Effect of fractionation on the physicochemical properties and the storage stability of Unniyappam

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‘Unniyappam’ or ‘appam’ is prepared out of rice and jaggery in ghee and is given to devotees at the Sabarimala Ayyappa temple in Kerala, India. It is one of the largest annual pilgrimage sites in the world with an estimate of over 40 to 50 million devotees visiting every year. Ghee is used in the Sabarimala temple as the frying medium to make Unniyappam. Ghee, the clarified milk fat prepared chiefly from cow or buffalo milk, is the most common and popular milk fat-based product in the Indian subcontinent since time immemorial. Modification of milk fat composition through the application of fractionation processes, which could result in fat fractions with favourable technical and nutritional properties, appears to be the most promising option for a better output. The Apparent merits of fractionated milk fat in the baking and confectionery sector have encouraged several scientists and efforts were made to incorporate fractions for preparations of sweets. The effect of fractionation was studied and it was shown that the products made with the inclusion of the $S_{30}$ fraction yielded the best overall acceptability score. The Unniyappam made by incorporating of $S_{30}$ fraction (18%) yielded the best results with greater textual and flavour scores attributing to higher overall acceptability. The Unniyappam prepared using the $L_{30}$ fraction had a poor texture and surface was uneven and excessive burning was observed while frying. The potential of having a solid fraction for increased textural properties and overall acceptability was identified in many products and such initiatives will help to come up with the concept of tailoring milk fat to compete with other fats and oils in meeting the needs of the food industry.

Keywords: Sabarimala Unniyappam, Appam, Fractionation, Milk Fat, Ghee, Butter Oil, HMF, LMF, Solid fraction, Sweets, Traditional sweets

INTRODUCTION

India is the largest producer of milk in the world, producing 187.7 million tons (BAHS 2019) whereas the world’s milk production amounts to 827.88MT (BAHS FAO 2019). India contributes to around 22.67%, of global milk production. Besides fluid milk consumption, the consumption of value-added dairy products is also growing due to higher incomes, urbanization, and demographic changes. Ghee is also gaining popularity in Australia, Arabian countries, the United States, the United Kingdom (UK), Belgium, New Zealand, the Netherlands, and many other African and Asian countries (Illingworth et al., 2009). The negative nutritional and physical image of the fat, especially certain saturated long-chain fatty acids, trans-fats, cholesterol, and poor spreadability and oxidative susceptibility, has driven the development of technologies to produce modified fat with different physicochemical or nutritional properties. Modified fats have a wide area of application. They can

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substitute the conventional costlier fats and be used in functional foods, such as nutraceuticals. Moreover, one can use different fractions derived from a single source of fat for different applications. Therefore, the modification of fat can be considered a tool that enhances natural fats' functionality and nutritional value and broadens their area of application (Gandhi et al., 2018).

**MATERIALS AND METHODS**

**Preparation of Ghee (Sserunjogi et al., 1998).**

Whole Milk

↓

Warming 40-50°C/10min.

↓

Cream Separation

↓

Ghee Boiler

↓

Boiling at 110-120°C

↓

Clarified fat

↓

Filtration

↓

Ghee (Sserunjogi et al., 1998).

**Fractionation of Ghee**

Fractionation processing (Deffense, 1993) was adopted for the fractionation of ghee. Melting will be carried out by heating ghee at 60°C to remove the crystal memory. It will be then slowly cooled to 30°C and held at this temperature for 24 h in an incubator for crystallization. The liquid will be separated from the crystals by decantation after centrifugation at 2000 rpm for 10 min in a temperature-controlled centrifuge (REMI) maintained at 30°C. The solid fraction obtained at 30°C (S30) will be regarded as a high melting fraction (HMF or LMF or L30). The weight of the solid fraction thus obtained was determined and the percentage yield was calculated. Subsequently, the liquid portion obtained at 30°C will be the L30 fraction (LMF or L30).

**Preparation of Sabarimala Unniyappam**

The method followed by Travancore Devaswom Board, Kerala was used for preparing Unniyappam. In a wide bowl, add rice flour (1 cup), crushed cardamom, jaggery syrup (3/4-1 cup), finely chopped and fried coconut pieces 2 tbsp, fried till seeds (1 tbsp), and mix well. Add water slowly and make a smooth batter, it should not be too thick or too thin. Set the batter for an hour.

After 1-3 hours, add ghee/fractionated to each mold of the pan and fry in ghee until the ghee becomes hot. Pour a spoonful of batter into each mold until 3/4 full and cook over a low to medium flame until the bottom side of the appam become crispy. Turn the appam to the other side and cook until the colour changes to a golden brown.

