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EVALUATION OF RAISIN JUICE QUALITY CHARACTERISTICS-A REVIEW

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ABSTRACT

The most significant fruit crop globally in terms of economic importance is grapes (***Vitis species***). These fruits are used to make wine as well as table grapes, raisins, and juices. Producing an enormous number of raisins is a common practice worldwide, with Mediterranean countries being particularly fond of these fruits. Raisins are made by mechanically drying grapes in an oven or by letting them dry naturally in the sun. Consumed as fresh fruit, raisins are valued for their tart flavor. Due to enzymatic activities (polyphenol oxidase and peroxidase), natural microbial and mold contamination of raisin juice, and flavor alterations during storage, it has a short shelf life of (7) days in the normal refrigerator. It's not always advisable to store raisin juices in the refrigerator to preserve the desired quality of certain fruits. This study aims to show that no more research has been carried out on raisin juices. In demand for awareness among people about raisin juices, this study is an effort to measure some quality parameters such as chemical composition, phenolic compounds, polyphenol oxidase enzyme activity, and sensory evaluation. Additionally, because grapes contain antioxidant polyphenols, consuming them has several positive effects on human nutrition and health

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Introduction

The genus grape (***Vitis vinifera L***.) has different 63 species belonging to ***Vitaceae*** family . A grape is a non-climacteric fruiting berry that is perennial and deciduous. which are mostly distributed between America and Asia and the moderate zones of the northern hemisphere (Mullins, 1992).

One of the most popular fruit crops in the world is grapes, illustrated grape production all over the world was approximately 73524196.23 tone in 2021 (FAO, 2021).

Drying is one of the ancient methods used to preserve grapes, known as raisins, Reducing and slowing down water activity to increase the shelf life of products. Broadly, some drying methods are applied to produce raisins: traditional sunlight drying, oven drying, and heat mechanical drying. Sun or traditional dryers, which are economically processed raisins, However, the quality of natural dried grapes is acceptable. On the other hand, direct solar dryers are the other kind. The parts to be dried are placed in a polynet shade in this dryer, which may or may not have transparent side panels or covers. 30% of total grape production is being used for direct consumption as fresh, 35% as dried items, 20–25% for traditional different outcomes such as raisin and grape juice, and 5–10% for alcoholic production. which is being offered for consumption as fresh and the rest as dried. Nearly one kg of raisins can be obtained from four kg of grapes by the drying method (Karabina, 2016). Due to factors such as contamination, the expiration date of fresh juice may be reduced to a few days in the refrigerator. People choose food to be fresh, quality, and safe to provide a range of accepting tastes, color views, textures, and aromatic foods; and to maintain nutritional value. (Mohamadi Sani, 2013)

The enzyme polyphenol oxidase (PPO) is extremely sensitive to heat, and as it dehydrates, its activity decreases. The enzyme's leftovers prevent the raisins from discoloring while they are being stored. However, the actions of enzymes like PPO enzyme, peroxidase, and pectin methylesterase cause undesirable qualities in juice, such as appearance, taste, and odor (Bub, Watzl, Blockhaus, Briviba, Liegibel, Müller, et al., 2003). The commercial food industry can be laid out as a logical series of stages to produce a satisfactory healthy food product from ingredients, allowing them to understand this food and develop items and processes that can aid in the various stages of production. (Mitić, Obradović, Grahovac, & Pavlović, 2010)

Raisin Juice Chemical Composition

The composition of grape juice is water, sugars, protein, oil, ash, calcium, phosphorus, iron, sodium, potassium, niacin, riboflavin, thiamine, and ascorbic acid. Raisins contain low micronutrients such as ash and fiber as well as sources of micronutrients carbohydrates, low protein, and lipids. Both main sugars like glucose and fructose are the two natural carbohydrates available in grape juice. In addition, the authenticity of grape juice depends on carbohydrates, acids, and flavor compounds such as volatile components, tannins, and color compounds. The degree quality of the juice is determined by the modification that occurs in grapes during growth and maturation (Bates, and, & Crandall, 2001).

