Original Research Article

Physicochemical and mineral composition of different varieties of raisinsfrom India

Abstract

Raisins (dried grapes) are favored for their distinctive, delightful flavor, high nutritional content, and their potential to lower the risk of several serious and chronic conditions. The quality of raisins is crucial, as it has a direct impact on the health and well-being of those who consume them. This study assessed the physiochemical composition, mineral content and sensory parameters of white seeded raisins. The physiochemical parameters such as raisin weight, raisin recovery, *p*H, moisture, ash, carbohydrate, protein and mineral content such as Potassium, phosphorus, calcium, magnesium, sodium, copper, iron and zinc were assessed. Result revealed that the Pandhari Sahebi showed higher raisin weight and protein content. Hussain Kadu showed maximum moisture content and carbohydrate content. Significantly, higher potassium and iron content was noted in Hussain Kadu. Hussain Kadu was preferred for raisincolour, texture and overall acceptability. The study concluded that grape variety significantly affects raisin quality and mineral content.

Keywords: Raisins, Minerals, Health benefit, Physicochemicalcomposition.

Introduction

Health and nutrition are the key factors that contribute most significantly to human development. Traditional Indian diets are known for their wide variety of plant-based foods, spices, herbs, and cultural practices. Epidemiological research has consistently found that a diet high in fruits and vegetables is associated with a reduced risk of many chronic diseases (World Health Organization, 2008; Fang et al., 2010). Chronic diseases, or non-communicable diseases (NCDs), are long-term health issues that develop gradually and are often affected by lifestyle choices. Worldwide, these conditions, including cardiovascular diseases, diabetes, cancer, and respiratory illnesses, significantly impact health, contribute to high rates of illness and death, and drive up healthcare expenses. Raisins (Vitis vinifera L.) have been a popular food since 1490 BC because of their nutritional benefits and high micronutrient content (Restani et al., 2016).In India, grapes are primarily consumed as table grapes (71%), while a smaller portion is used to

make various products such as raisins (27.0%), wine (1.5%), and other items (0.5%), including juice (Somkuwar et al., 2020). Raisins are prepared by drying grapes through various methods, including sun drying, natural air drying, or mechanical oven drying. Additionally, they can be artificially dried, dipped, or treated with sulfur dioxide to produce golden raisins. It wasone of the most significant and widely enjoyed dried fruits globally due to its high nutritional value (Mnari et al.2016). Raisins provide a rich supply of folic acid, pantothenic acid, vitamin B6, and other essential vitamins for human nutrition. They are also a valuable source of calcium, magnesium, phosphorus, iron, copper, and zinc. Raisins, similar to other dried fruits, are a concentrated source of carbohydrates, with approximately half of their available carbohydrates being fructose. They offer both soluble and insoluble fiber in amounts that significantly contribute to daily fiber intake, supporting cardiovascular health, reducing cancer risk, and alleviating constipation. Raisins also contain fructooligosaccharides (fructans), which function as probiotics and support colonic health. Furthermore, raisins are an excellent source of antioxidants, which provide strong protection against cardiovascular disease, aid in cancer recovery, and help alleviate constipation .Additionally, raisins contain no fat, which is beneficial for human nutrition (Bongers et al., 1991). Their low moisture content, high soluble solids, and low pH make them naturally stable and resistant to spoilage. Due to immense potential of raisins in improving human's immune system, its demand is increasing year by year (Sindhu and Radhai Sri, 2015).Considering nutritional importance and demand of raisins, an attempt to analysis physicochemical and nutrient content of raisins under present investigation.

Material and methods

Sample preparation

The experiment was conducted at experimental farm of ICAR- National Research Center for Grapes, (latitude 18°32'N and longitude73°51'E), Pune during 2022-2023.Nine year old vines of grape germplasm raised on Dogridge rootstocks were selected for this study. All the standard recommended cultural practices were followed during the investigation period. The raisin varieties used for study purpose were Angoor Kalan, Cheema Sahebi, Aledo, Dilkhush, Cardinal, Phakdi, Muscat Petit Grains, E-10-34 (Thompson Seedless × Catawba), Pandhari Sahebi, Hussain Kadu, Spin Sahebi, F-26-8,EC- 552020 and EC-552109. One kilogram of fresh grapes was immersed in an emulsion containing 2.5% potassium carbonate and 1.5% ethyl oleate for 10 minutes. The grapes were then dried in the shade for 14-15 days until the moisture content of the

dried raisins reached 16%. At this point, the final weight was measured, and the raisin recovery was determined using the appropriate formula:

Raisin recovery = weight of raisins/weight of fresh grapes ×100.

