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## Analysis of project about Cerrado fruits developed with students from two public schools.

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**Abstract.** The Brazilian Cerrado has enormous diversity featuring a large number of fruit native plants that have a high nutritional value and distinctive flavor. This work belongs to an extension program of Cerrado fruits, where two species stand out in this region: Cagaita tree (*Eugenia dysenterica* DC) and Pequi tree (*Caryocar brasiliense*). The same was done in a neighborhood located near the Federal University of Sao Joao del Rei, Campus of Sete Lagoas - MG and developed in two municipal schools, with the participation of students of 4th and 5th years and other servers. The goal of this project was to disseminate knowledge to the participants of the reality that surrounds them, and on these two fruits of the Cerrado, providing support materials for environmental preservation awareness. The work took four steps, one of which was to answer a questionnaire by students. The main results showed that students, teachers and cooks did not know Pequi and Cagaita, native fruit species of one of the richest biomes and threatened the world. It was possible to realize the interest of those involved in the project, in order to educate about the importance of ensuring the collection and use of these fruits for the next generations.

**Keywords:** Pequi, Cagaita, alternative power, nutritional quality.

### Introduction

The Brazilian Cerrado is a unique biome that occupies approximately 23% of the country and more than 50% of the State of Minas Gerais. Due to its large extent there is a great variety of climates, soils and plant diversity. But, the Cerrado is one of the most threatened biomes in the world (RIBEIRO & WALTER, 1998). The word diversity expresses well what is the Cerrado, one of the six Brazilian biomes: Amazon, Atlantic Forest, Caatinga, Pampa and Pantanal. The Cerrado occupies an area of 2036448 square kilometers and is the second largest biome in South America, but is not well known (ROESLER et al., 2008; Ferreira, 2016; MORAES, 2016).

To minimize the Cerrado degradation, one option was to include the recovery of native species stimulating research their potential, better knowledge of genetic resources in the region, study the profitability and sustainability of their use, contributing to the preservation (JEPSON, 2005).

The species of edible fruits of the Cerrado region preserves the food culture of primitive man and are used many years ago by the population. Several types of fruit provide high nutritional value and unique sensory attractive features that contribute to its intense aromas and its colors (SILVA et al., 2001). The fruits are traditionally eaten fresh or processed into juices, liqueurs, ice cream, jellies and candy (SILVA et al., 2008).

The city of Sete Lagoas is located in central Minas Gerais, is 70 km from the state capital, standing north of the metropolitan region of Belo Horizonte and covering the metallurgical region of Minas Gerais (BOTELHO, 2008). The main economic activities are agriculture, metallurgy and food industry industries. Among the many fruits found in the Cerrado of Sete Lagoas, Cagaita and Pequi are the most common. However, the city has gone through some changes, because there was a population and economic growth, due to the installation of various industries and also the

installation of a campus of the Federal University of Sao Joao del Rei in 2009. These industries, to be installed, occupied large areas of farms in and around the city, leading to deforestation and, consequently, in the overthrow of Cagaita and Pequi trees. Despite the devastation, many trees are still found in the city and region because its abundance is related to the climate and soil of Sete Lagoas region. Nevertheless, the population, even living daily with trees of Cagaita and Pequi, especially children and young people, are unaware of these trees their fruits (Ferreira, 2016; MORAES, 2016).

Cagaita tree (*Eugenia dysenterica* DC) is a native fruit of the Cerrado, which can reach up to 10 meters high and has a high fruit production capacity (500-2000 fruits per plant). Fructifies between October and December and blooms between August and September (SILVA et al. 1994). The Cagaita tree has slow growth, reaching an average height of 5 meters to 12 years old (SOUZA, 2006).

The Cagaita tree (Figure 1) belongs to the family of Mirtacia, as the trees of Jambo, Guava and Jaboticaba. Cagaita is flattened and globular, soft yellow color, thin-shelled, has an acid taste and is very juicy, with about 90% juice inside (SILVA & TASSARA, 2003). Despite the pleasant taste and be refreshing, Cagaita should be enjoyed in moderation, since its excessive consumption causes laxative effect (ÁVIDOS, 2004).

