Nutrient Composition of Dehydrated Tender Tamarind Leaves (*Tamarindis indica* L.) Powder

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**Abstract**

One of the vital objectives of this study is to analyze the nutrient composition of tender tamarind leaves powder and to create awareness for popularization of products based on tender tamarind leaves in daily diet. Data were analysed using one-way Analysis of Variance (ANOVA) procedure. Tender tamarind leaves powder has moisture content about 4.65 percent. Corresponding carbohydrates and energy content of tender tamarind leaves powder were 86.26 g and 375 Kcal/100 g respectively. Protein and fat content was 4 g/100 and 1.5 g/100 g respectively. Crude fibre content of tender tamarind leaves was 1.0 g/100 g. The vitamins such vitamin-C and beta-carotene content of tender tamarind leaves powder was 166.8 μg and 2.5 mg/100 g respectively. After processing reduction was observed in vitamin C and beta-carotene content in comparison with the fresh counterparts. The minerals such as iron and calcium were found to be 0.18 mg and 96.4 mg per 100 g respectively, all the nutrient content were reduced in comparison with the fresh counterparts due to the dehydration processing. Minerals such as iron and calcium were 0.18 mg and 96.4 per 100 g respectively. The dehydrated tender tamarind leaves powder got good acceptability and having fairly good storage stability which can be promoted as a green leafy vegetable for preparation of souring chutney, sauces and curries in regular consumption.

**Keywords:** Composition, Dehydration, Leaves Powder, Nutrient, Tender Tamarind Leaves, Tender Tamarind

**1. Introduction**

Tamarind (*Tamarindis indica* L.) Cultivated in subtropical and tropical areas of the world. In India *Tamarind indica* is considered as one of the cash trees. All parts of the tree got some use, but leaves are most useful parts, leaves can be consumed as vegetable and due to sourness of fruits, which can be used in preparation of sauces, souring curries, chutneys and certain beverages. Generally, traditional preparations like pickles and chutney powders play an important role in the eating habits. Pungency and sourness are the two important aspects of these products that have a major impact on sensory attributes. Tamarind fruit used in preparation of different products like tamarind juice concentrates tamarind powder, pectin, tartrates, tamarind kernel powder, tamarind paste and alcohol⁴. Pickles based on raw tamarind fruit are in vogue. The spiced rice preparation (pulihora) which is based on tamarind fruit pulp is very popular in southern parts of India. The fruit pulp of tamarind is also used in several food preparations to provide acidity. The fruit contains 10 to 14% tartaric acid on dry weight basis⁵. Canned beverages based on tamarind fruit pulp are very famous in the counties like Malaysia, Latin America and Thailand⁶. The extract from fruit pulp extensively used as a replacement for chemical acidulants like citric acid and phosphoric acid in soft drinks⁷. Information on fruit based products was available. Some reports were made regarding the utilization of tender tamarind leaves, raw pods, seedlings and flowers. Raw tamarind pods, tender leaves and seedlings consumed as vegetables⁸.

However, not much work has been done on the utilization of tamarind leaves including the tender leaves even though it contains high amount of tartaric acid. There is 28 to 12 % decrease in tartaric acid content of leaves during May to December and free tartaric acid disappears in the first three months⁹. The tender leaves of tamarind are also used in various vegetarian and non-
vegetarian foods in India. The leaf sap is also reported to have a diuretic effect. Tender tamarind leaves being edible and it can be used for souring curries, sauces, chutneys and certain beverages. Hence, the present study was undertaken to analyze the important nutrient present in the tender tamarind leaves. Finally these leaves were subjected to hot air oven dehydration at 60°C. Then the second lot was also subjected to hot air oven dehydration for the same temperature. After drying the tender leaves ground to powder and packed in aluminum foil covers.

2. Methodology

2.1 Sample Preparation

2.1.1 Collection of Tender Tamarind Leaves

Medium mature leaves of tamarind were collected from a fully grown tree in University of Agricultural Sciences, GKVK campus, Bengaluru, Karnataka, India, during the months of April-May 2015 for the study. The leaves were initially separated from the stalks and other extraneous matter was cleaned with brine and under running water.