Physiochemical analysis

Moisture content (in percentage) in the raisin sample were measured using moisture analyzer of LCGC (Model axis). Raisin pH was determined according to AOAC methods (2000). The pH was determined using a pH-meter. To estimate ash content, drying the raisin sample (5g) at 100°C and churned over an electric heater. It was then ashes in muffle furnace at 550°C for 5 hrs.24 Ash content was calculated using the following formula:

Ash content (%) = Weight of ash (g)/Weight of sample (g) X 100

To determine the biochemical, Anthrone method with D-glucose as the standard was used to estimate carbohydrate (Sadasivam and Manickam, 1997) while, Protein estimation was done by Lawry et al. (1951) method and was expressed in mg g-1. The estimation of phosphorus was made by Vanadomolybdatecomplex method by using Spectrophotometer. Zn, Fe and Cu were determined by direct feed digested sample on AAS by atomic absorption spectrophotometer. Mg, Ca, K and Na were determined by atomic absorption spectrophotometer.

Sensory evaluation

A sensory evaluation of raisins was carried out by using an organoleptic test. The prepared raisins in this study served to a panel of twenty semi-trend members across a range of age groups. The Hedonic nine-point scale was used to collect data on sensory attributes. The scale used for the test ranged from dislike extremely to like extremely. The sensory parameters such as colour, texture, flavor, sweetness, test, and overall acceptability were selected for the evaluations.

Statistical analysis

All parameters were determined in triplicate for each sample. The data recorded on various parameters was calculated using means of each treatment. Statistical analysis was performed with SAS (9.3).Analysis of variance (ANOVA) was used to assess the significance of differences among the various raisin varieties.

Result and discussion

Significant differences were recorded for weight of 50 raisin, raisin recovery, *p*H, moisture content, ash content, carbohydrate and protein content in all the studied raisin varieties (Table 1).

The highest value for raisin weight was recorded for Dilkhush variety (56.13± 5.7g), while the lowest value was noted for Cheema Sahebi (33.38± 2.4g). Raisin recovery was ranged from 20.95 to 26.17%. Maximum raisin recovery was recorded in Angoor Kalan while it was minimum in EC-552109. Different grape varieties had varying impacts on various quality parameters of raisins, as well as on raisin recovery (Somkuwar et al., 2020). The pH content was ranged from 3.27±0.3(Phakdi) to 4.08±0.6 (Angoor Kalan). According to Mahmutoglu et al. (1996) the pH of fresh grapes is always acidic as during drying process the water content of grapes get evaporated leading to more acidity. This is confirmed by present study. The differences in physical attributes observed among the samples could be attributed to factors such as their origins, cultivars, growing conditions, cultural practices, harvest timing, climatic conditions, as well as variations in processing methods and conditions during grape drying, treatment, storage, grading, packaging, and transportation. In this study, moisture content of raisin varied between 13 to 16 % in almost all the varieties of raisin. As per codex standards the limit of moisture content in raisin is defined less than 18 % for storage. Our results are in accordance with the result of Sharma et al. (2018) who recorded moisture content ranging between 9 to 16% in imported raisin varieties. Moisture content is a crucial parameter that affects mouthfeel and taste. If moisture levels fall below 14 percent, the product can become hard, while levels above 18 percent can lead to microbial contamination. Therefore, it is vital for maintaining food safety. The ash content present in raisins gives the total mineral content in it. Ash content of the raisin ranged from 3.454±0.052 to 7.526±0.323%. Maximum ash content was noted in Cheema Sahebi, while minimum was in Angoor Kalan. The ash content in these raisins are comparable with the ash content of imported raisin as reported by Sharma et al. (2018).

