

## **Physicochemical properties of two type of shahrodi grape seed oil (Lal and Khalili)**

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### **ABSTRACT**

*The present investigation was designed to evaluate the physicochemical properties of two type of Shahrodi grape seed oil (Lal and Khalili) which extracted by Soxhlet methods and petroleum ether as solvent. The physicochemical properties considered as response variables were: cloud percentage of extraction, peroxide value, acidity, soapy number, fatty acid and non soapy material. The results indicated that Lal grape seed oil showed the lower peroxide value and higher percent of oil extraction than Khalili grape oil. The results of this study indicated that the most content fatty acid in the seed oils of Lal and Khalili grape was linoleic acid, ranging from 63.17 % and 65.39 % of total fatty acids respectively. Also, The grape seed oils were contained low level of saturated fatty acid and high percentage of oleic acid and which are healthy and have beneficial effect on reducing cholesterol level.*

**Key words:** Grape seed oil, Peroxide value, Soapy number, Acidity, Fatty acid profile.

### **INTRODUCTION**

Grape (*Vitis vinifera*) is one of the most important of fruit and according to the FAO it was produced about 58 million metric tons annually [1], and its production was increased. Its production was over 67 million metric tons in 2005. The history of grape planting in Iran, back about 2000 years before Christ with 252197 hectares, 75% farmland for farming the grape in the world and Iran is the sixth country [2]. About 80% of the grape production is used in juice-making, and also in this process seeds and grape skins remained as by- product which was formulated for an animal feed [3]. Nowadays the investigation on grape seed has been increasing since its positive effects on human health [4].

Poly-unsaturated fatty acids are necessary for the body of human since they cannot be synthesized in the human's body. Grape seed oil (GSO) is suitable source of essential fatty acid. Grape seeds are containing about 14–17% of oil. The main importance in GSO is high concentration of unsaturated fatty acids such as linoleic acid (72–76%, w/w), which exceeds those in corn oil (52%), sunflower oil (60–62%) and safflower oil (70–72%). Also, GSO contains high concentration of tannins, i.e. oligomeric proanthocyanosides at 1000-fold upper than other oils. For this reason GSO has high stability and resistant to oxidation reaction. GSO has shown different pharmaceutical activities, like as regulation of autonomic nerve, reduction of cholesterol and of cardiovascular diseases and therefore its very suitable source of oil for elderly people and infants [5]. GSO is free of cholesterol. Previous studies have shown that if daily intake of GSO raised up to 45 g the HDL-Cholesterol content increased about 13% and

decreased LDL-cholesterol percent about 7% in three weeks [6]. Moreover GSO contains tocopherols which are the most important natural antioxidants and also have vitamin E activity [5]. Therefore GSO is one of the most important sources of vitamin E and contains rather high level of tocotrienols and tocopherols in the limit of 1–53.06 mg of vitamin E/100 g of oil [7]. Therefore, due to these unit properties of GSO, it's commercialized as a food ingredient in food industry, pharmaceutical applications and for cosmetic. Therefore, due to the unique attributes of grape seed's oil and high rate of production of grape seed, it needs more attention on this production. According to the previous studies the physico-chemical properties of different grape seed oil varieties has shown different results [2], [7], [8], [9]. The purpose of this study was to compare the physico-chemical properties of two different kinds of shahrood's grape, Khalili and Lal grape.

## MATERIALS AND METHODS

### Methods of preparing of samples

It is study two types of varieties of Shahrood's grape (Lal and Khalili grape) were kindly donated by grape farmers in Shahrood (Iran, Shahrood). Then all samples, separately, were milled and their oil extracted by the method of Soksleh and use of petroleum ether solution at 90°C for 6 hours.

### Methods

Peroxide value was done according to AOAC standards NO. 965.33.[10]. The present of acidity was done according to National standard. No: 4178. Refract index was done according to national standard NO. 5108. The soapy number was done according to national standard. No: 4888. Iodine number was done according to national standard NO. 5108.[11] In order to determine amount of fatty acids compounds all experimental samples were methyled according to AOAC standard No. 969.33 and then in order to examination of fatty acid compound it used according to AOAC standard NO. 940.28.[10] It was used Gas chromatography Model, Youglin 6000 equipped with a flame ionization detector (FID) and 60 m column. The carrier gas was hydrogen. Injection temperature 250°C, Program temperature 150°C, for 5 minutes and increasing of temperature with 5°C in per minute was until 175°C and keeping it for 35 minutes.

