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Characteristics and Composition of Grape Seed Oil

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ABSTRACT

Grape seed oil is rich in phenolic compounds, fatty acids and vitamins which have high economic, and importance. It is used as an edible oil due to its beneficial properties for health, that are detected by many studies, such as anticancer, cardio protective and protective effect against cellular toxicity, induced by the environmental pollutants such as carbon tetrachloride (CCL_4) . This pollutants generates free radical may cause a damage of the liver which is responsible for the metabolism of drugs and chemical toxic. The aim of this study was to detect the chemical composition of oil extracted from grape seeds (medium solvent) and antioxidant potential of oil by mixing with milk by product namely skim milk. Include the ameliorative effect against oxidative damage in cells induced by CCL_4. The results of revealed that the extracted grape seed oil is rich in unsaturated fatty acids and low concentrations of saturated ones. Also, the resulting oil has a high antioxidant capacity incorporate with the product namely skim milk. In addition the incorporate of oil with skim milk has a prophylactic effect against the toxicity induced in liver by CCL_4. On the other hand, enhance the activity of antioxidant enzymes namely Glutathione and Glutathione-S-Transferees. And antioxidant prosperity is claimed by a food model to be one of the mechanism of natural and hepato protective antioxidant.

Keywords: grape seeds, oils, antioxidant, antioxidant activity, antioxidant activity (DPPH), fatty acids

INTRODUCTION

Grapes (*Vitis vinifera* L .) are a second fruit crop in the Arab Republic of Egypt after citrus as the grape crop is one of the main fruit crops, with a cultivated area of 200 thousand feddans according to the 2018 statistics. The oil is rich in unsaturated fatty acids, in particular linoleic acid Schieber *et al.*, (2002).

Grape seeds of are important wastes of large quantities which are not used and rich in its content of essential fatty acids and antioxidants, which can be used in human nutrition and treatment of many diseases.

Grape and its products have been consumed for a long time. The studies have demonstrated an inverse association between intake of grape and its products and mortality from age-related diseases such as coronary heart diseases Xia *et al.*, (2010). The health benefits of grapes are thought to arise mainly from bioactivities of their polyphenols. Anthocyanins, flavonoids and resveratrol from polyphenols are the major functional components that are responsible for most of biological activities of grape. The grape and its main components of anthocyanins, flavonoids and resveratrol have a variety of bioactivities, such as antioxidant, cardioprotective, anticancer, anti-inflammation, anti-aging and antimicrobial activities, which are closely related to the prevention against disease and promotion of health, making greater potential for grape in the field of food and pharmaceutical application Georgiev *et al*., (2014).

Consumption of grapes and grape products can positively affect cardiovascular health risk factors, cancer, neurodegenerative diseases, and age-related cognitive decline. These effects are often attributed to the antioxidant activity and function of flavonoids present in grapes in addition to other measures such as increased nitric oxide production and this is reported by Vislocky *et al*., (2010). Due to the increasing demand for vegetable oils and their consumption and insufficient local production of edible oils, which necessitates to import of large quantities of oil to fill the gap, so it was necessary to search for new sources of non-traditional food oils and benefit from them. Of addition, more attention should be paid to minor components of grape because special pharmacodynamic effects could be found from minor components. The structural diversities and pronounced biological activities of compounds in grape indicate that grape are worthy of further studies that may lead to the identification of new functional constituents. The antioxidants from grape will widely be employed to prevent and treat these diseases in association with reactive oxygen species, such as atherosclerosis, coronary heart diseases and cancer Li *et al*., (2019). According to the preceding view, this study aims to take advantages of these residues from grape juice plants and extracted oil from them as well as antioxidants and identify to their natural and chemical properties.

Therefore, this study was conducted to evaluate the antioxidant potential of grape oil based on milk by product namely skim milk emulsion against the environmental pollutants. Also, that our approach will be suggested as screening technique in food supply chain for the suitability of grape oil (as healthy oil)in functional of formulation edible oil.

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MATERIALS AND METHODS

Material

Source of grape seed oil :-

Grape seed samples were collected after the Juice of grape process at Ganaklis factory in Beheira governorate, one of the factories of Al Ahram Beverage Company, a local industry

Samples were washed twice in distilled water, dried, milled, stored in refrigerator and protected from light until extraction and analysis.

