Sensory quality of red pumpkin (Cucurbita pepo L.) Burfi

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Abstract
The experimental treatments prepared without addition of red pumpkin powder in the burfi (Control) (T0), incorporation of 15 per cent (T1), 17 per cent (T2) and 19 per cent red pumpkin powder in the burfi (T3), and 30 per cent sugar. The mean sensory score for colour and appearance, consistency, flavour and overall acceptability ranged from 7.2 to 8.1, 7.4 to 7.9, 7.5 to 8.2 and 7.4 to 8.2, respectively for the treatments T0, T1, T2 and T3. The experiment was laid out in completely randomized design (CRD) with three replications for preliminary and five replications for experimental trials.

Keywords: Burfi, cow milk, khoa, red pumpkin powder, sensory quality

Introduction
Burfi is indisputable product having economic importance especially in rural as well as urban part of India as it provides good means for converting surplus milk into value added products. It has unique importance in market as it is liked by the people from all classes. Burfi retains its quality for considerable long period at atmospheric storage temperature due to its low moisture content and higher concentration of sugar. The method of preparation also ensures the destruction of almost all microorganisms present in raw material. In post manufacturing contamination from undesirable microorganisms during preparation, handling, packaging and storage of final product is avoided.

Typically, burfi has a mildly caramelized and pleasant flavour. When additives like cardamom, chocolate, coconut, fruit etc., are added, the mild pleasant flavour is further complemented to enhance both product appeal and value. The colour of burfi may range from off white to creamy or light caramel, depending mainly upon the type of milk solids used as base material and also the extent of heat desiccation during preparation of burfi. The body characteristics of burfi and its flavours vary considerably among product varieties. It may range from very loosely compacted to a closely-knit body, the texture could also vary from smooth to granular and crisp to chewy.

Red Pumpkin (Cucurbita pepo L.) plant is a fast-growing vine that creeps along the ground surface in a similar fashion like that of other Cucurbitaceae family vegetables and fruits such as cucumber, squash, cantaloupes etc. It is one of the most popular field crops cultivated around the world, including USA at the commercial scale for its fruit and seeds.

Pumpkin belongs to genus Cucurbita of the family Cucurbitaceae is one of the largest families of vegetable kingdom. They are widely grown and consumed in many tropical and sub-tropical countries around the world (Juna et al., 2006) [3]. Trace elements such as Copper, Calcium, Magnesium, Phosphorous and Vitamins such as carotenoids, tocopherol and other substances like proteins, phytoesters, poly-unsaturated fatty acids and flavonoid poly-phenolic antioxidants such as leutin, xanthin and carotenes are in abundance antioxidants which are naturally present in pumpkin that can be beneficial to human health. (Pasha et al., 2013) [6].

Materials and Methods
The burfi samples under preliminary and experimental trials were subjected to sensory evaluation using the method described in IS: 6273, Part -I and II (1971) [3] adopting 9 point Hedonic Scale. A panel of 5 trained judges was formulated for this purpose. The samples were coded every time to conceal their identity and were offered to the judges for evaluation of the quality attributes.
Pre-experimental trials
Preliminary trials were conducted to choose the levels of addition of red pumpkin powder in the burfi, by using 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 per cent red pumpkin powder. Control samples were also prepared without addition of pumpkin powder. The burfi samples were subjected to sensory evaluation by five trained judges. On the basis of the results of sensory evaluation, the best three levels 0, 15, 17, 19 per cent were chosen for experimental trials.

For the preparation of red pumpkin burfi the treatment combinations were as follows.

T₀: Control, prepared cow milk (Standardized with 4.5 % fat) without addition of red pumpkin powder.
T₁: Khoa + 1 per cent red pumpkin powder by weight of khoa.
T₂: Khoa + 3 per cent red pumpkin powder by weight of khoa.
T₃: Khoa + 5 per cent red pumpkin powder by weight of khoa.
T₄: Khoa + 7 per cent red pumpkin powder by weight of khoa.
T₅: Khoa + 9 per cent red pumpkin powder by weight of khoa.
T₆: Khoa + 11 per cent red pumpkin powder by weight of khoa.
T₇: Khoa + 13 per cent red pumpkin powder by weight of khoa.
T₈: Khoa + 15 per cent red pumpkin powder by weight of khoa.
T₉: Khoa + 17 per cent red pumpkin powder by weight of khoa.
T₁₀: Khoa + 19 per cent red pumpkin powder by weight of khoa.

