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## Effect of hydrocolloid on textural and sensorial quality of liquid jaggery based tamarind leather

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**Abstract**

The tamarind leather is confectionary accepted by all age groups, rich in minerals. The aim of the current study was to determine how hydrocolloid affected the textural and sensory qualities of tamarind leather made from liquid jaggery. Liquid jaggery in the tamarind leather gave product texture sticky. This stickiness could be removed by addition of hydrocolloid like guar gum and maltodextrin. Guar gum and maltodextrin in the leather was added in the proportion T<sub>0</sub> (0%), T<sub>1</sub> (0.5%), T<sub>2</sub> (1%), T<sub>3</sub> (1.5%) and T<sub>4</sub> (2%). The leather was prepared and well dried. The resultant leather was evaluated for its textural and sensory quality to decide the best quality leather, found that the leather with 1% guar gum and maltodextrin was found to be best for color and appearance, flavor, texture and overall acceptability.

**Keywords:** Tamarind leather, hydrocolloids, guar gum, maltodextrin, pectin

**Introduction**

The tropical fruit known as the tamarind (*Tamarindus indica* L.) is a member of the subfamily Caesalpinioideae and family Leguminosae (Fabaceae). Tropical Africa is home to the tamarind. (Vuyyala *et al.*, 2019) [22]. Almost every part of this versatile tree can be used for something, whether it be medicinal or nutritional. (El Sidding *et al.*, 2006) [7].

India is world's largest producer of tamarind (Deokar *et al.*, 2019) [6]. The tree is occasionally farmed, but it primarily grows wild. The drier southern states of India are the main locations for tamarind cultivation, with the crop being gathered by the peasants and sold on the open market. It naturally regenerates on wastelands and forest lands in several regions of India. Since ancient times, India has been importing processed tamarind pulp to the United States of America and other western nations. Over 10,000 tonnes of tamarind are exported to the US every year, bringing in over 100 million Indian rupees. In India, tamarind production and area were 188 thousand MT and 59 thousand hectares, respectively, in 2014–2015. (Anon, 2014) [2]. The tamarind leather fruit's nutritional makeup varies greatly. The tamarind fruit is composed of roughly 55% pulp, 34% seeds, shell, and fiber. The fruit has a modest quantity of vitamins A and C, but it is an excellent source of calcium, thiamin, and niacin. Tamarind's most notable feature is how acidic it is, with a total acidity range of 12.2 to 23.8% in the form of tartaric acid. (Morton, 1987; Chapman, 1984 and Persueglove, 1987) [10, 4, 15]. The tamarind pulp of the Ajanta variety had the following chemical composition: TSS 27.0 Brix, pH 2.6, acidity 1.5%, tartaric acid 1.8%, reducing sugar 17.7%, total sugar 38.8%, and ascorbic acid 3.9%. (Joshi *et al.* 2013) [9].

Mango leathers are enhanced with sugar and pectin, and fruit pulps are combined with suitable amounts of acid, sugar, pectin, and coloring before being dried and formed into sheets. Pectin was added to thicken the pulp, change the flexible texture, and guarantee that the dried products' forms would hold after the sugar added sweetness and solids content.

When making jaggery from sugarcane juice, liquid jaggery is a crucial intermediate product that is obtained. Because liquid jaggery contains extra nutritional elements with a variety of therapeutic benefits, it's a good nutraceutical. Many traditional dishes and ayurvedic medicine formulas contain liquid jaggery (Rajendran *et al.*, 2020) [16]. One adaptable substance that may be utilized in a variety of culinary compositions, similar to honey, is liquid jaggery.

(Nath *et al.*, 2015)<sup>[11]</sup>. With over 70% of the world's supply, India is the world's largest producer of jaggery. (Rao *et al.* 2007)<sup>[17]</sup>.

Fruit leather, sometimes referred to as a fruit bar or fruit slab, is a dehydrated fruit-based confection that is frequently consumed as a dessert or snack. It is created by using a cabinet drier to dry a very thin coating of fruit puree and other ingredients into sheets that resemble leather. (Andress and Harrison, 1999)<sup>[1]</sup>. Fruit leathers need hydrocolloids to retain their desired texture. They have been employed as thickening or gelling agents that have the ability to bind water molecules, improving the intended textural qualities of food products (Rascón-Díaz *et al.*, 2012)<sup>[18]</sup>. When various forms of hydrocolloids are utilized, the instrumental textural qualities of fruit leather are measured to match with the desired features. Pear fruit leather's cohesiveness and springiness were both enhanced and lessened by a high water content, according to an instrumental texture profile analysis. (Huang and Hsieh, 2005; CheMan and Taufik, 1995)<sup>[8, 5]</sup>. Mango and guava leathers became less hard as the moisture level rose. (Vijayanand *et al.*, 2000)<sup>[21]</sup>. Because of water absorption during storage, the piercing force of mango leather reduced as the water content increased (Azeredo *et al.*, 2006)<sup>[3]</sup>. Pear fruit leather was found to be harder, more cohesive, springy, and chewier when it contained a higher pectin concentration; on the other hand, when corn syrup was added, the fruit leathers became softer (Huang and Hsieh, 2005)<sup>[8]</sup>. In the leather having both pectin and cellulose (0.5 and 1% concentration), cellulose enhanced hardness more than pectin did, while starch decreased hardness relative to cellulose in the leather containing either 1.0% concentration of cellulose or both pectin and cellulose. Rising pectin and rising glucose syrup concentrations in kiwi fruit leather both significantly enhanced tensile strength. (Vatthanakul *et al.*, 2010)<sup>[20]</sup>, and strawberry fruit leather (Ratphitagsanti, 2004)<sup>[19]</sup>. Hence present investigation, the efforts has been made to prepare liquid jaggery based tamarind leather from Ajanta variety with different levels of hydrocolloids.

