Raisins

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Raisins are dried grapes consumed worldwide that contain beneficial components for human health. They are rich in fiber and phytochemicals such as phenolic compounds. Despite a 60% sugar content, several studies have reported health-promoting properties for raisins and this review compiles the intervention studies, as well as the cell line and animal model studies carried out to date. It has been demonstrated that raisins possess a low-to-moderate glycemic index, which makes them a healthy snack. They seem to contribute to a better diet quality and may reduce appetite. Their antioxidant capacity has been correlated to the phenolic content and this may be involved in the improvement of cardiovascular health. In addition, raisins maintain a good oral health due to their antibacterial activity, low adherence to teeth and an optimum oral pH. Raisin consumption also seems to be favorable for colon function, although more studies should be done to conclude this benefit. Moreover, gut microbiota could be affected by the prebiotic content of raisins. Cell line and animal model studies show other potential benefits in specific diseases, such as cancer and Alzheimer's disease. However, deeper research is required and future intervention studies with humans are needed. Overall, incorporating an 80–90 g portion of raisins (half a cup) into the daily diet may be favorable for human health.

Keywords: raisins ; polyphenols ; health benefits ; humans

1. Introduction

Raisins are dried grapes mostly obtained from different cultivars of *Vitis vinifera* L. and are extensively consumed worldwide. The type of raisin depends on the grape variety, color and size. The most common are dark raisins, usually obtained from Thompson seedless grapes. Golden raisins, or Muscats, are normally produced from white Muscat grapes. Sultanas originate from seedless yellow grapes and are usually sweeter and softer than other varieties. Zante currants, currants or Corinthian raisins are produced from black Corinth grapes and are smaller in size[1].

Raisins are sweet as they consist of about 60% sugar, predominantly fructose and glucose[2], which gives rise to the common conception that they are unhealthy. However, they are rich in dietary fiber (3.3–4.5 g per 100 g) (Table 1)[2][3], which contributes to their prebiotic effect[4][5] , as they are selectively used by host microorganisms and confer a health benefit [6]. During the production of raisins, the dehydration process converts part of the grape sugars into fructan, a form of fiber. While fructans are not detectable in grapes, in raisins, the fructan content can be up to 8% [3]. In plants, fructans are synthesized from sucrose by the action of two or more different fructosyltransferases[7].

Table 1. Nutritional composition of golden and dark seedless raisins (100 g)[8].

Nutrient	Golden raisins	Dark raisins	Units
Proximates			
Water	14.90	15.46	g
Energy	301	299	kcal
Protein	3.28	3.30	g
Total lipid	0.20	0.25	g
Carbohydrate (by difference)	80.02	79.32	g

Fiber (total dietary)	3.30	4.50	g
Sugars (total)	65.70	65.18	g
Minerals			
Calcium	64	62	mg
Iron	0.98	1.79	mg
Magnesium	35	36	mg
Phosphorus	101	98	mg
Potassium	746	744	mg
Sodium	24	26	mg
Zinc	0.37	0.36	mg
Vitamins			
Vitamin C (total ascorbic acid)	3.20	2.30	mg
Thiamin	0.008	0.106	mg
Riboflavin	0.191	0.125	mg
Niacin	1.142	0.766	mg
Vitamin B-6	0.323	0.174	mg
Folate (DFE) [1]	3	5	µg
Vitamin B-12	0	0	µg
Vitamin A (RAE) [2]	0	0	µg
Vitamin A (IU) [3]	0	0	µg
Vitamin E (alpha-tocopherol)	0.12	0.12	mg
Vitamin D (D2 + D3)	0	0	µg
Vitamin D	0	0	IU
Vitamin K (phylloquinone)	3.5	3.5	µg

Lipids			
Fatty acids (total saturated)	0.065	0.094	g
Fatty acids (total monounsaturated)	0.014	0.024	g
Fatty acids (total polyunsaturated)	0.057	0.053	g
Fatty acids (total *trans*)	0	0.001	g
Cholesterol	0	0	mg

[1] DFE (dietary folate equivalents); [2] RAE (retinol activity equivalents); [3] (IU) International Unit.

