Studies on standardization of beetroot jam by using date paste and effect on organoleptic properties of jam during storage

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Abstract

The present investigation was carried out to refine the traditional method of preservation of fruits and vegetables by using different proportions of beetroot. Ripened beetroot was taken to extract its pulp and different proportions i.e. 25%, 50% and 75% of date paste were used to standardize the jam. Thereafter, jam samples were packaged in glass bottles and stored at ambient temperature for 3 months. Ratings for taste, texture and overall acceptability of jams were increased up to two months of storage and thereafter followed decreasing trend up to the end of three months. Results pertaining to yeast and mold count of control sample (T0) and beetroot sample containing 50 per cent date paste (T1) during three months of storage at ambient conditions revealed that yeast and mold count of all the samples followed a gradual increasing trend throughout the storage period of three months. Initially yeast and mold count was 1×10^4 CFU/g in control sample and 2×10^4 CFU/g in sample containing 50 per cent date paste but it was increased to 19×10^4 CFU/g and 8×10^4 CFU/g respectively in both the samples at the end of storage. Jam prepared by using 50% date paste was rated superior as compared to rest of the treatments. Jam prepared from both the preserved samples after three months were also well acceptable by the panelists.

Keywords: Beetroot, date paste, jam, sensory, storage, ambient temperature

Introduction

Beetroot (Beta vulgaris L.) is a member of the Chenopodiaceae family which includes silver beet, sugar beet and fodder beet (Deuter and Grundy, 2004) [5]. They are biennials although they are usually grown as annuals and believed to have originated from Germany (Thompson, 2001). Beetroot produces green tops and a swollen root during its first growing season. It is highly productive and usually free of pests and diseases (Ado, 1999). It is rich in several vitamins, hence is an ideal vegetable for health conscious people (Deuter and Grundy, 2004) [5]. The beetroot is the second most important source of sugar (21.5 % of the world sugar) and is grown in 57 countries. It is a halophytic (as well as Na- salts scavenger) C3 plant containing up to 20 per cent sugar on fresh weight basis. The storage organ of this plant is usually called the root; of which 90 per cent is actually root derived and the remaining 10 per cent (the crown) is derived from the hypocotyls. A freshly harvested root of sugar-beet contains 75-76 per cent water, 15-20 per cent sugars, 2.6 per cent non- sugars and 4-6 per cent pulp. Red beets also possess some health benefits. Beets are enriched with nutrients like Mg, P, Na, K and Ca. It also contains ample of Se, Zn and Mn. The flavanoids and carotenoids present in it prevent damage to the cells. The red pigment of beets, betacynin is effective in prevention of colon cancer. Intake of red beets also reduces high blood pressure. It helps in production of RBC in the blood and removes harmful and toxic substances accumulated in the liver. Leaves of sugarbeet are known to counter bad breath. In Roman times, Hippocrates advocated use of beet leaves for healing of wounds. Sugarbeets have been used to get rid of tumors and to help people with blood diseases and leukemia. It has also been used to treat and cure boils, abscesses and even acne so much so that these have earned the status of “Beet Therapy”. Being a good source of carbohydrates, protein, fibre and minerals, sugarbeet tops are used as animal feed, either as fresh or even in ensilaged form. Some of the sugarbeet varieties are known as fodder beets. Once the juice has been extracted, pressed or dehydrated beet pulp provides an ideal foodstuff for cattle. Beetroot pulp can also be used to produce industrial pectin or dietary fibre for use with foods enriched with fibre. Processing by-products of sugarbeet, the beet pulp and molasses are also widely used as feed supplements for livestock.
It contributes to fibre in the feed and adds to its palatability. Molasses, a by-product from sugarbeet processing is widely used in the alcohol production (ethanol and butanol), other pharmaceuticals and in baker’s yeast. A tonne of molasses yields approximately 300 litres of alcohol. Alcohol derived from sugarbeet is suitable for human consumption (in spirits, perfume, vinegar, pharmaceutical products, etc.) and ideal for use in household products (Cleaning fluids, methylated spirits, etc.) and some other useful chemicals.

Date (Phoenix dactylifera L.) has long been one of the most important fruit crops in the arid regions of the Arabian Peninsula, North Africa, and the Middle East. During the past three centuries, dates were also introduced to new production areas in Australia, India, Pakistan, Mexico, southern Africa, South America, and the United States. Dates are a main income source and staple food for local populations in many countries in which they are cultivated, and have played a significant role in the economy, society, and environment of those countries.

Dates produce many products that are useful to humans. The primary product is the date fruit, which can be eaten fresh, dried, or in various processed forms. In North Africa and the Middle East, some dates are harvested and consumed during the Khalal stage, when the fruit are still very astringent with high tannin content (Dowson and Aten, 1962; Glasner et al., 2002; Kader, 1992) [6, 9]. However, most dates are harvested during the fully ripened Rutab and Tamar stages, when they are high in sugar and low in moisture and tannin content. Nutritional value of dates is carbohydrates 75 per cent, lipids 0.39 and protein 2.45 per cent. Date fruit are high-energy food sources with 72-88 per cent sugar content at maturity. During the Khalal stage, nearly all (80-85%) of the sugar is sucrose. As ripening progresses, the sucrose is hydrolyzed into reduced sugars such as glucose and fructose. Date fruit are good sources of iron and potassium; a fair source of calcium, chlorine, copper, magnesium, sulfur and a minor source of phosphorus. In addition, dates are a source of 16 amino acids and vitamins A, B1, and B2 (Ahmed et al., 1995; Vandercook et al., 1980).

