ORIGINAL ARTICLE

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

Ali Pilehvar¹, Bahram Amoogli Tabrizi², Afshin Javadi³
1- Student Of Veterinary Medicine, Faculty Of Veterinary Medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran
2- Department Of Clinical Science, Faculty Of Veterinary Medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran
3- Department Of Food Hygiene, Faculty Of Veterinary Medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran

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 components 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.

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 cycle 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 cholesterol 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, treatment of gastrointestinal disorders, antimicrobial activity, lipid and stress lowering effect, anti-allergic activity, antisolarm agent.

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, treatment of gastrointestinal disorders, antimicrobial activity, lipid and stress lowering effect, anti-allergic activity, antisolarm 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>
<thead>
<tr>
<th>Acid</th>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linoleic acid</td>
<td>ω-6unsaturated</td>
<td>69.6%</td>
</tr>
<tr>
<td>Oleic acid</td>
<td>ω-9unsaturated</td>
<td>15.3%</td>
</tr>
<tr>
<td>Palmitic acid(Hexadecanoic acid)</td>
<td>Saturated</td>
<td>7%</td>
</tr>
<tr>
<td>Stearic acid(Octadecanoic acid)</td>
<td>Saturated</td>
<td>4%</td>
</tr>
<tr>
<td>Alpha-linolenic acid</td>
<td>ω-3unsaturated</td>
<td>0.1%</td>
</tr>
<tr>
<td>Palmitoleic acid(9-Hexadecenoic acid)</td>
<td>ω-7unsaturated</td>
<td>less than 1%</td>
</tr>
</tbody>
</table>

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: group 1; 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.

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

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>8 weeks</td>
<td>Initial</td>
</tr>
<tr>
<td>GLC</td>
<td>101.67±0.33 a</td>
<td>103.25±0.21 a</td>
</tr>
<tr>
<td>TG</td>
<td>80.67±0.98 a</td>
<td>107.00±15.27 a</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>86.72±1.45 a</td>
<td>120.50±2.98 b</td>
</tr>
<tr>
<td>HDL</td>
<td>60.3±0.88 a</td>
<td>680.00±2.94 a</td>
</tr>
<tr>
<td>LDL</td>
<td>22.10±0.97 a</td>
<td>18.92±3.01 a</td>
</tr>
<tr>
<td>VLDL</td>
<td>16.13±0.17 a</td>
<td>20.60±2.94 a</td>
</tr>
</tbody>
</table>

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, Puiggrós 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 hypcholesterolemic 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 finding 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


**Citation of This Article**