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ORIGINAL ARTICLE

The Effect of Grape Seeds Oil on Lipid Content of Serum in Rats

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ABSTRACT
Grape seed extracts are industrial derivatives from whole grape seeds that have a great concentration of vitamin E, flavonoids, linoleic acid and phenolic OPCs. The typical commercial opportunity of extracting grape seed constituents has been for chemicals known as polyphenols having antioxidant activity in vitro.The aim of present study was to evaluate the effect of grape seeds oil on LDL, HDL, cholesterol, TG and VLDL of serum in rats.In this study, 20 male Wistar rats (220–250 g and 2-3 month age) were selected for the study and divided into four equal groups: group1; normal control which were received standard diet during the experiment, group 2, 3 and 4 were treatment groups which received grape seeds oil at a dose of 100mg/kg daily besides of standard diet for 1, 4 and 8 weeks, respectively. Grape seeds oil was given to animals through gastric gavage.
After mentioned periods, blood samples were obtained and serum was isolated through centrifuge at the 3000 RPM for 5 minutes. The mentioned parameters were measured using the available kits and spectrophotometry. LDL and VLDL were calculated using formula. In present study, the serum levels of GLC was constant, it shows that the metabolism pathway of oil doesn't involve GLC. Also, data showed that grape seeds oil yield to decrease in TG after 8 weeks treatment but its value in 8 weeks control groups was increased significantly. Cholesterol levels in 8 weeks control group was significantly higher than other groups. VLDL and LDL showed no significant difference during the study. HDL showed significant increase 2 month after treatment with grape seeds oil. In conclusion can be state that GEO is good replacement than other oil sources because of decreasing the TG and cholesterol and increasing the HDL.
Keywords: *GSO, LDL, HDL, VLDL, TG, Cholesterol, GLC, RAT.*

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INTRODUCTION

In chemistry, and especially in biochemistry, a fatty acid is a carboxylic acid with a long aliphatic tail (chain), which is either saturated or unsaturated. Most naturally occurring fatty acids have a chain of an even number of carbon atoms, from 4 to 28 [1]. Fatty acids are usually derived from triglycerides or phospholipids. When they are not attached to other molecules, they are known as "free" fatty acids. Fatty acids are important sources of fuel because, when metabolized, they yield large quantities of ATP. Many cell types can use either glucose or fatty acids for this purpose. In particular, heart and skeletal muscle prefer fatty acids. Despite long-standing assertions to the contrary, the brain can use fatty acids as a source of fuel [1,2] in addition to glucose and ketone bodies.

Low-density lipoprotein (LDL) particles are specialized lipid transport vehicles in the blood. They are formed in the circulation during an endogenous metabolic cascade of apolipoprotein B-100 (apoB-100)-containing lipoproteins [3]. This cascade originates in the hepatic secretion of very-low-density lipoprotein (VLDL) particles, then proceeds as a sequential metabolic continuum in the blood, where lipoprotein particle transformations are mediated by the actions of various lipolytic enzymes and lipid transfer proteins, and reaches its completion by generation of LDL particles. By providing cholesterol to peripheral tissues, the LDL particles are the key components in physiological cholesterol metabolism [3,4]. Hepatic LDL receptors remove LDL particles from the circulation, so tending to ensure that the concentration of circulating LDL particles remains at a physiologically relevant level [3]. However, elevated blood plasma concentrations of the LDL particles, whether of genetic or environmental origin, will attenuate the functioning of the LDL receptor pathway and enhance the influx of LDL particles into the arterial wall where the particles become trapped, modified, and thereby are converted to initiators and major players in the vicious circle of inflammation and lipid accumulation characteristic of atherogenesis [5,6,7]. Thus, LDL particles function at the interface between physiological and pathophysiological pathways of lipoprotein and lipid metabolism [8,9,10].

