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Quality Acai Marketed Pulp Microbiological in Municipality of Victory Conquer BA

Carlos Henrique Bittencourt Ferreira[1], Marcelo José Costa Lima Espinheira[1],Iaggo Raphael David[2,3], Stenio Fernando Pimentel Duarte[1,2,3,4*], Beatriz Rocha Sousa[2], Flavio Mendes de Souza[1]

[1]Independent Faculty of the Northeast – Bahia, Brazil.
[2]Public Health Foundation of Vitória da Conquista – Bahia, Brazil.
[3]Faculty of Technologies and Sciences – Bahia, Brazil.
[4]Faculty of Santo Agostinho – Bahia, Brasil.
Correspondingauthor: Stenio Fernando Pimentel Duarte - Rua Dely Viera Silva 675, Felicia - CEP: 45055-605. Vitória da Conquista, Bahia, Brazil.

***Abstract*—** *The growing demand for improved eating habits and quality of life, has been generating an increase in the consumption of foods with a high nutritional value, such as açaí pulp, which has been gaining in the market both for its nutritional value and for the tasty characteristic. However, because it is a food that the entire production chain is manipulated, it can be a risk to the health of the population that consumes it, due to the easy degradation of the product and its easy microbial contamination. The present work aims to analyze the microbiology quality of three brands that circulate in the region of Vitoria da Conquista - BA. The results were compared according to DRC No. 12 of 2001, ANVISA. Of the 27 samples analyzed, total coliforms were counted, Escherichia coli, being found in two marks nonconformities according to the current legislation and the contamination by Salmonella spp. was absent in all samples. It is concluded that the commercialized samples are mostly unsatisfactory hygienic-sanitary conditions, probably due to failures during the processing and handling of the product.*

Keywords*— *Açaí. Açaí pulp. Microbiological analysis. Quality.

I. INTRODUCTION

Over the years, the excessive search for quality of life and health, has generated an increase in people's knowledge about the need to have a healthy life and concern for their eating habits. Increasingly, food is gaining global recognition for the importance of health promotion, so companies are seeking alternatives to win the credibility of consumers around the world, trying to develop the ideal formula that provides physical and mental benefits from a natural composition with the least of side effects. Food is gaining importance for consumers because it really contributes to health, as it satisfies hunger as well as providing important nutrients to the body and preventing diseases.

One of the foods that has gained prominence for nutritional power is the acai fruit, which has been the subject of research in the world, for being a food seen as a medicinal fruit. The açaizeiro Euterpe oleracea Mart. is a palm tree of the family Arecacea, very found in the northern region of Brazil. It has a round, small, purple-colored fruit, having this coloration due to the presence of anthocyanins, natural açaí pigments (SOUSA et al., 2006). Due to the sensorial and nutritional quality, the açaí is not only being known in the Brazilian regions that cultivate it, but worldwide, mainly by athletes and people who seek a healthier and nutritious diet.

One of the explanations for the popularization of the fruit in Brazilian cities is not only due to the nutritional factor, but because the açaí has several forms of consumption, besides the pure or combined açaí, it has, for example, in the forms of jellies, syrup, powder, creams and ice creams. Internationally the fruit is consumed with exotic beverage purpose, already in the domestic market as energy drink(DARNET et al., 2011; Yamaguchi et al., 2015).

Açaí has gained international appreciation for its diverse benefits, because it contains antioxidant action and presents phytochemical composition, which generates the ability to lower the risk in the development of several diseases, also reducing cancer risk (BONOMO et al., 2014; In this paper, Even so, açaí in the past was underutilized because it deteriorated rapidly due to oxidation and contamination by bacteria, yeasts and fungi, being a fruit of high perishability, that is, of easy

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deterioration, even under refrigeration, thus occurring a greater ease of contamination of the product, presenting a short period of useful life. Several factors may explain this high perishability from the characteristics of the substrate itself, which favors the growth of contaminants, such as in the regions where the palm of the fruit grows, to the lack of good manufacturing practices, from obtaining the fruit to commercialization in establishments. Having knowledge about the preparation conditions and risks that the food can cause to the health of the consumer, it becomes possible to observe if the quality of the product is being served properly, and the microbiological standards and specifications established by the national legislation for foods(FRANCO; LANDGRAF, 2005 apud FARIA, 2012).

