Effect of Different Concentration of Guava Pulp, Apple Pulp and Sugar Solution on the Shelf Stability of Blend Leather Storage at Ambient Temperature

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Abstract

The aim of the study was to evaluate a suitable combination of guava pulp, apple pulp and sucrose solution for the preparation of guava and apple blend leather, stored at ambient temperature. The treatments were T0, T1 and T2. The samples were wrapped in the aluminum foil and evaluation was carried out for total period of 90 days. Physiochemical analysis, acidity, pH, brix and sensory characteristics of color, taste, texture and overall acceptability (using Larmond scale) were evaluated at 15 days interval. The TSS of guava and apple blend pulp was 8 brix0 when sucrose solution was added in different ratio. Then TSS of guava and apple blend leather was increased from 56.53g to 58.37a during storage. Maximum increased was observed T1 (20a%), while lowest value was observed in followed by T0 (13.93%). The pH of guava and apple blend pulp was 4, then the pH of guava and apple blend leather was decreased from 3.86g to 3.68a for the period of storage. Maximum reduced was perceived in T1 (5.03%), in compare minimum fall was observed in T0 (4.13%). The Titratable acidity of guava and apple blend leather was increased from 1.27g to 1.46a for the period of storage. Supreme increased was perceived in T0 (19.47%), while lowest raise was observed in T2 (15.38%). The storage intervals had effect on the mean scores for organolyptic assessment. Mean scores of juries for the color of guava and apple blend leather was reduced from 7.33g to 5.27a for the period of storage. Supreme decreased was perceived in T0 (41.67%), while lowest fall was observed in T2 (18.75%). Mean totals of juries for the taste of guava and apple blend leather was reduced from 6.83g to 4.80a for the period of storage. Maximum reduced was detected in T0 (44.4%), while lowest fall was observed in T2 (21.25%). Mean scores of judges for the texture of guava and apple blend leather was reduced from 700g to 5.07a for the period of storage. Maximum decreased was perceived in T0 (38%), while lowest fall was observed in T0 (18.75%). Mean scores of juries for the overall acceptability of guava and apple blend leather was reduced from 7.07g to 5.03a throughout the storage. Maximum decreased was perceived in T0 (42.31%), while lowest fall was observed in T2 (20%). Statistically result was showed that the treatment T2 was found most acceptable both Physiochemically and organoleptically.

Keywords: Apple pulp; Guava pulp; Storage; Physico-chemical analysis; Organolyptic analysis

Introduction

The main drawback of sugar (in sucrose) is its continuous degradation in to its fragments; glucose (dextrose) and fructose (levulose). This problem takes place in soft drinks which leads to changes in taste and flavor of fresh and aged beverages [1].

In 1915, the term stabilizer was consigned to a set of materials that were recognized as colloids, binders, holders, and fillers. These were also known by the name of improvers, a word used to denote enzymes or blends of enzymes and gums. Colloids, hydrocolloids, and gums are additional names of these materials, which specify that these ingredients are macromolecules, mostly polysaccharides, which have the capability to interact with water. In a mixture, the interaction with water also provides these substances, a pathway to interfere with lipids and proteins. Many substances have been used as stabilizers e.g. guar gum (E412), sodium carboxy methyl cellulose (CMC) (E466), gelatin (E441), xanthan (E415), carrageenan (Irish moss) (E407), locust bean gum (carob bean gum) (LBG) (E410), alginites and microcrystalline cellulose (Cellulose gel) (MCC) (E460) [2]. It has originated from Mexico to Peru. Guava is produced in all the tropics and subtropics of the world including Asia, Australia and America [3].

The fruit bars are possibly reflected a good food from health point of view as related to former confectionaries and candies usually in the form of thin leathery sheets, but they can take any form i.e. cubical or rectangular shape [4].

On the basis of water activity level, fruit leathers are classified into and softy texture. They contain acids and sugar naturally, while humectants are purposely added to minimize water activity and to provide softness even at lower moisture levels [5].

Ayub et al. [6] investigate the individual and combine effect of caloric sweeteners (sucrose, glucose and fructose) non caloric sweeteners (saccharine, cyclamate and aspartame), antioxidants (citric acid and ascorbic acid), chemical preservatives (potassium metabisulphate and potassium sorbate) and water activity of dehydrated guava slices. They resulted that different dilutions of caloric and non-caloric sweeteners were used for osmotically dehydration of guava slices. The analysis showed that sucrose: glucose, potassium metabisulphite, citric acid and ascorbic acid formed top quality product, which have low water activity and best sensory attributes.

