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Functional Dietary Cereal Bar Based an Amazon Fruits

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Abstract

The cereal bar has arisen from the need to have a product that would bring together practicality and nutritional quality. The goal is to employ cupuaçu (*theobroma grandiflorum*) light cereal grains making use of the byproduct of acai palm (*Euterpe oleracea Mart*) and sucralose for the preparation of a cereal bar that can add value to fibers and proteins to the nutrition of various sections of the population. Physical and chemical, microbiological and microscopy analyses have been executed in the fruit pulp of cupuaçu and in roasted and ground acai seeds. The samples comply with the ANVISA requirements regarding microscopic and microbiological analyses. The final formulation of functional cereal bars had 5.06% of protein and a high content of 7.41% total dietary fiber, 30 mg/100 g of Vitamin A and 33 mg/100 g of Vitamin C and minerals such as phosphorus, iron, manganese, and the less energy value than similar products found in the market. Data, which have been found, have made us to believe that we have developed a functional Amazon dietary cereal bar.

Keywords: Cereal bar; Cupuaçu; Açaí seeds

Introduction

The cereal bar has been developed out of the need to have a product could bring together practicality and nutritional quality to improve or replace the morning and afternoon snacks as a complement to main meals. The main components of the cereal bar are fibers and fast-absorbing carbohydrates. There is an attempt to increasingly add functional products and cereals to the diet through versatile products. Thus, food products, which are rich in fibers, proteins, minerals and vitamins have been developed worldwide [1].

Fibers can be classified according to their solubility into water soluble and insoluble fibers. Soluble fibers are found in fruits, vegetables, in oat bran and in vegetables. The insoluble fibers are present in all plant foods, their largest source being cereal grains, such as corn, soybeans, chickpeas and fruits eaten with their peel. Amazonian fruits have important functional components and nutritional values, which warrant further research.

In the Amazon there is a wide variety of fruits that still require technological research that could not only reveal their nutritional potential, encouraging their use in meals, but also to enable an increment in the economy.

Among the Amazonian fruits, cupuaçu (Theobroma grandiflorum), is among the so-called exotic fruits due to its pleasant and unique aroma and flavor. It has become well known in the Amazon region, where it is consumed in its natural form as juices, ice creams and the like. Açaí (Euterpe oleracea Mart.) is a native Amazon palm tree that has stood out economically due to the market potential of its products, mainly represented by the heart-of-palm and the juice extracted from the fruit. The seeds, on the other hand, are usually discarded and used in handicraft (bio-jewels, fragrance sachets), and energy during combustion and as organic fertilizer.

This work aims to employ cupuaçu (Theobroma grandiflorum), the light cereal grains, using the byproduct of açaí (Euterpe oleracea Mart.) and sucralose as it is a totally safe sweetener, approved by the Food and Drug Administration [2], and its use authorized as established as an Acceptable Daily Intake (ADI) at 0-15 mg/kg bodily weight [3], for the preparation of a cereal bar that can aggregate fiber values and protein to the diet of several sections of the population.

The intention is to develop a product that is similar to those found in the market, using this byproduct in a rationalized manner, finding an additional good use for the cupuaçu fruit, as well as financial benefits for the region.

Materials and Methods

In the experimental design the following ingredients were used: Cupuaçu pulp processed in the Laboratory of Nutrition/CPCS/INPA, corn glucose syrup/Natural Karo (Karo), oat flakes (Quaker), skimmed milk (Molico), cereals grain flakes Light Banana and Apples with Cinnamon (Jasmine), pure sucralose (Finh Tovani Benzaquen. Imp. Exp. and Representations-SP) to carry out six experiments for the formulation of cereal bars. The materials used for the production of the cereal bar were cupuaçu, sucralose, cereal flakes, acai seeds and kitchen utensils, refractory glassware, stainless steel mold, reagents and analytical equipment, polyethylene bags and vacuum sealer.

The oatmeal, the skimmed milk and the cereal flakes were purchased in city supermarkets. The selection of these products was conditioned criteria of tradition combined with reliability in the assurance regarding the production of products, packaging and storage conditions. Standards of security were further observed, such as expiry date, packaging conditions of packaging and sale display system.

