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Research Article

Nutritional Composition in Tamarind Seed During Germination

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Abstract

Determination of tamarind seed (*Tamarindus indica* Linn.) germination for 20 days was studied. Protein content of cotyledons and whole sprouts were significantly decreased ($p < 0.05$) while protein content of the stem was increased ($p < 0.05$). During germination, weight and length increased ($p < 0.05$). Tamarind sprouts at 10 days and 15 days had 4.68% and 3.99% protein content, 77.30% and 81.02% moisture content, 0.66% and 0.85% acidity , pH of 5.13 and 4.73, 1.03% and 1.53% crude fibre, 2.45% and 1.88% total sugars, 16.47% and 15.32% carbohydrate, respectively. Most compositions of tamarind sprouts at 10 days and 15 days were different ($p < 0.05$), except for fat and ash content, which were not ($p \geq 0.05$).

Keywords: *Tamarindus indica*, sprouts, protein content, waste recovery, Thailand.

Introduction

Tamarind (*Tamarindus indica* Linn.) is a leguminous tree from which most parts of the fruit may be utilized as food or other useful products. At present, a large amount of seed waste is discarded from the tamarind industry, so the utilization of tamarind seed is interesting from the perspective of possible utilization of this waste. Tamarind seed contains starch and some other valuable nutrients and much research has been undertaken on the use of seeds and seed coats [1, 2, 3, 4]. Germination of seeds to sprouts is one way to recover some of these components and to increase the value of the seeds and little work has been undertaken on this method. Tamarind sprouts show potential as a new source of fibre for human consumption.

The objectives of this work were to study the changes in composition and nutritional values of tamarind seeds and tamarind sprouts during germination.

Materials and Methods

Tamarind seeds were purchased from a local market in Songkhla Province and were then washed to clean them, and then dried at ambient room temperature. Prepared seed was stored in plastic bags and kept in a cool, dry place.

Study of compositional change of tamarind seeds and sprouts during germination
Tamarind seeds (200 seeds) were soaked for 24 hours and then sown on sandy loam in a plastic tray. Seed was placed in each hole at a depth about 1 cm and about 1 cm distance apart. The trays were sprinkled with the same amount of water twice a day. Tamarind seed or tamarind sprout trays were harvested at 2 day intervals until 20 days of germination. The length, weight, protein [5], moisture and pH were analysed using standard AOAC methods [6].

Study on nutritional values of tamarind sprouts at 10 days and 15 days
Planted tamarind seeds for 10 days and 15 days were then analysed for length, weight, protein (total nitrogen), moisture, crude fibre, acidity, fat content, carbohydrate (by difference) and pH using standard AOAC methods [6]. Total sugars were analysed by phenol – sulphuric method [7].

Statistical analysis
The experimental set up was designed using a randomized complete block design. All data were analyzed by using repeated measurements as per the ANOVA procedure. Means were separated by Duncan's New Multiple Range Tests.

Results and Discussion

Study of compositional change of tamarind seeds and sprouts during germination
In Figure 1 it is apparent that protein content of cotyledons and whole sprouts were significantly decreased ($p < 0.05$) from 2.67% to 0.66% and from 2.67% to 1.10%, respectively. The protein content of the stem was significantly increased ($p < 0.05$) from 0.24 to 0.64%. The weight and length gained of tamarind sprouts during seed germination are shown in Figure 2.

In Table 1, nutritional components in comparable quantities of tamarind seeds and sprouts grown for 10 and 15 days are recorded. The results show that nutrients in cotyledons and whole sprouts were decreased, except for moisture content and acidity, but in the stems the nutrients increased.

The results agreed with the findings of Bewly and Black [8] who explained that, initially on imbibition, the cell wall expands a little and straightens as the water uptake increases and then radicle emergence is started by embryonic axis. This affects the length and weight of tamarind sprouts, with both increasing. On germination rate of tamarind seeds, germination started at 4 days and the rate increased from 0.0 to 69.33% in 20 days.