Wandi and Cheman [7] developed three formulae of durian
leather and evaluated for its microbiological, physicochemical, sensory characteristics and storage constancy. They resulted that the vitamin C, water activity (a_w) and caloric content was increased. After storage of 12 weeks, all durian leather formulations were constant and revealed lower mold populations. Sensory evaluation of the study concluded that the three formulations showed acceptability in all attributes studied.

Uddin et al. [8] investigated ascorbic acid (vitamin C) retention and effects of different temperatures (30°C, 40°C, 50°C) and water activity (a_w) (0.43, 0.75, 0.84, 0.97) in dried guava during storage. They resulted that the degradation of ascorbic acid follows a pseudo-first-order reaction. As soon as storage circumstances were changed from a_w=0.43–0.97, the ratio constant increased about four to six fold. The level constants and conforming water activity values are related by polynomial equation of second order. They also concluded that the initiation energy for ascorbic acid degradation is originated within the range of 3.4 to11.0 kcal/mol. An empirical equation that is based on initiation energy for ascorbic acid degradation is originated with polynomial equation of second order. They also concluded that the storage of 12 weeks, all durian leather formulations were constant and revealed lower mold populations. Sensory evaluation of the study concluded that the three formulations showed acceptability in all attributes studied.

The diseased free fruit was selected and washed with water in order to remove dust, dirt and any other foreign material. The fruit was peeled, trimmed, cut and dipped in 1% citric acid to prevent oxidation. Then the fruit was blended in order to get the pulp. After that the following treatments of 20 degree brix were prepared.

Proposed plan of study

T_0=Control
T_1=Apple pulp (30%) and Guava pulp (70%) with sucrose + glucose (1:1) and gaur gum (0.25%)
T_2=Apple pulp (30%) and Guava pulp (70%) with sucrose + glucose (7.3) and gaur gum (0.25%)

Packaging

The prepared bar was packed in a transparent packaging material.

Physicochemical analysis

Titration of samples: About 10 ml sample solution was taken in volumetric flask of 100 ml and diluted with water to the mark. From the stock solution, 10 ml was poured into a titrating flask and 2-3 droplets of phenolphthalein were incorporated as indicator, then concentration of the solution was identified against 0.1 N NaOH solution until pink color was achieved, which stands for fifteen seconds. For each sample three consecutive reading were noted. The ascorbic acid was mathematically evaluated with the help of the following formula:

\[
\text{Titratable Acidity} (%) = \frac{\text{Acid Factor} \times 100 \times \text{ml of NaOH} \times N \times 100}{A \times B}
\]

Where,

- A=volume of sample in millimeters taken for dilution
- B=volume of sample in millimeters taken for titration

**Titration of samples**

Testing procedure: A panel of 10 juries from the university students and staff were selected on the basis of their sensory buds, eating and smoking habits. Members of this panel were asked to judges for texture, color and overall acceptability of the guava bar samples. The probes were then washed with distill water and with the help of dried tissue papers the electrodes were dried and the process of determining the pH was continued.

**Sensory evaluation**: The guava bar was sensory judged for taste, color, overall acceptability and texture by a panel of 10 juries. The assessment was completed by using 9 points hedonic scale of Larmond.
Statistical analyses: All the data regarding storage interval and treatments were statistically investigated by CRD 2 factorial as recommended by Gomez and Gomez and the means were separated by applying least significant difference (LSD) Test at 5% possibility level as defined by Steel and Torrie [10].

Results and Discussion

Guava and apple blend bar was prepared by different level of sucrose glucose mixture and guar gum. The samples were analyzed physicochemical for TSS, pH, acidity, ascorbic acid, reducing and non-reducing sugar, moisture, ash, water activity, TS and microbial count and sensory characteristics for color, texture, taste and overall acceptability. These parameters are discussed below.

TSS

The TSS of guava and apple pulp was 8%, while the initial TSS of guava and apple blend leather of T_0 to T_2 was 14.00, 77.10 and 78.50 which was gradually increased to 15.70, 79.00 and 80.40 correspondingly during storage. The mean values for intervals were significantly (P<0.05) intensified from 56.53g to 58.37a for the period of storage. Extreme mean values for treatments were perceived in T_1 (79.49a), but in contrast the lowest mean values were registered in T_0 (14.91f). During storage the highest raise in TSS was recorded in T_1 (20%), while lowest raise was observed in T_2 (13.93%), (Table 1).

The statistical study presented significantly (P<0.05) results which may be due to the effect of treatment and storage intervals on the acidity of guava leather during storage. The mean were separated by applying LSD test at 5% probability level (Table 1). In a similar result, Phimpharian et al. [11] observed an increased in TSS (from 82.42-86.9).

Sensory evaluation

The guava bar was analyzed for color, texture, taste and overall acceptability. These parameters are discussed below.