All lipoprotein particles share a common structure as micellar complexes with an amphipathic surface monolayer and a hydrophobic lipid core [8,10,11,12]. Importantly, lipoprotein particles are biologically functional only in their native state in an aqueous environment. LDL particles consist of a single copy of an apoB-100 molecule and ~3,000 individual lipid molecules, some present on the surface and some in the core of the particle. Of the LDL lipids, the most abundant and structurally most important are the ~1,600 cholesteryl ester (CE) molecules present in the core of each particle [10,11,12]. The oily lipid core is surrounded by a monolayer of phospholipids composed mainly of phosphatidylcholine and sphingomyelin, and of unesterified cholesterol molecules. The apoB-100, again, wraps around the surface of the LDL particle. It interacts with a fraction of the surface lipids, partially penetrates the phospholipid monolayer, and so may reach the outer core of the particle and interact with the lipids of this deeper layer of LDL as well [11].

Use of medicinal plants in medicine is increasing because of their widespread use and for their curing various diseases. Grape seed is well known for its pharmaceutical properties including; anti-inflammatory, immunomodulatory activity, arcaricadal property, antipruritic effect, treatment of gastrointestinal disorders, antimicrobial activity, lipid and stress loweringeffect, anti-allergic activity, antisolar agent.

Table 1 lists a typical fatty acid composition of grape seed oil [13]. Grape seed oil also contains 0.8 to 1.5% unsaponifiables rich in phenols (tocopherols) and steroids (campesterol, beta-sitosterol, stigmasterol) [14]. Grapeseed oil contains small amounts of vitamin E, but safflower oil, cottonseed oil, or rice bran oil contains greater amounts [15]. Grapeseed oil is high in polyunsaturates and low in saturated fat; it also does not contain cholesterol or trans-fatty acids.The aim of present study was to evaluate the effect of grape seeds oil on LDL, HDL, cholesterol, TG and VLDL of serum in rats.

Table 1: list of fatty acids exist in grapes seed oil

Acid	Type	Percentage
Linoleic acid	ω−6unsaturated	69.6%
Oleic acid	ω−9unsaturated	15.8%
Palmitic acid(Hexadecanoic acid)	Saturated	7%
Stearic acid(Octadecanoic acid)	Saturated	4%
Alpha-linolenic acid	ω−3unsaturated	0.1%
Palmitoleic acid(9-Hexadecenoic acid)	ω−7unsaturated	less than 1%

MATERIALS AND METHODS

In this study, 20 male Wistar rats (220–250 g and 2-3 month age) were selected for the study and were purchased from Animal House, Islamic Azad University and randomly divided into four equal groups: group1; normal control which were received standard diet during the experiment, group 2, 3 and 4 were treatment groups which received grape seeds oil at a dose of 100mg/kg daily besides of standard diet for 1, 4 and 8 weeks, respectively [16]. Grape seeds oil was given to animals through gastric gavage.

Animal care and experiments confirmed with the Guide for the Care and Use of Laboratory Animals of China and approval of the ethics committee of Islamic Azad University was obtained before the commencement of the study. The animals were housed under standard environmental conditions (23±1°C, with 55±5% humidity and a 12 h light/12 h dark cycle) and maintained with free access to water and a standard laboratory diet *ad libitum*. After mentioned periods, blood samples were obtained and serum was isolated through centrifuge at the 3000 RPM for 5 minutes. The mentioned parameters were measured using the available kits and spectrophotometry. LDL and VLDL were calculated using formula.

The Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA), version 13.0, was used for statistical analysis. All data are presented as mean ± SEM. Before statistical analysis, all variables were checked for normality and homogeneity of variance by using the Kolmogorov-Smirnoff and Levene tests, respectively. The data obtained were tested by ANOVA followed by Tukey's post-hoc multiple comparison test. $P<0.05$ was considered statistically significant.

RESULTS

In present study, the serum levels of GLC was constant, it shows that the metabolism pathway of oil doesn’t involve GLC. Also, data showed that grape seeds oil yield to decrease in TG after 8 weeks treatment but its value in 8 weeks control groups was increased significantly. Cholesterol levels in 8 weeks control group was significantly higher than other groups. VLDL and LDL showed no significant difference during the study. HDL showed significant increase 2 month after treatment with grape seeds oil (table 2).

