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## Textural properties and colour characteristics of date (*Phoenix dactylifera* L.) *peda*

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### Abstract

The Present research work was conducted in the Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (MS), India during the year 2020-2021. The invention was carried out to optimize the levels of date (*Phoenix dactylifera* L.) syrup in *peda* and study the shelf life of *peda*. On the basis of results of sensory evaluation, three levels of date syrup *viz.*, 15%, 20% and 25% were chosen. The date *peda* samples were analyzed for sensory, chemical, textural properties, colour characteristics and microbiological qualities. The *peda* sample (20% date syrup) had values for hardness, cohesiveness, adhesiveness, springiness, gumminess and chewiness 0.453 kg, 1.300, 0.015 kg. sec, 1.825 mm, 0.5889 kg. sec and 1.07474 kg. sec. The colour characteristics (L\*, a\* and b\*) values of fresh date *peda* samples ranged from 60.47 to 71.00, - 0.21 to 2.98 and 17.76 to 18.82, respectively.

**Keywords:** Date syrup, *peda*, textural property, colour characteristics

### Introduction

Traditional dairy products and sweets are an integral part of Indian heritage and have great social, religious, cultural, medicinal and economic importance. *Khoa* is one of the important Indian dairy products. It is used as a principal base material for the manufacture of variety of Indian sweets such as *Peda*, *Burfi*, *Gulabjamun*, *Kalakand*, *Kunda* etc. It is made of either dried or whole milk thickened by heating it in an open iron pan (Londhe and Pal, 2007) [10]. *Khoa* occupies a prominent place in traditional dairy products sector.

*Khoa* is highly nutritious food having 90 per cent digestibility coefficient of proteins and 69 per cent biological value (Balasubramanian *et al.*, 1955) [3]. *Khoa* based sweets are also rich in minerals like calcium, phosphorous, iron, etc. Although milk is a poor source of iron, milk sweets like *peda* and *burfi* provide adequate amount of iron which may be entering in them during the process of preparing *khoa* in an open vessel made of iron.

*Peda* is popular indigenous *khoa* based heat desiccated milk product, which is prepared from cow milk, buffalo milk or a combination thereof. It has been reported that the quantity of *pedha* produced in India exceeds any other indigenous milk based sweet using *khoa* as a raw material (Mahadevan, 1991) [11]. *Peda* has special importance in various celebrations like wedding, inaugural functions, to celebrate success in examinations or in such other events. Hindus, mostly offer *peda* to God as a '*Prasad*' which is then distributed to public.

All the types of *peda* have distinct characteristics and method of manufacture vary from region to region. Other ingredients are also incorporated to cater the special need of flavour, body and texture characteristics. Cereals like rice and wheat in the form of maida and suji was also tried in milk products, such as *kheer*, *gulabjamun* (De *et al.*, 1980).

The rest of date weight includes protein, fat, crude fibre, minerals, different vitamins (especially vitamin B), tannins, and many other components (Hashempoor, 1999) [7].

Date fruit has anti-tumor activity (Ishurd and Kennedy, 2005) [8], antioxidant and anti-mutagenic properties. Polysaccharides isolated from dates showed an antitumor activity (Ishurd and Kennedy, 2005) [8]. Date syrup contains in addition to sugar, macro and micro elements particularly high iron content (Al-Khateeb, 2008) [1]. The consumption of dates benefit in glycaemic and lipid control of diabetic patients (Miller *et al.*, 2002; 2003) [12-13]. Date syrup as a natural and nutritional additive is one of the best choice for milk flavoring and a safe alternative to added sugar to produce dairy products. Dates or date products provide unique functionality when used with other products including sweetening, flavouring and increasing nutritional quality. The fruit has been recommended in folk remedies for the treatment of various infectious diseases and cancers (Duke, 1992) [6].

Moreover, most of the carbohydrates in this product are in the form of fructose and glucose, which are easily absorbed by the human body. The presence of natural antioxidants and phenolics in dates make them suitable against different maladies like infectious and bacterial diseases, diabetes, hyperlipidaemia, and cancer.

Incorporation of plant origin material in milk or milk products, directly or indirectly adds dietary fiber in human food. So far the research on incorporation of plant and fruit origin materials in milk and milk products has been focused on value addition to improve acceptability, taste and flavor development.

**Materials and Methods**

The material used and methods employed for conducting the experiments are as follows.