Table 1: Sensory score of red pumpkin burfi

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Colour and appearance</th>
<th>Body and Texture</th>
<th>Flavour</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀ (0)</td>
<td>7.47&lt;sup&gt;e&lt;/sup&gt;</td>
<td>7.25&lt;sup&gt;e&lt;/sup&gt;</td>
<td>7.32&lt;sup&gt;f&lt;/sup&gt;</td>
<td>7.31&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₁ (1 %)</td>
<td>7.52&lt;sup&gt;de&lt;/sup&gt;</td>
<td>7.27&lt;sup&gt;de&lt;/sup&gt;</td>
<td>7.43&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>7.45&lt;sup&gt;de&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₂ (3 %)</td>
<td>7.65&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>7.38&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>7.50&lt;sup&gt;def&lt;/sup&gt;</td>
<td>7.58&lt;sup&gt;cd&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₃ (5 %)</td>
<td>7.70&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.46&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.56&lt;sup&gt;def&lt;/sup&gt;</td>
<td>7.69&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₄ (7 %)</td>
<td>7.73&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.57&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.68&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>7.66&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₅ (9 %)</td>
<td>7.75&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.67&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>7.70&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>7.67&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₆ (11 %)</td>
<td>7.79&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.64&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.57&lt;sup&gt;de&lt;/sup&gt;</td>
<td>7.68&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₇ (13 %)</td>
<td>7.87&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.41&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>7.71&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.71&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₈ (15 %)</td>
<td>8.18&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.91&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>8.15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.21&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₉ (17 %)</td>
<td>8.27&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>8.05&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>8.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.24&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T₁₀ (19 %)</td>
<td>8.11&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.78&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.94&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.78&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>S.E. ±</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>CD at 5 %</td>
<td>0.18</td>
<td>0.20</td>
<td>0.20</td>
<td>0.15</td>
</tr>
</tbody>
</table>

(Sensory score out of 9)

Preparation of red pumpkin powder

Selection of fresh Red pumpkin fruit
↓
Washing
↓
Cut the pumpkin in 2 x 3 cm pieces
↓
Peeled and soaked in 0.1% citric acid solution (15 min)
↓
Chopped and juice extracted
↓
Drying of pumpkin residue (Sun Drying)
↓
Grinding
↓
Sieving
↓
Packaging

Flow chart for pumpkin powder preparation (Kumar et al., 2015)<sup>[5]</sup>

Preparation of red pumpkin burfi

Cow milk
↓
Pre-heating (35-40°C)
↓
Filtration
↓
Standardization (4.5 %)
↓
Boiling of milk with continuous stirring-cum-scraping

~ 1324 ~
Addition of Red pumpkin powder + ground sugar (as per the treatments)
Stirring with wooden khunti on low flame
Spreading in tray and cooling
Setting
Cutting in to rectangular pieces
Packaging
Storage at room temperature (30±1°C)

Flow chart for preparation of red pumpkin burfi

The burfi samples were prepared by using the standard procedure described by Aneja et al. (2002)\(^1\) with suitable modifications.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Sensory quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Colour and appearance</td>
</tr>
<tr>
<td>T(_0) (Control)</td>
<td>7.40(^c)</td>
</tr>
<tr>
<td>T(_1)</td>
<td>8.20(^a)</td>
</tr>
<tr>
<td>T(_2)</td>
<td>8.28(^a)</td>
</tr>
<tr>
<td>T(_3)</td>
<td>7.64(^b)</td>
</tr>
<tr>
<td>S.E. ±</td>
<td>0.04</td>
</tr>
<tr>
<td>CD at 5 %</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Body and Texture
The mean body and texture score for the burfi samples were 7.53, 7.46, 7.56 and 7.39, respectively (Table 2). The body and texture of the burfi significantly (P<0.05 %) differed due to addition of pumpkin powder in burfi samples. The treatment T\(_0\) and T\(_2\) had highest body and texture score where as the treatment T\(_3\) had lowest consistency score. It indicated that the burfi become more hard texture with increased level of pumpkin powder. The treatment T\(_0\) and T\(_3\) were at par.

Flavour
The flavour score for red pumpkin burfi in present study for different treatments were 7.35 (T\(_0\)), 8.12 (T\(_1\)), 8.30 (T\(_2\)) and 7.54 (T\(_3\)), respectively (Table 2). The influence of incorporation of red pumpkin powder in the burfi samples was significant (P<0.05). All the experimental treatments significantly (P< 0.05) differed among themselves at all the stages of storage. Decrease in flavour score of burfi samples was observed in all the samples, but decrease in extent was more in T\(_0\) and T\(_3\) as compare to other samples. The decrease

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**Sensory Evaluation**

The burfi samples under preliminary and experimental trials were subjected to sensory evaluation using the method described in IS: 6273, Part –I and II (1971)\(^3\) adopting 9 point Hedonic Scale. A panel of 5 trained judges was formulated for this purpose. The samples were coded every time to conceal their identity and were offered to the judges for evaluation of the quality attributes.

