Study on Sensory Qualities of Skimmed milk after treatment at various temperatures

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Abstract:
In present study the sensory characteristics of various heat treated skimmed milk were analyzed at Department of Dairy Technology, Faculty of Animal Husbandry & Veterinary Sciences, Sindh Agriculture University Tandojam-Pakistan. The skimmed milk was produced from buffalo milk through cream separator and then divided into four groups i.e A, B, C and D. The group A was kept as untreated (control) and B, C, D (treated at 60°C for few sec (Thermization), 65°C for 30 min (Pasteurization), 110°C for 10 min (Sterilization), respectively). The sensory attributes such as appearance/color, taste/flavor and body/texture scores were analyzed. Results obtained revealed that Appearance/color of pasteurized and sterilized skimmed milk was not acceptable compared to thermizide and control skimmed milk. Sterilization process improved the taste/flavor and body/texture of skimmed milk. The present study concludes that the taste/flavor of skimmed milk was remarkably (P<0.05) improved with the use of sterilization process.

Key Words: Skimmed milk, Thermization, pasteurization, Sterilization

Introduction
Milk is known as a complete diet, providing the primary source of nutrition for young mammals before they are able to digest other types of food and composed of various essential components including protein, lactose, fat, minerals and vitamins etc. It is used as whole milk or as milk products including cheese, yoghurt, butter, Ice cream etc. The exact components of raw milk vary by species (Athar et al., 2003). Skimmed milk is the processed milk obtained by skimming of milk through cream separator, containing low fat content as compared to whole milk. The primary objective to make the skimmed milk is to reduce its fat contents thus it can be easily utilized by everyone (Sangwan, 2008). Skimmed milk is used in many food products like cheese, flavored beverages, cakes and breads etc. It is also an excellent alternative for those peoples who are conscious of intaking fat in their diets (Mulvihill and Ennis, 2003).

Heat treatment is one of a common preservation method, employed to ensure microbiological safety, but in cases where milk and its products are used as food ingredients, heat treatment is employed to improve the Organoleptic properties of such dairy formulations (Del Angel & Dalgleish, 2006). The main objectives of heat treatment is to improve the keeping qualities by inactivating the enzymes and unwanted microbes which may results in spoilage of the products.

Sensory evaluation is regarded as a test for evaluation as well as acceptance of milk and its products by consumers. It cannot determine the quantity of various components of the product but the products are evaluated through color, consistency, texture and odor etc. Thus sensory evaluation helps to provide the processors and producers with a guide to consumer acceptance for the products. Whole and low fat milk or skimmed milk can be characterized by three characteristics: appearance, texture, and flavor. Appearance is characterized as whiteness, yellowness, glossiness, and transparency of the liquid milk. Flavor descriptions include astringent, bitter, cooked, oxidized, salty, buttery, and sweet. Texture would be the measure of viscosity or mouth feel of the sample. Descriptors applied to texture characteristics included fat, heavy, watery and light (Phillips et al., 1995; Saba et al., 1998). Keeping the above views in mind, present study has been planned to observe the effects of various heat treatments including pasteurization, sterilization and thermization of skimmed milk, and observe their effects on sensory characteristics of treated skimmed milk.
Material and Methods

Milk Sample
Fresh Buffalo milk obtained from a Dairy farm of nearby locality, was used during present investigation

Equipments/Utensils
1. Hot Air Oven
Hot air oven (Memmert 854, Schawabch W. Germany) was used during determination of moisture content of various heat treated and untreated (control) skimmed milk samples.

2. Analytical balance
Analytical balance (Adam, Model No. AAA 2502) was used to take weight of samples and chemicals during analysis.

3. Cream separator
Cream separator (Domo, Sweden) was used for skimming or separation of cream from whole buffalo milk.

4. Water bath
Water bath was used to process the skimmed milk samples for thermization (60°C for few sec), pasteurization (65°C for 30 min) and sterilization (110°C for 10 min).

Experimental procedure
Present study was conducted to observe the influence of various heat treatments on sensory characteristics of skimmed milk. The whole buffalo milk (1L) collected from a Dairy farm of nearby locality, was brought to the Department of Dairy Technology, Faculty of Animal Husbandry & Veterinary Sciences, Sindh Agricultural University Tandojam–Pakistan. A flow chart of experimental procedure is shown in figure-1. As soon as the milk was received it was filtered through muslin cloth and volume was measured. Then it was pre-heated to 40°C and transferred to the supply tank of cream separator for skimming. After skimming, the milk was measured into four equal parts and accredited with A, B, C and D codes. The samples of skimmed milk coded with B, C and D were heated at temperatures of 60°C for few sec (Thermization), 65°C for 30 min (Pasteurization) and 110°C for 10 min (Sterilization), respectively. While sample coded with A was kept as non-heated (Control) for comparison purpose. A total of six trials each in duplicate batches were conducted and analyzed for sensory characteristics like appearance/color, flavor/odor and body/texture.
Analysis of sensory characteristics

Sensory characteristics of thermizide, pasteurized, sterilized and un-treated (control) skimmed milk was analyzed according to the method as reported by Nelson and Trout (1981). A panel of five expert judges was selected and the samples were offered for evaluation. The score was rated on hedonic scale of 10 for appearance/color, 45 for taste/flavor and 30 for body/texture.

Statistical Analysis

The data was analyzed according to statistical procedure of analysis of variance (ANOVA), and in case of significant differences, the mean were further computed using least significant difference (LSD) at 5% level of probability through computerized statistical package i.e, Student Edition of Statistics (SXW), version 8.1 (Copyright 2005, Analytical software, USA).

