Journal of Chemical, Biological and Physical Sciences

An International Peer Review E-3 Journal of Sciences

*Available online at* www.jcbsc.org

*Section B: Biological Sciences*

CODEN (USA): JCBPAT Research Article

# Phytochemicals and Mineral Potentials of *Tamarindus Indica L* Seeds As Influenced By Processing Treatments

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**Received:** 18 December 2015; **Revised:** 01 January 2016; **Accepted:** 12 January 2016

**Abstract:** *Tamarindus* belongs to the subfamily Caesalpinioideae. *Tamarindus* itself is a monotypic genus, containing the sole species *T. indica*. Tamarind is a multi-use tree. The present study was outlined to investigate the phytochemicals and mineral composition of *Tamarindus indica* L seeds as influenced by processing treatments such as soaking, dehulling, cooking, autoclaving and germinating the seeds. Extraction of *Tamarindus indica* L seeds were carried out at 37˚C with methanol and the extracted materials were then determined for the presence of phytochemicals. The alkaloids, steroids, flavonoids, terpenoids, tannins and phenolics were present in the soaked, cooked and autoclaved samples. Absence of phytochemicals was observed in case of dehulled seeds. But in case of germinated seeds, the presence of alkaloids, flavonoids and phenolics was noted. Further the ash content of the sample was determined and the ash obtained from all the processed samples were extracted with concentrated HCl and was subjected to mineral analysis. In soaked seeds, potassium and sodium decreased when compared to the control unprocessed seeds. In contrast sodium increased in dehulled and autoclaved seeds. Calcium and magnesium remains same in the entire processed sample as that of control group except that of dehulled seeds where magnesium is decreased and calcium is increased. Iron and phosphorus also remains similar as that of the control group except in case of germinated seeds where there is an increase in their content.

**Keywords:** Tamarindus indica L, phytochemicals, ash, processing treatments, mineral composition.

## INTRODUCTION

In Asia, Tamarind is now widely spread throughout semi-arid South and Southeast Asia[1, 2]. In India, it is most commonly grown in the drier warmer areas of the South and Central region, where it thrives best. Tamarind is often used as a roadside or avenue tree grown along canals, particularly in the North and South dry zones[3].Higher plants produce thousands of diverse chemical compounds with different biological activities and have important ecological roles.

The seeds of wild plants including the tribal pulses have received more attention. They are highly resistant to disease and pests and exhibit good nutritional qualities[4]. The underutilized legumes / wild tribal pulses have tremendous potential for commercial exploitation, but largely remain ignored. They offer a good scope to meet the ever-increasing demands for vegetable protein.

Although they have high protein content and possess good nutritional value, their utilization is limited by the presence of some antinutritional / antiphysiological / toxic substances, such as, saponins, tannins, polyphenols, phytic acid, protease and α-amylase inhibitors, haemagglutinins, lectins, etc. Removal of undesired components is very essential in improving the nutritional quality and organoleptic acceptability of legumes. This in turn help to effectively utilize their potential as human food. Methods for reducing antinutrients in food are carried out according to their physical (dehulling / cooking, autoclaving / pressure cooking, dry roasting, soaking, milling, selective extraction, irradiation) or biochemical (enzyme processing, germination and fermentation) character[5].

## MATERIALS AND METHODS

**Plant Material:** The seeds of *Tamarindus indica* were collected using random sampling technique (RST) from local areas of Bangalore district, Karnataka State, India. After dehulling the fruits, equal samples of seeds were combined to give one bulk population sample from which sub samples were taken.

The seed samples were dried in the sunlight for 24 hrs. After removing immature and damaged seeds, the matured seeds were washed under tap water, dried and stored in refrigerator until further use.