Naturally , starch, sugar content, and pigment density increase while the acidity pH and titratable acidity decrease (Bates, and, & Crandall, 2001). Principally, the chemical properties are changed depending on the varieties, and environment states as well as the processing of grape juice. Normally, the chemical composition of grape juice is illustrated as follows: Brix 28.85%, protein 0.69%, fiber 1.10%, and fat 0.82%. The mean pH and total soluble solids are 4.25 and 65.58, respectively. The amount concentrations of Ca, Na, P, Fe, and are Mg 817, 0.9, 492, 60, and 1,704 ppm, respectively (Mohamadi Sani, 2013)

The range of proline, the primary amino acid in grape juice, is 180–320 mg/L (12.5° juice dry matter), and these numbers agree with the definitions provided by (Huang & Ough, 1989)

Currently, diverse grape-derived products are being demanded by the marketing such as raisins, juices, molasses, alcoholic drinks, jelly, jam, syrup, and wine beverages.

Additionally, products of the grape industry (skins, seeds, seed oil, pomace) possess good nutraceutical values and are being supplied to the market in different forms such as powders, granulates, and concentrated or dried extracts (Barona, Aristizabal, Blesso, Volek, & Fernandez, 2012). Perhaps linked to the higher polyphenol and Maillard Reaction products such hydroxyl methyl furfural, are the increased antioxidant activity and browning index (Sanz, del Castillo, Corzo, & Olano, 2001). However, the increased sugar concentration and high temperature as results of the drying methods can also boost the antioxidant activity (Barona, Aristizabal, Blesso, Volek, & Fernandez, 2012).

Drinking fruit juices can have both positive and negative effects on the consumers' side of their body health. Consumer demand for safety and quality processed foods with high characteristics has encouraged better food production. 70% to 80% of freshly released grape juice is moisture and several dissolved solids. There are numerous chemical and inorganic compounds in these soluble solids. (Riahi & Ramaswamy, 2004). (Shi, Yu, Pohorly, & Kakuda, 2003) looked at the universal phenolic acids found in grapes, which include cinnamic acids (chlorogenic acid, caffeic acid, coumaric acid, ferulic acid, and neochlorogenic acid) and benzoic acids (gallic acid, vanillic acid, protocatechuic acid, and p-hydroxybenzoic acids). After being dried, raisins with a moisture level of more than 18% will be contaminated by mold; if it is less than 11%, they will have an unfavorable taste and a firm mouthfeel. Rounded to sixteen percent moisture content is the ideal range for raisins (Karimi, 2015). Additionally, it is high in vitamins A, B3, and C as well as trace minerals, specifically Ca, Mg, P, Na, and K (Papadakis, Gardeli, & Tzia, 2006).

Fruit juices contain phytochemicals that are helpful for disease prevention, including vitamins, carotenoids, flavonoids, and phenolic compounds (Gardner, White, McPhail, & Duthie, 2000). Antioxidant status is improved by consuming polyphenol-loaded juice (Bub, et al., 2003). On the other hand, raisin juice contains sufficient nutrients that support the growth of microbes. Infectious diseases may have originated from it (Riahi & Ramaswamy, 2004). Fifteen phenolic compounds with values ranging from 2 mg/kg to 198 mg/kg dry matter were discovered and measured in pomace. The principal anthocyanin glucosides in the juice are cyanidin and petunidin 3-O-glucoside, whereas the main phenolic components in the grapes and pomace are gallic acid and (+)-catechin hydrate, according to HPLC examination of the samples (Ramirez-

Lopez, et al., 2014). Other chemicals extracted by enzymatic hydrolysis from whole grapes, flesh, juice, or pomace include total phenolic, flavonoid, anthocyanin, and stilbenes. Additionally, nine phenolic chemicals were momentarily detected and measured in the entire grape samples. In grape juice, twelve phenolic compounds have been found and measured. The concentrations of each of them range from 3 mg/kg to 875 mg/kg of dry weight. The dry weight content ranged from 0.07 mg/kg to 910 mg/kg. (Papadakis, Gardeli, & Tzia, 2006) It was shown that one of the most important vitamins in grape juice is ascorbic acid (Vitamin C), Although vitamin C is heat-sensitive, its existence may guarantee the preservation of other components. Which is concerned with the performance of biocompounds in a healthy human body. (Maia, Sousa, Santos, Silva, Fernandes, & Prado, 2007).

