Research Article

Storage Study of Danadar Prepared from Cow Milk

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Abstract

Danadar is a chhana based sweets. In this research danadar was prepared from cow milk. The storage study of optimized danadar samples were conducted. During storage, sensory, chemical and microbial analysis were performed. Danadar samples were subjected to sensory evaluation studies at 5 days interval commencing from 1st day of storage period, with a view to assess the shelf life of the product under ambient temperature (30±1°C) and refrigeration temperature (7±1°C). Scores for all the sensory attributes of the prepared cow milk danadar decreased significantly (P<0.05) throughout the storage period. The moisture content of the sample also decreased significantly (P<0.05) with progress of storage period. The titratable acidity (percent lactic acid), free fatty acids (percent oleic acid), and peroxide values of danadar were significantly (P<0.05) higher at the end of storage period from the initial value obtained on 0 day. After 15th and 35th days of storage at ambient temperature (30±1°C) and refrigeration temperature (7±1°C), respectively, danadar samples developed oxidized flavor rendering the product unsuitable for consumption. The total viable, yeast mold, coliform and staphylococcal counts of the samples also increased significantly (P<0.05) as the period of storage advanced. It may be concluded that after 15th and 35th days of storage at ambient and refrigerated temperatures, respectively, all the above mentioned microbial counts in danadar increased to a undesirable level.

Keywords: Danadar, Storage, Ambient, Refrigerated Temperature

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Introduction

Various traditional milk products like rasogolla, gulabjamum, sandesh, burfi, peda, balusahi, danadar, misti dahi, etc. are made in our country since ancient times because of their social, economic, religious, medicinal and cultural affairs. The sweetmeats that are available in the market are mostly chhana-based palatable milk products. In each sphere of life, sweetmeats have occupied a significant place in our society. Sweetmeats have a significant role in our culture. There is no such ceremony or festival which goes without sweetmeats. Among these, danadar occupies a unique place in West Bengal.

Danadar is a popular chhana based sweet of West Bengal. It is characterized by an unorganized nature of business. Indigenous milk products have a big potential of the emerging dairy industry in the organized sector. Danadar is usually sold in spherical form. It is golden in color and has a semi hard to firm body with granular texture. It is boiled in the sugar syrup till golden color develops. Danadar is rolled on sugar granules. It is a classic way for preservation of milk solids. Danadar was originated by Dwarik’s sweet shop of Shyama Pukur Street in Kolkata. The shop used to sell danadar. Dwarik’s sweet shop was set up in 1885. In 1925, it was named as Dwarik Ghosh & Sons Ltd. Finally in 1955, the name became Dwarik Grand Sons.

The problem encountered in the manufacturing and storage of danadar is too many. In view of the influence of processing parameter towards micro structure, texture and flavor of danadar, it is essential that the sensory quality of the product which is one of the most important selling points for any product will be affected adversely by the improper method of processing and storage. In view of its popularity, economic benefits and assured market demands, there is an urgent need to produce danadar of good quality for meeting the FSSAI/Export standards. Restricted shelf-life for most of the desserts is also a major limitation in marketing of these products.
The present investigation is taken up to optimize the process to formulate *danadar* from cow milk. The process for preparation of *danadar* from cow milk was optimized and the final product was stored at ambient temperature (30±1°C) and refrigeration temperature (7±1°C), respectively, to analysed the shelf life at both temperatures.

**Material and Methods**

**Sample collection**

The optimized *danadar* samples were drawn in presterilized plastic pot of the laboratory, Faculty of Dairy Technology, Mohanpur, Nadia. All conical flasks, volumetric flasks, measuring cylinders, pipettes and burettes etc. used were made of *Borosil*.

**Sensory evaluation of danadar**

*Danadar* prepared was subjected to sensory evaluation by a panel of five judges using a 9 point Hedonic scale (*Amerine et al.*, 1965) as shown in Table 1 [1].

