**RESEARCH ARTICLE**

# Physico-chemical properties and proximate analysis of fresh and dried karonda (*Carrisa carandas*)

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**ABSTRACT**

Karonda (*Carrisa carandas*) is an important minor edible underexploited fruit crops. This study was designed to explore the physicochemical properties and proximate values of fresh and dried karonda. Fresh fruits were collected in the month of June and July. Well-matured fruits were harvested using hand picking and then sorted based on their color and uniformity. Proximate analyses of fresh and dried Karonda were performed using standard procedures. The results showed that the physical properties like length of fresh and dried karonda were 7.4±0.87 (cm) and 4.6±0.90(cm), width of the fresh and dried was found 7.3±0.75 (cm).  Density of fresh and dried karonda were found 0.63±0.00(g/ml) and 0.65±0.01(g/ml) respectively. The proximate results of fresh karonda were as follows: carbohydrate, (16.72±1.21%); protein (1.68±0.16%); fat (1.94±0.42%), moisture (87.29±0.73%); ash (1.32±0.05%), fiber (1.46±0.09%) and dried karonda had carbohydrate (61.51±1.21%), protein (2.07±1.07%), fat (4.47±0.30%), moisture (28±1.41%); ash (2.12±1.07%), fiber (1.92±0.01%), respectively, The  study revealed that the fresh and dried karonda have good potent of nutritional composition. The nutritive composition varies from fresh karonda to dried karonda, which could be a range of commercialized fruits for dietary supplements, helping the economy of poor people if value-added products are encouraged.

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## INTRODUCTION

Karonda (*Carrisa carandas* Linn.) is an important minor edible, underexploited fruit crop in India (Bhavya et al., 2017). It belongs to the family Apocynaceae and is commonly known as Karonda in India, Bengal currant or Christ's thorn in South India (Imran et al., 2012). It is found wild in Bihar, West Bengal, South India, and in commercial plantations in the Varanasi district of Uttar Pradesh. Carrisa species are of great socioeconomic importance in the tribal areas of Gujarat, Rajasthan, and Madhya Pradesh. A great beauty of plants is that their leaves are shining and ornamental, and they bear flowers and fruits almost throughout the year (Banik et al., 2012). The sweeter types may be eaten raw, but the more acidic types are best stewed with plenty of sugar (Yadav et al., 2018) ). The alcoholic extract of C. carandas roots has been reported to possess cardiotonic and antihypertensive activities. The ripe fruit is cool and acidic, and is used to treat sore throat, mouth ulcers, and skin disorders. The fruits possess

a significant amount of jelly grade pectin (Dey et al., 2017). The fruits are useful as an auxiliary in tanning and dyeing and for medicinal purposes. Karonda leaves can be used as a fodder for tusser silk worms. The unripe fruit is sour, astringent, bitter, thermogenic, constipating, anaphrodisiac, antipyretic, and useful in vitiated conditions such as pitta and kapha, hyperdipsia, diarrhea, anorexia, and intermittent fevers. The ripe fruit is sweet, cool, appetizer, and antiscorbutic, and is useful in burning sensation, skin diseases, scabies, etc. The roots are anthelmintic, stomachic, and antiscorbutic and are useful in stomach disorders, intestinal worms, and scabies (Dey et al., 2017).

Worldwide research has been conducted on the physicochemical properties and nutritional characteristics of the Karonda fruit. The chemical, physical, and nutritional values of the fruit were not studied in the selected study areas, although it became a stable food during the production period. South India, especially in North Karnataka, is underutilized due to its seasonal availability and lack of public awareness regarding its health benefits. Hence, the present study focused on the physicochemical properties and proximate analysis of fresh and dried karonda.

## MATERIALS AND METHODS

### Samples collection and preparation

Samples were collected from Vijayapura, District of Karnataka, from April to June. The well-matured fruits were harvested using hand picking, and sorting of the collected fruits was performed on the basis of color and uniformity. Approximately 3 kg of each sorted fruit was packed in polythene bags and the samples were transported to the Food Processing and Nutrition Department, KSAWU, Vijayapura.

### Methods of analysis physical properties

The length and width of the fruits were measured using a Vernier caliper (1/20, Germany) and their weights were measured using a digital weighing balance.