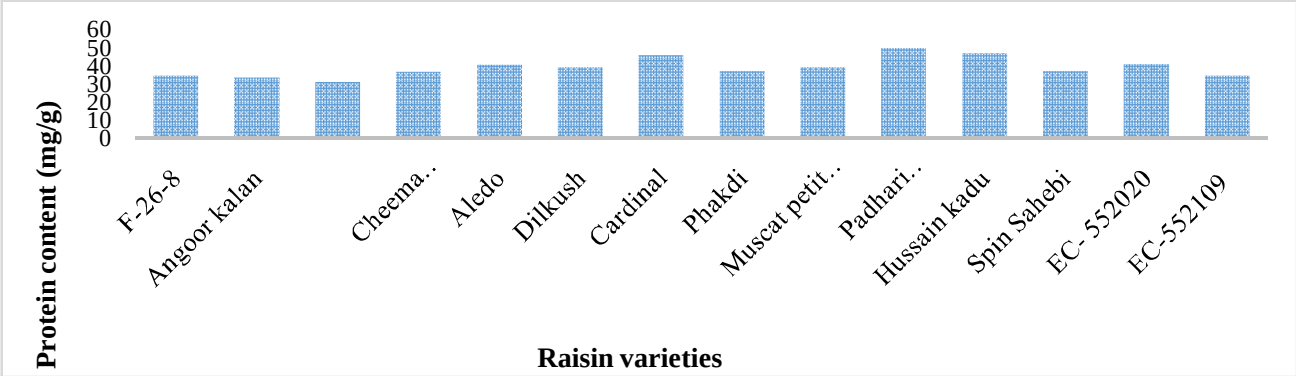

Fig 1: Carbohydrate content (mg/100 g DW) of different white seeded raisin samples.

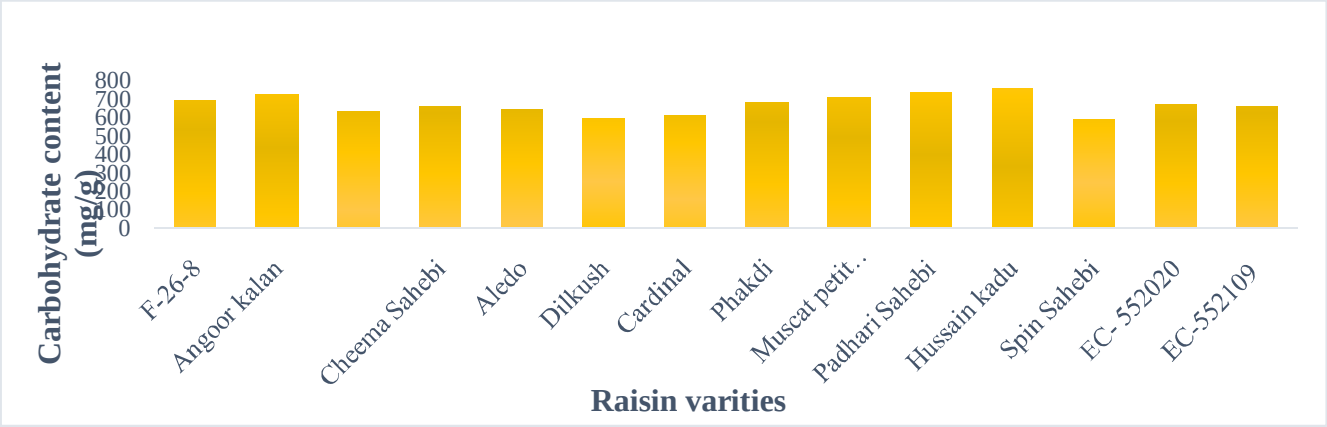

Fig 2: Protein content (mg/100 g DW) of different white seeded raisin samples.

The data on biochemical composition of raisins made from different grape varieties are presented in table 1 and Fig 1 and 2. Total carbohydrate content was ranged from 755.63±10.95mg/g in Hussain Kadu followed by Pandhari Sahebi (734.6±11.21mg/g) and Angoor Kalan (721.67±10.42mg/g), while lowest carbohydrate content was noted in the Dilkhush variety (586.85±13.56). Protein content in raisin ranged from E-10-34 (TS × Catawba) (30.89±6.71mg/g) to Pandhari Sahebi (49.56±7.53mg/g). The process of making raisins from fresh grapes involves drying, which results in the loss of water from the berries. The study clearly shows that variations in biochemical content of the raisins are influenced by the type of grapes used for drying.

