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A COMPARATIVE STUDY ON NUTRITIONAL VALUE AND SENSORY CHARACTERISTICS OF RAISINS PRODUCED FROM DIFFERENT SEEDLESS GRAPEVINE CVS

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ABSTRACT

The chemical and sensory characteristics of raisins made from four grapevine cvs, Thompson seedless, Superior, Early Superior and Flame seedless were evaluated during ٢٠١٠ and ٢٠١١ seasons. Thompson seedless sun dry raisins was preferable than the other produced raisins towards chemical and sensory characteristics. Both Superior and Early superior raisins ranked the second position in this respect. Flame seedless dried raisins was medium sweet, medium brownness, ununiformity raisin size as well as small sizes and medium chewiness texture. Great variation on the investigated characteristics was recorded on the different raisins produced from various grapevine cvs.

These findings suggest that raisins produced from Thompson seedless grape cv. was preferable than those prepared from other grapevine cv. and the raisins could be marketed on the basis of cultivars.

INTRODUCTION

The consumption of grapes and raisins dates back to prehistoric times. Wild grapes existed as far back as ٣٥٠٠٠ BC, when the species *Vitis sezonnensis* was known to grow in what is now southern France. Hunter gatherers likely recognized the qualities of wild grapes and

may have noticed that grapes took on an edible dried form after having fallen off the vine and laid in the sun. Grapes were probably dried for storage and travel in the Neolithic period, leading to the early production of raisins, and there is evidence of early use of raisins, as food and decorations, from prehistoric murals in the Mediterranean region to Bronze-Age archaeological finds at Lachish in Israel (USDA, ٢٠٠٩). The early Phoenicians and Egyptians, however, were eventually the ones to popularize the production and use of raisins and spread them throughout the western world, where they were valued for easy storage and transport (USDA, ٢٠٠٩).

About ٩٥ % of raisins today are dried "Thompson seedless" grapes, *Vitis vinifera* L. This variety is followed by the "Fiesta" (٣٪) and the "Zante currant" (١.٥ %). The term *currant* is used to describe its small berrylike size, but it is a hue grape. The terms *sultanas* and raisins are used inconsistently and sometimes interchangeably from country to country (Christensen, ٢٠٠٠).

Raisins are produced in most geographic regions of the world, and consumption occurs in all cultures and demographic sectors. The United States is the world's leading raisin producer, and California accounts for more than ٩٠ % of the total, using almost ٣ million tons of grapes to produce approximately ٤٠٠٠٠٠ tons of raisins per year. Other important raisin-producing countries are Turkey, China, Iran, Chile, South Africa, Greece, Australia, and Uzbekistan.

The vast majority of Egypt's raisins have been made from the fruits of Thompson seedless grapevines (*Vitis vinifera* L.). Recently introduced new cultivars encourages the researchers to improve production raisins with the development of new cvs. of grapevine, comes the chance to promote raisin production as well as improve health benefits and at the same time other characteristics can be improved.

Previous studies showed that raisins produced from different grapevine cvs greatly varied toward their chemical composition and sensory characteristics (Lawless and Heymann, ١٩٩٨; Uhlig and Clingeleffer, ١٩٩٨; Studer, ٢٠٠٠, Christensen and Peacock, ٢٠٠٠; Petrucci, ٢٠٠١; Clingleffer, ٢٠٠٢; Petrucci, ٢٠٠٢; Simsek *et al*.,

٢٠٠٤; Fidelibus *et al*., ٢٠٠٥; Peacock and Swanson, ٢٠٠٥; Angylo *et al*., ٢٠٠٧; Keast and Jones, ٢٠٠٩; Puglisi *et al*., ٢٠٠٩; Williamson and Carughi, ٢٠١٠; Breksa *et al*., ٢٠١٠ and Mesbahi *et al*., ٢٠١٢).

The target of this study was to evaluate the chemical and sensory characteristics of the raisins produced from four grapevine cvs Thompson seedless, Superior, Early Superior and Flame seedless.