Chemicals

The used solvents; methanol (Me OH), ethanol (Et OH), chloroform ($CHCl_3$), acetone (Ac), ethyl acetate, were obtained from the El-America Company, Cairo, Egypt. All solvents used were HPLC grade and produced by Merck (Darmstadt, Germany). All of these solvents were stored at 4ºC.

Methods

Extraction of oil grape seeds :-

The grape seeds freed (elaborated) from husk and other impurities, the extraction of grape seed oil ware carried outaccording the method described in AOAC, (2005)

Determination of antioxidants of grape seed oil combined with Skim Milk :

Determination of fatty acids :

The fatty acid profiles of the grape seeds oil were determined as methyl esters by gas liquid chromatography. according to AOAC, (2011).

the Antioxidant Activity (DPPH) Radical Scavenging Activity Assay of grape oil based on skim milk :-

Grape oil extracted antioxidant activity was subjected to the (DPPH) Radical Scavenging Activity Assay according to (Yen and Duh,1994)

RESULTS AND DISCUSSION

It is well known that wasted grape seeds contain simple sugars, carbohydrates, protein and crude oil. Crude oil ranges from 8-15%, according to Bravi *et al*., (2007), also containing 13-19% oil. Crews *et al*., (2006) reported that grape seeds belong to a category containing 8% To 15% of the oil.

Fatty acid composition of grape seed oils :-

The results in table (1) showed that grape seed oil contains a high percentage of unsaturated fatty acids, the highest one is linoleic acid (65.3%), which is the highest value in edible oils, oleic acid (23.4%) and linolenic acid (0.21%). Stearic acid 3.7%, and myristic acid was 0.08%, palmatic acid was 6.50%, palmitolic acid was 0.2%, and arshodic acid was 0.55% respectively.

Table 1. Fatty acid composition, saturated and unsaturated fatty acids :

Chemical name	Numeric code	Concentration%
Myristic acid	C_{14} : 0	0.08
Palmtic acid	C_{16} : 0	6.50
Palmitoloic acid	C_{16} : 1	0.2
Stearic acid	C_{18} : 0	3.7
Oleic acid	C_{18} : 1	23.4
linoleic acid	C_{18} : 2	65.3
linolenic acid	C_{18} : 3	0.21
Arachidic acid	C_{20} : 0	0.55

the previous Data inducted that the main fatty acids of grape seed oil were, linoleic, olic and linolenic acids. which had the higer amounts in gravy sodalist The content of linoleic acid (65.3 %). This quantity is very close to the data reported by Natella *et al*., (2002) and Beveridge *et al*., (2005). Whereas, a higher intake of "good" fats (monounsaturated) is associated with decreased risk of coronary heart disease caused by high cholesterol levels in the blood (Corbett, 2003). In addition the Data presented in table (1) showed that the major saturated fatty acids of grape seed oil were, palmitic (C16:0), stearic (C18:0), arachidic (C20:0), representing about 11.03% of total fatty acids, of which palmitic C16:0 was the dominant acid with the value of 6.50 %.

Evaluation of antioxidant activity of grape seed oil by (DPPH) Radical Scavenging assay :

Recently Interest has recently increased in the free radical theory of disease causation, particularly in vascular diseases certain forms of cancer geriatric diseases. A free radical is defined as any chemical species that has one or more unpaired electrons Ramadan *et al*., (2009).

In this study, illustrated that the antiradical properties of the grape seed oil were compared to that of (TBHQ) using stable 1,1-diphenyl-2-picryhidrazyl (DPPH) radicals. Table (2) shows the obtained data concerning the activity of oil combined with skim milk emulsion at concentration 0.1,0.25 and 0.5 mg/mL comparing with control (+ve) . The obtained data revealed that the total antioxidant activity (TAA) of oil , protein skim milk (S.M) and mixture were equivalent to 35.6 , 51.6 and 80 % at inhibition ratio concentration of 0.5 mg /ml respectively. The previous trend of data proved that the incorporation of skim milk with grape oil caused an increase in the antioxidant activity of the suggested emulsion from 35.6 and 51.60 to 80 % in the comparison with both oil and skim milk respectively . Also, the results revealed that this emulsion could be an suitable a adjunct supplemented diet. In addition as a natural ingredients in enhancing antioxidant properties of functional food processing.

