Effect of different levels of sweet potato paste on physico-chemical properties of kheer

A.V. Dadge*, B. M. Thombre, S.G. Narwade, B. N. Thorat and H. B. Awaz

Department of Animal Husbandry and Dairy Science, Vasantrao Naik Marathwada Krishi Vidyapeeth, College of Agriculture, Parbhani-431 402, India.

Received: 26-02-2015 Accepted: 11-09-2015 DOI: 10.18805/ajdfr.v34i4.6877

ABSTRACT

Kheer is sweetened dish of rice cooked in milk first finds mention as ‘Payas’. Sweet potato kheer was prepared from different levels of sweet potato paste viz. 2.5, 5.0 and 7.5 per cent on the basis of buffalo milk. Control kheer was prepared using 2.5 per cent rice in buffalo milk. The parameters considered for the present study were pH, viscosity, moisture, fat, protein, total solids and ash. The result showed that control kheer was significantly superior over kheer prepared from 2.5% sweet potato. PH was decreasing as the level of sweet potato paste increases. On the contrary as the level of sweet potato increased the viscosity also increased significantly. The moisture content of sweet potato kheer decreased as the level of sweet potato increased. As fat was concerned as the level of sweet potato increased the fat decreased with non significant effect. Similarly slight protein was also increased. However carbohydrate, total solids and ash content of kheer increased as the level of sweet potato increased with non-significant effect. The total solid, carbohydrate and ash content of sweet potato kheer increases whereas moisture and fat decreased as the level sweet potato increased. This might be due to higher carbohydrate and lower moisture content in sweet potato as compared to milk.

Key word: Kheer, Physico-chemical properties, Sweet potato.

INTRODUCTION

India is the largest milk producer in the world with a recorded production level of 132.43 million metric tonnes during 2012-13 which is increased by 5 per cent over the previous year and per capita availability of milk in India is 312 g/day. Maharashtra contributes significantly by contributing 87.69 lakh metric tonnes and per capita availability of milk is 223 g /day (NDDB Statistics, 2013). Practices of converting milk into various milk products as kheer, pedha, burfi, ghee, butter, dahi, and ice-cream etc. has been developed. The Indian milk production system was getting a pull according to the demand of the segmentised milk products market.

Kheer is sweetened dish of rice cooked in milk and a very delicious cereal based indigenous milk product. It is popular throughout the country and is enjoyed by all sections of the society because of its good taste, high nutritional values and relatively low cost. It is prepared by partial dehydration of whole milk in a karahi over direct fire together with sugar and rice or occasionally semolina, coconut, pistachio, cashew nut, almonds, saffron and cardamom (Patel and Singh 2002). Hence taking into consideration the medicinal and nutritional value of sweet potato, it was therefore decided to undertake the research project on “Effect of different levels of sweet potato paste on physico-chemical properties of Kheer with the following objectives

1) To standardized the process of preparation of sweet potato kheer.
2) To study the physico-chemical properties of sweet potato kheer.

MATERIALS AND METHODS

Materials: Whole, fresh, clean buffalo milk, sweet potato, sugar, a good quality cleaned rice, cardamom, karahi.

Methods: Treatment combinations: For the preparation of sweet potato kheer, the following treatment combinations were taken for study.

\[ T_0 = 97.5 \text{ Parts of buffalo milk + 2.5 parts of rice} \]
\[ T_1 = 97.5 \text{ Parts of buffalo milk + 2.5 parts of sweet potato paste} \]
\[ T_2 = 95.0 \text{ Parts of buffalo milk + 5.0 parts of sweet potato paste} \]
\[ T_3 = 92.5 \text{ Parts of buffalo milk + 7.5 parts of sweet potato paste} \]

*Corresponding author’ e-mail: amitdadge42@gmail.com.
The flow diagram for manufacture of *Kheer* is given below (Fig 1)

---

**Determination of acid:** The pH of sweet potato *kheer* was measured by using digital pH meter at a temperature of 25°C. The pH of the *kheer* was measured by using Brooke Field Visco-meter.

**Determination of viscosity:** Viscosity of the sweet potato *kheer* was measured by using Brooke Field Visco-meter.

**Chemical quality**

**Determination of moisture:** Moisture content of sweet potato *kheer* was determined according to methods described in IS:1224 (part II) 1981. The moisture content was calculated by using formula given below

\[
\text{Moisture \% (by weight)} = \frac{\text{Loss in weight of *kheer*}}{\text{Weight of *kheer* sample taken}} \times 100
\]

**Determination of fat:** Fat content of *kheer* samples was determined by Gerber’s method described in IS:1224 (part II) 1981. The fat content was calculated by using formula given below

**Determination of carbohydrate:** Carbohydrate content was estimated by subtraction method i.e. Carbohydrate = Total solids - (fat + protein + ash).

