Characterization of Dal Pinni: A composite dairy food

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Abstract   Dal Pinni is one of the important composite dairy based sweets popular in northern part of India, particularly in Punjab and Haryana region. It is prepared by heating with continuous stirring and scraping of soaked and grounded black gram (Urd dal peethi) with ghee, khoa and sugar followed by moulding into round or elliptical shape balls. Despite the fact that it is a common and most popular traditional dairy product, scanty or no scientific information is available about it. Through present study an effort was made to know the average composition of market samples of dal pinni and also the extent of variation between samples collected from famous sweet shops in Ludhiana city. All samples were evaluated for its sensory, physico-chemical and textural parameters. Except sweetness and protein content all other sensory and physico-chemical parameters were significantly (p<0.05) different. Physico-chemical parameters viz. moisture, fat, protein, ash and acidity ranged from 12.62-19.28, 18.96-25.09, 6.51-7.56, 0.30-1.01 and 0.57-0.82%, respectively. Besides sensory analysis, samples were also evaluated for instrumental parameters like texture profile and colour values which would be helpful in standardization of technology for mechanised production of dal pinni in bulk.

Keywords: Composite dairy food, sensory analysis, dal pinni, market survey, texture

Introduction

In India, a large variety of traditional sweets are manufactured and consumed and the basic ingredient of most of these traditional sweets is milk. Milk is considered a complete food but is deficient in some essential amino acids like methionine (Sabahelkheir et al., 2012) and minerals like iron; while cereal and pulses are rich source of these amino acids and minerals (Shewry, 2007). Therefore, any integration of milk with cereal and pulses which are usually considered to be a rich source of proteins and minerals may supplement these deficiencies of milk and milk products in the form of composite dairy foods. Composite dairy foods are popular and having important position in Indian diet. Amongst the various composite dairy foods like keher, paysam, panjiri, pinni, etc., pinni is prominent one. It is a rich source of fat, protein, minerals and energy. Considering its high nutritive value, traditionally pinni is considered as an ideal food for young ones, growing people, pregnant and lactating women. Amongst the various types of pinni available in the market, dal pinni, atta pinni, and besan pinni are the major variants. Dal Pinni is one of the most important composite traditional dairy based sweets popular in northern part of India, particularly in Punjab and Haryana region. It is prepared by prolonged heating with continuous stirring and scraping of soaked grounded black gram (Urd dal peethi) with ghee, khoa and sugar in iron kettle/ pan followed by moulding into round or elliptical shaped balls (Saxena et al., 1996). Pinni is characterized by light brown colour with grainy texture and pleasant flavour coupled with good nutritive value. The average composition of dal pinni consists of 9.98% moisture, 22.65% fat, 7.79% protein, 31.97% total sugar, 1.45% ash and 0.25% free fatty acid content (Saxena et al., 1996). Apart from basic ingredients, almonds and cashews are added for garnishing and increasing the aesthetic appeal of the product. Though exact data for the production and demand of dal pinni is not known, broadly estimated market value for the traditional dairy products in India is around Rs. 50,000 crores annually (Aggarwal, 2007).

Despite the fact that it is a common and popular product very limited scientific information is available about its average composition and product characteristics including sensory and
physico-chemical properties. Further, wide variation in sensory and physico-chemical attributes of market samples is usually observed which could be attributed to variation in composition and processing parameters of products from one shop to another. Keeping in view the above facts, present study was planned and conducted to study the extent of variation among various samples collected from famous sweet shops in Ludhiana city. The outcomes of this study would be helpful in standardization of ingredients as well as process parameters and thereby development of a suitable technology for bulk and mechanised production of this popular product.

**Materials and Methods**

**Sample Collection**

Samples were collected from three different and locally famous sweet shops (Shop A, B and C) in Ludhiana city. The samples were collected hygienically and stored at 25°C for 3-4 hours to avoid any chance of variation in results due to difference in storage temperature/conditions across the shops, followed by sensory, physico-chemical, and texture analysis. Samples were analysed in triplicate to minimise the chances of analytical errors.

**Sensory Analysis**

A sensory panel consisting of eight semi-trained panellists were selected from the faculty and students of College of Dairy Sciences and Technology, GADVASU, Ludhiana to evaluate the samples of *dal pinni* for sensory attributes. Each panellist was served all the three samples of *dal pinni* at a time, which were evaluated for sensory attributes such as colour and appearance, texture, sweetness, flavour and overall acceptability on 9 point hedonic scale (9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much, and 1 = dislike extremely) (Lawless and Heymann, 1998).

