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A Study of the Proximate and Mineral Composition of Commercial Raisin (*Vitis vinifera* L) Varieties

Sajeeda Niketh[1*] and Keshamma E[2]

[1]Associate Professor, Department of Chemistry and Biochemistry, Nrupathunga University, Nrupathunga Road, Bengaluru, Karnataka, India

[2]Associate Professor, Department of Biochemistry, Maharani Cluster University, Palace Road, Bengaluru, Karnataka, India

***Corresponding Author**

Dr. Sajeeda Niketh

Associate Professor, Department of Chemistry and Biochemistry Nrupathunga University, Nrupathunga Road Bengaluru-560 001, Karnataka, India

Email: sajeedaniketh@gmail.com

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Abstract

Raisins (*Vitis vinifera* L) are preferred due to their unique delicious taste, high nutritive value and ability to reduce the risk of many serious and chronic diseases. The quality of the raisins is of greatest significance since it directly affects the health and wellbeing of the consumers. We aimed to evaluate proximate composition and mineral contents of locally available raisin varieties viz. $Rblr_1$, $Rblr_2$, $Rblr_3$. The proximate composition *viz.* moisture, protein, fat, ash, and crude fiber and mineral contents *viz.* calcium, magnesium, copper and zinc were assessed. Results revealed that the proximate composition of $Rblr_3$ variety *viz.* moisture (%), crude fat (%), carbohydrate (%), protein (%), ash (%), and crude fiber (%) was relatively grater when compared with $Rblr_1$ and $Rblr_2$ varieties. Calcium and zinc contents (mg/100g) were higher in $Rblr_2$ variety, and magnesium and copper contents (mg/100g) were higher in $Rblr_3$ variety. In conclusion, the proximate composition and mineral contents of the different local varieties of raisins varied greatly from one another. These findings will benefit consumers in a way that they will remind them to constantly be on the lookout for signs of poor quality, such as cleaning flaws that could serve as a warning about tainted samples whose consumption could be harmful rather than beneficial.

Keywords: *Vitis vinifera* L, Raisins, Proximate composition, Minerals, Health benefits

Introduction

Man from time immemorial has been using natural products from plants, animals and minerals for the cure of various ailments owing to the physiological functions of these naturals products that are composed of phytochemicals and elements.[1,2] Humans require nutrients which could be in the form of chemical elements or certain compounds for the proper functioning of their physiological metabolism.[3-5] The nutrients that are required in large quantities for the provision of energy are termed macronutrients, e.g. carbohydrates, proteins, water and fats, while the essential micronutrients are required in minute quantities and are associated with the cellular structures, e.g. vitamins and mineral elements.[3-5]

The macro or micro elements present in some plants also contribute to the medicinal and prophylactic properties of such plants.[6,7] Although, these mineral nutrients are known to be in relatively low and inconsistent concentrations, the variability in concentration is as a result of environmental factors, e.g. climate, weather and physicochemical properties, including soil type, soil pH and erosion.[8] The presence of mineral elements in plants contributes immensely to their use as food, beverages, medicinal preparations and recreational products (e.g. tobacco). Consequently, the need to determine and quantify these elements is imperative.[9] The search to identify the elemental constituents of medicinal plants has been augmented as per reports published in literature by various research investigators.[10-14]

Raisins (*Vitis vinifera* L) or dried grapes, fall into the traditional dried fruit category as they typically contain no added sugar.[16] As per an estimate about 200 thousand tons of raisins are produced in India during 2015-16. About 22.527% of the total grape production is dried for raisin making. Major raisin making regions in India are Sangli, Solapur and Nashik districts of Maharashtra; and Bijapur and Bagalkot districts of Karnataka. Raisin export from India during 2015-16 was 26,824 tons and 15,123 tons of raisins were also imported during same year. The United States, China, Afghanistan, Iran and Turkey are major countries supplying raisins to Indian markets. Raisin imports in India has been growing with growth rate of 2.74%.[17]

Raisins are preferred due to their unique delicious taste, high nutritive value and ability to reduce the risk of many serious and chronic diseases like cancer, cardiovascular disease, hypertension, constipation, diabetes, etc...[18,19] Raisins besides being a concentrated source of carbohydrate, also provide high soluble and insoluble fibre along with fructans, boron, phenolics and antioxidants.[18,19,21-23]

The quality of the raisins is of greatest significance since it directly affects the health and wellbeing of the consumers. Besides, raisins are considered to be a very healthy dry fruit and are eaten by the sick, old and children to regain good health. Thus, it becomes very important to assess their quality at frequent intervals. Today consumers are preferring quality food and different agencies are monitoring the quality at different levels.[17] Considering the importance of quality parameters of raisins present study was conducted with the main objective to evaluate proximate composition and mineral contents of locally available raisin varieties.