Table 2: data obtained from groups during the study

Groups / Parameters	Control		Treatment		
	Initial	8 weeks	1 week	4 weeks	8 weeks
GLC	101.67±0.33 [a]	103.25±2.21 [a]	109.75±1.88 [a]	107.50±13.06 [a]	102.33±9.50 [a]
TG	80.67±0.88 [a]	107.00±15.27 [b]	81.75±6.76 [a]	90.75±15.26 [a]	73.67±8.98 [c]
Cholesterol	98.67±1.45 [a]	120.50±2.98 [b]	100.75±9.63 [a]	90.25±10.00 [a]	109.67±2.84 [a]
HDL	60.33±0.88 [a]	680.00±2.94 [a]	59.75±2.75 [a]	63.50±6.88 [a]	77.83±5.28 [b]
LDL	22.10±0.37 [a]	18.92±3.01 [a]	24.65±9.41 [a]	18.85±4.28 [a]	14.36±3.54 [a]
VLDL	16.13±0.17 [a]	20.60±2.94 [a]	16.35±1.35 [a]	18.15±3.05 [a]	17.63±2.91 [a]

Dissimilar letters show the significant difference at level 0.05.

DISCUSSION

In present study, we examine the effect of methanolic extract of grape seeds on biochemical parameters of blood. Results from this study show that in treated group, triglyceride and cholesterol level had a meaningful decrease (P<0.05) and HDL level had a meaningful increase (P<0.05) which is compatible with the results of Ganjali [17].

Researches in recent years by Yassa, Puiggros and saad also address to ability of grape seed extract to increase anti-oxidative defense and to control damages resulted from oxidative stresses. They point to presence of flavonoids as an essential factor in extract structure and suppose it probable that Proanthocyanidin compounds existing in grape seed extract are among effective factors in incidence of anti-oxidative properties [18,19,20]. In one study by Asadi showed that serum cholesterol values showed a trend to decrease in grape seed oil, corn oil and yogurt butter groups compared to the control [21]. Optional intake of yogurt butter made a significant increase in HDL-C values (42.34+/-9.98 mg/dL) yet decrease in LDL-C values (11.68+/-2.06 mg/dL) compared to the corresponding control (19.07+/-3.51; 30.96+/-6.38 mg/dL, respectively). Furthermore, such findings were concomitant with a significant decrease in the liver TC levels (1.75+/-0.31 mg/g liver) and an increase in the muscle TC levels (1.85+/-0.32 mg/g liver) compared to the corresponding control (2.43+/-0.31; 0.94+/-0.14 mg/g liver, respectively). They concluded that optional intake of manually prepared yogurt butter has more beneficial effects on serum lipoprotein cholesterol values with some alterations in the liver and muscle cholesterol states than the vegetable oils.

These results confirm the in vitro activity of GSO, indicating that acute antihyperlipidemic activities of GSE may act through inhibition of lipid digestion and absorption. Interestingly, it has been reported that long-term supplementation of GSO reduces plasma lipid profiles and prevents a high-fat diet-induced obesity in hamster and related metabolic pathways by improving adipokine secretion and oxidative stress [22]. The supplemented with proanthocyanidin-rich extract from grape seed inhibits progression of atherosclerosis in cholesterol-fed rabbits. This mechanism of action is related to prevention of Low density lipoprotein (LDL) oxidation in the arterial wall diet [23].

El-Adawi showed that silymarin decreased the elevation of TC, HDL-C, LDL-C, TG, suggesting the hepatoprotective effect of silymarin [24]. The antihypercholesterolemic effect of silymarin was associated with liver cholesterol reduction [25], which improves cholesterol uptake from blood [26]. They also showed that oral administration of proanthocyanidins from grape seed produced a hypocholesterolemic effect in a high cholesterol animal feed model; specifically it prevented an increase in total and LDL plasma cholesterol [27]. These findings are confirmed by Yousef who showed that administration of G combined with cisplatin has reduced the level of cholesterol when compared with cisplatin group [28]. The significant decrease in the elevated levels of cholesterol in rats receiving G prior to cisplatin indicated the ability of G to counteract cisplatin-induced toxicity. Regarding the current study, G reduced the levels of elevated TC and LDL-C in comparison with that of FB1-gp which confirms the previous results and might be explained by Tebib who demonstrated the protective effect of grape seed tannins against plasma cholesterol and LDL-cholesterol, then they hypothesized that tannins through their antioxidant properties would exert a beneficial effect against oxidant stress [29]. That fin-ding was supported by Natella who reported that oligomeric proanthocyanidins supplementation resulted in decreased lipid peroxidation, increased plasma antioxidant levels, and improved resistance of LDL to oxidation in volunteers consuming a lipid-rich test meal [30]. El-Adawi reported that G-supplemented diet exhibited an obvious hypolipidemic effect in rats fed on high cholesterol diet [27]. G could reduce the TC, LDL and