Judges evaluated the products with respect to color and appearance, flavor, body and texture and overall acceptability. The scores awarded by the judges were compiled for analysis. All the replicates were carried out 3 times to detect the mean and standard values.

<table>
<thead>
<tr>
<th>Numerical score</th>
<th>Score subjective</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Liked extremely</td>
</tr>
<tr>
<td>8</td>
<td>Liked very much</td>
</tr>
<tr>
<td>7</td>
<td>Liked moderately</td>
</tr>
<tr>
<td>6</td>
<td>Liked slightly</td>
</tr>
<tr>
<td>5</td>
<td>Neither liked nor disliked</td>
</tr>
<tr>
<td>4</td>
<td>Disliked slightly</td>
</tr>
<tr>
<td>3</td>
<td>Disliked moderately</td>
</tr>
<tr>
<td>2</td>
<td>Disliked very much</td>
</tr>
<tr>
<td>1</td>
<td>Disliked extremely</td>
</tr>
</tbody>
</table>

**Chemical analysis**

Representative sample of *danadar* was tested for moisture, fat, protein, carbohydrates and ash. The procedure as described in FSSAI: Part III-sec-1: 356-386(2011) was followed for sampling and analysis [2]. About 50 g of *danadar* was finely ground and kept in capped plastic sample cups at refrigeration temperature (7 ± 1°C) till analysis was completed. The moisture content was determined by the gravimetric method as described in manual of FSSAI (2011). The total fat content was determined by Rose-Gottleib method as described in (ISI 1981), SP: 18 (Part XI). The protein content of *danadar* was estimated by the micro-Kjeldahl method outlines by Jayram (1981)[3]. *Danadar* sample was analyzed for total solid and ash following the method described in IS: 2785 (1979)[4]. The total carbohydrates content was calculated by method of difference. For this purpose total fat, protein, and ash content of the *danadar* was subtracted from total solids.

**Microbiological Examination of Danadar**

The total viable, yeast and mold, coliform and staphylococcus counts in the samples were determined as per the methods suggested in APHA (1984)[5].

**Statistical analysis**

The Data obtained were statistically analyzed.

**Results and Discussion**

The shelf life of *danadar* samples was studied to assess the conditions for storage at ambient temperature (30±1°C) and refrigeration temperature (7±1°C). The following sensory, chemical and microbial changes were observed.
**Sensory changes**

Sensory evaluation plays a vital role not only in product development but also in determining the shelf life of a product. All deteriorative changes *i.e.*, oxidative, lipolytic, proteolysis, browning, acidity development; microbial and textural changes are collectively correlated with sensory quality and thus lead eventually to rejection of the stored product. From the consumers point of view, it is one of the primary characteristics based on which the quality of product is decided.

*Danadar* samples were subjected to sensory evaluation studies at 5 days interval commencing from 1st day of storage period, with a view to asses the shelf life of the product under ambient temperature (30±1°C) and refrigeration temperature (7±1°C). The color and appearance, flavor, body and texture and overall acceptability scores on Nine Point Hedonic scale were evaluated by judges independently. Whatever the changes in sensory scores of *danadar* at ambient and refrigerated temperatures were obtained, are presented in **Table 2**.