**Materials**

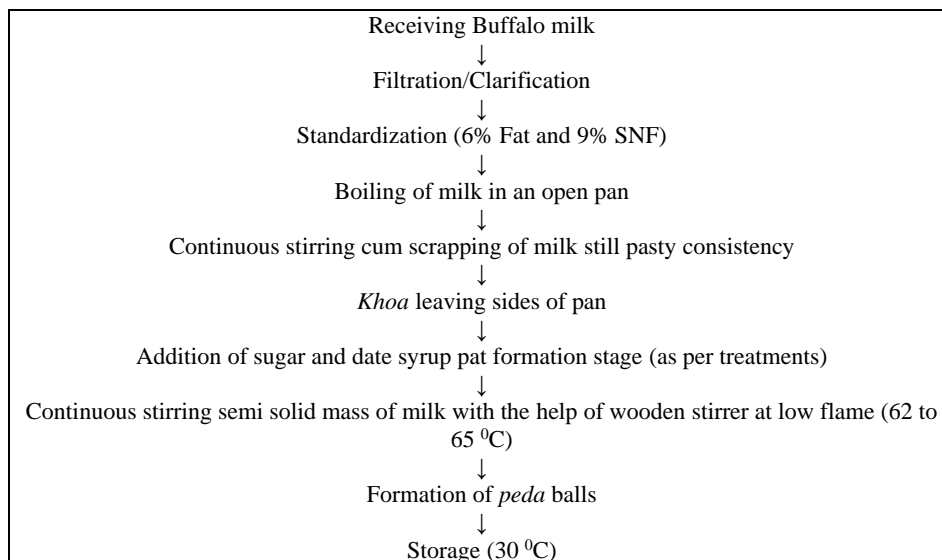
The khunti with flattened end with a relatively sharp edge with long handle was used for stirring cum-scraping the

milk. Fresh, clean, composite samples of buffalo milk utilized for preparation of *peda* was procured from local source. Good quality, clean, crystalline, white cane sugar was procured from local market. Good quality fresh date syrup manufactured by Lion dates Impex Pvt Ltd. Chennai was used during study. An iron karahi having 31 cm diameter and 8.5 cm depth was used for the desiccation of milk. Tempo make, Nashik (India) muffle furnace was used for determination of ash content in the samples. A colony counter with magnifying lens was used for counting the colonies formed by microorganisms. An instrument manufactured by Kirloskar Electronic Ltd., Mumbai (India) was used for microbiological work. Rectangular cardboard boxes with butter paper lining was used as packaging material for *peda*.

**Methods**

**Preparation of date *peda***

The *peda* samples were prepared as per the procedure described by Dharma Pal *et al.*, (1998) with suitable modifications.



**Fig 1:** Flow diagram for manufacturing of *peda*

**Treatment details**

On the basis of the results of sensory evaluation during pre-experimental trials 15%, 20% and 25% levels of date syrup were chosen for experimental trails. The sugar level 25% of *khoa* was kept constant for all the treatments.

T<sub>0</sub>: *Khoa* + without date syrup + 25% sugar

T<sub>1</sub>: *Khoa* + Date syrup @15% on *khoa* weight basis + 25% sugar

T<sub>2</sub>: *Khoa* + Date syrup @ 20% on *khoa* weight basis+ 25% sugar

T<sub>3</sub>: *Khoa* + Date syrup @ 25% on *khoa* weight basis + 25% sugar

**Texture Profile Analysis**

Textural profile analysis of *peda* samples was performed on the textural analyzer (TA.XT plus, Stable Micro systems, U.K) such as hardness, Cohesiveness, Gumminess, Springiness, Adhesiveness and Chewiness. The textural properties were evaluated using the TA.XT plus texture analyser of stable Micro system equipped with 50 kg load cell. The analyser is linked to a computer that recorded the data via a software programme. *Peda* sample of length 1 cm<sup>3</sup> was cut from the central portion of tofu cake with a stainless

steel cutter. A stainless steel probe of 5 mm diameter with a flat end was used to determine the textural properties with following settings.

Test mode	:	Compression
Pre-test mode	:	1 mm/ sec
Test speed	:	1 mm/ sec
Post-test speed	:	5 mm/ sec
Target mode	:	Distance
Distance	:	5 mm
Count	:	2 count

**Typical Textural Profile Curve**

The data obtained in the compression test were used for determination of the following textural parameters.