Cagaita (Figure 2) can be consumed fresh or can be used in the preparation of jams, jellies, liquors, refreshments and ice cream. The fruit contains vitamin C content significantly when compared to other fruits of the Cerrado (SILVA, et al. 1994). When fermented, produces vinegar and alcohol and its pulp can be frozen for up to a year. The Cagaita tree, for its beauty, is used in public landscaping, and economic potential it presents for society (ALMEIDA, 1998).



Figure 1. Cagaita tree.



Figure 2. Cagaita fruits

There are numerous species of the genus *Caryocar* especially in Brazil, where it is popularly named as Piqui, Barbacasco, Piquiá, Almond-of-thorn (OLIVEIRA et al., 2008). Therefore, Pequi tree is considered as a symbol of the state of Minas Gerais, its commercial exploitation is predominantly extractive form (CÂNDIDO et. al., 2012).

Pequi tree (*Caryocar brasiliense*) (Figure 3) is a typical Cerrado plant and fruit mainly from January to March, can be found fruits outside these times (RIBEIRO, 2000). It is an arboreal plant that comprises about 20 species and can reach 10 m high. Each mature plant can produce up to two thousand fruit per harvest (ÁVIDOS, 2004). The average fruit weight is approximately 120 g, wherein the shell is 82% of the fruit. (ALMEIDA, 1998).

Pequi (Figure 4) consists of exocarp brown-green color, external mesocarp (white pulp), which houses 1-6 pyrenes (stones), and internal mesocarp (edible fruit pulp) yellow color, strong odor and characteristic. The thorny cored protects a soft and tasty almond, so be careful to chew cooked Pequi because under the pulp is a layer of thin spikes that can pierce the oral mucosa (RIBEIRO, 2011).



Figure 3. Pequi tree

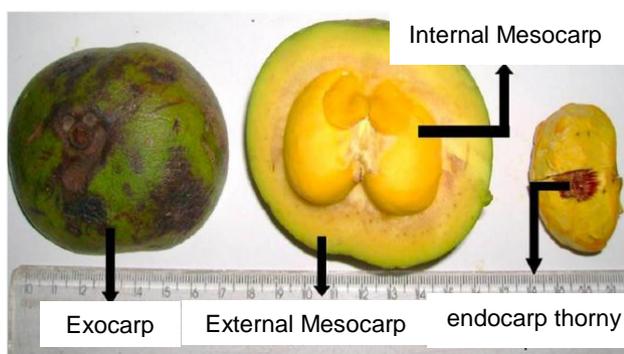


Figure 4. Morphological aspects of Pequi.

Source: ALVES et al.(2012)

The use of Pequi fruit is almost full: the shell is consumed largely by cattle. The core with the pulp is used in the preparation of dishes, such as rice and chicken; the pulp is used for the extraction and production of edible oil, sweet, liqueurs, syrups, and animal feed. (LORENZI, 1992; OLIVEIRA, 2009). Almond is destined for fresh consumption, the manufacture of peanut candy and white oil. However, both the pulp and almond Pequi are rich in riboflavin, thiamine, provitamin A and of great nutritional value oils (VERA et al., 2005).

The pulp Pequi is also rich in vitamin A and E, and has twice the Vitamin C of an orange, which makes the fruit prevent diseases associated with vision and protects against premature aging. The pulp Pequi has 66% oil and 13.5% protein, more protein than rice and potatoes. Being a product of easy production and desirable characteristics in taste and nutritional value, Pequi may represent a potential source of food and survival of a portion of the Brazilian population (RIBEIRO, 2000).

Minas Gerais is the main producer and consumer Pequi. In 2006, Brazil produced 5,000 tons of Pequi almonds, and the north of Minas

Gerais accounted for 22.34% of production. In this region, the extraction of Pequi represents 17.73% of family income, behind only beans (33.52%) and cassava (32.64). In 2009, production was 5,992 tones, with a value of production in the plant extraction Pequi (almond) R\$ 8.7 million. The northern Minas got 25% of this value, losing only to the state of Ceará and the whole of Minas Gerais (CÂNDIDO et al., 2012)

The search for new sources of nutrition for a balanced diet sparked interest in consuming exotic fruits, for several reasons: distinctive flavor, the presence of essential nutrients and micronutrients such as minerals and water soluble vitamins, especially vitamin C, in addition to appreciable amount of compounds secondary phenolic nature of known antioxidant activity (HARBORNE & WILLIAMS, 2000). Thus, the fruits of the Cerrado could be an alternative in the search for awareness and change people's habits, which should be encouraged to improve the quality of life.

