Centesimal and Mineral Composition of Priprioca (*Cyperus articulatus* var. *nodosus*, Cyperaceae)

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ABSTRACT – This study investigated a nutritional and mineral composition of the plant *Cyperus articulatus* var. *nodosus*, better known as priprioca. Priprioca was obtained in the Tabocal Community, Santarém, Pará, Brazil. 100mg of priprioca rhizomes were washed with 2% hypochlorite solution. These were dried in an oven at 40°C. The rhizomes were then ground to obtain a powder for analysis of the proximate and mineral composition. As a result, fiber, protein, carbohydrate and low lipid contents were found. Regarding minerals, higher levels of iron (118.5mg/100g), zinc (58.25mg/100g) were found, followed by potassium (50.6mg/100g). The results indicate that mineral values are valuable.

Keywords: Properties of *C. articulatus* var. *nodosus*; centesimal composition; studies with *Cyperus* sp.

Composição Centesimal e Mineral da Priprioca (*Cyperus articulatus* var. *nodosus*, Cyperaceae)

RESUMO – Este estudo investigou a composição nutricional e mineral da planta *Cyperus articulatus* var. *nodosus*, mais conhecida como priprioca. A priprioca foi obtida na Comunidade Tabocal, Santarém, Pará, Brasil. 100mg de rizomas de priprioca foram lavados com solução de hipoclorito a 2%. Estes foram secos em estufa a 40°C. Os rizomas foram então moídos para obter um pó para análise da composição centesimal e mineral. Como resultado foram encontrados teores de fibras, proteínas, carboidratos e baixo teor de lipídios. Em relação aos minerais, foram encontrados níveis mais elevados de ferro (118,5mg/100g), zinco (58,25mg/100g), seguido de potássio (50,6mg/100g). Os resultados indicam que os valores de minerais são valiosos.

Palavras-chave: propriedades de *C. articulatus* var. *nodosus*; composição centesimal; estudos com *Cyperus* sp.

Composición Centesimal y Mineral de Priprioca (*Cyperus articulatus* var. *nodosus*, Cyperaceae)

RESUMEN – Este estudio investigó la composición nutricional y mineral de la planta *Cyperus articulatus* var. *nodosus*, más conocido como priprioca. Priprioca se obtuvo en la Comunidad Tabocal, Santarém, Pará, Brasil. Se lavaron 100mg de rizomas de priprioca con una solución de hipoclorito al 2%. Estos se secaron en estufa a 40°C. A continuación, los rizomas se trituraron para obtener un polvo para el análisis de la composición mineral y próxima. Como resultado, se encontraron contenidos bajos de fibra, proteínas, carbohidratos y lípidos. En cuanto a los minerales, se encontraron niveles más altos de hierro (118,5mg/100g), zinc (58,25mg/100g), seguido del potasio (50,6mg/100g). Los resultados indican que los valores minerales son valiosos.

Palabras clave: Propiedades de *C. articulatus* var. *nodosus*; composición centesimal; estudios con *Cyperus* sp.

Introduction

An aromatic plant popularly known as priprioca, it is native to the Amazon region, occurs naturally in the North, Northeast and Southeast regions of Brazil. This plant stands out for its use in therapeutic purposes (Flora do Brasil, 2019).

C. articulatus var. *nodosus* was cultivated in approximately one hectare in the Santarém/PA region, where Universidade Federal do Oeste do Pará/UFOPA is located and the essential oil can be extracted in different processes, and used in laboratories, tests and in industries as for example by hydrodistillation.The essential oil yield was approx. 0.5% and was identified and chromatographically identified with sesquiterpenes as major compounds. In agronomic studies, there was a chemical variation of the compounds in the plant, according to climatic statistics and its relationship with the quality of the plant's development (Arévalo *et al*., 2014).

Many authors (Zoghbi, 2005; Mattoso, 2005; Barata *et al*., 2012) have studied essential priprioca oil and its aroma has aroused the interest of cosmetic industry. The priprioca rhizome has also medicinal properties as well as is used frequently as a traditional source for cosmetics.

The priprioca, in the State of Pará, has aroused great scientific and economic interest precisely because of the pleasant aroma of the essential oil obtained from its rhizomes (Galvão *et al*., 2019).

Priprioca crops experiments conducted in farmers' properties of the Brazilian Amazon by Potyguara & Zoghbi (2008). Rios *et al*. (2014) showed that the use of hand labor for the cultivation of one hectare ranges about 156-378 man/day ranging from cultivation to the cleaning rhizomes process. The income of fresh rhizomes priprioca range from 7.66 to 22.09t ha $^{-1}$ depending on the soil type and organic matter abundance in the soil. This study aimed to investigate the centesimal and mineral compositions of *Cyperus articulatus* var. *nodosus* rhizomes.

Material and Methods

Sample preparation

C. articulatus var. *nodosus* rhizomes were collected in Tabocal community (-54°43'00,10"W e -02°37'41,10"S) washed twice, cleaned and sterilized using sodium hypochlorite 2%. Rhizomes powder were dried at 40°C in the oven for twelve hours and ground to the finest particles using dry milling machine. The sample analyzed for its centesimal values, mineral profile of the rhizomes powder.