Table 1: Physical parameters of white seeded raisin samples.

Accession name	50 raisin weight (g)	Raisin recovery (%)	Juice pH (%)	Moisture content (%)	Ash content (%)	Carbohydrate content (mg/g)	Protein content (mg/g)
F-26-8	34.61±3.4	24.8±0.40	3.91±0.2	13.54±0.23	7.315±0.045	689.45±12.78	34.51± 8.91
Angoor Kalan	37.89± 3.7	26.17±0.78	4.08±0.6	13.98±0.18	3.454±0.052	721.67±10.42	33.21±5.60
E-10-34 (TS × Catawba)	39.51± 7.1	24.67±0.16	3.69±0.4	14.67±0.63	5.718±0.092	625.63±11.23	30.89±6.71
Cheema Sahebi	33.38± 2.4	24.28±0.86	3.58±0.3	15.23±0.21	7.526±0.323	659.02±12.78	36.72±5.89
Aledo	37.52±2.1	23.42±0.40	3.46±0.4	13.45±0.32	4.05±0.403	643.21±9.80	40.51±7.13
Dilkhush	56.13± 5.7	22.45±0.47	3.36±0.3	14.73±0.18	3.801±0.141	586.85±13.56	38.93±8.16
Cardinal	40.44± 6.6	22.59±0.59	3.46±0.1	14.91±0.11	4.771±0.061	610.93±12.89	45.67±10.76
Phakdi	37.74± 2.9	25.19±0.74	3.27±0.3	13.12±0.23	5.958±0.123	675.48±12.04	36.75±8.45
Muscat petit grains	38.41± 5.1	22.09±0.29	3.43±0.4	14.62±0.13	5.924±0.083	703.4±13.41	38.97±6.31
Pandhari Sahebi	54.98± 4.3	22.67±0.31	3.64±0.5	13.84±0.19	5.236±0.201	734.6±11.21	49.56±7.53
Hussain Kadu	42.25± 3.2	23.11±0.57	3.44±0.1	15.76±0.31	4.098±0.216	755.63±10.95	46.78±6.33
Spin Sahebi	37.10±2.1	24.45±0.47	3.71±0.4	14.55±0.43	3.482±0.043	589.04±11.67	36.78±5.34
EC- 552020	44.32±1.8	24.6±0.41	3.51±0.1	14.81±0.37	5.999±0.122	673.81±13.41	40.89±6.13
EC-552109	49.28± 4.6	20.95±0.25	3.46±0.3	13.78±0.27	4.192±0.024	658.93±10.45	34.61±6.78

Values were expressed as Mean ± SD; n=3

Nutritional qualities of white seeded raisin

The white seeded raisin samples were analysed for important mineral nutrients like potassium, sodium, calcium, magnesium, zinc, copper and iron (Table 2). The raisin samples exhibited high potassium levels as compared to other macronutrients and there are statistically significant differences between the studied raisin varieties, maximum potassium noted in Hussain Kadu (1.246±0.09%) followed by while minimum EC-552109 (1.237±0.046%). Similarly, Sharma et al. (2018) reported potassium content ranged from 0.396 to 0.861% in imported raisin content while Gary and Arianna (2010) noted 7.47 mg/g potassium content in seedless raisin. Potassium is a essential macronutrient for human health. It regulates the heartbeat, ensures proper function of the muscles and nerves, and is vital for synthesizing protein and metabolizing carbohydrates. A diet high in potassium helps lower blood pressure and decreases the risk of cardiovascular disease and related deaths (Gharibzahedi and Jafari, 2017). The range of sodium content varied from 0.077±0.005 (Cardinal) to 0.113±0.018 (EC-552109). He and MacGregor (2008) found that potassium intake reduces urinary calcium loss and lowers the risk of osteoporosis. Additionally, it mitigates the adverse effects of sodium by helping to regulate blood pressure. The calcium content was found to be in the narrow range of 0.055±0.003 to 0.072±0.004% in the different raisin cultivars. The result clearly showed that the raisin samples contained magnesium (Mg) concentrations in the range of 0.153±0.007 to 0.201±0.006%. Magnesium (Mg)plays a role in maintaining bone integrity and growth, controlling the cardiac cycle, and facilitating the function of muscles and nerves. Our results are significantly similar from those reported by Sharma et al. (2018). The phosphorus content was ranged from 0.054±0.009 (Phakdi) to 0.262±0.023 (EC- 552020).Simsek et al. (2004) explain that variations in the mineral content of raisin concentrate samples are due not only to the composition of the fruit and growing conditions but also to inappropriate extraction conditions, such as extraction time, temperature, and inadequate crushing. The zinc content of the raisin sample showed large variation from 3.301 to 5.051ppm with rest of varieties having intermediate values. Maximum copper content was noted in Dilkhush (3.552±0.173ppm) followed by Hussain Kadu (3.525±0.275ppm) while minimum was noted in E-10-34 (TS × Catawba) (1.775±0.309ppm). Zinc is crucial for various cellular processes, as it is necessary for the function of numerous enzymes. It also contributes to improving immune response, synthesizing proteins and DNA, healing wounds, and regulating

