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Development and Sensory Evaluation of Traditional Imali Candy with Enhanced Shelf-Life

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A B S T R A C T

Candy, a sweet confectionery product, is typically made by preserving fruits or vegetables in sugar syrup and drying them. While traditional candies use high-sucrose sweeteners (99.7% purity), excessive consumption contributes to diabetes, obesity, and cardiovascular diseases. To address this, the study developed a healthier Imli (tamarind) candy fortified with dates, balancing nutrition and sensory appeal. Tamarind, rich in iron, potassium, and antioxidants, was blended with fiber and vitamin-rich dates to reduce refined sugar dependency. Four formulations (T0–T3) with varying tamarind (10–40%), dates (10–40%), and sugar ratios were tested. Sensory evaluation (9-point hedonic scale) revealed T2 (40% tamarind, 20% dates) as the preferred variant, scoring highest (9.0) for taste, texture, and overall acceptability. Nutritional analysis confirmed enhanced protein, fiber, iron, and potassium content, alongside tamarind's anti-inflammatory benefits. Shelf-life studies demonstrated 6-month stability in LDPE packaging at ambient conditions. Economic assessment indicated commercial viability, meeting demand for affordable, nutritious sweets. The study concludes that tamarind-date candy offers a healthier, market-ready alternative to conventional candies, combining functional benefits with consumer-friendly sensory attributes

Keywords: *Imali* candy, Tamarind, Dates fortification, Sensory evaluation, Nutritional enhancement, Shelf stability

1. Introduction

Candy is a popular sweet confection typically prepared by integrating fruits or vegetables with sugar syrup, followed by draining excess syrup and drying the product to a shelf-stable state. Various fruits and vegetables, such as apples, ginger, mangoes, guava, carrots, and citrus peels, have been utilized for candy production (Durrani et al., 2011). Traditionally, white sugar (comprising approximately 99.7% sucrose) is used as the primary sweetening agent in candy formulation. Although the high sugar content inhibits microbial spoilage due to its low water activity (Rawat, 2015), excessive consumption of sucrose is associated with adverse health effects, including cardiovascular diseases, dental caries, hypertension, diabetes mellitus, and coronary thrombosis (Alam, 1999; Touger-Decker & van Loveren, 2003; Nguyen et al., 2009). Due to increasingly busy lifestyles, consumers often resort to processed and nutritionally inadequate foods. This highlights the growing need for the development of health-promoting confectionery products that do not compromise on sensory appeal or affordability. There is a notable shift among food manufacturers towards incorporating natural, functional ingredients to produce healthier alternatives. Tamarind (Tamarindus indica L.) and dates (Phoenix dactylifera L.) are two such ingredients with significant nutritional and therapeutic properties. The incorporation of tamarind and dates into confectionery can offer multiple health benefits, such as correcting sodium-potassium imbalances and addressing iron deficiencies. A novel tamarind candy formulation was developed using a composition of 50% tamarind and 50% sugar, with subsequent modifications including different incorporation levels of tamarind, sugar, and dates (40:40:20). This ready-to-eat confectionery product is not only palatable and convenient but also aligns with consumer demand for nutritious snacks available in local markets. The addition of dates enhances the candy's functional properties, owing to their rich content of phenolics, carotenoids, and anthocyanins (Saleh et al., 2011). Dates have been reported to exhibit a wide range of bioactivities, including antioxidant (Mohammed & Al-Okbi, 2004), antimutagenic (Vayalil, 2002), anti-inflammatory (Mohammed & Al-Okbi, 2004), antihyperlipidemic (Tang et al., 2013), antibacterial (Sallal & Ashkenani, 1989), and antifungal effects (Sallal et al., 1996). The formulation process involved three treatment variations of tamarind, dates, and sugar ratios. The developed tamarind candy was subjected to sensory evaluation for appearance, color, flavor, aroma, taste, texture, and overall acceptability. Tamarind, a member of the Leguminosae (Caesalpiniaceae) family, is a minor tropical fruit crop extensively used in culinary applications, particularly in southern India (Coates-Palgrave, 1988; Narina & Catanzaro, 2018). The fruit pulp, comprising 70–75% of the total fruit weight, is rich in carbohydrates, proteins, dietary fiber, and essential minerals such as iron, phosphorus, potassium, and calcium (Yahia & Salih, 2011). Tamarind pulp also contains significant levels of organic acids including tartaric, succinic, oxalic, citric, and quinic acids, along with water-soluble vitamins like thiamin and niacin, though retinol and ascorbic acid are present in lower concentrations (Ishola et al., 1990). Date palm (Phoenix dactylifera L.) is a crucial nutritional resource in arid regions of Southwest Asia and North Africa (Al-Farsi & Lee, 2008). Known by various regional names such as "Khajur" in Hindi and Urdu, dates are traditionally consumed during religious observances like Ramadan (Al-Shahib & Marshall, 2003). Date fruits are composed of approximately 70% carbohydrates, primarily sugars,

