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Research Paper

Nutritional quality of Trapiá (*Crataevatapia* L.) from the Caatinga Biome

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ABSTRACT: *Considering the importance of the Caatinga biome in livestock of the Brazilian semi-arid region, this study aimed to presentnutritional informationof Crataevatapia L., in order to feed goats in such environment. After collecting fruits and leaves from 10 different plants in the region and characterizing thefruits.the samples were submitted to the following tests: dry matter, crude protein, mineral matter, neutral and acid detergent fiber, nitrogen free extract, etherextract, lignin and in vitro digestibility. Also it was determined the pH and total soluble solids. The Crataevatapia L. specie showed satisfactory results regarding their feeding nutritional value.*

Keywords: *Goats, forage, animal nutrition, semiarid*

I. INTRODUCTION

Food is any material that after ingestion by the animal is able to be digested, absorbed and utilized, or that have nutritional value for the animal [1]. Thus, *Crataevatapia* L. may be considered as an important food for goats in Alagoas semiarid region, onceits fruits and leaves are greedily eaten by these animals.

The severity in the irregularity of the quantitative and qualitative supply of forage resources in the Brazilian semiarid region due to the increases in the challenging of the climate changes, animal production may be greatly compromised in this region. Thus, the use of alternative foods (feed waste, protein banks, hay, silage and concentrates), has often been recommended to farmers in the region in order to meet the nutritional deficiency of the herds [2]. In addition to these, authors [3, 4, 5]have describedthat viable alternativefor animal production might be the use of native plant species.

According to local studies [4, 5], the native vegetation of the northeastern region of Brazil is rich in forage species in its herbaceous, shrubs and trees strata. This author [4] have shown that over 70% of plant species of the Caatinga Biome participate significantly in the diet composition of domestic ruminants.

The *Crataevatapia* L. plant, popularly known as Trapiá, is one of Caparidaceae family tree, measuring 5-12 m tall, with brownish glabosstems, petiolate with alternate leaves composed of 8 oblong-eletic leaflets (Figure 1). It has a characteristic garlic odor on their leaves. Its wood has been used in construction, in liners, crates and for making canoes. The flowers are visited bybees; the fruits are edible and highly appreciated by the fauna. The fruits bark and leaves are considered to have medicinal value [6].

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Figure 1.Picture sample of a Trapiá plant (*Crataevatapia L.*) in Santana do Ipanema, Alagoas.

The tree has ornamental attributes that recommend for landscape trees. It is also recommended for reforestation for the recovery of degraded areas [6]. In folk medicine, the stem barkis used as a tonic, antidysentery; febrifuge and fruits are used in fighting infections of the respiratory tract and also treatment of hemorrhoids [7].

The objective of this work was aimed to present information on different aspects of *Crataevatapia* L., in order to feed goats.

II. MATERIAL AND METHODS

Fruits (n = 500) and leaves (n = 50) samples of *Crataevatapia* L., known as Trapiá, coming from adults plants (n = 10), with vigorous vegetative growth and healthy,were collected in Santana do Ipanema, São JosédaTaperain the State of Alagoas during November to December 2010.

After harvested, the fruits were selected manually, excluding those immature, stained or withbrokem parts. After the selection process, the fruits were washed in running water and lean on paper towels. It was later performed individually, the physical characterization of fruitby weighing, measureing its diameter and height; then it was performed the extraction of the pulp and placing it in petri dishes, separating and weighing the peel and seeds. The samples were stored in plastic bags at -8 °C for 3 days in ordinary freezer.

The leaves were collected (n = 50)from plants in the same conditions as described for fruits; then were stored at 12^{o}C for 24 hours before processing.The samples underwent a pre-drying under low temperature oven (55 to 60°C) with forced air circulation and then were milled to a particle size of 1 mm to perform all the determinations. These samples were properly packed in plastic containers and kept at room temperature.

All the samples were submitted to the following tests: dry matter (DM), crude protein (CP), Mineral matter (MM), neutral detergent fiber (NDF), acid detergent fiber (ADF), ether extract (EE) and total lignin (TL) according to the described methodology [12, 13, 14]. The determination of nitrogen free extract(NFE)followed the equation NFE = 100 – (CP + MM + EE +CF) and the *in vitro*digestibility followed the correspondent method [8].

The pH was determined by "pH microprocessor 100" from LABMETER after calibration was performed with buffer solutions of pH 4.0 and 7.0 at 20 ° C. Total soluble solids (TSS) were determined through direct readingusing a portable refractometer from DIGITAL after adding a drop of juice from the pulp to the prism to give reading with temperature correction (result in Brix).