MATERIALS AND METHODS

Raisins were made from the berries of ٨- years- old own- rooted, Thompson seedless, Superior, Early Superior and Flame seedless (*Vitis vinifera* L.) trained to an open- gable trellis in a private vineyard located at Matay district, Minia Governorate during ٢٠١٠ and ٢٠١١ seasons. Harvesting date of Thompson seedless was the last week of July. Superior, Early Superior and Flame seedless were harvested on the last week of June during both seasons. Thirty kilograms of each grapevine cv. were taken for making raisins through sun drying by putting ١٠.٠ kg/ tray in the sun for three weeks from each grapevine, three trays were used (on the basis of one tray for each replicate). Complete randomized design in three replicates (one tray for each replicate) was adopted. Raisins of each grapevine cv. were collected and weight when their moisture content was judged to be ١٨ % in the raisins of Thompson seedless, Superior, Early Superior and Flame seedless.

In the fresh berries of each grapevine cv., the following characteristics were determined. Moisture content %, total soluble solids %, total, reducing and non- reducing sugars %, total acidity % (as g tartaric acid/ ١٠٠ ml juice), ascorbic acid content (mg/ ١٠٠ ml juice), proteins %, fats %, different nutrients (Ca, P, P, Mg, S, Fe, Cu, as mg/ ١٠٠ ml juice) and total phenols (as g gallic acid/ ١٠٠ ml juice) (according to the procedure outlined by Ranganna (١٩٧٩); Evenhuis and Dewaard (١٩٨٠) and A.O.A.C. (١٩٩٠).

The same previous characters were also determined in the four types of raisins by the same procedures that previously mentioned.

Sensory evaluation:-

Seven panelists (two men and five women students and staff members of Hort. Dept. Fac. of Agric., Minia Univ. ranging in age from ٢٠ to ٥٠ years) were trained to perform the descriptive analysis. During training the panelists were asked to develop sensory characteristics describing variation among the four raisins reference standard (Table ٥).

The proper statistical analysis was done according to Gomez and Gomez (١٩٨٤) using the new L.S.D at ٥ %.

RESULTS AND DISCUSSION

١- Chemical characteristics of the fresh grapes in the four grapevine cvs.

It is clear from the data in Tables (١& ٢) that most chemical characteristics of the fresh grapes were significantly varied among the four grapevine cvs Thompson seedless, Superior, Early Superior and Flame seedless. Percentages of fructose, sucrose as well as juice content of vitamin C and copper (mg/ ١٠٠ ml juice) did not change significantly with varying grapevine cvs.

Table ١: Some chemical characteristics of the fresh grapes in the four grape cvs during ٢٠١٠ and ٢٠١١ seasons.

Character / Grape cvs	Moisture %		Total carbohydrates %		Total soluble solids %		Total sugars %		Reducing Sugars %	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Thompson seedless	٨١.٩	٨٢.٠	١٨.٠	١٧.٨	١٩.٩	٢٠.٠	١٦.٣	١٦.٥	١٥.٠	١٥.٢
Superior	٨٢.٤	٨٣.١	١٧.٤	١٧.١	١٩.٢	١٩.٣	١٦.٠	١٦.٠	١٤.٨	١٤.٩
Early Superior	٨٣.٠	٨٣.٥	١٦.٧	١٦.٤	١٨.٦	١٨.٧	١٥.٦	١٥.٥	١٤.٦	١٤.٥
Flame seedless	٨٣.٦	٨٤.٤	١٦.٠	١٥.٨	١٨.٠	١٨.٠	١٥.٠	١٥.١	١٤.٣	١٤.٢
New L.S.D at ٥ %	٠.٣	٠.٤	٠.٦	٠.٥	٠.٤	٠.٤	٠.٣	٠.٣	٠.٢	٠.٢

