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EVALUATION OF GRAPE (*Vitis vinifera* L.) SEEDS AS A NEW SOURCE OF EDIBLE PROTEIN AND OIL FOR HUMAN NUTRITION

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ABSTRACT

The present investigation was aimed to utilize of grape seeds (*Vitis vinefera* L.) as a new and untraditional source of edible protein and oil for food purposes. Chemical composition of whole grape seeds, nutritional value of grape seed protein and physico-chemical properties of grape seeds oil were studied. The results reveal that, grape seeds were a good source of diatery fiber (48.53%), carbohydrates (27.77%), protein (9.17%), oil (11.72%) and ash (2.81%). Seeds contained tannins 16.96 mg catechin/g. sample. Grape seeds are considered to be a good protein source because it was rich in some indispensable amino acids (33.73%) such as leucine, valine and isoleucine as well as, high in protein efficiency ratio (C-PER) and biological value (BV) compared with the FAO (1985) of school and child requirement patterns and casein protein. So, it could be concluded that grape seeds meal can be used as a food additives for some foods such as to bakery products or ground meat formulations to improve its properties. Grape seeds oil had a high content of unsaturated fatty acids (81.94%). Linoleic acid (61.93%) was the predominant fatty acid followed by oleic acid (17.80%). Also, it contained a moderate amount of saturated fatty acids (18.60%). Palmitic acid was (9.63%) followed by stearic acid (6.05%). Grape oils, had the same sunflower oil thermal stability during frying process for 2hrs. Sensoric properties for fried potato chips in grape oil were relatively equal to that fried in sunflower oil, and accepted by paneltests.

Generally, it could be concluded that grape seeds oil had an excellent dietetic properties and could be used in the food industries

INTRODUCTION

Food processing wastes had became an important factor and a serious sanitary problem that need to be studied. Recently, some efforts have been introduced for converting these materials into valuable products (Seleim *et al*., 1999; Owon and Kassab, 2001; Salem *et al*., 2002; Al-Barrak El-Adawy, 2005 and Zein *et al*. 2005).

Grape seeds obtained as waste materials from the canning and wine processing industries for oil production.

In Europe grape seeds account for 20-26% of the pomace, which is considered as a valuable by-product of oil extraction and as a source of protein for animal feed and tannins production (Kamel *et al*., 1985). While, El-Bastawesy *et al*. (2007) reported that grape seeds are considered to be rich source of edible oil with high natural antioxidants compounds and could be used in the food industries.

Utilization of the by-products of the canning industry such as grape, tomato and orange seeds to produce oil and protein became a partial solution to this problem (Tarandzhiiska and stamenov, 1989 and Igartuburu *et al*. 1991). Fazio *et al*. (1983) conducted studies on isolation of protein from grape seed meal, while Licher and Stamenov (1988) described the technological scheme of protein hydrolysate from grape seeds. Chorbanov *et al*. (1989) produced powered enzyme protein hydrolysates with good sensory properties from defatted grape seed meal.

There is no doubt that the demand of conventional edible oil will be increased as a result of population growth. Therefore, current work is necessary to evaluate unconventional new sources of edible oils. The industrial utilization of these oil seeds as source of oil and protein or protein food supplements is no existent. (Olaofe, 1994).

The grape seeds were a good source of dietary fiber (48.60%), oil (12.69%) and protein (9.15%). The oil seeds stayed liquid at room temperature and contained high amount of unsaturated fatty acids (79.23%) and low saturated fatty acids (20.77%). Moreover, it had an excellent dietetic properties and could be used in salad, margarine, mayonnaises and canned foods manufacture (Galan *et al*. 1986).

Grape seeds contained high amount of crude oil (15.30%), which contained high concentration of linoleic acid (67.0%) making it useful for food application (Hirose and Iwama, 1986).

Grape seeds had high content of oil (14.94%) and the chemical properties of extracted oil in the normal range of edible oil. Furthermore, it contains a large amount of unsaturated fatty acids (80.158%) especially, essential fatty acids and linoleic acid (Omega 6) was the predominant fatty acid (56.33%) which reflect the nutritional value of this oil (El-Bastawesy *et al*., 2007).

Therefore, the present work was carried out to evaluate the grape seeds as unconventional sources for edible protein and oil.