Results

Effect of heat treatments on sensory quality of skimmed milk

1. Appearance/color

The appearance/color score of heat treated and untreated (control) milk was evaluated by judges and score perceived is shown in Figure-2 and Appendix-I and II. Results reveal that no remarkable (P>0.05) influence of thermization process was on appearance/color of skimmed milk. The score rated for thermizide skimmed milk (7.7) was not significantly different from that of control skimmed milk (8.00). Moreover, pasteurization and sterilization processes revealed statistically comparable (P<0.05) results. Regardless, the score rated for pasteurized and sterilized skimmed milk was relatively similar (P>0.05), the score rated for untreated (control) skimmed milk was comparatively (P<0.05) higher than that of pasteurized and sterilized skimmed milk.

![Appearance/color (score) of thermizide, pasteurized, sterilized and control skimmed milk](image)

LSD (0.05) = 0.3477
SE± = 0.1667

2. Taste/flavor

The taste/flavor perception scores of various heat treated and untreated (control) milk was evaluated by judges and score perceived is presented in Figure-3 and Appendix I and II. The taste/flavor score was improved in heat treated skimmed milk compared to un-treated (control) skimmed milk35 to 36 to untreated (control) skimmed milk samples.
It was noticed that the heat treated (thermizide, pasteurized and sterilized) skimmed milk samples received better taste/flavor scores (i.e. 38.70±0.54, 39.00±0.63 and 40.33±0.33, respectively) compared to that of un-treated skimmed milk (35.33±0.21). Moreover, LSD (0.05) comparison of means revealed that thermization and pasteurization processes has similar influence (P>0.05) on taste/flavor score of skimmed milk, while sterilization process perceived better score for taste/flavor among both these processes.

![Graph of Taste/Flavor (score) of thermizide, pasteurized, sterilized and control skimmed milk](image)

LSD (0.05) = 1.3193  
SE± = 0.6325  

**Figure-3**  
Taste/flavor (score) of thermizide, pasteurized, sterilized and control skimmed milk

3. **Body/texture**

The body/texture scores of heat treated and un-treated (control) milk was evaluated by judges and rated score is shown in Figure-4 and Appendix-I and II. The body/texture score was improved with thermization, pasteurization and sterilization processes. Control skimmed milk received an average score (22.17±0.17) from total of 30. The score was enhanced to (23.33±0.33) in thermized skimmed milk, (25.33±0.21), in pasteurized and (26.33±0.33) in sterilized skimmed milk samples.

![Graph of Body/texture (score) of thermizide, pasteurized, sterilized and control skimmed milk](image)

LSD (0.05) = 0.8004  
SE± = 0.3837
Figure-4  Body/texture (score) of thermizide, pasteurized, sterilized and control skimmed milk

Discussion
Heat treatment of milk is a procedure to increase the keeping quality of milk by destroying the pathogenic organisms and make it safe for human consumption without markedly affecting the composition of milk. With reference to sensory characteristics of milk, the present study was planned to evaluate the effects of various temperatures on sensory quality of skimmed milk. The overall acceptability was increased with increase of temperature in treated skimmed milk samples as compared to untreated samples in present study. These findings are in contrast to the results of Husaain (2011), who reported that changes in temperature adversely affected the scores for taste, appearance and body of skimmed milk. He further reported that the changes in Organoleptic (Sensory) properties of skimmed milk could be occurred due to proteolysis process, lactose degradation, millard reaction etc. which is much faster in samples treated above 100°C and results in changing the color and flavor of milk samples. Present results are also in cross with the findings by Petrus et al. (2011), who concluded that temperatures ranged from 72 to 94°C/ 15 seconds has no effects on sensory characteristics of milk.

References


APPENDICES

Appendix-I  Descriptive statistics for sensory characteristics of thermizide, pasteurized, sterilized and control skimmed milk.

<table>
<thead>
<tr>
<th>Sensory Characteristics</th>
<th>Variance</th>
<th>Control skimmed milk</th>
<th>Thermizide skimmed milk</th>
<th>Pasteurized skimmed milk</th>
<th>Sterilized skimmed milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance/Color</td>
<td>Minimum</td>
<td>8.00</td>
<td>7.00</td>
<td>7.00</td>
<td>7.00</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
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<td>8.00</td>
<td>7.50</td>
<td>7.00</td>
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<td>Source</td>
<td>DF</td>
<td>SS</td>
<td>MS</td>
<td>F</td>
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<td>-------------------</td>
<td>---------</td>
<td>-----</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Appearance</strong></td>
<td>Between</td>
<td>3</td>
<td>3.791</td>
<td>1.263</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>Within</td>
<td>20</td>
<td>1.666</td>
<td>0.083</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>23</td>
<td>5.458</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Flavor/Taste</strong></td>
<td>Between</td>
<td>3</td>
<td>81.33</td>
<td>27.111</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>Within</td>
<td>20</td>
<td>24.00</td>
<td>1.200</td>
<td>-</td>
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<tr>
<td></td>
<td>Total</td>
<td>23</td>
<td>105.33</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Body/Texture</strong></td>
<td>Between</td>
<td>3</td>
<td>64.125</td>
<td>21.376</td>
<td>48.4</td>
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<tr>
<td></td>
<td>Within</td>
<td>20</td>
<td>8.833</td>
<td>0.441</td>
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<tr>
<td></td>
<td>Total</td>
<td>23</td>
<td>72.95</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Appendix - II

One-way analyses of variance (ANOVA) for sensory characteristics of thermizide, pasteurized, sterilized and control skimmed milk.