Character / Grape cvs	Glucose %		Fructose %		Sucrose %		Total acidity (g tartaric acid/ ١٠٠ ml juice)		Vitamin C content (mg/ ١٠٠ ml juice)	
Thompson seedless	٧.٩	٨.٠	٧.١	٧.٢	٠.١٨	٠.٢١	٠.٦٧٠	٠.٦٧٣	٠.٦	٠.٨
Superior	٧.٨	٧.٨	٧.٠	٧.١	٠.١٦	٠.١٩	٠.٧٠٠	٠.٧٠٤	٠.٦	٠.٧
Early superior	٧.٥	٧.٦	٧.١	٦.٩	٠.١٦	٠.١٩	٠.٧٢١	٠.٧٢٠	٠.٦	٠.٧
Flame seedless	٧.٣	٧.٢	٧.٠	٧.٠	٠.١٦	٠.١٩	٠.٧٥٥	٠.٧٥٠	٠.٥	٠.٦

Sensory characteristics of raisins

New L.S.D at ٥ %	٠.٢	٠.٢	**NS**	**NS**	**NS**	**NS**	٠.٠٢ ١	٠.٠٢ ٢	**NS**	**NS**

The maximum values of moisture % was presented in the fresh grapes of grapevines cvs, Flame seedless, Early Superior, Superior and Thompson seedless, in descending order. In most cases fresh grapes of grapevine cv.

Thompson seedless had higher amounts of all chemical constituents followed by Superior grape cv. The lowest values were recorded on grape cv. Flame seedless. This variation in chemical characteristics among the four grapevine cvs greatly explained the change in raisins produced from these grapevine cvs. These results were true during both seasons. The results of Ahmed *et al*., (٢٠٠١) supported the present results.

Table ٢: Some chemical characteristics of the fresh grapes in the four grape cvs during ٢٠١٠ and ٢٠١١ seasons.

Character / Grape cvs	Proteins %		Fats %		Calcium (mg/ ١٠٠ ml juice)		Phosphorous (mg/ ١٠٠ ml juice)		Potassium (mg/ ١٠٠ ml juice)	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Thompson seedless	٠.٢٣	٠.٢٢	٠.٣٠	٠.٣٥	١٧.٧	١٧.٥	٢٩.٩	٣٠.٤	١٩١.٠	١٩٢.٢
Superior	٠.٢١	٠.٢٠	٠.٢٧	٠.٢٧	١٧.٢	١٧.٠	٢٨.٣	٢٩.١	١٨٧.٠	١٨٨.٠
Early Superior	٠.١٩	٠.١٨	٠.٢٤	٠.٢٣	١٦.٦	١٦.٢	٢٧.٣	٢٧.٩	١٨٤.٠	١٨٣.٩
Flame seedless	٠.١٧	٠.١٦	٠.١٨	٠.٢٠	١٦.٠	١٥.٦	٢٥.٩	٢٦.٣	١٨١.٠	١٨٠.٠
New L.S.D at ٥ %	٠.٠٢	٠.٠٢	٠.٠٢	٠.٠٢	٠.٤	٠.٤	٠.٩	١.٠	٢.٢	٢.١
Character / Grape cvs	**Magnesium (mg/ ١٠٠ ml juice)**		**Sulphur (mg/ ١٠٠ ml juice)**		**Iron (mg/ ١٠٠ ml juice)**		**Copper (mg/ ١٠٠ ml juice)**		**Total phenol (mg/ g mallic acid)**	
Thompson seedless	٦.٦٩	٧.٥٠	٩.٤٩	٩.٦٠	٠.٩١	٠.٨٨	٠.١٠	٠.١١	١.١٠	١.٠٧
Superior	٥.٧٦	٦.٥٥	٩.٠٠	٩.١١	٠.٨٠	٠.٨٠	٠.١٠	٠.١١	١.١٦	١.١٤
Early superior	٥.٥٢	٦.٠١	٨.٥٠	٩.٦١	٠.٧١	٠.٧٣	٠.٠٩	٠.١٠	١.٢٣	١.٢٩
Flame seedless	٥.٢٢	٥.٥٥	٨.٠٠	٨.١١	٠.٦١	٠.٦٤	٠.٠٨	٠.١٠	١.٢٩	١.٣٣
New L.S.D at ٥ %	٠.٢٢	٠.٢٧	٠.٤١	٠.٤١	٠.٠٦	٠.٠٧	**NS**	**NS**	٠.٠٥	٠.٠٦

٢- Amount of fresh grapes to produce one kg raisin.

