Quality Evaluation and Development of Apple-Sapota Jam

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Abstract—Jam means a product prepared from sound, ripe, fresh, dehydrated, frozen or entire fruit including pulp it has thick consistency due to high pectin content hence an attempt was made to develop apple sapota jam. There are various types of jam available in market but most of them contains preservatives. The main advantage of this product is that it has been made without using pectin as apple already contains it. The aim behind making this product was to develop a new flavoured product having nutritional benefits. Apple and sapota pulp were blended in the ratios of 100:0, 80:20, 60:40, 40:60 respectively to prepare blended jams. The product was evaluated for proximate composition of moisture 48% and ash 28.2%, textural and sensory characteristics by a panel of 7 experienced judges using Nine-point hedonic scale it. The result showed that the sample with ratio of 80:20 apple sapota pulp has more overall acceptability than others.

Keywords—Jam, Apple-sapota, Citric acid, Sugar, Organoleptic evaluation, Microbial analysis.

1. INTRODUCTION

Fruits and vegetables processing in India in the form of frozen (IQF), dried, pulp, puree, paste, sauces, snacks, dressings, flakes, dices, dehydration pickles, juices, slices, chips, jams, and jelly is provided with a huge opportunity by India as the world’s second largest producer Fruit pulp with sufficient sugar is boiled to a reasonably thick consistency, firm enough to hold the fruit tissues in position to produce Jam. Jams can be prepared from one kind of fruit or from two or more kinds of fruits such as apple, pear, apricot, loquat, peach, papaya, karonda, carrot, plum strawberry, raspberry, mango, tomato, grapes and muskmelon, with scrapping and pulp adhering to cores of fruits being available in plenty in canning factories (Shrivastava & Kumar, 2002). A jelly-like, semi-solid product made from the entire fruit or fruit pulp or vegetable pulp cooked with sugar, along with some preservatives and ingredients such as citric acid and pectin for consistency, was created by Jam. Jam should contain 65% or more TSS and at least 45% pulp. Two methods for developing the jam are mainly used, one being from the pulp of a single fruit and the other by blending two or more fruit pulps. Fruit or veg pulp or juice is defined as jam, to which sugar, pectin and citric acid are added. In jam and jellies, sugar prevents spoilage and growth of micro-organisms. Because of sugar's water holding capacity, the shelf life of the product is increased (Awulachew, 2003). Their characteristics like stabilizing, thickening & texture are improved by pectin in different food products like jam and jellies. The accurate balance of jam and jellies is essential for by citric acid in preparation. Citric acid can be replaced in the preparation of jam by the use of acide lime and lemon juice because lemon and lime juices have a greater amount of citric acid, and jam is the most effective means of preserving fruits and vegetables. Much more satisfying results are obtained from properly prepared jam, which takes less time than other means of preservation such as drying and freezing. Suitable consistency was boiled with nutritive sweeteners such as sugar, dextrose, invert sugar or liquid and glucose to prepare Jam from sound, ripe, fresh, dehydrated, frozen or previously packed fruits including fruit juices, fruit pulp, fruit juice concentrate or dry fruit (Desrosier, 1978). The standard formulation of fruit pulp, sugar content, adjusted acidity and pectin content is subjected to commercial production of apple jam. Not less than 45% fruit and 55% sugar is used to make jam a Semisolid food. The deficiencies that occur in the fruit itself are overcome by adding flavouring and colouring agents and the substrate is concentrated to about 65% or above soluble solids. According to the end user, consumer preferences, market demand, food laws, buyer’s specifications and economic utilization of inputs required, formulations have been developed standards (Desrosier 1978).

Chopped apple fruit, apple puree, and sugar will be used to make apple jam. Due to apple's high level of natural pectin, it is one of the few non-citrus fruits that can be used for production. without addition of commercial pectin. Although it has low acid levels, it can be supplemented with natural screenet lime juice. As people become more conscious of what they eat, the term 'organic' is becoming more popular in food circles. Generally, organic farming refers to a system that relies on healthy soil to produce strong plants that resist pests and diseases; it generally prohibits the use of pesticides, genetically modifies organisms (GMO), synthetic preservatives and antibiotics/hormones. In the production of food products such as jam, there is "... the restriction of the use of food preservatives, of non-organic ingredients with mainly technological and sensory (Thulasimani, 2019). The most important temperate fruit commercially and fourth among the most widely produced fruits in the world, apple (Malus pumila) is one of the most important tree fruits of the world which originated in south/western Asia. The northern hilly area of Punjab, NWFP, and Balochistan (Chaudhary, 1994) is the only area where its cultivation is limited, and it is mostly grown in the states of Jammu & Kashmir, Himachal Pradesh, Uttarakanchal, Arunachal Pradesh and Nagaland. Water content, fibre, carbohydrates, protein, lipid, ash, vitamin C, and energy of 57 kcal per 100g of an edible portion was contained by Apple (Hussain, 2001).