**Physicochemical analysis**

Physical parameters like dimensions (Height and Diameter/Breadth ratio) and colour were measured using vernier calliper having least count 0.01mm and Hunterlab colorimeter, respectively. Chemical properties like moisture, fat, protein, ash and acidity were analysed using standard procedures (AOAC, 2000). Chemical used in this study were of analytical grade and purchased from Sigma chemicals, Bangalore, India.

**Colour measurement**

Surface colour of *dal pinni* samples were measured using Colour Flex Colorimeter (Hunterlab, Reston, Virginia) supplied along with the universal software Easy Match QC (version 4.62) and the results were expressed in terms of CIE-LAB system. The colorimeter was equipped with dual beam xenon flash lamp as source of light. Prior to analysing the samples, the instrument was calibrated with standard black glass and white tile as specified by the manufacturer of the equipment. Data was received through the software in terms of *L* (lightness), ranging from 0 (black) to 100 (white), *a* (redness), ranging from +60 (red) to -60 (green) and *b* (yellowness), ranging from +60 (yellow) to -60 (blue) values (Hunter, 1975).

**Textural measurement**

Textural profile analysis (TPA) of *dal pinni* was carried out using Texture Analyser, TA-XT Plus (M/s Stable Micro Systems, Surrey, UK) fitted with 50 kg load cell. 75 mm compression plate was used for texture profile analysis of samples. The product was subjected to compressive force by probe up to the distance of 10 mm twice. The conditions set in the Texture Analyser for measuring textural properties were as follows: Pre-Test Speed, 1 mm/s; Post-Test Speed, 5 mm/s; Test speed, 5 mm/s; Trigger force, 5.0 g; Time, 5.0 s. A two-bite test force distance compression curve (Bourne, 1978) was obtained and from the resulting force-time curves, numerical values of hardness, adhesiveness, springiness, cohesiveness, gumminess, and chewiness were obtained using the Exponent software (version 6.1.1.0).

**Statistical analysis**

All the data were expressed as mean ± standard deviation from three independent samples, calculated using Microsoft excel (Microsoft office 2007). The data was subjected to one way analysis of variance (ANOVA) using CPCS-1 software (Singh et al., 1991). Significance and critical difference (CD) were evaluated at 95 and 99 percent confidence interval (Rangaswamy, 1995).

**Results and Discussion**

**Sensory quality**

*Dal pinni* is characterized by light brown colour with grainy texture and pleasant nutty flavour. Average sensory scores with their standard deviation for all sensory attributes were shown in Figure 1. Average sensory scores for colour and appearance were found to be 7.06, 7.93 and 7.87 for sample A, B and sample C, respectively. All three samples varied significantly (p<0.05) (Table 1). Whereas, sample B and C did not vary significantly in terms of their colour and appearance scores (Fig. 1). Sample B was most appreciated sample by the sensory panellists for its colour and appearance which was closely followed by sample C and sample A.
Fig 1: Sensory score of market samples (Mean±SD) of dal pinni. abcmean values of treatments within a graph with different letters significantly differ (p < 0.05).

Table 1 Analysis of variance (ANOVA) for physico-chemical, sensory and textural attributes of market samples of dal pinni.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Degree of freedom (df)</th>
<th>MS</th>
<th>F</th>
<th>CD (5%)</th>
</tr>
</thead>
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<tr>
<td>Physico-chemical properties</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Moisture</td>
<td>2</td>
<td>33.97**</td>
<td>123.83</td>
<td>1.05</td>
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<tr>
<td>Fat</td>
<td>2</td>
<td>28.34**</td>
<td>52.25</td>
<td>1.47</td>
</tr>
<tr>
<td>Ash</td>
<td>2</td>
<td>0.07**</td>
<td>150.64</td>
<td>0.04</td>
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<td>6.59</td>
<td>NS</td>
</tr>
<tr>
<td>Acidity</td>
<td>2</td>
<td>0.054**</td>
<td>42.07</td>
<td>0.07</td>
</tr>
<tr>
<td>Height</td>
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<td>21.06</td>
<td>0.27</td>
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<tr>
<td>Dia/Breadth</td>
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<td>44.15</td>
<td>0.39</td>
</tr>
<tr>
<td>Colour</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L*</td>
<td>2</td>
<td>27.66**</td>
<td>63.06</td>
<td>1.32</td>
</tr>
<tr>
<td>a*</td>
<td>2</td>
<td>39.23**</td>
<td>524.23</td>
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</tr>
<tr>
<td>b*</td>
<td>2</td>
<td>13.30**</td>
<td>43.47</td>
<td>1.11</td>
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<tr>
<td>Color &amp; Appearance</td>
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<td>1.91*</td>
<td>4.82</td>
<td>0.65</td>
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<td>12.35</td>
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<td>Sweetness</td>
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<td>2.71</td>
<td>NS</td>
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<td>Flavour</td>
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<td>3.57**</td>
<td>15.49</td>
<td>0.50</td>
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<tr>
<td>Overall Acceptability</td>
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<td>2.51**</td>
<td>8.48</td>
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<td>TPA</td>
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<td>Hardness</td>
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<td>Chewiness</td>
<td>2</td>
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<td>13.1</td>
<td>0.26</td>
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</table>

