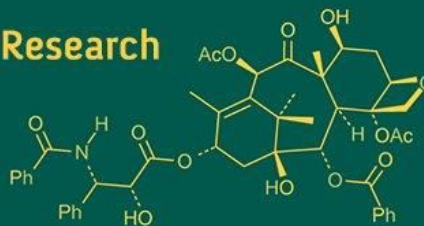


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Nutritional and sensory evaluation of Karonda pickle under storage

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Abstract

The karonda pickle recorded overall acceptability of 8.0 on nine point Hedonic scale with 3.71 pH, 3.68 °Brix TSS, 1.95% titrable acidity, 2.13% total sugars, 1.22 % reducing sugars, 20.52 mg/100g ascorbic acid in freshly prepared Karonda pickle. The overall acceptability score remained in the "Like very much" range throughout the storage period of up to four months, transitioning to "Like moderately" in the subsequent period upto six months on a nine-point Hedonic scale.

Keywords: Karonda pickle, value addition, nutritional composition, storage studies

Introduction

Karonda is a hardy crop requires low maintenance and is able to thrive in arid environments. It is ideally suited for sustainable farming in dry areas with limited water resources. In addition to its suitability to diverse climatic conditions, it is rich in nutrients, particularly vitamin C and iron, which enhances its versatility. Karonda has the potential to be a valuable resource for rural economies by enabling the production of a range of products, such as preserves and functional foods (Sarkar, 2024) ^[9].

Traditional systems of medicine like Unani and Ayurveda use karonda. Many tribes in India utilize this different parts of this plant as medicine. It has a number of phytochemicals that are terpenoids. It is nutritious and can help with a number of health problems, including skin problems, intestinal worms, and diarrhea. It possesses anti-inflammatory, antipyretic, antiviral, cardiogenic, and anti-convulsant qualities. Karonda being abundant in Iron and Vitamin C makes the fruit highly effective in treating conditions like anaemia and is traditionally recognized as an anti-scorbutic agent. Furthermore, research conducted at the Indian Horticultural Research Institute (Bangalore) highlighted the fruit's richness in the B-vitamin complex (Tripathi *et al.*, 2014) ^[14].

Due to its thorny nature, Karonda is recently getting popularised as live fence around agricultural fields and homesteads. Utilisation of the produce for processing into diversified processed products strengthens rural livelihood by providing a reliable income source. (Tripathi *et al.*, 2014; Sarkar 2024) ^[14, 9]

Fresh fruit is consumed only in small quantities as it is slightly sour and astringent in taste (Bajpai *et al.*, 2015) ^[12]. Processing helps to extend usability of the fruit (Srivatsava *et al.*, 2017) ^[12] and also beyond the harvest period. This helps to broaden consumer palate. The present study was taken up to study nutritional and sensory evaluation of karonda processed into pickle.

Materials and Methods

The study researching the potential of Karonda processing into pickle was conducted in 2017 and 2018. Research activities and analysis were carried out at College of Horticulture, Rajendranagar, Hyderabad, SKLTGHU and the Central Instrumentation Cell, PJTAU. Mature Karonda fruits of pink type were utilized to conduct the research.

pH

The 10g sample was mixed with 100 ml of distilled water. The mixture was stirred properly for homogenisation. Then the solution is left to stand for 30 minutes.

The supernatant was poured into a beaker. pH meter is calibrated using pH 4.0 and 7.0 standard buffer solutions. The electrode of pH meter was put in the test solution, and a glass rod was used to swirl the solution until a steady pH was recorded. The pH value was determined by averaging three measurements.

TSS (⁰Brix)

Total soluble solids in samples were recorded using a digital Refractometer.

Reducing Sugars (%)

The titrimetric technique developed by Lane and Eynon, as described by Ranganna (1986) [7] was employed to determine the quantity of reducing sugar present. 10 grams of the sample was grounded using a pestle and mortar. The mixture was pureed in a blender, followed by the addition of 100 milliliters of water. To neutralize the solution, 1 N NaOH was incorporated. The mixture was then filtered through Whatman filter paper and diluted to a total volume of 500 ml. A 100 ml aliquot of the filtrate was transferred to a 250 ml flask, where 2 ml of 45% lead acetate was introduced, and the combination was allowed to stand for 10 minutes. Subsequently, a few drops of 22% potassium oxalate solution were added, and the volume was adjusted to a specified amount with water before filtering. Add an additional 2 ml of 45% neutral lead acetate solution. In a 250 ml conical flask, 10 ml of a mixed Fehling's solution was prepared, consisting of 5 ml of Fehling A and 5 ml of Fehling B. This flask containing the mixed Fehling's solution was heated on a hot plate, and the clarified sample solution was added dropwise from a burette or pipette until only the faintest blue hue persisted. The end point is color shifting to brick red after the addition of methylene blue indicator. At the endpoint, measurements were recorded to estimate the amount of reducing sugars.