The mineral composition of peel, seeds and whole fruits of *Crataevatapia* L was measured by X-ray fluorescence spectrometry [9] using an spectrometer with energy dispersive in a Shimadzu EDX model - 800HS.
Mean values were compared statistically by Scott-Knott test at 5% probability.

III. RESULTS AND DISCUSSIONS

The whole fruit of Trapiá collected in the Caatinga biomeshowed diameter of 31.6 ± 0.4 mm, with an weight of 17.2 ±1.27 g. The constituents of the whole fruit showed the proportion of 55,1%, 28,1 % and 16,9% respectively for peel, pulp and seed.

Based on dry matter (DM) of the peel (92%), seed (94%), pulp (85%), whole fruit (93%) and leaves (93%) it can be inferred that the moisture content is above of 6.75%, which is recommended by the Norms and Standards for Nutrition and Animal Food [10]. It was found that the protein content ranged from 12 to 34 % (**Table 1**).

Table 1. Chemical and nutritional characterization of Trapiá (*Crataevatapia*L) collected in the Caatingabioma.

***Crataeva tapia* L.**	**DM (%)**	**CP**	**NDF**	**ADF**	**MM**	**pH**	**SST (ºBRIX)**
		% in DM					
Peel	91.86	11.64	70.09	56.70	19.85	5.55	3.94
Seed	93.48	34.44	70.02	59.89	21.31	4.81	0.83
Pulp	85.04	29.95	28.82	25.64	22.51	5.99	4.95
Whole Fruit	92.80	14.67	63.80	52.72	20.09	----	---
Leaves (a)	93.41	28.17	54.58	28.56	22.36	---	---
Leaves (b)	93.43	28.42	53.83	34.06	23.20	---	---

DM – Dry matter; CP – Crude Protein; NDF – Neutral Detergent Fiber; FDA – Acid Detergent Fiber - MM – Minerals in ashes of the dry matter; pH – Potencial Hidrogeniônico; SST – Total Soluble Solid in ºBRIX; (a) – São José da Tapera (n=5); (b) – Santana do Ipanema (n=5).

It is known that for a minimum animal performance, the feed should have in dry matter at least 8% of PB to meet the nitrogen needs of rumen bacteria [2]. The fruits of *Crataevatapia* L. showed considerable crude protein content (15%). Its pulp has shown the content (30%) higher than the results found for the coconut meal (22%), forage millet (13%), corn gluten meal (21%), soybean hulls (14%), wheat germ (28%) and sorghum grains (9%) [11]. Therefore, we can infer that the Trapiá may be used as protein concentrate source for ruminants.

The high protein content observed in Trapiá leaves collected in the city of São José da Tapera and Santana do Ipanema (28%) indicated the possibility of its utilization for forage conservation process as hay.

The voluntary dry matter intake is closely related to the concentration of neutral detergent fiber (NDF) in forage, since this constituent directly reflects the massive capacity to occupy space in the rumen and, indirectly, the density energy available in the feed. Concerningtheparts of the plant studied, the highest NDF values were observed in the fruit peel and seed (70%). In the leaves there were observed levels of NDF (55 and 54%) in the two regions studied.

On the other hand, the dry matter digestibility depends on the acid detergent fiber (ADF), which reflects the cell wall fraction; and the lignin, when bound to cellulose and hemicellulose forming the lignocellulose complex is the main limiting factor to the degradation of structural carbohydrates in the rumen. Our findings has shown that most of the ADF is in the seed (60%) and peel (57%) of Trapiá, which was expected due to the high concentration of the indigestible portion of carbohydrate, such as lignin shown in **Table 2**, which was 22 and 35% respectively in the seed and peel. It was observed that even with 28% of lignin content in the whole fruit, and 35% in theseedDM, we still had a good potential to be associated with digestibility (46%), being absorbed and usefull as actual food (**Table 2**).

The nitrogen free extract (NFE) represents the carbohydrate that is rapidly degraded in the rumen. The digestibility is one of the main components that determine the quality of a food. The extent of ruminal microbial digestion of carbohydrates is related to forage digestibility, together with the same rate of digestion of these carbohydrates will determine the nutritional value of the feed for the ruminant, not only from the aspect of energy, but also protein and other [12]. The highest value was observed in the digestibility of the seed (49%) and the lowest in the pell(42%). The digestion of forages is also determined by chemical and anatomical factors, which are affected by the species growing stage. The maturation of plants is accompanied by the thickening and

lignification of the cell wall, both related to the reduction in the digestibility of the material [13]. It was observed that the physical treatment of the seed by grinding mill favored digestibility.