**Sensory evaluation of products**

A trained sensory panel assessed the coded ghee samples at random, according to the 9-point Hedonic scale ISI scorecard. Sensory evaluation of the ghee samples was carried out with a twelve-member panel (ages 22 to 50 years) who were Scientists, Students, and Technical staff of the Institute with previous knowledge of sensory evaluation of dairy products. Samples were analyzed and the respective panel’s scores were recorded.

**Moisture**

The moisture content of the sample was estimated as per ISI: SP 18 (Part XI) 1981. About 5 g of the material was accurately weighed in a pre-weighed petri dish and placed in a hot air oven and dry for 2 hours at 100°C. The dish with the sample was cooled in a desiccator and weight was noted. Heated again at 100°C in an air oven for 30 minutes cooled and weighed. This process of heating for 30 minutes was repeated till the difference in weight between two successive observations was less than 1 mg. From the lost weight during the drying amount of moisture was calculated as follows:

Moisture content (% by weight) = \( \frac{100}{W} \) \( W_1 - W_2 \)

Where,

\( W_1 \) = Weight in g of the dish with ghee before drying,

\( W_2 \) = Weight in g of the dish with ghee after drying,

and

\( W \) = Weight in g of the empty dish

**Peroxide value:**

This was determined through iodometric titration according to standard methods for the oils analysis AOCS (1998) [9], and the results were expressed in meq O2 /kg oil. Two grams of product samples were weighed into a 250ml stoppered conical flask. Thirty milliliters of acetic acid chloroform solvent mixture were added to each and swirled to dissolve. Then 0.5 ml saturated potassium iodide solution was added with a Mohr pipette and left to stand for 1 minute in the dark with occasional shaking added about 30 ml of distilled water was. This was titrated with 0.01 N sodium thiosulphate solution, with vigorous shaking until yellow u was almost gone. 0.5 ml starch solution was added as an indicator and titration was continued until the blue colour disappeared indicating the endpoint.
Calculation of the peroxide value was done as below:

\[
\text{Peroxide value} = \frac{\text{drying amount of moisture}}{W} = \frac{\text{Titre} \times \text{N} \times 100}{W}
\]

where \(W\) is the weight of the sample, \(\text{Titre}\) = ml of Sodium Thiosulphate used, \(\text{N}\) = Normality of sodium thiosulphate solution Figure 1.

**Estimation of Free fatty Acid Content**

Free fatty acid (FFA) levels, expressed as % oleic acid, of ghee samples, were determined by the method IS: 548 (Part 1) - 2010, which is described below:

**Procedure**: Ten grams of ghee sample was accurately weighed in a 250ml conical flask. 50ml of neutralized alcohol (at 70°C) was added to the flask containing ghee. The contents were brought to a boiling water bath. The solution, while hot, was titrated against 0.1N sodium hydroxide solution, shaking vigorously during titration. The endpoint of the titration was perceived when the addition of a single drop produced a slight but definite colour change (pink colour) for at least 15 seconds. The FFA levels were expressed as per oleic acid percentage.

\[
\text{Free fatty acid [% (as oleic acid)]} = \frac{(V \times N \times 282 \times 100)}{(W \times 1000)}
\]

Substituting the value for normality as 0.1N

\[
\text{FFA (\% oleic acid)} = \frac{2.82 \times V}{W}
\]

Where \(V\) = Titrate value (ml) 
\(N\) = Normality of NaOH 
282 = molecular weight of oleic acid 
\(W\) = Weight of Sample(g) of fat

**Microbiological analysis**

The metalized polyester pouch containing the sample...
was opened and 11g of the product was weighed and transferred to 99 ml of the sterile physiological saline aseptically. Further dilution to the desired level was carried out by serially transferring 1ml of diluted sample to 9 ml sterile diluent blanks (FSSAI, 2016) Plate 1.

Total bacterial count

The total bacterial count was determined by using standard plate agar (Hi-Media). Pipetted 1 ml of the food homogenate (Mysore Pak/Unniyappam) to sterile labeled Petri plates. The molten agar (10-12 ml) to 42-45°C is poured into each plate. Mixed the media and dilutions by swirling gently, clockwise, anti-clockwise, to and fro thrice, and care was taken that the contents do not touch the lid. It was allowed to set. The count was taken after 24-48 hours of incubation at 37°C (FSSAI, 2012). All colonies that appear on SPCA were counted and expressed as log 10 cfu/g.

