Journal of Berry Research 4 (2014) 117–125
DOI:10.3233/JBR-140074
IOS Press

Invited Review

Greek raisins: A traditional nutritious delicacy

Effie Vasilopoulou[a] and Antonia Trichopoulou[a,b,*]

[a]*Department of Hygiene, Epidemiology and Medical Statistics, University of Athens Medical School, Athens, Greece*
[b]*Hellenic Health Foundation, Athens, Greece*

Received 11 May 2014; accepted 15 May 2014

Abstract. Raisins are dried grapes of seedless varieties. Two types are produced in Greece: the Zante currants or Corinthian raisins, and the sultana or Sultanina. Raisin production includes 3 steps: a pre-treatment (optional), drying, and post-drying process. The pre-treatment methods are not usually applied prior to the drying of the traditional Greek raisins, with the exception of Sultanina of Crete which may or may not be subject to a pre-treatment method. There are three types of drying methods: sun drying, shade drying, and mechanical drying. Traditional Greek raisins are naturally dried (sun or shade) with the exception of Sultanina of Crete, that may be dried naturally or mechanically. Raisins are a popular and healthy snack, which provide essential nutrients, soluble and insoluble fiber and health protective phytochemicals. Raisins provide many necessary vitamins and minerals, including iron, potassium, calcium and certain B vitamins. They also have extremely high boron content, a trace element considered important for the growth and maintenance of healthy bones. Cancer, diabetes and cardiovascular disease prevention effects have been attributed to raisin consumption. So raisins, a product with considerable potential for the agricultural and export sector, are also considered an exceptional snack with health promoting properties.

Keywords: Raisins, currants, sultana, phytochemicals, healthy snack

1. Introduction

Raisins, one of the most important traditional Greek products are dried grapes of seedless varieties. Two types of raisins are produced in Greece. The Zante currants, or currants or Corinthian raisins, which derive from the grape cultivar 'Black Corinth' and the sultana, a "white" (pale green), oval seedless grape variety also called the "Sultanina" [1].

"Black Corinth" has been cultivated in Greece since the years of Homer (7th or 8th centuries B.C.), while recording of its trade exist from the 12th century A.D [1]. In the 14th century, black raisins were sold in the English market under the label "*reysyns de Corauntz*" or "*grapes of Corinth*", after the Greek harbor which was the primary source of export. Gradually, the name got corrupted into "*currant*". However, by the 17th century, the trade shifted towards the Ionian Islands, particularly Zakynthos (Zante), after which it was named "*Zante currant*". Its cultivation is located in northern and western regions of the Peloponnese, as well as in Zakynthos. It is considered a unique product,

*Corresponding author: Antonia Trichopoulou, Hellenic Health Foundation, Kaisareias 13 & Alexandroupoleos, GR-11527 Athens, Greece. Tel.: +30 2107770697; Fax: +30 2107770771; E-mail: atrichopoulou@hhf-greece.gr.

significant to the Greek economy, since Greece produces more than 80% of the global production, while it is not produced in any other European Union country. This variety may be used in both the production of raisins or wine making [2].

The raisins "*Sultanina*" is assumed to originate from the former Ottoman Empire. The etymology of the name is from the Arab word "*sultan*" and it is believed to be a recognition of a sultan's appreciation for or ownership of the grape or of its possible origination in or near the town Soultanieh, which is situated in Persia. Its substantive cultivation in Greece began after the persecutions of the Greeks of Asia Minor (1912–24), enhanced by the Treaty of Lausanne in 1923 and the population exchange between Greece and Turkey. It was during this period that the cultivation of Sultanina grew rapidly in Crete, where many merchants and cultivators of Sultanina took shelter. The cultivation of sultanina also bloomed in the Corinthian region, where it found suitable climatic and landscape conditions. From there its cultivation was expanded to many other regions of Greece. Sultanina is referred to as the "three-way grape" because it is used for table grapes, raisins and wine. The variety was introduced into California in 1872 by William Thompson. The variety was quickly accepted by local growers, who misnamed it "Thompson Seedless", an appellation that has remained with it throughout its development and use in California [1, 2].

2. Cultivar identification

The term *grape variety* actually refers to cultivars rather than botanical varieties, because they are propagated by cuttings and may have unstable reproductive properties. *Vitis vinifera* (Common Grape Vine) is a species of *Vitis*, a liana or woody vine native to the Mediterranean region, central Europe and southwestern Asia. All of the familiar wine varieties belong to *Vitis vinifera*, which is cultivated in all the major wine regions of the world. *Vitis vinifera* was propagated on its own roots from the beginning of recorded history until about the 1870s [3].

