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DEVELOPMENT OF CEREAL BARS USING BACURI PULP FLOUR FOR SPORTSMEN: NUTRITIONAL COMPOSITION AND SENSORY ACCEPTABILITY

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ABSTRACT

The objective of this study is to develop and analyze the sensorial acceptability of cereal bars using bacuri pulp targeting the sports public. Formulations using different concentrations of bacuri flour were prepared: F1 (0%), F2 (10%) and F3 (20%). The formulations were submitted to microbiological analysis, centesimal composition and vitamin C. In the sensorial analysis, the attributes were evaluated with 107 athletes from Campo Grande - MS. Statistical analyses using the SPSS software were performed, considering $p<0.05$. In the physical-chemical characterization of cereal bars, carbohydrate and protein contents were F1 = 67.47% and 11.66%, F2 = 68.26% and 10.31%, F3 = 68.41% and 9.29%, respectively. The bars F1, F2 and F3 presented 1.27 mg, 2.12 mg and 3.38 mg of vitamin C in 100 g. The formulations were suitable for microbiological legislation. The formulation F2 presented an acceptability index of 82.2% in global acceptance, and was significantly superior to the others in all attributes. None of the formulations were rejected, with acceptance rates above 70%.The development of differentiated cereal bars aims to improve nutritional and functional composition for the sports public and athletes using regional ingredients such as bacuri pulp to generate innovation and nutritionally benefit consumers.

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INTRODUCTION

Athletes and physical activity practitioners are more concerned about nutrition because they seek a better performance in training/competitions and an improvement in body composition. This encourages an increasing use of food supplements or specialized products, such as functional cereal bars, to achieve their goals (Alves; Navarro, 2010). According to Gutcoski Athletes and physical activity practitioners are more concerned about nutrition because they seek a better performance in training/competitions and an improvement in body composition. This encourages an increasing use of food supplements or specialized products, such as functional cereal bars, to achieve their goals (Alves; Navarro, 2010). According to Gutcoski *et al.* (2007), cereal bars are foods easy to consume, and have shown a fast growth in the market due to their practicality.

The main aspects taken into account for the elaboration of this product are the selection of an appropriate carbohydrate, a high fiber content and a low fat, however with a high energy content. Whey protein, used by physical activity practitioners, is known to have a good profile of amino acids, which favor protein synthesis, reduce protein fatigue during exercise and improve anabolic response. Because of its fast digestion, whey proteins have become a good strategy for metabolic stress situations, such as during physical exercises. (Freitas *et al.,* 2006; Sgarbieri, 2004). In addition, the development of new products and the full use of Brazilian Cerrado fruits are currently being explored intensively by the different segments of the Brazilian and the world's agricultural sector due to the wide variety of raw material available (Roriz, 2012). Measures to prevent nutritional deficiencies and encourage a sustainable development of regional raw materials lead to the search and use of economically viable food sources, such as bacuri (Hiane *et al.,* 2003). Bacuri (*Attalea phalerata* Mart. Ex Spreng.), also known as "acuri", "ganguri" and "coconut-acuri", is a

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neotropical palm belonging to the family Arecaceae widely distributed through the states of Mato Grosso do Sul and Mato Grosso. It has a fruit containing a globose berry about 10 cm long, and the fruiting occurs between October and December (Lorenzi, 2000). The pulp of the fruit is yellow to orange due to its carotenoids content. The pulp oil is rich especially in oleic acid, a monounsaturated fatty acid beneficial to human health (Hiane *et al.,* 2003). With the preparation of new products, changes in formulations and the complementation of existing products, an evaluation of sensory acceptability by the target public becomes necessary. Sensory analysis is an important tool in this process. It is able to, through the use of specific methods, evaluate the quality of a product through sensorial organs (Torres, 2009). It is important to develop and study a nutritional product that adds nutritional and functional value to the sports public and athletes using as raw material regional ingredients such as bacuri pulp, in addition to contributing to new research in the area, generating innovation and nutritionally benefiting the consumers' health.