### Data Analysis

Data collected from the aforementioned study samples were analyzed based at 0.05% coefficient of error. The data analysis was performed using MINITAB statistical software, release 14.2 (MINITAB Inc., state college, PA and USA).

## RESULTS AND DISCUSSION

Table 1 are presented the percentage of oil extraction and physicochemical properties of the two variety of GSO including cloud density, refract index, acidity, peroxide value, iodine number, soapy number and non soapy material. The most significant differences between these two varieties of extracted oils were peroxide value and extraction efficiency.

The peroxide values of extracted oils from grape seeds of lal Shahrodi variety were lower than those oils extracted from grape seeds of Khalili Shahrodi types. Whereas the peroxide is the first product from oxidation of oil and its presence in oil shows that beginning of oxidation which is very undesirable. Therefore less peroxide value shows the better quality of oil. According the results of this research the peroxide value for lal Shahrodi GSO with 9.30 meq/kg was significantly ( $p \leq 0.05$ ) lower than the peroxide value for Khalili Shahrodi GSO with 10.63 meq/kg. Therefore the GSO of extracted from Lal Shahrodi grape seed is more desirable than GSO of extracted from Khalili Shahrodi grape seed.

The results of this research showed that the oil extraction efficiency of lal Shahrodi grape seeds with 23.14% significantly ( $p \leq 0.05$ ) were higher than oil extraction efficiency of Khalili Shahrodi grape seeds with 18.3%. Therefore the oil extraction of lal Shahrodi grape seed variety was more economic than extracted oil from Khalili grape seed variety.

Iodine number shows the saturation value of oils, therefore by increase of iodine number, the number of double bounds in oil decreased. Khalili GSO show a little higher iodine number than Lal GSO, but this difference was

significant ( $p \leq 0.05$ ). According to Codex Alimentarius, (2001), the limit of acceptable of iodine number is 128-150, therefore both of extracted oils are shown acceptable of iodine number [12].

As refract index shows the quality of oil, the value of this index will increase by increase of compounds with higher molecular weight in oil and oxidation reaction. During oxidation process some initial compounds produce such as Peroxides, Aldehyds, Kentons, and Alcohols. These compounds can combine with each other and produce some compounds with high molecular weight which caused to increase of refract index and density.

The results of this study showed that the level of refract index and density for Khalili Shahrodi GSO is 1.473 and 0.924 respectively and it was a little more than Lal Shahrodi GSO but they didn't have significant difference statically ( $p \leq 0.05$ ), this results may be due to more oxidative reaction in the Khalili Shahrodi. Also refract index of both experimental samples were according to international standard [12].

The acidity of Khalili Shahrodi GSO are not shown significant different ( $p \leq 0.05$ ) with Lal Shahrodi GSO, and the acidity of both of GSO was more than acceptable rate of national standard and this difference was higher in Khalili Shahrodi Grape oil.

There was no significant difference ( $p \leq 0.05$ ) between Khalili Shahrodi GSO and Lal Shahrodi GSO about soapy and non soapy material and also the values of soapy and non soapy material for both of experimental oils were matched with national standard. The results of our study were consistence with Gomez *et al.* (1996), [8]. According the results of Table 2, the total percentage of saturated fatty acids for both of oils were below 15 %, while unsaturated fatty acids totaled 87.78% and 92.04 for Lal Shahrodi GSO and Khalili Shahrodi GSO respectively.

Fatty acid profile of Lal Shahrodi and Khalili Shahrodi grape seed oils are summarized in Table 2. The results of Table 2 showed that the linoleic acid was the most abundant fatty acid in Lal Shahrodi GSO and Khalili Shahrodi GSO, with 63.17 % and 65.39% of total fatty acids respectively. After linoleic acid the concentration of oleic acid with levels of 23.19% and 25.10% for Lal Shahrodi GSO and Khalili Shahrodi GSO respectively were higher than other fatty acids. After linoleic and oleic acid, the palmitic acid and stearic acid had high concentration.