It is obvious from the data in Table (٣) that drying ratio or the amount of fresh grapes to produce one kg raisin was significantly varied among the four grapevine cvs. It ranged from ٤.١١ to ٤.٧١ in the first season and from ٤.٠٦ to ٤.٦٩ in the second one. It reached ٤.١١ – ٤.٠٦ for Thompson seedless, ٤.٣١ – ٤.٢٢ for Superior, ٤.٥٢ – ٤.٤٠ for Early Superior and ٤.٧ – ٤.٦٩ for Flame seedless during both seasons, respectively. The minimum values were recorded on Thompson seedless. Flame seedless grape cv. occupied the last position in this respect, since it had the highest values. These results were true during both seasons.

Table ٣: Amount of fresh grapes to produce one kg raisin and some chemical characteristics of the raisin produced from the four grape cvs during ٢٠١٠ and ٢٠١١ seasons.

Character / Grape cvs	Amount of fresh grapes to produce one kg raisin		Moisture %		Total carbohydrates %		Total soluble solids %		Total sugars %	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Thompson seedless	٤.١١	٤.٠٦	١٨.٠	١٨.٤	٧١.٠	٧١.٨	٦٥.٠	٦٥.٦	٦١.٠	٦٠.٩
Superior	٤.٣١	٤.٢٢	١٨.٠	١٨.٥	٧٠.٠	٧١.٠	٦٤.٠	٦٤.٢	٥٩.٢	٥٩.١
Early Superior	٤.٥٢	٤.٤٠	١٨.٢	١٨.٦	٦٩.٠	٦٩.٣	٦٣.١	٦٣.٠	٥٨.٠	٥٨.١
Flame seedless	٤.٧١	٤.٦٩	١٨.٣	١٨.٦	٦٨.٢	٦٨.٥	٦٢.٢	٦٢.٠	٥٧.١	٥٧.٣
New L.S.D at ٥ %	٠.١٣	٠.١٤	NS	NS	٠.٤	٠.٥	٠.٦	٠.٧	٠.٧	٠.٧

Character / Grape cvs	Glucose %		Fructose %		Sucrose %		Total acidity (g tartaric acid/ ١٠٠ ml juice)		Vitamin C content (mg/ ١٠٠ ml juice)	
Thompson seedless	٢٨.٨	٢٨.٧	٣٠.٥	٣٠.٠	٠.٥٥	٠.٥٥	١.٥٣٠	١.٥٢٧	١.٨	٢.٠
Superior	٢٨.٠	٢٧.١	٢٩.٠	٢٨.٧	٠.٥٥	٠.٥٥	١.٥٩٠	١.٥٨٠	١.٨	٢.٠
Early superior	٢٧.١	٢٦.٠	٢٨.٠	٢٧.٣	٠.٥١	٠.٥٢	١.٦٧٠	١.٦٦٤	١.٨	٢.٠
Flame seedless	٢٦.٠	٢٥.٥	٢٧.٠	٢٦.٩	٠.٥٠	٠.٥١	١.٧٠٠	١.٦٩٧	١.٧	٢.١
New L.S.D at ٥ %	٠.٦	٠.٥	٠.٦	٠.٦	NS	NS	٠.٠٣ ٠	٠.٠٣ ١	NS	NS

These results might be attributed to the great variation in moisture content in the fresh grapes of the four grapevine cv. The lowest percentage of moisture in the fresh grapes of Thompson seedless was corresponded with the lowest value of drying ratio and the vice versa was obtained with Flame seedless grape cv.

These results are in agreement with those obtained by Fidelibus *et al*., (٢٠٠٥) and Mesbahi *et al*., (٢٠١٢).

