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# Effect of processing on nutrient content of Lasoda fruit at different stages of maturity

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## Abstract
The nutrient content of lasoda fruit was estimated at various stages of maturity and blanching of the fruit from raw, ripe and dried stage. Moisture was found highest in ripe fruits (88.81±0.27%) and significant reduction ($P$<0.05) of the moisture content from raw (88.21±0.04%) to dried stage (11.40± 0.23%). There was a significant increase ($P$<0.05) in moisture content in blanching for raw (88.77±0.02%) and ripe (89.41±0.15%) stages and reduction in the dried stage (10.39±0.07%). The carbohydrate content found highest in dried lasoda fruits (60.42±0.10). Protein was found that the lasoda fruits are promising source of protein ranging from 11.63± 0.34g to 1.97±0.01g in dried and raw fruit stage respectively. In lasoda fruit fat content was found to be high in dried fruit (2.05±0.01g). The highest crude fiber was observed in dried (5.72±0.11) lasoda fruits. The ash content was found highest in dried (5.43±0.12) lasoda sample followed by ripe (5.03±0.01) and raw (4.11±0.01) and the same trend was observed in blanching. There was a significant decrease ($P$<0.05) in the β carotenoids content from 7.09±0.14µg/100g in raw stage to 9.21±0.18µg/100g of dried stage. Vitamin C in lasoda fruit was found significantly highest in fresh stage to dried fruit (0.28±0.01g).


**Keywords:** Nutrient content Lasoda fruit maturity

## Introduction
Underutilized fruit crops can be used in sustainable lands since they do not require external inputs such as irrigation or fertilization. The low external input requirements have also given rise to suggestions that underutilized crop production can go hand in hand with organic certification, thus opening niche market options for the producers. In addition, underutilized crops are components of mixed cropping systems, whether on terrace, agro forestry systems or home gardens. Besides, underutilized crops are integrated into the farming system and are better suited to harsh conditions than domesticated commercial crops. Since an uncertainty of climate is prevalent, a certain level of resilience can be built through increased agro-biodiversity (Ajay *et al*., 2016) [1].

Lasoda is a minor and underutilized fruit popularly eaten by people from ancient times and it is known as Indian cherry, Sebestyen lehua, lasora or gonda. It is commercially important and is available during May-June in the market in considerable quantities. The fruit is not being cultivated commercially as an orchard crop but grows wild in waste lands and in fruit orchards. It is found growing along farm boundaries, on farm land as scattered trees and also on road sides. Lasoda plant is found growing wild form in the states of Telangana, AP, Rajasthan, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Maharashtra, Gujarat etc.

The importance of lasoda fruit is well recognized both in rural as well as urban masses. Its fruit is edible, sweet and mucilaginous. The tender mature fruits are mostly pickled and also used for vegetable purpose. Fruits have medicinal feature and are considered as anthelmintic, diuretic, demulcent and expectorant. They are rich source of carbohydrates, phosphorous (60 mg/100g of pulp) and calcium (40mg/100g of pulp). Fruit is rich in sugars but typically acid less in nature. (Prerak *et al.,* 2015) [11].

## Material and Methods
Lasoda fruits were procured from ARI, PJTSAU, Rajendranagar and other raw materials required for product development were procured from the local market in Hyderabad. All the chemicals used in the investigation were of analytical Grade. Chemicals, glassware's were utilized from the laboratory of Post Graduate and Research Centre, PJTSAU, Rajendranagar, Hyderabad.

Raw, ripe and dried lasoda fruits were analyzed for different parameters which are listed below:

**Nutrient Composition**
**Moisture (AOAC method)**
**Procedure:** 10g of food material was placed in known weight of dry petri dish with lid. Petri dishes were transfer into hot air oven and dried at 100 to 105º C till a constant weight was obtained. It was followed by cooling in a desiccator for 15 min and the final weight of sample was taken.