MATERIALS AND METHODS

Materials :

Grape fruits (*Vitis vinifera*) “Romi Red grapes” were obtained from privete orchard near from Kafr El-sheikh City during seasons 2005-2006. The seeds were separated manually from grape fruits, washed with tap water, sun dried for 2 hours. The dried seeds were ground in a laboratory mill to pass through a 60-mesh sieve. The ground seeds were stored in tight polyethylene bags at -20°C until used..

Methods :

Physical properties of whole grape seeds:

Weight and volume of 1000 seeds and bulk density were measured according to Kramer and Twigg (1962). Seed dimensions (mm) were estimated using the average of length and thickness of 25 seeds as described by Adair *et al*. (1973).

Grape oil extraction :

Ground grape seeds oil were extracted as given by Folch *et al*. (1957) using a mixture of chloroform /methanol (2:1, v/v) as a solvent to seeds ratio of 20:1. The solvent seeds mixture was homogenized for 5 min. The mixture was filtered and filtrate was evaporated to dryness on a rotary evaporator. The obtained oil was kept in brown glass bottles at 4°C until analysis.

The remained flour, defatted grape seeds meal, was dried under vacuum until disappearance of the solvent odour and stored in phyethylene bags at 4°C until analysis.

Gross chemical composition of grape seeds :

Moisture, crude oil, crude protein (N × 6.25), crude fibers and ash contents of whole grape seeds and grape seeds meal were analysed according to the A.O.A.C. (1990). Total carbohydrates was estimated by difference. Tannines content in the methanol extracts were measured according to the vanillin method of Price *et al*. (1978). The developed colour was reed at 500 nm after 20 min. at room temperature. A standard curve was prepared using catechin. Tannin content was experesed in mg catechin equivalents. Non-protein nitrogen (NPN) was estimated as described by Paredes-1opez and Harry (1989) and measured using the kjeldahl method. Total nitrogen (TN) was determined by the kjeldahl method in A.O.A.C. (1990), while protein nitrogen (PN) was calculated by subtracting NPN from total nitrogen (TN).

True protein (TP) was evaluated as follows : TP = PN × 6.25

Amino acids composition :

Amino acids content of grape seeds meal was determined according to the method of **Moore and Stein (1963)** using amino acid analyzer (Beckman amino acid analyzer Model 1946L) at Central Laboratory, Fac. of Agric., Alex. Univ., Egypt. Tryptophan was colorimetrically determined according to the method of **Miller (1967)**.

Amino acids score (AAS): were computed using the **FAO/WHO (1973)** reference protein,

$$\text{A.A.S} = \frac{\text{mg of essential amino acids in 1 gm test protein}}{\text{mg of amino acids in 1 gm reference protein}} \times 100$$

according to **Pellet and Young (1980)**. The lowest score was taken as the first limiting amino acid.

Computation of A/E ratio :

The ratios between the content of an individual essential amino acids in the food protein (A) and the total essential amino acids content (E) was calculated according to **FAO (1985)** as follows :

$$\text{A/E ratio} = \frac{\text{mg of the individual essential amino acids}}{\text{g of total essential amino acids}}$$

Computed protein efficiency ratio (C-PER) :

Calculated according to the following regression equation by **Alsmeyer *et al*. (1974)**

C-PER = - 1.816 + 0.435 meth. + 0.781 Leu. + 0.211 his. – 0.944 tyr.

Biological value (BV):

Calculated using equation as given by **Block and Mitchel (1946)** as follows : BV = 49.09 + 10.53 × C-PER

Physical and chemical properties of grape seeds oil :

The refractive index, melting point, peroxide, iodine and saponification values were determined according to the methods described by **Leonard *et al*. (1987)**. Specific gravity, acid value, unsaponifiable matter and free fatty acids (as oleic acid %) were determined according to the standard **AOAC methods (1990)**. Cold test was carried out according to the modified method of **Dugan (1976)**. Ten grams of oil in a glass bottle with a cap were held in an ice-bath (2-3°C) for 7.5 hrs. Afterward, the bottle was removed and immediately cleaned. The oil was examined visually for any development of cloudy appearance.

Fatty acids composition :

Fatty acids in grape seeds oil were converted to their methyl esters according the method of **Stahl (1965)**. The fatty acids composition were analyzed by Gas Liquid Chromatography (GLC) in the Central Laboratory Fac., of Agric. Alex. Univ. Egypt, using A Hewlett Packard GLC (model 5890) equipped with a flame ionization detector and stainless steel column packed with 10% DEGS (Di-ethyl glycol succsinate) was used. One μl of fatty acid methyl ester was injected into the column.

