PHYSICO-CHEMICAL AND SENSORY PROPERTIES OF ORANGE MARMALADE SUPPLEMENTED WITH ALOE VERA POWDER

Farhat Rashid, Tanseem Kausar, Tahir Mahmood Qureshi, Sarfraz Hussain, Muhammad Nadeem, Ammara Ainee and Syeda Mahvish Zahra*

ABSTRACT

A study was conducted at the Institute of Food Science and Nutrition, University of Sargodha, Sargodha, Pakistan, to evaluate the effect of different concentration of Aloe vera (Aloe barbadensis Mill.) powder on physico-chemical and sensory properties of orange marmalade. All treatments (0, 2, 4, 6, 8 and 10% Aloe vera powder) were analyzed for titratable acidity, TSS, pH, moisture, fat, fiber and protein contents. The data indicated gradual increase in titratable acidity (0.08 to 0.18%), moisture (0.23 to 0.48%), protein (0.09 to 0.40%) and fiber (0.12 to 1.03%) among all treatments with increasing concentration of Aloe vera powder. However, a decreasing trend in pH (3.81 to 2.74), TSS (68 to 56 °Brix) and fat content (1.1 to 0.08%) was noticed with gradual increase in concentration of Aloe vera powder in orange marmalade. Sensory attributes like color, taste, texture, flavor and overall acceptability were found acceptable among all treatments but T1 (2% Aloe vera powder) was liked most and T5 (10% Aloe vera powder) was least appealing to the judges. It is concluded from present study that the addition of different concentrations of Aloe vera powder in orange marmalade significantly affected the physico-chemical and sensory properties of marmalade.

KEYWORDS: Orange marmalade; Aloe vera; Aloe barbadensis Mill; physico-chemical characteristics; organoleptic properties; Pakistan.

INTRODUCTION

Aloe vera (Aloe barbadensis Mill.) belongs to Asphodelaceae (Liliaceae) family. It is a shrubby, xerophytic, perennial and succulent pea-green color plant (19). It has 250 species around the world, but Aloe barbadensis Mill. and Aloe aborescens are considered as the most popular species (15). It contains 75 potentially active constituents like polysaccharides, enzymes, essential amino acids, non-essential amino acids, vitamins A (beta-carotene), C, E and B12, etc, mineral salts and other constituents like sterols and tannins together with their functional properties (19, 11). Aloe vera helps in healing of wounds due to its deepest penetration ability to body tissues. Its

*Institute of Food Science and Nutrition, University of Sargodha, Sargodha, Pakistan.

bioactive compounds act as anti-diabetic (2), anti-septic, anti-carcinogenic (10), anti-ulcer, anti-oxidant (3), anti-fungal and anti-inflammatory (8). It is also effective in treating diarrhea, toxicity, pruritis, hyper-cholesterolemia, gastro-intestinal problems, radiation injury, wound healing, burns and skin diseases (14). Currently it is used in cosmetics, food products such as ice cream, sauces, chocolates, and also in nutraceuticals (12).

Citrus fruits are not only rich source of ascorbic acid, but also contains several phytochemicals and flavonoids which play an important role in nutraceuticals (17). Other nutrients in citrus fruits include vitamin-B complex, flavonones, carotenoids (lycopene and ß-carotene), limonoids and related nutrients (thiamine, riboflavin, pyridoxine, folic acid, biotin, choline nicotinic acid/niacin, pantotenic acid and inositol) (4).

Different useful products are made from citrus fruits such as jam, jellies, marmalade, fruit juices, fruit squashes and drinks. One of the most common products of orange is orange marmalade which is a sugar preserve and defined as "semisolid or gel-like product prepared from citrus orange juice, puree and pulp together with one or more sweetening ingredients, fine shreds of peel and may contains suitable food grade pectin and acids.

The main objective of present study was to analyze the physico-chemical and sensory properties of orange marmalade supplemented with Aloe vera powder.