Raisin varieties depend on the type of grape used. Black Corinth (*Vitis vinifera L., var. Apyrena*) is an "almost male" variety in that the flowers have well-developed anthers (male), but only tiny underdeveloped ovaries (female). Clusters of 'Black Corinth' are small, averaging 0.18 kg. They are cylindrical, with prominent shoulder or winged. The berries are very small (0.35–0.6 grams), round, of reddish black color. Skin is very thin, and the flesh is juicy and soft. It is practically seedless, except in occasional large berry. When dried, raisins weigh 0.09–0.14 grams, and receive a dark brown or black color with medium to fine wrinkles. Leaves are medium-sized, heart-shaped and oblong. They are five-lobed with deep sinuses [2]. Greek currants are classified in two main quality categories related to product properties as well as to the applied agricultural practices and degree of product uniformity and cleanness. The highest quality category is produced in the northern Peloponnese and comprises two subcategories: Vostizza currant and Gulf currant. The second category, Provincial currant, is produced in Western Peloponnese and in two islands, Zante and Cephalonia [4].

Clusters of 'Sultanina' (*Vitis vinifera L. cv. Sultanina*) are large, averaging 0.45 kg, ranging from 0.23 to 0.68 kg. They are conical to shouldered, seldom winged. The berries are medium (average 1.8 grams), long oval, with a light green to light yellow color. They have medium skin and fleshy pulp. When dried, raisins weigh 0.4–0.6 grams, and receive a bluish dark brown color and medium wrinkles. Leaves are large, lyre-shaped petiolar sinus with overlapping edges [2].

The following Greek raisins have been registered in the EU registries, as Protected Designation of Origin (PDO: Corinthian currant Vostizza and Zante currants) and Protected Geographical Indication (PGI: Currant of Ilias and Sultanina of Crete – *dossier submitted*) [5].

Corinthian currant Vostizza: The world-renowned currants under the name "Vostizza" is exclusively cultivated on the semi-mountainous and mountainous area of the ancient town of Aeghio (its medieval name is Vostizza) from the 12th century. What differentiates Vostizza currants among other varieties is the slope of the ground of the vineyards and the microclimate of this region [5]. Compared to other Corinthian currants, Vostizza currants present higher total anthocyanins content and a lower total phenolics content and antiradical activity [4]. The microclimate of the area differentiates the Vostizza currant from currants produced in other areas and accounts for its exceptionally high reputation.

Zante currants: [6] Zante currants are intensely flavoured miniature raisins grown and dried on the island of Zakynthos. They derive exclusively from *Vitis corinthica* grapes, which are sundried naturally. The Zante currant

is grown on the island of Zakynthos without irrigation. The exceptional quality of the product is a result of the special soil and climate conditions of the region and of the methods applied in cultivation, drying and processing, which contribute to the high sugar content of the product and thus to its strong and characteristic sweet flavour. They also contribute to the maintenance of the uniformly small fruit size (diameter between 4 to 8 mm) and increase the anthocyanic pigment content, which gives the final product its uniform blackish purple colour.

Currants of Ilias (Stafida Ilias): [7] Currants of Ilias are Corinthian currants grown, harvested and dried in the defined geographical area of the Prefecture of Ilia. Besides its physical characteristics (uniform size of the fruit, round shape and deep black colour), the specific characteristics that distinguish Stafida Ilias from other types of dried grape are a higher sugar content (at least 70%) and tartaric acid content (at least 1,69%). In the first half of the 19th century exports led the area to specialise to such an extent that Stafida Ilias became a monoculture. The characteristics of the soil and the subsoil (high levels of humus and potassium) help give Stafida Ilias qualities that distinguish it from dried grapes produced in other regions, namely a high sugar and tartaric acid content.

Sultanina of Crete: [5] The product varies in colour from blonde to brown. It has a sweet taste and a soft texture although dense. It contains minimum 75% sugars and the moisture content is less than 16%. Due to the particular climatic conditions on the island of Crete the Sultanina of Crete has a very low microbial load, while it is characterized by a non detectable quantity of ochratoxins.

3. Production systems

The consumption of raisins dates back to prehistoric times. At that time, it was probably noticed that grapes took on an edible dried form after having fallen off the vine and lain in the sun. Following this natural example, grapes were probably then dried for storage and travel, leading to the early production of raisins, as dried grapes lasted through the winter months and could be more easily stored and transported [8]. History books note that raisins were sun-dried from grapes as long ago as 1490 B.C. [3].