Jam made from different types of fruits is a popular food item among the local population. It is usually prepared from cooked fruit or vegetable, sugars, citric acid and pectin (Broomfield, 1996) [4]. The physicochemical characteristics of fruit or vegetable thereof affect the technological quality of the product as some are more suitable than other for specific characteristics. Processing of jam is therefore, is highly justifiable by different researchers (Abdelazim et al, 2011) [11].

As defined by UNE regulation (1974), jams are products formulated from a minimum fruit content of 40 per cent (30% for citrus) and a final soluble solid content of 45° Brix. Moreover, some additives such as citric acid or gelling agents, commonly pectin, can be added. In traditional jam manufacture, all the ingredients are mixed in adequate proportions and the mix is concentrated by applying thermal treatments at normal or reduced pressure to reach the required final soluble content. This process leads to a thickened or gelled consistency, ensures the destruction of fruit enzymes, extracts some of the pectin from the fruit and concentrates the product to a point, where as a result of its acidity and reduced water activity, it becomes self-preserving (May, 1997).

Nevertheless, jams can also be produced from vegetables such as carrots, sweet potatoes and pumpkins. The traditional jam market has been stable during the last few years as a consequence of changes in consumption practices and the presence of alternative or new products on the market. Accordingly, the jam industry needs to improve its competitiveness and develop new products, such as vegetable jams, which may well be a way of achieving this objective (European Commission, 2001) [8].

Materials and Methods

The present investigation based on standardization of beetroot jam by using date paste was carried out in Agricultural Engineering Department, Maharashtra Institute of Technology, affiliated to Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra.

Source of experimental materials

Mature, ripened beetroot vegetables for the present investigation were procured from the local market of Aurangabad area.

Preparation of beetroot jam

Following procedure was followed for the preparation of the product

Beetroots obtained from local market were subjected to sorting and grading followed by thoroughly washing in order to remove dirt, dust and other foreign materials from their surface.

After washing, the beetroots were peeled, cored and cut into four-six equal pieces. The pulp was extracted by heating beetroots to get maximum recovery. Then sugar 40 %, 0.5-0.6 % citric acid, 0.8 % pectin and 0.1 % of sodium benzoate was added to pulp. The pulp was boiled till the TSS become 68.5 °brix. The process followed for preparation of beetroot jam is shown in below flow chart.

Flow chart

![Fig 1: Standardization of beetroot-date jam](image-url)
Samples of jam were prepared by using 100% beetroot pulp which is T₀, by using 75% beetroot pulp and 25% date paste which is T₁, by using 50% beetroot pulp and 50% date paste which is T₂, by using 25% beetroot pulp and 75% date paste which is T₃ for the standardization of beetroot-date jam.

The beetroot jam samples were evaluated for their organoleptic attributes namely color, flavor, taste, appearance and overall acceptability by a semi-trained panel comprising of ten panelists drawn from the staff and students of MIT College, Aurangabad. The panelists were asked to record their observations on sensory sheet based on “nine point hedonic rating scale” where 9 and 1 represented like extremely and dislike extremely, respectively.

Storage study of beetroot jam formulated with date paste
Glass bottles of capacity 250 g were employed to store beetroot jam. The packaged product samples were kept at ambient conditions for three months for storage studies. The products were evaluated for the sensory parameters i.e. color, flavor, taste, appearance and overall acceptability.

Organoleptic analysis
The beetroot jam samples were evaluated for their organoleptic attributes namely color, flavor, taste, appearance and overall acceptability by a semi-trained panel comprising of ten panelists drawn from the staff and students of MIT College, Aurangabad. The panelists were asked to record their observations on sensory sheet based on “nine point hedonic rating scale” where 9 and 1 represented like extremely and dislike extremely, respectively.

Table 1: Standardization of Beetroot-date jam

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Sample</th>
<th>Beetroot Pulp (%)</th>
<th>Date paste (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>T₀</td>
<td>100</td>
<td>00</td>
</tr>
<tr>
<td>2.</td>
<td>T₁</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>3.</td>
<td>T₂</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>4.</td>
<td>T₃</td>
<td>25</td>
<td>75</td>
</tr>
</tbody>
</table>

Storage study of beetroot jam formulated with date paste
Glass bottles of capacity 250 g were employed to store beetroot jam. The packaged product samples were kept at ambient conditions for three months for storage studies. The products were evaluated for the sensory parameters i.e. color, flavor, taste, appearance and overall acceptability.