Environmental education leads the individual and the community to think about new social and ethical values on attitudes aimed at conservation, use and proper handling of natural resources without compromising future generations (SILVA et al., 2014). The learning process begins with children, so that they can acquire a broader insight into the preservation of the environment. Therefore, environmental education should be offered at school to induce a critical eye to find solutions to environmental problems and the use of natural resources sustainably (KINDEL et al., 2006).

Pillotto (2008) reported that university extension pass on the knowledge to others, and is a process in which all at the same time they teach also learn.

This project was developed in the neighborhood (near campus), which is characterized by a low-income population, where families are in high vulnerability and high social risk. It is noteworthy that this poor often consume cheap, high-calorie and low-nutrient foods, which favors the increase in the number of obese and malnourished people, becoming a public health problem. Thus, Cagaita and Pequi can be used as alternative foods rich in nutrients. In this sense, the extension project was linked with environmental education.

The need to modify behavior in relation to trees Pequi and Cagaita, there was the implementation of the outreach program in 2014 entitled "Cagaita and Pequi, Economic and Social Importance for Sete Lagoas Population", performed by students of the courses of Food Engineering, Agricultural Engineering and Forestry and professors from the Federal University of Sao Joao del Rei - Campus Sete Lagoas. This action brought the scientific community and the public by promoting greater interaction to solve problems and to form students.

The neighborhood has lots of trees and native Pequi Cagaita, located in the streets, in yards and on sidewalks. Thus, the aim was to spread to students and servers knowledge about reality and about the fruits of the Cerrado especially Pequi and Cagaita, providing material support to environmental preservation. Still, in general, the project measured the perception of children as the fruits of the Cerrado after execution of this extension project.

## Methods

The target audience was students of 4th and 5th grades, teachers and cooks, two municipal schools of this neighborhood. In total were six classes involved, six teachers and 12 cooks.

A questionnaire was used for data collection. This procedure was performed at the beginning and end of the program, from August 2014 to July 2015. The questionnaire contained 9 questions that assessed the participant's knowledge of the existence of the fruits of the Cerrado, in your school neighborhood and the city of Sete Lagoas.

### *Activities prepared for interventions*

The study was conducted in four stages: 1) Preparation of didactic material; 2) Culinary Guide Development of Cagaita; 3) Intervention in Schools; 4) Intervention in the Community.

The first step was the preparation and distribution of a booklet for students with general explanations of the Cerrado, had information about the fauna and flora, explanations of some medicinal and food plants, with photos and also the description of fruit trees and fruits of the Cerrado, covering the period of occurrence of fruit, especially of trees Cagaita and Pequi. Still, more information about how these trees are born, grow and reproduce, and nutritional information, agronomic and how its fruits can be used by the population.

This primer also contained fixation exercises, designed for students, based on subjects studied and reports about Pequi and Cagaita and other fruits of the Cerrado, which are usually found in the region of Sete Lagoas, as pitomba and coconut macaúba.

In the second phase a questionnaire was applied to the cooks of the schools involved. Later, a

culinary manual has been prepared for the community about the Cagaita with alternative revenue of use and preparation of its fruits in order to preserve the food culture.

The last two stages were the intervention, first in class, directed to teachers and students through the application of the exercises and the development of recreational activities; and finally, the intervention in the neighborhood, so that the entire community had access to information and could participate in this project.