Raisin drying is mostly an "art" based on observation and experience. Weather conditions and date of harvest have the biggest influence on drying time. The length of time raisins take to dry is governed by the physical characteristics of the grapes as well as environmental conditions. Studies have demonstrated that larger berries and thicker fruit skin both increase the drying time. This explains the differences in sun drying time between '*Black Corinth*' and '*Sultanina*' which is 7 to 10 and 14 to 21 days respectively [9, 10].

The crop is harvested by hand when the grapes have acquired their characteristic color and sweetness and the clusters break off easily. Raisin production includes 3 steps: a pre-treatment (optional), drying, and post-drying process. All steps are very important in determining the quality of raisins [9].

3.1. Pre-treatment

Pre-treatment, although not a mandatory procedure, is a step to ensure the increased rate of water removal during the drying process [9]. To accelerate raisin drying, fruit dipping mixtures were developed in ancient times in the Mediterranean area, notably Asia Minor. Initially, they were formulated using olive oil and wood ash. In modern times, wood ash was replaced with food-grade potassium carbonate (K2CO3), and the olive oil by specially formulated dipping oils. Today, most commercial cold dips utilize a combination of potassium carbonate and ethyl esters of fatty acids (commonly referred to as ethyl oleate) as active constituents in unheated water. This treatment increases the rate of water loss twofold to threefold, an important factor in countries where drying conditions are very unpredictable [10]. Grapes were surface treated by dipping in ethyl oleate, which greatly increases the drying rate by altering the waxy layer structure at the grape surface, thus reducing the internal resistance to water diffusion.

Dipping in hot water or the application of chemical products (sulphur, caustic and ethyl or methyl oleate emulsions) as pretreatments are widely used in order to facilitate grape drying. Recently, new methods have been developed such as exposing the grapes to oil emulsions or dilute alkaline solutions [9].

The above described pre-treatment methods are not usually applied prior to the drying of the traditional Greek raisins, with the exception of Sultanina of Crete which may or may not be subject to a pre-treatment method.

3.2. Drying

During drying, the natural sugars in grapes crystallize, while water inside the grape must be removed completely from the interior of the cell onto the outside surface of the grape where the water droplets can evaporate. However, this diffusion process is difficult because the grape skin contains wax in its cuticle, which prevents the water from passing through [9]. In addition to this, the physical and chemical mechanisms located on the outer layers of the grape are adapted to prevent water loss. So, water movement within the grape is relatively speedy, while the transfer of water through the cuticle is rather slow [10].

There are three types of drying methods: sun drying, shade drying, and mechanical drying. Both drying by direct exposure to the sun and drying in the shade are natural drying methods, as no technical or mechanical means are used to start or accelerate the process. *Sun drying* is inexpensive but a rather slow process, while concerns such as environmental contamination, insect infections and microbial deterioration have to be considered [9]. Natural sun drying lasts for a period of 2 to 3 weeks, either in trays on the ground between the vines or hanging on the vines themselves (Dried On Vines – DOV) [8]. Raisins dry much more slowly on the vine than on trays, since temperatures on the vine are lower than on the ground [10]. However, DOV raisin production uses mechanical harvesters and the risk of rain damage is reduced. *Shade drying* has an impact on the color of the produced raisins. Emulsion-dipped grapes dried in the shade tend to retain more chlorophyll and consequently green color. Grapes dried in the dark remain even more green and lighter in color than shade-dried grapes. On the other hand, *mechanical drying* is completed in a safer and more controlled environment, as it is based on modern technology, where rapid drying is guaranteed. One type of mechanical drying is to use microwave heating. Water molecules in the grapes will absorb microwave energy resulting in rapid evaporation. Microwave heating often produces puffy raisins [9]. Moreover, raisins today may also be water-dipped and artificially dehydrated. This procedure involves a short (15 to 20 seconds) exposure to hot water (87 to 93°C) and then placement in a dehydration tunnel (71°C) for 20 to 24 hours [8]. Dipped raisins are dried artificially and have higher moisture content than natural raisins. Solar driers are also available today to speed up the process and to control better the conditions of drying in order to avoid the formation of fungi and the consequence production of micotoxins.

Traditional raisins are mainly produced by sun drying. This natural procedure accounts for the majority of the raisins produced and consumed. Traditional Greek raisins are naturally dried (sun or shade) with the exception of Sultanina of Crete, that may be dried naturally or mechanically. In the latter situation, fresh grapes are placed in an oven under controlled temperature and humidity conditions until their moisture content is reduced to the desirable level <16% [1].

