A study on preparation and characterization of pineapple jams prepared with carrot for enriching vitamin A content

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Abstract— The present investigation was made with an attempt to develop nutritional jam blend with β- carotene rich carrot. Since jam as widely used in households and mainly consumed by children, therefore, such kind of product could prove beneficial. The experimental product constituted of increasing concentration of carrot juice with decreasing amount of pineapple while absence of carrot in control product. The four treatments (T2,T1,T0 andT3) were compared on their different properties viz., physico-chemical analysis moisture percentage, acidity, protein, ascorbic acid, ash, and pH for estimating its nutritional content and safety and Organoleptic characteristics like flavor and taste, body and texture, color and appearance by trained panelist using 9 point hedonic scale. The treatments T3 showed best results obtaining the highest score value. Microbiological analysis was carried out to assess the shelf life of the treatments. The results revealed less than 10/g (standard value) yeast and mould count and negative coliform test when compared with the FPO standards.

Keywords— Jam, β-carotene, moisture, cfu, carrot, treatments, antioxidant activity.

I. INTRODUCTION

Carotenoids are natural isoprenoid pigments that provide leaves, fruits, vegetables and flowers with distinctive yellow, orange and some reddish colours as well as several aromas in plants. Their bright colours serve as attractants for pollination and seed dispersal. Carotenoids comprise a large family of C40 polyenes and are synthesised by all photosynthetic organisms, aphids, some bacteria and fungi alike. As such, carotenoids are commercially important in agriculture, food, health and the cosmetic industries. In plants, carotenoids are essential components required for photosynthesis, photoprotection and the production of carotenoid-derived phytohormones, including ABA and strigolactone [1]. Jams are important food products which are prepared and preserved by sugar at a high concentration. Sucrose is the most sugar used for jam manufacture during which it is inverted to fructose and glucose due to fruit acids or added citric acid and heating effect, and it is desirable to invert 30-40% of the whole amount of sucrose [2].

It was studied that pineapple fruit is considered a highly nutritious fruit because it contains a high level of vitamin C [3], a natural antioxidant which may inhibit the development of major clinical conditions including heart disease and certain cancers [4]. The fruit also contains phenolic compounds and β-carotene [5] which constitute natural sources of antioxidants. [6] and [7] reported that carrot (Daucus carota L) is one of the popular root vegetables grown throughout the world and is the most important source of dietary carotenoids in Western countries including the United States of America [8][9]. China is the major carrot producing country in the world [10]. The area under carrot in India is 22,538 ha with an annual production of 4.14 lakh tons. It was studied that with Uttar Pradesh, Assam, Karnataka, Andhra Pradesh, Punjab and Haryana being the major producing States. In recent years, the consumption of carrot and its products have increased steadily due to their recognition as an important source of natural antioxidants besides, anticancer activity of β-carotene being a precursor of vitamin A [11]. It has been observed that natural antioxidants, particularly in fruit and vegetables have gained increasing interest among consumers and researchers because epidemiological studies have indicated that frequent consumption of natural antioxidants is associated with a lower risk of cardiovascular disease and cancer [12]. In the present study, Jam is prepared with two ingredients which are highly rich in its beta carotene content i.e., Pineapple and carrot. Jams are main attraction for children, so a nutritive jam would bring together both - taste and health.

II. MATERIALS AND METHODOLOGY

A. Sample Collection

Fruit sample pineapple and carrot were collected from local vendors of Lucknow. Fruits samples were washed under running tap water. The outer rind of pineapple and carrot was removed. The washed samples were chopped into small pieces for pulping.

B. Development of product

Fresh and ripe (not over ripe) fruits were selected for preparation of jam. Completely rotten fruit were removed and discarded. Fruit bearing falling injury, pest injury and other defect were retained for processing. The part of fruit bearing falling injury or such other mechanical injury was removed with the help of stainless steel knife. The fruits were then cut in their slices by removing the core. The fruits were boil with 1/3rd part of water for 10 minutes until the slice become soft. Then pulp is collected. Generally can sugar (Sucrose) of good quality are used in the preparation of jelly. The citric acid was added to boiling pulp. The temp was raised to 105°C. Heating of jam to a temp of 103°C -105°C to bring the TSS about 65% this was the easiest way to ascertain the end point.
C. Control and treatment

Control: T0 was prepared by using pineapple, sugar, pectin and citric acid (100:50:1:1).