The low energy value, the absence of sucrose and of cholesterol, the absence of chemical additives and preservatives and other human harmful products were decisive in the choice of the Grain Flakes Light Banana and Apple with Cinnamon (Jasmine) for formulations. Sodium and protein values were also observed as criteria for the selection. The

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sodium present in these flakes is among the lowest and the protein values slightly higher than in similar products surveyed.

The nutritional values of these flakes have revealed the contents of their components in 40 g portion, equivalent to half a 200 ml cup of tea and can be verified in Table 1.

To obtain the pulp of the cupuaçu, firstly, the fruits were washed, sanitized and subjected to analytical processing criteria. Once broken and discarded the material unfit for human consumption, the microbiological analysis of cupuaçu pulp was carried out.

The cupuaçu pulp used was processed under strict hygienic criteria in Nutritional Assessment Laboratory (INPA). Corn glucose syrup and sucralose were added to the cupuaçu pulp, which was, then, cooked until the pulp turned into a thick jam and acquired a dark caramel color. The jam was, then, cooled with thermal shock.

To the jam at room temperature, the roasted and grounded acai seed was added and mixed and cereal flakes, followed by compression into shape in a rectangular stainless steel mold, measuring 8 cm x 2.5 cm. Later the cupuaçu cereal bars were removed from the molds and cut into 25 g units and, then, individually vacuum packed in polypropylene bags.

The açaí seed used was processed in the Nutrition Laboratory of the INPA from the pulped açaí, which had been used in other research studies. The process is illustrated in Figure 1.

The determination of macro and micronutrients in the acai seed was performed after the final processing stage: grinding. Walkley-Black allowing extraction of the Organic Matter in Plant Tissue was used. 0.0500 g of dry matter (DM) were weighed and placed in a 500 ml Erlenmeyer flask to which 10 ml of solution of potassium dichromate was added; 20 mL of concentrated H_2SO_4; leaving it to cool. The reagents and the solutions of 1 N potassium dichromate were prepared - by weighing 49.04 g of $K_2Cr_2O_7$ p.a (kiln-dried at 100°C), transferring to a 1000 mL volumetric flask and completed the mark with distilled water. The Phenanthroline indicator was used being dissolved 1.485 g of phenanthroline (monohydrate) and 0.695 g $FeSO_4.7H_2O$ in distilled water and complete at 100 mL. And further the 0.5 N Ferrous Sulfate by transferring 139 g of $FeSO_4.7H_2O$ p.a to the 1000 ml volumetric flask, dissolving in distilled water, adding 15 ml of concentrated H_2SO_4. After cooling the volume was completed.

The cereal flakes used in the production of the cereal bars were chosen from the various brands found in the market and selected the Jasmine Grain Flakes Light Banana and Apples with Cinnamon flakes, purchased in supermarkets in the city.

Nutritional Information Serving Size 40 g (1/2 cup of tea)		
Energy	143 kcal=600 kJ	7%
Carbohydrates, of which:	26 g	9%
Saccharose	0.0 g	-
Maltose	4.1 g	-
Proteins	4.1 g	8%
Total fat, of which:	2.5 g	4%
Saturated fat	0.3 g	1%
Trans fats	0.0 g	-
Monounsaturated fats	1.0 g	-
Polyunsaturated fats	1.2 g	-
Cholesterol	0.0 mg	-
Dietary fiber	4.3 g	17%
Sodium	59 mg	2%
Iron	1.4 mg	10%

Table 1: Nutritional Information.