**Calculation**

$$\text{Moisture \%} = \frac{\text{Sample initial Wt } (W_1) \text{ - Final Wt } (W_2)}{\text{Initial Wt } (W_1)} \text{ x } 100$$

**Proteins (AOAC, 2000)**
The kjeldhal method can conveniently be divided into three steps.
1. Digestion
2. Neutralization
3. Titration

**Reagents required**
- **Conc. $H_2SO_4$**
- **Digestion mixture:** 100 g of $K_2SO_4$, and 20 g of $CU_2SO_4$. $5H_2O$ was weighed and mixed uniformly
- **Mixed indicator**: 0.1% bromocresol green and 0.1% methyl red indicator in 95% ethanol were prepared separately. 10 ml of bromocresol green was mixed with 2ml of methyl red solution in a bottle provided with a stopper, which delivers about 0.05 ml per four drops.
- **NaOH (40% solution):** 40 g NaOH was dissolved in 100 ml of distilled water.
- **Boric acid (2% solution):** 50 mg of boric acid was dissolved in 100 ml of distilled water.
- **Ammonium Sulphate (1mg/ml solution):** 50 mg of ammonium sulphate was dissolved in 50 ml of distilled water.
- **HCl (N/70 solution):** 1.2315 ml of concentrated HCl was made up to one liter volume with distilled H2O to get N/70 HCL solution.

**Procedure**
0.1 g of sample was weighed into a kjeldhal flask to which 0.2 g of the digestion mixture was added and digested in Kelplus – kjeldhal digester with 20 ml of conc.$H_2SO_4$ until all the organic matter was oxidized and uniform greenish – blue digest was obtained. The digest was cooled and volume was made up with 100 ml distilled water. An aliquot of 5 ml was taken for steam distillation in Kelpus distillation unit with excess of 40% NaOH solution (10 ml). The liberated ammonia was observed in 100 ml of 2% boric acid containing a few drops of mixed indicator. This was titrated against N/70 HCl. A simultaneous standard (Anhydrous ammonium sulphate) was made to estimate the amount of nitrogen taken up by N/70 HCl. From the nitrogen content of the sample, the protein content of different samples was calculated by multiplying with the factor of 6.25.

**Calculation**

$$\text{\% of Nitrogen present in given sample} = \frac{(S\text{–}B) \text{ x N x } 14 \text{ x } 100}{\text{Sample weight x}1000}$$

**Where**
S-Sample titre value, B- Blank titre value, N- Normality of HCl

**Carbohydrates (AOAC, 2000)**
**Reagents required**
1. 2.5 N HCl
2. **Anthrone reagent:** 200 mg of anthrone was dissolved in 100 ml ice cold 95% $H_2SO_4$.
3. **Stock standard glucose solution:** 100 mg of glucose was dissolved in 100 ml of distilled water (1 mg/ml)
4. **Working standard solution:** 10 ml of stock standard solution was diluted to 100ml with distilled water.

**Procedure**
100 mg of sample was weighed and placed in boiling test tube. Then it was hydrolyzed by keeping it in a boiling water bath for 3 hrs with 5 ml 2.5 N HCl and cooled to room temperature. It was neutralized with solid $Na_2CO_3$ until the effervescence ceased. The volume was made up to 100 ml and centrifuged to collect the supernatant and from this 0.5 ml and 1 ml aliquots were taken. The standards were prepared with concentration of 0.2 ml, 0.4 ml, 0.6 ml, 0.8 ml, 1 ml along with a blank and the volume was made up to 1ml in all test tubes. Then 4ml of anthrone reagent was added followed by 8 min of heating in boiling water bath. After cooling, the red green color was read at wavelength of 630 nm. The standard curve was plotted with concentration on X-axis and absorbance on Y-axis. From the standard graph, amount of carbohydrate present in sample was calculated.

**Calculation**

$$\text{Amount of carbohydrates present in sample} = \frac{\text{Mg of glucose}}{\text{Volume of test sample}} \text{ x } 100$$

**Fat (AOAC, 2000)**
Fat was determined by Soxhlet method (AOAC, 2000). 2 g of sample was accurately weighed into a dry thimble and extracted using petroleum ether (60 - 80º BP) as a solvent for 16 hr. The fat extract was collected in a previously weighed dry flat-bottomed flask and separated from the solvent by evaporating in oven or hot water bath. The flask was dried in an oven at 80-$100^0$ C and cooled till constant weight was achieved. Fat content of the samples were expressed as g/100 g of sample. The amount of fat present in a given food sample was calculated by the formula.