**MATERIALS AND METHODS**

This study was conducted at Institute of Food Science and Nutrition, University of Sargodha, Sargodha, Pakistan during the year 2012. Fresh and prime quality oranges were procured from local market. After proper washing, sorting and grading of oranges, extraction of juice was carried out. Fresh and thick Aloe vera leaves were collected from nursery and used for gel extraction with knife by dividing the leaves in two parts vertically. Transparent gel obtained was then dried by conventional method of sun drying, and ground using food processing grinder to achieve fine powder.

*Preparation of fruit peel:* Thin slices of flavedo of whole citrus fruits were boiled in water for 2-3 minutes at 90-100 °C to remove their bitterness and also to make them soft.

*Preparation of orange marmalade:* The orange juice was extracted by using rose head machine. Juice was filtered to make it pure. Pectin was dissolved in 2 L water (70-80 °C) by high speed blender. Then sugar and
dissolved pectin were added in orange juice along with water and cooked till its total soluble solids (TSS) were reached to 68-70 percent. After adding shreds, cooking was again carried out for 15-20 minutes. Then citric acid and sodium benzoate were added for preservation purpose. Further, color, flavor and Aloe vera powder were added just before switching off heating. After cooling up to 82°C, the orange marmalade was filled in bottles. Formulation of orange marmalade is given below.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange juice</td>
<td>100 ml</td>
</tr>
<tr>
<td>Orange shred</td>
<td>1.32 kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>0.62 kg</td>
</tr>
<tr>
<td>Pectin</td>
<td>7 g</td>
</tr>
<tr>
<td>Water</td>
<td>400 ml</td>
</tr>
<tr>
<td>Citric acid</td>
<td>0.2%</td>
</tr>
<tr>
<td>Sodium benzoate</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

Different samples of orange marmalade were prepared according to Aloe vera powder treatments as given below:

- \( T_0 \) = No Aloe vera powder,
- \( T_1 \) = 2% Aloe vera powder,
- \( T_2 \) = 4% Aloe vera powder,
- \( T_3 \) = 6% Aloe vera powder,
- \( T_4 \) = 8% Aloe vera powder,
- \( T_5 \) = 10% Aloe vera powder.

**Chemical analysis of orange marmalade:** The moisture, crude fat, crude fibre, crude protein, pH, total soluble solids (°Brix) and percent titratable acidity of orange marmalade were determined by following methods as described by AOAC (1).

**Sensory evaluation:** The samples were also evaluated for color, flavor, taste, texture and overall acceptability by a panel of twenty semi-trained judges, consisted of staff and students from Institute of Food Science and Nutrition, University of Sargodha through nine point hedonic scale (5, 9).

**Statistical analysis:** Data were analyzed statistically using minitab statistical software version 16 (Minitab Inc., State College, PA, USA) for analysis of variance (ANOVA) and LSD multiple comparison test. For all comparisons, level of significance was set to \( P < 0.05 \) (18).

**RESULTS AND DISCUSSION**

**Acidity and pH**

The results (Fig. 1) showed a significant \( P < 0.05 \) effect of Aloe vera powder treatments on the pH and acidity of orange marmalade. The pH of
orange marmalade gradually decreased with increase in Aloe vera powder concentration in orange marmalade. The decreasing trend of pH with successive treatments was attributed to the increased trend in acidity.

These results are supported by the findings of Pal et al. (13) who observed that the addition of different concentrations of Aloe vera juice in lassi resulted in gradual but limited increase in acidity and decrease in pH. Titratable acidity increase may be due to high concentration of organic acid and their salts during storage or may also be due to formation of acid by degradation of polysaccharides, oxidation of reducing sugars and also by degradation of pectic and uronic acid (6).

Total soluble solids and moisture

Total soluble solids (°Brix) were decreased with corresponding increase in concentration of Aloe vera powder in orange marmalade (Fig. 2). On the other hand, moisture level increased with increase in concentration of Aloe vera powder in orange marmalade. This effect might be due to TSS of Aloe vera powder that contained less sugar. Shakir et al. (16) reported decreasing trend in ascorbic acid, pH, reducing sugars and TSS while, increasing trend in acidity and moisture for apple, pear and mixed fruit jam during storage.