Treatment 1: T1 was prepared by using pineapple pulp, carrot pulp, sugar, pectin and citric acid (80:20:50:1:1).

Treatment 2: T2 was prepared by using pineapple pulp, carrot pulp, sugar, pectin and citric acid (60:40:50:1:1).

Treatment 3: T3 was prepared by using pineapple, carrot, sugar, pectin and citric acid (40:60:50:1:1).

D. Chemical analysis of developed product

The chemical analysis i.e. moisture, protein, acidity, vitamin-C, ash, pH, TSS etc. were estimated by using standardized procedures.

E. Determination of moisture

Sample was heated at specified temperature for specified period of time and the loss in weight was recorded as moisture content if sample. Shallow bottom dish either made of stainless steel or nickel or porcelain or silica 7-8 cm diameter, about 2.5cm deep, provided with easy removable lid.

Calculation:

\[
\text{Percentage of moisture content} = \frac{(W1-W2)}{(w_1 - w)} \times 100
\]

Weight of empty dish = \( w \) g;

Weight of the dish + sample = \( w_1 \) g; Weight of the dish + sample after drying = \( w_2 \) g

F. Determination of acidity

90 ml of distilled water was taken and 10 gm of sample was mixed into a 250 ml conical flask. Then took 50 ml of 0.1N of NaOH in burette and started titration till get endpoint. We shook it vigorously during titration; endpoint is from color less to light pink (persists for 30 sec.)

Calculation

\[
\text{Acidity (\%)} = \frac{(V \times N \times 9)}{W} \times \frac{100}{\text{Volume made}}
\]

\( V \) = Volume of 0.1N NaOH ; \( W \) = weight of sample ; \( N \) =Normality of NaOH

G. Estimation of pH

The pH was estimated by standard Stevens’s method given in Ranganna in 1986.

H. Determination of ash content (Ranganna, 1986)

Total ash was determined according to A. O. A. C. (1975). 5 gm sample was weighed into crucible and ignited at law flame till ant the material was completely charred. That was kept in muffle furnace for 6 hrs at 600°C and further cooled in desiccators and weighted. This was repeated till two consecutive weights were constant and per cent ash was calculated.

\[
\text{Ash % by mass} = 100 - \frac{(M_2 - M)}{(M_1 - M)}
\]

\( M_2 \) = weight of crucible with ash; \( M \) = weight of empty crucible; \( M_1 \) = weight of crucible with sample.

I. Ascorbic acid content

The ascorbic acid (vitamin C) was determined by titration. This was done by titrating sample solution with standard dye solution. 5ml of standard ascorbic acid solution was diluted with 5 ml of 3% oxalic acid, it was titrated with the dye solution till pink color persists for 10 seconds. The dye factor was calculated in mg of ascorbic acid per ml of dye (Dye factor=0.5/titer). 10g of sample was blended with 3% oxalic acid and then volume was adjusted to 100ml and then filtered. 10 ml was pipette into the conical flask and titrated with the standard dye to the pink end point.

Calculation:

\[
\text{Ascorbic acid (mg/100g)} = \frac{\text{titer} \times \text{dye factor} \times \text{volume made} \times 100}{\text{Volume of filter taken} \times \text{wt. of sample}}
\]

J. Determination of beta carotene

\( \beta \)- carotene content was determined by using the method described by Wongo (2005) with minor modification. Dried extract was dissolved in 1 ml petroleum ether. The solution is purified using chromatographic column (as per the procedure mentioned above). The elute was transferred in cuvette and absorbance reading using spectrophotometer at 440nm. Concentration of beta carotene was calculated using the standard curve data as follows:

\[
\beta\text{-carotene (ug/g)=} \frac{\text{Absorbance} \times \text{Total extract volume(ml)} \times 10^4 \times A^{1\%}_{1cm} \times \text{sample weight}}{\text{sample weight}}
\]

* \( A^{1\%}_{1cm} \) extinction coefficient=2592

K. Antioxidant activity of jam by ferric reducing assay

Took the required amt of sample and add 1 (ml) methanol to it. Add 2.5ml of phosphate buffer (200mM, pH 6.6). Add 1% potassium ferricyanide. Placed the test tubes in boiling water bath for 20 min at 50°C, cooled rapidly and mixed with 2.5ml of 10%trichloroacetic acid. And 0.5ml of 0.1% ferric chloride
The amount of iron (II)-ferricyanide complex formed was determined by measuring the formation of Perl’s Prussian blue at 700 nm after 10 min. The increase in absorbance of reaction mixture indicated the increased reducing power.

