Preparation of ice cream blended with Cocoa and Sago powder

Vipin Kumar Verma and Shanker Suwan Singh

Abstract
Ice cream coca powder is one of the most popular dessert options all over the globe liked by people of all age groups. Cocoa originates from beans of the cocoa tree (*Theobroma cacao* L.) and it is an important commodity in the world and the main ingredient in chocolate manufacture. Its value and quality are related to unique and complex flavors. Bulk cocoas (Forastero type) exhibit strong basic cocoa notes, whereas fine varieties (Criollo, Nacional) show aromatic, floral, or smoother flavor characteristics in ice cream. The obtained ice cream made from coca and sago powder is effective in thickness and stability quality. The role of sago powder was as a stabilizer. A combination of coca and sago powder was used ratio (1.5:2), (1.5:3), (1.5:4) for different treatment i.e. for the combination was effective in ice cream without affecting the physio-chemical analysis and sensory of formed ice cream. The microbiological analysis was performed to study the consumption quality of the manufactured ice cream. The standard plate count was highest 2.40x10³, coliform count was NIL and highest yeast and mould 10 indicating that the product is safe for consumption. According to the analysis, treatment T₂ with 1.5% sago powder and 3% coca powder was found the best among the four.

Keywords: coca powder, sago powder, Ice Cream.

1. Introduction
Ice cream is a frozen food made from milk fat, milk solids-not-fat, sweeteners, and flavorings; a variety of fruits, nuts, and other items also may be added. Ice cream in the United States has a legal definite, which can be found in the Code of Federal Regulations (CFR 2003b), which specifies solids, fat, and air contents. These specifications state that vanilla ice cream must contain a minimum of 10% milk fat by weight, a minimum of 20% milk solids and at least 192g of total food solids per liter of ice cream, with each liter of ice cream weighing a minimum of 540 g. Other ice cream categories exist, such as reduced calorie ice creams, which in the United States must meet the nutrient claims that comply with "reduced fat." (CFR 2003a) These legal requirement soften dictate the types and ratios of ingredients used in frozen desserts as well as some of the processing conditions. Because minimum contents (except air content) normally are stated in the federal requirements, commercial ice creams vary considerably in body, flavor, melt, and texture characteristics. Recent statistics have shown that 61% of all frozen dessert products manufactured in the United States fall into the ice cream category and 26% into the non-fat and low-fat ice cream category. The remaining portions of frozen dessert products consist of frozen yogurt (5%), water ices (4%), sherbets (3%), and other (1%) categories [International Dairy Foods Association (IDFA) 2002].

Cacao is a top source of antioxidants, and it contains an abundance of magnesium and iron. To make our cacao powder, the finest cacao beans are milled at low temperature to protect the nutrients and flavor. Our cacao powder is a healthy alternative to conventional over-processed “cocoa” used for baking, hot chocolate, desserts and smoothies.

The present study was planned and conducted to evaluate the suitability of sago (tapioca starch) as a functional ingredient in ice cream. In this study an attempt was made to prepare a regular fat (10.0%) ice cream using a combination of sago and whey protein concentrate (WPC-70) as stabilizer and emulsifier respectively and see whether it can compare favourably with premium ice cream. The experimental ice cream (10.0% fat) was compared against two control ice creams, one having 10.0 % fat and other having 14.0% fat using commercial stabilizer (Na-alginate) and emulsifier (glycerol monostearate). The tentative formulation of sago and WPC based ice cream was studied using vanilla as flavouring. Sago and WPC was incorporated in experimental ice cream mix at 1.0 and 0.5% (w/w) respectively.
Sago in combination with WPC helped in imparting desired body and texture, and richness quite similar to premium ice cream. The sensory characteristics of experimental ice cream were at par with those of premium ice cream but significantly greater than those of regular control ice cream. It can be concluded that regular ice cream can be successfully prepared using sago and WPC with sensory characteristics at par to that of premium ice cream. Such ice cream was sensorily more acceptable than regular ice cream made using commercially available stabilizer and emulsifier.

Nutritional information of sago powder

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Amount percent per 100 gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>94gm</td>
</tr>
<tr>
<td>Protein</td>
<td>0.2gm</td>
</tr>
<tr>
<td>Fat</td>
<td>0.2gm</td>
</tr>
<tr>
<td>Calcium</td>
<td>10mg</td>
</tr>
<tr>
<td>Iron</td>
<td>1.2mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>5mg</td>
</tr>
</tbody>
</table>

There are several health benefits of sago powder
- Sago or sabudana is a food which is full of energy and carbohydrates. It is extracted from the centre of sago palm stems in the form of starch.
- Pearl sago is used as one easily digestible non-irritating baby food as well as a food in inflammatory cases.
- Sago grains are about 2mm in diameter. They are source of pure carbohydrate with very little protein, vitamin C, calcium and minerals.
- The main content of sago is carbohydrate and has an ancient history in aiding to certain herbal medicines. Sago along with rice is used to cool the body.
- Various dishes are made from sago as it is easily mixed with wide variety of tastes and spices. However, sago is low in proteins, vitamins and minerals, its combination with other supplements can result into high nutrition and taste.
- Sago food is full of energy, and often served as a food to break the fast. It has high beneficiaries for sick people as a supplement providing enough energy to combat the weakness and ailments.
- In weeks only you can gain weight with the help off sago. People who are suffering from eating disorder or lack of appetite can increase their weight with the help of the rich calories containing in the tapioca.
- Five milligrams of potassium is contained by 100 grams of sago. Potassium is known for improving the circulation of blood and also the whole cardiovascular system.