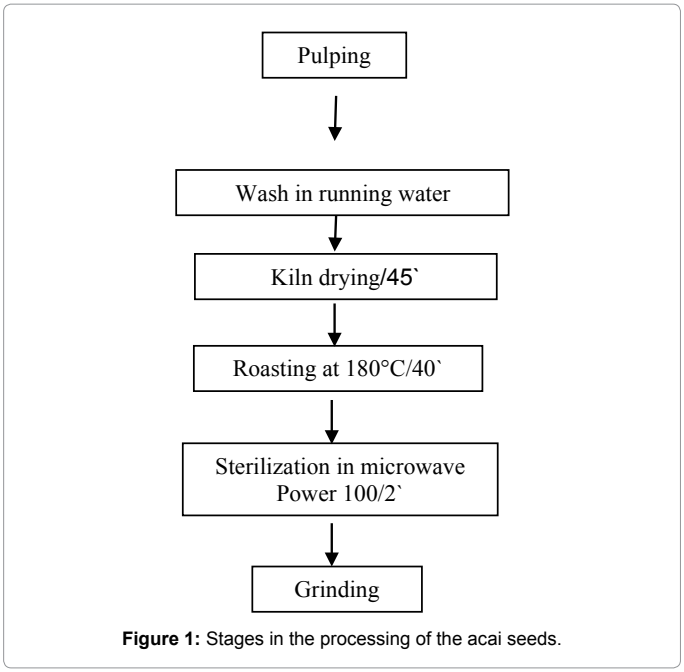

Figure 1: Stages in the processing of the acai seeds.

The pulp of the fruit and the cereal bar were evaluated in triplicate, as to the physical, chemical characteristics and microbiological ones. The Moisture content was obtained by drying the material in a kiln with air circulation at 65°C to constant weight [4]. The lipid content was determined by the AOAC method [4]. The lipid fraction was extracted with the use of petroleum ether in a Soxhlet apparatus and its concentration determined gravimetrically. Protein contents were determined from the dry matter through the Micro-Kjeldahl method according to AOAC. The determination of ash or fixed mineral residue was carried out gravimetrically in a muffle furnace at 450°C to constant weight [4].

The determination of the fraction of fiber was performed according to the enzymatic-gravimetric method [5]. The technique used is constituted in the treatment of the sample with heat-resistant alpha-amylase and subsequent digestion with pepsin and pancreatine followed by precipitation with ethanol. The ash and protein contents reminiscent in the isolated residue are discounted and the resulting value corresponds to the total fiber. This methodology allows for the separate assessment of the soluble and insoluble dietary fiber content. The quantification of carbohydrates was obtained by difference following the determination of the previous fractions [4].

Six tests with distinct formulations with different components and quantities for the selection of the best formulation for the cereal bars were performed. This can be verified in Table 2 and presented according to the number of the formulation. Different sweeteners were initially used in these formulations in the attempt to find the one that would best corresponded to our expectations. Xilitol was initially used followed later by sucralose.

The Food and Drug Administration (FDA) has approved low-calorie sweeteners for use in a variety of food products (Table 3) and an "acceptable daily dose" (ADI) for each sweetener has been established. This is the maximum value deemed safe for an individual to intake each

Ingredients	Oat flakes	Powder skimmed milk	Sucralose	Cereals without sugar	Corn glucose	Roasted and ground acai seeds	Xilitol	Biscuit corn starch	Roasted Brazil nuts	Cupuaçu Pulp
Formulation 1	250 mL	125 mL	0 g	0 g	125 mL	25 mL	15 g	70 g	59 g	200 g
Formulation 2	50 mL	25 mL	0 g	0 g	25 mL	25 mL	5 g	0 g	50 g	200 g
Formulation 3	0 mL	125 mL	2 g	90 g	125 mL	30 mL	0 g	67 g	0 g	300 g
Formulation 4	0 mL	125 mL	0.8 g	125 g	160 mL	60 ml	0 g	0 g	0 g	500 g
Formulation 5	60 mL	60 mL	3 g	125 g	125 mL	40 mL	0 g	0 g	0 g	500 g
Formulation 6	60 mL	60 mL	1.5 g	125 g	10 mL	40 mL	0 g	0 g	0 g	500 g

The formulations were prepared in the Nutrition Laboratory/CPCS/INPA.

Table 2: Formulations for obtaining the cereal bar.