## Materials and Methods

### Materials

An experiment entitled 'Effect of Hydrocolloid on Textural and Sensorial Quality of Liquid Jaggery Based Tamarind Leather' was carried out in the Department of Food Chemistry and Nutrition, College of Food Technology VNMKV Parbhani.

Ingredients used in the preparation of leather *viz.* tamarind, liquid jaggery, pectin, citric acid, guar gum and maltodextrin and packaging material HDPE bags were procured from local market.

### Methods

#### Preparation of tamarind pulp

Tamarind pulp was developed as per the methods given by Joshi *et al.* (2013)<sup>[9]</sup>.

Fresh sound quality ripe, mature tamarind fruit were selected. These fruits were cleaned by removing shell, rags and seeds. Once tamarind pods were washed with water to remove any foreign particle. Water in the ration with flesh 1:2 was added. This was heated to 70 °C for 10 minutes and soaked for 6 hours. After soaking process maceration and

straining process was carried out to obtain tamarind pulp. The pulp of tamarind was passed through a 1 mm filter mesh.

#### Preparation of tamarind leather

Tamarind leather was developed as per process standardized by Pavani *et al.* (2022)<sup>[14]</sup> with slight modification. The puree for drying was prepared by mixing 100 grams of tamarind pulp with 30 grams of liquid jaggery, 0.4 grams of citric acid, 1 grams of pectin and 2 grams of funnel seeds extract stirred continuously till all ingredients distributed uniformly. Quantity of guar gum and maltodextrin was varied according to treatment given in the Table 1.

Next, the puree was cooked for ten minutes to ninety-°C. The puree was then transferred into aluminum trays that had been coated with glycerin. The sample was dried for 12 hours at 65±5 °C in a cabinet tray dryer. Samples were taken out of the dryer, chopped, and then placed inside HDPE bags.

**Table 1:** Formulation of recipe of tamarind leather at different level of guar gum and maltodextrin

Ingredients	Control (T <sub>0</sub> )	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Tamarind pulp	100	100	100	100	100
Liquid Jaggery	30	30	30	30	30
Citric acid	0.4	0.4	0.4	0.4	0.4
Pectin	1	1	1	1	1
Guar gum	0	0.5	1	1.5	2
Maltodextrin	0	0.5	1	1.5	2
Funnel Seed Extracts	0	2	2	2	2

#### Sensorial evaluation of tamarind leather

Leather was evaluated for sensory characteristics like color, flavor, texture and overall acceptability by semi trained panel members on a 9-point Hedonic Scale with corresponding descriptive terms ranging from 9 'like extremely' to 1 'dislike extremely'.

#### TPA analysis of tamarind leather

When determining if a product is acceptable to consumers, there are some food-related factors that are very important. One of the most important characteristics of leather is its texture, which may be analyzed using criteria like cohesion, chewiness, stickiness, and hardness. these characteristics aid in calculating the force needed to bite or chew the fruit leather during mastication.

Using a load cell weighing two kilograms, texture analysis was carried out using a single arm texture analyzer (TA-XT Plus, Stable Micro Systems, Surrey, UK). A two-cycle compression force versus time curve was recorded using a disk probe with a 35 mm diameter moving at 10 mm/min. The data generated was analyzed using the texture analyzer's built-in software.

**Table 2:** Set parameters of TAX-T2 plus texture analyzer

Test mode	Compression
Pre-test speed	1 mm/sec
Test speed	5 mm/sec
Post-test speed	5 mm/sec
Target mode	Distance
Distance	10 mm
Time	5 sec

**Statistical analysis:** A statistical analysis was performed on the data that was collected for this investigation. The data was analyzed according to a completely randomized design (CRD) The analysis of variance. When necessary, the analysis of variance demonstrated that S.E. and C.D. at the 5% level were significant at the  $p < 0.05$  level.

## Result and Discussion

### Effect of hydrocolloids on sensorial quality of tamarind leather

The hydrocolloids at different quantity *viz.* 0, 0.5, 1, 1.5 percent were used in preparation of tamarind leather and results were found are presented in Table 3.