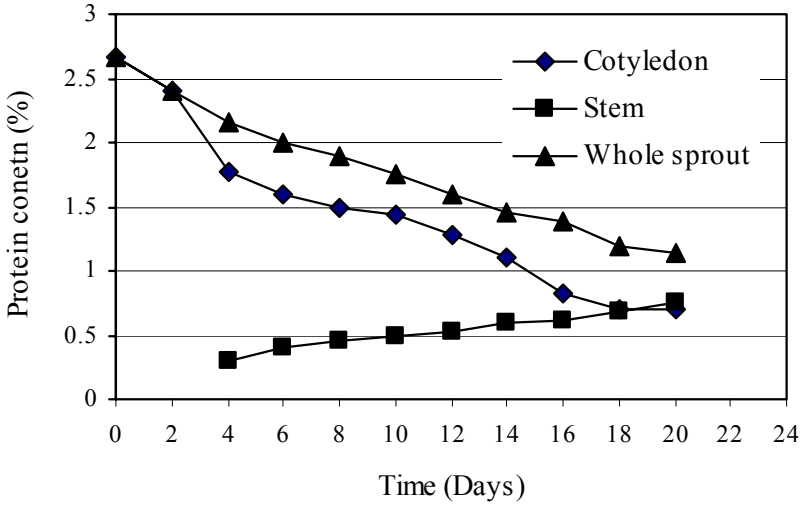

Figure 1. Change of protein content in the different parts of tamarind sprouts during germination.

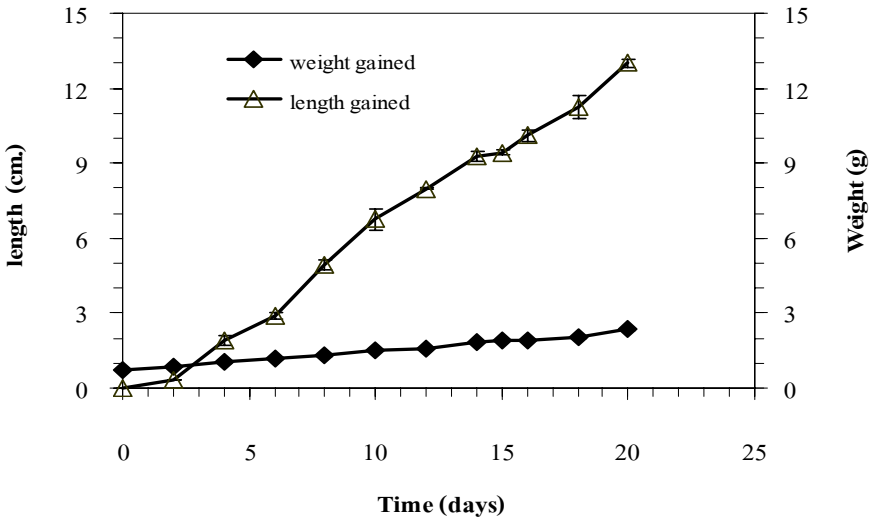

Figure 2. Weight and length gained during germination.

The results were also similar to Coronel [9] who reported that germination of tamarind seeds varied from 65 – 75%. Germination in tamarind was epigeal, the radicle emerges from one end of the seed and descends rapidly. The elongated hypocotyl arches slightly and raises the cotyledons enclosed in the testa, above the ground. The testa falls to the ground when the cotyledons expand.

Study on nutritional values of tamarind sprouts at 10 days and 15 days

Tamarind sprouts at 15 days had nutritional components lower than tamarind sprouts at 10 days, except for moisture, acidity and crude fibre. Tamarind sprouts at 10 days and 15 days had

protein content of 4.68% and 3.99%, 77.30% and 81.02% moisture content, 0.66% and 0.85% acidity, pH of 5.13 and 4.73, 1.03% and 1.53% crude fibre, 2.45% and 1.88% total sugars, 16.47% and 15.32% carbohydrate, respectively. The composition of tamarind sprouts at 10 days and 15 days were significantly different, ($p < 0.05$), while fat and ash contents of sprouts at 10 days and 15 days were not ($p \geq 0.05$). The composition of cotyledons at 10 days and 15 days were significantly different ($p < 0.05$), except for fat and crude fibre. Cotyledons at 15 days had nutritional components lower than cotyledons at 10 days, except for moisture and acidity. Moisture content and acidity in cotyledons increased significantly ($p < 0.05$). The possibilities have been considered to explain regulation by the stem as a sink, drawing off the products of reserves mobilization in the cotyledons. Growth of the stem uses the products of breakdown, therefore do not accumulate in the storage tissues. After the catabolites of stored protein, carbohydrates, fat, sugar and minerals, the compounds were transported to the seedling axis, to be used in the synthesis of cell components and cell wall materials [10]. For dietary fibre, this was 19.48% and 21.45% in the whole sprout at 10 and 15 days, respectively (Table 1). The dietary fibre content in tamarind seed tended to decrease from dry seed in whole sprouts during germination. Even lower in content, but dietary fibre in dry seed is not available for human digestion due to hardness. Similar results are also recorded by Yomo and Srinivasen [11], Sugiura and Sunobe [12], Basha and Beevers [13] and Juliano and Varner [14] on compositional change during germination of several kind of bean seeds.

Table 2 shows a comparison of different kinds of sprout from various seeds such as mung bean, soy bean and riang (a local seed of Southern Thailand). The compositions varied depending on the nature of the seed.