Artificial sweetener	ADI*	Estimated ADI equivalent**	OK for cooking?
Aspartame (NutraSweet, Equal)	50 mg per kg	18 to 19 cans of diet cola	No
Saccharin (Sweet'N Low, SugarTwin)	5 mg per kg	9 to 12 packets of sweetener	Yes
Acesulfame K (Sunett, Sweet One)	15 mg per kg	30 to 32 cans of diet lemon-lime soda***	Yes
Sucralose (Splenda)	5 mg per kg	6 cans of diet cola***	Yes

Source: Mayo foundation for medical education and research [18].
*FDA- Acceptable daily intake (ADI) limit per kilogram (2.2 pounds) of body weight.
**Product equivalent to the consumption of a person that weighs 150 pounds (68 kilograms).
***These products generally contain more than one type of sweetener.

Table 3: Low-calorie Sweeteners/acceptable daily intake/equivalent estimate.

day during his/her lifetime. The ADIs should be around 100 times less than the lesser amount that can cause health problems.

The açaí seeds, upon being roasted and ground were submitted to assessments with the purpose of identifying the concentrations of energy and nutrients in this by-product at 100 g on dry base. In these assessments, concentrations of energy, humidity, proteins, soluble, insoluble fibers and total dietary fiber, carbohydrates, lipids and ash were evaluated. The results of the analyses of these elements can be visualized in Table 4. The analysis of the macro minerals has been described in Table 5. The descriptive statistics of the concentration of these macronutrients can be analyzed in Table 6.

The chemical analyzes in triplicate of the samples of the cereal bars were performed to determine the centesimal composition according to Association of Official Analytical Chemists – AOAC6, soluble and insoluble dietary fiber through the enzymatic-gravimetric method [5]. The Nifext fraction (Nitrogen free extract) comprises the most digestible carbohydrates, namely, those which are not included in the fiber fraction, which was obtained by calculating the difference from the other fractions studied. The total caloric value was calculated from the sum of the corresponding calories to proteins, lipids and carbohydrates (Nifext), which provide 4, 9 and 4 kcal/g respectively [6].

Three randomly were chosen cereal bars on the batch for pasteurization and microbiological analyzes for total Coliforms, fecal Coliforms, Psychrophiles (CPP); Mesophilic (CPP); Molds and Yeasts; Salmonella *sp* both for the cupuaçu pulp and for the açaí by-product were used. Such microbiological tests were performed from 25 mg of dry sample, with dilutions ranging from 10-1 to 10-3 in peptone water in dilution 0.1%. The results of the microbiological analyzes can be visualized in Table 7.

The cereal bars were subjected to microbiological evaluation as to the presence of fecal and total coliforms, mesophilic and psychotropic bacteria, molds and yeasts according to the ICMSF [7] methodology, as well as microscopic test for the identification of elements such as dirt, insect fragments, larvae and parasites in compliance with Resolution 12/78, of the CNNPA/MS 5. The statistical analysis in this research work made use of the analyses of the Minitab for Windows 12.1, the basic statistics, mean, maximum and minimum standard deviation.

For the choice of the formulation considered as the best accepted, six different concentrations of cupuaçu pulp, flakes, roasted and ground açaí seed, sucralose, oat and other ingredients were tested (Table 2) submitted to sensorial assessment, resulting in two samples in scale of preference and the reduction to just one and the most accepted.

Chemical, microbiological and sensorial analyses we made in the six nutraceutical bars. The fluctuation methods as described by the Association of Official Analytical Chemists International [6] were used. The methods used for isolating foreign matters proved to be adequate as very little vegetal residue was found in the paper filter, not interfering, thus, in the visualization and in the identification of contaminants, although it is impossible to have the production of food products totally free from contaminants from different origins [7].

The values for molds and yeasts in the three cereal bar samples have revealed that these are much lower of the tolerance allowed by the Resolution as can be confirmed in the fragment of the Annex to the Resolution (n) (Table 8).

The tolerance is maximum and the standards are minimum for the different groups of food products, as per Table 8 for the purpose of registry and inspection for food products. Such limits and criteria can be complemented whenever the need arises for the establishment of surveillance and tracking programs for pathogenic microorganisms and hygienic and sanitary quality of products.

