Study of physico-chemical properties of mosambi jelly

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Abstract
This study was designed to develop the mosambi fruit jelly and also determined the physico-chemical properties. Three mosambi fruit jelly samples such as T1, T2 and T3 were developed and subjected for sensory evaluation. Best sample was selected and all samples were analyzed for physico-chemical properties. Results showed that the sample T3 got highest score for overall acceptability (8.22±0.64) compared to sample T1 and T2. Mechanical properties such as cohesiveness, gumminess, hardness, springiness and chewiness for three samples were assessed out of which gumminess and cohesiveness were highest for T3 with values 1889 and 0.81 respectively. Samples were also assessed for chemical analysis such as carbohydrates, reducing sugars, protein, vitamin C and scavenging activity and compared with that of mosambi juice. Vitamin C and scavenging activity were low for T3 i.e., 6.22% and 16.36% respectively when compared to mosambi juice which has vitamin C and scavenging activity of 62% and 95.75% respectively. Moisture content, pH, titrable acidity were highest for T1 i.e., 35.16% and 3.5 respectively. Ash, TSS, titrable acidity were highest for T3 i.e., 99.79%, 76° Brix and 0.81 respectively.

Keywords: Mosambi juice, mosambi jelly

1. Introduction
Jelly is a semi-solid product prepared by boiling a clear, strained solution of pectin-containing fruit extract, free from pulp, after the addition of sugar and acid. A perfect jelly should be transparent, well-set, but not too stiff. Jelly should not be gummy, sticky, or syrupy or have crystallized sugar. Jelly should taste fresh and fruity.

Mosambi is also known as sweet lime in the Indian subcontinent region. It is native to Asia and best cultivated in India, China, Southern Japan, Vietnam, Malaysia, Indonesia and Thailand. All parts of the mosambi plant can be used as a traditional medicine and also it does not have any toxicity and adverse effects of any part of plant. It was reported that it has some pharmacological activities like antibacterial, antifungal activity, antioxidant activity anti-hyperglycemic activity and antitumor potential (Ahmed Abdullah Khan et al., 2016) [1].

Susana Rubio Arraez et al. (2016) [18] studied on physio-chemical properties of citrus jelly with non-carcinogenic and functional sweeteners. Soluble solids, moisture content, pH, water activity, anti-oxidant, optical and mechanical properties of the jelly were determined. Mechanical properties of samples were evaluated with texture profile analysis test (TPA) using a texture analyser.

Ahmed Abdullah Khan et al. (2016) [1] carries studies on phytochemical and pharmacological properties on citrus limetta (mosambi). It includes that nearly all parts of plant can be used as a traditional medicine and also it does not have any toxicity and adverse effects of any part of plant. It was reported that it has some pharmacological activities like antibacterial, antifungal activity, antioxidant activity anti-hyperglycemic activity and antitumor potential. Andres Alejandro Damian Reyna et al. (2017) [2] conducted studies on polyphenolic content and bacterial effect of Mexican citrus limetta and citrus reticulate. Reported that citrus limetta and citrus reticulate shows an important content of phenolics and flavonoids which makes them potential sources of polyphenolic compounds. The extracts of *C. reticulate* and *C. limetta* were found to show antimicrobial activity.
Awadhesh Kumar and Bhagwan Deen et al. (2017) \cite{3} studies on preparation and shelf life of jelly from wood apple (*Limonia acidissima* L.) fruits. Three different formulations of jelly from wood apple fruit were prepared under subjected for determination of TSS, ascorbic acid, titrable acidity, sugars, organoleptic quality and microbial growth by standard plate count method for four months. It was concluded that development of jelly with 75% water and 25% mature fruit pulp was found to be best during organoleptic quality.

Bhavana soni et al. (2013) \cite{4} conducted microbial analysis in estimation of microbial population in some confectionary products like jam, jelly, biscuits. By analyzing four confectionary products jelly shows less contamination than others where as biscuits (parle G) shows more contamination.

Chaudhari and Nikam (2013) \cite{5} conducted studies on development and sensory analysis of beetroot jelly. Three variations of beetroot jelly were prepared and subjected for sensory analysis. By using 9 point hedonic scale by a panel of 10 trained members. The beetroot jelly was developed with standard formulations using 2% pectin 0.5% citric acid and 61% sugar scored highest in sensory evaluation (8.3) for overall acceptability.

