

## Nutritional value and antinutritional factors of foliaceous vegetable *Talinum fruticosum*

### Valor nutricional e fatores antinutricionais da folha vegetal *Talinum fruticosum*

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#### ABSTRACT

*Talinum fruticosum* Juss (L.) is an unconventional plant belonging to the family Portulacaceae; it is a herbaceous perennial plant that grows in tropical regions as a foliaceous vegetable. *T. fruticosum* leaves are a source of fiber and minerals and they contribute to assemble the micronutrients for daily nutritional requirements. These plants supply the essential nutrients to the human organism; however, these plants contain antinutritional factors such as lectins and tannins which may compromise their bioavailability. In the present study, the *T. fruticosum* leaves samples were investigated on proximate composition and antinutritional factors. Samples were exposed to heat treatment for washing and for cooking for 10 min. These procedures neither significantly changed the carbohydrates and lipids contents, nor eliminated the hemagglutinating activity which is inactivated at 70 °C, although no effective reduction of tannin from the leaves was observed.

**Key words.** *Talinum fruticosum*, bredo, antinutritional factors, unconventional vegetable, proximate composition

#### RESUMO

*Talinum fruticosum* Juss (L.) é uma planta não convencional da família Portulacaceae e trata-se de planta herbácea perene que cresce em regiões tropicais como vegetais folhosos. As plantas fornecem nutrientes essenciais ao organismo, no entanto, a biodisponibilidade pode ser comprometida pela presença de fatores antinutricionais tais como lectinas e taninos. Em virtude das folhas de *T. fruticosum* serem fonte de fibra e de minerais e por contribuem para reunir os micronutrientes necessários para a nutrição diária, no presente estudo as amostras de folhas dessa planta foram investigadas quanto à composição centesimal, bem como os fatores antinutricionais. As amostras foram submetidas ao tratamento térmico nos procedimentos de lavagem e de cozimento durante 10 min. Estes processos não foram capazes de alterar significativamente os teores de carboidratos e lipídeos, tampouco a supressão da atividade hemaglutinante que é inativada a 70°C. Contudo não houve eficácia na redução dos teores de tanino presentes nas folhas estudadas.

**Palavras-chave.** *Talinum fruticosum*, bredo, fatores antinutricionais, vegetais não convencionais, composição centesimal

## INTRODUCTION

Plants generally provide essential nutrients for the body and can be a source of nutrients for people of all social classes in view their reasonable cost and accessibility, which can be grown without the need for major financial investment. However, the bioavailability of their nutrients may be compromised by the presence of antinutritional factors such as lectins and tannins. Based on the most recent definition of lectins, they are considered to be proteins with at least one non-catalytic domain able to recognize and bind reversibly to specific mono- and oligosaccharides<sup>1</sup>.

Tannins are polyphenols that form complexes with proteins, making them insoluble and inactivating their enzymatic activity. They may also bind to other macromolecules such as starch, causing a reduction in the nutritional value of food<sup>2</sup>.

Considering the detrimental effects of antinutritional factors present in food intended for human consumption, most of these substances appear to be inactivated or inhibited with appropriate heat treatment<sup>3</sup>.

*Talinum fruticosum* Juss (L.) is a non-conventional plant of the family Portulacaceae; it is herbaceous perennial plant that grows in tropical regions as a leafy vegetable. Its leaves are smooth and succulent, or spirally provision opposite cross with flowers and small inconspicuous met in inflorescences axillary or terminal film<sup>4</sup>.

This plant is commonly known as bredo but is also called other popular names such as “gomes major,” “ceirão” and spinach, and it is a traditional food during Easter. The leaves of this herb are prepared as broths and the cooked leaves are used to accompany sea food which is allowed in this period of abstinence from red meat.

In the present study, the leaves were investigated to determine their proximate composition, and antinutritional factors. The aim of this study was to demonstrate its nutritive value and thereby to promote the consumption and utilization of this species in regions where it is grown.

## MATERIAL AND METHODS

### Material

*Talinum fruticosum* leaves were collected from Cruz do Espírito Santo, Paraíba, Brazil. Rabbit erythrocytes were obtained from the Federal University of Paraíba and human blood was obtained from healthy donors from the Hematology Center of Paraíba.