contributing an energy value of around 314 kcal per 100 grams. They are also rich in dietary fiber (6.4–11.5%), proteins (2.3–5.6%), and essential minerals and vitamins. The seeds and pulp contain both saturated and unsaturated fatty acids, including palmitoleic, oleic, linoleic, and linolenic acids (Elena et al., 2013; Ikbel et al., 2022). By leveraging the nutritional benefits of tamarind and dates, this study aimed to develop a functional, health-oriented candy product that meets the demands of health-conscious consumers.

2. Market Survey

2.1 Purpose and Advantages of Market Survey

To assess the feasibility and consumer acceptance of a value-added tamarind-based candy product, a market survey was conducted. The primary advantages derived from this survey included:

1. Identification of current consumer demands and preferences.
2. Insights into necessary improvements in existing products.
3. Information on similar products already available in the market.
4. Support in cost estimation for the new product.

Development of effective marketing strategies based on consumer behavior.

2.2 Methodology

The survey was administered through online platforms using a structured questionnaire developed via Google Forms. It was circulated among a diverse demographic to capture feedback across all age groups. The survey was conducted over a period of four days, from **27th July 2024 to 31st July 2024**.

2.3 Key Findings

A total of 100 respondents participated in the survey.

Table 1. The summarized results of survey

Survey Question	Response Trend
Are you concerned about health when choosing snacks?	89% responded "Yes", indicating health consciousness
Do you prefer homemade or naturally made food products?	81% preferred homemade/natural products
What qualities do you expect in a new food product?	90% mentioned quality and nutritional value
Do you prefer sweet-tasting food products?	76% expressed preference for sweet products

2.4 Interpretation and Implications

The market survey revealed that:

1. Consumers are increasingly health-conscious and prioritize nutritional value in their food choices.
2. There is a strong preference for homemade and naturally formulated products.
3. Sweet taste remains a popular sensory preference, indicating market potential for sweet yet healthy alternatives.
4. The data supports the development of a tamarind-date candy, as it aligns with consumer expectations for quality, nutrition, and palatability.

These insights validate the concept and formulation of a health-oriented, sweet confectionery product that leverages the nutritional benefits of tamarind and dates.

Today's consumer is becoming more concerned about the health benefits of reduced calories and consuming additional proteins and dietary fiber in the diet. Diabetes and blood pressure are the major health problems of the majority of the Indian population. Our main objective for making of this imli candy was to make a combination of healthy ingredients in a consumable form and to make a healthy product at an affordable cost. In market we have seen various types of confectionary product which are mainly prepared from white sugar which are 99.70% sucrose, chocolate, milk powder and cocoa powder which do not have much health benefits and hence we developed Imli candy with incorporation of dates which are rich in protein, vitamins and minerals. The Imli candy is best for the many health benefits such as intestinal ailments, skin infections, controlling blood pressure, maintaining Blood sugar levels and sore throats because the ingredients used in Imli candy is beneficial and 60% of the ingredients are Tamarind and Dates. They are loaded with good

protein, minerals, fats and fibre. The candy releases those feel good brain chemicals that bring us a much-needed moment of happiness in our otherwise chaotic lives. The key points are as follows-

1. **Progressive sugar reduction** from 50% (T0) to 30% (T3) was compensated by the inclusion of natural date sugars.
2. **Tamarind content variation** (40–50%) helped balance tartness and maintain the distinctive flavor profile.
3. **Incremental date enrichment** (0–20%) improved nutritional value through increased natural sugars, fiber, and minerals.
4. **Total solids consistency** was maintained at 100% to ensure uniform texture and moisture control across treatments.
5. **Progressive sugar reduction** from 50% (T0) to 30% (T3) was compensated by the inclusion of natural date sugars.
6. **Tamarind content variation** (40–50%) helped balance tartness and maintain the distinctive flavor profile.
7. **Incremental date enrichment** (0–20%) improved nutritional value through increased natural sugars, fiber, and minerals.
8. **Total solids consistency** was maintained at 100% to ensure uniform texture and moisture control across treatments.

2. Material and methods

Mixture preparation: The present study was under taken to develop Imli candy from the raw materials. Mixtures were prepared by blending Tamarind pulp, dates, sugar and spices in the ratio of 40:20:40 respectively. Tamarind: Tamarind were procured from local markets of Ballarpur. Tamarind free from insects and pest were used for making the candy. We took Tamarind in a plate and removed lighter dirt particles, minute fibre, seeds and impurities. Grinding of Tamarind in the grinder. Then transfer the Tamarind into a broad non-stick pan containing sugar syrup. Dates: Dates were procured from local markets of Ballarpur. Dates free from insects and pest were used for making the candy. We took Dates in a plate and removed lighter dirt particles, minute fibre, seeds and impurities. Grinding of Dates in the grinder. Then transfer the Dates into a broad non-stick pan containing sugar syrup.