Methods

The proximate compositions (crude protein, crude fat, crude fibre, ash, moisture and carbohydrate) were determined according to the methods of AOAC (2005).

The mineral composition was determined using, analytical methods of atomic absorption spectrophotometer after ashing and dissolving the samples in 10% hydrochloric acid (Perkin-Elmer Inc., 1982). All the determinations were carried out in triplicates.

Results and Discussion

Results of centesimal composition of *C. articulatus* var. *nodosus* are described Table 1 and shown that sample is still rich in humidity (29.95±70), fat (13.60±50), fibers (32.33±80) and carbohydrates (29.26). Table 2 shows the concentration of minerals (mg/g) and evidenced that higher values are in iron (118.5mg/100g), zinc (58.25mg/100g), followed by potassium (50.6mg/100g). Other essential minerals to daily ingestion as magnesium, copper, calcium and manganese were detected.

According to Muthuri and Kinyamario (1989) the ash content of the plant material is related to the residue that remains after the combustion of the dry material in the oven. It is considered a measure of the total mineral content of the plant material. Ashes content of *C. articulatus* var. *nodosus* rhizome was 3.07±20%, a value closely related to *C. rotundus* (2.67±0.21%) (Oladunni *et al*. 2011). According to Ekeanyanwu & Onogbu (2010), the ashes content in *Cyperus esculentus* was 1.8%. The ashes content recommended for animal feeding should range 1.5-2.5% (Pomeranz & Clifton, 1981).

In relation to the value found for crude fibers in *C. articulatus* var. *nodosus* was 32.33±80%. The value found to *C. rotundus* is more than 2 times higher than *C. articulatus*, 12.63±0.01% (Oladunni *et al*., 2011). *C. esculentus* presented around 24% of fibers. Fibers content in priprioca

is considered high and this high level of crude fibers has been related to difficult bioavailability of nutrients in some food samples. Crude fibers are water insoluble and responsible to help the elimination of these residues from alimentation (Joshly, 1970). Priprioca is a good fibers source and could help to desaccelerate the glucose releasing (Onwuliri & Obu, 2002). According to to Eastwood (1974) and Mendelhoff (1978), relation between absence of fibers in the diet and the incidence of a great quantity diseases affecting human being as diabetes mellitus, obesity and heart diseases is significantly. The consumption of significatives amounts of ground priprioca, therefore, does not constitute a risk factor for such pathologies, since it is just used as a condiment.

Lipid content found in *C. articulatus* var. *nodosus* (1.360%) (Table 1) was lower than *C. rotundus* (29.48%) and *C. esculentus* (24.3%), according to studies of Oladunni *et al*. (2011) and Ekeanyanwu & Onogbu (2010), respectively.

Without a doubt, protein is one of the important elements of a balanced diet (Boyd & Blackburn, 1970; Sinclair, 1975). Once they are constituents of animal organism during growing and aminoacidic profile is decisive for its quality and determine its value as component of a diet (Pezzato, 1999). Crude protein level found in *C. articulatus* var. *nodosus* (4.030%) was lower in comparison with those values found in *C. rotundus* (9.04%) (Oladunni *et al*., 2011), nevertheless *C. esculentus* showed 3.8% of protein (Addy & Eteshola, 1984).

Carbohydrate content of *C. articulatus* var. *nodosus* (29.26%) (Table 1) was higher than in *C. rotundus* (21.47±0.83) (Oladunni *et al*., 2011) however, the level of carbohydrates in *C. esculentus* (30.0%) was similar to priprioca (Ekeanyanwu & Onogbu, 2010).

Caloric value of *C. esculentus* was 369.30Kcal/100g (Ekeanyanwu & Onogbu, 2010), while in this work *C. articulatus* var. *nodosus* presented 145Kcal/100g (Table 1).

Table 1 – Proximate composition of *Cyperus articulatus* rhizomes powder on dry matter basis %.

Parameters	Percentage composition (%)
Moisture*	29.95 ± 0.70
Fat*	1.360 ± 0.50
Crude Protein*	4.030 ± 0.130
Ash* Crude Fibre*	3.07 ± 0.20 32.33 ± 0.80
Carbohydrate* Energy* Kcal/100g	29.25 ± 0.30 145

* Means of triplicate determinations

Considering mineral distribution, Table 2 shows the highest levels of minerals found in *C. articulatus* var. *nodosus*, such as iron (118.5mg/100g), zinc (58.25mg/100g) and potassium (50.6mg/100g).

Accordingly Lynch (1997), iron has an essential role in many metabolic process, including oxygen transport, oxidative metabolism and cell growth. Accordingly Recommended Daily Intake/ RDI 269 (Brasil, 2005), RDI of iron for adults is 14mg. Iron level found in *C. esculentus* was 4.12mg/100g (Ekeanyanwu & Onogbu, 2010). Iron amount present in priprioca (118.5mg/100g) (Table 2) is quite higher considering the value found in *C. esculentus*, what shows that the consumption of this rhizome has potential to combat anemia. Accordingly Franco (1995), iron deficiency is the most common cause of nutritional anemia in human beings. In the studies with tiger nut tubers (*C. esculentus*), Ahmed *et al*. (2019) found 39.50 to iron and according to the same author this mineral is highly relevant because of its requirement for blood formation.