2.2 Pre-Treatment of the Sample

The cleaned tender leaves were subjected to pre-treatment prior to dehydration. The leaves were divided into two lots; the first lot was blanched and dehydrated. The tender leaves were blanched in hot water at 80°C for one minute and rapidly cooled in chilled water finally these for the same temperature. After drying the tender leaves ground to powder and packed in aluminum foil covers.

2.3 Analysis Nutrients of the Sample

The Nutrient composition of the tender tamarind leaves powder was analyzed for macro and micro nutrients such as moisture, carbohydrates, energy, protein, fat, crude fiber, β-carotene, vitamin C, iron and calcium using standard methods.

2.3.1 Moisture Content Estimation of the Sample

Moisture content was determined by taking 10 g of sample in petridish and followed by drying carried out in an hot air oven at 60°C temperature, then cooled and weighed sample.

\[
\text{Moisture content (\%)} = \frac{\text{Initial Wt.(g)} - \text{Final Wt.(g)}}{\text{Wt.of the sample}} \times 100
\]

2.3.2 Protein Content Estimation of the Sample

Protein content of the dried tender tamarind leaves sample was calculated as percent total nitrogen by the Kjeldhal method.

\[
\text{Per cent nitrogen (\% N) = } \frac{(V_a - V_b) \times 0.0014 \times \frac{V_1}{V_2} \times 100}{\text{W}}
\]

2.3.3 Fat Content Estimation of the Sample

Fat content was determined as crude ether extract by using sample which is basically moisture free. For the removal of solvent evaporation process was adopted and the weighing was carried out for residue of the fat.

\[
\text{Fat content (g/100g) = } \frac{\text{Weight of the ether extract}}{\text{Weight of the sample taken}} \times 100
\]

2.3.4 Crude Fiber Content Estimation of the Sample

The estimation of crude fiber was carried out by using moisture and fat free samples and expressed as g/100 g of sample.

\[
\text{Per cent of crude fiber (g/100g) = } \frac{\text{Loss in weight on ignition}}{\text{Weight of sample used (g)}} \times 100
\]

\[
\frac{(W_2 - W_1) - (W_3 - W_1)}{\text{Wt of the sample (g)}} \times 100
\]

2.3.5 Vitamin C Content Estimation of the Sample

Ascorbic acid content was determined calorimetrically. Ascorbic acid was first dehydrogenated by bromination. The dehydroascorbic acid was then reacted with 2, 4 dinitrophenyl hydrazine to form osazone and dissolved in sulphuric acid to give an orange-red color solution which was measured at 540 nano meter.

2.3.6 Beta-Carotene Content Estimation of the Sample

The beta-carotene analysis was done by following procedure 5 to 10 g of sample was taken and acetone about 25 ml was added into it, then the mixture was transferred to an empty beaker grinding was done and allowed to stand for few minutes then filtration was carried out. The residue was subjected to decanting and later it was subjected to acetone extraction process. Then 100 ml of 5% Na$_2$SO$_4$ solution and petroleum ether about 15 mililiter were added to extract. Then along with petroleum ether volume was made up to the quantity of
50 ml and 452 nm absorbance was used to measure beta-carotene content.

2.3.7 Ash Content Estimation of the Sample

5 grams of sample was taken in crucible. Then the charring carried out slowly in a muffle furnace for about 240 to 300 min at 600°C temperature. Later the sample was taken out cooled and weighing has done to know the ash content of the sample.

\[
\text{Ash content (g/100g sample)} = \frac{\text{Weight of the ash}}{\text{Weight of the sample}} \times 100
\]

2.3.8 Preparation of Mineral Solution

Ash obtained from muffle furnace and dilute hydrochloric acid dissolved together to obtain mineral solution.

2.3.9 Calcium Content Estimation of the Sample

Calcium oxalate and the solution of oxalate in dilute acid against standard potassium permanganate precipitation were done to estimate the calcium content of the sample.

2.3.10 Iron Content Estimation of the Sample

Atomic absorption spectrophotometer was used to determine the Iron content of the sample and results were expressed in mg/100 g of sample.

2.4 Composition of Carbohydrates

Differential method was adopted to calculate Carbohydrates content of the sample.

\[
\text{CHO (g/100 g) = 100 – [Protein (g) + Fat (g) + Ash (g) + Fibre (g) + Moisture (%)]}
\]

2.5 Composition of Energy

The composition of energy was computed for all the samples.

\[
\text{Energy (Kcal) = Protein (g) } \times 4 + \text{ Fat (g) } \times 9 + \text{ Carbohydrate (g) } \times 4
\]

3. Results

The present study was undertaken to know the nutrient composition of the tender tamarind leaves powder.