For the purpose of implementing the sampling plan the following has to be understood:

a) n: Is the number of units to be randomly collected from a same batch to be individually analyzed? In cases in which the established standard is the absence in 25 g, as for *Salmonella sp* and *Listeria monocytogenes* and other pathogens, the mixture of the aliquots withdrawn from each sample units is possible, the p/v proportion being complied with (one part in weight of the sample to 10 parts in volume from the breeding ground).

b) c: Is the maximum acceptable number of units of samples with counts in between m and M limits (3-class plan)? In the cases where the microbiological standard is expressed through "absence", **c** is equal to zero; the 2-class plan is applied.

Characteristics	Nutritional composition (average 100 g)
Energy	68.36 kcal
Unit	4.02 g
Proteins	3.63 g
Soluble fiber	0.43 g
Insoluble fiber	78.05 g
Total dietary fiber	78.48 g
Carbohydrates	10.85 g
Lipids	1.16 g
Ashes	1.86 g

Source: Altman, 1956.

Table 4: Concentration of energy and nutrients in the açai seed on a 100 g dry basis.

c) m: Is the limit that, in a 3-class plan, separates the acceptable batch from the product or batch with an acceptable intermediate quality?

d) M: Is the limit that, in a 2-class plan, separates the acceptable from the unacceptable product? In a 3-class plan, M separates the batch with an intermediate acceptable quality from the unacceptable batch. Values above M are unacceptable.

The formulations were prepared in the Nutrition Laboratory/ CPCS/INPA and submitted to the tasting of 100 untrained volunteer tasters with the purpose of selecting the most acceptable through a sensorial analyzes with the use of the test of preference in accordance with Monteiro [8]. The tasters were participants of the XX Brazilian Congress on Nutrition – CONBRAN, in Rio de Janeiro on May 2008 (Tables 9 and 10).

Pieces of 2 cm of each one of the formulations were served to the tasters who were asked to mark with and (X) the value that best described their impression on each sample, using the scale below to describe how much they had enjoyed it or not. Water was served for the cleaning of the palate in between the assessment of the samples, and the tasters were provided with instruction prior to the test. The assessment of the result was done by the provision of the following grades: (1) I disliked it very much; (2) I disliked a lot; (3) I fairly disliked it; (4) I lightly disliked it; (5) Indifferent; (6) I lightly liked it; (7) I fairly liked it; (8) I liked it a lot; (9) I liked it very much. A statistical analysis of the answers was, then, conducted in order to verify the degree of acceptability of the product.

Results and Discussion

The macro minerals calcium, phosphorus, sodium, chloride, magnesium, potassium and macronutrients since they are necessary in great amounts (about 1 or 2 grams per day) and essential trace elements iron, zinc, copper, manganese, minerals present in roasted and ground açaí seeds of are found in Tables 5 and 6. The corresponding values for such elements can also be found in the same tables.

The values of the macro minerals phosphorus (P), calcium (Ca) and potassium (K) and considerable amounts of the essential micro minerals micros copper (Cu), iron (Fe), manganese (Mn) and zinc

Sample	N	P	K	Ca	Mg	S	Na	CP*	B	Cu	Fe	Mn	Zn
N°	g kg^{-1}							%	mg kg^{-1}				
1	8.27	1.42	5.74	1.35	0.75	0.46	1.47	5.17	1.53	8.59	9.95	24.16	11.85
2	8.38	1.43	5.05	1.03	0.72	0.41	1.44	5.24	1.90	7.55	2.28	22.67	11.93
3	7.33	1.43	5.03	1.03	0.72	0.45	1.54	4.58	1.78	7.69	7.80	23.49	11.17

The analysis of the macro minerals were performed in laboratory of nutrition/CPCS/INPA
*Crude protein

Table 5: Concentration of macro mineral nutrients in açai seed on a 100 g dry basis.