Accordingly Salgueiro *et al*. (2000) zinc deficiency can cause delay of growth, high risk of abortiom, diarrheia, anorexia, loss of weight, loss of hair and prematurity in pregnancy. *C. articulatus* var. *nodosus* showed 58.25mg/100g of zinc (Table 2), while this mineral is absent of *C. esculentus*. RDI

value for zinc in adults, accordingly to Taras (2005), is 10mg. In this way, the daily consumption of 17.17g of ground priprioca would contain the recommended daily dose.

Potassium is described by anti-hypertensive effect which induces increment of water and sodium in the body, suppresses renin and angiotensin secretions, increases prostaglandin secretion, reduces peripheric vascular resistance by direct arteriolar dilatation, diminishes adrenergic tonus and stimulates activity of sodium-potassium pump (National Academy of Sciences, Food and Nutrition Board, 2001; Nakamura *et al.*, 1993). According to Mahan and Stump (2005), RDI levels of potassium for adults range from 1,600 to 2,000mg per day. *C. esculentus* presented very high amount (486.0mg/100g) in comparison to others species. Potassium amount found in *C. rotundus* (110.11) was higher than *C. articulatus* var. *nodosus* (50.6) (Table 2).

Copper exerts catalytic role and promotes iron mobilization to hemoglobin synthesis (Andrade, 2002). RDI levels for copper according to the standard is 900mcg and the maximal doses is 10mg (Brasil, 2005). Copper value of priprioca (5.39mg/100g) (Table 2) was lower than *C. rotundus* (28.11mg/100g).

According to Di Dio & Mauri (1941), manganese acts over growth, normal bone development, cell changes, fermentation, haemato-genesis and reproduction. RDI levels of manganese in *C. articulatus* is 2.3mg and maximal doses is 5mg (Brasil, 2005). *C. esculentus* presented 0.26mg/100g of manganese (Ekeanyanwu & Onogbu, 2010). The amount of 15.25mg/100g of manganese was found in *C. articulatus* var. *nodosus* (Table 2), while it was absent in *C. rotundus*.

Magnesium is an intracellular mineral that presents a fundamental role in many biological reactions as well. It is enzymatic systems activator that control carbohydrates, lipids, proteins and metabolism electrolytes. Magnesium also influences cell membrane integrity and transport, mediates muscle contractions and nervous impulses transmissions. Besides that, magnesium is a oxidative phosphorylation cofactor (Magnoni & Cukier, 2004). RDI 269 (Brasil, 2005) determined RDI for magnesium as 260mg as the recommended level for adults. Magnesium amount in *C. articulatus* var. *nodosus* was considered low (4.36mg/100g) (Table 2) in comparison with *C. rotundus* (50.76).

Calcium is a very relevant mineral for bone tissue health, cardiac function, nerves and muscle contraction (Buzinaro *et al.*, 2006). Ahmed *et al.* (2019) found high values of calcium (152ppm) in the tiger nut (*C. esculentus*). Accordingly RDI 269 (Brasil, 2005), RDI of calcium is up to 1,000mg. Calcium amount found in *C. rotundus* (16.4mg/100g) was higher than *C. articulatus* var. *nodosus* (5.25mg/100g) (Table 2), while in rhizomes of *C. esculentus* was 100mg/100g (Ekeanyanwu & Onogbu 2010).

In last decades, the salt consumption in most countries was excessive, ranging from 9 to 12g per person per day (Brown *et al.*, 2009). RDI 269 (Brasil, 2005) preconize daily ingestion of sodium in 2,000mg. *C. rotundus* presented 119.29mg/100g of sodium, what is considered high in relation to *C. articulatus* (15.07mg/100g) (Table 2). Sodium amount detected in *C. articulatus* var. *nodosus* corresponds about 1% of the recommended daily intake value.

In *C. articulatus* var. *nodosus* were found important minerals such as iron, zinc and manganese following levels: 118.5, 58.25 and 15.25mg/100g while in *C. rotundus* were not identified this minerals types.

Table 2 – Mineral composition of *Cyperus articulatus* rhizomes powder mg/100g.

Mineral	Sample contents (mg/100g)
Cu	5.39 ± 0.50
Mn	15.25 ± 0.71
Mg	4.36 ± 0.85
Na	15.07 ± 0.29
Zn	58.25 ± 0.63
Ca	5.25 ± 0.37
Fe	118.5 ± 0.75
K	50.6 ± 0.81

Conclusion

The results shown that *C. articulatus* var. *nodosus* rhizomes are rich fibers, proteins and carbohydrates as well as has a low lipid level. The rhizomes also possess a significative amount of essential minerals detected as iron, zinc and potassium.

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