International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(10): 1441-1444
www.biochemjournal.com
Received: 07-07-2024
Accepted: 11-08-2024

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Preparation of tamarind sauce from different genotypes

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DOI: https://doi.org/10.33545/26174693.2024.v8.i10s.2776

Abstract
A study was conducted on tamarind to evaluate tamarind sauce prepared from different genotypes at the "Post Harvest Technology Laboratory, Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra" during the year 2022–23, wherein fourteen different genotypes were collected and sauce was prepared from them, and sensory acceptability was evaluated. Acceptability was evaluated using hedonic categorization on a 9-point scale. The results were recorded, and it was found that genotype AKCHT-11 had the highest overall acceptance score based on color, flavor, taste, and consistency.

Keywords: Tamarind, sauce, genotypes, sensorial analysis

Introduction
Tamarind (*Tamarindus indica* L.) is an economically important fruit or spice of India. It is also termed "Indian Date" from the date-like appearance of dried pulp. Tamarind (*Tamarindus indica* L.) grows especially in parts of the subcontinent, and it is a significant indigenous fruit tree. Tamarind has medicinal value with antioxidant, antimicrobial, hypolipidimic, antidiabetic, and digestive properties (Isha & Milind, 2012) [8], among others. All parts of the tamarind plant, including the roots, leaves, and wood, are utilized, but the most valuable part is the fruit and pulp. Tamarind fruit, which contains about 30–50% of edible pulp (Pursglove, 1987) [15], is simultaneously a very acidic and yet sweet fruit, attributed to the high tartaric acid content and reducing sugars, respectively (El-Siddig *et al*., 2006) [6]. The pulp also contains high levels of carbohydrate, protein, calcium, phosphorus, fiber, iron, vitamin B2, and some vitamin C (Singh *et al*., 2007) [18]. The fruit is consumed raw or used in juice, jam, syrup, candy, curries, salads, seasonings, and sauces.
Tamarind is cultivated throughout India, has an immense amount of variety, and is available in many different forms. Maharashtra has several regional varieties as well as enhanced variants that are cultivated commercially in various regions. Popularly produced improved varieties are Pratisthan, Akola Smruti, PKM-1, DTH, and Ajintha (Kumar, P. *et al.* 2015) [13]. Local varieties have been grown for a long time by the cultivators and have been incorporated into certain areas within the area. This implies that there is a lot of room for development with this crop by applying genetic and plant breeding knowledge.
The preservation of tamarind and processing of value-added products in an effective way and to preserve the contents of fruits. If tamarind were stored for a long period, it would become a problem and lead to many physicochemical changes (Kakade, 2004) [11]. The tamarind juice concentrate is being produced on a commercial scale, and several tons of the concentrate are not only marketed within the country but also exported to various countries. Looking at the increasing area under tamarind cultivation, methods of preservation need to be developed to regulate the prices of fresh tamarind fruits and to safeguard the interests of tamarind growers in glut season (Kotecha and Kadam, 2003) [12].
The preparation of tamarind sauce has the potential to adjust prices throughout peak and off-season periods, increase revenue, and provide opportunities for employment. Also, preservation of tamarind sauce ensures that it is available to consumers throughout the year without losing its nutritional value (Raghavan, S. *et al.* 2014) [16]. It is critical to convert tamarind into various value-added goods, and it may be one of the solutions for ensuring

year-round availability of seasonal fruit while also providing nutritional and novel healthy foods to consumers (Kumar, P., and Gupta, R. 2015) [7].

The present investigation will be extremely valuable for future research on the processing aspects of tamarind sauce of various genotypes. It will also assist in reducing the significant loss of pulp quality caused by the post-harvest handling chain and long-term storage. There has been very little study in this location, and there is less scientific material accessible on tamarind processing. The value and demand for tamarind goods and by-products are likely to rise in the future. The research on the production of consumer acceptable tamarind sauce must be explored by using diverse recipes and storage conditions (Mahmoud, M. *et al*. 2018).

Therefore, it is necessary to identify tamarind fruits and find the most promising elite genotypes. Considering the above information, the research was conducted for the preparation of sauce from different genotypes, which were being collected and studied with the objective of finding out the best suitable genotype for the preparation of tamarind sauce from 14 different genotypes having good consumer acceptability.

Material and Methods

Preparation of tamarind sauce

Extraction of pulp

Ripe healthy pods of uniform size, color, and maturity were selected. The flesh was removed manually from the shell. Fiber, rags, and seed were also separated, and their weights were recorded. The tamarind flesh was incorporated with water while kneading in the ratio of 1:1.5. The flesh was soaked for 6 h and then heated up to 80 °C for 10 min. The flesh was filtered through muslin cloth. The recovery of fresh pulp was calculated on a fruit weight basis (V. K. Raghavan *et al.*, 2014) [16].