In light of the aforementioned facts, this study was, therefore, undertaken to: (1) develop and standardize the mosambi jelly (2) Determine the physico-chemical properties of mosambi jelly.

### 2. Materials and Methods

#### 2.1. Raw materials and chemicals

All the raw materials such as mosambi, sugar, citric acid, pectin were purchased from a local market (Pulivendula, India). All chemicals used in the research were of analytical grade and purchased from HiMedia Laboratories Pvt. Ltd. (Mumbai, India).

#### 2.2 Physico-chemical characteristics

Physico-chemical characteristics of the samples were determined by using standard AOAC methods.

#### 2.3 Formulation of Mosambi Jelly

Different jellies were made using mosambi juice in different proportions of sugar and pectin.

**Table 1:** Different formulations for preparation of jelly from mosambi juice

| Samples | Juice   | Sugar  | Pectin | Citric acid |
|---------|---------|--------|--------|-------------|
| T1      | 500 ml  | 250 g  | 5 g    | 0.5 g       |
| T2      | 500 ml  | 260 g  | 7.5 g  | 0.5 g       |
| T3      | 500 ml  | 270 g  | 10 g   | 0.5 g       |

#### 2.4 Flow Chart for Preparation of Jelly

![Flow Chart for Preparation of Jelly](image-url)
2.5 Organoleptic Evaluation of Mosambi Jelly
Organoleptic evaluation of mosambi jelly was carried out by using 9 point hedonic scale. Samples were tested for various sensory parameters such as flavor, appearance, taste, texture, and overall acceptability (Chaudhari and Nikam, 2013) [5].

3. Results and Discussion
3.1 Organoleptic Evaluation
Organoleptic evaluation was done for all samples by using 9 point hedonic scale method.

3.2 Physico-Chemical Parameters

| S. No | Parameters       | T1          | T2          | T3          |
|-------|-----------------|-------------|-------------|-------------|
| 1     | Ash             | 96.721%     | 99.11%      | 99.796%     |
| 2     | pH              | 3.5         | 3.7         | 3.4         |
| 3     | TSS             | 66°B        | 68°B        | 70°B        |
| 4     | Brix / acid ratio | 134.69     | 102.874     | 86.3557     |
| 5     | Acidity         | 0.49        | 0.661       | 0.8106      |
| 6     | Moisture        | 34.286      | 35.16       | 34.786      |

3.2.1 Ash
Ash analysis was done by using AOAC method and the percentage of ash obtained for Sample11-T1, sample112-T2 and Sample113-T3 are 96.721%, 99.11% and 99.796% respectively.

3.2.2 pH values
pH value of different jelly samples were determined by using pH meter. pH value for T1-T1, T2- T2, and T3-T3 were 3.5, 3.7, and 3.4 respectively. From the above observation pH for T2 was highest and for T3 was found to be lower.

Fig 2: Graph showing ash analysis of mosambi jelly
pH of mosambi jelly is high when compared to pH of pomegranate jelly which has pH of 3.2.

3.2.3 TSS values
TSS values of different jelly samples were determined by using refractometer. TSS values for T1, T2, T3 were 66°B, 68°B, 70°B respectively. From the above observation TSS for T3 was highest and for T1 was found to be lower.

3.2.4 Brix/acid ratio
Brix/acid ratio values of different jelly samples were determined by using brix and acidity values. Brix/acid ratio values for T1, T2, and T3 were 134.69, 102.874, and 86.3557 respectively. From the above observation brix/acid ratio for T1 was highest and for T3 was found to be lower.
3.2.5 Titrable Acidity values

![Graph showing Brix/acid values of mosambi jelly](image)

**Fig 5:** Graph showing Brix/acid values of mosambi jelly

3.2.6 Moisture content:

Moisture content values of different jelly samples were determined by using hot air oven. Moisture values for T1, T2, and T3 were 34.286, 35.16, and 34.786 respectively. From the above observation moisture value for T3 was highest and for T1 was found to be lower.

