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Analysis and Comparison of Nutritional, Anti-Nutritional and Mineral Values in Two Kinds of *Treculia Perrieri* (Tsitindry) Meal comes from Sun Dried Seed and Cooked Seed

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Abstract Given the current climate change and rice price spikes in Madagascar, the government must turn to natural products such as *Treculia perrieri*. The present work was carried out in order to compare the different elements in the flour prepared from cooked and uncooked seed. The levels of lipids, proteins, glucose, ash and energy value in flour made from uncooked seed of 13g/ 100g; 30.9g/ 100g; 72g/100g; 2.15g/100g and 615.02Kcal/100g are superior to those found in the cooked seed flour of 9.42g/100g; 14.7g/100g; 64.17g/100g, 2.14g/100g and 401.61g/100g. Except the water content is greater than 9.42g/100g in flour made from cooked seed compared to uncooked seed flour 7.5g/100g. Similarly for mineral levels in uncooked seed flour such as potassium 720.05g/100g, magnesium 180.33g/100g, iron 10.2g/100g, calcium 220.12g/100g and sodium 52.13g/100g are higher compared to cooked seed flour of 444.69g/100g; 143.11g/100g; 7.25g/100g; 146.73g/100g; 49.32g/100g. In addition the rates of anti-nutritional in cooked flour are inferior to the flour comes from uncooked seed, except the tannin and polyphenol levels are absent in both types of flour. The rates are 0mg/100g for saponins, 0.002mg/100g for pyrogalic, 0.004mg/100g for catechol and 0.009mg/100g for polysaccharides against saponin level is 0.002mg/100g, 0.009mg/100g for pyrogallics, 0.011mg/100g for catechics and 0.01mg/100g for polysaccharides.

Keywords *Treculia perrieri* (Tsitindry), Physico-chemical analysis, Nutritional, Antinutritional, Cooked baked flour, Uncooked seed meal

1. Introduction

Treculia perrieri are wet woods below 300m, alluvium; it blooms in the months of July and October. The fruits are ripe between the months of January - February. Tsitindry is widely spread in the DIANA region, specifically the district of Ambanja (Sambirano). Treculia perrieri (Tsitindry) is a plant endemic to Madagascar. It is classified in:

Class: Equisetopsida
Subclass: Magnoliidae
Superorder: Rosanae
Order: Rosales
Family: Moraceae
Genus: *Treculia*
Species: *Treculia perrieri*
Variety: *Treculia perrieri var. perrieri*
Vernacular names: Katoka, Tobory, Tsipa, Titindry [1-4]

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Treculia perrieri is a tree up to 30m deep trunk furrowed winged buttresses, bark smooth and greyish. Young pubescent twigs. Leaves persistent petiole puberulous at first, 8 to 12 mm. Leafy blade, angular or obtuse and unequilateral at the base rounded or acute at the apex, wider in the lower half than the upper half, 11 to 18 cm long by 4 to 7 cm; About 15 lateral veins on each side; thin nerves regularly crosslinked. Dioecious flowers rarely monoecious, usually male receptacles on young twigs, females on aged twigs [1-4].

Receptacles male, obovate with shrunken base, up to 4cm by 3. Flowers intertwined with peltate bracts in escutcheon, welded on the 2/3 of their length, exceeded by the flowers at anthesis. Perianth hyaline short-bellied with 3-4 small ciliate teeth and 4 exserted stamens. Female receptacles of similar shape, but larger (6 out of 5). Female flowers in several rows, interspersed with peltate bracts, the stigmata protrude alone. Two stigmatic branches of 5 to 7mm slightly papilleuses, obtuse, surmounting a hairy style of about 3mm. Syncarp sessile irregular shape exceeding 30 cm and 5 kilos, fleshy, presenting towards the surface 6-7 rows of ovoid achenes about 1 cm. Woody pericarp slender, brown on dry seed without albumen; thin integument. Unequal cotyledons

completely folded the notched, bilobed tops receding at the level of the radicle, the widest enveloping the other in tongue [1-4].