**Statistical Analysis**

Experiment was laid out in Completely Randomized Design (CRD) with 3 replications for preliminary trials and 5 replications for experimental trials. The data was tabulated and analyzed according to Snedecor and Cochran (1994)\(^8\).

**Result and Discussion**

**Colour and appearance**

The results for colour and appearance presented in the Table 2. The mean colour and appearance score for the treatments T\(_0\), T\(_1\), T\(_2\) and T\(_3\) were 7.40, 8.20, 8.28 and 7.64, respectively. It was revealed that the mean sensory score for colour and appearance of the product under different treatments was significant (P<0.05 %). It means that the addition of different levels of pumpkin powder in the burfi influenced the colour and appearance of the product. It become more dense with increased levels of pumpkin powder which adversely affected sensory score. All the treatments differed significantly among themselves. The treatment T\(_2\) had 8.28 colour and appearance score which was superior among other treatments in term of its colour and appearance under study. Whereas treatment T\(_0\) (7.40) had the lowest but sensorily acceptable sensory score.

**Table 2:** Sensory quality of fresh red pumpkin burfi

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Colour and appearance</th>
<th>Body and Texture</th>
<th>Flavour</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(_0) (Control)</td>
<td>7.40(^c)</td>
<td>7.53(^c)</td>
<td>7.35(^b)</td>
<td>7.38(^c)</td>
</tr>
<tr>
<td>T(_1)</td>
<td>8.20(^a)</td>
<td>7.46(^a)</td>
<td>8.12(^c)</td>
<td>8.10(^c)</td>
</tr>
<tr>
<td>T(_2)</td>
<td>8.28(^a)</td>
<td>7.56(^a)</td>
<td>8.30(^b)</td>
<td>8.30(^a)</td>
</tr>
<tr>
<td>T(_3)</td>
<td>7.64(^b)</td>
<td>7.39(^a)</td>
<td>7.54(^b)</td>
<td>7.45(^c)</td>
</tr>
<tr>
<td>S.E. ±</td>
<td>0.04</td>
<td>0.02</td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td>CD at 5 %</td>
<td>0.14</td>
<td>0.06</td>
<td>0.06</td>
<td>0.19</td>
</tr>
</tbody>
</table>

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(Sensory score out of 9)
in flavor may be attributed due to loss in freshness, which is inherent with any food product. It was due to rancid flavour developed in the burfi samples. Similar observation with respect to flavour degradation was recorded on kalakand by Rao and Gayal (2007)\(^7\).

**Overall acceptability**

The overall acceptability of any food product depends on mainly sensory attributes i.e. colour and appearance, body and texture, flavour and taste of particular product. The overall acceptability score for red pumpkin burfi sample was 7.38 (T\(_0\)), 8.10 (T\(_1\)), 8.30 (T\(_2\)) and 7.45 (T\(_3\)), respectively (Table 2). The overall acceptability of red pumpkin burfi sample was significantly (P<0.05) influenced due to incorporation of pumpkin powder in the product. The treatment T\(_2\) (8.30) had highest overall acceptability score followed by T\(_1\) (8.10), T\(_0\) (7.38) and T\(_3\) (7.45), respectively. All the treatments significantly (P<0.05) differ among themselves. The treatment T\(_1\) and T\(_2\) comparatively had higher overall acceptability score over the treatments T\(_0\) and T\(_3\). Waghmare (2012)\(^9\) described the preparation of burfi from buffalo milk with constant level of sugar (30 per cent weight of khoa) and different levels of bottle gourd pulp (5, 10 and 15 per cent by weight of khoa). He observed that the overall acceptability score ranged in between 6.87 to 8.47. The burfi prepared by using 10 per cent pineapple pulp secured highest score for overall acceptability i.e. 8.47 and ranked at most acceptable product.

**Conclusion**

The most acceptable red pumpkin burfi can be prepared using 17 per cent pumpkin powder and 30 per cent sugar. The prepared red pumpkin burfi from 17 per cent pumpkin powder had 8.28 colour and appearance score, body and texture 7.56, flavour score 8.30 and overall acceptability score 8.30.