**Table 1. The duration for the dehydration**

| Tender tamarind leaves | Time (hrs.) |
|------------------------|-------------|
| Non-blanched           | 5           |
| Blanched               | 6           |

The Table 1 represents the result of duration for dehydration of non-blanch and blanch tender tamarind leaves. The non-blanch dehydrated leaves sample took 5 hour while blanch leaves it took 6 hours. The unequal time taken for dehydration may be because of moisture content present in blanch as well as non-blanch tamarind leaves. The rate of drying of green leafy vegetables shown that the loss of moisture was at its highest magnitude in the starting first hours of drying process. After this first hour, there was continuous decrease in moisture content was observed in vegetables.

**Figure 1.** Dehydration duration for the non-blanch and blanch samples.

It can be seen that in Figure 1 the duration for dehydration by the non-blanch and blanch are unequal. Blanched sample took more time when compared to non-blanch sample this is may be due to the presence of moisture content of the sample. However blanching and dehydration can be adopted for processing green leaves that will more helpful in removal of moisture content and makes them concentrated sources of the nutrients. Hence, it can be interpreted that blanching helps in improving the net bioavailability of certain important nutrients.

3.1 Nutrient Analysis

The nutrient content of tender tamarind leaves powder such as moisture, protein; fat, crude fiber, carbohydrates, energy, ash, iron, beta-carotene, calcium and vitamin C
are shown in Table 2.

| Nutrients       | Content per 100 g |
|-----------------|-------------------|
| Moisture (%)    | 4.65              |
| Protein (g)     | 4.08              |
| Fat (g)         | 1.52              |
| Crude fibre (g) | 1.0               |
| Carbohydrate (g)| 86.26             |
| Energy (Kcal)   | 375               |
| Ash (g)         | 2.5               |
| β-carotene (μg) | 166.8             |
| Vitamin C (mg)  | 2.40              |
| Iron (mg)       | 0.18              |
| Calcium (mg)    | 96.4              |

The leaves powder contains 4.6 per cent of moisture, 4.08 g of Protein, 1.5 g of fat, 1.0 g of crude fibre, 86.2 g of carbohydrate, 375 Kcal of energy, 2.5 g of Ash/100 g. Vitamins like beta-carotene and vitamin C content were 166.8 μg and 2.4 mg/100 g respectively. In Figure 2 shown Minerals such as iron and calcium were 0.18 mg and 96.4 mg/100 g respectively.

It contains more of energy (375 Kcal/100 g), carbohydrates (86.2 g/100 g), protein (4.0 g/100 g), β-carotene (168.8 μg/100 g) and vitamin C (2.4 g/100 g) compared to other nutrients. This is because of blanching of the tender leaves it will help in the retention of some B vitamins. Hence, it can be interpreted that blanching helps in improving the net bioavailability of certain important nutrients.

4. Discussion

It has been observed that the moisture content in tender tamarind leaves powder was 4.6 per cent. Tender leaves contains protein about 4.08 g. 1.5 g of fat per 100 g was found in tender tamarind leaves powder. Tender tamarind leaves powder contains crude fibre about 1.0 g. Tender leaves powder has carbohydrates about 86.2 g and energy content was about 375 Kcal/100 g. Ash content of the leaves powder was 2.5 results revealed that blanched dehydrated sample contained higher amount of ash when compared to fresh samples and vitamin C and beta-carotene content in tamarind leaves powder had 2.40 mg per 100 g and 166.8 μg respectively, the results shown that after processing reduction was observed in vitamin C and beta-carotene content in comparison with the fresh counterparts. The minerals such as iron and calcium were found to be 0.18 mg and 96.4 mg per 100 g respectively, all the nutrient content were reduced in comparison with the fresh counterparts due to the dehydration processing (Oven drying).

5. Conclusion

The above study revealed that tender tamarind leaves contained appreciable quantity of nutrients and tamarind leaves being edible it can be used as green leafy vegetable for souring curries, sauces and chutneys.

6. References

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