Fat and fibre

The fat contents of marmalade gradually decreased with increase in Aloe vera powder concentration. It was also observed that with increase in concentration of Aloe vera powder in orange marmalade, fiber contents increased (Fig. 3).
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Fig. 2. Effect of Aloe vera concentration on TSS (Brix) and moisture percentage of orange marmalade.

Fig. 3. Effect of Aloe vera concentration on fat and fibre percentage of orange marmalade.

Fig. 4. Effect of Aloe vera powder on protein percentage of orange marmalade.

Protein contents

The results (Fig. 4) indicate that increased concentration of Aloe vera powder in orange marmalade resulted in gradual increase of protein contents of marmalade. Maximum increase in protein contents was observed in T5 and minimum in T1.

Organoleptic properties

The results indicated that Aloe vera powder supplementation affected the organoleptic properties of orange marmalade. There was a decreasing trend of score for color with the subsequent treatments. Maximum score was achieved by T1 which indicates that the increase in concentration of Aloe vera powder in orange marmalade, the color was not liked by judges.

The taste of treatments T1 and T2 were liked by the most as shown in Table. The mean value for T5 (10% Aloe vera powder) was least appealing to the judges which might be due to over heating or brix fluctuation.

### Table. Effect of Aloe vera powder on organoleptic properties of orange marmalade.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Organoleptic properties</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Color</td>
<td>Taste</td>
</tr>
<tr>
<td>T0</td>
<td>7.85±0.04a</td>
<td>7.56±0.05a</td>
</tr>
<tr>
<td>T1</td>
<td>7.93±0.05a</td>
<td>7.07±0.09b</td>
</tr>
<tr>
<td>T2</td>
<td>6.18±0.01b</td>
<td>5.90±0.08c</td>
</tr>
<tr>
<td>T3</td>
<td>5.59±0.09c</td>
<td>5.93±0.05c</td>
</tr>
<tr>
<td>T4</td>
<td>4.34±0.04d</td>
<td>5.46±0.04d</td>
</tr>
<tr>
<td>T5</td>
<td>3.54±0.04e</td>
<td>4.46±0.12e</td>
</tr>
</tbody>
</table>

Data in columns with different letters are significantly different using LSD pairwise comparison test at 5% level.

The mean values for texture showed that almost all the members of panel rejected the treatment T5, due to improper setting of marmalade. The mean values showed that all the treatments got good score for flavour except T5 which was disliked by judges due to improper setting. The mean values showed that all the treatments got good score for overall acceptability except T5 which was least liked by judges. Treatment T1 was liked most having 2% Aloe vera powder. The mean values for the treatments T4 and T5 showed unsatisfactory results regarding overall acceptability. The observations related to organoleptic evaluation of product in this work are relevant to the reports of Manoharan et al. (10) who found that increase in concentration of Aloe vera pulp lowered the flavor color, taste and texture (7). Similar results
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were obtained by Jayabal and Karthikeyan (7) who observed that increase in concentration of Aelo vera juice decreased the sensory properties of Aloe vera sauce and chocolate.

CONCLUSION

The results of present study revealed that the addition of different concentration of Aloe vera powder in orange marmalade significantly affected the physico-chemical and sensory properties of marmalade. It was observed that by increasing the concentration of Aloe vera powder in orange marmalade, titratable acidity, moisture, protein and fiber contents were also increased, whereas pH, brix and fat contents of marmalade decreased. Sensory properties like color, taste, texture, flavor and overall acceptability of orange marmalade were found in T₁ (2% Aloe vera powder) while T₅ (10% Aloe vera powder) was least liked by judges. Hence, it is recommended that the Aloe vera powder could be added at 2% in the preparation of orange marmalade without much affecting its acceptability.

REFERENCES