Sample	N	P	K	Ca	Mg	S	Na	CP	B	Cu	Fe	Mn	Zn
	g kg^{-1}							%	mg kg^{-1}				
Average	7.99	1.43	5.27	1.14	0.73	0.44	1,48	5.00	1.74	7.94	20.01	23.44	11.65
Standard Deviation	0.58	0.01	0.40	0.18	0.02	0.03	0.05	0.36	0.19	0.56	2.24	0.75	0.42
Variance	0.33	0.00	0.16	0.03	0.00	0.00	0.00	0.13	0.04	0.32	5.02	0.56	0.17
IC 95%	7.34; 8.65	1.42; 1.43	4.82; 5.73	0.93; 1.35	0.7; 0.75	0.41; 0.47	1.43; 1.54	4.59; 5.41	1.52; 1.95	7.30; 8.58	7.47; 22.55	2.60; 24.28	1.18; 12.12

Averages descriptive statistics on concentration of macro mineral nutrients in açai seed
The analysis of the concentration of nutrients in açai seed were performed in Laboratory of Nutrition/CPCS/INPA

Table 6: Descriptive statistics of the concentration of nutrients in açai seed on a 100 g dry basis.

Sample	NMP/g	NMP/g	UFC/g	UFC/g	UFC/g	25 g
	Coliforms	Fecal Coliforms	Psychrophiles (CPP)	Mesophilic (CPP)	Molds/ yeast	*Salmonella sp*
1	0/g	0/g	<10 UFC/g	<15 × 10^1 UFC/g	10 × 10^1 UFC/g	Absense
2	0/g	0/g	<10 UFC/g	<10 UFC/g	14 × 10^1 UFC/g	Absense
3	0/g	0/g	<10 UFC/g	<10 UFC/g	<10 UFC/g	Absense

The microbiology analysis of cereal bars were performed in Laboratory of Microbiology/INPA
*Average of analyzes on three samples of randomly selected bars
Averages of analyzes on three randomly chosen cereal bars on the batch.
MPN/g (Most Probable Number per gram)
CFU/g (Colony Forming Units per gram)
CPP (standard plate count)

Table 7: Results of microbiology *applied in the analysis of cereal bars.

Food group	Micro-organism	Tolerance for Sample indicative	Tolerance for sample representative			
			N	c	m	M
10 Flour, pasta, and bakery products, (processed and packaged) and similar						
m) compressed cereal, bars or other shapes, with or without additions	*B.cereus*/g	5×10^2	5	2	10^2	5×10^2
	Coliforms a 45ºC/g	5×10	5	2	10	5×10
	Salmonella sp/25 g	Absense	5	0	Absense	-
n) granola cereal mixture and not compressed, with or without additions, and the like	*B. cereus*/g	5×10^3	5	2	10^3	5×10^3
	Coliforms a 45ºC/g	5×10^2	5	2	10^2	5×10^2
	Estaf.coag.positive/g	10^3	5	2	5×10^2	10^3
	Salmonella sp/25 g	Absense	5	0	Absense	-

Source: ANVISA, 2010.

Table 8: Microbiological sanitary standards for food.

	N°	Sum	Max	Min	Average	Median	Desv.A	Percentage
I liked it slightly	1	145	6	1	4.83	5	2.21	28.16%
I enjoyed it	2	157	8	1	5.23	5	2.51	30%
I realy enjoyed it	3	213	9	2	7.1	7	1.99	41%
I enjoyed it regularly	4	106	7	1	3.53	3	1.89	24%
I enjoyed it very much	5	97	7	1	3.23	3	1.80	22%
I extremely like it	6	241	9	2	8.03	8.5	1.49	54%

The tasters were participants of the XX Brazilian Congress on Nutrition – CONBRAN, in Rio de Janeiro on May 2008.

Table 9: Evaluation of preference of tasters CONBRAN 2008.

	N°	Sum	Max	Min	Average	Median	Desv. A	Percentage
I realy enjoyed it	3	13	9	2	7.10	7	1.99	41%
I Extremely like it	6	41	9	2	8.03	8.5	1.49	54%

The tasters were participants of the XX Brazilian Congress on Nutrition – CONBRAN, in Rio de Janeiro on May 2008.

Table 10: Evaluation for "extremely like it" preference tasters CONBRAN 2008.

(Zn), make the use of this by-product viable in the nutrition of higher animals.

Studies by Altman [9], Rodrigues Filho et al. [10], Kabacznik [11] and Townsend et al. [12] Corroborate with the above results showing high levels of protein, fiber and lignin, together with the presence tannins (inulin) polyphenols and antioxidants as can be seen in the chemical analysis of the açaí seed (Table 11).