MATERIALS AND METHODS

Materials: The fruits of bacuri (*Attalea phalerata* Mart. Ex Spreng.) were collected in Campo Grande and Bonito, Mato Grosso do Sul (MS) state, and taken to the laboratories of the Food Technology and Public Health Unit (UTASP) of UFMS, where they were processed for flour preparation and production of cereal bar formulations. The ingredients were obtained from the local commerce of the city of Campo Grande-MS. We used whey protein (Mix Nutri®), wheat flakes (Natubom®), rice flakes (Top®), brown sugar (Natubom®), honey (Apis®), chia (Natubom®), Brazil nut (Natubom®) and soy lecithin (Tradal®).

METHODS

Fruit processing: Sanitizing (washing under running water for removal of dirt, sanitizing for 15 minutes in sodium hypochlorite solution, 200 mg/L^{-1}, and washing under running water) and the pulp separation processing of bacuri almonds were performed at the Food Processing Laboratory, located at the UTASP/UFMS. The pulps were sliced, homogenized and stored under freezing. To prepare the bacuri flour, the homogenized pulp was oven dried at 60ºC for 48 hours and then ground in a mill (Tecnal® brand), sieved and packed in containers protected from light and moisture. Figure 1 shows the flowchart with the processing of bacuri fruits until the flour is obtained (Fig 1).

Elaboration of formulations of cereal bars: Preliminary tests were performed at the UTASP/UFMS Food Processing Laboratory to achieve a standard formulation and its variations. The cereal bars were prepared following good practices of handling and manufacturing (Brasil, 2003). Initially, they were performed using the ingredients presented in the materials as described in Table 1. For the preparation of cereal bars, the ingredients were weighed and all dry ingredients were mixed (except for whey protein). The binders were added and cooked at low heat until homogenized. Then, the dry ingredients were added. Whey protein was added after the fire was put out when the mixture reached ≤ 50ºC (measured with a digital spit-type thermometer) to prevent protein denaturation. Water (10 mL) was added and mixed again. The dough was wrapped in aluminum foil covered with bakery paper, pressed with a polythene spatula until reaching a thickness of approximately 1 cm, with a 3-cm wide cut.

Centesimal composition

The pulp, the bacuri flour and cereal bar formulations had their centesimal composition evaluated in triplicate

The moisture contents of the samples were determined by oven drying at 105°C according to the method described by the AOAC (1990). Protein quantification was performed by total nitrogen content, according to the micro Kjeldahl method, and multiplied by the factor 6.25 for conversion of nitrogen into protein (AOAC, 1990). Ash determination was performed in a muffle by the AOAC method (1990) and lipid values by the Bligh and Dyer (1959). The determination of total dietary fiber was performed in pulp and flour samples by the enzymatic method (AOAC, 2005), and the carbohydrates by difference. Total calories were calculated using Atwater conversion values of 4 kcal/g of protein, 4 kcal/g of carbohydrate and 9 kcal/g of lipid, according to Atwater and Woods (1896).

Determination of vitamin C: Vitamin C was determined in the pulp, bacuri flour and formulations by the Tillmans Titrametric method (Brasil, 1986). This analysis is based on the reduction of the indicator 2,6-dichlorophenol Indophenol (DCFI) by ascorbic acid.

Microbiological analysis: Before sensory analysis, the cereal bars were submitted to microbiological analysis as determined by the Resolution RDC no. 12/2001, which regulates Microbiological Food Standards. For the cereal bar, the counts of coliforms were made at 45ºC in the presence of *Salmonella spp.* at 25g and also the count of *Bacillus cereus* (Brasil, 2001).