Procedure of tamarind sauce

The extracted pulp was taken in a stainless steel vessel, and sugar given in the recipe was added to the pulp. Fine powder of spices (cloves, cardamom, black pepper, cumin, mace, cinnamon, and red chillies) was placed in two separate muslin bags, and the bags were immersed into pulp. The pulp was heated until it was reduced to about 1/3 of its original volume. The muslin bags were then squeezed to extract the aroma and flavor of the spices, and they were removed from the pulp. Salt, remaining sugar, and sodium benzoate (0.05%) were added, and the mass was heated for a few minutes so that the volume of the finished product was about 1/3 of the original pulp. The finished product was poured into standy pouches (M. S. S. Khan *et al*. (2017); S. K. Gupta and R. K. Sharma (2015) [7].

Sensory evaluation

The sauce samples were evaluated for the sensory parameters using the standard procedure reported by Amerine and Pangborn (1965) [4]. The sauce was evaluated for sensory attributes by a panel of 5 semi-trained judges, using a 9-point Hedonic scale ranging from like extremely to dislike extremely for different parameters. The mean values of scores for color, flavor, taste, consistency, and overall acceptability were calculated.

Like Extremely	9
Like Very Much	8
Like Moderately	7
Like Slightly	6
Neither Like nor Dislike	5
Dislike Slightly	4
Dislike Moderately	3
Dislike Very Much	2
Dislike Extremely	1

Results and Discussion

The data regarding sensory evaluation of tamarind sauce is presented in Table 1. The score for different sensorial characters was given on a 9-point Hedonic Scale. It was observed that the panel members liked the sauce of genotype AKCHT-11 with the highest score of 7.38 based on its colour which was followed by AKCHT-5 as the sauce was not extremely dark. Adeola and Aworh (2010) [2] also noted that a tamarind drink that was darker scored lower than a lighter one. The darkening may have resulted from Maillard browning when the amino acids and reducing sugars in the tamarind were subjected to thermal processing (Alais & Linden, 1991) [3].

It was recorded that based on flavor, the sauce of genotype AKCHT-11 had a maximum score of 7.32. It is likely that the tamarind, along with the spices used, introduced a unique flavor to the sauce. Other researchers have also shown that the flavor of food products developed with tamarind is liked by consumers (Jyothirmai *et al.*, 2006; Jittanit *et. al.*, 2011) [10, 9]. Some compounds that influence tamarind flavor include pyrazines, thiazoles, furans, and some carboxylic acid derivatives such as palmitic, oleic, and phenylacetaldehyde (Wong *et. al.*, 1998) [19].

The liking for taste of sweetness of sauces for tamarind sauce by the consumer panel was significantly higher in the sauce prepared from genotype AKCHT-11 (8.11) as this genotype is sweet in taste compared to other thirteen genotype studies, which was followed by AKCHT-5 (7.82). It is possible that the sweet and tart taste notes from sugar and acid and the roasted flavor from pyrazines (Bredie *et. al.*, 1998) [5] make the sauces more acceptable to consumers.

The genotype AKCHT-11 scored the highest 7.85, as the sauce prepared from this genotype was excellent in consistency. Consequently, the panelist rating for overall acceptability of the sauce, 7.53, was found to be in the genotype AKCHT-11, which was being followed by genotype AKCHT-5. Similar results were observed by Abdi and Serrem (2013) [1] in tamarind sauce and Reddy and Chikkasubbanna (2009) [17] in aonla syrup. All the panelists also agreed that if the tamarind sauces were available on the market, they would purchase them for consumption.

Preparation of tamarind sauce

Table 1: Sensorial analysis of tamarind sauce

Genotype	Colour	Flavor	Taste	Consistency	Overall Acceptability
AKCHT-1	7.19	7.26	7.36	7.47	7.32
AKCHT-2	7.16	7.18	7.42	7.33	7.27
AKCHT-3	7.22	7.22	7.22	7.51	7.29
AKCHT-4	7.31	7.25	7.32	7.81	7.42
AKCHT-5	7.35	7.31	7.82	7.64	7.53
AKCHT-6	7.06	7.12	7.57	7.58	7.33
AKCHT-7	7.25	7.24	7.28	7.29	7.26
AKCHT-8	7.30	7.08	7.45	7.37	7.30
AKCHT-9	7.23	7.27	7.52	7.52	7.39
AKCHT-10	7.33	7.15	7.43	7.42	7.33
AKCHT-11	7.38	7.32	8.11	7.85	7.67
AKCHT-12	7.12	7.16	7.63	7.46	7.34
Pratishthan	7.28	7.11	7.78	7.54	7.43
Akola Smruti	7.26	7.23	7.68	7.61	7.45

Conclusion

Based on sensory evaluation of tamarind sauce prepared from 14 different genotypes. The genotype AKCHT-11 was found to have the highest overall acceptance score (7.67) based on all color, flavor, taste, and consistency. Therefore, the genotype AKCHT-11 is appropriate for making sauces. The conclusions drawn are based on the findings of a one-year study only. Hence, these results need further confirmation by long-term study for sustainable and remunerative quality of tamarind sauce. Further research should be conducted into incorporating tamarind into food products to improve nutrition and boost food security. Simple techniques to process mature tamarind pods for pulp to enhance its industrial use should be developed.

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