٣- Some chemical characteristics of the different raisins.

It is noticeable from the obtained data that all chemical constituents except moisture %, sucrose %, vitamin C content and copper content in the juice significantly varied among the different raisins produced from the four grape cvs. Raisins produced from Thompson seedless grapes had the higher values. Raisins produced from Superior occupied the second position in this respect. The lowest values were recorded on the raisins that produced from grapevine cv. Flame seedless. The same trend was noticed during the ٢٠١٠ and ٢٠١١ seasons (Table ٣& ٤).

The great variation previously mentioned in the chemical characteristics of the fresh grapes among the four grapevine cvs surely reflected on differing the raisin production.

These results are in harmony with those obtained by Simsek *et al*., (٢٠٠٤); Peacock and Swanson (٢٠٠٥); Fidelibus (٢٠٠٥); Keast and Jones (٢٠٠٩); Puglisi *et al*., (٢٠٠٩) and Breksa *et al*., (٢٠١٠).

٤- Sensory characteristics of the different raisins.

Data in Table (٥) clearly show that sensory characteristics (appearance, flavor and texture) were considerably varied among the raisins produce from different grapevine cvs. According to Weaver (١٩٧٦) the ideal raisins characterized with medium browness, browness uniformity and medium berry sized, size berry uniformity, very sweet, low sour and astringent flavour, medium chewiness and free from stickiness. Raisins produced from grapevine cv. Thompson seedless was considered a prime product since it had medium browness, browness uniformity, medium sized, size uniformity, very sweet, low sour and astringent flavours, medium chewiness and free

from stickiness comparing with the other raisins produced from the other grape cvs. The best raisins produced from Superior grapes occupied the second position in this respect. It characterized by light and uniformity browness small size berries, uniformity of the berries, sweet as well as low sour and astringent flavour. Unfavourable sensory characteristics were recorded on the raisins produced from Flame seedless grape cv.

Table ٤: Some chemical characteristics of the raisin produced from the four grape cvs during ٢٠١٠ and ٢٠١١ seasons.

Character / Grape cvs	Proteins %		Fats %		Calcium (mg/ ١٠٠ ml juice)		Phosphorus (mg/ ١٠٠ ml juice)		Potassium (mg/ ١٠٠ ml juice)	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Thompson seedless	٢.٣١	٢.٣٤	١.٥٠	١.٥٠	٧٦.٧	٧٧.٠	١٤٣.٩	١٤٢.٩	٧٩١.٠	٨٠١.٠
Superior	٢.٢٤	٢.٢٧	١.٤٢	١.٤٣	٧٥.٠	٧٥.٤	١٤١.٠	١٤٠.٠	٧٨٦.٠	٧٩٥.٠
Early Superior	٢.١٦	٢.٢٠	١.٣٦	١.٣٧	٧٣.٣	٧٣.٧	١٣٨.٩	١٣٧.٨	٧٧٧.٠	٧٨٨.٠
Flame seedless	٢.١١	٢.١٤	١.٣١	١.٣٠	٧٢.٠	٧٢.٣	١٣٦.٠	١٣٥.٠	٧٧١.٠	٧٨١.٠
New L.S.D at ٥ %	**٠.٠٥**	**٠.٠٥**	**٠.٠٥**	**٠.٠٥**	**٠.٩**	**١.٠**	**١.٣**	**١.٤**	**٥.٥**	**٥.٦**
Character / Grape cvs	**Magnesium (mg/ ١٠٠ ml juice)**		**Sulphur (mg/ ١٠٠ ml juice)**		**Iron (mg/ ١٠٠ ml juice)**		**Copper (mg/ ١٠٠ ml juice)**		**Total phenol (mg/ g mallic acid)**	
Thompson seedless	٣٨.٢	٣٩.٨	٤٢.٧	٤٣.٥	٣.١	٢.٩	٠.٣٢	٠.٣٣	٧.٢	٧.٠
Superior	٣٧.٣	٣٩.٠	٤٢.١	٤٣.٠	٢.٨	٢.٦	٠.٣٢	٠.٣٣	٨.١	٧.٩
Early superior	٣٦.٥	٣٧.٨	٤١.٦	٤٢.٢	٢.٥	٢.٣	٠.٣٢	٠.٣٣	٨.٩	٨.٧
Flame seedless	٣٥.٠	٣٦.٠	٤١.٠	٤١.٥	٢.٣	٢.١	٠.٣٣	٠.٣٣	٩.٣	٩.١
New L.S.D at ٥ %	**٠.٧**	**٠.٧**	**٠.٥**	**٠.٥**	**٠.٢**	**٠.٢**	**NS**	**NS**	**٠.٤**	**٠.٤**