$$\text{Reducing sugar (\%)} = \frac{\text{Dilution} \times \text{mg of invert sugar} \times 100}{\text{Weight of the sample} \times \text{Titre} \times 100}$$

Total Sugars (%)

For the determination of total sugars, the filtrate obtained during the assessment of reducing sugars was utilized (Ranganna, 1986) [7]. An aliquot of the sample filtrate was taken. To this, 10 ml of dilute HCl was added, and the inversion process was conducted at room temperature for 24 hours. Following this, the contents were cooled. 40 percent sodium hydroxide solution is used to neutralize the solution using phenolphthalein as an indicator, and the final volume was recorded. A total of 10 ml of mixed Fehling's solution (5 ml each of Fehling A and B) was placed into a conical flask. The flask containing the mixed Fehling's solution was heated on a hot plate, and the sample solution was added dropwise from the burette until the faintest blue color persisted. Subsequently, 2-3 drops of methylene blue indicator were introduced, and the titration was completed until the color shifted to brick red. At the endpoint, the readings were recorded, and the total reducing sugars were calculated and expressed as percentage in terms of invert sugar.

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

$$\text{Non reducing sugars (\%)} = (\text{Total sugars \%} - \text{Reducing sugars \%}) \times 0.95$$

$$\text{Total sugars percent} = \text{Percentage of Reducing sugars} + \text{Percentage of Non reducing sugars}$$

Titration Acidity

The known weight of the homogenized sample was measured and adjusted to 100 ml in a volumetric flask followed by filtration. A known volume of the aliquot was transferred into a conical flask and titrated with a standard sodium hydroxide solution (0.1 N NaOH), utilizing phenolphthalein as the indicator. The acidity was determined using the formula provided by AOAC (2000) [1].

$$\text{Titration Acidity (\%)} = \frac{\text{Equivalent weight of acid} \times \text{volume made} \times \text{Titre value} \times \text{normality of alkali} \times 100}{\text{Volume of aliquot} \times \text{Wt. of sample} \times 1000}$$

Ascorbic Acid

The visual titration method where 2, 6 dichlorophenol-indophenol dye which is blue in alkaline solution and red in acidic solution, is reduced by ascorbic acid to a colourless form. The decrease is measurable and specific to ascorbic acid in solutions with the pH 1.0 to 3.5 (AOAC, 2000) [1].

Organoleptic Evaluation

Descriptive terms were given to various quality attributes like Texture, colour, taste, flavour and overall acceptability. A panel of 15 members have done Organoleptic scoring for sensory acceptability on 9 points hedonic scale. The Hedonic scale ranges from highest score 9 'like extremely' to lowest score 1 'dislike extremely'. (Jones, 1955; Marek *et al.*, 2007) [4, 5]

Results

pH

The alterations in pH during the six-month storage of karonda pickle are detailed in Table 1. Initially, the pH of the karonda pickle was measured at 3.71 right after its preparation. A gradual shift in pH was noted throughout the storage period, with a significant change occurring only after two months. By the end of the six-month period, the pH of the karonda pickle had decreased from 3.71 to 3.59. Saroj and Singh (2018) [10] reported similar outcomes in different mango pickle recipes, noting a decline in pH values for mango pickles regardless of the type during a 90-day storage period.

Total Soluble Solids

The variations in Total Soluble Solids observed during the six-month storage of karonda pickle are detailed in Table 1. The freshly prepared product exhibited a TSS of 3.68 °Brix. Over the six-month storage duration, Total Soluble Solids increased, although no significant differences were noted. Comparable findings were documented by Bulla (2010) [3] in dehydrated sweet mango pickle and by Park *et al.* (2011) [6] in pickled paprika.

Titration acidity

Table 1 details the changes in titration acidity for karonda pickle over a six-month storage duration. The data reveals a clear upward trend in acidity levels; starting at an initial

value of 1.95% in the fresh batch, the acidity climbed to 2.24% by the end of the study. This increase was most pronounced during the early stages of storage. similar patterns of rising acidity during storage have been documented in other products, such as oil-based paneer pickle across various temperatures and packaging types (Shukla & Vaid, 2004) ^[11] and mango pickle (Saroj and Singh, 2018) ^[10].

Total Sugars

Table 1 shows the variations in total sugar content for karonda pickle throughout a six-month storage period. At the outset, the freshly made pickle had a total sugar content of 2.13%. By the end of the six-month duration, the total sugars increased to 2.43%. A significant rise was observed starting from the second month and continuing until the conclusion of the study. These findings align with the research conducted by Saroj and Singh, 2018 ^[10] in mango pickle recipes.