*. Significant at p<0.05 level (2-tailed), **. Significant at p<0.01 level (2-tailed), ns Non-significant
Texture is one of the most important sensory parameters for any food products including dal pinni. The average texture scores (sensory) of the three samples ranged from 6.93 to 8.06 (Fig. 1). Sample C was the most preferred sample amongst the panellists for its textural attributes followed by sample A and B, respectively. The sensory score for textural properties of sample C was significantly (p<0.01) higher than sample A and B; the difference between sample A and B was non-significant. The low score for textural properties of sample A may be due to high fat content which led to greasy texture, and probably why not appreciated by sensory panellists. Whereas lower scores of sample B may be attributed to gritty texture, possibly as a result of lower fat content in the product.

The average sweetness values varied from 7.25 to 7.87 (Fig. 1). Sample C was most appreciated sample for its sweetness score by sensory panellists, followed by sample A and B. There were no significant (p>0.01) differences in the sweetness scores amongst the samples. In dal pinni, flavour is the most important sensory parameter which affects overall acceptability. The average sensory scores for flavour and overall acceptability were ranging between 6.81 to 8.00 and 7.00 to 8.00, respectively. Overall acceptability scores for sample C was significantly (p<0.01) higher than sample A and sample B, which may be due to superior textural and flavour attributes of sample C over other two samples. For all sensory attributes, the difference between the scores for sample A and B was non-significant except colour and appearance attribute (Fig. 1).

Physico-chemical analysis

Physico-chemical parameters like moisture, fat, protein, ash and acidity are given in Figure 2. There was significant (p<0.01) difference in the fat content of samples (Table 1). In dal pinni, fat is responsible for mellow texture and pleasant flavour. Optimum fat content is essential for sensorily good quality of this product. Higher fat content may leads to greasy texture while lower fat content may result in gritty or hard texture of dal pinni. Sample C was most preferred sample by sensory panellists probably because of superior texture and flavour as a result of optimum fat content (22.38%) in the product. Similar results were also reported by Saxena et al. (1996) in their study on the preparation, packaging and storage of pinni and Patel (1996) in his study on analysis of market samples of plain peda. The moisture content varied significantly (p<0.01) (Table 1). The probable reasons for wider variation in moisture content of samples could be due to difference in processing parameters, in-house storage conditions of samples and freshness of samples. Besides fat, protein is another important constituent of pinni, which improves it nutritional profile. There was non-significant (p>0.01) difference in the protein content of samples (Table 1 and Fig. 2a).

The ash content of sample A was significantly (p<0.01) lower than that of sample B and C, while the difference between sample B and C was non-significant (p<0.01) (Fig. 2). Besides basic ingredients which are the principal source of mineral content in dal pinni, cast iron heating/ frying kettle is also another factor from where iron gets leached out and added into product during manufacturing process i.e. continuous heating, stirring and scraping for long period (De, 1980).

Acidity of sample A and C was significantly (p<0.01) lower
than sample B. However, the difference was non-significant (p>0.01) in case of acidity of sample A and sample C (Fig. 2b). Similar results were also reported by Ray et al. (2002) and Patel et al. (2006) for market sample of peda and Chawla et al. (2011) for market samples of doda burfi.

Dimensions of dal pinni were measured in terms of height and diameter to breadth ratio. The height (cm) and diameter to breadth ratio were ranged from 2.70-3.40 and 2.13-3.60, respectively. There was significant (p<0.05) difference in dimensions of samples which is quite logical, as generally it is prepared by hand moulding which led to variation in shape and size from shop to shop. Current finding is in unison with the results of Saxena et al. (1996).

**Colour**

Instrumental colour values of dal pinni measured in terms of L*, a* and b* values using Hunter Lab Colorimeter were shown in Figure 3. The L* values which represents lightness varied from 39.61-45.56, while a* values indicating redness varied between 15.20-22.30, while b* values indicating...
yellowness varied between 24.75 to 28.58 (Fig. 3).