### Density (g/ml)

Karonda fruit density was calculated from weight and volume of karonda fruits (Anon., 1983) by using the formula

$$\text{Density} = \frac{\text{Fruit weight (g)}}{\text{Fruit volume (ml)}}$$

### Moisture (%)

The stainless steel boxes (weight, W empty) were placed on a top loading balance, and their weights were recorded. The sample was carefully transferred into a stainless steel box using a stainless steel spatula to avoid contamination.The weights of the stainless steel boxes contained  the samples on a top loading balance and were recorded as (weight, W initial). The stainless steel boxes were placed using tongs into a hot air oven whose temperature was set at 100 ºC for 16-18 hr. Taken the weights of the stainless steel boxes contained  the samples on a top loading balance and recorded them as (weight, W initial)Placed the stainless steel boxes using tongs into a hot air oven whose temperature was set at 100 ºC for 16-18 hr. The samples were taken from a hot oven using tongs and placed in a desiccator.  The weight of the steel box was recorded after cooling to room

temperature and placed in a hot oven for another 4 h. Samples were placed in a hot oven using tongs and placed in a desiccator, and the weight of the steel box was recorded after cooling to room temperature (weight, W final). Repeat the process of heating in hot air oven, cooling in desiccator and weighing the stainless steel box with sample until a constant weight was obtained (AOAC official methods of analysis (2005),

$$\text{Moisture (\%)} = \frac{\text{(W initial - W final) x 100}}{\text{Weight of the sample}}$$

Take the mean of the two observations for each sample and report the value.

**Ash (%)**

The ash content of the fruit was determined using the gravimetric principle of the AOAC official method 2015, and approximately 5–10 g of the sample was weighed accurately into a crucible (which was previously heated to approximately 6000 C and cooled). The crucible was placed on a clay pipe triangle and heated first over a low flame until all the material was completely charred, followed by heating in a muffle furnace for approximately 3–5 h at approximately 6000 °C. It was then cooled in a desiccator and weighed again. To ensure the completion of ashing, the crucible was again heated in a muffle furnace for ½ hour, cooled, and weighed. This was repeated until consecutive weights were obtained, and the ash was almost white or grayish-white in color.

**Protein (%)**

The crude protein content of the sample was estimated according to the Microkjeldahl method AOAC (2000), procedure and calculated as the product of percent nitrogen and a multiplication factor. The Kjeldahl method can be conveniently divided into three steps (Digestion, Neutralization and Titration). A powdered sample (500 mg) was weighed in a digestion tube, 1 g of digestion mixture (98 g of potassium sulfate + 2 g of copper sulfate) and 10 ml of concentrated $H_2SO4$ were carefully added, and the samples were placed in the digestion unit for 1 h at 375 °C. The tubes were removed, cooled, and distilled water (50 ml approximately) was carefully added from each side. In a 100 ml conical flask, 40 ml of 4% boric acid was added along with a few drops of mixed indicator (1 ml of 0.2% bromocresol + 3 ml of 0.2% methyl red). Distillation for approximately 10 min with 50 ml of 40% NaOH and steam digestion for 10s were performed. The contents of the conical flask turned green/brown after the distillation. Titration was performed with standard HCl (0.5 N) until the flask turned pink in color. The blank was run simultaneously.

$$\text{Nitrogen (\%)} = \frac{\text{(Sample TV-Blank TV) x 14.00 x 0.5 x 6.25 x 100}}{\text{Weight of sample (mg)x1000}}$$

Where, TV = Titration value
From the nitrogen content of the sample, the protein content was calculated by multiplying with a factor of 6.25
Protein (%) = % N x 6.25 3.3.2.9.

