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Assessment of Textural Properties of *Kalakand* Sold in Parbhani District

Suryakant N. Hakke, Shankar G. Narwade and Sachin V. Gaikwad*

Department of Animal Husbandry and Dairy Science, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.) – 431 402

**Corresponding author*

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A B S T R A C T

The study was conducted to characterize textural attributes of market and laboratory made *Kalakand* samples. Three different types of samples of *Kalakand* procured from the Vicinity of the traditional manufacturing of eleven shops were selected randomly for the study from different region of Parbhani district, the manufacturers manufacturing and selling the product and having good popularity among consumers were selected and the study were replicated four times. Market *Kalakand* samples were collected and simultaneously one *Kalakand* sample was prepared in laboratory. For the qualitative preparation of *Kalakand*, the comparison made between laboratory made plain *Kalakand* (T_1) with market plain *Kalakand* (T_2), market fig *Kalakand* (T_3) and market kashmiri *Kalakand* (T_4) with addition of 6% sugar. *Kalakand* was evaluated for textural qualities *viz*., Hardness, cohesiveness, adhesiveness, springiness, gumminess and chewiness. The score for laboratory made *Kalakand* were 0.266, 0.832, 0.000, 4.285, 0.221 and 0.946. For plain *Kalakand* was 0.065, 2.547, 0.001, 3.166, 0.165 and 0.524. In fig *Kalakand* was 0.244, 0.946, 0.001, 3.818, 0.230 and 0.881 and Kashmiri *Kalakand* contained 0.150, 3.506, 0.001, 3.378, 0.525 and 1.776 per cent, respectively. The rheological properties concerns to hardness are directly related with moisture content of the *Kalakand* sample, lower content of moisture per cent in *Kalakand* sample increases the hardness.

Introduction

Milk is an extremely complex biological fluid with scores of nutrient content contained in fluid characteristics of three physical phases; diluted emulsion, colloidal dispersion and solution. The chemical makeup of milk and its physicochemical behavior provide scientific basis for process of milk and manufacture of products. The increased availability of milk during the flush season coupled with inadequate facilities to keep liquid milk fresh during transit from rural production areas to urban market has led to the conversion of milk into traditional milk products. In addition manufacture of this traditional dairy product help in preservation of milk solids for longer time at room temperature and also creates employment and opportunity. *Kalakand* is one of the traditional milk products which are made by desiccation of heat with caramelized flavor and granular

texture prepared from acidified milk. It also accompanies reduction of water activity results in destruction of pathogenic micro-organism and inactivation of enzyme activity. The main reaction in preparation is denaturation and coagulation of milk proteins. The color of *Kalakand* varies from off white to light caramel color. Being a whole milk concentrate, *Kalakand* is a good source of proteins, minerals, energy giving fat and lactose. It is 4-6 times more nutritious than milk in terms of per unit weight and calorific value (Shalini, 2015). *Kalakand* has unique importance in market because it is liked by all classes of people. It has specially importance in various celebrations like wedding, inaugural functions, birthday and diwali period. Therefore, the demand for this product is constant throughout the year. *Kalakand* is indisputable product having economic importance especially in rural part of India as it provides good means for converting surplus milk into value added products. Several varieties of *Kalakand i.e.* fig *Kalakand*, mango *Kalakand*, ash guard *Kalakand*, sapota *Kalakand*, kashmiri *Kalakand*, strawberry *Kalakand*, plain *Kalakand* etc. are sold in the market of Maharashtra.

In Parbhani city kashmiri, plain and fig *Kalakand* are most popular. All the varieties of *Kalakand* have distinct characteristics and method of manufacture vary from region to region. The base for all these types of *Kalakand* is however *khoa* and sugar. In different proportions other ingredients are also incorporated to cater the special need of flavour, body and texture characteristics.

However, so far no serious attention was paid to improve the existing technology and exploit it on large industrial scale. Therefore, this product remained at cottage and small industries in different part of our country resulting into large variation in quality of final product.

Materials and Methods

Collection of samples

Preliminary survey was conducted in Parbhani market, to know the different types of *Kalakand* available in market and their availability throughout the study period. On the basis of survey, the three types of *Kalakand* purchased from eleven shops and brought to the laboratory and stored at 5^0C temperature till its use for analytical purpose. Market *Kalakand* samples were collected and simultaneously one *Kalakand* sample was prepared in laboratory as a control sample. For control sample, buffalo milk was procured from Buffalo Dairy Farm maintained by department of Animal Husbandry and Dairy Science, Parbhani.