The great variation on the chemical characteristics on fresh berries in the four grape cvs previously mentioned surely reflected on changing sensory characters of the raisins that produced from various grape cvs.

Sensory characteristics of raisins

These results are in harmony with those obtained by Simsek *et al*., (٢٠٠٤); Peacock and Swanson (٢٠٠٥); Fidelibus (٢٠٠٥); Keast and Jones (٢٠٠٩); Puglisi *et al*., (٢٠٠٩) and Breksa *et al*., (٢٠١٠).

As a conclusion, the raisins produced from grape cvs Thompson seedless, Superior, Early Superior and Flame seedless, in descending order are considered prime and popular raisins.

Table ٥: Sensory characteristics of the raisins produced by various grapevine cvs.

Attributes	Thompson seedless		Superior		Early Superior		Flame seedless	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Appearance								
- Browness	Med.	Med.	light	light	light	light	heavy	heavy
-Brownness uniformity	Unif.	Unif.	Unif.	Unif.	Unif.	Unif.	Ununif.	Ununif.
- Raisin size	Med.	Med.	small	small	small	small	small	small
-Raisin size homogeneity	Unif.	Unif.	Unif.	Unif.	Unif.	Unif.	Ununif.	Ununif.
Flavor								
- Sweet	Very sweet	Very sweet	sweet	sweet	sweet	sweet	Med. sweet	Med. sweet
- Sour	Low sour	Low sour	Low sour	Low sour	Low sour	Low sour	Low sour	Low sour
- Astringent	Nil	Nil	Nil	Nil	Nil	Nil	Low	Low
Texture								
- Chewiness	Med.	Med.	Med.	Med.	Med.	Med.	Med.	Med.
- Stickiness	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Med. = Medium
Unif. = Uniformity
Ununif. = Ununiformity

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"دراسة مقارنة للقيمة الغذائية والخصائص الحسية للزبيب الناتج من الأصناف المختلفة للعنب"

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تم تقييم الخصائص الكيميائية والحسية للزبيب الناتج من أربعة أصناف من العنب هي الطومسون سيدلس والسوبيريور والإيرلي سوبيريور والفليم سيدلس وذلك خلال موسمي ٢٠١٠ ، ٢٠١١.

أوضحت النتائج أن الزبيب الناتج بالتجفيف الشمسي للعنب الطومسون سيدلس كان مفضلا عن أنواع الزبيب الأخري بخصوص الخصائص الكيميائية والحسية. وجاء الزبيب الناتج من أصناف العنب السوبيريور والإيرلي سوبيريور في المركز الثاني في هذا الصدد بينما كان الزبيب الناتج من العنب الفليم سيدلس متوسط الحلاوة ولونه بني متوسط وحجم

Sensory characteristics of raisins

حباته غير متجانس وحجم الحبات صغير وقوامه متوسط المضغ وكان هناك تفاوت في هذه الصفات تحت الدراسة في مختلف أنواع الزبيب الناتجة من اصناف العنب المختلفة.

تشير نتائج هذه الدراسة أن الزبيب الناتج من صنف العنب الطومسون سيدلس كان أفضل من أنواع الزبيب الأخري الناتجة من أصناف العنب المختلفة. كذلك أوضحت الدراسة أن تسويق الزبيب يجب أن يكون علي أساس الأصناف المستخدمة.