**Calculation**

$$\text{\% Fat (g/100g sample)} = \frac{\text{Final wt of beaker – Empty weight of beaker}}{\text{Weight of sample}} \text{ x } 100$$

**Estimation of crude fiber (AOAC 2005)**
**Procedure**
1g of moisture and fat free sample was weighed and kept in the fibre bags. The glass spacer was kept into the bags. The bags were loaded in the sample carousel at the previewed positions (positions 1-12). The sample carousel was put into the glass container carefully. The glass container axial was placed on the previewed position of the hot plate. The programme was started in the Fibretherm (Gerhardt). After completion of the program, the fibre bags were removed. The residue was transferred to crucible and weighed ($W_1$) and dried over night at 80-100˚C in oven. Then transferred to

desiccator for cooling and weighed ($W_2$). The crucible was heated in a muffle furnace at 600˚C for 2-3 hrs. Then crucible was cooled in desiccator and weighed ($W_3$).

**Observations**

Weight of the sample = ($W_1$) g

Weight of the crucible + sample before heating at 600˚C = ($W_2$) g

Weight of the crucible + sample after heating at 600˚C = ($W_3$) g

Weight of crude fibre = ($W_2$-$W_3$) g

**Calculations**

$$\text{Crude fibre (g\%)} = \frac{100-(moisture+fat)\text{X weight of the crude fiber}}{weight\ of\ the\ sample\ taken(moisture\ and\ fat\ free)W1}$$

**Ascorbic acid (AOAC, 2000)**

**Reagents**

- **2, 6-dichlorophenol indophenol dye solution**: In a volumetric flask, 50 mg of sodium salt of 2, 6-dichlorophenol indophenol dye and 42 mg of sodium bicarbonate were taken and dissolved in 100 ml hot distilled water. The volume was made upto 200 ml with distilled water.
- **Metaphosphoric acid (3%)**: Three grams of metaphosphoric acid was dissolved in a small quantity of distilled water and the volume was made up to 100 ml or 30 g in 1000 ml of water.
- **Standard ascorbic acid:** 100 mg of L-ascorbic acid was dissolved in a small quantity of 3% met phosphoric acid in 100 ml volumetric flask and diluted to 100ml volume. From this 10 ml was taken in another 100 ml volumetric flask and volume was made up with 3 per cent met phosphoric acid (1 ml = 0.1 mg of ascorbic acid).

**Standardization of dye**

In a 100 ml conical flask, 5 ml of standard ascorbic acid solution was taken and 5 ml of 3 per cent met phosphoric acid was added. The dye solution was filled in a burette and standard ascorbic acid solution was titrated. The end point was pink color which persisted for about 10 seconds. This was repeated for samples in triplicates.

$$\text{Dye factor} = \frac{0.5}{\text{Titre value}}$$

**Procedure**

Five milliliter of 3 per cent met phosphoric acid extract of the sample was taken in a conical flask and titrated with standard dye. The end point was pink color which existed for 15 seconds. The titre value was noted.

**Calculations**

$$\text{Ascorbic acid (mg / 100ml)} = \frac{\text{Titre value x Dye factor x Volume made}}{\text{Aliquot taken x Volume of sample taken}} \text{ x 100}$$

**β Carotene estimation (Srivastava & Kumar (2003)**

**Procedure**

5g of sample of extrudates was ground with few crystals of anhydrous sodium sulphate and mixed with 10-15ml acetone. It was then decanted and supernatant was collected in a beaker. The process was repeated twice and the combined supernatant was transferred to a separating funnel. 5-10 ml of petroleum ether was added and mixed thoroughly. Two layers were separated out on standing. The lower layer was discarded and the upper layer was collected in 100 ml volumetric flask. The volume was made up to 100ml with petroleum ether and optical density was recorded at 452nm. Petroleum ether was used as blank. The beta carotene was then calculated using the following expression:

**Results and discussion**

**1. Moisture**

The moisture content of the lasoda fruit was estimated at various stages of maturity of the fruit from raw, ripe to dried stage to study the variation in moisture content. It was found highest in ripe fruits (88.81±0.27%) and significant reduction ($P$<0.05) of the moisture content from raw (88.21±0.04%) to dried stage (11.40± 0.23%). Similar results were reported by Prakash, (2013) that the moisture content of Carissa carandus L. fruit decreases during young, mature and ripened stage (79.96 ± 0.02%, 76.63± 0.07% and 73.23±0.05%). There was a significant increase ($P$<0.05) in moisture content in blanching for raw (88.77±0.02%) and ripe (89.41±0.15%) stages and reduction in the dried stage (10.39±0.07%).

**2. Carbohydrate**

The carbohydrate content found highest in dried lasoda fruits (60.42±0.10), followed by raw (2.81±0.17) and ripe (2.38±0.13). The carbohydrate content was highest in dried lasoda, as the moisture content was low and solid content was high. There was a significant difference in carbohydrate content between raw, ripe and dried lasoda fruits.