### Heat treatment

Proximate composition was determined on three forms of the leaves: fresh, bleached and cooked for 10 min in boiling water. Leaf extract was subjected to different elevated temperatures to test for inactivation of the antinutritional factors.

### Proximate composition analysis

Moisture content was determined using the AOAC method<sup>5</sup> and ash content according to AOAC<sup>6</sup>. Total nitrogen content was obtained using the Kjeldahl method and the percentages of nitrogen were transformed into protein content by multiplying by a conversion factor of 5.3 (AOAC<sup>6</sup>). Total fat extraction was performed according to the AOAC<sup>6</sup> method, using a Soxhlet apparatus. Carbohydrate content was determined by the phenol-sulfuric acid method<sup>7</sup>.

### Determination of antinutritional factors

#### Hemagglutinating activity

Hemagglutinating activity was assayed in tubes with serial dilutions of the leaf extract according to Moreira and Perrone<sup>8</sup>. All 10 tubes of the series received 100 µL of 0.15 M NaCl. Added to the first tube of the series were 100 µL of the supernatant from the 0.15M NaCl the extract of the leaves. The second tube received 100 µL from the mixture of the first and so on until the tenth tube with a total of 200 µL was discarded. A 100- µL aliquot of 2% suspension rabbit and human (A, B or O) erythrocytes in the same buffer was added to each tube. Hemagglutination was determined after a 1-h incubation at 37°C. Hemagglutinating and hemolytic activities were expressed as a titer, namely, the reciprocal of the highest dilution that gave a positive result.

### Determination of soluble proteins

Protein concentration was determined by the method described by Bradford<sup>9</sup> using bovine serum albumin (BSA) as standard. The samples were submitted to extraction at a proportion (1:10) with the following buffers: 0.1 M glycine, pH 2.6, pH 9.0 M Glycine 0.1, 0.1 M Tris-HCl pH 7.6, all with 0.15 M NaCl, with stirring for 3 h at room temperature. Afterward, each extract was centrifuged at 5,000 rpm for 25 min at 4 ° C, and the supernatants used for analysis.

**Tannin content determination** - Total tannins were extracted in water and determined by a colorimetric method as described by Rangana<sup>10</sup>. They were quantified using the Folin–Denis reagent, and the results were expressed as tannic acid equivalents.

### Statistical analysis

Analyses were performed in duplicate. The data were processed statistically using Kruskal–Wallis with the help of the Program Biostat 5.0. The means and standard deviation were determined and differences were considered significant at  $P < 0.05$ .

## Results and discussion

### Chemical Composition

The proximate composition of the leaves of *T. Fruticosum* are described in Table 1. The fresh leaves of the plant have a 89.08% moisture content. With washing and cooking, the moisture content was significantly higher because of the swelling of the leaves. Aletor and Adeogun<sup>11</sup> found in leaves of *T. triangulare* a 91% moisture level. Wallace, Marfo and Plahar<sup>12</sup>, in examining fresh leaves of plants of the species *E. hirta*, *I. involucrata* and *X. maffafa* found lower moisture (74.41%, 84.61% and 88.41%) compared to that observed in this study, and 91.43% moisture in leaves of *L. Taxaracifolia* (wild lettuce). Singh, Kawatra and Sehgal<sup>13</sup> found 95.4% moisture in leaves of fresh carrot. We observed a significant reduction in ash content with heat treatment, which could be explained by the increase in moisture after heat-

ing. Wallace, Marfo and Plahar<sup>12</sup> found the species *X. maffafa* to have a similar value (1.48%).

Protein content decreased significantly with cooking, but not with washing. Aletor and Adeogun<sup>11</sup> found higher protein content (2.5%) in leaves of the same species studied here. Higher values (3.42%, 2.60%, 2.71%) were also reported in work with leaves of other species<sup>12</sup>.

The thermal processing applied did not cause a significant change in the content of carbohydrates presents. Low levels of lipids were found in leaves of *T. Fruticosum* when compared with other food sources, but these quantities are greater than those found in other plant leaves<sup>14</sup>. Thus, heat processing did cause loss of these macronutrients.