Titratable acidity

The acidity of guava pulp was 0.256, while the initial acidity of guava leather of T_0 to T_1 was 1.22, 1.24 and 1.32 which was gradually increased to 1.39, 1.46 and 1.56 similarly for the period of storage. The mean values for intervals were significantly (P<0.05) proliferated from 1.27g to 1.46a for the period of storage. Supreme mean values for treatments were perceived in T_1 (1.45a), but in contrast the lowest mean values were listed in T_2 (1.30f). For the period of storage the highest raise in acidity was recorded in T_2 (15.38%), while deepest raise was perceived in T_0 (19.47%) (Table 2).

The statistical study presented significantly (P<0.05) results which may be due to the effect of treatment and storage intervals on the acidity of guava leather during storage. The mean were separated by applying LSD test at 5% probability level (Table 2). Phimpharian et al. [11] reported finding in acidity during storage of mango sheet (from 0.3-0.75).

pH

The pH of fresh guava pulp was 4, while the initial pH of guava leather was T_0 to T_1 was 3.84, 3.86 and 3.87 which was gradually reduced to 3.67, 3.67 and 3.71 respectively for the period of storage. The mean values for intervals were significantly (P<0.05) reduced from 3.86g to 3.68a for the period of storage. Highest mean values for treatments were perceived in T_1 (3.87, in contrast least mean values were noted in T_0 (3.75f). During storage highest fall in pH was recorded in T_1 (5.03%), in compare minimum fall was observed in T_0 (4.13%) (Table 3). The statistical study presented significantly (P<0.05) results which may be paid to the effect of treatment and storage intervals on the pH of guava leather for the period of storage. The mean were separated by applying LSD test at 5% probability level (Table 3). Phimpharian et al. [11] noticed a reduction in pH values during storage of pineapple leather (from 3.6-3.8). Azeredo et al. [13] observed a decreased in pH values during storage of mango leathers (from 3.8-3.5).

Sensory evaluation

The guava bar was analyzed for color, texture, taste and overall acceptability. These parameters are discussed below.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Storage Interval (Days)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>T_0</td>
<td>14.00</td>
<td>15</td>
</tr>
<tr>
<td>T_1</td>
<td>14.4</td>
<td>17</td>
</tr>
<tr>
<td>T_2</td>
<td>14.7</td>
<td>18</td>
</tr>
<tr>
<td>Mean</td>
<td>15.1</td>
<td>16</td>
</tr>
</tbody>
</table>

Values having different alphabetical letters are significantly (P<0.05)

Table 1: Effect of storage period and treatments on TSS (%brix) of guava and apple blend bar.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Storage Interval (Days)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>15</td>
</tr>
<tr>
<td>T_0</td>
<td>1.22</td>
<td>1.24</td>
</tr>
<tr>
<td>T_1</td>
<td>1.24</td>
<td>1.29</td>
</tr>
<tr>
<td>T_2</td>
<td>1.36</td>
<td>1.39</td>
</tr>
<tr>
<td>Mean</td>
<td>1.27g</td>
<td>1.31f</td>
</tr>
</tbody>
</table>

Values having different alphabetical letters are significantly (P<0.05)

Table 2: Effect of storage period and treatments on Titratable acidity (%)of guava and apple blend bar.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Storage Interval (Days)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>T_0</td>
<td>3.84</td>
<td>3.81</td>
</tr>
<tr>
<td>T_1</td>
<td>3.86</td>
<td>3.82</td>
</tr>
<tr>
<td>T_2</td>
<td>3.87</td>
<td>3.85</td>
</tr>
<tr>
<td>Mean</td>
<td>3.86g</td>
<td>3.83f</td>
</tr>
</tbody>
</table>

Values having different alphabetical letters are significantly (P<0.05)

Table 3: Effect of storage period and treatments on pH of guava and apple blend bar.
acceptability at an interval of 15 days for a whole period of 90 days. The sensory analysis was approved through Larmond scale (hedonic 9 point) by 15 judge's panel having knowledge about sensory evaluation. These evaluation are as under [14].

## Color

Initially the mean score of judges for color of guava bar of $T_0$ to $T_2$ was 6.8 and 8 which was gradually decreased to 3.5, 6.1 and 6.5 similarly for the period of storage. The mean values for intervals were significantly ($P<0.05$) intensified from 6.83g to 4.80a for the period of storage. Supreme mean values for treatments were perceived in $T_2$ (7.27g) and in contrast the lowest mean values were listed in $T_0$ (4.70g). During storage the highest fall in color was recorded in $T_0$ (41.67%), while lowest fall was observed in $T_2$ (18.75%) (Table 4).