Regarding the Currant of Ilia two methods are used for drying [7]:

1. Direct exposure of the fruit to the sun on special surfaces called *alonia* that resemble sloping roofs (each side slopes down from the top, where there is a gap between them).
2. Drying in the shade, on special frames. This is slower than drying in the sun but produces currants with a better colour. The grapes are placed on frames consisting of two lengths of wood connected by three or four more pieces nailed perpendicularly to these. Reeds or very thin strips of wood are placed on the frames, parallel to the main sides, and the grapes are put to dry on them. They dry naturally in the air.

3.3. Post-drying

After the drying process is complete, raisins are sent to processing plants where they are cleaned with water to remove any foreign objects that may have become embedded during the drying process. Stems and off-grade raisins are also removed. The washing process may cause rehydration so another drying step is completed after washing to ensure that all moisture has been removed [9].

Production of micotoxins due to fungi is one of the most concerns today for raisins production, especially for field drying and during the storage in unsuitable conditions. Warm place (20–30°C) and high humidity must be avoided and ventilation through raisins is very important to prevent fungi formation [3].

During drying, several chemical reactions take place that lead to the brown color. One important browning reaction in raisins is called the Maillard browning reaction or non-enzymatic browning. Certain sugars and proteins react

together in a complex series of steps, creating distinctive flavors and brown pigments. A second reaction that leads to browning of raisins is through the enzyme polyphenol oxidase (PPO) contained within the cells. When PPO is exposed to oxygen, as happens when grapes dry and cells break open, the PPO comes into contact with phenolic compounds (principallycaftaric acid in grapes) to form brown color compounds. The combination of Maillard browning and enzymatic browning is responsible for color development in raisins [10].

4. Nutritional value

Raisins are one of the most widely consumed dried fruits, combining a palatable, sweet taste, due to their high concentration of sugars, and a high nutritional value. Raisins may be eaten raw or cooked, as ingredients in various recipes. Raisins have concentrated sugar content that makes them a rich source of energy. It is worth noting that during the occupation of Greece in World War 2, many people survived from starvation eating raisins, along with other Mediterranean staples such as olive oil, corn bread or corn gruel and greens.

Raisins are a popular and healthy snack, which provide essential nutrients, soluble and insoluble fiber and health protective phytochemicals [8]. Raisins consist of ∼60% sugars by weight and their sweetness is contributed by simple monosaccharides such as glucose and fructose making them a good source of quick energy, while no sucrose (disaccharide) is detected [11].

Raisins are a good source of soluble and insoluble fiber and help meet dietary fiber recommendations. Mannose is the predominant sugar in the soluble fiber. Insoluble fiber contains slightly more glucose than mannose residues. Pectin (measured as uronic acids) accounts for over 50% of total fiber. Lignin levels are low in all types of raisins [8]. Raisins provide over 5 g of fructans per 100 g. Fructans (fructooligosaccharides) are polymers of fructose molecules that are formed from the sugars in the grapes during the dehydration process. Fructans are considered as components of dietary fiber. So, adding fructans to total fiber values of raisins nearly doubles their fiber content. Sun-dried raisins contain 5.7 g fructans per 100 g of fruit, higher than all commonly consumed fruits [12].

Raisins being an excellent source of carbohydrates and a moderate Glycemic Index (GI) food are considered as an ideal snack to provide sustained energy [8]. Raisins provide many necessary vitamins and minerals, including iron, potassium, calcium and certain B vitamins. Raisins, like most fruits, are high in potassium (310 mg per serving meaning 9% of the recommended daily value) and low in sodium, while compared to other fruits, they are high in magnesium and iron. Moreover, raisins have extremely high boron content (2.2 mg per 100 g), an element considered important for the growth and maintenance of healthy bones and joints [13].

Raisins along with grapes are the only fruits that contain significant levels of tartaric acid (TA), 2.0–3.5 g/100 g of TA and 0.6–0.9 g/100 g of TA respectively. Because of its low solubility in water, some of the TA in grapes is lost during processing of grape juice and wine, and so grapes and raisins remain the most practical sources of tartaric acid in the diet. Studies on tartaric acid have shown that its presence in the diet has a positive impact on colonic health [8].

Raisins are also high in certain phytochemicals such as triterpenes, fatty acids, amino acids, 5-hydroxy-2-furaldehyde and phenolic compounds mainly flavonoids (quercetin, kaempferol), isoflavonoids (daidzein, genistein), phenolic (caftaric, coutaric acid) and hydroxycinnamic acids [11]. In comparison to soybeans, which are considered a rich source of daidzein and genistein (2 g/kg wet weight), currants and California raisins contain even higher values, 2.25 and 1.84 mg/kg, respectively [8]. The consumption of one micro-portion of currants (18 g) provides approximately 1 mg of polyphenols identified by GC/MS analysis and 34 mg estimated by the Folin-Ciocalteau assay [14]. Concluding, the combined presence of range of phenolic compounds makes currants a rich source of antioxidants and an important contributor to total polyphenol intake [4].