**Fat (%)**

Fat was estimated as the crude ether extract of dry material (AOAC, 2005). An empty beaker was weighed (W1). Dry samples (5–10 g) were weighed into thimbles and covered with fat-free cotton. The thimble was inserted into a thimble holder and placed

in a beaker. Approximately 150 ml of the petroleum ether solvent was added. The extraction beaker was kept in a Gerhardt Soxhlet instrument. The beaker was properly fitted to ensure that the sealing rings of the PTFE cylinders fit tightly to avoid solvent leakage. The samples were extracted with petroleum ether (60–80 °C. P) for one and half hour. The ether extract was then filtered through a weighed beaker. Petroleum ether was removed by evaporation, and the flask was dried in an oven at 80–100 °C, cooled in a desiccator, and weighed (W2).

$$\text{Fat content of the sample (g\%)} = \frac{\text{W2-W1 X 100}}{\text{Sample Weight}}$$

**Crude Fiber (%)**

The crude fat content of the fruit was analyzed using the AOAC method (2005). About 3.5 g of the sample was placed into a 500 ml beaker, 200 ml of 1.25% was added, and boiled gently for 20 min, placing a watch H2SO4 glass over the mouth of the beaker. During boiling, the level of the sample solution was kept constant using hot distilled water. After boiling for 20 min, 20 ml of 28% KOH was added and boiled gently for 30 min with occasional stirring. The bottom of the sintered glass crucible was covered with a 10 mm sand layer and wetted with distilled water. The solution was poured into a sintered glass crucible, and the vacuum pump was turned on. The wall of the beaker was rinsed with hot distilled water several times, and the wash was transferred to a crucible and filter. The residue in the crucible was washed with hot distilled water and filtered using 1% and 1% NaOH. The crucible was dried for 2 h in a drying oven at 130°C, cooled for 30 min in a desiccator, and weighed. The crucible was then transferred to a small muffle furnace and incinerated for 30 min at 500°C. The crucible was then cooled in a desiccator and weighed. The crude fiber content of the fruit was calculated as the residue after the subtraction of the ash.

$$\text{Crude fiber (\%)} = \frac{\text{W1-W2 X}}{\text{W3}} 100$$

Where: W1 = weight of (Crucible + sample) after drying; W2 = weight of (Crucible + Sample) after Ash; W3 = weight of the sample

**Total carbohydrates (%)**

Total carbohydrate content was calculated as per AOAC (2006). The carbohydrate content was calculated by subtracting the sum of the protein, fat, moisture, and ash contents from 100. The total carbohydrate content was calculated using the following formula.

Total Carbohydrates = 100% - % (crude protein + ash + crude fat +Moisture

**Titratable acidity (%)**

The titratable acidity was determined by titrating the sample juice with 0.33 M sodium hydroxide solution to a pH end-point of 7. Titratable acidity is expressed in g/L (Bindon and Ketal, 2013).

**Total sugars (%)**

The filtrate obtained for the estimation of reducing sugars was used for the estimation of the total sugars. An aliquot of the filtrate was then collected. Dilute HCl (10 ml of dilute HCL was added, and the inversion was carried out at room temperature for 24 h. Subsequently, the contents were cooled and neutralized with a 40 cent sodium hydroxide solution using phenolphthalein as an indicator, and the final volume was made. The solution was filtered through Whatman No. 1 filter paper, and titration was performed using the filtrate. Ten milliliters of mixed Fehling's solution (5 ml each of Fehlings A and B) was placed in a 250 ml conical flask. The flask containing mixed Fehling's solution was heated on a hot plate, and the sample (clarified sugar) solution was added dropwise from the burette until the faintest blue color remained. 2-3 drops of methylene blue indicator was added, and the titration was completed until the color changed to brick red. At the end point, the readings were recorded and the total reducing sugars were calculated. The total sugar content was expressed as a percentage in terms of inverted sugar according to the following formula (Ranganna, 1986).

$$\text{Total sugars as invert sugars (\%)} = \frac{\text{Factor x Volume made up x Dilution x 1000}}{\text{Titer value x Weight of sample taken}}$$

Non reducing sugars (%) = (Total sugars as invert sugars %) - Reducing sugars%) x 0.95
Total sugars % = Reducing sugars % + Non reducing sugars %