Yeast and mold count

Yeast and mold count was determined by plating using potato dextrose agar (Hi-Media). Pipetted 1 ml of the food homogenate (Mysore Pak/Unniyappam) to sterile labeled Petri plates. The molten agar (10-12 ml) to 42-45°C is poured into each plate. Mixed the media and dilutions by swirling gently, clockwise, anti-clockwise, to and fro thrice, and care was taken that the contents do not touch the lid. It was allowed to set. The pH of the medium was adjusted to around 3.5 by adding 1.6 ml of sterile lactic acid solution (10 %) to 100 ml of potato dextrose agar. The count was taken after 2–5 days of incubation at 25°C (FSSAI, 2012). All colonies were counted and expressed as log 10cfu/g.

Coliform count

The coliform count was determined by plating using violet red bile salts agar (Hi-Media). Pipetted 1 ml of the food homogenate (Mysore Pak/Unniyappam) to sterile labeled Petri plates. The molten agar (10-12 ml) to 42-45°C is poured into each plate. Mixed the media and dilutions by swirling gently, clockwise, anti-clockwise, to and fro thrice, and care was taken that the contents do not touch the lid. It was allowed to set. The count was taken after 18-24 hours of incubation at 37°C (FSSAI, 2012). All colonies were counted and expressed as log 10cfu/g.

RESULTS AND DISCUSSION

Effect of solid and liquid fractionated Gir Ghee on the sensory quality of Unniyappam

Control (T0) Unniyappam was prepared using whole Gir Ghee. Samples T1, T2, and T3 were prepared by replacing whole ghee with solid fractions (S30) at 6,12,18 percent levels whereas the samples T4, T5, and T6 were prepared by replacing whole ghee with a liquid portion(L30) of ghee at 06, 12, 18 percent levels.

Color and Appearance

The color and appearance score was the highest for S30.
incorporated Unniyappam at 18% level T₃ (8.49) followed by T₂ (8.37) and T₁ (8.21). The score for color and appearance for L₃₀ incorporated fractions was lower. There was no significant difference (P < 0.05) in the color and appearance among the samples.

### Flavor

The flavor score was observed high for the S₃₀ incorporated Unniyappam T₃ (8.45) followed and then by the control sample T₀ (8.35). The score for L₃₀ incorporated fractions was lower. There was no significant difference (P < 0.05) observed between the control and S₃₀ incorporated Unniyappam, but a significant difference was found between S₃₀ incorporated Unniyappam and L₃₀ incorporated Unniyappam.

### Body and Texture

The textural values were recorded and the highest value observed was for S₃₀ fraction T₃ (8.64) incorporated Unniyappam followed by T₀, T₂, and T₁, respectively. The scores were lower for L₃₀ incorporated fractions. The values were 8.45, 8.03, 8.29, 8.64, 7.96, 7.58, and 7.12 for T₀, T₁, T₂, T₃, T₄, T₅, and T₆, respectively. There was no significant difference (P<0.05) among the scores of S₃₀ fraction (T₁, T₂ and T₃) incorporated Unniyappam products Table 1.

### Overall Acceptability

The overall acceptability of Unniyappam made by incorporating S30 fraction at 18% was the highest and was significantly higher (P < 0.05) to L30 incorporated preparations. The optimized Unniyappam with the inclusion of the S30 fraction at the 18 % level recorded the best score and was selected for further studies.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Color and appearance</th>
<th>Flavor</th>
<th>Body and texture</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀</td>
<td>8.18⁺</td>
<td>8.35⁺</td>
<td>8.45⁺</td>
<td>8.39⁺</td>
</tr>
<tr>
<td>T₁</td>
<td>8.21⁺</td>
<td>8.15⁺</td>
<td>8.03⁺</td>
<td>8.18⁺</td>
</tr>
<tr>
<td>T₂</td>
<td>8.37⁺</td>
<td>8.34⁺</td>
<td>8.29⁺</td>
<td>8.37⁺</td>
</tr>
<tr>
<td>T₃</td>
<td>8.49⁺</td>
<td>8.45⁺</td>
<td>8.64⁺</td>
<td>8.52⁺</td>
</tr>
<tr>
<td>T₄</td>
<td>7.94⁺</td>
<td>6.90⁺</td>
<td>7.96⁺</td>
<td>7.48⁺</td>
</tr>
<tr>
<td>T₅</td>
<td>7.95⁺</td>
<td>6.75⁺</td>
<td>7.58⁺</td>
<td>7.30⁺</td>
</tr>
<tr>
<td>T₆</td>
<td>7.14⁺</td>
<td>6.59⁺</td>
<td>7.12⁺</td>
<td>6.90⁺</td>
</tr>
<tr>
<td>CD (P≤0.05)</td>
<td>0.59</td>
<td>0.49</td>
<td>0.62</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Note:
Scores were given as per a 9-point hedonic scale
*All values are an average of three trails
Similar superscripts indicate non-significant (NS) at corresponding critical difference (CD)
T₀ = Control Product was prepared using whole ghee
T₁ = Product was prepared by replacing 06% of whole ghee with an S₃₀ fraction
T₂ = Product was prepared by replacing 12% of whole ghee with an S₃₀ fraction
T₃ = Product was prepared by replacing 18% of whole ghee with an S₃₀ fraction
T₄ = Product was prepared by replacing 06% of whole ghee with an L₃₀ fraction
T₅ = Product was prepared by replacing 12% of whole ghee with an L₃₀ fraction
T₆ = Product was prepared by replacing 18% of whole ghee with an L₃₀ fraction