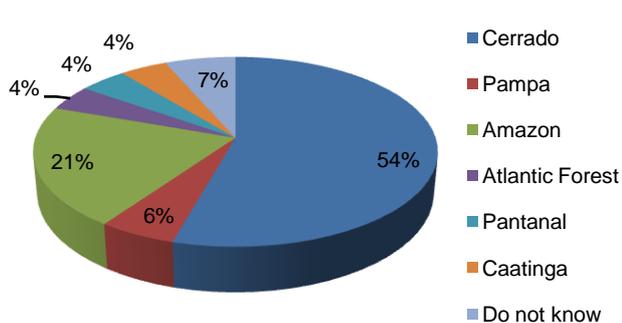
## Results and discussion

The six classes were chosen by the principal, who reported that these students would be better prepared to participate in the project and could better to pass this knowledge to other colleagues and schools. However, some children missed school in the questionnaire application day. A total of 92 children participating in the initial questionnaire and 89 children at the end of the questionnaire.

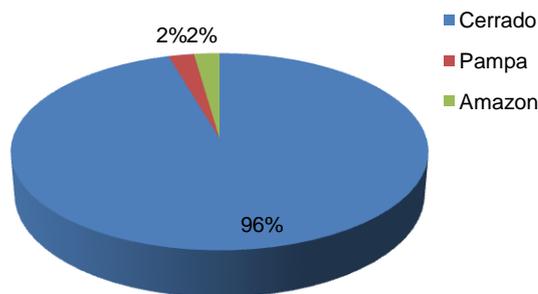
During the project, there were various participatory activities using the elaborate playbook, where the topics were addressed through: oral presentation, slides, posters with Pequi figures and Cagaita. There was also the making of a mural on the Brazilian Cerrado containing figures that students brought from their homes.

The questionnaire measured the students' knowledge about perception changes of the existence of the fruits of the Cerrado. The questionnaire collected gender information, age and grade. The age of the students was between 8 and 13 years.

Before distributing the booklet (Graph 1), the students were in doubt and were unable to identify the characteristic biome of the city of Sete Lagoas, however, 54% of students answered that the Cerrado occupies the region of Sete Lagoas. After the project activities, most students (96%) responded that the Cerrado biome is the characteristic of the city of Sete Lagoas, showing that most children understood that the city is based around the Cerrado (Graph 2).



**Graph 1.** Perception of students on the characteristic biome of Sete Lagoas, prior to the project.



**Graph 2:** Perception of students on the characteristic biome of Sete Lagoas, after the project.

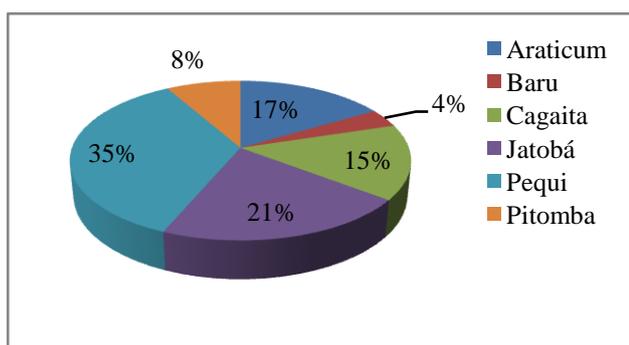
In both questionnaires had the question: "Do you know in the school neighborhood the native fruit trees of the biome of Sete Lagoas? Which are?". Before the presentation of the booklet and development activities, 22% of students did not know the fruit trees and 78% knew what were the typical fruit trees of the Cerrado present in the neighborhood. In contrast, students mentioned that the trees were bananas, papaya and mango, showing the need to differentiate the fruits of the Cerrado of other fruits over the activities in the project. Tropical fruits like oranges and bananas are consumed and found throughout the country, while the fruits of the Cerrado are produced by existing native trees only in the region, and the fruits in restricted periods of the year.

There was a greater understanding of children about the fruit trees of the Cerrado, suggesting that is interesting continue with the project about the fruits of the Cerrado. Only 3

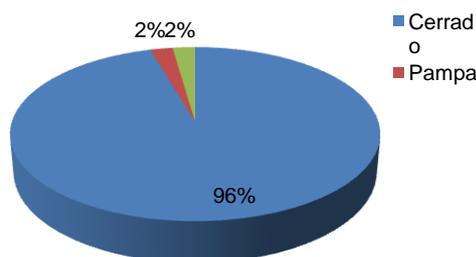
students indicated the orange, mango and banana after the project, and the other 90% indicated correctly, being the trees of Pequi and Cagaita more frequently cited by students.