Corinthian currants have been found to contain several simple phenol species, among which benzoic acids predominated; phenylacetic acids and hydroxy-cinnamic acids as well as flavonoids were also identified. The total polyphenol content of Greek currants was found on average 191 ± 26 mg GAE/ 100 g (by Folin-Ciocalteau assay) [14]. The predominant polyphenolic compound in all currants was vanillic acid at mean concentration 1.21 ± 0.23 mg/100 g currants. Caffeic acid, gallic acid, syringic acid, coumaric acid, protocatechuic acid, ferulic acid, and quercetin also predominated. Research results on Greek raisins point to the Corinthian currants and sultanas as significant antioxidant components of the Mediterranean Diet [15].

Table 1
Nutritional composition per 100 g of different varieties of raisins

	Zante currant[1]	Sultanina[2]	Corinthian currant Vostizza[2]
Energy (Kcal)	283	294	294
Carbohydrates (g)	74.1	65	77.5 ±2
Proteins (g)	4.1	1.8	2.5
Lipids (g)	0.3	0.4	0.4
Fiber (g)	6.8	7.0	6.7
Potassium (mg)	892	860	710
Magnesium (mg)	41	35	30
Iron (mg)	3.3	1.8	4
Calcium (mg)	86	52	10
Phosphorus (mg)	125	Not available	180

[1]USDA National Nutrient Database for Standard Reference Release 26. [2]Agricultural Cooperatives Union Aeghion, Greece, 2014 (http://www.pesunion.gr/english/prod_kordiatr.html)

Raisins are considered as an ideal snack since they provide energy and also help meet nutritional needs. The nutritional composition of the various Greek raisins is presented in Table 1.

5. Health aspects

Scientific evidence has emerged over the years regarding the health effects of grapes and wine, but less is known about the beneficial health effects of raisins, which are a favorable snack widely consumed. The lack of sucrose, the main dietary sugar, hinders dental plaque formation since the synthesis of adherent glucans from dietary sucrose is obstructed, and leads to the prevention of tooth decay and gum disease making raisins a healthy alternative to the commonly consumed sugary snack foods [11].

As raisins are a rich source of fiber, a single serving of raisins provides a significant amount of fiber in a daily diet and can have beneficial effects on colon health [16]. Moreover, evidence suggests that dietary fiber may act synergistically with tartaric acid in raisins to stimulate the growth and/or activity of bacteria in the digestive system in ways claimed to be beneficial to health [17]. Another beneficial health effect due to the presence of tartaric acid is the increased bioavailability of minerals, notably calcium and iron. Therefore, where these minerals are poorly absorbed, it is recommended to add fruits high in tartaric acid such as grapes and raisins. Raisins mixed with iron-fortified cereals may enhance iron absorption, while raisins in vegetable salads may enhance calcium absorption. Raisins are rich in boron, an element that may have an important role in bone growth and maintenance by preventing osteoporosis and arthritis [8].

Raisins are also rich in phytochemicals, which may convey protection against colorectal [16] and gastric [18] cancer and may also play a role in the prevention of cardiovascular disease through a triglyceride- and cholesterol-lowering effect [19]. They have also been reported to provide protection against diabetes by lowering the postprandial insulin response and modulating sugar absorption [20]. Thus, regular consumption of raisins may reduce glycemia and cardiovascular risk factors including inflammation and circulating levels of oxidized LDL [21]. Foods high in phenolic antioxidants can protect against DNA damage during intense physical activity by counteracting oxidative stress [22], making raisins a suitable snack for athletes. Strong correlations were found between the phenolic content of raisins and their antioxidant capacity, so that raisin constituents may lower oxidative stress in humans and thereby lower risk of chronic disease [23].

The protective effects of fruits and vegetables against cancer have been attributed to several components among which soluble and insoluble fiber [24] and polyphenolic compounds, particularly flavonoids [25]. Given that raisins are an important dietary source of both of these cancer-protective compounds, beneficial health effects of raisin consumption are plausible. Besides their high antioxidant activity and dietary fiber content, raisins also have a low to

moderate GI. These health beneficial attributes of raisins give them significant potential for diabetes or cardiovascular disease prevention [26–28].

Recommendations for school canteens have defined raisins as a snack that provides important health beneficial nutrients, while it does not exceed levels of certain health detrimental nutrients when consumed in excess [28]. Raisins are characterized as an appropriate snack for pupils that, in addition to oral and body health, do not contribute to childhood obesity [29].