Central America is native to Sapota, and chiku, commonly known as Sapota, is mainly cultivated in India for its fruit value, while South-East Mexico, Guatemala, and other countries commercially grow it for the production of chickle, a gum-like substance obtained from latex and is mainly used for the preparation of chewing gum. The states of Gujarat, Maharashtra,
Karnataka, Tamil Nadu, Andhra Pradesh and Kerala mostly grow sapota. India's main producer of sapota is the state of Karnataka, with 293,000 ha of plantations that produce 360,000 MT of fruit each year (Suhasini et al., 2012). Fresh pulp of sapota, sherbets, milkshake and ice cream are produced by using it as a fresh fruit, and chewing gum is principal made of chicle which is obtained from the bark of the chikoo tree. In addition to their beauty, sapodilla trees are also useful for landscaping because of their tolerance to neglect (Balerdi et al., 2005). The constituents in ripe Sapota fruits per 100 g of edible portion, such as moisture 73.7g, carbohydrate 21.4g, protein 0.7g, fat 1.1g, calcium 28 mg, phosphorous 27mg, iron 2mg and ascorbic acid 6mg, glucose ranged from 5.84 to 9.23%, fructose 4.47 to 7.13%, sucrose 1.48 to 8.75%; total sugars 11.14 to 20.43%, starch 2.98 to 6.40% and tannin content varied 3.16 to 6.45% because of the skins, are good source of sugar which range between 12 to 14% and are being provided by Sapota fruits (Sulladmath and Reddy, 1985). Very little work on processing of sapota has been done in our markets and food processing industries have been in a developing stage in Bangladesh, with the consumption of processed fruit products gradually becoming popular. Locally processed fruit products are now available in the market and quality products from sapota might be welcomed by the consumers who have affinity for sapota round the year if they are developed (Wards and Aurand, 1977). As nutrient content of the Sapota is high and this fruit can be recommended to alleviate micronutrient malnutrition. The value addition of Sapota not only serve a longer shelf life but also support for better income generation for those who are engaged in collection and processing of this fruit. The studies done on Sapota so far revealed that the Sapota fruit is one of the healthiest fruits and can be used for preparation of value-added products with longer shelf lives. The developed processed products may be commercialized for better income generation and increase the variety in fruit products. It opens Market opportunities for the developed value-added products along with empowerment of rural sector through value addition of perishable fruit (Jamil et al., 2016).

2. MATERIALS AND METHODS
The experiment was conducted in the laboratory of “Institute of Bioscience and Technology” MGMU University Chhatrapati Sambhaji Nagar. The Apple, sapota, Achras zapota (Family: Sapotaceae) was collected from the local market. The major ingredients used were sugar, citric acid.

2.1 Extraction of Apple-sapota pulp
The fully ripe healthy and fresh Apple and sapota was washed thoroughly with potable water and the skin was removed by a knife. The seeds were removed and then Apple and sapota fruit was grind by a grinding machine. The pulp made from apple and sapota apply directly in jam.

2.2 Product Development
The product was prepared and developed according to following method: (Shrivastava & Kumar, 2002)

```
Flow Chart
Ripe Fresh Fruits
↓
Washing (with normal water)
↓
Peeling and Cutting (manually)
↓
Addition of Sugar (as per formulation)
↓
Cooking (up to end point)
↓
Addition of Citric Acid
↓
Judging of end point
(By cooking up to 105 °C / 68-70% TSS or by sheet test)
↓
Filling hot into sterilized bottles
↓
Cooling (to room temperature)
↓
Capping (manually)
↓
Storage (at cool and dry place)
```

The fruit was collected from the local market. The major ingredients for the preparation of products were fruit, sugar, citric acid and other requirements were used.

2.3 Concentration By Heating
Steam jacketed open kettle was used. The fruit pulp was concentrated by continuous boiling and stirring. The required quantity of sugar was added directly during boiling Sugar also acts as preservative and brix is checked @ 68°B & temperature 105°C.

2.4 Judgement Of Endpoint
The final point of jam is judged with one of the following methods;
i. Drop test: A drop of hot jam is put into a beaker of water and if the mass remains as one and undispersed– the jam is done.

ii. Sheet test: A spoon of jam is dropped from a distance on to a plate and if it falls down as a sheet – jam is done.

iii. Brix test: By a hand refractometer.

iv. Thermometer test: The thermometer must be accurately calibrated and fast working. When designed concentration is reached usually the temperature is 105°C.