Two models are used for the extraction of raisin juice: hot and cold extraction; both methods have several positive and negative sides. Red fruits are typically processed using the hot break method to maximize the ultimate juice yield and color-flavor extraction. Using a tubular heat exchanger, crushed fruit or mash is heated to 40 to 60 degrees Celsius. (Hawsar S. Hussein, 2019). Raisins are cleaned, immersed in pure water for fifteen minutes, combined with some pure water, ground, and then pressed through cheesecloth in the cold extraction method. One kilogram of raisins can yield 2 to 3 liters of raisin juice. About 18% of the concentrated raisin juice is made up of solid matter controlled by a hand refractometer. The prepared juice is then kept in a refrigerator at +4 °C after being moved to a sanitized container (ABDULLAH, 2012). The benefits of using a machine for extraction are saving time, increasing capacity, increasing efficiency, and reducing waste and spoilage (Francis Olawale Abulude & Agriculture, 2007).The goal is to extract as many yields as possible to increase profit. According to (Barona, Aristizabal, Blesso, Volek, & Fernandez, 2012) it is even better if the pressure can be applied until the lowest moisture level since this can further reduce the expenses associated with disposal.

Shelf Life of Raisin Juice

Many microorganisms, especially those that can withstand acidity, such as molds, fungus, and yeasts, can cause illness in fresh juice that uses fruit as a substrate. Produce may develop discolorations, bad tastes, and off aromas. Yeast is the main cause of spoilage fruit juice. The fluids' low pH preserves the endurance of the most bacteria and creates an ideal environment for fungi. (Tournas, Heeres, & Burgess, 2006) In the refrigerator, freshly squeezed white grape juice went sour in ten days. because the juice had 5000 CFU/ml (3.7 logs CFU/mL) at that point. The juice treated with 126 mg/cm2 UV dose, according to the same researchers, did not spoil and had a microbial load of less than 5000 CFU/mL after 13 days. This included 1.53 log CFU/mL (33.88 CFU/mL) total count, 0.79 log CFU/mL yeasts (6.17 CFU/mL), and 1.06 log CFU/mL (11.48 CFU/mL) lactic acid bacteria. (Tran & Farid, 2004). Fruit juices are commonly spoiled by the stringent ***anaerobe bacterium gluconobacter***, which needs free oxygen to thrive. ***Alicyclobacillus*** deterioration in fruit juices treated with heat is becoming a significant issue. (Battey & Schaffner, 2001). The development of the microbe is linked to the juice's antiseptic and smokey taints. (Jensen & Whitfield, 2003). Additionally, this microbial species can grow in a pH range of 2.5 to 6.0. When it comes to perishable goods, the total aerobic plate count can be used to indicate possible spoiling by indicating the overall microbiological quality of the product. Another useful tool for determining the hygienic conditions in which food is produced and/or prepared is the aerobic plate count. (Andrews, De Graaf, & Stamation, 1997)

Fruit juice preservation techniques including pasteurization, refrigeration, and sterilization are frequently employed to preserve the sensory qualities of juices like color, flavor, and taste while also ensuring microbiological stability by eliminating harmful microbes. (Noor, Hasan, & Rahman, 1970).

Decreasing the rate of water activity in food processes is one effect of lowering the water activity in a food product. During their measurements, they found that the water activity varied with temperature and that the levels of water activity that were evaluated were 0.850, 0.880, 0.900, 0.920, 0.940, 0.960, and 0.980. Additionally, the incubation time was conducted at temperatures ranging from 10 ˚C to 40 ˚C. (Tassou, Natskoulis, Magan, & Panagou, 2009)

Quality of Raisin Juice

Because its components are more exposed to air and easier for microbes to reach, fresh fruit juice has a higher propensity for contamination than whole fruits. Dissolved oxygen, metal warnings, and other elements that alter the fruit juice's flavor, scent, and color are examples of further quality losses. Fruit juice acquires an unwanted hue due to the nonenzymatic Maillard reaction, which creates brown pigments from reducing sugars and amines. (Bates, and, & Crandall, 2001).