6. Greek raisin trade

The Phoenicians and Armenians started the raisin trade with the Greeks and Romans. Raisins were particularly valued by the Greeks and Romans, who decorated places of worship with raisins and offered them as an award to winning athletes, while Roman physicians prescribed raisins as a panacea. Phoenicians created vineyards in southern Spain and Greece. The Spanish vineyards grew Muscat raisins, which are oversized, with seeds and full taste, while farmers of Corinth, Greece, grew tiny, seedless, pungent raisins called currants [3].

In the 11th century, crusader knights first introduced raisins to Western Europe, when they returned home from the Mediterranean, and it wasn't long after that raisin becomes an important part of the European nutrition. Their integration into the European cuisine and their increased demand led to the boosting of their price by the 14th century. There was an unsuccessful attempt to expand cultivation of grapes for raisins in other European countries like England, France and Germany, but climates in these countries were too cold for drying the fruit. In contrast, Greece had the ideal climate and soon became one of the major raisin markets [3].

The systematic cultivation of black currant started in the 14th century first in Northwestern Peloponnese (Corinth, Ilia, Achaia) and later in the early 16th century, the Venetians transplanted the currant vines from the Peloponnese to the Ionian islands Zante and Cephalonia, which were under their rule. The Zante currants soon became the island's "black gold". They were one of the island's most characteristic products and the top export product of Zante to Europe by the early 19th century. On the other hand, in the Peloponnese currant production was abruptly interrupted due to the Greek war of independence. Following the war (1830), the vines were intensively cultivated again with grapes for raisins and by the second half of the 19th century the Corinthian currant was the top exported product, covering 50–70% of the total exports of Greece. It is noteworthy that in 1836 the currants cultivation represented 3% of the total vine cultivation in Greece, while over the next 25 years the currants cultivation raised up to 23% [30].

The catastrophe of French and Spanish vineyards by the insect phylloxera in 1878 compelled French wine producers to turn to Corinthian raisins for wine making. This significantly increased the demand for currants, especially Stafida Ilias, which became renown at that time. As production rose, the Prefecture of Ilia became the epicenter of the raisin trade and a rail line was built, so that the currants could be more quickly and easily transported, linking Pyrgos (the capital of the Prefecture) with the port of Katakolo. The rail line was inaugurated on 3 February 1883 and was the very first rail line to be built in Greece [7]. This was the "golden era" in which many currant vine farmers became wealthy, while in the period between 1887 and 1893 the value of currants significantly exceeded that of all other export goods [31]. The Greek cultivators, not anticipating the speed of this expansion, went on extending their own currant vineyards from 435,000 stremmas in 1880 to 670,000 in 1891. The increased raisin demand had such an impact that even the olive groves were changed into vineyards [32].

However, when French vineyards recovered from the phylloxera, the French government voted protective laws for the local vineyards and established strict norms on imported currants and raisins. So, the price for currants and raisins fell to a sixth of its former international level. The situation was further worsened through the worldwide economic bank crisis at the beginning of the 1890s, which severely affected Greece. Greece was not able to sufficiently manage the declining demand for its extended production. Eventually, in the beginning of the 1900s the Greek currant market collapsed causing irreparable harm to the local economy and society. More than 350.000 people from the currant producing areas of Greece emigrated between 1890 and 1915, mostly to America. The currant crisis caused economical and political turmoil and social riots occurred. The farmers fought for better prices and demanded the introduction of a currant trade monopoly to stabilize their profits. The Greek government attempted to relieve the situation by intervening in the market and issued a law retaining 15% of the currant production each year in order to reduce supplies and increase prices. Thus, a "currant bank" was founded in 1899 with capital from the government

and shareholders the producers who were obliged to store a proportion of their crop. However, the very rich crop of 1903 closed it down, as its capital was not sufficient to buy the large surplus [33].

A solution then came from the Bank of Athens involving a project for an international "Privileged Company to Protect Production and Trade in Currants" attracting capital from abroad. A first attempt to found this institution in 1903 failed, but a second attempt in 1905 was successful and the newly founded company managed to stabilize the currant market and the international prices for raisins, though at a lower level than before 1893. Nevertheless, price crashes were avoided and lost confidence in the merchandise restored. The company was obliged to buy all currants that had not been sold abroad for higher prices by the growers. Export of these revenue currants in their natural state was not allowed, so as not to ruin world market prices. So, as an alternative, they had to be turned into wines, other alcohol or other products within the country. The company held the monopoly to sell alcohol in Greece, and it was not allowed for anybody in the entire country to make alcohol from any materials other than raisins. Additionally the company was encouraged to advertise currants in new markets to increase the consumption of this natural Greek monopoly abroad [31].