The ether extract (EE) percentage is the total fat in the sample. Excess fat in the diet is detrimental to the digestion of food, because it forms a film which hampers the enzymatic action in the rumen, the absorption of nutrients by the ruminal epithelium and reduces the residence time of food in the gastrointestinal tract, or reflects on digestibility and voluntary food intake [13]. Maximum ether extract recommended for goats is 7% [10]. Therefore, among the parts of the plant, the peel proved to be the best option. The seeds after extraction with ether give a residue that makes it possible to feed the animals.

Table 2.Components of additional chemical analyzes of fruit Trapiá (Crataevatapia L.)

***Crataeva tapia* L.**	**NFE (%)**	**Ether Extract (%)**	**Lignin (%)**	**Digestibility *in vitro* (g / 100g)**
FruitPeel	19,5	2,3	22,04	41,85
Ground seed	22,04	14,5	34,87	48,61
Whole Fruit	26,3	11,1	27,65	47,69

It was observed values of mineral material (MM) relatively similar between the parts of the plant studied, but the medium value for leaves was 22.78%. Although they are required in small amounts, minerals play a key role in the metabolism of other nutrients in the animal body, and are important in energy metabolism.

The mineral residue percentage is a rough assessment of the levels of essential ions to the maintenance of the animals. The value must always be accompanied by the analysis of the calcium and phosphorus from food (**Table 3**). In this study a high percentage of mineral material was observed.

A more thorough study of food and fodder comprise general knowledge of properties such as appearance, flavor, taste, structure and microscopic changes, and also the determination of nutrients through the proximal analysis [14].

Acidity is an important parameter in assessing the conservation of a food product state, as usually in a food decomposition process, either by hydrolysis, oxidation or fermentation, changes almost always the concentration of hydrogen ions, and therefore its acidity.

The organic acids are intermediates in the fruit and respiratory metabolism are very important from the point of view of taste and smell. Soluble solids, measured by refractometry in Brix, are used as an index of total sugars in fruits, indicating the degree of maturity. They consist of water soluble compounds, which represent substances such as sugars, acids, vitamin C and some pectin [15].

Table 3 showsthe mineral composition of Trapiá. It can be observed the contents of micro and macro elements and the relevance of potassium and sulfur as minerals supplement that can be offered to the animals, and the peel can be considered a good source of calcium. The nutritional needs of goats are also related to the requirements of minerals and vitamins [16]. Goats need of microelements in dosages of 30 to 50 mg / kg DM of Iron, 5 to 10 mg / kg DM of Copper and 0.1 mg/kg DM of selenium, among others. It also needs of macroelements such as of Sodium from 0.04 to 0.20% of DM; Magnesium from 0.04 to 0.2% of DM; Potassium 0.50% of DM and Sulphur 0.14 to 0.26% of DM

Table 3.Mineral composition of Trapiá (*Crataevatapia*L.) in three separate portions: fruit peel, seeds and whole fruit (n = 3).

***Crataevatapia* L.**	**Minerals (%)**									
	C	K	S	Cl	Ca	Si	P	Fe	O	Mg
Peel	99,1	0,60	0,13	0,12	0,03	0,02	0,01	0,002	-	-
Seeds	81,9	0,13	0,51	0,01	0,01	-	0,07	0,001	17,3	0,02
Whole fruit	83,3	0,38	0,34	0,06	0,03	0,01	0,05	0,001	15,8	0,02

The concept of the term "nutritional amount" refers to the chemical composition and digestibility of forage. Have the quality of a forage plant is represented by the association of chemical composition, digestibility and voluntary intake, among other factors, fodder concerned.So it is very important the knowledge of crude protein, crude fiber and dry matter, and other components, and the in vitro digestibility of dry matter, when initiate reviews of a promising plant [17].

Regarding the chemical composition of other seeds or fodder plant of worldwide importance that as soybeans, cotton, sunflower and turnip, when compared to Trapiá*Crataevatapia* L., has medium potential, however, the fact that the plant is resistant to drought is presented with the potential to be used as fodder.

IV. CONCLUSION

The *Crataevatapia* L. plant specie showed satisfactory results regarding their nutritional value for animal feed, it is necessary also to carry out studies on the possible anti-nutritional factors present in the food and forms of use for animal diet.

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