Furthermore, raisins represent an important source of potassium and other bioactive compounds, including phenolic compounds and tartaric acid, which may benefit human health[1]. The growing interest in phytochemicals lies in their biological and physiological activities with health-promoting attributes. Polyphenols are plant secondary metabolites and are reported to have multiple biological effects[9][10]. The major polyphenols found in raisins are phenolic acids (caftaric and coutaric acid) and flavonols (quercetin and kaempferol glycosides, and rutin)[11][12][13]. Anthocyanins have also been identified [14]. Both the total and individual phenolic content vary widely among different raisin varieties[14][15]. Other minor phytochemicals found in raisins are triterpenoids (oleanolic acid, oleanolic aldehyde, betulin and betulinic acid) [16] and tartaric acid, which works synergistically with fiber to maintain a healthy digestive system[17].

2. Ochratoxin A (OTA) in raisins

Despite having these beneficial components, some authors have also described the presence of ochratoxin A (OTA) in raisins. OTA is a mycotoxin produced by Aspergillus ochraceus and other Aspergillus species, to which carcinogenic, nephrotoxic, teratogenic, immunotoxic and possible neurotoxic properties have been attributed [18][19]. Raisins can become contaminated with the fungus if there is a spell of humid weather during the drying process[20]. Consequently, the European Commission has established a maximum level of 10 µg/kg for OTA in dried vine fruit [21]. Although several studies have found mycotoxin levels in raisins to be below the safety limit[18] [22][23], others have reported samples that exceed it [19]. Ostry et al. [20] estimated the dietary exposure dose of OTA from raisins for children and adults and found that the risk of an acute toxic effect was minimal. Although there might be a risk of delayed toxic effects (particularly carcinogenic) after the ingestion of very low single or repeated doses of OTA, this may be outweighed by the health-promoting properties of raisins.

Thus, the aim of this study is to compile the intervention studies carried out so far on raisins and their beneficial impact on human health. To do so, the words “raisin or raisins” and “health benefits” were used for searching on Scopus and Pubmed. Moreover, the cell line and animal model studies resulting from the search have also been incorporated. Despite not being considered as prestigious as human studies, they can also reveal knowledge about molecular action mechanisms and prove an approximation for humans.

3. Conclusions

According to the scientific evidence presented in this review, despite their high content of sugar, raisins are a source of beneficial components and a healthy snack. Due to their composition, they contribute to a better diet quality, and their consumption before a meal could be favorable for regulating appetite in normal-weight healthy subjects. Eating raisins may reduce hunger and affect dietary intake by altering hormones influencing satiety, thus diminishing the energy intake of the meal, which in turn could help to maintain a correct body weight. Their antioxidant capacity has been extensively demonstrated and correlated to the phenolic content, and although this may be an indication of their potential to exert beneficial effects on human health, more scientific evidence in intervention studies is required. Due to their phenolic components and high fiber content, raisins may improve cardiovascular health parameters by increasing the plasma antioxidant capacity and lowering total and LDL cholesterol levels, systolic blood pressure and molecules linked to inflammation response. Incorporating raisins to the daily diet seems to lower some CV risk factors, even though these effects were not appreciated in overweight individuals. Moreover, raisins have a low-to-moderate GI, which makes them a healthy choice for diabetics or those with insulin resistance, and their consumption could be linked to a lower risk of T2D. The potential of raisins to preserve a good dental health has also been demonstrated, due to their antibacterial activity, low adherence to teeth and an oral pH not below the threshold that damages enamel. Raisin intake might also be favorable for colon function and their prebiotic content seems to affect gut microbiota. It would be of great interest to perform more studies concerning the impact of raisin intake on gut microbiota and colon function before drawing any clear conclusion. Cell line and animal model studies have shown interesting results, suggesting the investigation of consuming raisins in other diseases, such as cancer and Alzheimer's disease, but in intervention studies with humans. Although raisins have shown to be a potential beneficial food, deeper and further research is required to state whether eating raisins could be favorable and beneficial for preserving a good health. Overall, with the research done so far, it seems that adding 80–90 g of raisins to the daily diet may be favorable for human health. However, more intervention studies with specific biomarkers are required.

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