In blanching there was a significant increase in carbohydrate content in dried (63. ±0.12), followed by raw (2.84±0.11) when it compared to the fresh fruit.

**3. Protein**

It was found that the lasoda fruits are promising source of protein ranging from 11.63± 0.34g to 1.97±0.01g in dried and raw fruit stage respectively. Similarly Prakash, (2013) reported that the proteins in the fruit of Carissa Carandus increased from its young stage (0.28± 0.36g) until the fruit ripens (3.37±2.14g). There was a decrease in protein content in dried (10.99±0.01) and raw (1.94±0.01) blanched lasoda fruits, but it was observed that there was increase in protein content of ripe blanched fruits. There was a significant difference in protein content of dried and raw blanched fruits.

**4. Fat**

In lasoda fruit fat content was found to be high in dried fruit followed by raw and ripe stage (2.05±0.01g, 1.62±0.01g and 1.24±0.01g). There was a significant difference in fat content between dried, raw and ripe lasoda fruits.

In blanching, there was increase in fat content of dried (2.60±0.02) and ripe fruits compared to the fresh fruits. It was observed that, there was a significant difference in fresh and blanched fruits of dried and ripe, but no significant ($P$<0.05) change was observed in blanching of raw lasoda fruit.

**5. Crude fiber**

The highest crude fiber was observed in dried (5.72±0.11), followed by ripe (1.85±0.04) and raw (1.83±0.02) lasoda fruits. There was an increase in crude fiber of fresh (5.72±0.11) to blanched (5.88±0.01) of dried fruits. It was observed that, there was significant ($P$<0.05) difference between fresh and blanched dried fruits. No significant

difference was observed in fresh and blanched fruits of raw and ripe lasoda.

**6. Ash**

The ash content was found highest in dried (5.43±0.12) lasoda sample followed by ripe (5.03±0.01) and raw (4.11±0.01) and the same trend was observed in blanching. There was significant difference ($P<0.05$) between fresh and blanched dried fruit and found no significant difference between fresh and blanched fruits of raw and ripe.

Gopalan *et al.* (2004) [6] in their study reported 82.5 per cent moisture, 2 g of crude protein, and 2 g of fat and 0.03 g of fiber in lasoda fruit. Kaushik and Dwivedi (2004) determined 74% moisture content and protein, crude fiber and fat content to the value of 2% each. They also reported that the fruit pulp is rich in carbohydrates, extractive matter and ash.

**7. Ascorbic acid**

Vitamin C in lasoda fruit was found significantly highest in fresh stage to dried fruit (0.28±0.01g) followed by ripe (0.12±0.02g) and raw (0.09±0.01g) fruit and the same trend was also observed in the different maturity stages (raw, ripe, Dried). But each individual maturity stage of fruit (raw, fresh) during the processing (raw blanched), there was no significant difference in ascorbic acid. Similar results were obtained by Atefeh *et al*., (2013) [5] who reported a raised ascorbic acid at different stages of maturity. Mahendran and Bandara (2000) reported that moisture stress reduced the ascorbic acid content of tomato fruits when the stress was imposed during the fruit ripening stage.

***β* carotenoids**

The results of estimation of *β* carotenoids in different stages of ripening and blanching are given in the As per the results obtained it was observed that there was a significant decrease ($P<0.05$) in the β carotenoids content from 7.09±0.14μg/100g in raw stage to 9.21±0.18μg/100g of dried stage. β carotenoids content was increased from unprocessed (raw, dried) to blanched fruit (raw, dried) except ripe fruits of unprocessed and blanched lasoda fruits. There was a significant ($P<0.05$) difference between unprocessed dried fruit (9.21±0.18 μg/100g) and dried blanched fruit (9.57±0.04 μg/100g).

According to Kotikova *et al.,* (2009) [8], the carotenoids and the antioxidant content of tomato mostly depends on cultivars, stage of maturity, environmental factors and growing conditions.

**Conclusion**

On the basis of results obtained from the present investigation, the following conclusions are drawn: Carbohydrate, protein, fat, ash was found highest in dried fruits. Moisture content was found highest in ripe Lasoda fruits. There was significant difference in blanching and different stages of maturity in nutrient content of Lasoda fruits except ascorbic acid. Blanching induces the development of a uniform yellow color, inactivates the activity of enzymes and micro-organisms that cause spoilage and softens the fruit.

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