**Table 2** Effect of storage at ambient and refrigerated temperatures on sensory attributes of cow milk *danadar*

<table>
<thead>
<tr>
<th>Storage Day</th>
<th>Color &amp; appearance</th>
<th>Flavor</th>
<th>Body &amp; texture</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ambient temperature</td>
<td>Refrigerated temperature</td>
<td>Ambient temperature</td>
<td>Refrigerated temperature</td>
</tr>
<tr>
<td>0</td>
<td>8.27±0.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.27±0.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.47±0.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.47±0.03&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>7.43±0.03&lt;sup&gt;Bb&lt;/sup&gt;</td>
<td>8.33±0.03&lt;sup&gt;Bb&lt;/sup&gt;</td>
<td>7.67±0.12&lt;sup&gt;Bb&lt;/sup&gt;</td>
<td>8.10±0.06&lt;sup&gt;Ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>10</td>
<td>6.60±0.21&lt;sup&gt;Bc&lt;/sup&gt;</td>
<td>7.65±0.03&lt;sup&gt;Bc&lt;/sup&gt;</td>
<td>6.10±0.06&lt;sup&gt;Bc&lt;/sup&gt;</td>
<td>7.80±0.06&lt;sup&gt;Ac&lt;/sup&gt;</td>
</tr>
<tr>
<td>15</td>
<td>5.53±0.05&lt;sup&gt;Bd&lt;/sup&gt;</td>
<td>7.45±0.03&lt;sup&gt;Bd&lt;/sup&gt;</td>
<td>5.40±0.06&lt;sup&gt;Bd&lt;/sup&gt;</td>
<td>7.45±0.03&lt;sup&gt;Bd&lt;/sup&gt;</td>
</tr>
<tr>
<td>20</td>
<td>6.67±0.09&lt;sup&gt;d&lt;/sup&gt;</td>
<td>6.95±0.03&lt;sup&gt;e&lt;/sup&gt;</td>
<td>6.73±0.06&lt;sup&gt;e&lt;/sup&gt;</td>
<td>6.73±0.06&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>25</td>
<td>5.65±0.03&lt;sup&gt;e&lt;/sup&gt;</td>
<td>6.10±0.06&lt;sup&gt;f&lt;/sup&gt;</td>
<td>5.82±0.04&lt;sup&gt;f&lt;/sup&gt;</td>
<td>5.82±0.04&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>30</td>
<td>5.10±0.06&lt;sup&gt;i&lt;/sup&gt;</td>
<td>5.27±0.12&lt;sup&gt;g&lt;/sup&gt;</td>
<td>5.35±0.03&lt;sup&gt;g&lt;/sup&gt;</td>
<td>5.35±0.03&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>35</td>
<td>4.62±0.04&lt;sup&gt;g&lt;/sup&gt;</td>
<td>4.80±0.03&lt;sup&gt;h&lt;/sup&gt;</td>
<td>4.83±0.04&lt;sup&gt;h&lt;/sup&gt;</td>
<td>4.83±0.04&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Superscript letters a,b,…,h: means ± SE with different superscript within a column differ significantly (P<0.05)

Superscript letters A,B: means ± SE with different superscript within a row differ significantly (P<0.05)

**Color and appearance**

The Table 2 and Figure 1 indicates the color and appearance scores of *danadar* samples stored at ambient and refrigerated temperatures. The color and appearance score of *danadar* was initially higher. As the storage period increased, cow milk *danadar* stored at 30°C showed a rapid increase in browning index, resulting in lower final score. The initial color and appearance score of *danadar* was 8.27±0.13 at both ambient and refrigerated temperature, which decreased to 5.53±0.03 and 4.62±0.04 in 15<sup>th</sup> and 35<sup>th</sup> days of storage, respectively. The color turned to dull and yellow along with the slime formation and mold growth on the surface.

![Color & Appearance](image-url)
The final score declined to a minimum extent after 15th and 35th days, respectively at ambient and refrigerated conditions, after which they were declared unacceptable by the panel of judges. Color and appearance score for cow milk danadar decreased significantly (P<0.05) throughout the storage period as shown in Table 2.

**Flavor**

The changes in flavor score of danadar samples prepared from cow milk during storage are presented in Table 2 and expressed in Figure 2. It is evident from table that; danadar stored at refrigerated temperature had a better flavor score than at ambient temperature. The flavor score of the danadar prepared from cow milk decreases with increase in storage periods. The deterioration was faster at 30°C than at 7°C, indicating a significant increase in the free fatty acids resulting concomitant increase in peroxide value so as flavor score during storage. The pleasant flavor of danadar, stored at ambient temperature turned acidic and foul smell at the end of 15th days while for refrigerated condition 35th days, respectively. The study further revealed that the decline in flavor score was due to the production of rancid flavor and bitter taste along with some other off flavor reached to an extreme level in 35th days of storage after which the refrigerated danadar samples were declared unacceptable by the judges.