TG in G pre and post treated groups. The hypolipidemic effect of G may result from increasing the rate of cholesterol catabolism by increasing the activity of hepatic cholesterol 7-a-hydroxylase enzyme. This enzyme is the rate-limiting enzyme of bile acid biosynthesis, thus suggesting that G could stimulate the conversion of cholesterol to bile acids, an important pathway of elimination of cholesterol from body [31]. The water-soluble antioxidant, pro-anthocyanidins in the G might trap reactive oxygen species (ROS) in aqueous series such as plasma thereby inhibiting oxidation of LDL. In conclusion can be state that GEO is good replacement than other oil sources because of decreasing the TG and cholesterol and increasing the HDL.

REFERENCES

1. Ebert D, Haller RG, Walton ME (2003) Energy contribution of octanoate to intact rat brain metabolism measured by 13C nuclear magnetic resonance spectroscopy. *The Journal of neuroscience: the official journal of the Society for Neuroscience* 23(13):5928–35.
2. Marin-Valencia I, Good LB, Ma Q, Malloy CR, Pascual JM (2012) Heptanoate as a neural fuel: energetic and neurotransmitter precursors in normal and glucose transporter I-deficient (G1D) brain. *Journal of Cerebral Blood Flow & Metabolism* 33(2):175–182.
3. Brown MS, Kovanen PT, Goldstein JL (1981) Regulation of plasma cholesterol by lipoprotein receptors. *Science* 212:628–35.
4. Hegele RA (2009) Plasma lipoproteins: genetic influences and clinical implications. *Nat Rev Genet* 10:109–121.
5. Williams KJ, Tabas I (1998) The response-to-retention hypothesis of atherogenesis reinforced. *Curr Opin Lipidol* 9:471–474.
6. Hevonoja T, Pentikäinen MO, Hyvonen MT, Kovanen PT, Ala-Korpela M (2000) Structure of low density lipoprotein (LDL) particles: basis for understanding molecular changes in modified LDL. *Biochim. Biophys. Acta.* 1488:189–210.
7. Pentikäinen MO, Öörni K, Ala-Korpela M, Kovanen PT (2000) Modified LDL - trigger of atherosclerosis and inflammation in the arterial intima. *J Intern Med* 247:359–370.
8. Steim JM, Edner OJ, Bargoot FG (1968) Structure of human serum lipoproteins: nuclear magnetic resonance supports a micellar model. *Science* 162:909–911.
9. Öörni K, Pentikäinen MO, Ala-Korpela M, Kovanen PT (2000) Aggregation, fusion, and vesicle formation of modified low density lipoprotein particles: molecular mechanisms and effects on matrix interactions. *J Lipid Res* 41:1703–1714.
10. Kumpula LS, Kumpula JM, Taskinen MR, Jauhiainen M, Kaski K (2008) Reconsideration of hydrophobic lipid distributions in lipoprotein particles. *Chem Phys Lipids* 155:57–62.
11. Prassl R, Laggner P (2009) Molecular structure of low density lipoprotein: current status and future challenges. *Eur Biophys J* 38:145–158.
12. Segrest JP, Jones MK, De Loof H, Dashti N (2001) Structure of apolipoprotein B-100 in low density lipoproteins. *J Lipid Res* 42:1346–1367.
13. Kamel BS, Dawson H, Kakuda Y (1985) Characteristics and composition of melon and grape seed oils and cakes. *Journal of the American Oil Chemists' Society* 62(5):881–883.
14. Oomah BD, Liang J, Godfrey D, Mazza G (1998) Microwave Heating of Grapeseed: Effect on Oil Quality. *J. Agric. Food Chem.* 46(10):4017–4021.
15. Herting DC, Drury EJE (1963) Vitamin E Content of Vegetable Oils and Fats. *J. Nutr.* 81:4017–4021.
16. Adisakwattana S, Moonrat J, Srichairat S, Chanasit C, Tirapongporn H, Chanathong B, Ngamukote S, Mäkynen K, Sapwarobol S (2010) Lipid-Lowering mechanisms of grape seed extract (Vitisvinifera L) and its antihyperlidemic activity. *Journal of Medicinal Plants Research* 4(20):2113-2120.
17. Ganjali Z, Javadian F, Estakhr J, Heidari A (2012) Anti-Lipidimic and Anti-Hyperglycemic Properties of Methanolic Extract of Grape Seed in Diabetic rats. *International Journal of Animal and Veterinary Advances* 4(3):173-175.
18. Yassa N, Beni HR and Hadjiakhoondi A (2008) Free Radical Scavenging and Lipid Peroxidation Activity of the Shahani Black Grape. *Pak J BiolSci* 11(21):657-661.
19. Puiggròs F, Sala E, Vaqué M (2009) In Vivo, in Vitro, and in Silico Studies of Cu/Zn-Superoxide Dismutase Regulation by Molecules in Grape Seed Procyanidin Extract. *J Agric Food Chem.* 57(9):3934-42.
20. Saad AA, Youssef MI, and El-Shennawy LK (2009) Cisplatin induced damage in kidney genomic DNA and nephrotoxicity in male rats: The protective effect of grape seed proanthocyanidin extract. *Food Chem Toxicol* 47(7):1499-1506.
21. Asadi F, Shahriari A, Chahardah-Cheric M (2010) Effect of long-term optional ingestion of canola oil, grape seed oil, corn oil and yogurt butter on serum, muscle and liver cholesterol status in rats. *Food ChemToxicol.* 48(8-9):2454-7.
22. Décordé K, Teissèdre PL, Sutra T, Ventura E, Cristol JP, Rouanet JM (2009) Grape-seed procyanidins prevent low-grade inflammation by modulating cytokine expression in rats fed a high-fat diet. *Mol. Nutr. Food Res.* 53:659-666.
23. Yamakoshi J, Kataoka S, Koga T, Ariga T (1999) Proanthocyanidin-rich extract from grape seeds attenuates the development of aortic atherosclerosis in cholesterol-fed rabbits. *Atherosclerosis* 142:139-149.
24. El-Adawi H, El-Azhary D, Abd El-Wahab A, El-Shafeey M, Abdel-Mohsen M (2011) Protective effect of milk thistle and grape seed extracts on fumonisin B1 induced hepato- and nephro-toxicity in rats. *Journal of Medicinal Plants Research* 5(27):6316-6327.

