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Compositional Analysis of Tamarind Pulp and Spray Dried Tamarind Pulp Powder

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Abstract—*The present study was aimed to study the compositional properties of Ripe Tamarind Pulp and spray dried tamarind pulp powder. Proximate analysis of ripe tamarind pulp revealed 23.30% moisture, 2.97%, protein, 5.49% crude fiber, 2.19 % ash, 65.95% carbohydrate and 0.10% fat while spray dried tamarind pulp powder showed 2.62% moisture, 21.69%, protein, 3.64% crude fiber, 1.69% ash, 70.28% carbohydrate and 0.08 % fat. Mineral analysis of ripe tamarind pulp revealed high potassium content (777.20 mg/100g) followed by calcium (234.36 mg/100g), phosphorous (159.41 mg/100g), magnesium (87.16 mg/100g) and sodium (62.25 mg/100g) while spray dried tamarind pulp powder showed 582.31 mg/100g potassium, 182.26 mg/100g calcium, 117.82 mg/100g phosphorous, 65.95 mg/100g magnesium and 42.67 mg/100g sodium. Ripe tamarind pulp showed 338.56 mg GAE/100g total phenolic content and 84.58% radical scavenging activity while tamarind pulp powder possessed 204.53 mg GAE/100g total phenolic content and 49.27% radical scavenging activity.*

1. INTRODUCTION

Tamarind is an arboreal fruit of *Tamarindus indica* L. which belongs to family Leguminosae or Caesalpiniaceae. The tree is native to Eastern Africa, including parts of the Madagascar dry deciduous forests (Lim, 2012). It is almost found throughout the tropics and subtropics of the world and has become naturalized at many places particularly in India, South East Asia, tropical America, the Pacific Islands and the Caribbean. The major production areas are the Asian countries including India and Thailand. India is the world's largest producer of tamarind with an average production of about 191750 Tonnes in the year 2013-2014 (Spice Board of India).

Tamarind tree is a multipurpose tree of which almost every part finds at least some use, either nutritional or medicinal (Kumar and Bhattacharya, 2008). The most valuable and commonly used part is the fruit which yields acidic pulp (Jyothirmayi *et al.* 2006). A typical tamarind fruit contains about 55% pulp, 34% seeds, and 11% shell and fibres (De Caluwe *et al.* 2010). The pulp of the fruit contains tartaric acid, reducing sugars, pectin, protein, fiber and cellulosic materials. The percentage of the constituents varies from sample to sample with tartaric acid ranging from 8–18%, reducing sugars 25-45%, pectin 2-3.5% and protein 2-3% (Obulesu and Bhattacharya, 2011). Besides being a rich source of sugars, tamarind pulp is an excellent source of B-vitamins and exhibit high antioxidant capacity that appear to be associated with a high phenolic content. The fruit pulp is a good source of minerals especially potassium, calcium, phosphorous magnesium and sodium (Almeida *et al.* 2009). Nevertheless, the proximate composition of the tamarind pulp depends on locality (El-Siddig *et al.* 2006). Tamarind pulp in powder form has other benefits and economic potentials. In powder form it offers low logistic expenditures due to reduced weight and volume, and easy to use in different food formulations compared with squeezing of pulp from tamarind fruit. Besides this, in case of tamarind pulp powder there is no need to bother about disposal of the residue as is the case when whole tamarind fruit is used (Jittanit *et al.* 2011).

The present study was undertaken to study the Compositional Properties of Ripe Tamarind Pulp and spray dried Tamarind Pulp Powder

2. MATERIALS AND METHODS

Materials

Fresh and fully ripened tamarind pods (sour variety) were purchased from local market (Sangrur, India) and were stored in refrigerator until needed for the experiment. Soya protein isolate purchased from Nutrimed Health Care Private Ltd. (Delhi, India) was used as a drying aid.

Sample preparation and spray drying

Tamarind pulp extracted under optimized conditions as determined in our previous study was mixed with of soya protein isolate (SPI, as drying aid) in a laboratory type blender until the protein dissolved completely [17]. The mixture was then spray dried in a tall type laboratory scale spray dryer (S.M. Scientech, Calcutta, India) under optimum spray drying conditions including 170 °C inlet air temperature, 400 mL/h feed flow rate, and 25% concentration of drying aid (Muzaffar and Kumar, 2015). After completion of spray drying, powder

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was recovered from the cyclone and cylindrical parts of dryer chamber by lightly sweeping the chamber. The powder was then packed in laminated pouches and stored in desiccator for further analysis.

Characterization of tamarind pulp and spray dried tamarind pulp powder

Proximate analysis

The proximate composition of tamarind pulp powder was determined according to AOAC method (2000).

Mineral analysis

Minerals were analyzed by the method given by Food and Agriculture Organization of the United Nations (FADA/SIDA) (1983) with slight modifications. Briefly, 2 g of sample was placed in Kjeldahl tubes and freshly prepared nitric acid-sulfuric acid mixture (25 mL) in the ratio of 1.5:1 was added. The sample was digested at 250 °C for 2–3 h or until a clear solution was obtained. After cooling, the solution was diluted with 100 mL deionized water and the residue was filtered through an ashless filter paper. The mineral content of the sample was determined by atomic absorption spectroscopy (ICE 2000, Thermo Scientific, Waltham, MA) with air acetylene flame for Ca, P, Mg, Na and K.