The gas chromatographic condition was :

a) Temperature :		**b) Flow rates :**	
Dectector	**:** 300°C	Hydrogen	**:** 30 ml/min
Injector	**:** 250°C	Nitrogen	**:** 30 ml/min
Oven	**:** 170°C	Air	**:** 330 ml/min

Chemical properties of the frying oil :

Chemical properties were measured by determination of refractive index, acid, peroxide and iodine values in grape seeds and sunflower oils before and after frying process (for 2hr.) of potato chips.

Organoleptic properties of fried potato chips using grape seeds and sunflower oils :

Fried potato chips was evaluated organoleptically according to the method of Simpson *et al*. (1965). The panelists (12 judges) were asked to evaluated colour, taste, odour, texture and over all acceptability on a 1 to 10 hedonic scale. A score 1 being(dislike extremely) and 10 being (like extremely).

RESULTS AND DISCUSSION

Physical properties of grape seeds :

Some physical properties of whole grape (*Vitis vinifera*) seeds were determined to evaluate their characteristics. Data presented in Table (1) indicate that the seed index (weight of 1000 seeds gm), and volume of grape seeds were 33.40 gm and 31.80 cm^3, respectively. Thus, bulk density was 1.05 gm/cm^3. Also, grape seed dimensions including length, width and thickness were 6.52, 4.05 and 2.78 mm., respectively.

Table (1): Some physical properties of grape seeds.

Properties	Grape seeds
Seed index (gm)*	33.40
Volume of 1000 seed (cm^3)	31.80
Bulk density (gm/cm^3)	1.05
Seed dimensions :	
Length (mm)	6.52
Width (mm)	4.05
Thickness (mm)	2.78

*** Seed index = Weight of 1000 seeds.**

Gross chemical composition of whole and meal grape seeds :

Data in Table (2) show that protein contents of grape seeds and grape seeds meal were 9.17% and 12.03%, respectively. Grape seeds and grape seeds meal contained 11.72% oil, 2.60% as crude oil, respectively. The crude fibers content in both grape seeds and grape seed meal were very high due to the presence of the hulls (48.53 and 52.91%, respectively).

Table (2): Gross chemical composition of whole grape seeds and grape seed meal (on dry weight basis).

Constituents %	Whole grape seeds	Grape seed meal
Moisture	11.36	9..84
Crude oil	11.72	2.60
Nitrogenous constituents:		
Total nitrogen (TN)	1.87	2.05
None protein nitrogen (NPN)	0.51	0.58
Protein nitrogen (PN)	1.36	1.47
Crude protein (CP)	9.17	12.03
True protein (TP)	8.50	9.19
Crude fibers	48.53	52.91
Ash	2.81	2.97
Total carbohydrate	27.77	29.49
Tannins content*	16.96	12.72

*** Tannins content as mg catechin/ g dry weight.**

The data reveal also that both grape seeds and grape seed meal contained 2.81 and 2.97% ash, 27.77% and 29.49% total carbohydrates, respectively. Crude protein, ash and carbohydrates contents were increased in grape seed meal due to remove oil from grape seeds.Meanwhile, tannins content decreased from 16.96 to 12.72 mg/1 g dry weight as result the oil for grape seeds and grape seed meal, respectively. These results are in agreement with those reported by Hirose and Iwama, 1986 and Igartuburu *et al*. , 1991.

Nitrogenous constituents of whole grape seeds were 9, 17, 8.50, 1.36 and 0.51% for CP, TP, PN and NPN, respectively. The highest values of the nitrogenous constituents were detected in grape seed meal (12.03, 9.19, 1.47 and 0.58%, respectively. These results are in agreement with those reported by Abou-Rayan (1997).

Amino acids composition of grape seeds meal :

The amino acids content of grape seeds meal are shown in Table (3). The major indispensable amino acids present in grape seeds meal were leucine (8.19%), valine (5.24%), lysine (4.36%), isoleucine (4.29) and phenylalanine (4.30%).

Table (3): Amino acids composition of grape seeds meal (g/100 g protein).