2. Methods and Materials

2.1. Preparation of *Treculia perrieri* Flour

a) Preparation of *Treculia perrieri* flour after cooking: the seeds are extracted from ripe fruit. And after, the seeds are separated from the pods and boiled for a few moments so that the pod around them bursts. Drain and dry the pods before shelling them for ease. After the cotyledons are sun-dried then the cotyledons are ground to obtain the *Treculia perrieri* flour.

b) Preparation of *Treculia perrieri* flour after drying in the sun: after extracting the seeds from ripe fruits, the seeds are washed and immediately dried in the sun to burst the pods. Shelled sun-dried seeds and cotyledons before grinding for flour.

2.2. Analyzes of Minerals in Two Types of Flour

The flour is put into a muffle oven at 550°C to obtain a white ash containing the minerals.

The Ca, Mg, K, Na mineral contents are determined by atomic absorption spectrophotometry. After wetting, 5 to 25 ml of concentrated hydrochloric acid is added. The suspension is then boiled and filtered. The phosphorus level is determined by colorimetry or spectrophotometry at 560 nm [6, 9, 13, 26].

2.3. Nutritional Value Analysis in Two Types of Flour

- **Lipids:** the sample is treated with hexane. Five grams of sample are introduced into extraction cartridges for six hours. The extracted extract is put in a drying oven at 75°C for one hour until a constant mass is obtained [26, 32, 35, 43].
- **Crude ash:** the 5 g sample taken is placed in a muffle furnace set at 550°C. White ash is weighed after cooling.
- **The proteins:**

Two protein extraction techniques are used.

a) The flour obtained is suspended in a sodium phosphate buffer (0.05 $mol.l^{-1}$ at pH 8.0) at a rate of 4 g in 9 ml. The debris is removed by centrifugation at 20,000 g. Proteins from the supernatant and the centrifugation pellet is precipitated in the presence of TCA at 50 μl^{-1}. They are dissolved in decinormal soda and measured according to the LOWRY method [6, 11, 26].

b) The flour is suspended in a sodium phosphate buffer (1 $mol.l^{-1}$ at pH 0.8) at a rate of 1 g in 9 ml and milled under constant pressure (420 kg/cm^2).

Cell debris is removed and the suspension centrifuged at high speed under the conditions described in the art. The soluble proteins obtained, according to the two techniques, are separated into two groups by chromatography and the supernatants extracted after high speed centrifugation are dialyzed for 16 hours against a sodium phosphate tap (0.01 $mol.l^{-1}$ at pH 8, 0) containing urea at a final concentration of 8 $mole.l^{-1}$. The dialysates are then chromatographed in a column of diethylaminoethylcellulose equilibrated with the same buffer. In this method, the cationic protein retained by the resin and in other cases the anionic proteins remain adsorbed. The cationic and anionic proteins separated by chromatography are hydrolysed at 140°C. for 24 h in the presence of 6N HCl. Their respective amino acid composition is determined after analysis of the hydrolysates [6, 11, 26].

- **Carbohydrates:** are determined spectrophotometrically at 490 nm. The Fischer and Stein method is applied and it uses DNS at 540 nm to evaluate soluble sugars [14, 18, 24, 26].

2.4. Determination of Antinutritional Factors in Two Types of *Treculia perrieri* "Tsitindry" Flour

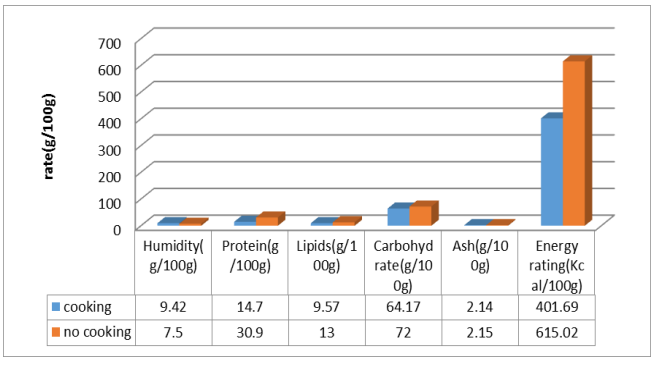
The determination of the total phenol content was based on the reaction with the Folin Ciocalteu reagent. The blue color obtained has a maximum absorption at 725 nm. The tannins were determined according to the spectrophotometric method using acidified vanillin and tannic acid as standard (λmax = 500 nm). Determination of saponin content was made using the aerosimetric method based on the formation of stable foams by Koziol saponins [20, 25, 26, 28, 33].