Table 2. The antioxidant activity of grape seed oil combined with skim milk.

	Inhibition %		
Compound	**0.1mg/ml**	**0.25mg/ml**	**0.5mg/ml**
grape seed oil	24.4±0.9	24.5±1.3	35.6±1.6
Skim milk	39.8±0.5	43.2±1.2	51.6±1.1
Emulsion (grape seed oil+skim milk)	53.5±4.6	9.7±2.6	80±0.7

Three replicates of mean ± SD., control
***corresponding to positive control = 0.78±**

Oxidative stability of vegetable oils depends on their fatty acid composition, the presence of minor fat-soluble bioactives and the initial amount of hydroperoxides Ramadan, (2009). The radical scavenging activities for oils and fats can be interpreted as the combined action of different internal antioxidants. However, when non-degradable substances and polar fractures, which mainly contain tocopherol, sterols, polar fats, and low levels of phenols, are found at high levels, strong RSA for these components in addition to synergistic activity with primary antioxidants and this can be expected What sikka *et al.*, (2001). there is a balance between the different antioxidant and oxidants at normal status. Oxidative stress is developed when oxidants outnumber antioxidants and peroxidation products occur, these may cause pathologic effects.

Gul *et al*., (2004) found that Reactive Oxygen Species to have potential toxic effect sat high levels, so when the production of ROS exceeds the available antioxidant defense, significant oxidative damage occurs to many cellular organelles by damaging lipid, proteins and DNA. It opens to be clear that ROS are crucial in the generation of adverse CCl_4 side effects. It is not known which the main effective antioxidant enzymes have the greatest activity in the removal of CCl_4 induced ROS. Thus, the determination of the oxidative stress and ROS – associated enzymes in the experimental animal model upon the proposal emulsion plus CCl_4 was the aim of the present section. The aforementioned antioxidant enzymes namely, glutathione (GSH) and Glutathione-s-transferees (GST) are an important antioxidant in animals. Glutathione is capable of preventing damage to important cellular components conceal. In addition GST activity showed positive correlation with lipid peroxidation, an indication that it plays a role in oxidant defense. This is consistent with what Olayan and others have reported Al-Olayan *et al*., (2014)

By reactive oxygen species such as free radicals, lipid peroxides. It is reduced from (GSH) a glutamic acid, cysteine and glycine, service as a reducing agent in many biochemical reactions, being converted to oxidized glutathione (GSSG). Also, Glutathione-s-transferases (GSTS) enzymes that act in excretion of xenobiotic substances and protecting cells against chemical toxicity and stress. This is consistent with what Olayan and others have reported Lushchak, (2012).

Our results revealed that intoxication of rats upon CCl_4 (G2) caused a significant elevation ROS and MDA values. Table (3) and Fig. (1) and (2) represent the protective effect of both emulsion and pharmaceutical product on the toxicity induced by CCl_4 on rats. The dose of CCl_4 (0.5) oral dose twice/week) concede a remarkable decease in the content of GST (iu) and GSH (mu) level in G2. From 4.00 and 43.11 to 2.65 and 16.33 respectively in the comparison with –ve control after 4 weeks of lineaments. An increase was found to be 5.09 and 43.4 in the content of GST and GSH upon the manipulation with emulsion compared with (-ve) control.

Concerning the effect of pharmaceutical product (G4), results showed that a modulated effect in GSH and GST were 39.01 and 4.09 respectively in the comparison with +ve control group (2), it can be seen from the recorded data that, to some extent a similar trend of results for emulsion and pharmaceutical products was noticed.