**Table 3:** Effect of hydrocolloids on sensorial quality of tamarind leather

Treatment	Color and Appearance	Texture	Taste	Flavor	Overall Acceptability
Tg <sub>0</sub>	8.3	7.1	8.3	8.3	7.9
Tg <sub>1</sub>	8.2	7.5	8.2	8.3	8.0
Tg <sub>2</sub>	8.2	8.3	8.2	8.2	8.2
Tg <sub>3</sub>	8.1	8.1	8.2	8.2	8.0
Tg <sub>4</sub>	8.1	8.0	8.0	8.0	8.0

\*Each value is average of three determinations

### Color and appearance

When evaluating a product's quality and consumer acceptability, color is a crucial factor. Table 3 shows that the leather's color and appearance were essentially the same for every treatment. Samples Tg<sub>0</sub>, Tg<sub>3</sub>, and Tg<sub>4</sub> have hedonic ratings of 8.3, 8.1, and 8.2, respectively, on the scale, while samples Tg<sub>1</sub> and Tg<sub>2</sub> have hedonic ratings of 8.2, which is considerably higher than the other treatments. It is important to remember that a greater hydrocolloid content is undesirable for color, as the sensory rating drops from 8.3 to 8.1.

### Texture

The addition of maltodextrin and guar gum to the product affected its textural qualities, resulting in why sample Tg<sub>2</sub> (8.3) received the highest hedonic score. Texture scores of Tg<sub>0</sub> (7.1), Tg<sub>1</sub> (7.5), Tg<sub>3</sub> (8.1), and Tg<sub>4</sub> (8.0) are hedonic. Because the T1 sample combines the benefits of maltodextrin and guar gum, it received the highest score. The hard texture of the leather caused the texture to drop from Tg<sub>3</sub> to Tg<sub>4</sub>.

### Taste

Owing to a lower concentration of guar gum and maltodextrin, Tg<sub>0</sub> was found to have the best taste score, followed by Tg<sub>1</sub>, Tg<sub>2</sub>, Tg<sub>3</sub>, and Tg<sub>4</sub>. A maximum of 1% of maltodextrin and guar gum was permitted; any amount

above that was not because it would adversely affect the flavor characteristics.

### Flavor

Up to 1 percent, it was discovered that the average flavor score for leather treated with guar gum and maltodextrin at various levels-0, 0.5, 1, 1.5, and 2 was relatively similar. The treatment with the highest percent of maltodextrin and guar gum received the lowest score (8.0).

### Overall Acceptability

Furthermore, it was possible to see that the sample Tg<sub>2</sub> (8.2) performed exceptionally well when compared to the control and all other samples. This suggests that the total acceptability of leather may be raised by adding up to 1 percent more guar gum and maltodextrin, whereas the total acceptability may be lowered by adding more than 1 percent. These outcomes were similar to those of Patil *et al.* (2017) [13] in terms of the quality characteristics of fruit leather derived from date and mango.

### Texture Profile Analysis of Tamarind Leather

Texture is a major factor in deciding whether or not customers are ready to accept the developed product. Using a Texture Analyzer, the textural characteristics of the tamarind leather were measured in relation to hardness, cohesiveness, springiness and gumminess.

**Table 4:** Texture profile analysis of tamarind leather

Sample	Parameters			
	Hardness(kg)	Cohesiveness(g/sec)	Springiness(mm)	Gumminess
Tg <sub>0</sub>	52.1	1.023	0.874	78.8
Tg <sub>1</sub>	54.6	1.032	0.877	80.3
Tg <sub>2</sub>	57.3	1.244	0.910	82.4
Tg <sub>3</sub>	60.2	1.346	0.987	85.5
Tg <sub>4</sub>	62.2	1.508	0.998	87.1

The data presented in Table 4 demonstrated that adding hydrocolloids, such as maltodextrin and guar gum, to tamarind leather could make it harder. Sample Tg<sub>4</sub> (62.2 kg) had the highest hardness, whereas sample Tg<sub>0</sub> had the lowest hardness due to the complete absence of hydrocolloids.

According to data revealed in Table 4, the springiness test results for tamarind leather ranged from 0.874 to 0.998 mm. The extremely low springiness value indicates that once force is applied to the tamarind leather, it does not return to its original state. The outcomes closely matched the findings

of Parn *et al.* (2015) [12], who noted that both varieties of date bars had low springiness values, with values falling below 1. This suggests that because of their low cohesiveness, leather can be chewed on easily.

With respect to gumminess, guar gum and maltodextrin affects the gumminess of tamarind leather with value Tg<sub>0</sub> (78.8) to Tg<sub>4</sub> (87.1).

### Conclusion

It can be concluded that hydrocolloids guar gum and maltodextrin addition in the tamarind leather was accepted

up to 1 percent by sensory attributes. This might lead to the creation of premium tamarind leather with less sticking issues and better-quality goods in terms of acceptance overall, color, flavor, and texture.

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