The statistical study presented significantly ($P<0.05$) results which may be due to the effect of treatment and storage intervals on the color of guava leather for the period of storage. The mean were separated by applying LSD test at 5% probability level (Table 4). Jain and Nema [14] reported loss of color during storage of guava leather applying LSD test at 5% probability level (Table 4). Babalola et al. [16] (from 6.8-5.2). Naz [15] also observed a decreased in color during her study (7.10-6.16). The statistical study presented significantly ($P<0.05$) results which may be due to the effect of treatment and storage intervals on the color of guava leather for the period of storage. The mean were separated by applying LSD test at 5% probability level (Table 4). Jain and Nema [14] reported loss of color during storage of guava leather applying LSD test at 5% probability level (Table 4).

## Taste

Initially the mean score of judges for taste of guava bar of $T_0$ to $T_2$ was 4.5, 8 and 8 which was gradually decreased to 2.5, 5.60 and 6.30 similarly for the period of storage. The mean values for intervals were significantly ($P<0.05$) intensified from 6.83g to 4.80a for the period of storage. Supreme mean values for treatments were perceived in $T_2$ (7.14s) and in contrast the deepest mean values were listed in $T_0$ (3.4857s). The statistical study presented significantly ($P<0.05$) results which may be due to the effect of treatment and storage intervals on the taste of guava leather for the period of storage. The mean were separated by applying LSD test at 5% probability level (Table 4). The texture of fruit leathers is mostly affected by their moisture content and drying temperatures by Che-man et al. [17].

The statistical study presented significantly ($P<0.05$) results which may be due to the effect of treatment and storage intervals on the texture of guava leather for the period of storage. The mean were separated by applying LSD test at 5% probability level (Table 4). The texture of fruit leathers is mostly affected by their moisture content and drying temperatures by Che-man et al. [17].

## Overall acceptability

Primarily the mean score of juries for overall acceptability of guava bar of $T_0$ to $T_2$ was 5, 8 and 8 which was progressively reduced to 3.1, 5.6 and 6.5 correspondingly for the period of storage. The mean values for intervals were significantly ($P<0.05$) intensified from 7.07g to 5.03a for the period of storage. Maximum mean values for treatments were perceived in $T_2$ (7.22s) and in contrast the deepest mean values were listed in $T_0$ (3.4857s). The statistical study presented significantly ($P<0.05$) results which may be due to the effect of treatment and storage intervals on the texture of guava leather for the period of storage. The mean were separated by applying LSD test at 5% probability level (Table 4). The texture of fruit leathers is mostly affected by their moisture content and drying temperatures by Che-man et al. [17].

The statistical study presented significantly ($P<0.05$) results which may be due to the effect of treatment and storage intervals on the texture of guava leather for the period of storage. The mean were separated by applying LSD test at 5% probability level (Table 4). The texture of fruit leathers is mostly affected by their moisture content and drying temperatures by Che-man et al. [17].
The statistical study presented significantly (P<0.05) results which may be due to the effect of treatment and storage intervals on the overall acceptability of guava leather for the period of storage. The mean were separated by applying LSD test at 5% probability level (Tables 6 and 7). Overall acceptability generally related to all sensory attributes in all food products. It is stated that the suitability of fruits and vegetables is influenced by their aroma by Karmas and Harris. Sharma et al. [19] noticed a decreased in overall acceptability during storage of apricot fruit bar (from 7.8-7.2).

Conclusion and Recommendations

In present study guava bar was prepared by using different level of sucrose glucose mixture with guar gum. The samples were analyzed for physicochemical, microbiologically and sensory. From this study physicochemically the samples GL2 prepared by sucrose: glucose (7:3) followed by GL1 prepared by sucrose (10: 0) showed best result, while GL0 prepared by glava pulp and followed by GL, prepared by sucrose: glucose (50: 50) showed lowest result. Sensory and microbiologically GL1 followed by GL2 showed good result, while GL0 followed by GL1 showed lowest result.

References


Table 7: Effect of storage period and treatments on overall acceptability of guava and apple blend bar.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Storage Interval (Days)</th>
<th>Mean</th>
<th>% Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>0</td>
<td>7.07</td>
<td>6.67f</td>
</tr>
<tr>
<td>T1</td>
<td>15</td>
<td>6.30e</td>
<td>5.97d</td>
</tr>
<tr>
<td>T2</td>
<td>30</td>
<td>5.67c</td>
<td>5.37b</td>
</tr>
<tr>
<td>Mean</td>
<td>7.07g</td>
<td>6.67f</td>
<td>6.30e</td>
</tr>
</tbody>
</table>

Values having different alphabetical letters are significantly (P<0.05) not same.