Microbial analysis
Yeast and mold count
The yeast and mold count was determined according to A.P.H.A. (1992). Potato Dextrose Agar acidified to pH 3.5 with sterile 10 per cent tartaric acid was used and incubation was carried out at 22±2 °C for 5 days.

\[ cfu = \frac{\text{No. of colonies}}{\text{gm Volume of sample plated(ml)}} \times \text{Dilution Factor} \]

Results and Discussion
The results of the present study have been discussed as follows under suitable headings:

Sensory evaluation of prepared jams
As per (Table 2), findings of present investigation indicates that ratings for the sensory attributes such as taste and flavor of all the samples were increased gradually throughout the three months of storage period. However, ratings for color, appearance and overall acceptability of all the samples during storage followed decreasing trend. The rating for color varied from 8 to 9 at the beginning of storage and which reduced to 7 at the end of storage. Similar findings were reported by Hussain et al. 2010².

Table 2: Sensory Evaluation of beetroot date paste Jams

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>T₀</th>
<th>T₁</th>
<th>T₂</th>
<th>T₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Colour</td>
<td>8.5</td>
<td>8.5</td>
<td>8.5</td>
<td>7.5</td>
</tr>
<tr>
<td>2</td>
<td>Taste</td>
<td>8.2</td>
<td>8.1</td>
<td>8.2</td>
<td>7.8</td>
</tr>
<tr>
<td>3</td>
<td>Appearance</td>
<td>8.0</td>
<td>8.1</td>
<td>8.2</td>
<td>7.2</td>
</tr>
<tr>
<td>4</td>
<td>Flavour</td>
<td>8.3</td>
<td>8.1</td>
<td>8.3</td>
<td>8.0</td>
</tr>
<tr>
<td>5</td>
<td>Overall acceptability</td>
<td>8.4</td>
<td>8.1</td>
<td>8.3</td>
<td>7.1</td>
</tr>
</tbody>
</table>

Mean±SD: 6.9±0.17, 6.8±0.16, 6.9±0.11, 6.3±0.34

* Each value is an average of minimum 15 determinations

ANOVA

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>0.362</td>
<td>4</td>
<td>0.0905</td>
<td>0.31813</td>
<td>0.723754</td>
<td>3.055568</td>
</tr>
<tr>
<td>Within Groups</td>
<td>2.62</td>
<td>15</td>
<td>0.174667</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2.982</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As per the statistical analysis the one way ANOVA showed significant readings which shows the accuracy and precision of the method of organoleptic analysis used for determination of overall acceptability of the prepared jam.

Colour: It was observed from the results of sensorial evaluation (Table 2), that do not have significant effect of color characteristics of jam and the control sample found to more or less similar results of treated samples except T₃ sample.

Taste: From (Table 2) and (Fig. 2) it can be concluded that control sample and sample containing 50% date paste (T₂) is having more score for taste as compare to other samples.

![Fig 2: Organoleptic evaluation of beetroot date jam](image)
Flavour: The flavour profile of prepared jam up to the concentration of 50%, however further increase in concentration of date paste resulted in decrease in acceptability.

Overall acceptability
The overall acceptability of product is also found to be in correlation with the score of appearance and flavour and the sample T₂ containing 50% of date paste found most superior amongst the treated sample after control sample. Hence, on the basis of sensorial evaluation of product, it is concluded that date paste at the concentration of 50% is optimum for development of beetroot date paste Jam with superior sensorial quality profile.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Control Sample (T₀)</th>
<th>Yeast and Mold count (CFU/g)</th>
<th>Beetroot sample containing 50% Date Paste (T₂)</th>
<th>Yeast and Mold count (CFU/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Storage Period (Months)</td>
<td></td>
<td>Storage Period (Months)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>14×10⁴</td>
<td>0</td>
<td>2×10⁵</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>15×10⁴</td>
<td>1</td>
<td>3×10⁵</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>17×10⁴</td>
<td>2</td>
<td>5×10⁵</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>19×10⁴</td>
<td>3</td>
<td>8×10⁵</td>
</tr>
</tbody>
</table>

Initially yeast and mold count was 14×10⁴ CFU/g in control sample and 2×10⁵ CFU/g in sample containing 50 per cent Date Paste but it was increased to 19×10⁴ CFU/g and 8×10⁵ CFU/g respectively in both the samples at the end of storage. (Ehsan et al. 2003)⁷

**Organoleptic quality of beetroot jams during storage**

Findings of present investigation indicate that ratings for the sensory attributes such as taste and flavor of all the samples were increased gradually throughout the three months of storage period. However, ratings for color, appearance and overall acceptability of all the samples during storage followed decreasing trend. The rating for color varied from 8 to 9 at the beginning of storage and which reduced to 7 at the end of storage (Dowson et al. 1962)⁶.

**Yeast and mold count**

Results pertaining to yeast and mold count of control sample (T₀) and Beetroot sample containing 50 per cent Date Paste (T₂) during three months of storage at ambient conditions are furnished in (Table 3) Findings revealed that yeast and mold count of all the samples followed a gradual increasing trend throughout the storage period of three months.

References