The Graphs 3 and 4 showed the demonstrated knowledge and awareness of students about the possible fruits found in Sete Lagoas, which are characteristic of our biome. Students could mark how many alternatives they thought right. All the fruits mentioned in the question are found in Sete Lagoas, so it was expected that all items were marked. However, no student marked all alternatives.

Prior to the application the booklet and resolution of playful exercises, the most marked fruit was the Pequi (Graph 3). In the final questionnaire all the fruits have been signaled in proportions similar, demonstrating that students increased their knowledge of the fruits of the Cerrado and recognized which are present in your city (Graph 4).



**Graph 3.** Native biome fruits that can be found in Sete Lagoas according to the students involved before the project execution.



**Graph 4.** Native biome fruits that can be found in Sete Lagoas according to the students involved, after the execution of the project.

According to the Ministry of Environment, in addition to environmental aspects the Cerrado and its fruit has great social importance. Maroons and riverine, for example, survive their natural resources through local consumption and sale of fruits like Pequi in urban centers, street markets of the city

and regional roads and highways (Ministério do Meio Ambiente, 2014).

The last questionnaire indicated that 96% of students have enjoyed the project.

Several comments came after the completion of projects. Some of them were: a) "The

students showed interest in the activities developed in the extension project."; b) "I liked the project, brought a lot of information telling us about the need to conserve and protect our fruit, because survive in the Cerrado and we can use the fruits in diet"; c) "I did not like because I do not like to eat fruit."

Woitowicz (2014) reported that the university extension is communication between the university and the community, causing the student to interact where he lives, developing social and cultural activities that contribute to the population of this area. Therefore, "it is a relationship between theory and practice, where knowledge extends out of the classroom and is reproduced in the social environment, which allows learning through the application."

Culinary manual presented options to insert Cagaita in Brazilian cuisine, then they were given to the cooks in schools, as well as being residents of the neighborhood, were housewives and responsible for school meals.

The results of the questionnaires of the cooks showed that 67% marked the Cerrado and 33% Caatinga as the predominant biome in the region. When asked about which fruits are found in the Biome of Sete Lagoas, 19% of cooks marked Araticum, 27% marked Cagaita, 20% marked Jatoba, 29% marked Pequi, 5% marked pitomba and no marked Baru fruit.

In analyzing the results was possible to perceive the difference of responses between the cooks about the fruits of the Cerrado. Among the respondents, 75% have eaten Cagaita or used in the preparation of income, while 25% never used or not used Cagaita to prepare recipes. On being asked about the possible ways to Cagaita consumption, 46% of the cooks said consume Cagaita in the form of juice, 9% have consumed in the form of liquor and 18% make tea from the leaves of cagaiteira, while 27% never used the Cagaita to prepare recipes.

The results of early research showed that the students and the servers had little knowledge about the fruits of the Cerrado, especially Cagaita and Pequi. It was felt that knowledge was acquired from the transfer of information in an interdisciplinary and didactic way in developing the project.

## Conclusion

Students participated spontaneously and showed interest in the activities. Environmental preservation is the source of biological diversity in the Brazilian Cerrado and the loss of diversity will result in loss of resources, such as fruit species and their potential effects when placed in food.

It was possible to provide students and the community information about Pequi and Cagaita in order to educate them about the wealth of fruit that can be used sustainably and distributed homogeneously. Besides pointing out the various

forms of consumption Pequi and Cagaita from in natura until processed.

Elaborate handbooks were presented, analyzed and delivered to students. Students understood that the region of Sete Lagoas is based around the Cerrado and also can enjoy the fruits that are potentially beneficial in diet. There was also encouraging reading and writing, discovery of new words, and use all the material prepared for study. Despite the Cerrado present several edible fruit used in Brazilian cuisine, according to the cooks, many did not use Cagaita because of enteric disorders. When they learned about the various forms of consumption, would lead to Cagaita to prepare culinary dishes for their families.

Still, there was favoritism for economic and social development of the region where the university is located, since environmental education awakens the individual's perception, forming more prepared citizens to keep the urban and natural spaces where they live. In general, in order to promote changes in the understanding and behavior of students about the fruits of the Cerrado was reached and had significant results, however, there is still a lot of work to achieve more effective results.

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