![Figure 2](image_url)

**Figure 2** Effect of storage on flavor at ambient and refrigerated temperature

During storage, danadar undergoes various sensory, chemical and microbial changes which tend to affect the taste and smell of the product. The initial flavor score of danadar was 8.47±0.03 at both ambient and refrigerated temperature and decreased to 5.40±0.06 and 4.80±0.03 in 15th and 35th days of storage, respectively. Flavor score for cow milk danadar decreased significantly (P<0.05) throughout the storage period as shown in Table 2.

**Body and Texture**

Table 2 and Figure 3 depicts that the body and texture score of danadar decreases with the increase in storage period, probably due to evaporation of moisture during storage. The decrease in the body and texture score was more in the sample stored at 30°C than that of the samples stored at 7°C. The body and texture of spoiled danadar was described as sandy, hard, coarse, gritty and dry surface towards the end of storage.

The initial body and texture score of danadar was 8.93±0.03 at both ambient and refrigerated temperatures, which decreased to 5.23±0.12 and 4.83±0.04 on 15th and 35th days of storage, respectively. The body and texture scores of danadar declined with the advancement of storage period regardless whether it was stored at ambient or refrigeration temperature. The body and texture scores were also decreased significantly (P<0.05) with storage as shown in Table 2.
Overall acceptability

Tables 2 and Figure 4 depicts that the overall acceptability score of danadar decreases gradually with the increase in storage period, probably due to expulsion of moisture during storage, development of acidity, oxidation of fat and growth of microorganism.

A higher reduction of the score was observed in the samples stored at 30°C, whereas a lower reduction was found at refrigerated temperature. The initial overall acceptability score of danadar was 8.47±0.03 at both ambient and refrigerated temperatures decreased to 5.10±0.10 and 4.38±0.06 on 15th and 35th days of storage, respectively. The overall acceptability scores decreased with the increase in storage, regardless of temperature. The overall acceptability scores were also decreased significantly (P<0.05) with storage as shown in Table 2.

Chemical changes

The chemical analysis of danadar samples stored at ambient and refrigerated temperatures were performed in laboratory and their chemical profiles such as moisture, titratable acidity, free fatty acids and peroxide value (PV) are placed in Table 3 and discussed hereunder.
Table 3 Effect of storage at ambient and refrigerated temperatures on chemical attributes of cow milk danadar

<table>
<thead>
<tr>
<th>Storage Day</th>
<th>Moisture (%)</th>
<th>Free fatty acid (% Oleic acid)</th>
<th>Titratable acidity (% LA)</th>
<th>Peroxide value (mmol/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ambient temp</td>
<td>Refrigerated temp</td>
<td>Ambient temp</td>
<td>Refrigerated temp</td>
</tr>
<tr>
<td>0</td>
<td>29.83±0.44</td>
<td>29.83±0.44</td>
<td>5.10±0.01</td>
<td>5.10±0.01</td>
</tr>
<tr>
<td>5</td>
<td>26.33±0.17</td>
<td>28.50±0.29</td>
<td>5.22±0.01</td>
<td>5.15±0.01</td>
</tr>
<tr>
<td>10</td>
<td>23.00±0.29</td>
<td>27.50±0.29</td>
<td>5.45±0.01</td>
<td>5.25±0.01</td>
</tr>
<tr>
<td>15</td>
<td>19.83±0.44</td>
<td>26.50±0.50</td>
<td>5.67±0.07</td>
<td>5.28±0.02</td>
</tr>
<tr>
<td>20</td>
<td>25.50±0.29</td>
<td>5.42±0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>24.17±0.17</td>
<td>5.55±0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>23.83±0.44</td>
<td>5.62±0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>20.83±0.44</td>
<td>5.75±0.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a,b,...,h: means ± SE with different superscript within a column differ significantly (P<0.05)
A,B: means ± SE with different superscript within a row differ significantly (P<0.05)