**Hardness**

It is defined as the value of the peak force of the first compression of the product.

Hardness, g (H) = Maximum force of first compression.

**Cohesiveness**

Extent to which a material can be deformed before it ruptures

depending on the strength of internal bonds. (Ratio of the positive force areas under first and second compressions).

### Adhesiveness

The energy required to overcome attractive force between the food and any surface it is in contact.

Adhesiveness, g, mm ( $A_3$ ) = Negative area in the graph.

### Springiness

Height that the food recovers during the time that elapses between the end of the first bite and the start of the second bite.

Springiness =  $D_1$ .

### Gumminess

Energy required for disintegrate semi-solid food product to a state ready for swallowing.

Gumminess = Hardness x Cohesiveness

### Chewiness

Energy required for masticating a solid food product to make it ready for swallowing.

Chewiness (g) = Gumminess x Springiness

### Colour Characteristics of date *peda*

Colour scanning machine (Model-Color Flex EZ) manufactured by Premier colorscan, Thane, (Maharashtra) was used for measurement and comparison of *peda* colours.

The color was measured by using CIELAB scale at 10° observer at D65 illuminant. It works on the principle of focusing the light and measure energy reflected from the

sample across the entire visible spectrum. It provides reading in terms of  $L^*$ ,  $a^*$  and  $b^*$ , where, luminance ( $L^*$ ) form the vertical axis, which indicates whiteness (+) to darkness (-). In the same way  $a^*$  indicates redness (+) to greenness (-) and  $b^*$  yellowness (+) to blueness (-).

The instrument was calibrated before placing the sample by placing black tile and white tile provided with instrument. Once the instrument was standardized, it was ready to measure the color of *peda* samples. The *peda* was placed in sample cup. The deviation of the color of the sample to standard was also observed and recorded in the computer interface.

### Statistical design and analysis of data

The experiment was laid out in completely Randomized Design (CRD) with four replications for pre-experimental and five replications for experimental trials. The data was tabulated and analyzed according to Snedecor and Cochran (1994) [18].

### Results and Discussion

The results of the present investigation are presented and discussed here under following headings.

#### Textural Properties of Date *Peda*

The quality of product is monitored not only by the sensory properties but also by their textural profile. The instrumental method of texture assessment aims at quantifying objectively the textural characteristics to the maximum extent possible. The textural characteristics of *peda* are greatly influenced by its composition and manufacturing parameters. The textural profile of *peda* was measured in terms of hardness, cohesiveness, adhesiveness, springiness gumminess and chewiness. The results pertaining to textural analysis of *peda* is presented in following Table 1.

**Table 1:** Effect of different levels of date syrup on textural properties of *peda*

Tret.	Hardness (kg)	Cohesiveness	Adhesiveness (kg.sec)	Springiness (mm)	Gumminess (kg.sec)	Chewiness (kg.sec)
T <sub>0</sub>	0.893	3.110	0.053	1.758	2.77723	4.88237
T <sub>1</sub>	0.523	2.258	0.035	1.778	1.18093	2.09969
T <sub>2</sub>	0.453	1.300	0.015	1.825	0.5889	1.07474
T <sub>3</sub>	0.410	1.085	0.010	1.860	0.44485	0.82742

### Hardness

Hardness is the most commonly evaluated characteristics in determining the textural property of *peda*. The changes in values of hardness due to addition of different levels of date syrup in the *peda* presented in Table 1. The values of hardness for *peda* samples varied from 0.410 to 0.893 kg. The hardness of *peda* sample prepared without date syrup (T<sub>0</sub>) was found maximum (0.893 kg) as compared to other samples. It represents that addition of date syrup decreased the hardness of *peda*. The highest value of hardness of *peda* sample (T<sub>0</sub>) may be due to no date syrup content of *peda* and lower moisture content of sample. Hardness of *peda* depends upon moisture, fat and total sugar content.

Patel (1996) [14] reported that moisture content of *peda* had direct relationship with hardness. The obtained results justify the higher content of moisture per cent in *peda* sample decreases the hardness.

### Cohesiveness

Cohesiveness refers to the extent to which a material can be deformed before it ruptures. 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 it is unit less.

From the Table 1, it was indicated that there was decrease in cohesiveness due to the effect of increase in moisture content and the level of date syrup in the *peda*. The highest value for cohesiveness was found in T<sub>0</sub> sample (3.110) whereas the lowest cohesiveness value was found in T<sub>3</sub> sample (1.085). The cohesiveness of *peda* sample ranged from 1.085 (T<sub>3</sub>) to 3.110 (T<sub>0</sub>).