3. Results and Discussions

3.1. Nutritional Value of *Treculia perrieri* "Tsitindry"

Table 1. Nutritional Value Analysis

Type of flour	cooking	No cooking
Humidity (g/100g)	9.42	7.5
Protein (g/100g)	14.7	30.9
Lipids (g/100g)	9.57	13
Carbohydrate (g/100g)	64.17	72
Ash (g/100g)	2.14	2.15
Energy rating (Kcal/100g)	401.61	615.02



a) Moisture content and ash: the water content 9.42g/100g of flour prepared from cooked seed against 7.5g/100g of cooked seed flour. The result shows that the water content in cooked flour is higher compared to uncooked flour. For both flours, the ash rate is about the same 2.14g/100g against 2.15g/100g.

b) Content of proteins, fats, carbohydrates and energy value:

- Total protein. The protein level is very high in the uncooked seed 30.9 g/100g almost twice in the cooked seed 14.7g/100g. The result showed that the seed of *Treculia perrieri* is rich in protein but the presence of heat destroys almost half of the protein level.
- Terror in lipids. The lipid content of the two samples is 9.57 g/100 g for flour cooked against 13 g/100 g for the flour prepared uncooked seed. *Treculia perrieri* flour has a medium lipid level. But cooking destroys 1.3 of lipid levels in the seed of "Tsitindry".
- Total carbohydrate. 64.17g/100g carbohydrate rate in cooked seed meal against 72g/100g of uncooked seed. The result showed that the seed of "Tsitindry" is very rich in carbohydrates. But the preparation with boiling water removes 1.3 of total carbohydrates.
- Energetic value. 615.02Kcal/100g the energy value comes from the uncooked seed flour against 401.61Kcal/100g of cooked seed meal. So the heat affects the energy supplying elements in the seed. According to the results, almost 213.41Kcal/100g disappears in the seed preparation.

The nutrient levels are higher in the uncooked seed than in the cooked seed. Except at the rate of ash and moisture about the same. According to the results, the differences are due to the method of preparation of the flour. If the flour comes from the cooked seed, the nutritional rates are down and opposite for the flour comes from the uncooked seed, the rates are rising. So the cooking is the first responsible for the disappearance of different levels of nutrients in the seed of *Treculia perrieri*.

3.2. Minerals in the *Treculia perrieri* "Tsitindry"

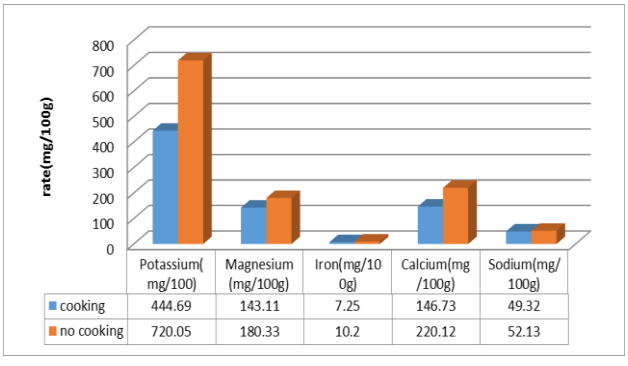
a) Potassium, magnesium, iron, calcium and sodium minerals:

- Potassium level. 720.05mg/100g the potassium level in the uncooked seed against 444.69mg/100g of flour from the cooked seed. The potassium level in the cooked seed meal is half of the potassium level in the uncooked seed meal. So the potassium level in the uncooked seed meal is much higher compared to the cooked seed. The heat removes 1/2 of potassium levels in the seed. The seed of "Tsitindry" is very rich in potassium.
- Magnesium levels. The seed of *Treculia perrieri* contains magnesium with an interesting rate. But, the rate in uncooked seed meal is higher than that of cooked seed flour 180.33mg/100g against 143.11mg/100g. Magnesium plays a role, important in human life, it is very interested to eat flour comes from uncooked seed for assimilated maximum magnesium.
- Real iron. Iron is among the trace elements in the human nutrient. *Treculia perrieri* shows that in flour prepared with uncooked seed at a rate of 10.2mg/100g greater than the rate of cooked seed flour 7.25mg/100g. The heat destroys some iron levels in the cooked flour.
- Late of calcium. 220.12mg/100g calcium level in uncooked seed flour against 146.73mg/100g cooked seed flour. The result shows that the calcium level in the uncooked seed meal is higher than that in the cooked seed meal. But the heat destroys 73.39mg/100g of calcium in the seed.
- Sodium level. Sodium level 49.32mg/100g for cooked seed against 52.13mg/100g of cooked seed. Sodium has a mean level in the seed of "Tsitindry".

Based on the results, mineral levels in uncooked seed meal are high compared to flour made from cooked seed. This causes intense heat during the cooking of seed. Volatile elements are very sensitive to heat as Calcium almost moist rates are gone. Similarly for potassium, magnesium.

Table 2. Mineral Analysis

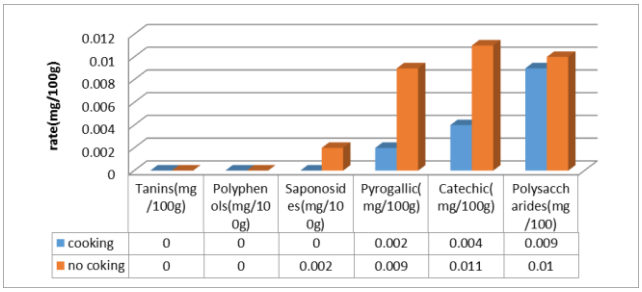
Type of flour	cooking	No cooking
Potassium (mg/100g)	444.69	720.05
Magnesium (mg/100g)	143.11	180.33
Iron (mg/100g)	7.25	10.2
Calcium (mg/100g)	146,73	220,12
Sodium (mg/100g)	49.32	52.13



3.3. Antinutritional Value in *Treculia perrieri* "Tsitindry"

Table 3. Summary of antinutritional factors

Antinutritional factors	cooking	No cooking
Tannins (mg/100g)	0	0
Polyphenols (mg/100g)	0	0
Saponosides (mg/100g)	0	0.002
Pyrogallic (mg/100g)	0.002	0.009
Catechic (mg/100g)	0.004	0.011
Polysaccharides (mg/100g)	0.009	0.01



a) Content of tannins, polyphenols, saponosides, pyrogallics, catechins and polysaccharides

The levels of tannins and polyphenols are absent in both types of flour. But Saponosides remain in trace state in uncooked seed meal (0.002mg/100g) and absent altogether in cooked seed meal. For other items like Pyrogallic 0.002mg/100g; Catechic 0.004mg/100g and 0.009mg/100g polysaccharides in cooked seed are lower than rates in uncooked flour (Pyrogallic 0.009mg/100g); Catechic 0.011mg/100g; Polysaccharides 0.01mg/100g). According to the results, the differences are due to the high temperatures during the preparation. Heat is an effective way to rid or reduce anti-nutritional levels in *Treculia perrieri* seed meal but has a deleterious effect in major heat-sensitive elements such as Calcium, Magnesium and Potassium.

4. Conclusions

It is difficult to distinguish in which type of flour is very important in food. The results show that the presence of heat decreases the rate of anti-nutrients, mineral levels and nutritional values in flour prepared from cooked sheath. To conclude that mineral rates and nutritional values in uncooked seed are almost twice the rates in the cooked seed. The flour of "Tsitindry" is an effective relief to solve the famine in Madagascar.

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