### Storage Stability of Unniyappam

#### Effect of ghee fractionation on the Moisture content of Unniyappam during storage

The moisture content of the samples was recorded from the 0th day to the 9th day. It was observed that the moisture content decreased during storage. The moisture content has decreased for the S₃₀ incorporated Unniyappam also. The values of the S₃₀ incorporated Unniyappam was low in comparison with the Unniyappam using whole Gir Ghee and Market Ghee (P<0.05).

The values were in the range of 21.03 to 19.55% for the Gir Ghee used sample., 19.78 to 19.30 for the S₃₀ incorporated Unniyappam, and 22.15 to 20.77% for Unniyappam prepared using market Ghee during storage. There was a significant difference in the moisture content of Unniyappam made out of Market Ghee whereas there was no significant difference in Unniyappam made out of Gir Ghee and S₃₀ incorporated Ghee Table 2.

#### Effect of ghee fractionation on the Peroxide value content of Unniyappam during storage

The peroxide values of the Unniyappam samples were observed for the control and S₃₀ incorporated fraction and are delineated in Table 3. It was found that the peroxide value increased during storage for all three variants of Unniyappam. There was no significant difference (P<0.05) in peroxide value amongst the three types of Unniyappam. The peroxide value for the Unniyappam using whole Gir ghee, and Market Ghee and S₃₀ incorporated Unniyappam ranged from 5.14 to 6.80, 5.17 to 6.81, and 4.80 to 6.20 from 0th day to 9th day.
Table 2. Effect of ghee fractionation on the Moisture content of Unniyappam during storage

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Storage days</th>
<th>Moisture (percent)</th>
<th>0&lt;sup&gt;th&lt;/sup&gt;</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt;</th>
<th>6&lt;sup&gt;th&lt;/sup&gt;</th>
<th>9&lt;sup&gt;th&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&lt;sub&gt;0&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>21.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.90&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.55&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>19.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.52&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.45&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.30&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>22.15&lt;sup&gt;b&lt;/sup&gt;</td>
<td>21.98&lt;sup&gt;b&lt;/sup&gt;</td>
<td>21.56&lt;sup&gt;b&lt;/sup&gt;</td>
<td>20.77&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>CD (P≤0.05)</td>
<td></td>
<td></td>
<td>1.82</td>
<td>1.32</td>
<td>1.53</td>
<td>1.22</td>
</tr>
</tbody>
</table>

Note:
*All values are an average of three trails
Similar superscripts indicate non-significant (NS) at corresponding critical difference (CD)
T<sub>0</sub> = Control (Whole ghee)
T<sub>1</sub> = Whole ghee replaced by 18% of S<sub>30</sub> fraction of ghee
T<sub>2</sub> = Product was prepared using market ghee

Table 3. Effect of ghee fractionation on the Peroxide value of Unniyappam during storage

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Storage days</th>
<th>Peroxide value (percent)</th>
<th>0&lt;sup&gt;th&lt;/sup&gt;</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt;</th>
<th>6&lt;sup&gt;th&lt;/sup&gt;</th>
<th>9&lt;sup&gt;th&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&lt;sub&gt;0&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>5.14&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.21&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.80&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>4.80&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.20&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>5.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.81&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>CD (P≤0.05)</td>
<td></td>
<td></td>
<td>0.75</td>
<td>0.63</td>
<td>0.61</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Note:
*All values are an average of three trials
Similar superscripts indicate non-significant (NS) at corresponding critical difference (CD)
T<sub>0</sub> = Control (Whole ghee)
T<sub>1</sub> = Whole ghee replaced by 18% of S<sub>30</sub> fraction of ghee
T<sub>2</sub> = Product was prepared using market ghee

Table 4. Effect of ghee fractionation on the Free fatty acid content of Unniyappam during storage