Treatments details

For the qualitative preparation of *Kalakand*, the comparison made between laboratory made plain *Kalakand* (T_1) with market plain *Kalakand* (T_2), market fig *Kalakand* (T_3) and market Kashmiri *Kalakand* (T_4) with addition of 6% sugar.

Preparation of laboratory *Kalakand*

Laboratory *Kalakand* (T_1) was prepared from fresh buffalo milk by adopting the method as suggested by De (2013). Boil the specific quantity of milk in karahi placed over a brisk and non-smoky fire. Stir continuously with a khunti with a circular motion. After 10-15 minutes, add to it the required amount of citric acid as dilute solution in water. This will partially coagulate the milk. At this time vigorous stirring is required to obtain a product of good quality. When a semi-solid stage is reached, add sugar and stir well. Add crushed cardamom if desired. Remove plate and allowed to cool at room temperature. *Kalakand* is now ready.

Flow Diagram of *Kalakand*

Buffalo Milk

⇩

Heat treatment till boiling (10-15 minutes)

⇩

Add citric acid @ 0.5% w/v

⇩

Boil and stir till semi solid consistency

⇩

Add sugar @ 6 % and crushed cardamom

⇩

Heat on low fire for 5 min with continuous stirring

⇩

Pour in greasy tray

⇩

Cool and Stored at room temperature

Textural profile analyser

TPA on samples was performed by using the Texture Analyser TA.XT2 plus of Stable Micro System equipped with 5 kg load cell to characterize the hardiness, cohesiveness, springiness, adhesiveness, gumminess and chewiness of *Kalakand*. The samples of *Kalakand* were cut into 1 cm^3 size pieces and their temperature maintained at 25^0C during the textural analysis. The samples were subjected to mono axial compression of 5 mm height. The force distance curved was obtained curve was obtained for a two bite compression cycle with the test speed of 1mm/s. The pre & post-test speed were set up at 1.0 mm/s & 5.0 mm/s respectively.

Results and Discussion

Textural properties samples of *Kalakand*

The texture is an important attribute of *Kalakand* deciding it's acceptability by the consumers. The statistical analysis of various data recorded for textural characteristics of *Kalakand* samples are presented in Table 1. Analysis of variance of the data pertaining to various textural attributes revealed that hardness, cohesiveness, adhesiveness, springiness, gumminess and chewiness of different *Kalakand* samples showed significant changes. Detailed findings and relevant discussion is given in following paragraphs.

Hardness

In textural profile studies, hardness refers to the force required to attain a given deformation (Larmond, 1976). On a two bite force distance curve (Figure 1), it is the highest point of the peak in the first bite compression cycle. The values for hardness of fresh market *Kalakand* samples varied from 0.065g (T_2) to 0.244 g (T_3) and laboratory *Kalakand* sample 0.266 g (T_1). Significant differences ($p < 0.05$) in the hardiness of *Kalakand* samples were observed. This variation might be due to the variation in

chemical composition of the *Kalakand*, amount of sugar added and extent of desiccating and also blending of different levels of fruit pulp in market sample. Hardness of *Kalakand* depends upon various factors including moisture content and mineral content. Surprisingly, the hardness of laboratory samples was found highest compared to other samples. This may be due to higher khoa content of *Kalakand* and lower moisture content of sample. These findings are in agreement with Jain *et al.,* (2015) observed variation in textural properties of *Kalakand*. Hardness of the product is directly related to moisture content, the hardness of *Kalakand* ranged between 474.57 ± 0.24^{ba} to 1725.35 ± 0.69^{ca} (Fig. 1–4).

Cohesiveness

Cohesiveness refers to the extent to which a material can be deformed before it ruptures (Larmond, 1976). In other words, it refers to how a food product stays together after deformation. It is the ratio of the area under the second peak to that under the first peak and is unit less. The values of Cohesiveness in market *Kalakand* ranged from 0.946 (T_2) to 3.506 (T_4) and laboratory *Kalakand* sample had 0.832 (T_1). The cohesiveness was highly significant (P<0.05) among the all samples presented in Table 1. These finding are in agreement to results by Arora *et al.,* (2008) reported that the cohesiveness of artificial sweetened *Kalakand* values were 0.25-0.20.