**Table 1: chemical properties of two different grape seed oil**

Chemical properties	Grape Lal Shahrodi	Grape Khalili Shahrodi	Acceptable limit <sup>c</sup>
Oil extraction (%)	23.14 ± 2.02 <sup>a</sup>	18.3 ± 3.98 <sup>b</sup>	-
Density	0.919 ± 0.02 <sup>a</sup>	0.924 ± 0.12 <sup>a</sup>	
Acidity (%)	0.61 ± 0.07 <sup>a</sup>	0.67 ± 0.05 <sup>a</sup>	Max 0.6
Peroxide value (meq/kg)	9.30 ± 4.65 <sup>a</sup>	10.63 ± 1.30 <sup>a</sup>	Max 10
Iodine number	123.55 ± 7.45 <sup>a</sup>	126.13 ± 9.02 <sup>a</sup>	128-150
Soapy number (mg KOH/gr)	190.02 ± 6.18 <sup>a</sup>	187.5 ± 8.06 <sup>a</sup>	188-194
Non soapy material	1.43 ± 1.02 <sup>a</sup>	1.47 ± 0.12 <sup>a</sup>	Max 2
Refract index (40 <sup>o</sup> c)	1.470 ± 0.01 <sup>a</sup>	1.473 ± 0.02 <sup>a</sup>	1.467-1.477

<sup>a-b</sup> significant difference between column at confidence level of  $p < 0.05$ .

<sup>c</sup> (Codex Alimentarius, 2001)

**Table 2: fatty acid profile of two different grape seed oil**

Fatty acid (%)	grape Lal Shahrodi	grape Asgari Shahrodi	Acceptable limit <sup>b</sup>
C14:0	0.05 ± 0.01 <sup>a</sup>	0.09 ± 0.01 <sup>a</sup>	0 - 0.3
C16:0	8.92 ± 1.21 <sup>a</sup>	9.01 ± 0.97 <sup>a</sup>	5.5 - 11
C16:1	0.36 ± 0.02 <sup>a</sup>	0.42 ± 0.07 <sup>a</sup>	0 - 1.2
C17:0	0.10 ± 0.03 <sup>a</sup>	0.12 ± 0.01 <sup>a</sup>	0 - 0.2
C17:1	0.07 ± 0.01 <sup>a</sup>	0.08 ± 0.01 <sup>a</sup>	0 - 0.1
C18:0	4.21 ± 0.77 <sup>a</sup>	4.33 ± 0.31 <sup>a</sup>	3 - 6.5
C18:1	23.19 ± 2.14 <sup>a</sup>	25.10 ± 1.92 <sup>a</sup>	12 - 28
C18:2	63.17 ± 4.05 <sup>a</sup>	65.39 ± 6.14 <sup>a</sup>	58 - 78
C18:3	0.78 ± 0.07 <sup>a</sup>	0.82 ± 0.06 <sup>a</sup>	0 - 1
C20:0	0.24 ± 0.01 <sup>a</sup>	0.21 ± 0.04 <sup>a</sup>	0 - 1
C20:1	0.21 ± 0.05 <sup>a</sup>	0.23 ± 0.03 <sup>a</sup>	0 - 0.3
C22:0	0.9 ± 0.01 <sup>a</sup>	0.12 ± 0.02 <sup>a</sup>	0 - 0.3
C24:0	0.03 ± 0.01 <sup>a</sup>	0.04 ± 0.01 <sup>a</sup>	0 - 0.1

<sup>a</sup> significant difference between column at confidence level of  $p < 0.05$ .

<sup>b</sup> (Codex Alimentarius, 2001)

These results this research were similar with the finding of previous studies which investigated on two type of Shahrodi grape oil (red and Fakhri), and their result has shown that the values of linoleic, oleic, palmitic and stearic acid acid were 60.16-64.90%, 22.29-20.70%, 9.66-7.36% and 3.7-4.70% in the two variety of grape seed oil respectively [2].

Previous studied have reported lower or higher content of fatty acids as compared with our findings depending on seed origin, variety and method of oil extraction. Lutterodt et al. (2011) [9] have been shown higher linoleic acid and lower oleic acid content for grape seed oil ( ruby red variety). The results of our research are shown that there are significant differences between grape seed oils composition from different origin and varieties.

### CONCLUSION

During of grape juice process was produces high level of fruit seeds. That its oils has suitable source of essential and other health-benefitting fatty acids. Chemical and physicochemical characterization of grape seed oil was presented in this work. The results of the profiles of fatty acid, indicated that two main fatty acid, in GSO were linoleic and oleic acid which are essential fatty acids for body and less volume of saturation acid rather other oils, therefore has beneficial effect of human health. So the use of this oil is suggested as plant oil in daily diets.

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