Amino acids	Grape seeds meal	Casein standard protein	FAO/WHO standard protein (1973)
Indispensable amino acids :			
Thereonine	3.12	3.43	4.00
Valine	5.24	8.42	5.00
Methionine	1.21	2.96	3.50
Cystine	0.28	-	
Isoleucine	4.29	5.01	4.00
Leucine	8.10	9.20	7.00
Phenylalanine	4.30	9.81	6.00
Tyrosine	2.26	-	
Lysine	4.36	7.50	5.50
Tryptophan	0.57	1.21	1.00
Total indispensable amino acids	33.73		
Dispensable amino acids:			
Aspartic acid	8.06	5.97	
Serine	4.93	5.59	
Glutamic acid	20.87	17.53	
Proline	4.35	5.92	
Glycine	8.21	1.72	
Alanine	5.72	2.65	
Histidine	3.61	2.63	
Arginine	8.13	4.22	
Total dispensable amino acids	63.88		

The sulfur containing amino acids and tryptophan were relatively very low in grape seeds meal compared to their other indispensable amino acids. The grape seeds meal had a moderate amounts of tyrosine and cystine, which not detected in casein, as a standard protein. Indispensable amino acids content of grape seeds meal are in a good amounts as recommended by FAO / WHO (1973).

On the other hand, the results in Table (3) reveal that eight dispensable amino acids in grape seeds meal were detected as follows : glutamic acid (20.87), glycine (8.21%), arginine (8.13%), aspartic acid (8.06%), alanine (5.72%), serine (4.93%), proline (4.35%) and histidine (3.61%). The data also show that glutamic acid was the major dispensable amino acid and glycine was the second major amino acid followed by arginine and aspartic acid. These results are in agreement with Chorbanov *et al*. (1989) and Abou-Rayan, (1997). Generally, from the aforementioned data, it could be observed that grape seeds meal contained highe amounts of some amino acids such as aspartic acid, glutamic acid, glycine, alanine, histidine and arginine compared with those of casein.

Amino acid score (AAS), computed protein efficiency ratio (C-PER) and biological value (BV):

Chemical score of indispensable amino acids of grape seeds meal are shown in Table (4). The results reveal that methionine + cystine were the first limiting amino acids in grape seeds meal followed by tryptophan. These results are in agreement with those of Fazio *et al*. (1983) while, Kamel *et al*. (1985) reported that arginine was high grape seeds protein and the limiting amino acids were sulphur-containing amino acids and lysine.

Table (4): Amino acids score, computed protein efficiency ratio (C-PER) and biological value (BV) of grape seeds meal.

Indispensable amino acids	FAO/WHO, 1973 standard protein (g/100 g protein)	Grape seeds meal	Amino acid score
Theroenine	4.00	3.12	78.00
Valine	5.00	5.24	104.80
Methionine + Cystine	3.50	1.49	42.57
Isoleucine	4.00	4.29	107.25
Leucine	7.00	8.10	115.71
Phenylalanine+ Tyrosine	6.00	6.56	109.33
Lysine	5.50	4.36	74.27
Tryptofan	1.00	0.57	57.00
C-PER		3.67	-
B.V.		87.74	-

Igartuburu *et al*. (1991) found that the major amino acid was glutamic acid followed by tyrosine and aspartic acid, while limiting amino acids were lysine, tryptophan and sulphur-containing amino acids. Moreover, the amino acids composition and properties of protein from Palomino grape seeds were very similar to those of cereals and other oil seeds, which were also deficient in lysine, tryptophan and the sulphur-containing amino acids. On the other hand, it is very poor in methionine, cystine, tryptophan and cannot be used as a single source of protein. Also, data in the present study reveal that grape seeds meal, considered as a good source of indispensable amino acids. Therefore, it could be used as a food additive to bakery products and meat products to improve its qualities

The computed protein efficiency ratio (C-PER) and Biological value (BV) of grape seeds meal were 3.67 and 87.74, respectively as shown in Table (4). It was noticed that grape seeds meal showed high PER (3.67) and BV (87.74) compared with those of casein, standard protein, (2.50) and 76.23, respectively.

Table (5) shows that the A/E ratio between an individuals essential amino acid content and total essential amino acids content of grape seeds meal compared with FAO requirement patterns (1985). It was observed that grape seeds meal was a rich source of leucine, and isoleucine compared with FAO of school child and adult requirement patterns.

Table (5): A/E* ratio of grape seeds meal compared with FAO/WHO (1985).