Tamarind Fruit

↓

Peeling (Manually)

↓

Extraction of Pulp

↓

Separation of Fibre and Seeds

↓

Grinding (Tamarind + Dates)

↓

Making Sugar Syrup

↓

Adding All Ingredients

(Tamarind, Dates, Spices)

↓

Heating / Cooking

↓

Cooling (Till Hardness is Achieved)

↓

Shaping into Proper Candy Forms

↓

Sanding (Sugar Dust Coating)

↓

Final Cooling

↓

Packaging

Figure 1. Flowchart for Imali Candy Processing

Table 2. Experimental Formulations of Imli Candy with Varying Composition Ratios

Treatment	Tamarind (%)	Sugar (%)	Dates (%)	Total (%)	Key Characteristics
T0	50	50	0	100	Control (traditional formulation)
T1	50	40	10	100	Initial date incorporation
T2	40	40	20	100	Optimized formulation*
T3	50	30	20	100	High-date variant

3. Methodology

1. Determination of moisture content: Hot air oven method was used to determine the moisture content of the sample (AOAC, 2005). 10g sample was taken in a pre-dried Petri dish and placed in to oven maintained at 105 ± 2°C. Sample was kept till constant weight was achieved in three consecutive weighing. Then the samples were cooled in a desiccator before weighing on electronic balance. Moisture content was calculated using equation. % Moisture = (W1-W2) x 100 W1 W1= weight of sample before drying W2= weight of sample after drying

2. Determination of fat content by Soxhlet apparatus: The total fat content of the sample was estimated by Soxhlet methods (AOAC, 2005). Soxhlet apparatus was used to estimate the lipid content of sample. Firstly, a dried round bottom flask is taken and weighed accurately and recorded. Accurate 5g of sample was taken into thimbles and kept in the Soxhlet tubes. Petroleum ether was poured into the round bottom flask. Now all the tube and condenser were connected. The temperature of the heating mental was set at 120°C. Fat extraction was carried out for 8 hours and the extracted fat was collected into the flask. Now this flask was removed and placed in hot air oven so the solvent will evaporate till constant weight reached and final weight of the flask was recorded. All experiments were conducted three times to minimize the error. The amount of fat present in the sample was calculated as. Fat (%) = (W2-W1) x 100 W Where, W1 = weight of empty flask (g) W2 = weight of flask with oil (g) W = weight of initial sample (g)

3. Determination of ash content by muffle furnace: The total mineral content of sample was determined by the ashing method (AOAC, 2005). For determination of ash content, 5g of sample was weighed in a silica crucible. It was then heated on the gas stove for charring of sample. After charring crucible was placed into muffle furnace maintained at 550˚C for about 3-5hrs. After completion of ashing, the Crucible was cooled in a desiccator and weighed. To ensure completion of ashing, it was heated again in the furnace for half an hour more, cooled and weighed. This was repeated consequently till the weight became constant (ash became white or greyish white). All experiments were conducted three times to minimize the error. Ash % = (W1-W) x 100 (W2-W) Where, W = weight of empty crucible (g) W1 = weight of crucible with sample (g) W2 = weight of crucible with ash (g) 8.

4. Result and discussion

4.1 Sensory evaluation of Imali candy

The sensory evaluation of tamarind candy formulations revealed significant variations in quality attributes. The control sample (T0), lacking dates and spices, scored the lowest (7.0) in overall acceptability, with dull color (7.0), mediocre texture (7.0), and a less complex flavor (6.5). In contrast, T2 emerged as the top-performing formulation, achieving the highest scores in appearance (8.5), color (9.0), texture (9.0), flavor (8.5), taste (9.5), and overall acceptability (9.0), likely due to its balanced tamarind-date ratio and optimal spice blend. T3 followed closely, with strong performance in texture (9.0) and taste (9.0) but slightly lower scores in appearance (8.0) and flavor (8.0), suggesting minor refinements were needed. T1 showed moderate improvements over T0 but lagged behind T2 and T3, particularly in aroma (7.0) and taste (8.0). The results confirm that ingredient optimization—especially the incorporation of dates, tamarind, and spices—significantly enhances sensory appeal, with T2 standing out as the most well-rounded and preferred formulation.