Materials and Methods

Collection of Raisin Samples

About 250 g of local varieties of raisin samples *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ were procured from local markets of Bengaluru, Karnataka, India, and were manually cleaned to eliminate any dust, stones, twigs or other extraneous materials. Cleaned raisin varieties were then stored in airtight containers for further analysis.

Proximate Composition Analysis

Three local varieties of raisin samples *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ were analyzed for the proximate composition *viz.* moisture, protein, fat, ash, and crude fiber as per the methods described in Association of Official Analytical Chemists (AOAC, 2000).[24] Nutrients were expressed on dry weight basis.

Moisture content

Moisture content was determined as per the method described in AOAC (2000)[24] as follows:

- Dry the empty dish and lid in the oven at 105°C for 3 h and transfer to desiccator to cool. Weigh the empty dish and lid.
- Weigh about 5 g of raisin samples to the dish. Spread the sample to the uniformity
- Place the dish with sample in the oven. Dry for 3 h at 105°C.
- After drying, transfer the dish with partially covered lid to the desiccator to cool. Reweigh the dish and its dried sample.

Moisture content was calculated using following formula:

Moisture content (%) = (Initial weight (g) – Final weight (g)/Weight of sample (g) X 100

Crude fat

The fat content was determined as per procedure described in AOAC (2000).[24] Soxhlet apparatus was used to determine crude fat content of the raisin samples.

Procedure:

- Place the bottle and lid in the incubator at 105°C overnight to ensure that weight of bottle is stable.
- Weigh about 3-5 g of raisin sample to paper filter and wrap.
- Take the sample into extraction thimble and transfer into Soxhlet.
- Fill petroleum ether about 250 ml into the bottle and take it on the heating mantle.
- Connect the Soxhlet apparatus and turn on the water to cool them and then switch on the heating mantle.
- Heat the sample about 14 h (heat rate of 150 drop/min).
- Evaporate the solvent by using the vacuum condenser.
- Incubate the bottle at 80-90°C until solvent is completely evaporated and bottle is completely dry.
- After drying, transfer the bottle with partially covered lid to the desiccator to cool. Reweigh the bottle and its dried content.

The percentage of crude fat was calculated using the following formula:

Crude fat (%) = Weight of ether extract (g)/Weight of sample (g) X 100

Protein

Protein content was determined as per procedure described in AOAC (2000)[24] as follows:

- Place the raisin sample (0.5-1.0 g) in digestion flask.
- Add 5 g Kjedahl catalyst and 200 ml of conc. H_2SO_4.
- Prepare a tube containing the above chemical except sample as blank. Place flasks in inclined position and heat gently until frothing ceases. Boil briskly until solution clears.
- Cool and add 60 ml of distilled water cautiously.
- Immediately connect flask to digestion bulb on condenser and with tip of condenser immersed in standard acid and 5-7 drops of mix indicator in receiver. Rotate flask to mix content thoroughly; then heat until all NH_3 is distilled.

- Remove receiver, wash tip of condenser and titrate excess standard acid distilled with standard NaOH solution.

Percentage of nitrogen and protein was calculated by the following equations:

$$Nitrogen\ (\%) = T_S\text{-}T_B \times Normality\ of\ acid \times 0.014) / Weight\ of\ sample\ (g) \times 100$$

Where,

T_S - Titre volume of the sample (ml)

T_B - Titre volume of Blank (ml),

0.014-M eq. of N

$$Protein\ (\%) = Nitrogen \times 6.25$$

Where,

6.25-The protein-nitrogen conversation factor

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:

$$Ash\ content\ (\%) = Weight\ of\ ash\ (g) / Weight\ of\ sample\ (g) \times 100$$

Total carbohydrate

The total carbohydrate content of the raisin varieties was determined as total carbohydrate by difference, calculated by subtracting the measured protein, fat, ash and moisture from 100.[24]

Estimation of Minerals

Five grams of defatted raisin sample was weighed and heated at 550ºC. Then, the obtained ash was digested with concentrated hydrochloric acid (HCl) on hot plate. The digested material was then filtered using Whatman No. 42 filter paper and the final volume made to 100ml with distilled water that was further used for analysis with respects to minerals contents by using methods of AOAC (2000).[24]