Moisture

The changes in moisture content of danadar samples from cow milk during storage are presented in Table 3 and Figure 5. It is evident from the table that danadar stored at refrigerated temperature had a better shelf-life than that at ambient temperature. In the sample, as expected the moisture decreased to 19.83±0.44 and 20.83±0.44 at ambient and refrigerated temperatures, respectively. After 15th and 35th days the samples became hard at ambient and refrigerated temperatures, respectively and became unacceptable for testing. The moisture content scores were also decreased significantly (P<0.05) with storage as shown in Table 3. Thus, it can be suggested that the danadar from cow milk can be stored for 15th days at ambient temperature and 35th days at refrigerated temperature.

![Moisture content (%)](image)

Figure 5 Effect of storage on moisture at ambient and refrigerated temperature

Titratable acidity (as % lactic acid)

The changes in titratable acidity of danadar prepared from cow milk during storage are shown in Table 3 and Figure 6. The table indicates that the refrigerated samples could be stored for longer period than that at ambient temperature. The TA for cow milk danadar samples were increased to 0.12±0.014 and 0.13±0.003 at ambient and refrigerated temperatures in 15th and 35th days, respectively. The initial count 0.07±0.002 of danadar prepared from cow milk increased to 0.12±0.014 on 15th day at ambient temperature. Similar trend but at a lower rate was observed in the refrigerated temperature. The refrigerated samples registered less increase than at ambient temperature. The TA was also increased significantly (P<0.05) with storage as shown in Table 3. Thus, it may be concluded that after 15th and 35th days of storage at ambient and refrigerated temperatures, respectively danadar develops acidic flavor which makes the product unsuitable for consumption. Sen and Rajorhia (1990) also reported significant increase in acidity of full fat soft grade sandesh during storage [6].
According to Amarita et al. (2001) significant increase in acidity may be due to the conversion of lactose and other sugars present in milk to lactic acid and other acids by starter culture [7].

**Figure 6** Effect of storage on titratable acidity at ambient and refrigerated temperature

**Free Fatty acids (as % oleic acid)**

The changes in free fatty acids content of *danadar* prepared from cow milk during storage are illustrated in Table 3 and Figure 7. Results reveals that FFA content of *danadar* stored at ambient temperature increased more sharply than that at refrigerated temperature. The FFA content was 5.10±0.01 on first day at both ambient and refrigerated temperatures, which gradually increases to 5.67±0.07 and 5.75±0.00 on 15th and 35th days, respectively at ambient and refrigerated temperatures, respectively.

The results indicate that the FFA content of *danadar* increased with increase in storage periods irrespective of temperature. The FFA were also increased significantly (P<0.05) with storage as shown in Table 3.

**Figure 7** Effect of storage on Free fatty acid at ambient and refrigerated temperature

**Peroxide value**

Peroxide value (PV) is a measure for autoxidation of lipids in the food system. The higher PV signifies a greater accumulation of oxidative product as a result of progressive oxidation. Therefore, with a view to evaluate the oxidative deterioration during processing and storage, the PV of samples was determined. The changes in PV of
Danadar prepared from cow milk during storage are shown in Table 3. The fresh sample had initial PV value of 0.07±0.003 which increased to 0.55±0.007 and 1.07±0.009 at the end of 15<sup>th</sup> and 35<sup>th</sup> days, when stored at ambient and refrigerated temperatures, respectively. From the view point of keeping quality of danadar, it can be concluded that storage at refrigerated temperature produced better results than that of ambient temperature. The peroxide values were increased significantly (p<0.05) with storage as shown in Table 3 and Figure 8. Thus, it may be concluded that after 15<sup>th</sup> and 35<sup>th</sup> days of storage at ambient and refrigerated temperature, respectively; danadar develops oxidized flavor which makes the product unsuitable for consumption.