2.5 Sensory evaluation of jam:

The Sensory evaluation of jam samples was carried out according to the standard method of Amerine et al., (1965) The mean score of at least 5 semi-trained individuals on a 9-point Hedonic scale judges for each quality parameter viz., appearance, taste, texture, transparency and overall acceptability was recorded.

sensory analysis of jam using 9-point hedonic scale test.

9- Like extremely
8- Like very much
7- Like moderately
6- Like slightly
5- Neither like nor dislike
4- Dislike slightly
3- Dislike moderately
2- Dislike very much
1- Dislike extremely

That sensory analysis of product was analyzed by above nine hedonic rating scale.

2.6 Physical analysis:

1. TSS: TSS of the jam is determined by Hand refractometer.
   • TSS is measured in the unit of °Brix.
   • In Refractometer prepared mixture is placed in between prisms and then TSS is get calculated.
   • The TSS of jam is between 68°Brix.

(Note: Total soluble solids (TSS) were determined by the method described by Rangana (2003). Sugar content of the samples was determined according to the method of Lane and Eynon (1923)).

2. pH: pH is calculated with the help of pH paper.

2.7 Proximate Analysis

1) Moisture content analysis

This method involves measurement of weight loss due to evaporation of water at the boiling point. Hot air ovens were used to determine moisture content. The procedure is as follows:
   • Take a clean and dry Petri Dish and add 10 g of sample in it.
   • Heat the Petri Dish in a hot air oven at 100°C.
   • Take weight of the plate after an hour interval weight becomes constant. After getting the reading, determine moisture content by using formula.

Formula:

\[
\text{Moisture content (\%) = } \frac{\text{Initial weight} - \text{Final weight}}{\text{Weight of sample}} \times 100
\]

2) Ash content

Food gets charred (burnt) I continuous heating which can be used for detection of ash content. The procedure for determining as ash content is as follows:
   • Take an empty crucible and weight it. Weight 5 gram of food sample.
   • Take this sample in empty crucible and 5 ml of ethanol and ignite it. This is called as charring.
   • Keep the crucible in muffle furnace at above 550°C for 5 hours.
   • Keep the crucible in desiccators for cooling. After cooling take weight of crucible and calculate the % of ash.

Formula:-

\[
\text{Ash (\%) = } \frac{\text{Weight before drying} - \text{Weight after drying}}{\text{Weight of sample}} \times 100
\]

2.8 Microbial analysis:

Total Plate Counts (TPC)

Food samples are most commonly tested for microbiological quality using this method. It is quick and efficient method, giving the viable count present in the food sample. Foods with high TPC are generally of poor quality. The method involves following steps:
Preparation of sample:
- Weight accurately 1 gm of jam.
- Take 1 ml of this sample and add 9 ml of distilled water prepare $10^{-5}$ dilution.

Inoculation & Incubation:
- Pipette out 0.1-1 ml of above diluted sample in each sterile Petri-dish containing nutrient agar media.
- Rotate the Petri-Plate. Keep the petri-plate in inverted position at 370°C for 1-2 days and measure number of colony per ml of sample.

3. RESULTS AND DISCUSSION
Following is a summary of the results of numerous experiments performed during the study period:

3.1 Formulation of apple- sapota jam
The jam prepared from apple and sapota fruit with different treatments was coded as: Jam $S_0$, $S_1$, $S_2$, $S_3$. The formulation of different fruit jam is as shown below.

| Table No. 3.1 Treatment details (%) |
|-------------------------------|----------------|----------------|----------------|----------------|
| Sample | Apple | Sapota | Water | Sugar | Citric acid |
| $S_0$ | 62.5% | - | 6.25% | 31.25% | 0.06% |
| $S_1(4:1)$ | 50% | 12.5% | 6.25% | 31.25% | 0.06% |
| $S_2(3:2)$ | 37.5% | 25% | 6.25% | 31.25% | 0.06% |
| $S_3(2:3)$ | 25% | 37.5% | 6.25% | 31.25% | 0.06% |

3.2 Sensory evaluation obtained by various judges:
The apple-sapota jam was performed the basis of panel members grade score. The statistical analysis was carried out in MS excel programme. Tables were prepared. It is evident from the tables that all the organoleptic qualities were significantly affected significance of apple-sapota sample.

| Table No. 3.2 Average mean score of apple- sapota jam by consumer panel |
|---------------------|-----------------|----------------|----------------|
| Parameter          | $S_0$ | $S_1$ | $S_2$ | $S_3$ |
| Appearance         | 7.5  | 7.8  | 7.3  | 6.6  |
| Aroma              | 7    | 7.6  | 7.1  | 6.8  |
| Color              | 8    | 7.3  | 7.1  | 6.8  |
| Taste              | 6.6  | 7.3  | 7.3  | 7    |
| Consistency        | 7.3  | 7.3  | 7.1  | 6.5  |
| Overall acceptability | 7.1 | 7.8  | 7.6  | 7    |

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Figure No. 3.2 Sensory evaluation of apple-sapota jam of sample $S_1$

The following chart explains the result of pH and TSS range of product. After the comparision of the following values with the
standard one, we concluded that the product contains proximate amount of the parameters.