Results and Discussion

The results of proximate composition raisin varieties *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ were represented in Table 1 and plotted in Figure 1. Results delineated that the proximate composition of $Rblr_3$ variety *viz.* moisture (%), crude fat (%), carbohydrate (%), protein (%), ash (%), and crude fiber (%) was relatively grater when compared with $Rblr_1$ and $Rblr_2$ varieties. The moisture (%) was higher in $Rblr_3$ variety by 7.25% and 3.62% as compared to $Rblr_1$ and $Rblr_2$ varieties respectively. Similarly, the crude fat (%) was higher in $Rblr_3$ variety by 34.09% and 17.05% as compared to $Rblr_1$ and $Rblr_2$ varieties respectively. Furthermore, the protein (%) was higher in $Rblr_3$ variety by 9.93% and 4.96% as compared to $Rblr_1$ and $Rblr_2$ varieties respectively. Moreover, the ash (%) was higher in $Rblr_3$ variety by 15.82% and 7.91% as compared to $Rblr_1$ and $Rblr_2$ varieties respectively. In addition, the crude fiber (%) was higher in $Rblr_3$ variety by 7.69% and 3.37% as compared to $Rblr_1$ and $Rblr_2$ varieties respectively. Whereas, the carbohydrate (%) was decreased in $Rblr_3$ variety by 4.56% and 2.28% as compared to $Rblr_1$ and $Rblr_2$ varieties respectively.

Table 1. Proximate composition of raisin varieties

Proximate Composition	**$Rblr_1$ Variety**	**$Rblr_2$ Variety**	**$Rblr_3$ Variety**
Moisture (%)	14.85 ± 1.53	15.43 ± 1.32	16.01 ± 0.98

Crude fat (%)	0.58 ± 0.11	0.73 ± 0.07	0.88 ± 0.61
Carbohydrate (%)	71.61 ± 2.28	70.05 ± 1.82	68.49 ± 3.04
Protein (%)	9.98 ± 1.04	10.53 ± 1.21	11.08 ± 1.14
Ash (%)	2.98 ± 0.46	3.26 ± 0.35	3.54 ± 0.38
Crude fiber (%)	3.84 ± 0.16	4.02 ± 0.27	4.16 ± 0.14