**Microbiological changes**

The microbiological quality of danadar samples indicates towards the hygienic practices that were adopted during production of milk, preparation of danadar and storage. The ANOVA data are presented in Table 4.

![Figure 8 Effect of storage on Peroxide value at ambient and refrigerated temperature](image)

**Table 4** Effect of storage at ambient and refrigerated temperatures on microbiological attributes of cow milk danadar

<table>
<thead>
<tr>
<th>Storage Day</th>
<th>Total viable count (log cfu/g)</th>
<th>Yeast and mold count (log cfu/g)</th>
<th>Coliform count (log cfu/g)</th>
<th>Staphylococcus count (log cfu/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ambient temperature</td>
<td>Refrigerated temperature</td>
<td>Ambient temperature</td>
<td>Refrigerated temperature</td>
</tr>
<tr>
<td>0</td>
<td>2.10±0.006&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.10±0.006&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.18 ± 0.009&lt;sup&gt;h&lt;/sup&gt;</td>
<td>0.00 ± 0.000&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>2.40±0.012&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.27±0.015&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.50 ± 0.009&lt;sup&gt;ac&lt;/sup&gt;</td>
<td>0.33 ± 0.019&lt;sup&gt;bg&lt;/sup&gt;</td>
</tr>
<tr>
<td>10</td>
<td>2.67±0.015&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.39±0.007&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.89 ± 0.012&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.58 ± 0.012&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>15</td>
<td>3.18±0.027&lt;sup&gt;Aa&lt;/sup&gt;</td>
<td>2.64±0.021&lt;sup&gt;Be&lt;/sup&gt;</td>
<td>2.15 ± 0.009&lt;sup&gt;ak&lt;/sup&gt;</td>
<td>0.89 ± 0.009&lt;sup&gt;Be&lt;/sup&gt;</td>
</tr>
<tr>
<td>20</td>
<td>2.79±0.009&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td>1.76 ± 0.007&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.55 ± 0.015&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>25</td>
<td>2.97±0.015&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td>1.89 ± 0.012&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.68 ± 0.015&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>30</td>
<td>3.10±0.006&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>2.14 ± 0.019&lt;sup&gt;b&lt;/sup&gt;</td>
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</tr>
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<td>35</td>
<td>3.28±0.015&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>1.12 ± 0.009&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

a,b,…,h: means ± SE with different superscript within a column differ significantly (P<0.05)
A,B: means±SE with different superscript within a row differ significantly (P<0.05)

**Figure 8 Effect of storage on Peroxide value at ambient and refrigerated temperature**

**Total viable count**

A Table 4 and Figure 9 indicates the TVC data and indicates that it increases with the increase in storage period at both ambient and refrigeration temperatures. TVC of optimized danadar was found to be acceptable up to 15<sup>th</sup> and
35th days, stored at ambient temperature and refrigerated temperatures, respectively. The fresh sample had initial TVC were 2.10 ± 0.006 and 2.10 ± 0.006 which increases to 3.18 ± 0.027 and 3.28 ± 0.015 at the end of 15th and 35th days when stored at ambient and refrigerated temperature, respectively.

![Figure 9](image)

**Figure 9** Effect of storage on total viable count at ambient and refrigerated temperature

The TVC were also increased significantly (P<0.05) with storage as shown in Table 4. Thus, it may be concluded that after 15th and 35th days of storage at ambient and refrigerated temperature, respectively the TVC increase in danadar up to upper limits, which make unsuitable for consumption. The increase of TVC in rasogolla is reported by Singh et al. (2007)[8], but was in contrast with those reported by Arora et al. (1996)[9]. Prabha (2006), reported that significant increase in total viable count during storage of dietetic burfi [10]. Sen and Rajorhia (1990) reported that increase in sugar level of sandesh reduces microbial proliferation in the product. They observed that as sugar level was increased, standard plate count significantly decreased.