**Determination of ash:** The total ash content of *kheer* sample was determined by method given by IS 1479 part II : (1961). The total ash was calculated by following formula

\[
\text{Total ash \% (by weight)} = \frac{W_1 - W}{W_2 - W} \times 100
\]

Where,

- \( W \) = weight of the empty crucible
- \( W_1 \) = weight of the crucible with ash
- \( W_2 \) = Weight of the crucible with sample in gram

**Determination of total solids:** Total solids was determined as per IS 1479 (Part-II) 1961 procedure.

\[
\text{Weight of residue} = \frac{\text{Weight of sample}}{\text{Weight of sample} - \text{Weight of residue}} \times 100
\]

**Statistical Analysis:** The statistical analysis is done by using completely randomized block design as described by Panse and Sukhatme (1967).

**RESULTS AND DISCUSSION**

**Physico-chemical analysis of finished product:** Physico-chemical properties includes pH, viscosity, moisture, fat, protein, carbohydrate, ash and total solid. The results obtained on account of these parameter are presented in forthcoming tables.

The above Table 1 indicates that the average pH of sweet potato *kheer* as 7.04, 6.75, 6.67 and 6.55 for treatment \( T_0 \), \( T_1 \), \( T_2 \) and \( T_3 \) respectively. Treatment \( T_0 \) with \( T_1 \), and treatment \( T_2 \) and \( T_3 \) were significant with each other. Whereas \( T_1 \) and \( T_2 \) were non significant. It was also observed that as the quantity of sweet potato paste in the buffalo milk increased, the pH of the *kheer* was decreased.

Kothule (1990) studied physical properties and packaging studies on *kheer* from vermicelli and reported the pH as 6.26 to 6.43. Patel *et al.* (2011) developed the process for manufacture of long life dairy dessert *kheer* and reported the pH as 6.04 to 6.10. Jha *et al.* (2012) development of processed for shelf stable dairy dessert *dalia* and its physic-chemical properties and reported that the pH content of processed *dalia* dessert was from 6.39 to 6.50.

**TABLE 1:** pH of sweet potato *kheer*

<table>
<thead>
<tr>
<th>Treatment</th>
<th>( R_1 )</th>
<th>( R_2 )</th>
<th>( R_3 )</th>
<th>( R_4 )</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>( T_0 )</td>
<td>7.0</td>
<td>7.10</td>
<td>7.05</td>
<td>7.0</td>
<td>7.04</td>
</tr>
<tr>
<td>( T_1 )</td>
<td>6.72</td>
<td>6.80</td>
<td>6.70</td>
<td>6.80</td>
<td>6.75</td>
</tr>
<tr>
<td>( T_2 )</td>
<td>6.67</td>
<td>6.70</td>
<td>6.65</td>
<td>6.67</td>
<td>6.67</td>
</tr>
<tr>
<td>( T_3 )</td>
<td>6.52</td>
<td>6.55</td>
<td>6.60</td>
<td>6.55</td>
<td>6.55</td>
</tr>
</tbody>
</table>

S.E. = 0.021  C.D. at 5% = 0.065
TABLE 2: Viscosity of the sweet potato kheer

<table>
<thead>
<tr>
<th>Treatment</th>
<th>R_1</th>
<th>R_2</th>
<th>R_3</th>
<th>R_4</th>
<th>Mean</th>
<th>S.E. ± 0.024</th>
<th>C.D. at 5% 0.071</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_0</td>
<td>5.20</td>
<td>5.26</td>
<td>5.32</td>
<td>5.24</td>
<td>5.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_1</td>
<td>7.20</td>
<td>7.26</td>
<td>7.22</td>
<td>7.18</td>
<td>7.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_2</td>
<td>10.20</td>
<td>10.18</td>
<td>10.28</td>
<td>10.30</td>
<td>10.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_3</td>
<td>16.90</td>
<td>16.88</td>
<td>16.96</td>
<td>16.91</td>
<td>16.91</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean: 14.20 R

From Table 2 the average viscosity was found 5.25, 7.21, 10.24 and 16.91 cP for treatment T_0, T_1, T_2 and T_3 respectively. The maximum viscosity was being observed in treatment T_3 and minimum viscosity was observed in treatment T_0 (control). The result also indicates that the viscosity of sweet potato kheer was found to be increased from 5.25 to 16.91 cP as the concentration of sweet potato paste increased from 2.5 percent to 7.5 percent. This may be due to increase in total solids in the buffalo milk due to addition of sweet potato paste.

Kothule (1990) prepared kheer from wheat flour and sorghum flour vermicelli fortified with skim milk powder and observed that in kheer prepared from both wheat flour and sorghum flour vermicelli was more viscous. Pinate (1993) standardized the process for preparation of kheer using semolina, SMP, WMP and 12 per cent cane sugar and reported the viscosity at 30 cP ranged from 2.2 to 1600 cP. Kadam (1998) prepared kheer ready mix and reported that ready mix containing 25 per cent rice yielded with optimum viscosity.