Values were expressed as Mean ± SD; n=3

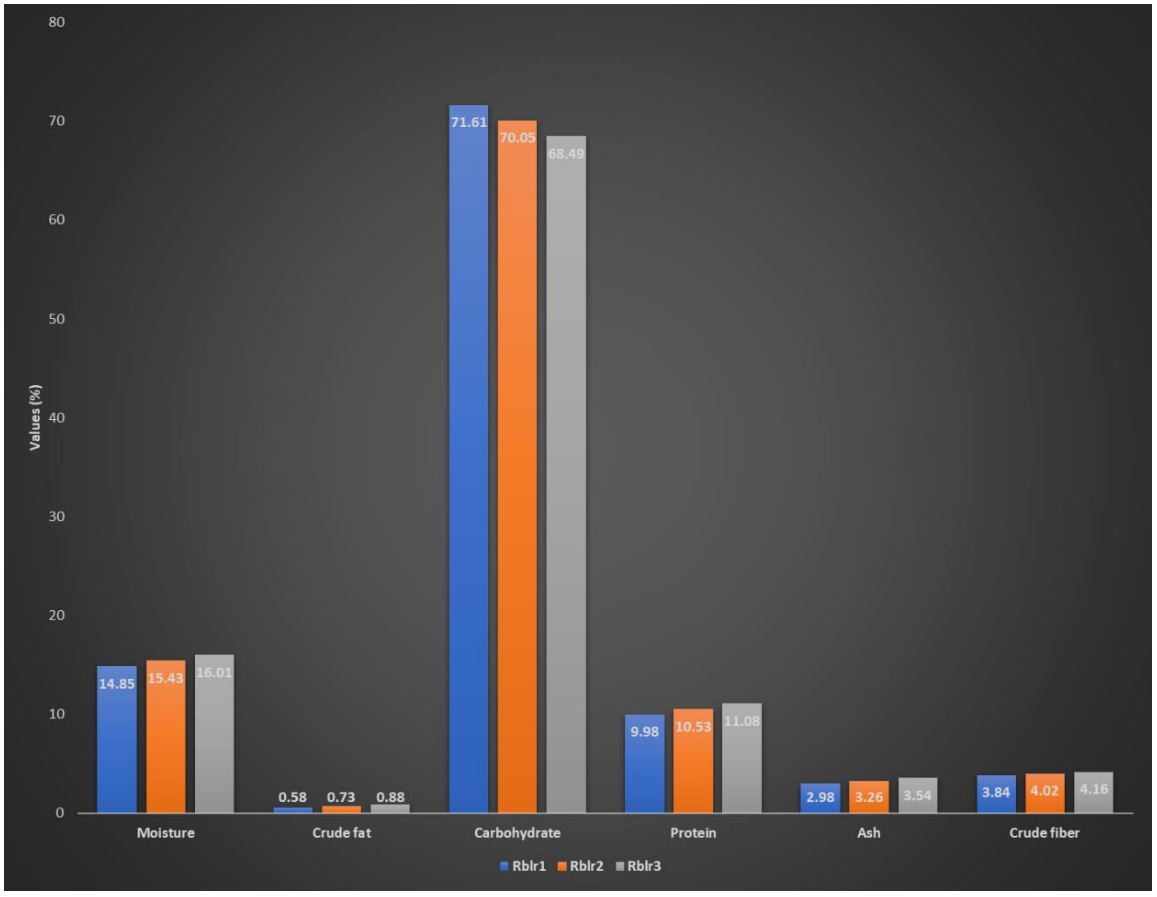

Figure 1. Proximate composition of raisin varieties

As per Codex standards the limit of moisture content in raisins is defined 18 percent.[25] Our study results on moisture content of three different varieties studied *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ are in accordance with the results of Ghrairi et al., who have reported the moisture content ranging between 15% to 25%.[22] Moisture is an important parameter and gives good mouth feel and taste depending upon its value. If moisture is less than 14 percent it becomes hard while moisture more than 18 percent invites the attack of microbes. Hence, it plays an important role in ensuring food safety. The moisture percentage of three different varieties of raisins studied in our study *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ are within acceptable limit of moisture. The maximum moisture content in seedless raisins should be 18% and substantially free from stems, extraneous plant material and damage according to Codex standards.[25]

The ash content of raisin gives the total mineral content in it. In our study, ash content

of three different varieties of raisins studied *viz.* Rblr1, Rblr2, and Rblr3 ranged from 2.98% to 3.54%. Ash content gives the total mineral content of the raisins. The ash content of three different varieties of raisins studied *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ in our study are comparable with the findings of Ghrairi et al.[22]

The results of protein estimations studied in three different varieties of raisin samples in our study *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ revealed, significant differences between the varieties. These findings were consistent with the literature reports wherein the Iraqi and Turkish varieties of raisins recorded protein percentages between 11.53% - 12.59%, which is the lowest protein content compared to the Indian and American varieties, which recorded (14.66%).[26] With regards to fat content estimated in three different varieties of raisin samples in our study *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ revealed substantial differences. These findings were comparable with the literature findings wherein the Indian varieties recorded the lowest values (0.6%), followed by the Turkish variety (1.2%), and the American variety (1%) recorded the highest values.[27]

There was notable difference in crude fiber (%) between three different varieties of raisin samples studied in our study *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$. These findings were comparable with the literature reports wherein the Indian variety recording the highest values (4.6%) followed by Iraqi variety recording the lowest values (1.5%).[27] Moreover, these findings were comparable with the results of a fiber evaluation of black grape raisin varieties.[28]

The results of mineral composition raisin varieties *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ were represented in Table 2 and plotted in Figure 2. Results revealed that the calcium content (mg/100g) was higher in $Rblr_2$ variety by 11.91% and 4.77% as compared to $Rblr_1$ and Rblr3 varieties respectively. Similarly, the magnesium content (mg/100g) was higher in $Rblr_3$ variety by 15.55% and 10.49% as compared $Rblr_1$ and $Rblr_2$ varieties respectively. Furthermore, the copper content (mg/100g) was higher in $Rblr_3$ variety by 48.51% and 47.52% as compared Rblr1 and $Rblr_2$ varieties respectively. In addition, the zinc content (mg/100g) was higher in $Rblr_2$ variety by 53.33% and 46.67% as compared $Rblr_1$ and $Rblr_3$ varieties respectively.