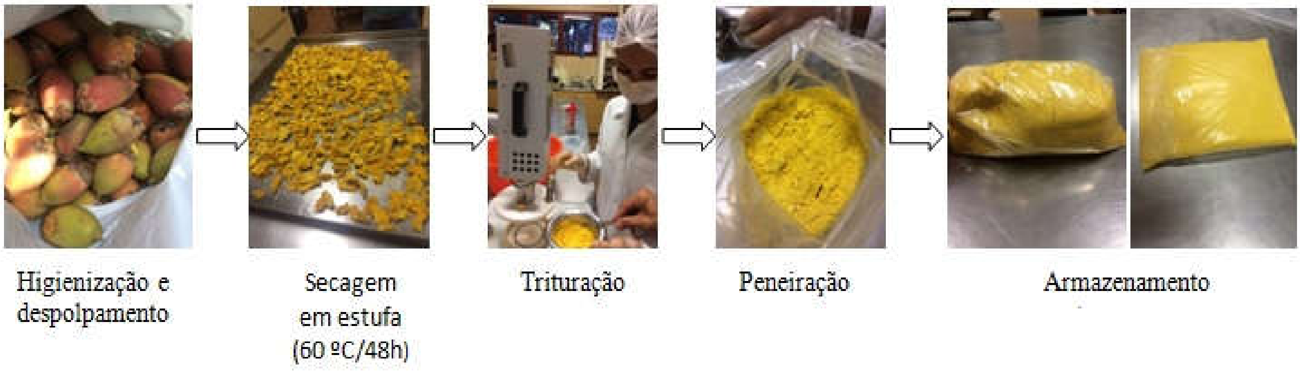

Figure 1. Flowchart of Bacuri fruit processing to obtain flour from its pulp. Source: Authors

Sensory analysis: The acceptance of cereal bars was evaluated by 107 adult male and female athletic testers at the Korpus Academy and the Western Military Command (CMO), both located in Campo Grande-MS. The attributes evaluated were appearance, texture, aroma, flavor, sweetness and color, in addition to global acceptance and intention to buy (Minim, 2006; Dutcosky, 2011). The samples were coded with three-digit numbers, randomized and balanced, and delivered in disposable plastic cups. Each taster received 10 g of each cereal bar formulation (F1, F2 and F3), one glass of drinking water to be used as a blank among samples. A structured hedonic scale of nine points (9 =liked very much, 8 = liked a lot = 7 liked moderately, 6 = liked regularly, 5 = neither liked nor disliked, 4 = disliked regularly, 3 = disliked moderately, 2 = disliked a lot, 1 = disliked very much) was used (Dutcosky, 2011). For the intention to buy test, a structured hedonic scale of 5 points were used varying from 5 (certainly would buy) to 1 (certainly would not buy) (Minin, 2006). The calculation of the acceptability index (AI) proposed by Monteiro (1984) was determined by the formula:

AI (%) = A x 100/B

Where: A = average score obtained by the product; B = maximum score assigned to the product.

Statistical Analysis: The data were organized and analyzed using the SPSS software (*Statistical Package for the Social Sciences*).The results were submitted to analysis of variance (ANOVA) using the Tukey test for comparison of means considering a 5% level of significance ($p<0.05$).

Ethical aspects: This study was approved by the Research Ethics Committee of the Federal University of Mato Grosso do Sul - UFMS, under opinion no. 1,233,483. Individuals who agreed to participate in the study signed an Informed Consent.

RESULTS AND DISCUSSION

Centesimal composition of pulp and bacuri flour and formulations of cereal bars: According to Aragão and Fernandes (2014), physical activity practitioners preferably consume, during pre-and post-workout, carbohydrate and protein foods, as well as cereal bars, which are sources of carbohydrates, protein with a high biological value (whey protein) and a good quality vegetable protein source, besides being an adequate source of fibers. According to Table 2, the bacuri pulp analyzed had 27.27% of carbohydrates. When compared with other fruits from Cerrado, such as the bocaiuva pulp (22.1%), genipapo (22.1%) and pequi (1.78%), the value was higher (Ramos *et al.,* 2008; Pacheco *et al.,* 2014; Ribeiro, 2011). The lipid value of the bacuri pulp in this study was lower than that of the bocaiuva pulp (8.14%) and pequi (33.4%), and higher than the genip apopulp (0.00%) (Ramos *et al.,* 2008; Ribeiro, 2011; Pacheco *et al.,* 2014). The moisture of bacuri pulp was higher than the bocaiuva (52.99%) and the pequi (54.24%), and lower than the genipapo pulp (70%) (Ramos *et al.,* 2008; Pacheco *et al.,* 2014; Ribeiro, 2011). According to Kopper (2009), bocaiuva flour presents 35.75% of carbohydrates in its composition, i.e., lower than the bacuri flour. In relation to moisture, bacuri presented a value lower than the bocaiuva flour (9.85%). It is noteworthy that a moisture content of 7.51% is within the maximum value range as stipulated by the ANVISA (2005), i.e., 15.0% (15 g/100 g). Flours with a moisture content above 14% allow the development of microorganisms and decrease flour stability (Table 2). The greater the water activity, the lower the validity (Sgarbieri, 2004).