Taking the various sources of contamination in which the açaí is exposed, the present work aims to evaluate the microbiological quality of the açaí marketed in the city of Vitória da Conquista-BA.

II. THEORETICAL REFERENCE

2.1 Açaí the açaí

Palm is a palm of the species Euterpe oleracea Martius, which bears as a fruit the açaí, being able to reach 10 to 15 meters in height. Being a palm tree found in the Amazon region, where it is native, mainly in the state of Pará, where its natural dispersion is found. The fruits of this palm are arranged in bunches, having a globulous shape and its bark is brown in color.(2005), and in this paper, we present the results of the study.

The fruit of the açaizeiro has an ovoid shape of 1 to 2 cm in diameter and an average weight of 1.5 grams, it consists of epicarp corresponds to the thin external layer of the fruit, being able to vary of purple or green depending on its maturation, the pulp mesocarp or pulp is 1mm thick, which incorporates the bulky and hard endocarp that follows the shape of the fruit and integrates the seed inside (NASCIMENTO, 2008)

The characteristic of the purple color (violet variety) of the fruits of the açaizeiro is convenient of the abundance of pigments , which are the anthocyanins (Greek anthos: flower and kianos: blue) and helps protect the body against carcinogenic and atherogenic agents, with excellent antioxidant capacity, in the same way it is through the color that can also indicate the level of quality of the fruit and the drinks that are elaborated from them (BASHO, 2010 apud ALVES; MENDONÇA, 2011; NEIDA; ELBA, 2007; ROGEZ, 2000 apud POMPEU; BARATA; ROGEZ, 2009).

In a study developed by Altman (1959), Kabacznik & Rogez (1998) and Hervé Rogez (2000) have reported that the fruit of the açaí is rich in proteins, dietary fibers, lipids and the important micronutrients and macronutrients, vitamin And, minerals such as manganese, boron, chromium and copper can be nutritionally one of the most complete foods, in addition to flavonoids such as polyphenols, tannins and pigments, substances known for their antioxidant, anticancer and hypocholesterolemic action, as well as properties with antibacterial, antiviral (POMPEU et al., 2011).

According to studies, 65% of the recommended needs for an adult man with a lipid content and 25% to 65% of the recommended amounts of proteins are included. still, calcium, magnesium, potassium and nickel. A low concentration of saturated fat and trans fatty acids such as omega-6 and omega-9 (Coelho, 2008). The benefits of açaí have been demonstrated in experiments with overweight adults, where it was observed that the supplementation of 200g of açaí pulp per day in these individuals, after one month of use, led to a significant reduction in the mean levels of fasting glycemia, cholesterol total cholesterol and LDL cholesterol (UDANI et al., 2011).

The açaí fruit has been gaining market importance as a food of relevance for health promotion and prevention of diverse pathologies, because it presents physicochemical properties with antioxidant power, and helps to inhibit or diminish the effects triggered by free radicals, indicates that açaí is part of functional foods or is also classified as a nutraceutical food, that is, it provides medical health benefits, including prevention or treatment of certain diseases (CAVALCANTE et al., 2018).

2.2 Internal and external market

With the increase in the consumption of açaí, there was an increase in the economic exploitation of products and by-products of some fruit species, attributed to the growing consumer concern with the relationship between diet and health, generating also the need to search for the standardization and quality of the products marketed (YAHIA, 2010).

Açaí has been gaining the national and international market due to its energetic and nutritional characteristics, causing a progressive increase of the consumption of the product in the market in recent years. Usually açaí has been marketed as frozen pulp both for the foreign and domestic market. The increase in demand is explained by the fact that it has aroused the interest of people seeking food with nutritional quality.

Brazil is the largest consumer and producer of açaí, and has been gaining strength in the export of the product in several countries like Japan, China, Canada and Europe. Açaí products are prominent in the herbal, food and cosmetic industry, so the industries are

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increasing investment not only in cultivation but also in the qualification of labor. Due to this increase in demand, the cultivation of açaí has been gaining prominence in the source of income and contribution in the offer of job vacancies, being essential for the generation of direct and indirect jobs, besides generating millions in annual revenues (MENEZES et al. 2008) It is

important to emphasize the importance of the standardization of the quality of the products made from the açaí fruit, because with the prominence and the qualities of the açaí it has become a commodity of high added value, present in several commercial points. However, there are many products that are marketed in the informal market without uniformity and without proper hygienic-sanitary control (SANTOS; COELHO; CARREIRO, 2008).