Adhesiveness

Adhesiveness is sometimes referred to as stickiness, which is related to how a food adheres to the palate during chewing. The average values of adhesiveness of market and laboratory fresh *Kalakand* samples are given in the Table 1. The values of adhesiveness in all market *Kalakand* was 0.001 g.s and laboratory *Kalakand* sample (T_1) had lowest and negligible. The adhesiveness was highly significant (P<0.05) among the all samples. The variation could be due to the difference in raw material used, processing parameter used during manufacturing and chemical composition of *Kalakand*. This is supported by Jain *et al.,* (2015) reported that the adhesiveness of *Kalakand* ranged between 0.26 ± 0.02^{ab} to 0.47 ± 0.03^{aa} g.s.

Springiness

Springiness refers to the height that the sample recovers during force relaxation time between first and second bite compression cycle (Patel *et al.,* 2011). The springiness depends on factors such as heat treatment and degree of firmness. The overall mean values of springiness of market and laboratory samples of *Kalakand* were ranged from 3.166 mm (T_3) and 3.818 (T_2) to 4.285 mm (T_1). The mean springiness values differed significantly (P<0.05). This might be due to the increase in concentration of fruit pulp blend in the market samples of *Kalakand*. The results agreed with Arora *et al.,* (2008) observed that the springiness of artificially sweetened *Kalakand* (3.6 to 1.74 mm). Kumar *et al.,* (2009) reported that the average springiness of *khoa* 0.184 mm.

Gumminess

Larmond (1976) defined gumminess as the energy required to disintegrate a semi-solid food to a state ready for swallowing. It is related to primary parameters of hardness and cohesiveness and is obtained by multiplication of these two parameters. The mean values of gumminess of market *Kalakand* which varied between 0.165 g (T_2) to 0.525 g (T_4) and laboratory *Kalakand* had 0.221 g (T_1). The Mean gumminess value differed highly significantly (P<0.05) among all samples. These finding are in agreement to results by Jain *et al.,* (2015) reported that the

gumminess of *Kalakand* ranged between 130.93 ± 0.84^{aa} to 676.23 ± 0.73^{dc}.

Chewiness

Chewiness refers to the energy required to masticate food into a state ready for swallowing and is a product of hardness, cohesiveness and springiness (Patel *et al.*, 2011).

The chewiness values differed significantly ($P<0.05$) among samples and ranged from 0.524 (T_2) to 1.776 g.mm (T_4) in market samples and 0.946 g.mm (T_1) in laboratory sample.

It might be due to wide variation in chemical composition of the *Kalakand* samples and variation in the value of hardness, cohesiveness and springiness among samples. These finding are in agreement to results by Kumar *et al* (2009) reported that the average chewiness of *khoa* (base material for *Kalakand*) 1.038.

Table.1 Textural properties of Kalakand sold in Parbhani market

Sample No.	Hardness (kg)	Cohesiveness	Adhesiveness (kg)	Springiness (mm)	Gumminess	Chewiness (kg)
T_1	0.266	0.832	0.000	4.285	0.221	0.946
T_2	0.065	2.547	0.001	3.166	0.165	0.524
T_3	0.244	0.946	0.001	3.818	0.230	0.881
T_4	0.150	3.506	0.001	3.378	0.525	1.776