Antioxidant properties

Determination of total phenolic content

Total phenolic content of spray-dried tamarind pulp powders was estimated by Folin-Ciocalteu method followed by Vasco *et al.* (2008) with slight modifications. Briefly, 100 mg of the sample was mixed with 15 ml of methanol and centrifuged for 10 min. Then 0.5 ml of supernatant was added to 2.5 ml Folin Ciocalteau reagent (0.2N) and allowed to stand for 5 min for reaction. After this, 2 ml of 7.5% sodium carbonate was added to the reaction mixture and diluted to 25 ml using distilled water. The mixture was then incubated for 2 h at room temperature and the absorbance was measured at 760nm against methanol as blank using DR6000 UV-vis spectrophotometer (Hach Lange, Germany). The total phenolic content was determined by comparing with the standard curve using gallic acid (0–100 µg/mL). The results were expressed as mg of gallic acid equivalents per 100 gram (GAE mg/100g) of the sample.

DPPH radical scavenging activity

Hydrogen donating or radical scavenging activity of the sample was determined by the method followed by Moon and Shibamoto (2009) with some modifications. About 100 mg of the sample was mixed with 15 ml of methanol and centrifuged for 10 minutes. Aliquot (1 ml) of the supernatant was added to 3 ml of a DPPH-methanolic solution (0.0635 mM). The reaction mixture was incubated at room temperature for 40 min and the absorbance was measured at 515 nm using double UV-visible spectrophotometer (DR6000, Hach Lange). Methanol was used as the control. DPPH radical scavenging activity of the sample was calculated as:

$$DPPH\ radical\ scavenging\ activity\ (\%) = \frac{(Abs\ control - Abs\ sample)}{Abs\ control} \times 100 \quad (3.8)$$

where Abs control is the absorbance of control and Abs sample is the absorbance of sample.

Statistical analysis

All the analysis was carried out in triplicates and the results were presented as mean values with standard deviations.

3. RESULTS AND DISCUSSION

Proximate composition and Mineral Analysis

Results of proximate composition and mineral analysis of ripe tamarind pulp and spray-dried tamarind pulp powder are shown in Table 1. Ripe tamarind contained high moisture content of 23.30% while powder showed low moisture content of 2.62 %. Protein content of the powder was high (21.69%) as compared to ripe pulp (2.97), which can be attributed to the soya protein isolate added during spray-drying. Ripe pulp showed 5.49±0.49 crude fibre and 2.19±0.10 ash content while powder was having 3.64% crude fibre and 1.69% ash content. Fat content of the ripe pulp and powder was very low, 0.10% and 0.08%, respectively. Carbohydrate content of the ripe tamarind pulp and powder was 65.95% and 70.28%, respectively. The major minerals of tamarind pulp and powder were potassium (777.20 and 582.3 mg/100g), calcium (234.36 and 182.26 mg/100g), phosphorous (159.41 and 117.82 mg/100g), magnesium (87.16 and 65.95 mg/100g) and sodium (62.25 and 42.67 mg/100g).

Table 1 Proximate, mineral analysis and antioxidant activity of ripe tamarind pulp and spray dried tamarind pulp powder

Parameters	Ripe tamarind pulp	Spray dried TPP
Moisture (%)	23.30±0.98	2.62±0.05
Protein (%)	2.97±0.32	21.69±2.79
Fat (%)	0.10±0.03	0.08±0.01
Ash content (%)	2.19±0.10	1.69±0.30
Crude fiber (%)	5.49±0.49	3.64±0.73
Carbohydrate (by difference) (%)	65.95	70.28
Potassium (mg/100g)	777.20±2.98	582.31±3.92
Calcium (mg/100g)	234.36±2.13	182.26±2.54
Phosphorous (mg/100g)	159.41±3.51	117.82±1.72
Magnesium (mg/100g)	87.16±1.67	65.95±1.23
Sodium (mg/100g)	62.25±2.31	42.67±1.05
Total phenolic content (mg GAE/100g)	338.56	204.53±2.59

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DPPH radical scavenging activity (%)	84.58	49.27±1.82

Values were expressed as the average of triplicates ± standard deviation.

Antioxidant properties

Total phenolic content and DPPH radical scavenging activity of spray dried tamarind pulp powder was 204.53 GAE mg/100g and 49.27%, respectively, which was less than that of ripe tamarind pulp, showing 338.56 GAE mg/g total phenolic content and 84.58 % DPPH radical scavenging activity.

4. CONCLUSIONS

The study revealed that ripe tamarind pulp and its powder form developed by spray drying showed good nutrient profile with high antioxidant activity, thus suggesting that it might enhance the nutrient profile besides being acting as a souring agent in different food formulations.

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