Indispensable amino acids	FAO/WHO (1985)		A/E ratio of grape seeds meal
	School child	Adult	
Thereonine	126	81	100.00
Valine	112	117	168.00
Methionine	99	153	38.80
Isoleucine	126	117	137.54
Leucine	198	171	259.70
Phenylalanine	99	171	137.86
Lysine	198	144	139.79
Tryptophan	40	45	18.28

*** Total indispensable amino acids content of grape seeds meal = 31.19**

Physical and chemical properties of grape seeds oil :

- Physical properties :

Some physical properties of grape seeds oil are presented in Table (6). The refractive index of grape seeds oil was 1.4740, which similar to the value those of sunflower oil (1.4697) (Langstraat, 1976). Specific gravity of grape seeds oil was lower (0.913) than those of melon seed, bitter almond, apricot kernel and roselle seed oils (Tekin and Velioglu, 1993; Owon and Kassab 2001 and Salem *et al*. 2002).

Table (6): Some physical and chemical properties of grape seeds oil.

Properties	Grape seeds oil*	Sunflower oil**
Physical properties :		
Refractive index at 25°C	1.4740	1.4697
Specidic gravity at 25°C	0.913	-
Melting point (°C)	-10	-
Cold test (2-3°C)	(+)***	(+)***
Chemical properties :		
Free fatty acids (as oleic acid) %	0.54	0.90
Acid value (mg/KoH/g oil)	0.78	1.88
Peroxide value (meq/Kg oil)	6.90	5.30
Iodine value (gI/100 g oil)	133	128
Saponification value (mg KoH/g oil)	192	191
Unsaponifiable matters (% w/w)	1.52	1.20

*** The values are mean of three determinations.**
**** The data published by Langstraat (1976).**
***** (+) clear at test conditions.**

Grape seeds oil stayed liquid at room temperature (25°C ± 5), as indicated by their approximate melting point (-10°C). No cloudy appearance develop in grape seeds oil when kept in ice bath (2-3°C) for 7.5 hrs. These could be explained by the high amount of unsaturated fatty acids present in the grape seeds oil (81.94%) (Table 7). This suggests that, grape seeds oil could be used in salad, margarine, mayonnaise and canned foods. The oil used in mayonnaise must be pass a cold test to make sure that it would not crystallize and break the mayonnaise emulsion during cold storage, also an oil to be used for canned food such as fish, should be liquid at refrigerator temperature (Badifu, 1991).

- Chemical properties :

The chemical properties of grape seeds oil are illustrated in Table (6). The present data indicate that the free fatty acids (as oleic acid) and acid value were 0.54% and 0.78 mg KoH/gm, respectively. While peroxide value was higher (6.90 meq/kg oil), than sunflower oil (5.30 meq/kg oil). Acid value is a measure of the extent decomposition of glycerides. The peroxide value was lower than that of the stipulated maximum level of Anon. (1982), which indicated that maximum value should most be more than 10 meq/kg oil for the edible oils. The iodine value of grape seeds oil was higher (133 g I/100 g oil), than sunflower oil (128 g I/100 g oil). Saponification value of grape seeds oil was (192 mg KoH/g oil). Iodine and saponification values of grape seeds oil were nearly equal to the sunflower oil, which reported by Langstraat (1976). These reflect that the molecular weights of the fatty acids in the glycerides of grape seeds oil were relatively equal to of sunflower oil. The high iodine and saponification values obtained for grape seeds oil are confirming the unsaturated nature of these oils. The unsaponifiable matter includes hydrocarbons, higher alcohols and sterols. Most oils and fats of normal purity contain less than 2% of unsaponifiable matter (Anon, 1982). The unsaponifiable matter of grape seeds oil was relatively higher (1.52%) than those reported by Kamel *et al*. (1985), they dound that, the grape seeds oil contained 0.93% unsaponifiable matter.

Fatty acids composition of grape seeds oil :

The fatty acids composition of grape seeds oil are showed in Table (7). The unsaturated fatty acids (81.94%) played the important role in grape seeds oil, while (18.06%) saturated fatty acids was detected. These reflects the nutritional value of grape seeds oil.

The high level of unsaturated fatty acids in grape seeds oil is of special from a nutrional standpoint. Generally, it is accepted that increasing the proportion of unsaturated to saturated fatty acids in a diet will reduce the level of blood coronary heart disease (Fick, 1984). Of further nutritional interest is the high level of linoleic acid (ω6), an essential fatty acid which must be supplied by diet

The main unsaturated fatty acids in grape seeds oil were linoleic and oleic acids, which together amounted about 79.73% of the total fatty acids (Table, 7). The high portion of poly unsaturated fatty acids of grape seeds oil (62.04%) considered it as a good source of essential fatty acids in human nutrition. Grape seeds oil had a high content of linoleic acid (61.93%). Linoleic acid (ω6) is required for the cell membrane structure choloesterol transportation in the blood and for prolonged blood clotting (Adams, 1982).

