STANDARDIZATION AND EVALUATION OF QUALITY OF THE JACKFRUIT PULP INCORPORATED ICE CREAM

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ABSTRACT

Jackfruit (Artocarpus heterophyllus Lam.) is one of the most underutilised fruit containing high amounts of vitamins, minerals, phytochemicals, proteins, carbohydrates and other nutrients. During the flush season, jackfruit is inexpensive and readily available in large quantities. An infinite number of raw fruits are wasted each year, as the fruit is perishable and there are only few value added products. Ice cream is one of the most popular dairy products that is enjoyed by people of all ages. The experiment was conducted at the Department of Community Science, College of Agriculture, Kerala Agricultural University, Vellanikkara, Kerala in the year 2022. The organoleptic evaluation of the standardised ice creams was conducted in order to select the best treatment. The revealed that the selected ice cream had incorporation of 10 percent jackfruit pulp securing the highest mean score in terms of parameters like appearance (8.89), taste (8.82) and overall acceptability (8.81). These scores were significant when statistically evaluated using Kendall’s Coefficient of Concordance. The selected ice cream was subjected to physico-chemical analysis using standard procedures along with control. The jackfruit incorporated ice cream is a nutritious delicacy with novel taste.

Keywords: Ice cream, Jackfruit pulp ice-creams, Organoleptic evaluation, Physico-chemical analysis

INTRODUCTION

Jackfruit (Artocarpus heterophyllus Lam.) is a widely available tropical fruit. The jackfruit, which is regarded as the world’s largest edible fruit is shown to contain significant amounts of vitamins, minerals, phytochemicals, proteins, carbohydrates and other nutrients. The phytonutrients included in jackfruit, are known to have a variety of positive health effects such as anti-aging, anti-cancer and anti-hypertensive characteristics. In spite of having nutritional benefits, the jackfruit is an underutilised crop in the tropical to subtropical climate where most of the fruits get discarded owing to ignorance. Ripe jackfruit’s edible bulbs are typically eaten fresh or converted into canned foods. Additionally, the jackfruit is used to create a variety of products, including jackfruit candy, juice, jam, jelly, finger
chips, fruit bars, fruit leather, halvah, pickles, papad, ready-to-serve beverages, wine, toffee, cake and milk-based shrikhand, rasogolla, basundi and kulfi.

Ice cream is a frozen product and the popularity of ice cream is attributed to their refreshingly cool and delightfully sweet characteristics unanimously enjoyed by people of all ages. Ice cream is a frozen product prepared from cow or buffalo milk or a combination thereof or from cream and or other milk products with or without the addition of cane sugar, eggs, fresh fruits, fruit juice, preserved fruits, nuts, chocolate, edible flavours and permitted food colours. Ice cream is a wholesome, delectable, relatively balanced, and easily digestible food. Ice cream is a particularly appealing food for growing kids and people who need to gain weight because these ingredients are virtually entirely digested. Ice cream’s nutritional value and energy content are influenced by the food value of the ingredients used to make it. From unripe, ripe and raw fruits and seeds, many dishes have been created. The consumer trend nowadays is toward foods with more natural antioxidants, dietary fibres, natural colourants, minerals, and vitamins as well as foods that are low in calories, low in cholesterol, low in fat and devoid of artificial additives, among other things. In recent years, fruit based ice cream has attracted attention due to presence of different functional properties. The development of ice cream using jackfruit pulp has been attempted in light of the demand for ice cream and the fruit’s nutritional value. The initiative of this study was started with the following goals because there is very less evidence of systematic research on jackfruit ice cream. Hence, this study was conducted with an aim to develop jackfruit incorporated ice creams and to evaluate the physico-chemical properties of the ice cream with best concentration of jackfruit pulp addition.

MATERIALS AND METHODS
Collection of ingredients

The experiment was conducted at the Department of Community Science, College of Agriculture, Kerala Agricultural University, Vellanikkara, Kerala in the year 2022. Fresh cow’s milk required for the study was procured from College of Dairy Science and Technology, Kerala Veterinary and Animal Sciences University, Mannuthy. The jackfruit variety “varikka” was selected for the study and it was procured from the local households. The other ingredients used for the preparation of ice cream were skimmed milk powder, sugar, vanilla flavour and cream which were purchased from the local market. The stabilizers used were guar gum, xanthan gum, carrageenan, sodium alginate and dextrose which were also purchased from the local market.