Assessment of the quality and safety of black raisin juice in the markets of Erbil - Iraq showed that natural colored juice and sucrose sugar are added, but relatively safe after water activity within (2) weeks the results of water activity in raisin juices (0.949-0.963) ("Determination of Some Quality and Safety Parameters for Black Raisin Juice," 2019; Hawsar S. Hussein, 2019).

The most acidic pH that results from pressing grapes and grape juice typically falls between 3.2 and 4.0. During harvest, malic and tartaric acids account for more than 90% of the acidity in grapes. The organic acid profile has a significant impact on fruit juice quality. Tartaric and malic acids are the two main organic acids that make up 90% or more of the overall acidity in grapes.

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Textural/structural balance is influenced by titratable acidity (TA), or the acid content of the fruit and the wine that results from it. There are four sources from which one can determine a wine's organic acid content. In unfermented grapes, citric acid is present at (0.2 g/L to 3.0 g/L) , but tartaric and malic acids are present at (2.0 g/L to 10 g/L and 1.0 g/L to 8.0 g/L) , respectively.(Amerine, 1980)

Fruit juice contains a small amount of protein; hence, it is not considered a juice ingredient. Fruit juices include small amounts of amino acids; however, these are necessary due to their interactions with decreasing sugar during the nonenzymatic browning (also known as the Maillard reaction) of the juice. While the products of this reaction have antibacterial and antioxidant properties, browning degrades the fruit juices' quality. (Selen Burdurlu & Karadeniz, 2003).Fruit juices are well recognized as excellent providers of vitamin C. Furthermore, because vitamin C is heat-sensitive, its presence may guarantee that other ingredients are retained, making it a crucial indicator of food quality. Also, an antioxidant is ascorbic acid.(Dani, Oliboni, Vanderlinde, Bonatto, Salvador, & Henriques, 2007).

Most of the grapes' dietary fiber is in the pulp, skins, and seeds as pomace. It is imperative to consume this processed raw material as part of a diet because, after manufacture, it ends up in dumps, a huge loss of substances that promote health.(Costea, Hudiță, Ciolac, Gălățeanu, Ginghină, Costache, et al., 2018).Polyphenol oxidase (PPO) and lipoxygenase (LOX), which cause the juice to oxidize, are the two most significant enzymes for assessing the quality of fruits and vegetables. While the presence of enzymes can occasionally have a positive impact on juice processing, they are typically major issues that lead to the juice's quality declining.(Falguera, Pagán, Garza, Garvín, & Ibarz, 2011) Additionally, pectin methylesterase is also known as pectinesterase. Pectinesterase has been implicated in the development or absence of textural characteristics, according to reports.(Vora, Kyle, & Small, 1999).Sensory analysis examines the texture, flavor, taste, appearance, and smell of a product or food by employing the panelists' senses of sight, smell, taste, touch, and hearing.(Ruiz-Capillas & Herrero, 2021) . The components found in grapes determine the quality of the grapes as well as the flavor, stability, and sensory qualities of the wine. Among these molecules are sugars like glucose and fructose.(Jordão, Vilela, & Cosme, 2015). The primary method used in product development and quality control to assess food items' flavors and determine which sweetener is optimum to replace sucrose in a particular product is sensory evaluation.(Porto Cardoso & AndrÉ Bolini, 2008).

Total phenolic content (PPC) in fruit juices

Plants can be analyzed for polyphenol, flavonoid, and tannin content using a variety of techniques (Akan, Bagatur, & Karaogul, 2023; Alwazeer, Elnasanelkasim, Çiçek, Engin, Çiğdem, & Karaoğul, 2023; Hamad, Alma, Gulcin, Yilmaz, & Karaogul, 2017; Ikinci, Dursun, & Karaogul, 2021; Eyyup Karaogul, Altuntas, & Alma; E. Karaogul, Kirecci, & Alma, 2016; E. Karaogul, Parlar, Parlar, & Alma, 2016; Ugurtay & Karaogul, 2022; Verep, Ates, & Karaogul, 2023). Reagents like Folin-Denis can be used in simple, less expensive techniques to assess the total PPT. According to this analysis, raisins have a total phenolic content that varies between (9 and 12) mg of gallic acid equivalents per gram of raisin (Xu, Zhang, Wang, & Lu, 2010). It was found that the universal phenolic acids found in grapes include benzoic acids (p-hydroxybenzoic acids, vanillic acid, protocatechuic acid, and gallic acid) and cinnamic acids (chlorogenic acid , coumaric acid, caffeic acid, ferulic acid, , and neochlorogenic acid). Then, the whole phenolic and antioxidant content of the grape-based raisins may be lost. (Breksa, Takeoka, Hidalgo, Vilches, Vasse, & Ramming, 2010)