cell signaling and division. Zinc aids in proper growth and development throughout pregnancy, infancy, childhood,

and adolescence, and it also plays a role in maintaining the sense of taste (Ryu and Aydemir, 2020). The iron content of the raisin samples varied from 59.361±5.231 to 71.736±5.831ppm. However, it varied significantly among the different raisin samples. Raisin's high iron content is advantageous for women, who often experience iron deficiency and anemia. Iron is crucial for the formation of hemoglobin, which carries oxygen in the blood. These findings confirm the significant role that consuming raisins at recommended amounts plays in supporting human health.

Table 2. Nutritional parameter of white seeded raisins.

Accession name	P content (%)	K content (%)	Na content (%)	Ca content (%)	Mg content (%)	Zn content (ppm)	Cu content (ppm)	Fe content (ppm)
F-26-8	0.066±0.008	1.011±0.065	0.084±0.011	0.063±0.007	0.195±0.004	3.975±0.767	2.651±0.519	60.052±1.112
Angoor Kalan	0.091±0.013	1.156±0.021	0.071±0.008	0.055±0.003	0.172±0.010	4.325±0.713	2.725±0.427	65.625±4.099
E-10-34 (TS × Catawba)	0.099±0.115	1.067±0.022	0.083±0.006	0.063±0.014	0.184±0.007	4.225±0.359	1.775±0.309	59.361±5.231
Cheema Sahebi	0.088±0.010	1.212±0.065	0.085±0.012	0.064±0.004	0.193±0.003	3.975±0.321	2.951±0.208	69.906±1.235
Aledo	0.175±0.010	1.101±0.018	0.102±0.015	0.067±0.006	0.185±0.002	4.075±0.556	2.516±0.454	65.859±4.367
Dilkhush	0.104±0.0106	1.206±0.097	0.085±0.022	0.061±0.008	0.187±0.011	3.901±0.408	3.552±0.173	65.625±5.437
Cardinal	0.083±0.012	1.162±0.062	0.077±0.005	0.061±0.003	0.187±0.011	5.051±0.404	2.725±0.623	69.825±7.154
Phakdi	0.054±0.009	1.04±0.06	0.086±0.011	0.065±0.002	0.181±0.003	3.351±0.556	2.316±0.294	68.025±2.531
Muscat Petit Grains	0.128±0.007	1.283±0.037	0.079±0.006	0.067±0.004	0.181±0.017	3.375±0.880	2.675±0.330	60.575±0.852
Pandhari Sahebi	0.175±0.011	1.133±0.019	0.094±0.013	0.067±0.003	0.183±0.005	3.775±0.684	2.753±0.311	64.825±4.425
Hussain Kadu	0.111±0.009	1.246±0.09	0.083±0.005	0.072±0.004	0.153±0.007	3.301±0.594	3.525±0.275	71.736±5.831
Spin Sahebi	0.094±0.009	1.084±0.019	0.109±0.011	0.064±0.006	0.155±0.011	3.975±0.639	3.251±0.591	60.512±4.632
EC- 552020	0.262±0.023	1.082±0.029	0.111±0.012	0.065±0.004	0.201±0.006	3.175±0.287	1.803±0.270	59.925±4.657
EC-552109	0.114±0.013	1.237±0.046	0.113±0.018	0.063±0.004	0.191±0.007	4.475±0.694	2.098±0.365	71.725±7.362