Materials and Methods

Plan of Work

FCM: Milk was collected from local market of Allahabad.

SMP: Skim milk powder was collected from local market of Allahabad.

CREAM: Cream was collected from local market of Allahabad.

STABILIZER & EMULSIFIER: Stabilizer and emulsifier was collected from local market of Allahabad.

SUGAR:-Sugar collected from local market of Allahabad.

COCOA POWDER: cocoa powder was collected from local market of Allahabad.

SAGO POWDER: sago powder was collected from local market of Allahabad.

Treatments Combination

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Amount in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>10</td>
</tr>
<tr>
<td>Sugar</td>
<td>15</td>
</tr>
<tr>
<td>Milk SNF</td>
<td>12</td>
</tr>
<tr>
<td>Stabilizer &amp; Emulsifier</td>
<td>0.5</td>
</tr>
</tbody>
</table>

- T0-Control prepared from ice cream (100:00:00)
- T1-Experimental sample prepared from ice cream with sago &cocoa powder (96.5:1.5:2)
- T2- Experimental sample prepared from ice cream with sago &cocoa powder (95.5:1.5:3)
- T3- Experimental sample prepared from ice cream with sago &cocoa powder (94.5:1.5:4)

Plan of Work

Flow diagram for manufacturing of sago ice cream blended with cocoa powder
(Experimental sample)

Select the ingredients (Milk, Cream, SMP, Emulsifier and Stabilizer)

Blending the ingredients

Making the mixture

Blended the Sago powder (1.5%)

Pasteurization the mix (68°C/155°F for 30 min.)

(1st stage 2,500psi)

Homogenization the mixture

(11nd stage 500psi)

Cooling and ageing the mix (0-4°C/39°F)

Adding the cocoa and sago powder

Experimental Sample

T1 (96.5:2) (M:C)    T2 (95.5:3) (M:C)    T3(94.5:4) (M:C)

Freezing the mixture (-4 to -5°C/23 to 25°F)

Packaging of ice cream

Hardening and storage of ice cream (-23 to -29°C/-10 to -20°F)
Average of data obtain on different parameter of fortified cookies by using wheat flour, flaxseed flour and Dried carrot Pomace
The different parameter of control and experimental Ice Cream

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CHEMICAL ANALYSIS (%)</th>
<th>C.D VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0</td>
<td>T1</td>
</tr>
<tr>
<td>Fat</td>
<td>10.11</td>
<td>10.20</td>
</tr>
<tr>
<td>Protein</td>
<td>3.54</td>
<td>3.57</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>22.94</td>
<td>23.20</td>
</tr>
<tr>
<td>Moisture</td>
<td>62.68</td>
<td>62.25</td>
</tr>
<tr>
<td>Total Solids</td>
<td>37.32</td>
<td>37.75</td>
</tr>
<tr>
<td>Acidity</td>
<td>0.16</td>
<td>0.18</td>
</tr>
<tr>
<td>Ash</td>
<td>0.73</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Organoleptic Scores (9 Point Hedonic Scale)

<table>
<thead>
<tr>
<th>Colour &amp; appearance</th>
<th>8.15</th>
<th>7.96</th>
<th>7.64</th>
<th>7.83</th>
<th>0.49</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavour &amp; taste</td>
<td>8.20</td>
<td>7.75</td>
<td>8.13</td>
<td>8.19</td>
<td>0.33</td>
</tr>
<tr>
<td>Body &amp; texture</td>
<td>7.96</td>
<td>7.58</td>
<td>7.84</td>
<td>7.56</td>
<td>0.19</td>
</tr>
<tr>
<td>Melting resistance</td>
<td>8.10</td>
<td>7.69</td>
<td>8.77</td>
<td>7.68</td>
<td>0.18</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>8.10</td>
<td>7.72</td>
<td>8.78</td>
<td>7.82</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Microbiological Analysis

<table>
<thead>
<tr>
<th>SPC(10³cfu/g)</th>
<th>1.60</th>
<th>2.60</th>
<th>2.20</th>
<th>2.40</th>
<th>1.14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coliform test (10²cfu/g)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Yeast&amp;Mould count(10 cfu/g)</td>
<td>0.20</td>
<td>0.60</td>
<td>1.00</td>
<td>0.80</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Cost Analysis

| Ice cream Rs/Liter | 101.70 | 101.19 | 101.09 | 101.29 |  |

Result and Discussion
Chemical Parameters of Ice Cream

Fat
The highest Fat percentage was recorded in the sample of T3 (10.52), followed by T2 (10.39), T1(10.20) and T0 (10.11). There was non-significant difference b/w T0-T1, T1-T2, T2-T3 and there was significant difference b/w the all treatment.