The method most frequently used to quantify total phenolics in plant materials is the Folin–Ciocalteu test. In the presence of phenolic chemicals, phosphomolybdic–phosphotungstic acid (also known as the Folin–Ciocalteu reagent) is reduced to a blue-colored complex in an alkaline solution. Most of the antioxidants found in grape skins and seeds are phenolic compounds. (Careri, Corradini, Elviri, Nicoletti, & Zagnoni, 2003). For example, anthocyanins, catechins, and resveratrol are concentrated in the flesh grape part .(Kammerer, Claus, Carle, & Schieber, 2004).

Juice high in polyphenols enhances antioxidant status, reduces DNA oxidation (Deoxyribonucleic Acid), and boosts the activity of immune cells.(Bub, et al., 2003). Fruit juices that have a great flavonoid content, particularly those made from grape juice, lower the incidence of coronary artery diseases.(Stein, Keevil, Wiebe, Aeschlimann, & Folts, 1999).

It has been shown that consuming only fruit juice improves nutritional intake. Additionally, it was believed that children between the ages of 2 and 11 had no reason to be overweight (17). (Nicklas, O'Neil, & Kleinman, 2008). When consumed in moderation, grape juice may improve neurocognitive function in older adults experiencing early-onset dementia. (Huang & Ough, 1989). Grape seed extract rich in polyphenols has a significant ability that is a crucial neuropathological characteristic in Alzheimer's disease. (Ksiezak-Reding, Ho, Santa-Maria, Diaz-Ruiz, Wang, & Pasinetti, 2012).

The authors demonstrated that epicatechin and catechin were engaged in this mechanism, while resveratrol was unsuccessful. Grape polyphenols' anti-inflammatory and antioxidant characteristics make them capable of preventing liver damage. (Nassiri-Asl & Hosseinzadeh, 2009)

Rich in polyphenols, grape skin extract has been shown to mitigate diet-induced obesity and hepatic steatosis while also improving liver steatosis. (Park, Park, Kim, & Kang, 2003)

Additionally, it has been shown that consuming purple grape juice high in flavonoids may reduce the risk of cardiovascular illnesses and prevent thrombosis. (Albers, Varghese, Vitseva, Vita, & Freedman, 2004)

Concentrated mostly in grape skins and seeds, flavonoids constitute the primary class of potent anticancer components in grape products.(Hogan, Canning, Sun, Sun, & Zhou, 2010).

Conclusions

Vitis vinifera is a versatile plant that can be used in breeding projects to produce desirable features including greater resistance to diseases and climate change. Investigating this kind of resource is a better idea than following the global trend of growing only commercially viable types. We present a thorough analysis of the nutritional traits of Vitis vinifera and hybrid grape cultivars, both classic and contemporary. Research is presented comparing the sugar, organic acid, phenolic, nitrogenous and aromatic components, and sensory properties of the cultivars and associated wines.

Different drying techniques affect grape composition, particularly when related to increases in carbohydrate concentration. Additionally, because of the drying process, the total calories per gram, antioxidant activity, and density of other components—such as fibers—increase dramatically when compared to fresh fruit. The quality of grape juice can be greatly influenced by several factors, including the grape cultivar and maturity level, as well as environmental factors like soil quality, climate region, vineyard management, harvesting practices, and harvesting method, in addition to processing techniques. It's not always advisable to store raisin juices in the refrigerator to preserve the desired quality of some fruits. Microbial contamination may primarily come from the water used to prepare raisins.

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