**Processing treatments:** The seeds were subjected to five different types of processing.

- **Soaking:** The seeds were soaked in water for 5 days, dried at 60° C and ground to a fine powder using a blender.
- **Dehulling:** The seeds were soaked in water for 5 days and then hand pounded to separate the hull. The dehulled seeds were then dried at 60° C and ground to a fine powder.
- **Cooking:** The seeds were cooked for 30 minutes, mucus was removed from seed coat and washed. The cooked seeds were then dried at 60° C and ground to a fine powder.
- **Autoclaving:** The seeds were autoclaved, cooled and then dried at 60° C and ground to a fine powder.
- **Germination:** The seeds were treated with 50% $H_2SO_4$ for 30 minutes. After 30 minutes, it was washed and sowed onto a medium containing coco pith and sand in the ratio 1:1. After 10 days, the seeds were cleaned, dried overnight at 60° C and ground to a fine powder.

**Phytochemical screening (Qualitative analysis):** Phytochemical screening was carried out for the entire five processed samples as described below.

**Table 1:** Phytochemical screening of processed tamarind seeds.

| No. | Phytochemical | Control | Soaked | Dehulled | Cooked | Autoclaved | Germinated |
|---|---|---|---|---|---|---|---|
| 1. | Alkaloid | + | + | - | + | + | + |
| 2. | Terpenoid | + | + | - | + | + | - |
| 3. | Steroid | + | + | - | + | + | - |
| 4. | Flavonoid | + | + | - | + | + | + |
| 5. | Tannin | + | + | - | + | + | - |
| 6. | Phenolics | + | + | - | + | + | + |

Note: (+) sign indicates Presence (–) sign indicates Absence.

**Methanolic extract:** A 10% methanolic extract of the sample (using 70% methanol) was prepared and used for the detection of phytochemicals as described by Mojab et al.[6]

**Test for flavonoids:** The presence of flavonoids in the test samples were determined by the acid/alkaline test. A piece of magnesium ribbon was dropped into a test tube containing 2 ml of the extract, followed by a few drops of concentrated HCl. The solution was allowed to settle for 10 mins. The color change and precipitation was observed. Yellow substance formation indicates flavonoids.

**Test for alkaloids:** 2 ml of the extract was mixed with few drops of concentrated HCl and few drops of Dragendorff's reagent in a test tube. Yellow precipitation indicates the presence of alkaloids.

**Test for tannins:** 2 ml of the extract was mixed with a few drops of ferric chloride solution. Brownish green to blue black precipitate formation indicates the presence of tannins.

**Test for terpenoids and steroids:** The Libermann – Burchard test was used for the detection of terpenoids and steroids as described by Mojab et al.[6] 2 ml of the extract was mixed with 3 – 5 drops of acetic anhydride in a test tube. 1 – 2 drops of concentrated $H_2SO_4$ was slowly added from the sides of the test tube. Formation of blue and purple color indicates the presence of terpenoids and steroids.

**Mineral analysis:** The mineral composition – calcium, magnesium, sodium, potassium, iron and phosphorous – were analyzed in the acid-soluble ash of all the five processed samples as described below.

**Determination of the ash:** The ash content of the sample was determined by the method described by AOAC[7] (1965). This includes an inorganic fraction – the total of the incombustible sample left after ignition (ash). The sample (2.0 gm) is ignited at 600° C for 6 hours to burn all organic material. The inorganic material which does not burn or volatilize at that temperature is called ash.

**Sample preparation for determination of mineral composition :** The ash obtained (as described above) from 2.0 gm of the sample was dissolved in 2.0 ml of concentrated HCl, filtered through filter paper into dilution tubes, washed with double distilled water and made upto 25 ml (acid-soluble ash) prior to mineral analysis[8] by atomic absorption spectrophotometry as described below.

**Atomic Absorption Spectrophotometry:** The atomic absorption spectrophotometry was employed to analyze calcium, magnesium, sodium, potassium, iron and phosphorous present in acid-soluble ash. The stock standard of 1000 ppm was prepared in deionized water. All the glass wares and plastic wares used were mineral free. The samples were diluted 50 times with deionised water. The readings were noted in Atomic Absorption Spectrometer (GBC 932, Australia).

## RESULTS

Plant seeds are easily available and are the richest source of phytochemicals, minerals, and proteins. Legumes have to be processed prior to consumption due to their high content of antinutritional compounds, such as lectins, polyphenols, tannins, trypsin inhibitors, phytic acid and galactosides. Various processing treatments such as soaking, dehulling, cooking, autoclaving and germination have been carried out on the tamarind seed and phytochemicals and minerals determined.