During fruit pulping, it was verified that they were very fibrous, which was confirmed by the analysis of total fibers, as fruits presented 16.87 g in 100 g of flour and 7.86 g in 100 g of pulp, considered high in fibers (Brasil, 2012). Foods with high fiber contents are best suited for pre-workout meals. They include oats, breads, cereal bars and whole grains. Such foods make the practitioner more disposed during training, which delays fatigue and exhaustion (Moura et al., 2007). Table 3 shows the means of centesimal composition analyses of the three cereal bar flour formulations based on bacuri flour. The bars presented lipids within the range 2.55%-5.24%, supplied mainly by bacuri flour and lecithin. Total carbohydrates within the range 67.47%-68.41% were provided mainly by honey, oats, rice flakes and bacuri flour. We found that the protein content of the bars significantly decreased ($p=0.007$) with the addition of bacuri flour to the formulations, with an opposite effect on ash content ($p = 0.001$) and lipid content ($p = 0.022$). The formulations produced using bacuri flour were superior in relation to protein and carbohydrate and inferior in relation to lipids when compared to the cereal bar with 5% of dry jenipapo (0.05% of protein, 59.61% of carbohydrates and 4.27% of lipids) and the cereal bar with bocaiuva pulp and almonds (7.69% of protein, 52.92% of carbohydrates and 12.31% of lipids) (Torres, 2009; Munhoz, 2013). Regarding ash content, the formulations of this study obtained 1.26-1.60%. The values were close between cereal bars with dry murici raisins and dry banana, presenting 1.15%-1.38% (Guimarães, 2009). The protein value of the bars developed had an average of 10.42%, higher than those observed for cereal bars using dry banana and dry murici, which presented an average of 7.35% (Guimarães, 2009). The values described for protein contents by Gutkoski *et al.* (2007), from 9.7% to 12.3% in oat-based cereal bars, and by Lima *et al.* (2010), from 10.2 to 11.2% in cereal bars with baru pulp and almond, presented values close to the bars produced using bacuri flour. In the study conducted by Silva (2012), cereal bars developed with 12.5% and 25% of pumpkin seed meal presented a lower content of carbohydrates (63.34% and 52.29%) in relation to the bacuri flour bars as elaborated in this study. Table 4 shows the energetic and macronutrient value of the formulations developed compared to a commercial honey bar in a 30-g portion. According to Table 4, the formulation F3 closely resembled the commercial cereal bar. By containing whey protein in the formulations, the cereal bars had up to 1.8 times more protein when compared to commercial bars, in addition to a vegetable protein source. As bacuri flour is a source of fatty acids, the lipid contents increased according to flour concentration. However, in all formulations, the contents were lower than those found for commercial bars. In addition, commercial cereal bars have glucose syrup, colorants, preservatives, trans fat and stabilizers in their composition and the formulations produced in this study do not contain any of such compounds. According to Santos (2010), bars developed using green banana flour have values for energy (45 Kcal), protein (1.26 g) and lipid (0.35%) in 25-g portions lower than bars produced using bacuri flour.

Determination of vitamin C: According to the nutritional recommendations advocated by DRIs, the amount of vitamin C that men and women need daily is 90 and 75 mg, respectively. In this context, the bacuri pulp flour presented 262.04 mg/100 g of this vitamin and the pulp 82.61 mg/100 g.