$L^*$ values were 39.61, 43.63 and 45.56 for sample C, A and B, respectively. This indicates that the brightness of sample B was higher than sample A and C. Though, $L^*$ values for sample B was higher than sample C, an insignificant difference was recorded in sensory ratings of sample B and C for colour and appearance attribute (Fig. 1). Therefore, it could be concluded that brighter/lighter product having higher $L^*$ value, was also preferred by sensory panellists for their colour and appearance attribute over other samples. The lower $L^*$ value may be due to addition of caramel colour and/or Maillard reaction promoted by the heat interaction of sugar with protein. There was significant ($p<0.01$) difference in $L^*$ value of all market samples of dal pinni. Chawla et al. (2011) also reported the similar results for market samples of doda burfi. Recorded values for $a^*$ (Redness) were 15.20, 17.39, and 22.30 for sample C, B and A, respectively. There were significant ($p<0.01$) difference in $a^*$ values for market samples of dal pinni (Table 1). The $b^*$ (Yellowness) values ranged from 24.75 to 28.58 (Fig. 3). The $b^*$ values varied significantly ($p<0.01$) between samples (Table 1). Whereas the difference between sample A and B was non-significant (Fig. 3). Maillard browning is characterized by two primary hues viz., red and yellow. The browning of dal pinni is due to the combination of redness (positive value of $a^*$) and yellowness (positive $b^*$) (Renuka et al., 2010).

Textural profile analysis (TPA)

Texture is one of the most important physical parameters which categorizes the food products on the basis of various

![Fig 4a: Textual attributes of market samples (Mean±SD) of dal pinni. abcmean values of treatments within a graph with different letters significantly differ (p < 0.05).](image)

![Fig 4b: Textual attributes of market samples (Mean±SD) of dal pinni. abcmean values of treatments within a graph with different letters significantly differ (p < 0.05).](image)
and varied significantly (p<0.01). Gumminess (kg) and chewiness (kg) for all the samples were ranging between 0.72 to 2.14 and 0.15 to 0.69, respectively. Values for cohesivenss and springiness of the samples. Gumminess and chewiness are the secondary important parameters which affect the hardness prominently. However, some other factors like heating, stage and mode of sugar addition and ball formation methods also affect the hardness of dal pinni. Cohesiveness is one of the primary parameters of texture measurement which can be expressed as the rate at which the material disintegrates under mechanical action. Cohesiveness of the sample A and B; and Sample B and C varied significantly (p<0.01) while, both the samples varied significantly (p<0.01) with sample C. Similar results were also reported by Chawla et al. (2011) for market samples of doda burfi and Renuka et al. (2010) for gulab jamun. Adhesiveness, a negative peak in the texture profile analysis was observed to be -0.14, -0.001, and -0.04 kg for sample A, B and C, respectively. Adhesiveness values varied non-significiantly (p>0.01) between the samples (Table 1). Springiness values varied significantly (p<0.01) between the samples (Table 1). The Springiness values of dal pinni samples varied from 20.66 to 32.07. Springiness values varied significantly (p<0.01) for sample A and B; and sample B and C respectively while the difference between sample A and C was non-significant. Gumminess and chewiness are the secondary textural attributes which mainly depends on hardness, cohesiveness and springiness of the samples. Values for gumminess (kg) and chewiness (kg) for all the samples were ranging between 0.72 to 2.14 and 0.15 to 0.69, respectively and varied significantly (p<0.01). Expected to be the two main probable reasons for variation of samples for their sensory and physicochemical attributes. Sample C was rated as the best sample, for its flavour, texture and overall acceptability. Compositional properties for best rated sample were 15.13% moisture, 22.38% fat, 6.71% protein, 1.00% ash and 0.61% acidity. Except protein content all other physico-chemical parameters like moisture, fat, ash and acidity varied significantly. Lack of mechanization coupled with guiding standards lead to wide variation in quality of products available in the market. Therefore, outcomes of this study are expected to be helpful in optimization of ingredients and processing parameters for mechanised production and manufacture of uniform quality odal pinni.

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References


Conclusions

Samples collected from different shops of local market were evaluated for its sensory, physico-chemical and textural parameters. There was wide variation across the samples in terms of composition, sensory and physicochemical parameters. Composition and processing parameters are expected to be the two main probable reasons for variation of samples for their sensory and physicochemical attributes. Sample C was rated as the best sample, for its flavour, texture and overall acceptability. Compositional properties for best rated sample were 15.13% moisture, 22.38% fat, 6.71% protein, 1.00% ash and 0.61% acidity. Except protein content all other physico-chemical parameters like moisture, fat, ash and acidity varied significantly. Lack of mechanization coupled with guiding standards lead to wide variation in quality of products available in the market. Therefore, outcomes of this study are expected to be helpful in optimization of ingredients and processing parameters for mechanised production and manufacture of uniform quality dal pinni.