### Yeast and Mold count

Table 4 and Figure 10 depict the yeast and mold count of danadar. The count increases with the progress of storage. The fresh sample had initial yeast and mold count was 1.18 ± 0.009 which increases to 2.15 ± 0.009 and 2.25 ± 0.012 at the end of 15th and 35th days when stored at ambient and refrigerated temperatures, respectively. The increase in yeast and mold count was slow at refrigerated temperature but after 35th days it became unacceptable on sensory basis. The yeast and mold counts were also increased significantly (P<0.05) with storage as shown in Table 4. Such increase of yeast and mold in rasogolla was also reported by Singh et al. (2007) [8]. Fleet (1990) and Rohm et al. (1992) stated that low pH of yogurt and fermented milk provides a selective environment for the growth of yeast [8, 11,12]. It was reported that the low pH, nutritional profile, surface moisture, presence of lactic acid, peptides and amino acids helps in rapid growth of yeast in cheese (Ledenbach and Marshall, 2009). The presence of oxygen and low pH favors the growth of mold (Ledenbach and Marshall, 2009) [13].

### Coliform count

From Table 4 and Figure 11, it was observed that danadar samples were found to be acceptable up to 15th and 35th days, stored at ambient and refrigerated temperatures. The initial coliform count was absent in freshly prepared danadar which increases to 0.89 ± 0.009 and 1.12 ± 0.009 at the end of 15th and 35th days, when stored at ambient and refrigerated temperatures, respectively. Coliform count at both ambient and refrigerated temperatures was found to increase with the increase in storage period. Coliform score of optimized danadar stored at refrigerated temperature was found to be acceptable up to 35th days as compared to 15th days stored at ambient temperature. The coliform counts were also increased significantly (P<0.05) with storage as shown in Table 4.
From Table 4 and Figure 12, it was found that the Staphylococcus count at both ambient and refrigerated temperatures was found to increase with the increase in storage period. The staphylococcus count was absent in freshly prepared danadar from cow milk, which increased to 0.94 ± 0.006 and 0.98 ± 0.012 at the end of 15th and 35th days when stored at ambient and refrigerated temperatures, respectively. Staphylococcus count of optimized danadar stored at refrigerated temperature was found to be acceptable up to 35th days as compared to 15th days for danadar stored at ambient temperature. The staphylococcus counts were also increased significantly (P<0.05) with storage both at ambient and refrigerated temperatures as shown in Table 4. Bhattacharya and Desraj (1980a) and Soni et al. (1980) recommended refrigerated temperature which ranged from 4-6°C and 8-12°C for storage of rasogolla prepared from cow and buffalo milk respectively [14,15]. Few others suggested storage at room temperature for both cow and buffalo milk rasogolla (Kundu and De, 1972 and De, 1980)[16,17].
Figure 12 Effect of storage on staphylococcus count at ambient and refrigerated temperature

Conclusion

Scores for all the sensory attributes of the prepared cow milk danadar decreased significantly (P<0.05) throughout the storage period. The moisture content of the sample also decreased significantly (P<0.05) with progress of storage period. The titratable acidity (percent lactic acid), free fatty acids (percent oleic acid), and peroxide values of danadar were significantly (P<0.05) higher at the end of storage period from the initial value obtained on 0 day. After 15th and 35th days of storage at ambient and refrigerated temperatures, respectively, danadar samples developed oxidized flavor rendering the product unsuitable for consumption.

The total viable, yeast mold, coliform and staphylococcal counts of the samples also increased significantly (P<0.05) as the period of storage advanced. It may be concluded that after 15th and 35th days of storage at ambient and refrigerated temperatures, respectively, all the above mentioned microbial counts in danadar increased to a level which made the product unsuitable for consumption.

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References


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