**Qualitative analysis of Phytochemicals:** The alkaloids, steroids, flavonoids, terpenoids, tannins and phenolics are present in the samples as been shown in **Table 2.** Absence of phytochemicals is observed only in case of dehulled seeds. But in case of germinated seeds, the presence of alkaloids, flavonoids and phenolics has been noted.

**Table 2:** Ash content of processed tamarind seeds.

| No. | Treatments | Ash |
|---|---|---|
| 1. | Control | 4.58 |
| 2. | Soaked | 3.36 |
| 3. | Dehulled | 3.6 |
| 4. | Cooked | 3.76 |
| 5. | Autoclaved | 3.48 |
| 6. | Germinated | 2.35 |

**Mineral analysis by Atomic Absorption Spectrophotometry: Table 3** illustrates the amount of minerals present in the processed seed sample. The control group contains iron, phosphorus, calcium, magnesium, potassium and sodium – 356.0, 1143.0, 11000, 608.0, 225.3 and 5300 mg/100gm respectively. In soaked seeds, potassium and sodium decreased to 9.5 and 42.5 mg/100gm. In contrast sodium increased to 11000 and 14000 mg/100gm in dehulled and autoclaved seeds. Calcium and magnesium remains same in all the processed sample as that of control group except that of dehulled seeds where magnesium is decreased and calcium is increased. Iron and phosphorus also remains similar as that of the control group except in case of germinated seeds where there is an increase in their content.

**Table 3:** Mineral composition (µg/g) of processed tamarind seeds.

| Samples | Iron | Phosphorus | Calcium | Magnesium | Potassium | Sodium |
|---|---|---|---|---|---|---|
| Control | 356.0 | 1143.0 | 11000 | 608.0 | 225.3 | 5300 |
| Soaked | 553.0 | 1343.0 | 16000 | 674.0 | 9.5 | 42.5 |
| Dehulled | 376.0 | 1653.0 | 19000 | 368.0 | 71.0 | 11000 |
| Cooked | 344.0 | 1073.0 | 9000 | 648.7 | 131.6 | 156.0 |
| Autoclaved | 316.0 | 1345.0 | 8000 | 818.0 | 1471.0 | 14000 |
| Germinated | 756.0 | 1673.0 | 11000 | 608.0 | 121.9 | 656.0 |

## DISCUSSION

Tamarind seed is an underutilized byproduct of the tamarind pulp industry. Only a small portion of the seed, in the form of tamarind kernel powder (TKP), is used as a sizing material in the textile, paper and jute industries. Though many applications of this seed are possible, there have been hardly any other uses for it including using it as an additive in food formulations. Panigrahi *et al.*[9] reported that whole tamarind seed contains 131.3 g/kg crude protein, 67.1g/kg crude fibre, 48.2 g/kg crude fat, 56.2 g/kg tannins and trypsin inhibitor activity (TIA) of 10.8, with most of the carbohydrate in the form of sugars. The trypsin inhibitor activity is higher in the pulp than in the seed, but both are heat labile. According to Ishola *et al.*[10] the seed also contains 47 mg/100g of phytic acid, which has minimal effect on its nutritive value. It also contains 14-18% albuminoid tannins located in the testa.

According to Purseglove[11], the seeds contain 63% starch and 4.5-6.5% of semi drying oil. Both pulp and the seeds are good sources of protein (269.3 g/kg), oil (109.1 g/kg) and calcium[10].Tamarind kernel powder is used in developing food products such as jelly and marmalades. Legume seeds are valuable source of protein, oil, carbohydrates, minerals and vitamins. They are playing an important role in human nutrition mainly in developing countries[12, 13]**.** In our present study we have proved that tamarind seed contains very good quantity of minerals and the mineral content can be enhanced by processing the tamarind seeds.

## ACKNOWLEDGEMENT

The study was supported by UGC under UGC – Major Research Project (2010 – 2012) New Delhi. The authors wish to acknowledge DOS in Biochemistry, Bangalore University for offering their facilities for the analysis. The authors would also like to thank Mount Carmel College Autonomous, Bengaluru for their patronage.

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