Standardization of jackfruit pulp (JP) incorporated ice cream

For the standardisation of JP incorporated ice creams, the pulp was prepared from fresh jackfruit. For this the jackfruit was first washed in running tap water to remove dirt and dust, then cut with sharp knife to get bulbs after removal of seed. The bulbs or carpel was ground to paste form in grinder for three minutes at medium speed and passed through one mm stainless steel sieve in order to get uniform pulp. The pulp
The pulp was added at various concentrations ranging from 5 - 30 percent in different treatments (T1 - T6), respectively. Plain ice cream without the addition of pulp served as control (T0). The experiment was conducted in a completely randomised design (CRD) and was replicated thrice.

**Preparation of JP incorporated ice cream**

**Table 1. Composition of ice cream**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cow's milk (ml)</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>Cream (ml)</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Skimmed milk powder (g)</td>
<td>7.4</td>
</tr>
<tr>
<td>4</td>
<td>Sugar (g)</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Stabilizer (g)</td>
<td>0.5 (0.1 each)</td>
</tr>
<tr>
<td>6</td>
<td>Vanillin (ml)</td>
<td>0.1</td>
</tr>
<tr>
<td>7</td>
<td>Water (ml)</td>
<td>10</td>
</tr>
</tbody>
</table>

The composition for the preparation of ice cream is illustrated in Table 1. To the milk, the skim milk powder, sugar and water, were added and pasteurized at 85 °C for one minute. This mix was homogenised and allowed to cool to 40 °C to which cream was added. The homogenised mix was kept for ripening at 4 °C for 24 h. After ripening, the JP was added and then kept for storage in freezer (Figure 1).

**Standardisation of level of JP in ice cream**

The jackfruit pulp from the jackfruit variety “varikka” was added to ice creams at 0, 5, 10, 15, 20, 25 and 30 percent level for the treatments T0 to T6, respectively (Table 2) and is compared with plain icecream (without adding the JP).

The ice cream prepared with these formulations was evaluated for sensory qualities and level of addition was standardised on the basis of sensory qualities of ice cream with three replications and the physico-chemical analysis of best treatment selected were analysed.
The organoleptic evaluation of the jackfruit incorporated ice creams were carried out by a panel of selected 20 judges using a nine-point hedonic scale with the replications in the College of Agriculture, Vellanikkara. The judges were asked to indicate their opinion on a nine-point hedonic scale (9 for like extremely to 1 for dislike extremely). The experts analysed each treatment for their appearance, colour, texture, taste, flavour and overall acceptability of the product. The scale of likeness used for the study was: 1 - Disliked extremely, 2 - Disliked very much, 3 - Disliked moderately, 4 - Disliked slightly, 5 - Neither liked nor disliked, 6 - Liked slightly, 7 - Liked moderately, 8 - Liked very much and 9 - Liked extremely.

Physico-chemical analysis

The physico-chemical qualities such as moisture, protein, fat, sucrose, TSS acidity and pH of the selected jackfruit pulp incorporated ice cream were estimated using the standard procedures.

Table 2. Treatments for the standardisation of jackfruit incorporated ice cream

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Treatment</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T0</td>
<td>Ice cream</td>
</tr>
<tr>
<td>2</td>
<td>T1</td>
<td>Ice cream + 5 % JP</td>
</tr>
<tr>
<td>3</td>
<td>T2</td>
<td>Ice cream + 10 % JP</td>
</tr>
<tr>
<td>4</td>
<td>T3</td>
<td>Ice cream + 15 % JP</td>
</tr>
<tr>
<td>5</td>
<td>T4</td>
<td>Ice cream + 20 % JP</td>
</tr>
<tr>
<td>6</td>
<td>T5</td>
<td>Ice cream + 25 % JP</td>
</tr>
<tr>
<td>7</td>
<td>T6</td>
<td>Ice cream + 30 % JP</td>
</tr>
</tbody>
</table>

Organoleptic evaluation

The organoleptic evaluation of the jackfruit incorporated ice creams were carried out by a panel of selected 20 judges using a nine-point hedonic scale with the replications in the College of Agriculture, Vellanikkara. The judges were asked to indicate their opinion on a nine-point hedonic scale (9 for like extremely to 1 for dislike extremely). The experts analysed each treatment for their appearance, colour, texture, taste, flavour and overall acceptability of the product. The scale of likeness used for the study was: 1 - Disliked extremely, 2 - Disliked very much, 3 - Disliked moderately, 4 - Disliked slightly, 5 - Neither liked nor disliked, 6 - Liked slightly, 7 - Liked moderately, 8 - Liked very much and 9 - Liked extremely.

Statistical analysis

The observations recorded during organoleptic evaluation, were tabulated and data was analysed by using Completely Randomized Design (CRD). The scores obtained for the organoleptic evaluation were evaluated by Kendall’s Coefficient of Concordance (W).