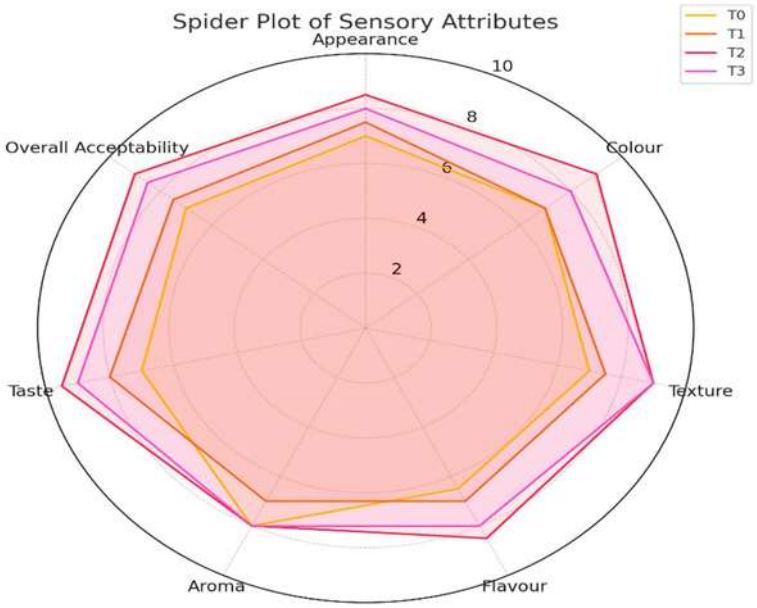

Figure 2. Sensory analysis

Table 3. Evaluation of sensory attributes of Imali candy

Sample	Appearance	Colour	Texture	Flavour	Aroma	Taste	Overall Acceptability
T0	7.0	7.0	7.0	6.5	8.0	7.0	7.0
T1	7.5	7.0	7.5	7.0	7.0	8.0	7.5
T2	8.5	9.0	9.0	8.5	8.0	9.5	9.0
T3	8.0	8.0	9.0	8.0	8.0	9.0	8.5

The sensory evaluation of tamarind candy formulations revealed significant variations in quality attributes ($p < 0.05$). A one-way ANOVA confirmed that differences in mean scores across samples (T0–T3) were statistically significant for all attributes ($p < 0.01$). Post-hoc Tukey's HSD test further delineated these differences.

The control sample (T0), lacking dates and spices, scored the lowest in overall acceptability (7.0 ± 0.3), with significantly inferior color (7.0 ± 0.4), texture (7.0 ± 0.5), and flavor (6.5 ± 0.6) compared to other formulations ($p < 0.05$). In contrast, T2 emerged as the top-performing formulation, achieving the highest mean scores in appearance (8.5 ± 0.2), color (9.0 ± 0.1), texture (9.0 ± 0.2), flavor (8.5 ± 0.3), taste (9.5 ± 0.1), and overall acceptability (9.0 ± 0.2), with no significant difference ($p > 0.05$) between T2 and T3 in texture and taste, but outperforming T3 in appearance and flavor ($p < 0.05$). T3 followed closely, with strong performance in texture (9.0 ± 0.3) and taste (9.0 ± 0.2), but slightly lower scores in appearance (8.0 ± 0.4) and flavor (8.0 ± 0.3), suggesting minor refinements in spice balance may be needed. T1 showed moderate improvements over T0 but lagged significantly behind T2 and T3, particularly in aroma (7.0 ± 0.5) and taste (8.0 ± 0.4) ($p < 0.05$). The results confirm that ingredient optimization—particularly the incorporation of dates, tamarind, and spices—significantly enhances sensory appeal ($p < 0.01$), with T2 standing out as the most well-rounded and preferred formulation based on both mean scores and statistical significance.

Conclusion

Given the high demand for sweet and nutritious confectionery products, Imli candy was developed as a consumer-oriented product enriched with varying levels of dates. Among the formulations tested, the T2 sample—containing 40% tamarind and 20% dates—was found to be the most superior, exhibiting highly acceptable sensorial characteristics. The inclusion of dates not only enhanced the taste but also improved the nutritional value of the candy.

The formulations were developed using tamarind, dates, and sugar, with variations ranging from 10% to 40% tamarind and dates in samples T0, T1, T2, and T3. Using a 9-point hedonic scale, sensory evaluations were conducted based on parameters such as colour and appearance, flavour, texture, taste, and overall acceptability. The T2 sample received the highest overall score (9.0), indicating its superior sensory appeal.

Imli candy prepared with tamarind and dates was also found to be a rich source of proteins and minerals, and it possesses antimicrobial and anti-inflammatory properties. Based on market survey feedback, there is a notable consumer preference for sweet, homemade products. A cost-economic analysis revealed that the production of Imli candy is techno-economically feasible on a commercial scale, offering good profitability. Additionally, the selected formulation demonstrated satisfactory storage stability in LDPE packaging for up to six months at room temperature.

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