2.3 Acai Processing

Acai is a very perishable product, rapidly changing its characteristics, chemical, physical and sensory in a short period of time, even under proper refrigeration. Being important to take care in each stage of the production chain, being concerned about the final quality of the product.

Contamination of the açaí occurs at the beginning of the harvest, after being harvested and placed on the ground, where there is a high risk of contamination by direct contact with impurities of the soil, besides there is no concern with the hygiene of the place of packaging of the fruit or with the future quality of the açaí. Transport must also be standardized in order to avoid degradation and contamination of the fruit.(Nascimento et al., 2006).

The entire production chain of the açaí has a risk of contamination, as well as the handling of this fruit in the industry, being important the quality of the packaging, the conditions and quality of the raw material and all the processing of fruit pulp are related to the final quality of the product. Industrialists should understand the need to ensure product quality to gain credibility between consumers and merchants (COHEN et al., 2011).

therefore the training and qualification of the workforce becomes paramount, since the açaí must be handled correctly to ensure that good manufacturing practices are performed from the harvest to the consumer table (ANVISA, 2017).

2.4 Microbiological Quality

The acai fruit has a low resistance in its shell, other factors that help to modify the quality of the product is the chemical composition of the açaí itself, making it easily degraded, even with all the care of good manufacturing practices in the stepsthe production chain, the risk of contaminationstill very high because the fruit has a low acidity, pH above 4.5, for favoring the growth of microorganisms, including pathogens that are the body (MATTIETTO, 2017)

Quality is acai easily lost at any stage of the productive chain of the fruit, but over the years and with the growth in the market both internal and external, companies have been changing practices from harvesting, transportation, storage and processing to final distribution to the consumer.

Taking into account the intense growth of açaí consumption in the large Brazilian capitals and in international countries and the understanding of the high perishability of the açaí pulp, it is necessary to have minimum standards of quality to guarantee a food of good origin and free of any kind of poisoning. The Technical Regulation for setting the Quality and Identity Standards (PIQ) for açaí pulp established by the Ministry of Agriculture, Livestock and Food Supply (MAPA) in normative instruction, has the purpose of determining the minimum quality standards for both the açaí as pulp (BRASIL, 2001)

2.5 Main contaminants of açaí pulp

According to Farias; Oliveira and Costa, 2012 the contamination of the açaí can be explained by microbiota coming from hygienic sanitary conditions of the equipment, processing environment and the manipulators. That is why it is important to guarantee the quality of manufacturing to maintain the properties of the fruit until the consumer's hand.

Foodborne microbial diseases can be fragmented into food poisoning and foodborne infections that are caused by ingestion of food containing microbial toxins or viable cells of pathogenic microorganisms that can cling to the intestine and proliferate (JONES, LEMES, 2014).

One of the modes which analyzes the conditions of the fruit is the physical aspect, where the pulp must have small dark signs, obtained by the fruit bark, containing a not sweet and not sour taste, with the purple or green coloration. The water used is also a form of quality parameter, having to be potable and meet drinking standards.

One of the contaminants of great importance to cause several pathologies to men and animals are the one of the family Enterobacteriaceae that possess the greater and more diversified Gram-negative rods. Some of the bacteria present in this family are total coliforms, thermotolerant or fecal coliforms, and Salmonella (MURRAY; RONSETHAL; PEFALLER, 2006; GAVA; SILVA; FRIAS., 2008).

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The group of total bacteria, are environmental bacteria present on the surface of fruits naturally, in addition to soil and other environments, thermotolerant bacteria are present in the intestine, this type of pathogen present in the fruit is indicative of poor sanitary conditions during some stage of production some type of contamination of the external environment occurred (OLIVEIRA, 2007).

In addition to the bacteria other pathogens can contaminate the açaí, with the contamination of the fruit through bird feces or insects, the fragments of these contaminants are not easily identified by the fact of the diminutive size, which increases the possibility of the product made from the açaí arrive contaminated with a possible pathogen. A great example of açaí contaminant at the time of harvesting, storage or transport is the crushing of the insect barber, which is eventually contaminated with the protozoan Trypanosoma cruzi, making it an oral transmission vehicle for Chargas disease.