### Table No. 3.3 Effect of apple and sapota jam on TSS and pH

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Sample $S_0$</th>
<th>$S_1$</th>
<th>$S_2$</th>
<th>$S_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS</td>
<td>68° Brix</td>
<td>68° Brix</td>
<td>68° Brix</td>
<td>68° Brix</td>
</tr>
<tr>
<td>pH</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

### 3.4 Proximate analysis of apple – sapota jam

The proximate examination of apple- sapota jam presented in table No;3.4 that table includes all values for the food analysis tests viz; moisture content, Ash content. The results are displayed in a table the moisture content were recorded 25.35%, Ash content recorded as 0.34%.

### Table No. 3.4 Result of Proximate analysis of apple – sapota jam

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content</td>
<td>48%</td>
</tr>
<tr>
<td>Ash content</td>
<td>28.2%</td>
</tr>
</tbody>
</table>

### 3.5 Microbial analysis of apple- sapota jam:

For the microbial analysis, the total plate count test was done. The result showed that there was minimal microbial load in the product. The results of the plate count are mentioned below in the table 3.5.

### Table No. 3.5 Result of Total Plate Count

<table>
<thead>
<tr>
<th>Dilution factor</th>
<th>Attempted (A)</th>
<th>Attempted (B)</th>
<th>Attempted (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10^{-2}$</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>$10^{-3}$</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>$10^{-4}$</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>$10^{-5}$</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### 3.6 DISCUSSION

4 trials were conducted during the study, based on the different composition of apple- sapota jam. The controlled sample was market-based jam and the other sample make by the apple-sapota jam with different proportion.

- $S_0$: control sample of 100% apple pulp. In this sample crystallization was caused due to high amount of sugar.
- $S_1$: mixture of 80% apple pulp and 20% sapota pulp in this sample proportion of materials for jam is changed. Overall acceptability & consistency of $S_1$ is best.
- $S_2$: mixture of 60% apple pulp and 40% sapota pulp in this sample consistency is not good.
- $S_3$: mixture of 40% apple pulp and 60% sapota pulp in this sample crystallization occurred because sapota contains more amount of natural sugar. That’s why its consistency was not good.

All the panelists found Sample $S_1$ (80% apple and 20% sapota pulp) more attractive and preferred it because it tasted better in terms of appearance, aroma, color, consistency, taste, and overall acceptability, as indicated by a consumer acceptance test. It shows that 80% apple and 20% sapota pulp was effective in preserving the appearance, aroma, color, consistency, taste, and overall acceptability of apple-sapota jam. The scores of 7.8, 7.6, 7.3, 7.3, 7.3, 7.8, for appearance, aroma, color, consistency, taste, and overall acceptability of apple-sapota jam of Sample $S_1$, $S_2$, and $S_3$ respectively. Maximum score (7.8) for consistency was obtained by apple sapota jam prepared from 80% apple and 20% sapota pulp.

$S_1$ recommending better results and Flavor, texture and maintain shelf life. The overall acceptability shows the more numbers to $S_2$ and $S_3$ sample. The proximate and microbial analysis is carried out of selected sample $S_1$. All values for the food analysis tests viz; moisture content, Ash content. The results are moisture content were recorded 32.2%, Ash content 4%.

Evaluation of sample for different chemical properties, such as TSS, citric acid, and pH value, was carried out, the proximate composition for different levels of apple and sapota on the making of jam. I made a significant difference between sample $S_0$ (100% apple pulp), $S_1$ (80% apple and 20% sapota pulp), $S_2$ (60% apple and 40% sapota pulp) and $S_3$ (40% apple and 60% sapota pulp) without using pectin, as apples contain a good amount of it.

### 4.CONCLUSION

It can be concluded from the present findings as sapota being a seasonal crop, and one of the best ways to preserve it is in the form of jam. Using the technique preservation by sugar, an attempt for formulation of Apple-Sapota jam is made to make it available throughout the year.

In the present experiment among $S_0$, $S_1$, $S_2$, $S_3$ it is concluded that the Sample $S_1$ has more consumer acceptance than other samples. $S_1$ (80% apple and 20% sapota pulp) has improved the overall quality with special reference to sensory evaluation of apple- sapota jam. The added 80% apple and 20% sapota pulp resulted in consistency, more stable brown color during color analysis and highest sensory score in sensory evaluation.
REFERENCES