Value were expressed in Mean±SD, n=3

Sensory analysis

The results of the organoleptic test are present in Fig 3. The study was performed during 2022-2023 revealed that overall acceptability was reported highest in Hussain Kadu (7.5) followed by Phakdi (7.2) while lowest was observed in E-10-34 (TS × Catawba) (6.2). However, Hussain Kadu preferred for colour and texture. Muscat Petit Grains and Cardinal scored maximum for Sweetness. Highest mean score for mouthfeel (7.4) was observed in Pandhari Sahebi while taste (7.6) was noted in Hussain Kadu. Evaluating the quality of raisins includes considering various factors such as appearance, texture, taste, cleanliness, and other relevant attributes. These criteria are crucial for determining the market demand for raisins.The results of the current study confirm that Hussain Kadu is the best option from nutritional point of view. Somkuwar et al. (2024) also observed variability in the organoleptic quality of raisins produced from different grape varieties.

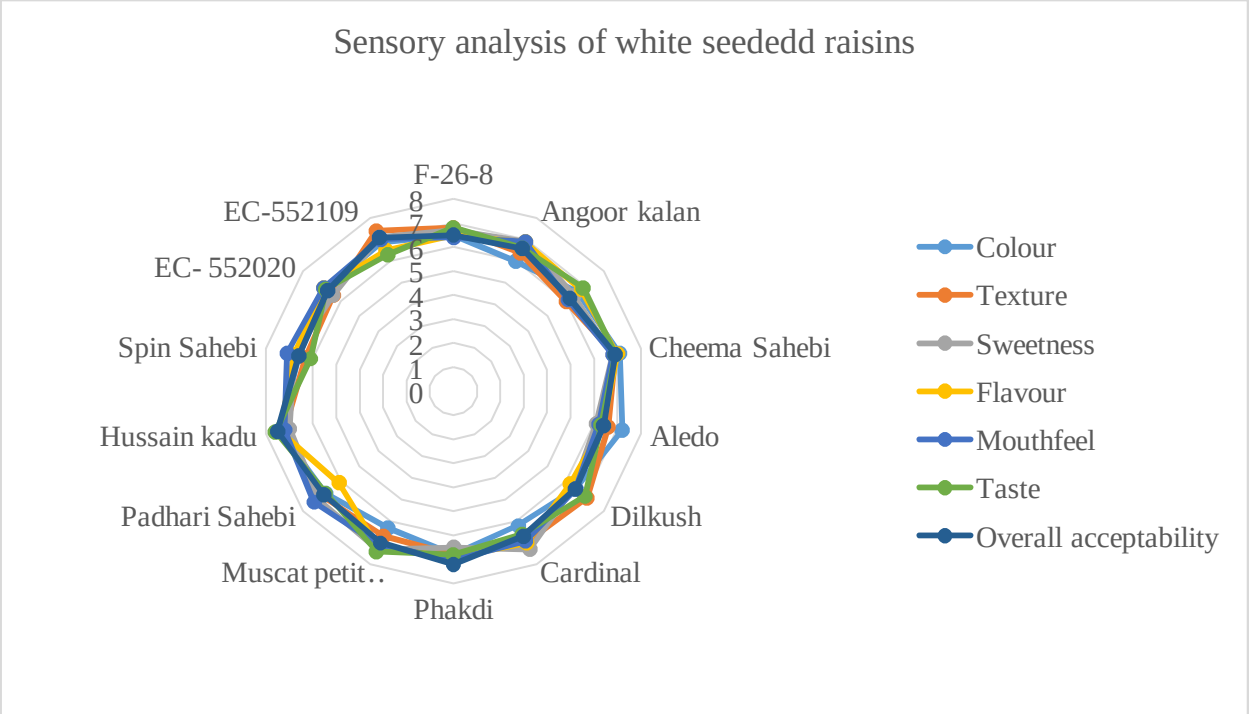

Fig 3. Sensory analysis of white seeded raisins.

Conclusion

In the present investigation, physiochemical parameter and mineral content of the different varities of raisins varied greatly from one another. These variations can be attributed to the types of varieties and the differing environmental and experimental conditions. Our findings

demonstrate that all raisin varieties are a natural source of energy and essential minerals like potassium and magnesium, which may help prevent various diseases.

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