The ingredients used in the formulation of cereal bar met the requirements of Resolution 12/78, the CNNPA/MS [13], as the microscopic tests, foreign elements in the product (dirt, fragments of insects, larvae and parasites) not being identified in the analyzed samples. The results showed that 100% of the samples were free from insect fragments in accordance with the current food legislation; perhaps because they have been developed in the INPA laboratories. The results of microbiological analyzes in samples of cereal bars produced can be seen in Table 7.

The values, which were found, were obtained by plate count. They are, therefore, expressed in CFU/g and are common to all the samples analyzed. The results have shown that all of them were in line with the recommended microbiological standards as required by ANVISA as per Resolution RDC 12 RDC no 1214 - SVS, January 2, 2001 that recommends a 5 x 10 limit for Thermo tolerant Coliforms and the absence of *Salmonella sp*.

Cereal bars are products not featured in the Tables (Table 8 compiled in part) specified in the Annex to Resolution RDC No. 12 of 02 January 2001. Therefore, according to the recommendations of this Resolution, the similarity of the nature and of the processing of the product is considered as the basis for their compliance with the established standards for a similar product, contemplated in said Annex to the Regulation that establishes Sanitary Microbiological standards for Food Products.

The results of these tests have ensured the choice of the most accepted formulation for the cereal bar. The statistical design of the sensorial analysis used descriptive statistics and the results of both can be seen in Tables 9 and 10.

After the result of this evaluation, the analysis of the centesimal composition of the formulation (A6) for the cereal bar considered the most accepted by the tasters was carried out. The data of centesimal composition on a wet basis are shown in Table 12.

The final formulation of the Amazon functional dietary cereal bar has presented, on an average, 5.6% protein, a slightly higher content vis-à-vis the products found in the market with average values of 4.4% protein. It has also shown lower carbohydrate content (60.12%), higher content of total fibers (7.41%), ashes (1.4%), high moisture content (25.32%) (ANVISA, 2005) due to cupuaçu having 86.2%/100 g humidity in its pulp [15] (TACO, 2006) and lower energy value 66.5 kcal/25 g as compared to those industrialized by large food companies, which present on an average 74.0% carbohydrates, 4.0% fibers and energy value of 74.93 kcal/25 g. Such values allow the classification of

Constituents	Percentage %
Humidity	13.60
Stereo extract	3.01
Alcoholic extract	9.32
Aqueous extract	2.80
Gross proteins	4.34
Hemicellulose	12.26
Cellulose	34.41
Lignin	7.72
Ashes	1.34

Source: Townsend et al. [13].

Table 11: Chemical composition of the acai seed.

Humidity	25.32%
Protein**	5.06%
Lipids	0.61%
Ash	1.48%
Insoluble fiber	5.44%
Soluble fiber	1.97%
Total dietary fiber	7.41%
Total carbohydrates ***	60.12%
Vitamin A	30 mg
Vitamin C	33 mg
Energy	266 kcal

*Averages of three triplicates
**Protein, % (Nx5,7)
***Carbohydrate content calculated by difference
The analysis were performed in Laboratory of Nutrition/CPCS/INPA

Table 12: Approximate Proximate composition (% wet basis) of the formulation (6) end of the Amazon cereal dietary functional bar*.

the functional cereal bar as a product with high levels of fiber, because according to Mattos and Martins [16-18], they can be classified above the range considered by them as moderate, between 2.4 and 4.4 g/100 g fibers.

Parameters, which establish the moisture value, have not been found in the legislation - Anvisa- Resolution - Rdc No. 263 OF 22 September 2005 [17].

Acknowledgment

Nutritional values have found a great opportunity open for the use of the seed and can turn into an additional income generator for the families that produce açaí, in addition to lowering the costs of many products. Besides such peculiarities, the roasted and ground açaí by-product is rich in protein and dietary fibers that justify their aggregation to human consumption increasing quality and decreasing costs. The formulations for the cereal bars with bioactive fruits, in addition to the results obtained in the microbiological analyses has shown lower energy value when compared to similar products in the market and have been well accepted by the tasters, which leads us to believe in the possibility that we have found an Amazon functional dietary cereal.

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