**RESULTS AND DISCUSSION**

The physical properties, such as length, width, and density, were determined, and the results are presented in Table 1. The length recorded in fresh karonda was 7.4±0.87 cm and the length of dry karonda was found to be 4.6±0.90 cm. Decreased length was observed in dry karonda due to the loss of moisture during drying, which leads to a decrease in the sphericity of the fruits (Isik et al., 2007). The width of fresh karonda was found to be 7.3-0.75 and the width of dried karonda was recorded to be 4.9±0.34 cm. Width decreases after drying, with decreasing sphericity of the fruits (Isik et al., 2007). The density of fresh karonda had 0.63g/cc and dry karonda was 0.65g/cc. The results revealed that the density of fresh karonda fruit was lower than that of dry karonda fruit because of the increased density during the drying process due to the variation in mass, volume, structure of the cell wall, and the removal of water (Ratti et al., 2007). The acidity content recorded in fresh karonda was 1.11%, whereas that of dried karonda was 0.93%. The acidity content decreases because of the removal of water molecules and moisture content (Mahapatra et al., 2012). Upon drying, the TSS, total sugars, and reducing sugars decreased compared to those in fresh karonda. The TSS, total sugars, and reducing sugar contents of fresh karonda were 14.03,13.69 and 2.46 %, respectively, while those of dry karonda were 8.18, 8.94, and 1.60 %, respectively.

**Table 1: Physico-chemical properties of fresh and dried karonda**

| Parameters | Acidity (%) | TSS ($^0$brix) | Total sugars (%) | Reducing sugar (%) | Length (cm) | Width (cm) | Density (g/ml) |
|---|---|---|---|---|---|---|---|
| Fresh Karonda | 1.11±0.1 | 14.40±0.13 | 13.69±1.09 | 2.46±0.01 | 7.4±0.87 | 7.3±0.75 | 0.63±0.00 |
| Dried karonda | 0.93±0.00 | 8.18±0.08 | 8.94±0.31 | 1.60±0.08 | 4.6±0.90 | 4.9±0.34 | 0.65±0.01 |

**Table 2: Proximate composition of karonda fresh and dried karonda**

| Parameters | Moisture (%) | Protein (%) | Fat (%) | Ash (%) | Fiber (%) | Carbohydrates (%) |
|---|---|---|---|---|---|---|
| Fresh Karonda | 87.29±0.73 | 1.68±0.16 | 1.94±0.42 | 1.32±0.05 | 1.46±0.09 | 16.72±1.21 |
| Dried karonda | 28±1.41 | 2.07±0.12 | 4.47±0.30 | 2.12±1.07 | 1.92±0.01 | 61.51±0.01 |

Table 2 shows the proximate compositions of the fresh and dry karonda. Fresh karonda had a moisture content of 87.29 %, which was higher than that of the dried karonda (28 %). The loss of moisture content during the drying process results in the absorption of water molecules and the rapid evaporation of water molecules, which results in the loss of moisture in dried karonda (Mishra et al., 2005). The ash content was higher in dried karonda 2.12% and lower in fresh karonda 1.32 %). The increase in ash content in dried karonda is due to the removal of moisture during drying (Morton, 1987). The carbohydrate content was reported to be 16.72 % in fresh karonda and 61.51 % in dried karonda. The carbohydrate content was found to be higher in dried karonda than in fresh karonda during the process of drying and the removal of moisture content  (Kyzlink, 1990), which causes an increase in the carbohydrate content in dried karonda. The protein contents of fresh and dried karonda were 1.68 % and 2.07 %, respectively. The protein content was higher in dried karonda than in fresh karonda. The fat content was found 1.32 % in fresh karonda and 4.47 in dried karonda. The fat content was higher in dried karonda than in fresh karonda. The fiber content in fresh karonda and dried karonda was 1.46% and 1.96%, respectively. Increased fiber content was found in dried compared to fresh karonda, and after drying, the dietary fiber increased either because of a reduction in the moisture content or the enzymatic breakdown of substances into soluble compounds (Pewlong et al., 2014).

**CONCLUSION**

Fresh and dried Karonda were screened for physicochemical properties and proximate composition, such as carbohydrate, fat protein, crude fiber, and total sugars. This study revealed that fresh and dried karonda have a good nutritional composition. Nutritive composition varied from fresh karonda to dried karonda. The nutritional results obtained in this study justify the need to preserve the traditional use of wild edible fruits. The fresh and dried karonda has a good nutritional composition, which could be a range of commercialized fruits for dietary supplements, which can be helpful for the economy of poor people if value-added products are encouraged. Further studies are underway on other nutritional aspects and the significance of fresh and dried Karonda.

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