**L. Microbiological Analysis**

The microbiological analysis i.e. coliform count and yeast & mould count was done by using standard procedure laid down in I.S. 1947 PART III. Ringer’s solution was prepared as per the procedure given in ‘APHA Standard Methods for the Examination of Dairy Product’s (1992). Nutrient agar and Potato dextrose agar media was prepared as per the procedure given in ‘APHA Standard Methods for the Examination of Dairy Products’ (1992). Colony count was interpreted in the form of CFU/g in each product.

**III. Result & Discussion**

In the present study, β-carotene rich fruit samples were used for jam preparation and hike their nutritional value. Pineapple was used as the major ingredient and carrot was in different proportion according to the above mentioned treatment. The study showed that the experimental products (T1, T2, T3) obtained a better response as compared to the control (T0) product. The scoring for sensory evaluation was done by a panelist of 30 members. Among the three treatments, T2 acceptability was maximum in terms of its flavor and taste as shown in Figure 1.

Antioxidant activity was studied for the control and three treatments. A higher activity was seen in the case of T3 (0.508). It also showed that no significant change was observed from T0 to T1, T2 and T3.

**A. Determination of beta-carotene in the product**

The β-carotene was determined in the product and a elevated level of β-carotene was observed in the blended experimental microbial analysis. The analysis included Ash, moisture, pH, protein, reducing sugar, phenolic content, antioxidant activity carotene, T1 (0.67 µg/g), T2 (0.625 µg/g). The level of β-carotene and enrichment of vitamin A. Following are the results obtained in control (0.034 µg/g) was seen to be far lower than the during the study.
TABLE I: RESULTS OF THE CHEMICAL ANALYSIS, ORGANOLEPTIC SCORES AND MICROBIAL ANALYSIS OF THE PRODUCT

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatments</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td><strong>1. Chemical analysis (in percent)</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>pH</td>
<td>3.6</td>
<td>3.14</td>
<td>4.18</td>
<td>4.62</td>
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<tr>
<td>Moisture %</td>
<td>28.1</td>
<td>33.2</td>
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<tr>
<td>Protein (OD)</td>
<td>0.188</td>
<td>0.207</td>
<td>0.232</td>
<td>0.252</td>
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<tr>
<td>Reducing sugar (OD)</td>
<td>0.037</td>
<td>0.035</td>
<td>0.041</td>
<td>0.036</td>
</tr>
<tr>
<td>Ash %</td>
<td>0.27</td>
<td>0.36</td>
<td>0.39</td>
<td>0.56</td>
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<tr>
<td>Phenolic content (OD)</td>
<td>0.686</td>
<td>0.688</td>
<td>0.646</td>
<td>0.653</td>
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<td>TSS%</td>
<td>70</td>
<td>68</td>
<td>70</td>
<td>70</td>
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<tr>
<td>Beta-Carotene (OD)</td>
<td>0.018</td>
<td>0.353</td>
<td>0.324</td>
<td>0.381</td>
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<tr>
<td>Antioxidant activity</td>
<td>0.501</td>
<td>0.504</td>
<td>0.506</td>
<td>0.508</td>
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<td><strong>2. Organoleptic scores (9 point hedonic scale)</strong></td>
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<tr>
<td>Color &amp; appearance</td>
<td>7.5</td>
<td>7.8</td>
<td>8</td>
<td>7.2</td>
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<td>Body &amp; texture</td>
<td>7.54</td>
<td>7.65</td>
<td>8.6</td>
<td>7.9</td>
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<td>Flavor &amp; taste</td>
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<td>7.34</td>
<td>8.1</td>
<td>7.45</td>
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<td>Over all acceptably</td>
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<td>7.8</td>
<td>7.2</td>
<td>7.3</td>
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<td><strong>3. Microbial analysis</strong></td>
<td></td>
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<tr>
<td>Coli form test (cfu 10⁹/g)</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Yeast &amp; mould count (per g)</td>
<td>3.1</td>
<td>3.3</td>
<td>3.25</td>
<td>5.7</td>
</tr>
</tbody>
</table>

V. REFERENCES