The obtained results justify the increase in moisture per cent in *peda* sample decreases the cohesiveness.

Rasane *et al.* (2012) [17] reported cohesiveness of market samples of *peda* ranged between 0.29 to 0.38. Further reported that the lower score for cohesiveness in treated product is due to higher moisture content in rice bran brown *peda*.

### Adhesiveness

Adhesiveness is related to the sensory stickiness and indicated by a negative peak following the first peak. The *peda* sample

T<sub>3</sub> had 0.010 kg.sec and *peda* sample prepared without date syrup (T<sub>0</sub>) had highest 0.053 kg.se. adhesiveness. The change in adhesiveness due to addition of different levels of date syrup presented in Table 1. The decrease in adhesiveness value in the *peda* samples prepared with date syrup may be due to fiber content.

The similar findings were observed by Jain *et al.* (2012) [9] they reported significant decrease in the adhesiveness of *lal peda* with increase in concentration of inulin (0.5 to 2%).

**Springiness**

The springiness depends on factors such as heat treatment and degree of firmness. There was no significant difference among the *peda* samples T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. Among the *peda* samples, *peda* samples without date syrup (T<sub>0</sub>) had lowest springiness value 1.758 mm, while the highest value (1.860 mm) was observed in *peda* sample prepared with 25% date syrup (T<sub>3</sub>). Patil *et al.* (2015) [16] reported that *burfi* increases the springiness.

**Gumminess**

Gumminess is related to primary parameters of hardness and cohesiveness and is obtained by multiplication of these two parameters. Among all *peda* samples, *peda* sample without date syrup (T<sub>0</sub>) had highest gumminess value (2.77723 kg.sec), while lowest values (0.44485 kg.sec) was observed in *peda* sample prepared with 25% date syrup (T<sub>3</sub>).

Patel *et al.* (2006) [15] reported that very high gumminess in *plain peda* prepared by traditional method.

**Chewiness**

Chewiness refers to the energy required to masticate food into a state ready for swallowing and is a product of gumminess

and springiness. Chewiness is one of the most important textural properties of date *peda*. The addition of date syrup significantly affected the chewiness of *peda*.

Among all *peda* samples, *peda* sample prepared with 25% date syrup (T<sub>3</sub>) showed lowest chewiness value (0.827421 kg.sec) while the highest value (4.882370 kg.sec) was observed in *peda* sample prepared without date syrup (T<sub>0</sub>).

Arora *et al.* (2010) [2] observed variation in textural properties of *burfi* made from sucrose and artificial sweeteners.

**Colour characteristics of date *peda***

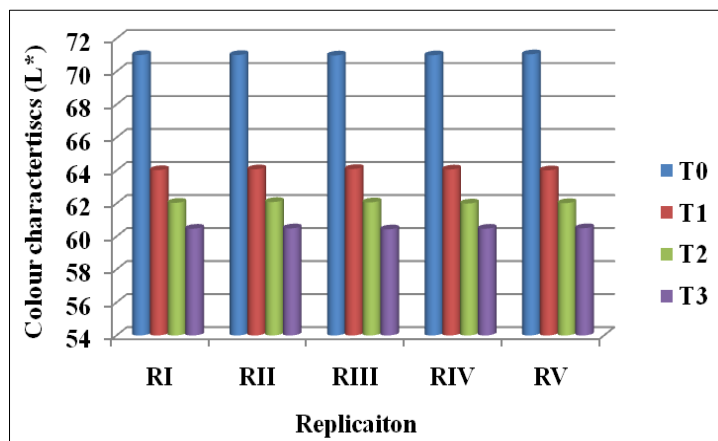
Colour has always been one of the main consumer’s criteria for judging the quality of food product. The colour scanning machine was used to objectively quantify the difference in colour attributes of *peda* samples. The results obtained from the colorimeter gives three values in term of L\*, a\* and b\*.

**Colour (L\*)**

The colour characteristics (L\*) of *peda* sample is depicted in Tables 2. L\* value represents degree of whiteness (100) to darkness (0), the values for colour L\* ranged from 60.47 to 71.00. Significant differences in L\* value of *peda* sample were observed.