Total saturated fatty acids (18.06%) were mainly composed of palmitic (9.63%), stearic (6.05%), arachidic (0.29%) and behneic acid (1.83%). On the other hand, unsaturated fatty acids were composed of palmitoolic (2.10%), oleic (17.80%), linoleic (61.93%) and linolenic acid (0.11%). The fatty acids content of grape seeds oil were comparable to the of specially selected sunflower oil was characterized by a high content of linoleic acid ω6 (Tarandzhiiska and Stamenov, 1989). Fatty acids composition and the physico-chemical characteristics of grape seeds oil were similar to those found in sunflower and safflower seeds oil. (Hirose and Iwama, 1986). The high linoleic acid (ω6) (61.93%) and low saturated fatty acids content characterized grape seeds oil with high nutritional quality and excellent dietetic properties as well as could be, useful for food application. (Smolin and Grosvenor, 2000). Finally, it could be concluded that the grape seeds oil are considered to be rich source of edible oil with high physical and chemical properties and could be used in food industries.

Table (7): Fatty acids composition of grape seeds oil (% of total fatty acids).

Fatty acids	Grape seeds oil	Sunflower oil
Unsaturated fatty acids:		
Palmitooleic acid ($C_{16:1}$)	2.10	0.00
Oleic acid ($C_{18:1}$)	17.80	43.12
Linoleic acid ω6 ($C_{18:2}$)	61.93	29.36
Linolenic acid ω3 ($C_{18:3}$)	0.11	traces
Total unsaturated fatty acid	81.94	72.48
Saturated fatty acids:		
Lauric acid ($C_{12:0}$)	0.10	2.77
Myristic acid ($C_{14:0}$)	0.16	1.05
Palmitic acid ($C_{16:0}$)	9.63	3.26
Stearic acid ($C_{18:0}$)	6.05	15.50
Arachidic acid ($_{20:0}$)	0.29	-
Behneic acid ($_{22:0}$)	1.83	-
Total saturated fatty acid	18.06	22.58

Effect of frying process on grape seeds oil properties :

Some physical and chemical properties of grape seeds and sunflower oils before and after frying process of potato chips. (2hrs) were determined and the results are given in Table (8).

Before frying process, the results indicate that refractive index of grape seeds oil was higher than that of sunflower oil (1.4740 and 1.4697, respectively). The data also notice that the grape seeds oil had lower acid, peroxide and iodine values than those of sunflower oil. After frying process (2hrs), the same data show that refractive index, acid and peroxide values of both oils were increased. Acid values were increased to 8.75 and 15.13 mg KoH/g oil with changed in the capacities of 7.97 to 13.25 (mg KoH/g oil) for grape seeds and sunflower oils, respectively. Peroxide values were increased to 18.70 and 16.10 meq/kg with changed capacities of 11.80 to 10.80 (meq/kg oil) for grape seeds and sunflower oils, respectively. The changes in the capacities of acid value of grape seed oil after frying were lower than those of sunflower oil, in the case of peroxide value, the change capacities of grape seeds oil were higher than those of sunflower oil. Iodine values of both oils were decreased and the change capacities of iodine value for grape seeds oil was lower than those of sunflower oil (Table, 8). The previous data clear that thermal stability of grape seeds oil during frying process for 2hrs was relatively equal to those of sunflower oils.

Table (8):Some physical and chemical properties of grape and sunflower oils, before and after frying (for 2 hrs) for potato chips.

Properties	Before frying		After frying		Change capacities	
	Grape seeds oil	Sunflower oil	Grape seeds oil	Sunflower oil	Grape seeds oil	Sunflower oil
Refractive index at 25°C	1.4740	1.4697	1.4863	1.4822	0.0123	0.0125
Acid value (mg KoH/gm oil)	0.78	1.88	8.75	15.13	7.97	13.25
Peroxide value (meq/kg oil)	6.90	5.30	18.70	16.10	11.80	10.80
Iodine value (gI/100g oil)	133.00	128.00	120.15	113.40	-12.85	-14.60

Organoleptic properties of fried potato chips by grape seed oils

The results in Table (9) shows the organoleptic properties of potato chips fried (2hrs) in grape seeds and sunflower oils. The colour of potato chips fried by sunflower oil was improved than those of grape seeds oil. The taste of potato chips fried in grape seeds oil was slightly lower than those of fried in sunflower oil.