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Storage days</th>
<th>Free fatty acid content (percent oleic acid)</th>
<th>0&lt;sup&gt;th&lt;/sup&gt;</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt;</th>
<th>6&lt;sup&gt;th&lt;/sup&gt;</th>
<th>9&lt;sup&gt;th&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&lt;sub&gt;0&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>1.85&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.93&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.05&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.11&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>1.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.87&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.99&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>1.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.12&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.27&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.35&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>CD (P≤0.05)</td>
<td></td>
<td></td>
<td>1.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.19</td>
<td>0.17</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Note:
*All values are an average of three trials
Similar superscripts indicate non-significant (NS) at corresponding critical difference (CD)
T<sub>0</sub> = Control (Whole ghee)
T<sub>1</sub> = Whole ghee replaced by 18% of S<sub>30</sub> fraction of ghee
T<sub>2</sub> = Product was prepared using market ghee

Effect of ghee fractionation on the Free fatty acid value of Unniyappam during storage

The S<sub>30</sub> fraction incorporated Unniyappam had 1.79 percent oleic acid, whereas the whole Gir ghee Unniyappam had 1.85 and Unniyappam prepared from market Ghee had 1.91 percent oleic acid on the 0<sup>th</sup> day (Table 4). The FFA values increased from the 0<sup>th</sup> day to the 9<sup>th</sup> day for all the varieties however there was no significant difference observed up to the 6<sup>th</sup> day. The FFA of unniyappam made of market ghee showed a significant difference on the 6<sup>th</sup> and 9<sup>th</sup> day whereas there was no significant difference in the S<sub>30</sub> incorporated product.

Effect of storage on Microbiological quality of Unniyappam

Table 5 showed the microbiological quality of the Unniyappam samples. The Total plate count (log<sub>10</sub> cfu/g) for S<sub>30</sub> incorporated unniyappam samples was low compared to the whole gir and market ghee unniyappam.
Table 5. Microbiological quality of Unniyappam after incorporating S30 Fractions

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Total bacterial count (log_{10} cfu/g)</th>
<th>Storage days</th>
<th>0m</th>
<th>3m</th>
<th>6m</th>
<th>9m</th>
<th>12m</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td></td>
<td></td>
<td>2.66a</td>
<td>2.82a</td>
<td>3.01a</td>
<td>3.21a</td>
<td>S</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2.32a</td>
<td>2.57a</td>
<td>2.89a</td>
<td>3.18a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.75a</td>
<td>2.84a</td>
<td>3.15a</td>
<td>3.38a</td>
<td></td>
</tr>
<tr>
<td>CD (P≤0.05)</td>
<td></td>
<td></td>
<td>0.82</td>
<td>0.85</td>
<td>1.14</td>
<td>1.53</td>
<td></td>
</tr>
</tbody>
</table>

Coliform (log_{10} cfu/g)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>S</td>
</tr>
<tr>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>Nil</td>
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<td></td>
</tr>
</tbody>
</table>

Yeast and mold (log_{10} cfu/g)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>1.09a</td>
</tr>
<tr>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>1.01a</td>
</tr>
<tr>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>1.12a</td>
</tr>
<tr>
<td>CD (P≤0.05)</td>
<td></td>
<td></td>
<td>0.10</td>
</tr>
</tbody>
</table>

Note:
*All values are an average of three trails
Similar superscripts indicate non-significant (NS) at corresponding critical difference (CD)
T0 = Control (Whole ghee)
T1 = Whole ghee replaced by 18% of S30 fraction of ghee
T2 = Product was prepared using market ghee
S = Spoiled

(2.32, 2.66, 2.75cfu/g). The results were in good agreement with those reported by Sharma et al., 2010. The coliform count was found nil throughout the study. The yeast and mould count was also within the limits and the unniyappam was rated very good up to nine days of storage at ambient temperature conditions. The good results might have been related to the initial food quality and the good control throughout the storage period. Similar results were also obtained by Yadav et al., 2013.

CONCLUSION

Economic fractionation of milk fat into liquid and solid fat fractions, which differ markedly from one another in chemical composition and physical characteristics, but within the statutory limits of food safety by FSSAI could increase the utilization of milk fat in many food applications. The superiority of utilizing Gir Ghee in Sweet preparation such as and Unniyappam was significant from the sensory evaluation of the products. The Apparent merits of fractionated milk fat in the baking and confectionery sector have encouraged several scientists and efforts were made to incorporate fractions for preparations of Unniyappam. The potential of having a solid fraction for increased textural properties and overall acceptability was identified in both the products. Such initiatives will help to come up with the concept of tailoring milk fat to compete with other fats and oils in meeting the needs of the food industry.

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STATISTICS, Department of animal husbandry, dairying and fisheries, GOI, New Delhi.