**Table 2:** Colour characteristics (L\*) of *peda* influenced by different levels of date syrup

Treatment	Mean
T <sub>0</sub>	71.00 <sup>a</sup>
T <sub>1</sub>	64.05 <sup>b</sup>
T <sub>2</sub>	62.04 <sup>c</sup>
T <sub>3</sub>	60.47 <sup>d</sup>
SE ±	0.014
CD at 5%	0.041



**Fig 1:** Colour characteristics (L\*) of *peda* influenced by different levels of date syrup

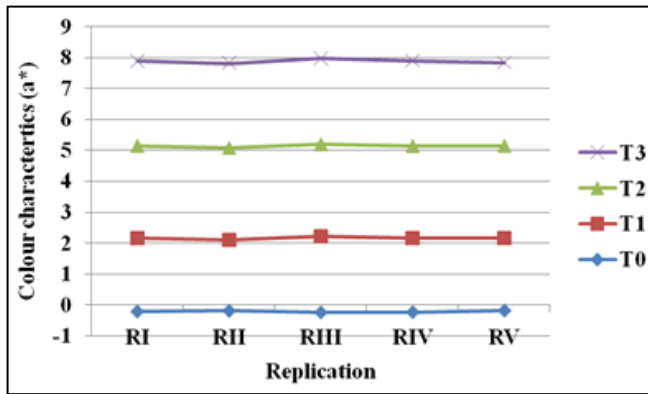
**Colour (a\*)**

The colour characteristics (a\*) of *peda* sample is depicted in Tables 3. Positive a\* values represent redness. A negative a\*

values represents degree of greenness. The values ranged from - 0.21 to 2.98. Significant differences in a\* value of *peda* sample were observed.

**Table 3:** Colour characteristics (a\*) of *peda* influenced by different levels of date syrup

Treatment	Mean
T <sub>0</sub>	- 0.21 <sup>d</sup>
T <sub>1</sub>	2.38 <sup>c</sup>
T <sub>2</sub>	2.74 <sup>b</sup>
T <sub>3</sub>	2.98 <sup>a</sup>
SE ±	0.016
CD at 5%	0.048



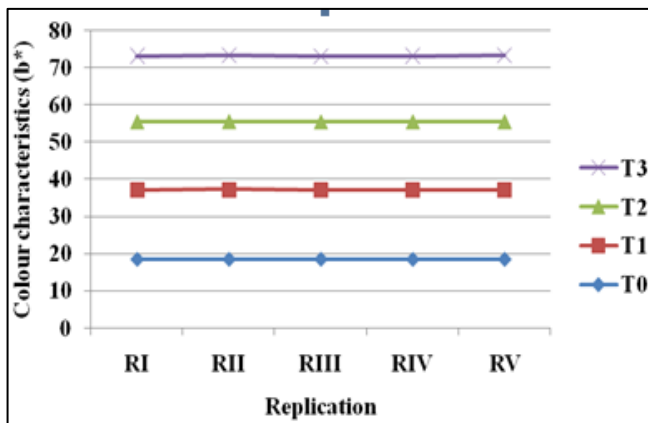
**Fig 2:** Colour characteristics (a\*) of *peda* influenced by different levels of date syrup

**Colour (b\*)**

The colour characteristics (b\*) of *peda* sample is depicted in Tables 4. Positive b\* values represents degree of yellowness. The values ranged from 17.76 to 18.82 of all *peda* samples. All treatment were significantly (P < 0.05) differed from each other.

**Table 4:** Colour characteristics (b\*) of *peda* influenced by different levels of date syrup

Treatment	Mean
T <sub>0</sub>	18.82 <sup>a</sup>
T <sub>1</sub>	18.44 <sup>b</sup>
T <sub>2</sub>	18.26 <sup>c</sup>
T <sub>3</sub>	17.76 <sup>d</sup>
SE ±	0.012
CD at 5%	0.036



**Fig 3:** Colour characteristics (b\*) of *peda* influenced by different levels of date syrup

**Conclusions**

The results of this investigation would lead to conclusions as under: *Peda* sample containing 20% date syrup and 25% sugar had hardness, cohesiveness, adhesiveness, springiness, gumminess and chewiness values were 0.453 kg, 1.300, 0.015 kg.sec, 1.825 mm, 0.5889 kg.sec and 1.07474 kg.sec. The mean colour characteristics (L\*, a\* and b\*) values of fresh date *peda* (20% date syrup) were 62.04, 2.74 and 18.26, respectively.

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