Table 2. Mineral composition of raisin varieties

Mineral Composition (mg/100g)	**$Rblr_1$ Variety**	**$Rblr_2$ Variety**	**$Rblr_3$ Variety**
Calcium	36.77 ± 2.13	41.74 ± 1.89	39.75 ± 2.54
Magnesium	16.51 ± 1.01	17.5 ± 1.25	19.55 ± 1.54
Copper	1.04 ± 0.12	1.06 ± 0.32	2.02 ± 0.24
Zinc	1.05 ± 0.06	2.25 ± 0.14	1.20 ± 0.11

Values were expressed as Mean ± SD; n=3

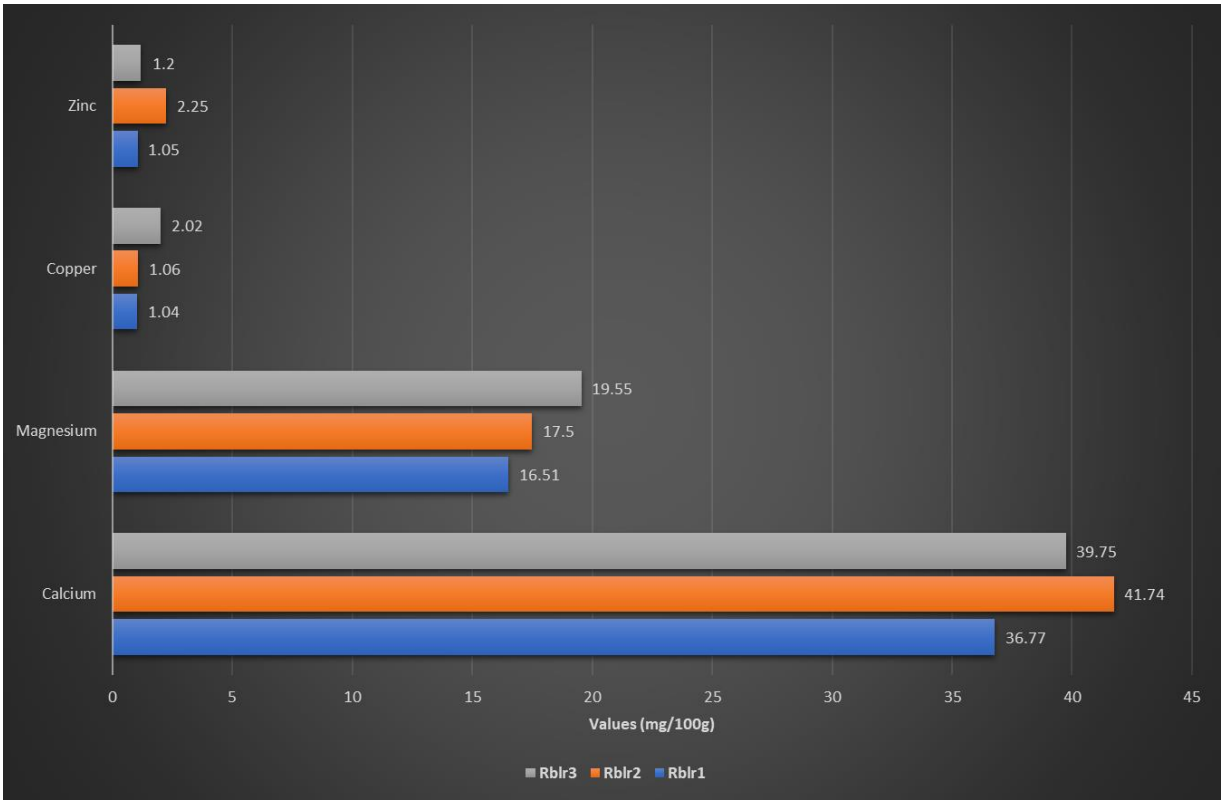

Figure 2. Mineral composition of raisin varieties

Due to their health benefits, mineral elements and their proportions play a significant role in enhancing the nutritional value of raisins. Raisins are an excellent source of mineral salts due to their abundance of calcium, magnesium, copper, and potassium.[29] Black raisins are considered one of the most essential types due to their iron content, which is required for the production of hemoglobin in red blood cells, which the body uses to transport oxygen.[30] Our study findings on mineral composition of raisin varieties studied *viz.* $Rblr_1$, $Rblr_2$, and $Rblr_3$ were comparable with mineral composition of raisin varieties reported by various research investigators in the literature.[21,22,31] Furthermore, Simsek et al., reported that different levels of minerals in raisin samples may also be due to improper extraction procedures, insufficient crushing, etc… apart from the fruit composition, cultivar and the variations due to cultivation factors.[32]

Conclusion

In conclusion, the proximate composition and mineral contents of the different varieties of raisins varied greatly from one another. This variation can be attributed to various factors such as origins, cultivars, cultural practices during cultivation, processing techniques, pretreatments, storage, packaging, and environmental conditions during transportation and retail storage. The study findings will benefit consumers in a way that they will remind them to constantly be on the lookout for signs of poor quality, such as cleaning flaws that could serve as a warning about tainted samples whose consumption could be harmful rather than beneficial.

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