Table 1. Formulations of cereal bars with different concentrations of bacuri pulp flour

Ingredients	F1 (%)	F2 (%)	F3 (%)
Dry phase	**0**		
*Bacuri Flour		10	20
Whey protein	12	10	10
Wheat flakes	18	10	10
Rice flakes	25	20	20
Brazil nut	3	3	3
Chia	2	2	2
Binding phase			
Brown sugar	7	5	5
Honey	30	35	25
Lecithin	3	5	5
Total (g), except water	100	100	100

*Bacteria meal was added into the formulations until 10% and 20% of the formulation.
10 mL of water were added to each formulation to improve texture due to whey protein and bacuri flour

Table 2. Centesimal composition of bacuri flour and pulp

Components (g/100 g¹)	Pulp		Pulp flour		p-alue*
	WB	DB	WB	DB	
Moisture	56.90 ± 0.01	-	7.51± 0.01	-	0.0001
Ash	1.25± 0.03	2.9	3.14± 0.02	3.40	0.0001
Lipid	5.97± 0.30	13.85	11.83±0.14	12.79	0.0001
Protein (N x F)[1]	0.75± 0.20	1.74	2.38± 0.07	2.57	0.008
Total fibers	7.86±1.30	18.24	16.87±2.79	18.23	0.0001
Carbohydrate²	27.27	63.27	58.28	63.01	

Mean values of determinations in triplicate ± standard deviation. WB: wet basis; DB: dry basis. [1]F: pulp and flour = 6.25. [2]Calculated by difference = 100 - (protein + lipids + ash + moisture + fibers). *ANOVA one-way variance test.

Table 3. Centesimal composition of cereal bar formulations using different concentrations of bacuri flour on a wet basis

Components (g/100 g¹)	F1	F2	F3	p-value*
Moisture	17.04±0.14[a]	13.64±0.60[b]	15.46±0.68[a]	0.006
Ash	1.25±0.15[c]	1.48±0.02[b]	1.60±0.02[a]	0.001
Lipid	2.56±0.92[b]	3.29±1.10[ab]	5.24±0.40[a]	0.022
Protein (N x F)[1]	11.66±0.62[a]	10.32±0.74[ab]	9.29±0.22[b]	0.007
Carbohydrate²	67.47	68.26	68.41	
Caloric value (kcal/100 g)	339.56	343.93	357.96	

Mean values of determinations in triplicate ± standard deviation. [1]F: pulp and flour = 6.25. [2]Calculated by difference = 100 - (moisture + ash + lipids + protein). *ANOVA one-way variance test. Means followed by the same letters on the same row do not differ by post-hoc Tukey test at 5% probability.

Table 4. Nutritional comparison of cereal bar formulations using bacuri flour and a commercial honey-based bar

Components	Quantity in 30 g** (1 unit)			
	F1	F2	F3	Commercial Bar*
Energy value (Kcal)	101.87	103.18	107.39	108
Carbohydrates (g)	20.24	20.48	20.52	21.6
Proteins (g)	3.49	3.10	2.79	1.92
Lipids (g)	0.77	0.99	1.57	2.7

*Ritter® honey-based commercial bar. **Portion of 30 g according to the RDC no. 359 of December 23, 2003.

Table 5. Determination of vitamin C in bacuri pulp and flour, and cereal bar formulations and the respective percentage of recommendation for adults, according to DRIs

Samples		% of DRI Vitamin C	
	Vit. C	Men	Women
Pulp (mg/100 g)*	82.61±0.42	91.8	110
Flour (mg/100 g)*	262.04±0.92	291.2	349.4
F1 (mg/30 g)**	0.38±0.00	0.42	0.51
F2 (mg/30 g)**	0.64±0.00	0.71	0.85
F3 (mg/30 g)**	1.01±0.01	1.13	1.35

* Determination performed in duplicate. Mean ± standard deviation.
** Portion of 30 g according to the RDC no. 359 of December 23, 2003.

Table 6. Results of microbiological analysis of formulations of cereal bars

Formulations	*Bacillus cereus* (MPN/g)	Coliforms at 45ºC (MPN/g)	Salmonella sp. (absence/25 g)
F1	<1.0x10¹	<1.0x10¹	Absence
F2	<1.0x10¹	<1.0x10¹	Absence
F3	<1.0x10¹	<1.0x10¹	Absence
ANVISA*	5 x 10²	5 x 10	Absence

*Resolution RDC no. 12 of January 2001 (BRASIL, 2001).