Table 1. Comparable components of tamarind seeds and sprouts growth for 10 and 15 days.

Tamarind sprouts	Nutrient compositions (%)*				
	pH	Moisture	Protein	Acidity	Fat
Tamarind seeds	6.32^{a}± 0.04	15.20^{a}±0.15	13.37^{a}±0.25	0.37^{a}±0.03	4.29^{a}±0.22
Whole sprouts 10 days	5.13^{b}±0.02	77.30^{b}±0.42	4.68^{b}±0.13	0.66^{b}±0.02	0.48^{b}±.0.02
Whole sprouts 15 days	4.73^{c}±0.03	81.02^{c}±0.54	3.99^{c}±0.12	0.85^{c}±0.02	0.45^{b}±0.02
Cotyledons 10 days	4.85^{d}±0.02	64.95^{d}±0.73	3.40^{d}±0.05	0.37^{a}±0.02	0.30^{c}±0.01
Cotyledons 15 days	4.39^{e}±0.01	70.69^{e}±0.64	2.98^{e}±0.06	0.48^{d}±0.04	0.26^{c}±0.01
Stem 10 days	4.65^{f}±0.05	81.50^{c}±0.34	1.12^{f}±0.05	0.32^{e}±0.03	0.14^{c}±0.02
Stem 15 days	4.17^{g}±0.03	90.40^{f}±0.20	1.39^{f}±0.01	0.38^{a}±0.01	0.16^{c}±0.02
	Sugars	Ash	Crude fibre	Dietary fibre	Carbohydrates
Tamarind seeds	9.14^{a}±0.19	2.06^{a}±0.06	2.36^{a}±0.10	29.47^{a}±0.04	65.08^{a}±0.37
Whole sprouts 10 days	2.45^{b}±0.02	1.07^{b}±0.03	1.03^{b}±0.02	19.48^{b}±0.06	16.47^{b}±0.30
Whole sprouts 15 days	1.88^{c}±0.04	1.02^{b}±0.04	1.53^{c}±0.03	21.45^{c}±0.04	13.52^{c}±0.45
Cotyledons 10 days	1.84^{c}±0.03	0.84^{c}±0.02	0.95^{d}±0.01	25.05^{d}±0.03	30.51^{d}±0.81
Cotyledons 15 days	1.29^{d}±0.04	0.77^{d}±0.03	0.90^{d}±0.03	24.41^{e}±0.04	25.30^{e}±0.62
Stem 10 days	0.88^{e}±0.03	0.61^{e}±0.03	0.47^{e}±0.02	9.32^{f}±0.03	16.63^{b}±0.33
Stem 15 days	1.22^{d}±0.06	0.71^{d}±0.05	0.68^{f}±0.03	7.12^{g}±0.04	7.34^{f}±0.24

*The different superscripts in the same column denote significant difference ($p < 0.05$)

Table 2. Comparison of nutritional values of tamarind sprouts, riang sprouts, mung bean sprouts and soy bean sprouts per 100 grams.

Composition (% wet basis)	Tamarind sprouts at (10 days)	Tamarind sprouts at (15 days)	Riang* sprouts	Mung bean* sprouts	Soy bean* sprouts
Moisture	77.30	81.02	79.6	90	83.5
Protein	4.68	3.99	7.5	2.8	9.1
Fat	0.48	0.45	3.5	0.1	3.4
Carbohydrate	16.47	13.52	6.7	6.6	3.0
Crude fiber	2.03	2.53	1.3	0.7	6.7
Dietary fiber	19.48	21.45	na	na	na
Ash	1.07	1.02	1.4	0.5	1

* Modified from Division of Nutrition (1987) [15]
Na = not available

Conclusions

During the germination of tamarind seeds, protein content of whole sprouts and cotyledons was significantly decreased ($p < 0.05$) from 2.67 to 1.10% and from 2.61 to 0.66% respectively, while protein content of the stem was significantly increased ($p < 0.05$) from 0.24 to 0.64%. Tamarind sprouts at 15 days had less protein, fat, ash, total sugars and carbohydrate than sprouts at 10 days, except for moisture, acidity and crude fibre. Tamarind sprouts at 10 days and 15 days had protein content of 4.68% and 3.99%, 77.30% and 81.02% moisture content, 0.66% and 0.85% acidity, pH of 5.13 and 4.73, 1.03% and 1.53% crude fibre, 2.45% and 1.88% total sugars, 16.47% and 15.32% carbohydrate, respectively. Tamarind sprouts at 10 days and 15 days were found to have lower content than tamarind seeds while moisture, weight and length were increased with increased germinating time. The use of tamarind sprouts shows good potential to be a new nutrition source, especially for dietary fibre.

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