In August 1925, the Autonomous Currants Organization (A.S.O.) was founded by the Greek state aiming to protect the cultivation and trade of Corinthian raisins in an attempt to find solutions to the raisin problem through the Greek market and the industrial processing of raisins. In December 1998 A.S.O. is replaced by the Currants (Corinthian Raisins) Cooperative S.KO.S. A.S.E. with partners the agricultural cooperative unions in the areas where Currants (Corinthian Raisins) are cultivated.

Greece has the monopoly of currants within the EU. The only competitor of the Corinthian currant, which holds the 70% of world production (Australia and the USA are the others) is sultana, produced in Crete, which has its own market share as it is cheaper. In 1980 Greece reached the production peak of 70.000 tons of black currants. However, during the past decade raisin production in Greece has steadily declined from 39.000 to 20.000 tons for currants and from 37.000 to 1.500 tons for sultaninas [1].

Raisins, an exceptional snack with health promoting properties, also have a high potential for the agricultural and export sector.

References

[1] Hellenic Republic, Ministry of Rural Development and Food [homepage on the Internet]. 2014 MINAGRIC [cited 2014 Febr. 5]. Available from: http://www.minagric.gr/index.php/el/for-farmer/crop-production/ampeli/1062-apojiramenistafida.html

[2] Christensen LP. Raisin Grape Varieties. In: University of California, Agricultural and Natural Resources Publication 3393. Raisin Production Manual. California: Oakland; UCANR Publications. 2000; p. 38-47.

[3] Mencarelli F, Bellincontro A. DiRenzo G. GRAPE: Post-harvest Operations. Mejía D, editor. Information Network on Post-harvest Operations (INPhO), Food and Agriculture Organization of the United Nations. 2005.

[4] Chiou A, Panagopoulou EA, Gatzali F, De Marchi S, Karathanos VT. Anthocyanins content and antioxidant capacity of Corinthian currants (Vitis vinifera L., var. Apyrena). Food Chem. 2014;146:157-65. doi: 10.1016/j.foodchem.2013.09.062

[5] European Commission, Agriculture and rural development. [DOOR database]. [cited 2014 Febr. 5]. Available from: http://ec.europa.eu/agriculture/quality/door/list.html

[6] Official Journal of the European Union. Council Regulation (EC) No 510/2006, Stafida Zakynthou. C 179/19-22, 1.8.2007.

[7] Official Journal of the European Union. Council Regulation (EC) No 510/2006, Stafida Ilias. C 233/20-23, 28.8.2010.

[8] Health Research & Studies. Prepared for Center Sun-Maid Growers of California. Health benefits of Sun-Dried Raisins. Prepared by Carughi A, Contributors: Lamkin T and Perelman D. 2008.

[9] Esmaiili M, Sotudeh-Gharebagh R, Cronin K, Mousavi MAE, Rezazadeh G. Grape Drying: A Review. Food Reviews International. 2007;23:257-80. doi: 10.1080/87559120701418335

[10] Christensen LP, Peacock WL. The Raisin Drying Process. In: University of California, Agricultural and Natural Resources Publication 3393. Raisin Production Manual. California: Oakland; UCANR Publications. 2000. p. 207-16.

[11] Wu DC. Grape products and oral health. J Nutr. Supplement: Grapes and Health. 2009;139(9):1818S-23S. doi:10.3945/jn.109.107854

[12] Camire ME, Dougherty MP. Raisin dietary fiber composition and *in vitro* bile acid binding. J Agric Food Chem. 2003;51(3):834-7.

[13] Rainey CJ, Nyquist LA, Christensen RE, Strong PL, Culver BD, Coughlin JR. Daily boron intake from the American diet. J Am Diet Assoc. 1999;99(3):335-40.

[14] Chiou A, Karathanos VT, Mylona A, Salta FN, Preventi F, Andrikopoulos NK. Currants (Vitis vinifera L.) content of simple phenolics and antioxidant activity. Food Chemistry. 2007;102:516-22. doi:10.1016/j.foodchem.2006.06.009

[15] Kaliora AC, Kountouri AM, Karathanos VT. Antioxidant properties of raisins (Vitis vinifera L.). J Med Food. 2009;12(6):1302-9. doi: 10.1089/jmf.2008.0227

[16] Kountouri AM, Gioxari A, Karvela E, Kaliora AC, Karvelas M, Karathanos VT. Chemopreventive properties of raisins originating from Greece in colon cancer cells. Food Funct. 2013;4(3):366-72. doi: 10.1039/c2fo30259d