Table (9): Organoleptic properties of fried potato chips by grape seeds and sunflower oils.

Samples	Organoleptic properties				
	Colour	Taste	Odour	Texture	Over all acceptability
Grape seeds oil	7.20	7.15	7.90	8.10	7.50
Sunflower oil	7.60	7.25	7.50	8.10	7.60

Odour of potato chips fried in grape seeds oil was higher than those of fried in sunflower oil. Texture of potato chips fried in grape seeds oil was equal to those of fried in sunflower oil. Overall acceptability of potato chips fried in grape seeds oil was similar to those of fried in sunflower oil.

Finally, from the previous results, it could be concluded that the grape seeds meal had a good quality and considered to be a rich indispensable amino acids with high C-PER and B.V of protein. Furthermore, it could be used as a principle ingredient for making some bakery products for infant and adults.

Also, grape seeds could be implied as an important source of edible oil and recommended to use grape seed oil for human consumption as edible oils.

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تقييم بذور العنب كمصدر جديد للبروتين والزيست صالح لتغذية الإنسان

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أجرى هذا البحث بغرض الاستفادة من بذور العنب الأحمر الرومى (*Vitis vinfera* L.) كمصدر جديد وغير تقليدى للبروتين والزيت صالح لأغراض التغذية حيث تم دراسة التركيب الكيميائى لبذور العنب الكاملة والجودة الغذائية لبروتين دقيق بذور العنب بالإضافة الى الخواص الطبيعية والكيميائية للزيت المستخلص من بذور العنب.

حيث أوضحت النتائج ما يلى :

- أوضح التركيب الكيميائى لبذور العنب الكاملة أنها تعتبر مصدر جيد للألياف الغذائية ٤٨,٥٣% والكربوهيدرات ٢٧,٧٧% ومصدر مناسب للبروتين ٩,١٧% والزيت ١١,٧٢% والرماد ٢,٨١% واحتوت على تانينات ١٦,٩٦ ملجم كاتيكين/١جم عينة.

- عند تقييم جودة بروتين دقيق بذور العنب وجد أنه يحتوى على بروتينات عالية الجودة فهو غنى بالأحماض الأمينية الأساسية مثل الليوسين والفالين والأيزوليوسين ويتميز بإرتفاع كفاءته وقيمته الحيوية مقارنة بما تنص علية منظمة الـ FAO بخصوص إحتياجات الأطفال والبالغين وبمحتوى بروتين الكازين من الأحماض الأمينية الأساسية. ولذلك ينصح بإضافة دقيق بذور العنب لبعض الأغذية مثل منتجات الخبيز أوخلطات اللحوم المفرومة لتدعيم وتحسين خواصها.

- أما بالنسبة لخواص زيت بذور العنب فقد أظهرت النتائج أن له صفات غذائية تماثل الزيوت الغذائية المعروفة مثل زيت عباد الشمس.

- يتميز زيت بذور العنب بإحتوائة على نسبة مرتفعة من الأحماض الدهنية الغير مشبعة ٨١,٩٤% حيث كان حمض اللينوليك أكثرها تواجداً ٦١,٩٣% يليه حمض الأوليك ١٧,٨٠% كما يحتوى أيضاً على نسبة منخفضة من الأحماض الدهنية المشبعة ١٨,٠٦% حيث كان حمض البالمتك أعلاها ٩,٦٣% يليه حمض الأستياريك ٦,٠٥%.

- يتميز هذا الزيت بأنه يماثل زيت عباد الشمس فى درجة الثبات الحرارى أثناء عمليات التحمير المختلفة وفى خواص التذوق الحسى لشرائح البطاطس المقلية فى كل منهما حيث كانت مقبولة لدى المحكمين بدرجة متقاربة.

ومما سبق تعطى هذه الصفات لزيت بذور العنب مميزات غذائية ممتازة تجعله زيت صحى لتزويد الجسم بإحتياجاته من الأحماض الدهنية الضرورية كما أنه مفيد جداً فى التطبيقات الغذائية وينصح بإضافته لبعض الأغذية مثل السلطات والمرجرين والمايونيز والأغذية المعلبة لتدعيم وتحسين خواص هذه الأغذية.