Protein
The highest Protein percentage was recorded in the sample of T3 (3.64), followed by T2 (3.61) aT1 (3.57) and T0 (3.54). There was non-significant difference b/w T0-T1, T1-T3, T2-T3 and there was significant difference b/w the all treatment.

Carbohydrate
The highest Carbohydrate percentage was recorded in the sample of T3 (23.83), followed by T2 (23.47), T1 (23.20) and T0 (22.94). There was non-significant difference b/w T0-T1, T1-T2, T2-T3 and there was significant difference b/w the all treatment.

Moisture
The highest Moisture percentage was recorded in the sample of T0 (62.68), followed by T1 (62.25) T2 (61.72) and T3 (61.15). There was non-significant difference b/w T0-T1, T1-T2 and there was significant difference b/w the all treatment.

Total Solids
The highest Total Solid percentage was recorded in the sample of T3 (38.85), followed by T2 (38.28), T1 (37.75) and T4 (37.32). There was non-significant difference b/w T0-T1, T1-T2 and there was significant difference b/w the all treatment.

Acidity
The highest mean Acidity percentage was recorded in the sample of T3 (0.23), followed by T2 (0.21), T1 (0.18) and T0 (0.16). There was non-significant difference b/w T0-T1, T2-T3 and there was significant difference b/w the all treatment.

Ash
The highest mean Ash percentage was recorded in the sample of T1 (0.86), followed by T2 (0.82), T1 (0.77) and T0 (0.73). There was non-significant difference b/w T0-T1, T2-T3 and there was significant difference b/w the all treatment.

Organoleptic Parameters of Ice Cream

Color & Appearance
The highest mean Color & Appearance score was recorded in the sample of T0 (8.15), followed by T1 (7.96), T3 (7.80) and T2 (7.64). There was non-significant difference b/w T0-T1, T0-T3, T1-T3, T2-T3 and there was significant difference b/w the all treatment.

Flavor & Taste
The highest mean Flavor & Taste score was recorded in the sample of T0 (8.20), followed by T1 (8.19), T2 (7.40) and T1 (7.75). There was non-significant difference b/w T0-T2, T0-T3, T1-T2 and there was significant difference b/w the all treatment.

Body & Texture
The highest mean Body & Texture score was recorded in the sample of T0 (7.96), followed by T1 (7.56) and T3 (7.56). There was non-significant difference b/w T0-T2, T0-T3, T1-T3 and there was significant difference b/w the all treatment.

Melting Resistance
The highest mean Melting Resistance percentage was recorded in the sample of T0 (8.10), followed by T2 (7.87), T1 (7.69) and T3 (7.38). There was non-significant difference b/w T0-T2, T1-T2, T1-T3 and there was significant difference b/w the all treatment.

Overall Acceptability
The highest mean highest overall acceptability score was recorded in the sample of T0 (8.10), followed by T2 (7.88), T3 (7.82) and T1 (7.72). There was non-significant difference b/w T0-T2, T1-T3 and there was significant difference b/w the all treatment.

Microbial Parameters of Ice Cream

S.P.C (x 10³)cfu/g
The highest mean S.P.C (x 10³) cfu/g highest percentage was recorded in the sample of T1 (2.60), followed by T3 (2.40), T2 (2.20) and T0 (1.60). There was all non-significant difference b/w The treatments.

Coli form (x 10²)cfu/g
None of the samples of coca ice cream samples showed the presence of the coli forms at 0 day which indicates that proper hygienic conditions were maintained during the preparation and storage of the product.
Yeast and Mould
The highest mean yeast and mould highest percentage was recorded in the sample of T₂ (1.0) followed by T₃ (0.80), T₁ (0.60) and T₀ (0.20). Ther was all non-significant difference b/w the treatments.
Based upon the above study the following inferences can be drawn:
- Ice cream was prepared using Coca powder i.e. H₀ is accepted.
- Ice Cream of acceptable sensory qualities i.e. H₂ is accepted.

Conclusion
In view of the experimental result obtain during the present investigation, it may be concluded that the Ice-cream made from Ice cream mix with 2%, 3% 4% coca powder with 1.5% sago powder i.e. T₀ received highest score and was liked very much by the panel of judges in the Organoleptic evaluation, best in chemical characteristic (maximum total solids, acidity, protein, carbohydrate and ash), best in microbial analysis (minimum yeast and mould count; and negative in coli form test) thereby indicating good storage stability of Ice cream. The cost of preparation of Ice-cream in T₂ 101.09 per liter of ice cream. However, since this is based on one-time experiment, further trial may be needed to substantiate the results.

Reference
18. Manickavasagam A, Thangavel K. A survey of water consumption and product output from ten sago factories in India, Department of agricultural processing, Agricultural University, Combatore, 2006; 29(1&2):68-70.