Table 3. The protective effect of both emulsion and pharmaceutical product on the toxicity induced by CCl_4 on rats

Group	Parameters	
	GSH(mM)	GST(IU)
control (- ve)	43.11 ±0.44	4.00±0.1
G2 + ve CCl_4	16.33 ± 0.69 a	2.65±0.03 a
G3+ ve + oil+skim milk	43.4± 0.34 b	5.09±0.13 b
G4 +ve + pharmaceutical product	39.01 ± 0.55 ab	4.09±0.04 b

Data are expressed as mean ± for 6-rats/group
a significant from control group with one-way ANOVA at $p < 0.05$.
b significant from CCl_4 group with one-way ANOVA at $p < 0.05$.

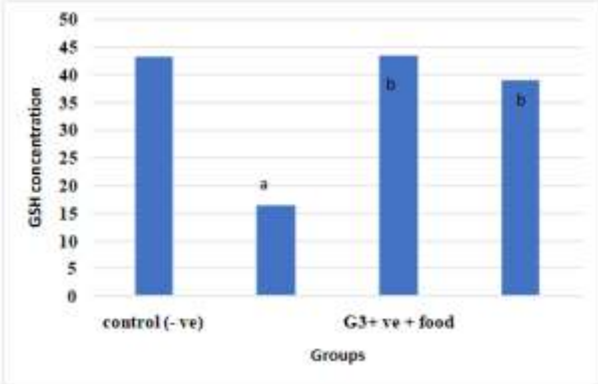

Fig .1. The protective effect of both emulsion and pharmaceutical product on the toxicity induced by CCl_4 by measuring the level of GSH.

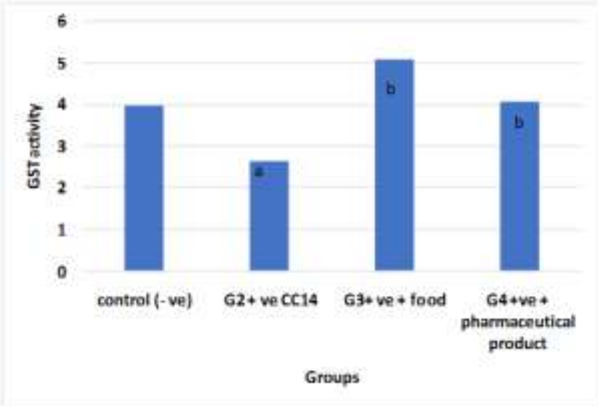

Fig .2. The protective effect of both emulsion and pharmaceutical product on the toxicity induced by CCl_4 by measuring the level of GST.

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صفات ومكونات زيت بذور العنب

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زيت بذور العنب غني بالمركبات الفينولية والأحماض الدهنية والفيتامينات ذات الاهمية الاقتصادية والغذائية العالية حيث يتم استخدامه كزيت صالح للأكل بسبب خصائصه المفيدة للصحة والتي تم اكتشافها من قبل العديد من الدراسات مثل خصائصه كمضاد للسرطان وعلاج أمراض القلب وتأثيره الوقائي ضد السمية الخلوية الناجمة عن الملوثات البيئية مثل رابع كلوريد الكربون التي تعمل علي توليد اصول حرة تسبب تلف الكبد, لذلك كان الهدف من الدراسة هو الكشف عن التركيب الكيميائي للزيت بعد استخلاصه بواسطة المذيبات ودمجه مع الحليب الخالي من الدسم بسبب خصائصه المضادة للأكسدة ضد التاثيرالناتج عن رابع كلوريد الكربون . كشفت نتيجة الاستخلاص إن زيت بذور العنب غنى بالأحماض الدهنية غير غيرالمشبعة وتركيزات منخفضة من الأحماض الدهنية المشبعة ووجد أن الزيت الناتج لدية قدرة عالية كمضاد للأكسدة مع المنتج الثانوي0 بالإضافة إلى أن دمج الزيت مع الحليب الخالي من الدسم له تأثير وقائي ضد السمية التي يسببها رابع كلوريد الكربون في الكبد. من ناحية أخرى تعزيز نشاط إنزيمات مضادات الأكسدة وهي الجلوتاثيون و الجلوتاثيون-S- ترانسفريز كان ملحوظا. ويدعي أن النجاح المضاد للأكسدة بواسطة نموذج غذائي هو أحد آليات مضادات الأكسدة الطبيعية والوقائية للكبد