to 0.7%) and sterols (about 0.2% phytosterol and tocosterols). The composition varies by cultivar, region, altitude, time of harvest, and extraction process. Preliminary clinical studies provide evidence that consumption of olive oil may lower risk of heart disease risk factors such as lower blood cholesterol levels and reduced LDL cholesterol oxidation (4) and that it may also possibly influence inflammatory, thrombotic, hypertensive and vasodilator mechanisms. (5) Although epidemiological studies indicate that a higher proportion of monounsaturated fats in the diet, it may be linked with a reduction in the risk of coronary heart disease (6).

*Nigella sativa* has a pungent bitter taste and smell. It is used primarily in confectionery and liquors. Peshawari naan is, as a rule, topped with *kalonji* seeds. Nigella is also used in Armenian string cheese, a braided string cheese called Majdouleh or Majdouli in the Middle East.Thymoquinone, found in the seed oil extract of *N. sativa*, has been shown to

have anti-neoplastic effects in rats and mice and in cultured human cells from several types of cancer, including pancreatic ductal adenocarcinoma. It has protective antioxidant and anti-inflammatory effects, and promotes apoptosis (cell death) of the cancer cells (7). This study was conducted to evaluate the therapeutic value of olive oil or *Nigella sativa* oil in treatment of experimentally induced hyperlipidemia in male mice.

## Materials and methods

The olive oil and *Nigella sativa* oil were extracted mechanically from original sources and the dose of olive oil (0.4 mg/Kg BW) was estimated according to (8) and the same dose was used for *Nigella sativa* oil in order to compare the efficacy of both remedies. Twenty male albino mice were used, their aged range 8-10 weeks and weighed about 24-30g, they were kept in a suitable environmental condition of 20-25$^{o}$C. The animals were fed standard pellet diets throughout the adaptation period of all groups, at the beginning of experiment hyperlipidemic diet were prepared by addition of 1% cholesterol in diet and 0. 5% $H_2O_2$ in drinking water (9) that was given to all groups for two months except negative control group.

Blood samples were taken from mice which were for determination of lipid profile, mice were fasted over night and blood sample were collected at the end of experiment, blood was drawn via cardiac puncture technique from anesthetized mice and the test carried out (10). The determination of lipid profile which is a group of blood tests determined by enzymatic method for detection TC and TG by using kits which were supplied by Linear Chemicals Company, and separation method for HDL-C (11) while LDL-C and VLDL-C were calculated by fried Wald formula (12).The statistical analysis was basis of one way analysis of variance (ANOVA) using significant level at ($P<0.05$).The statistical analysis was made by using least significant differences (LSD) for determination the differences among means of different groups (13).

## Results and discussion

The oral administration of OO or NSO at a dose 0.4 ml/kg B.W. for two months exerts hypocholesterolemia (decrease TC and LDL-C) and hypotriglycerimic effect and significant increase in good cholesterol (HDL-C) in OO treated group in comparison to all groups. Table, 1 demonstrates the mean values of serum cholesterol concentration (mg/dl) in male mice. There has been a significant decrease ($P<0.05$) in groups NC,OO and NSO as compared with PC after two months of treatment with mean value of (106.63±2.49, 235.56±17.12, 160.32±3.74 and 165.08±6.68) for group NC, PC, OO and NSO respectively. In the mean values of serum TG concentration (mg/dl) in the two treated and control groups, there was a significant ($P<0.05$) decrease in all groups compared to positive control group with mean values of, 78.67±0.45,125.09±2.39 and 125.46±1.33 in groups NC, OO and NSO respectively compared to that of PC (140.86±3.77) (Table, 1). The data pertaining to the serum (HDL-C) concentration of the control groups and treated groups have been showed in (Table.1). Statistical analysis revealed that the mean values of serum (HDL-C) (mg/dl) of male mice of the treated OO group tended to increase with a significant ($P<0.05$) difference in comparison with the other groups with the mean values of (61.53±0.88 in OO,59.58±1.01 NSO and 58.23±0.48 in NC) comparing to PC (41.17±0.40).There was a significant ($P<0.05$) decrease in the mean values of serum LDL-C concentration of all groups (NC, OO, NSO) comparing to PC. The mean values (mg/dl) were (32.60±2.11, 166.01 ±16.91, 73.38±4.25 and 80.41±6.03) for groups NC, PC, OO and NSO respectively (Table, 1). The concentrations of serum VLDL-C in male mice of different groups was clarified in (Table, 1). The results showed that the mean values of VLDL-C (mg/dl) in all groups were significantly decreased at $P<0.05$ compared with PC group at the end of two months treatment. The mean values of VLDL-C were (15.73±0.09, 28.17±0.75, 25.01±0.47 and 25.09±0.26) for groups NC, PC, OO and NSO respectively.