Cost of production

Cost of production of the most acceptable combination of the jackfruit incorporated ice cream was computed considering the material cost, labour charges, fuel and electricity costs.

RESULTS AND DISCUSSION

The results of the organoleptic evaluation and the results of the physico-chemical analysis of the selected best treatment in jackfruit incorporated ice creams are given in this section.

Organoleptic evaluation

Sensory evaluation is used to quantify, analyse and evaluate how a product’s attributes are experienced by consumers. The human senses of sight, hearing, taste, smell and touch are employed to quantify these sensory properties, which are a mixture of traits that together create a sensory experience (appearance, texture, taste, colour and flavour). The jackfruit incorporated ice creams developed under different treatments were evaluated for higher acceptability through sensory analysis. Jackfruit contributes to the desirable appearance, flavour and sensory properties of desserts and confectioneries. In the study, the suitability of JP in ice-cream was assessed.

The mean score obtained for the organoleptic qualities of each treatment were
statistically analysed using Kendall’s coefficient of concordance and the mean scores were determined (Table 3).

In the study based on sensory evaluation, the treatment T2 (10% jackfruit pulp) was selected as the best combination securing highest scores in all the organoleptic parameters such as appearance, colour, flavour, taste, texture and over acceptability.

The average sensory scores presented in Table 3 revealed that the incorporation of jackfruit pulp in the ice cream significantly enhanced the overall sensory scores compared to the control ice cream. The sensory evaluation scores revealed that acceptability was highest for the ice cream mix incorporated with 10 percent (T2) jackfruit pulp. The highest total score of 52.85 was noticed in T2 followed by 51.08 (T1), 48.19 (T3), 47.41 (T4), 45.81 (T5) and 45.37 (T6), respectively. Kendall’s value showed that there was significant agreement between the judges at 1% level.

The maximum sensory score for appearance (8.89) and for colour (8.73) was enhanced...
obtained to the ice cream containing 10 percent JP (T2). The ice cream prepared using 30 percent JP (T6) scored the lowest score for both appearance and colour. It was found that as the level of JP increased the score of appearance increased, up to addition of 10 percent pulp and then the scores declined. This is mainly because of lower the concentration of JP the colour of the ice cream was lighter and higher concentration of the JP, the darker and less appealing was the ice cream.

It was observed that the obtained score for flavour of the ice cream prepared by addition of JP at the rate of 0, 5% and 10 percent were 8.46 (T0), 8.44 (T1) and 8.76 (T2), respectively. The maximum score (8.76) was recorded to the sample containing 10 percent (T2) JP. The scores reduced with further addition of JP and minimum score (6.84) was to the product prepared with 30 percent JP (control). Similar observations were found in terms of taste as well. The scores improved with the addition of JP when compared with control and then decreased when JP was added more than 10 percent. The strong pungent flavour of jackfruit is the reason for such an observation.

The score for texture ranged from 7.78 to 8.84 (Table 2). The maximum score was recorded for treatment T2 (8.84) and minimum score for both T5 and T6 (7.78). The reduction in texture of JP incorporated ice cream might be because of the carpel of jackfruit which was fibrous, soft and mushy as reported by Swami et al. (2019), which supports the finding of the study.

The overall acceptability score for T0 and T2 were 8.56 and 8.81, respectively. The ice cream prepared using 10 percent JP was yellow in colour, had optimum firmness and pleasing sweet and sour jackfruit flavour. The ice creams prepared using 5 percent JP were light yellow in colour, lightly hard body and lacked in flavour on the other hand, the ice creams prepared using more than 10 percent JP were dark yellow in colour, lacking firmness and pungent in flavour and taste. On the basis of these results, T2 (10% JP) was selected and used for further study.

Gaikwad et al. (2020) prepared ice cream using jackfruit pulp and concluded that the best quality ice cream could be prepared by addition of 15 percent JP of Barka type, 15 percent sugar and 0.1 percent carrageenan stabilizer. The results obtained in this study were on par with the study conducted by Haque et al. (2015) where fruitcakes containing up to 10 percent jackfruit pulp were most acceptable concerning sensory evaluation. The higher amount of jackfruit pulp was not accepted by the consumer in terms of overall internal and external appearances.

**Physico-chemical analysis of the ice creams**

The ice cream which was selected as best in the organoleptic evaluation (T2) was evaluated for nutritional value along with control (Table 4). The moisture content of the selected ice cream was observed to be 61.67 percent and for control was 60.82 percent. Nadelman et al. (2017) reported that the moisture content of ice cream developed from conventional sheep milk was 67.61%. According to Deosarkar et al. (2016) the recommended moisture content for ice cream is 61.7% which is on par with the study.