2.6 Legislation

According to MAPA, "the pulp of açaí is that pulp extracted from the açaí, without addition of water, by mechanical means and without filtration, and can be submitted to physical process of conservation", when the pulp has an addition of water receives a classification according to their physical and chemical characteristics (Brazil, 2000). According to the regulations, it is made by thick or special açaí (Type A) where it is the extracted pulp with addition of water and filtration, presenting a total solids content above 14%, the medium or regular açaí (Type B) has a dense appearance, exhibiting above 11 to 14% of total solids, the fine or popular açaí (Type C) has a total of 8 to 11% of total solids. The whole pulps are those extracted without addition of water and should present 40 to 60% of total solids.

The pulps should always be prepared with clean fruits and free of earthy material, of animal or vegetal detritus besides the parasites. They should not present foreign substances or inedible fragments of the fruit, always analyzing if they have the presence or absence of dirt, parasites or larvae in the fruit (SANTOS et al., 2008).

The standardization of the quality of frozen açaí is determined in the DRC no. 12 of January of 2001, of the National Agency of Sanitary Surveillance (ANVISA), where the quality parameters of concentrated or unpasteurized fruits with or without heat treatment are described or not. It should present tolerance values of the sample and 10^2 for coliforms 45º C / g and absence of Salmonella sp./25g (BRASIL, 2001), as well as the Ministry of Agriculture, Livestock and Food Supply (MAPA).

III. METHODOLOGY

3.1 Preparation and preparation of the samples

In order to carry out the analyzes, different brands of frozen açaí pulps were selected in establishments located in the regions of the municipality of Vitoria da Conquista.

Three different batches of three different brands of açaí pulps were collected, for each lot three samples were taken, totaling twenty-seven samples, where the acquisition was made on May 20, 2019, from three establishments, all of them distributors. The samples were conditioned in containers from the establishments and later stored in an isothermal box for the preservation of the samples until the arrival at the microbiological laboratory of the Independent Faculty of the Northeast to perform the procedures.

3.2 Microbiological analyzes

The standard values are according to the microbiological data base of RDC No. 12, of January 2001, of the National Agency of Sanitary Surveillance (ANVISA), thus being classified the values obtained in the analysis of açaí pulp as conform or non-conform (BRAZIL, 2001). Table 1 shows the values of the recommended microbiological standards of açaí.

The samples were submitted to the tests of total coliforms, thermotolerant (Escherichia coli) and Salmonella sp. Due to the large number of samples, the pool consisted of the homogenization of each sample, according to the recommendations of the Adolf Lutz Institute (2008), where potions representative of each sample of the same batch were collected and packed in a single container, after homogenization, thus formed a pool of the composite samples with the three units purchased from each batch. After the formation of the pools, the analytical assays of the açaí pulps were carried out. The analytical results used for the total coliforms test (CFU / g) and Escherichia coli (CFU / g) were the AOAC 998.08 method, which defines coliforms as acid and gas gram-negative bacilli from lactose during metabolic fermentation. The Salmonella sp. were made by the ISO 6579-1 method which is an international standard with specific technique for Salmonella sp.

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Table 1 - microbiological standardization used to evaluate açaí pulp.

Microorganism	Tolerance for sample
Total coliforms	1.0×10^2 UFC / g
Thermotolerant coliforms	1.0×10^2 UFC / g
Salmonella sp.	Ausência/ 25g

Source: Brazil, 2001

IV. RESULTS AND DISCUSSION.

The values found in the analyzed samples of açaí pulps are presented in Table 2, which refer to contamination by total coliforms, Escherichia coli and Salmonella sp. in açaí pulps.

Table 2 - Microbiological analyzes in açaí samples marketed in the city of Vitoria da Conquista - BA.