25. Krecman V, Skottova N, Walterova D, Ulrichova J, Simanek V (1998) Silymarin inhibits the development of diet-induced hypercholesterolemia in rats. *Planta Med.* 64:138-142.
26. Steinberg D, Pathasarathy S, Carew TE, Khoo JC, Witztum JL (1989) Modifications of low-density lipoprotein that increase atherogenicity. *N. Engl. J. Med.* 320:915-924.
27. El-Adawi H, Abdel Mohsen M, Youssef D, El-Sewedy S (2006) Study on the Effect of Grape Seed Extract on Hypercholesterolemia: Prevention and Treatment. *Int. J. Pharm.* 2:593-600.
28. Yousef MI, Saad AA, El-Shennawy LK (2009) Protective effect of grape seed proanthocyanidin extract against oxidative stress induced by cisplatin in rats. *Food Chem. Toxicol.* 47:1176-1183.
29. Tebib K, Besancon P, Rouanet JM (1994) Dietary grape seed tannins affect lipoproteins, lipoprotein lipases and tissue lipids in rats fed hypercholesterolemic diets. *J. Nutr.* 124:2451-2457.
30. Natella F, Belelli F, Gentili V, Ursini F, Scaccini C (2002) Grape seed proanthocyanidins prevent postprandial oxidative stress in humans. *Agric. Food Chem*. 50:7720-7725.
31. Del Bas JM, Fernandez-Larrea J, Blay M, Ardevol A, Salvado MJ, Arola L, Blade C (2005) Grape seed procyanidins improve atherosclerotic risk index and induce liver CYP7A1 and SHP expression in healthy rats. *FASEB* 19:479-481.

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