Reducing sugars

The amount of reducing sugars during the six-month storage of karonda pickle was measured and is shown in Table 1. A reducing sugar content of 1.22% was observed in the freshly made karonda pickle, which showed a significant increase from the third month of storage to the sixth month, reaching 1.37%. This increase in reducing sugars could be due biochemical processes like polysaccharide hydrolysis and sugar inversion. Similar observations were made by Saroj and Singh (2018) ^[10] in various mango pickle recipes.

Ascorbic acid

The changes in ascorbic acid levels during the storage of karonda pickle are detailed in Table 1. The ascorbic acid

was at its peak in freshly prepared karonda pickle (20.52 mg/100 g), while the lowest level was observed after a six-month storage period (15.92 mg/100 g). Approximately 22% of ascorbic acid was lost throughout the storage duration. This loss may be attributed to the degradation of ascorbic acid during storage into dehydroascorbic acid. Comparable findings were noted by Bulla (2010) ^[3] in sweet mango pickle over a six-month storage period, Thakur *et al.* (2017) ^[13] in seedling mango pickle and Saroj and Singh (2018) ^[10] in mango pickle.

Organoleptic evaluation

The findings indicate that the Karonda pickle, right after its preparation, achieved scores of 8.27, 8.07, 8.13, 7.93, and 8.00 (fig. 1) for colour, flavour, texture, taste, and overall acceptability, respectively. Further investigation into the product's storage was conducted at monthly intervals. The findings showed that sensory scores for colour, flavour, and texture diminished as the storage period progressed, yet no significant differences were observed up to six months. The sensory score for taste peaked at 8.40 during the second month of storage, followed by a gradual and significant decline after the third month. The sensory score for overall acceptability reached its highest at 8.47 in the second month of storage, with a notable decrease after four months. This increase in taste and overall acceptability during the second month may be attributed to the softening of the pickle due to the conversion of insoluble pectin fractions into a soluble form. Nevertheless, the overall acceptability score of the pickle remained in the "Like very much" range throughout the storage period up to four months, transitioning to "Like moderately" in the subsequent period. Shukla & Vaid (2004) ^[11], Rao *et al.* (2011) ^[8], Thakur *et al.* (2017) ^[13] and Saroj and Singh (2018) ^[10] documented comparable findings.

Table 1: Changes in chemical properties of Karonda pickle during storage

Storage Period	Chemical properties of Karonda Pickle					
	pH	TSS (° Brix)	Titration acidity (%)	Total Sugars (%)	Reducing Sugars (%)	Ascorbic acid (mg/100 g)
0 Months	3.71	3.68	1.95	2.13	1.22	20.52
1 Month	3.70	3.69	2.09	2.17	1.23	20.06
2 Months	3.68	3.72	2.16	2.21	1.24	19.46
3 Months	3.66	3.75	2.18	2.23	1.25	18.83
4 Months	3.64	3.78	2.20	2.28	1.27	18.08
5 Months	3.62	3.80	2.22	2.32	1.30	17.13
6 Months	3.59	3.82	2.24	2.43	1.37	15.92
SEm±	0.01	0.04	0.01	0.01	0.01	0.40
C.D. at (5%)	0.03	NS	0.02	0.04	0.02	1.21
C.V.	0.24	1.65	0.34	0.89	1.07	3.68

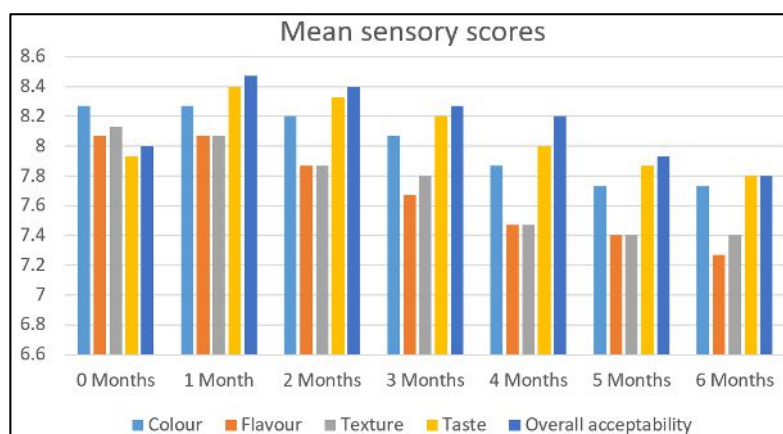


Fig 1: Organoleptic evaluation of Karonda pickle in storage

Conclusion

Karonda can be utilized to produce pickle, with the overall acceptability score remaining in the "Like very much" range throughout the storage period of up to four months, transitioning to "Like moderately" in the subsequent period according to a nine-point Hedonic scale. The study indicated a favorable future for Karonda in the processing sector.

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