### Antinutritional factors

The presence of antinutritional factors in foods compromises their nutritional quality. Table 2 displays the finding for the different antinutritional factors investigated. Plant lectins have the capacity to resist gastric digestion and pass into the intestinal region<sup>15</sup>. The specificity of lectins for specific sugars allows these proteins bind to intestinal microvilli thereby reducing the area of absorption of nutrients<sup>14</sup>. The lectins in *T. Fruticosum* leaves have a specificity for sugars present in the membrane of human and rabbit erythrocytes. The fresh leaves of the plant showed hemagglutinating activity. The inactivation of this antinutritional factor was demonstrated over range of temperatures starting at 40 °C with increments of 5 °C. Total inactivation was seen at 70°C.

**Table 1.** Proximate composition of leaf *Talinum fruticosum*

	fresh leaves (X±SD)	bleached leaves (X±SD)	cooked leaves (X±SD)
Moisture(%)	89.80 ± 0.04 <sup>a</sup>	91.12 ± 0.24 <sup>b</sup>	92.60 ± 0.32 <sup>c</sup>
Protein(%)	1.32 ± 0.16 <sup>a</sup>	1.38 ± 0.17 <sup>a</sup>	1.24 ± 0.18 <sup>b</sup>
Fat(%)	3.13 ± 0.54	2.99 ± 0.42	3.23 ± 1.51
Carbohydrates(%)	2.96 ± 0.14	2.88 ± 0.42	2.92 ± 0.28
Ash(%)	1.46 ± 0.16 <sup>a</sup>	1.24 ± 0.02 <sup>b</sup>	0.40 ± 0.09 <sup>c</sup>

X – Arithmetic mean; SD – Standard deviation  
a, b and c – significant difference,  $p < 0.05$

**Table 2.** Antinutritional factors in *Talinum fruticosum* leaves

<b>Antinutritional factor</b>	<b>Fresh leaves</b>	<b>Bleached leaves</b>	<b>Cooked leaves</b>
Erythrocytes			
A	UH	-	-
B	UH	-	-
O	UH	-	-
Rabbit	UH	-	-
Tannin (mg/100g)	1072 <sup>a</sup>	2794 <sup>b</sup>	1309 <sup>a</sup>

UH: Hemagglutinating activity  
a and b – significant difference  $p < 0.05$

The tannin content found in the leaves of the fresh plant leaves (1073 mg/100 g) was not reduced to acceptable amounts after heat treatment. Levels of polyphenols above 1,000 mg/100 g dry weight are considered high and damaging to protein digestibility<sup>15</sup>. Santos<sup>2</sup> studied the effect of cooking on the antinutritional factors in leaves of broccoli, cauliflower and cabbage noting that with the increase of time for cooking there was no reduction of tannin content to negligible levels for cabbage and broccoli. Umaru, Adamu, Dahiru and Nadro<sup>16</sup> when studying species of fruit consumed in Nigeria, detected tannin levels of  $7.40 \pm 0.14\%$  in *B. aegyptiaca*,  $6.39 \pm 0.5\%$  in *Hyphaena thebaica* and  $5.90 \pm .13\%$  in *Borassus aethiopum*. Del Vecchio, et al.<sup>17</sup> investigated the content of antinutritional factors in pumpkin seeds, fresh, cooked and roasted, noting a significant decrease in the levels of cyanide, an inhibitor of trypsin, hemagglutinating activity and tannin, but the treatment that was most efficient was cooking.

## CONCLUSION

The results of this study suggest that *Talinum fruticosum* plant is a low calorie food containing low levels of macronutrients, namely lipids and carbohydrates. As it is a source of fiber and minerals, this plant contributes to meeting daily nutritional requirements for micronutrients. Heating (70 ° C) was able to inactivate the lectin, but it did not reduce the levels of tannins to tolerable levels. Further studies are necessary to determine the time and temperature needed to reduce tannin levels in order to enhance the nutritional quality of this plant. It is also important to conduct toxicological tests with the leaves

of the plant to determine the amounts that can be consumed without deleterious effects.

Further research of this underutilized vegetable from different regions should also be carried out, since its compounds may vary with maturity, soil and cultivation among other factors likely to change its composition.

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