[17] Spiller AG, Story AJ, Furumoto JE, Chezem JC, Spiller M. Effect of tartaric acid and dietary fibre from sun-dried raisins on colonic function and on bile acid and volatile fatty acid excretion in healthy adults. British Journal of Nutrition. 2003;90:803-7. doi:10.1079/BJN2003966

[18] Kaliora CA, Kountouri MA, Karathanos TV, Koumbi L, Papadopoulos GN, Andrikopoulos KN. Effect of Greek Raisins (Vitis Vinifera L.) from different origins on gastric cancer cell growth. Nutrition and Cancer. 2008;60(6):792-9. doi:10.1080/01635580802295776

[19] Williamson G, Carughi A. Polyphenol content and health benefits of raisins. Nutrition Research. 2010;30:511-9. doi: 10.1016/j.nutres.2010.07.005

[20] Kanellos PT, Kaliora AC, Tentolouris NK, Argiana V, Perrea D, Kalogeropoulos N, Kountouri AM, Karathanos VT. A pilot, randomized controlled trial to examine the health outcomes of raisin consumption in patients with diabetes. Nutrition. 2014;30:358-64. doi: 10.1016/j.nut.2013.07.020

[21] Anderson JW, Weiter KM, Christian AL, Ritchey MB, Bays HE. Raisins compared with other snack effects on glycemia and blood pressure: A randomized, controlled trial. Postgrad Med. 2014;126(1):37-43. doi: 10.3810/pgm.2014.01.2723

[22] Alasalvar C, Shahidi F, editors. Dried Fruits: Phytochemicals and Health Effects. 1st ed. Functional Food Science and Technology. Wiley J & Sons, Inc. Publication Wiley-Blackwell; 2013. ISBN 978-0-8138-1173-4.

[23] Breska PA, Takeoka RG, Hidalgo BM, Vilches A, Vasse J, Ramming WD. Antioxidant activity and phenolic content of 16 raisin grape (Vitis vinifera L.) cultivars and selections. Food Chemistry. 2010;121:740-5. doi: 10.1016/j.foodchem.2010.01.029

[24] Norat T, Aune D, Chan D, Romaguera D. Fruits and Vegetables: Updating the epidemiologic evidence for the WCRF/AICR lifestyle recommendations for cancer prevention. Cancer Treat Res. 2014;159:35-50. doi: 10.1007/978-3-642-38007-5_3

[25] Holt EM, Steffen LM, Moran A, Basu S, Steinberger J, Ross JA, Hong CP, Sinaiko AR. Fruit and vegetable consumption and its relation to markers of inflammation and oxidative stress in adolescents. J Am Diet Assoc. 2009;109(3):414-21. doi: 10.1016/j.jada.2008.11.036

[26] Anderson JW, Waters AR. Raisin consumption by humans: Effects on glycemia and insulinemia and cardiovascular risk factors. J Food Sci. 2013;78(Suppl 1):A11-17. doi: 10.1111/1750-3841.12071

[27] Muraki I, Imamura F, Manson EJ, Hu BF, Willet CW, Dam van MR, Sun Q. Fruit consumption and risk of type 2 diabetes: Results from three prospective longitudinal cohort studies. BMJ. 2013;347:f5001. doi: 10.1136/bmj.f5001

[28] Committee on Nutrition Standards for Foods in Schools, Food and Nutrition Board, Institute of Medicine. Nutrition Standard in Schools: Leading the Way Towards Healthier Youth. National Academy Press, Washington, DC. 2007; pp. 120-22

[29] Patel BP, Luhovyy B, Mollard R, Painter JE, Anderson GH. A premeal snack of raisins decreases mealtime food intake more than grapes in young children. Appl Physiol Nutr Metab. 2013;38(4):382-9 doi: 10.1139/apnm-2012-0309

[30] Mariana Kavroulaki. History of Greek Food. Raisins, Currants, Sultanas. 2007 [cited 2014 March]. Available from: http://1historyofgreekfood.wordpress.com/2007/10/

[31] Schonharl K. Fighting the financial crisis in Greece: The Privileged Company to Protect Production and Trade in Currants (1905) as international bank cooperation. The Historical Review/La Revue Historique Section of Neohellenic Research/Institute of Historical Research. 2013;10:107-34.

[32] Dertilis G. The Industrial Revolution and the Greek Economy (1830–1910). Athens: Ant. Sakkoulas. 1984.

[33] Andreades A. The Currant crisis in Greece. The Economical Journal. 1906;16(61):1-51.