		Tests done	Salmonella sp./25g	Total Coliforms UFC/g	Escherichia Coli UFC/g
Mark (A)	A1	A1-R1	Absent	$<1x10^2$	$<1x10^2$
		A1-R2			
		A1-R3			
	A2	A2-R1	Absent	$<1x10^2$	$<1x10^2$
		A2-R2			
		A2-R3			
	A3	A3-R1	Absent	$<1x10^2$	$<1x10^2$
		A3-R2			
		A3-R3			
Mark(B)	B1	B1-R1	Absent	$<1x10^2$	$<1x10^2$
		B1-R2			
		B1-R3			
	B2	B2-R1	Absent	$11,3x10^3$	$<1x10^2$
		B2-R2			
		B2-R3			
	B3	B3-R1	Absent	$16,1x10^3$	$<1x10^2$
		B3-R2			
		B3-R3			
Mark (C)	C1	C1-R1	Absent	$5,8x10^3$	$<1x10^2$
		C1-R2			
		C1-R3			
	C2	C2-R1	Absent	$2x10^3$	$<1x10^2$
		C2-R2			
		C2-R3			
	C3	C3-R1	Absent	$1x10^4$	$<1x10^2$
		C3-R2			
		C3-R3			

Source: Applied field research.

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According to Faria, Oliveira and Costa (2012), the contamination from total coliforms in açaí pulps is frequently cited in the literature, and can be explained by inadequate handling during processes or by contamination of the equipment. According to DRC No. 12 of January 2001 establishes limits for contamination of pulps. From the samples analyzed according to table 2 only one brand was in compliance with the legislation, being that brand B presented a higher count than allowed by RDC, generating nonconformity, since it was observed in table 2 that for lots B2 the count and 11, $3x10^3$ CFU / g for lot B3 had a count of $16.1x10^3$ CFU / g, resulting in a significant growth of coliforms at 45 ° C / g. The samples obtained from mark C according to table 2 showed counts greater than $1x10^2$ with counts of order 10^3 for lots C1 and C2 and the highest count was observed according to table 2 for all marks in lot C3, taking counting of 10^4, being the only brand to show nonconformity in all the lots analyzed, being able to be explained by inadequacy in the processes of manipulation of the fruit, coming from the harvest and the procedures after the açaí was cut from the palm tree, possibly happened the contamination by counting on the environment as the soil or inadequate transport.

In studies done by Santos (2015), it showed the importance that the training of good manufacturing practices with the manipulators of pulps, results in a significant improvement in the contamination by microorganisms. In addition to the studies done by Pompeu, Barata and Rogez (2009), they point out that the importance of refrigeration is of extreme value because it reduces the microbial load.

For the results regarding thermotolerant coliforms the presence of Escherichia coli was analyzed, the frequency of the contamination by the bacteria was very satisfactory, because in all the brands and batches analyzed a count was found below $1x10^2$ that according to the legislation of the ANVISA to RDC n º 12 is within the established limits. According to the results obtained, it shows that hygienic-sanitary conditions are acceptable, besides the equipment and utensils of the place should always be well sanitized regularly, always having a control in the storage of the product and the manipulation of the acai pulp by the employees.

For the Salmonella sp. was found absence in all brands and lots collected, according to ANVISA Administrative Rule No. 1 must have absence in 25g for any food product. The Salmonella genus has as its main reservoir the gastrointestinal tract of animals and humans. Opening species that cause typhoid, and salmonellosis. The transmission of diseases by this bacterium is explained by the ingestion of contaminated food or poor hygiene habits, so it is important to care in the handling of products from the production chain to consumption in a simple establishment.

V. CONCLUSION

The açaí has been gaining more and more market due to its peculiarities that its users have conquered, but like all food it is necessary to take all possible precautions to avoid any type of contamination or deterioration of the product.

The samples analyzed in the city of Vitória da Conquista - BA had some occasional disappointments, all samples were absent for Salmonella sp. Escherichia coli analyzes were present in all samples, but were within the limit acceptable by legislation.

According to the results only a single brand had the microbiological quality totally satisfactory. Already the other two marks were observed nonconformity in the count of total coliforms, being outside the allowed standards. Signaling that a failure in one or more stages of the production chain may have occurred, observing the great need for sanitary measures to try to reduce the degree of contamination and the importance of implementing a quality control in the harvesting processes until the arrival of the product to the final costumer.

It is considered of great relevance to improve the training of employees to improve the effectiveness of the service of permanent training, in addition it is of extreme importance a more rigorous surveillance in the establishments, to be able to guarantee that the consumption of food does not bring health risks.

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