**Table, 1: The lipid profiles test parameters of different male mice groups after two months**

| Lipid profile of groups | Total cholesterol mg/dl | Triglyceride mg/dl | HDL-C mg/dl | LDL-C mg/dl | VLDL-C mg/dl |
|---|---|---|---|---|---|
| Negative control group( NC) | 106.63±2.49 C | 78.67±0.45 C | 58.23±0.48 B | 32.60±2.11 C | 15.73±0.09 C |
| Positive control group(PC) | 235.56±17.12 A | 140.86±3.77 A | 41.17±0.40 C | 166.01±16.91 A | 28.17±0.75 A |
| Olive oil treated group (OO) | 160.32±3.74 B | 125.09±2.39 B | 61.53±0.88 A | 73.38±4.25 B | 25.01±0.47 B |
| *Nigella sativa* treated group(NSO) | 165.08±6.68 B | 125.46±1.33 B | 59.58±1.01 B | 80.41±6.03 B | 25.09±0.26 B |

**n=5 P<0.05 Different letters refer to significant differences among groups.**

It is found that the consumption of OO increase HDL-C levels (14) which is the same result of present study. Preliminary clinical studies provide evidence that the consumption of OO may lower blood cholesterol levels and reduce LDL-C oxidation. In other studies (15 and 16) showed that the daily intake of virgin OO could reduce susceptibility of LDL-C to oxidation, which was similar to the results in the current study.

There are many studies of using NSO in treatment for different diseased conditions. It is noticed that Nigella sativa has cholesterol-lowering effect by reduceding TC,LDL-C, TG levels and hence HDL-C (17 and 18) which have the same results of the present study. However NSO did not show the similar result on HDL-C level; also NSO may have protective antioxidant effect on LDL-C(7)and lipid lowering potential(19).Treatment with NSO decreased TC, TG, LDL-C and with no significant increase in HDL-C(20 and 21) which was the same result seen in the current study. There was a lowering effect of OO and NSO to lipid profile (TC, TG, LDL-C and VLDL-C) and the increase in HDL-C in OO treated group however this effect on HDL-C not to be noticed with NSO treated group.

These results may be due to the presence of monounsaturated fatty acid oleic acid, vitamin E and oleuropein in OO (22), the high monounsaturated fatty acid and phenolic compounds which may responsible for antioxidant effect of OO (23). IN other study the presence of phenolic compounds such as hydroxytyrosol and oleuropein in extra virgin OO has a powerful antioxidants both *in vivo* and *in vitro* (24). Also the presence of omega 3 in OO will decrease TG. NSO decreases also lipid profile (TC, TG, LDL-C and VLDL-C) because the presence of monounsaturated fat and phenols. NSO contains abundance of conjugated linoleic acid, thioquinon and nigellon (dithymoquinone) which are the reason of the protective antioxidant effect.

In conclusion, the present study found that slight difference sexisted between treatment with OO and NSO especially in HDL-C level. This may be due to the differences in concentrations of phytochemicals such as saturated fats, trans fat, omega 3, 6 and 9, monounsaturated fatty acid and sterols or stanols that present in each one.

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# دراسة مقارنة بين زيت الزيتون وزيت الحبة السوداء في علاج فرط الدهنية المستحدث في ذكور الفئران المهقاء

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## الخلاصة

اجريت الدراسة الحالية على عشرين فأراً بالغاً قسمت عشوائياً الى اربعة مجاميع متساوية. اعتبرت المجموعة الاولى مجموعة سيطرة سالبة جرعت المخفف (زيت عباد الشمس) بينما تم استحداث فرط الدهنية بالدم في المجاميع الثلاثة الاخرى، اعتبرت المجموعة الثانية سيطرة موجبة جرعت المخفف، اما المجموعتين الثالثة والرابعة فقد جرعت بزيت الزيتون او زيت الحبة السوداء بجرعة(0.4 ملغم/كغم من وزن الجسم ) لمدة شهرين. وفي نهاية التجربة صومت الحيوانات لليلة واحدة و تم قياس معايير الدهون في الدم والتي تضمنت (الكوليستيرول الكلي والكليسيريدات الثلاثية و البروتينات الدهنية عالية الكثافة والبروتينات الدهنية الواطئة الكثافة والبروتينات الدهنية الواطئة الكثافة جداً). تستنتج الدراسة الى وجود تحسن ملحوظ على مستوى احتمالية اقل من (0.05) في جميع المعايير السابقة الذكر مقارنة بمجموعة السيطرة الموجبة، بينما كانت قيمة البروتينات الدهنية العالية الكثافة مرتفعة بصورة معنوية في المجموعة المعاملة بزيت الزيتون مقارنة بجميع المجاميع بضمنها مجموعة السيطرة السالبة.

**الكلمات المفتاحية: فرط الدهنية، زيت الزيتون، زيت الحبة السوداء، الفئران.**