Fig.1 Typical textural profile curve of kalakand sample T1

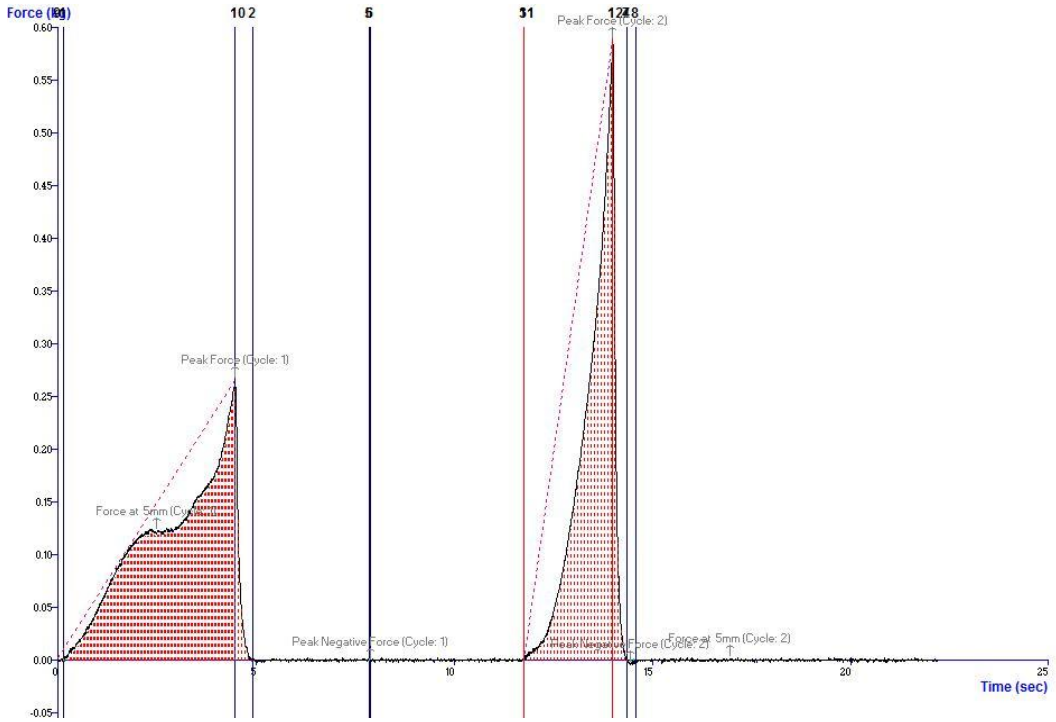


Fig.2 Typical textural profile curve of kalakand sample T2

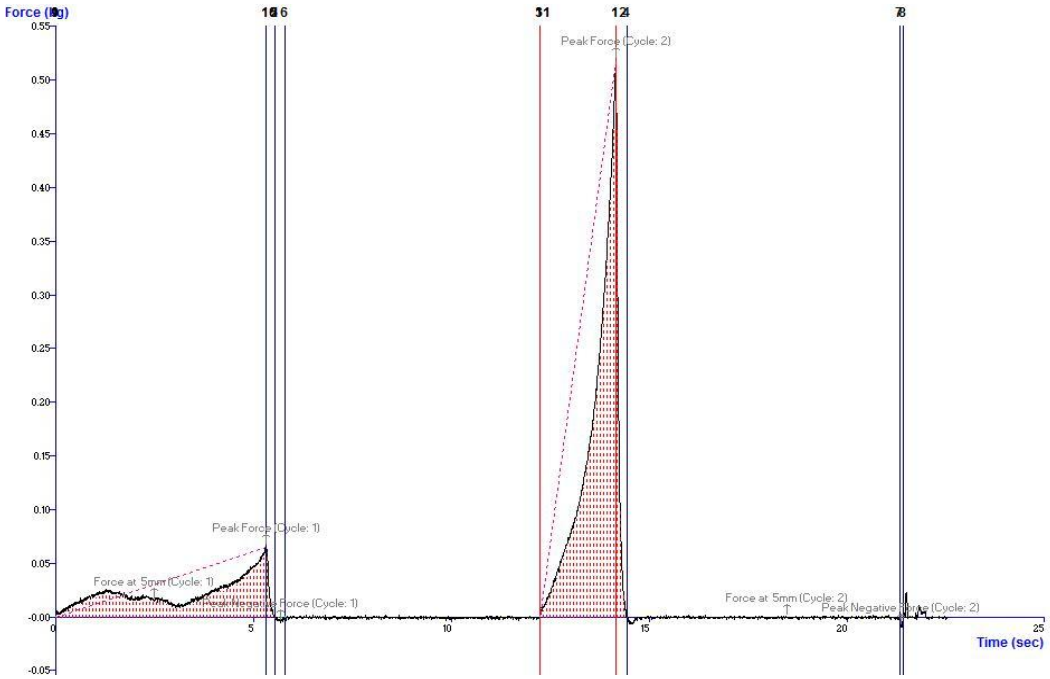


Fig.3 Typical textural profile curve of kalakand Sample T3

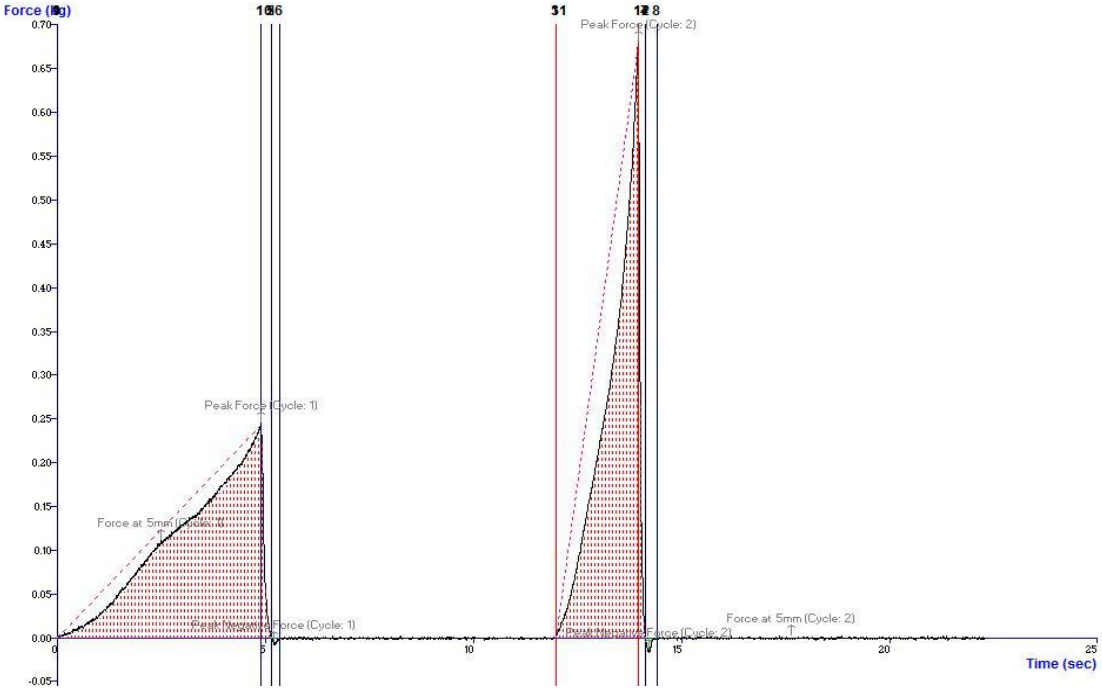
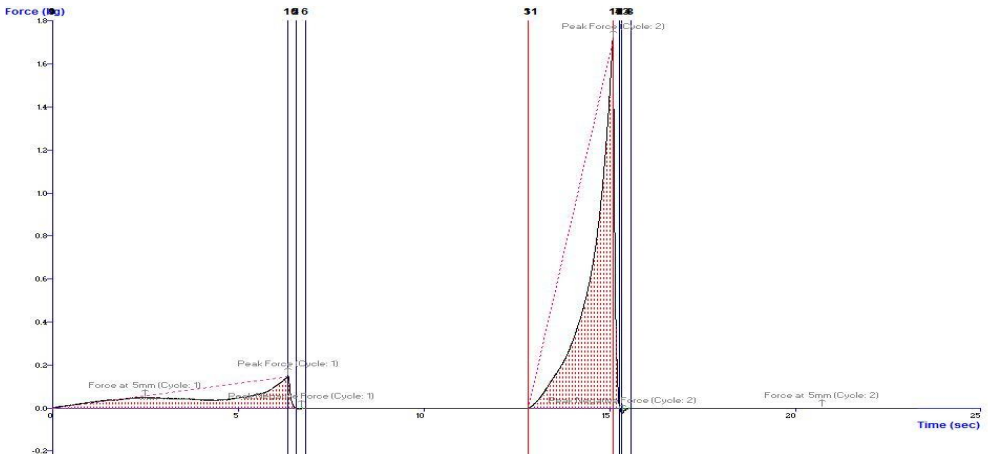


Fig.4 Typical textural profile curve of kalakand sample T4



In conclusion, the three different *Kalakand* samples were collected from eleven different shops in the market of Parbhani district and one laboratory made *Kalakand,* showed wide variation in their textural profile. This may be due to the variation in their method of preparation and varying levels of pulp, sugar and moisture content. The correlation study indicated that, there is a direct relation between moisture levels and textural variations, which affects also the sensory attributes of the *Kalakand* samples.

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