It may observed from Table 3, that the average moisture content of the product was found to be 44.95, 50.70, 50.92 and 51.15 per cent for treatments T_0, T_1, T_2 and T_3 respectively. There were significant differences between the treatment T_0 and T_3, whereas the non significant differences were observed between treatment T_0, T_1 and T_2 respectively. It was also observed that the moisture content was in increasing order from treatment T_1 to T_3. This might be due to the increase in the blending of sweet potato paste in the buffalo milk.

Shrinivasan and Anaantkrishnan (1964) reported the moisture content of plain kheer as 45 to 55 per cent and skim milk kheer as 40 to 50 per cent. Rangappa and Acharya (1974) gave the moisture content of plain kheer and sweetened kheer as 50.00 and 45.00 per cent.

The Table 4 indicates that the fat content in the formulated products ranged between 14.05 to 15.00 per cent. The highest fat content was recorded for treatment T_0 i.e. 15.00 and the lowest fat content was recorded for treatment T_3 i.e. 14.05 per cent. All the treatment were non significant with each other. This might be due to increase in addition of sweet potato paste. Shrinivasan and Anaantkrishnan (1964) reported the fat content of plain kheer and skim milk kheer to be in 15 to 25 per cent. Narwade et al. (2003) prepared kheer from safflower milk blended with buffalo milk with different level of sugar and the reported fat content was 11.60 per cent.

The average protein content of the sweet potato kheer was found to be 5.27, 5.32, 5.37 and 5.65 per cent for treatment T_0, T_1, T_2 and T_3 respectively (Table 5). There were non significant differences observed in T_0, T_1 and T_2 respectively, whereas significant differences was observed in T_2 and T_3. The highest protein content was recorded for treatment T_3 i.e. 5.65 per cent. The lowest protein content was recorded for treatment T_0 i.e. 5.27 per cent. This might be due to increase in blending of sweet potato paste which contain more protein. Mani et al. (1955) observed the protein content as 5.9 per cent of kheer prepared from 4.1 per cent fat and 12.5 per cent total solid. Chaudhary (1989) reported the protein content of kheer as 5.44 per cent. Narwade et al. (2003) prepared kheer from safflower milk blended with buffalo milk with different level of sugar and reported the protein content as 5.30 per cent.

It may be observed from Table 6, that the mean carbohydrate content ranged between 27.77 to 33.30 per cent. Whereas, the least value of carbohydrate content was recorded for T_3 treatment i.e., 27.77 per cent. Significant difference was observed in treatments T_0 and T_4, whereas non significant difference was observed in T_0, T_3, T_2 and T_4 respectively. It may be observed from Table 6 that the carbohydrate content were found to be in decreasing order from T_0 to T_3. It was due to the blending of sweet potato paste in increasing order. Singh et al. (1990) reported the carbohydrate content in kheer ready...
mix as 67.90 to 68.40. Jha (2000) made the kheer mix powder and reported carbohydrate content as 65.80 per cent.

Table 7 indicated that the treatment T₀, T₁ and T₂ and T₃ were at par with each other and T₄, significant with each other. The values recorded were found to be decreasing order from 1.42 to 1.35 for treatment T₀ to T₃. This might be due to increasing level of blending of sweet potato paste which contains more amount of ash i.e. 0.66 per cent. Mani et al. (1955) observed the ash content as 2.3 per cent of kheer prepared from 4.1 per cent fat and 12.5 per cent total solid. Niturkar (1989) prepared kheer by using 8 per cent skim milk fortified vermicelli and 12 per cent sugar and reported ash content as 1.67 per cent. Jha (2000) observed the ash content in kheer mix powder as 2.64 per cent.

It is clearly indicated from Table 8 that the average total solids content of the finished product were found to be 54.98, 49.30, 49.07 and 48.85 per cent for treatment T₀, T₁, T₂ and T₃ respectively. The highest total solids content was recorded for treatment T₀ i.e. 54.98. The lowest total solids contents was recorded for treatment T₄ i.e. 48.85. It was observed from above findings that as blending of sweet potato paste were increased the total solids content of the finished product was also decreased from treatment T₀ to T₃.

Shrinivasan and Anaantkrishnan (1964) reported the total solid content of plain kheer and skim milk kheer 45 to 55 and 50 to 60 per cent respectively. Rangappa and Acharya (1974) observed that total solid content of plain kheer as 50.00 and sweetened content as 55.00 per cent. Chaudhary (1989) reported the total solid content of kheer made from whole milk as 55.00 per cent.

**CONCLUSION**

1. Addition of sweet potato paste in kheer increased moisture content significantly in finished product as compared to control.
2. PH, Fat, carbohydrate, ash and total solids content decreased, whereas protein content increases significantly in treated product as compared to control.

**REFERENCE**