![Graph showing moisture values of mosambi jelly](image)

**Fig 6:** Graph showing the titrable acidity values of mosambi jelly

**Fig 7:** Graph showing the moisture values of mosambi jelly (Sample 111-T1, sample 112-T2 sample 113-T3)
3.3 Nutritional Composition of Mosambi Jelly

| Parameters       | Juice | T1   | T2    | T3    |
|------------------|-------|------|-------|-------|
| Carbohydrates (%)| 12.98%| 52%  | 64%   | 74%   |
| Reducing Sugars (%)| 12.8%| 15.92%| 16.32%| 16.54%|
| Protein          | 1.25% | 0.78%| 0.78% | 0.78% |
| β-carotene (%)   | 0.396%| 0.0496%| 0.0496%| 0.0496%|
| Vitamin C (%)    | 62%   | 14.22%| 8%    | 6.22% |
| Scavenging activity (%)| 95.75%| 38.86%| 37.27%| 16.36%|

Table 3: Nutritional composition of mosambi jelly

3.3.1 Carbohydrates
The analysis of carbohydrates done by phenol sulphuric acid method in fresh juice, T1, T2, and T3. The results are 12.98%, 52%, 64%, and 74% respectively. From the above observation, T3 has high percentage of carbohydrates when compared to T1 and T3.

![Graph showing% of carbohydrates in mosambi jelly](image)

3.3.2 Reducing Sugars
Reducing sugars in fresh juice, T1, T2, and T3 are analyzed by using AOAC method. From above observation% reducing sugars in fresh juice, T1, sample112, and T3 are found to be 12.8%, 16.317%, 11.668%, and 15.922% respectively.

![Graph showing% of reducing sugars in mosambi jelly](image)

3.3.3 Proteins
Proteins composition in fresh juice, T1, T2 and T3 are analyzed by using Folin lowry method. From above observation protein content in fresh juice, T1, T2 and T3 are 1.25%, 0.78%, 0.78% and 0.78% respectively.
3.3.4 Vitamin C
Vitamin C composition in fresh juice, T1, T2 and T3 are analyzed by using AOAC method. From above observation Vitamin C content in fresh juice, T1, T2, T3 are 62%, 14.22%, 8% and 6.22% respectively.

3.3.5 β – Carotene
β- Carotene in fresh juice, T1, T2 and T3 are analyzed. The results of β – Carotene in fresh juice, T1, T2 and T3 are 0.396, 0.0496, 0.0496 and 0.0496 respectively.
3.3.6 Antioxidant
Antioxidant activity of Juice and samples of mosambi jelly are analysed by using DPPH method. The antioxidant activity of juice and mosambi jelly are as shown in the following graph.

![Graph showing scavenging activity of juice and mosambi jelly](image)

**Fig 13:** Graph showing scavenging activity of juice and mosambi jelly

3.4 Mechanical Properties
Mechanical properties of mosambi jelly like hardness, cohesiveness, gumminess, springiness and chewiness are determined by using Brookfield Texture Analyser.

| Parameters    | T1     | T2     | T3     |
|---------------|--------|--------|--------|
| Hardness      | 2480 g | 4060 g | 2320 g |
| Cohesiveness  | 0.54   | 0.40   | 0.81   |
| Gumminess     | 1336 g | 1630 g | 1889   |
| Springiness   | 2.08   | 3.53 mm| 1.60 mm|
| Chewiness     | 27.3mJ | 56.4 mJ| 29.6 mJ|

![Resultant graph for texture analysis of T1](image)

**Fig 14:** Resultant graph for texture analysis of T1

![Resultant graph for texture analysis of T2](image)

**Fig 15:** Resultant graph for texture analysis of T2
3.5 Optical Properties

Color

Color of mosambi jellies are determined by using Hunter Lab Color Flex Spectrometer. The Values of L, a, and b for T1, T2, and T3 are as follows.

| Color Parameter | L    | a    | b    |
|-----------------|------|------|------|
| T1              | 26.75| 2.22 | 0.27 |
| T2              | 31.22| 3.5  | 1.99 |
| T3              | 23.00| 2.22 | 0.27 |

From above observation, T3 having great L value is more close to black when compared to T1 and T2. All samples have positive values and all samples have positive b values.

4. Conclusion

Mosambi juice can be used as a raw material for the preparation of jelly. From the above studies, it was concluded that a good quality value added product can be prepared from mosambi juice. According to sensory analysis T3 (T3) was best scored sample. According to microbial analysis jelly is microbiologically safe for consumption. The manufacture of mosambi jelly is therefore an alternative use of mosambi fruits.

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