The TSS of the selected ice cream was found to be 38.33% which was slightly higher than
Shelke et al. (2020) studied the utilisation of jamun pomace as functional ingredient to enhance the physico-chemical and sensory characteristics of ice cream, the TSS content of ice cream was found to be in the range of 29 to 39 percent. According to Jayatilake et al. (2020), there was a gradual decrement of TSS in synbiotic ice cream incorporated with arrowroot during frozen storage period from 31.75% to 28.65%.

The air interface in ice cream is stabilised in part by milk proteins, which is crucial for overall structure and stability. Protein content of the control was 3.61% and the developed jackfruit ice cream was 3.57%. Similar observation was found in vanilla ice cream 3.78% protein prepared by Patel et al. (2016). Remya et al. (2019) prepared biyoghurt incorporating jackfruit pulp and the protein content ranged between 3.00 g to 3.05 g/ 100 g in both “koozha” and “varikka” varieties of jackfruit.

In a conventional ice cream, the microstructure formed throughout the ageing, freezing and aeration processes is significantly influenced by the fat. The fat also aids in flavour release and serves as a vehicle for lipid-soluble flavours (Underdown et al., 2018). The developed jackfruit ice cream had fat content of 3.59% and for control ice cream was 4.79%. As per FSSAI (2016), if the fat content is more than 2.5 and less than 10.0%, the ice cream is categorised into medium fat ice cream. Hence, the developed ice cream is a medium fat ice cream. Total fat contents in the ice creams developed by Espinoza et al. (2020) showed almost similar values in all formulations analysed ranging from 4.2 to 6.4 percent.

To achieve the ideal pH, acidity is a crucial consideration. When the mixture is pasteurised, the presence of excessive amount of acid may cause the mixture to curdle. Acidity of the control ice cream was 0.14 with a pH 6.62 and developed jackfruit ice cream was slightly higher than the control 0.18 percent with a pH of 6.46 which is optimum. Shinde et al. (2021) developed ice cream incorporating jackfruit seed flour, the acidity (%) was increased from 0.21 percent to 0.24 percent during five weeks of storage period.

Although a variety of sugars, including glucose, fructose, sucrose and sugar alcohols, are utilised in the manufacturing of ice cream, sucrose is the primary sweetener which gives

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Quality Parameters</th>
<th>Control Ice cream</th>
<th>Jackfruit Ice cream</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moisture (%)</td>
<td>60.82</td>
<td>61.67</td>
</tr>
<tr>
<td>2</td>
<td>TSS (%)</td>
<td>37.18</td>
<td>38.33</td>
</tr>
<tr>
<td>3</td>
<td>Protein (%)</td>
<td>3.61</td>
<td>3.57</td>
</tr>
<tr>
<td>4</td>
<td>Fat (%)</td>
<td>4.79</td>
<td>3.59</td>
</tr>
<tr>
<td>5</td>
<td>Acidity (%)</td>
<td>0.14</td>
<td>0.18</td>
</tr>
<tr>
<td>6</td>
<td>pH</td>
<td>6.62</td>
<td>6.46</td>
</tr>
<tr>
<td>7</td>
<td>Sucrose (%)</td>
<td>18.96</td>
<td>19.27</td>
</tr>
</tbody>
</table>

Table 4. Physico-chemical analysis of ice creams
taste to the ice-cream. In this study, the sucrose content of control ice cream was 18.96% and the developed jackfruit ice cream contains 19.27 percent sucrose, which was slightly higher compared to the sucrose content when ice cream was developed by Mansour et al. (2021) with date fibre powder (15%).

Cost of the products

The cost of production of the jackfruit incorporated ice cream was Rs. 50/100 g. The cost of commercially available premium ice creams is in the range is Rs. 55-80/100 g. Gaikwad et al. (2020) reported average cost of production for jamun juice incorporated at level of 5%, 10% and 15 percent and control ice cream samples was Rs. 50.91, Rs. 54.06, Rs. 57.09 and Rs. 48.04, respectively.

CONCLUSIONS

Addition of 10 percent jackfruit pulp to the ice cream enhanced the overall acceptability of the product when compared to the control (plain ice cream). When jackfruit pulp, above 10 percent was added, the overall acceptability of the product decreased due to increase in intensity of appearance, pungent colour, flavour and taste. The texture was also negatively affected when concentration of pulp was more than 10 percent. The scores obtained in organoleptic evaluation were significant when evaluated statistically using Kendall’s coefficient of concordance. The physico-chemical analysis was conducted for the selected best treatment which showed results that are in accordance with similar studies. Hence, jackfruit could be judiciously used for the development of ice cream which could serve as a delicious and nutritious delicacy for people of all ages.

REFERENCES


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