Table 7. Profile characterization of sport practitioner tasters

Questions	Total number of testers (n=107)	
	n	%
Gender		
Male	83	77.57
Female	24	22.43
Consumption of cereal bars		
Yes	64	59.80
No	43	40.20
Knowledge about the fruit		
Yes	27	25.20
No	80	74.8
Modality of physical activity		
Cycling	1	9
Running	29	27.1
Racing and soccer	5	4.7
Judo	1	9
Bodybuilding	54	50.5
Bodybuilding and soccer	1	9
Swimming and running	1	9
Soccer	15	14
Frequency of physical activity		
Up to 3 times/week	15	14
4-5 times/week	47	43.9
Daily	43	40.2
Not applicable	2	1.9

Table 8. Means of affective sensory acceptance, intention to buy and acceptability indexes for standard cereal bar formulations (F1, F2 and F3)

Formulations/ Attributes	F1 Mean± SD	F2 Mean± SD	F3 Mean± SD	p-value*
Appearance	6.17 ± 2.16^{b}	7.35 ± 1.38^{a}	6.83 ± 1.94^{a}	<0.0001
AI (%)	68.5	81.66	70.8	
Texture	6.24 ± 1.95^{b}	7.46 ± 1.44^{a}	6.67 ± 1.81^{b}	<0.0001
AI (%)	69.3	82.8	74.1	
Aroma	6.64 ± 1.70^{ab}	7.18 ± 1.55^{a}	6.52 ± 1.84^{b}	0.012
AI (%)	73.7	79.7	72.4	
Flavor	6.64 ± 2.07^{b}	7.55 ± 1.63^{a}	6.36 ± 2.16^{b}	<0.0001
AI (%)	73.7	83.9	70.7	
Color	6.08 ± 2.32^{b}	7.13 ± 1.64^{a}	6.74 ± 1.89^{a}	0.001
AI (%)	67.6	79.2	74.9	
Sweetness	6.66 ± 2.2^{b}	7.41 ± 1.85^{a}	6.55 ± 2.2^{b}	0.006
AI (%)	74	82.3	72.8	
Global Acceptance	6.66 ± 1.85^{b}	7.40 ± 1.35^{a}	6.40 ± 1.98^{b}	<0.0001
AI (%)	74	82.2	71.1	
Intention to buy	3.89 ± 1.54^{ab}	4.31 ± 0.92^{a}	3.64 ± 1.41^{b}	0.001
AI (%)	77.8	86.2	72.8	

SD: Standard Deviation; F1: Standard; F2: 10% bacuri flour; F3: 20% bacuri flour; AI: Acceptability Index. ANOVA one-way variance test. Means followed by the same letters on the same row do not differ by post-hoc Tukey test at 5% probability.

According to Table 5, vitamin C values in pulp meet the daily needs at 91.8% and 110% for men and women, respectively. The bacuri flour exceeds the daily recommendations by 291.2% and 349.4%, because it contains more of this vitamin. It can be observed that vitamin C values in the formulations developed presented a considerable variation from the formulation F1 to the F3 due to the addition of bacuri flour. However, we observed a decrease in this vitamin when compared to the flour. This could have occurred due to processing. According to Correia *et al.* (2008), one of the vitamins most sensitive to industrial processing is vitamin C. Food processing causes changes and interactions among food constituents that may affect their chemical properties and, consequently, nutrient stability, causing losses (Correia et al., 2008). According to a study conducted by Lopes *et al.* (2015), mangaba may be considered a source of vitamin C (52.36 mg/100 g). However, when compared to the bacuri pulp, it has a lower value. Other Cerrado fruits, as shown by Cardoso (2011), such as araticum (5.23 mg/100 g), cagaita (34.11 mg/100 g) and jatobá (8.91 mg/100 g), besides not being considered sources of this vitamin, presented values lower than the bacuri pulp (Table 5). The amount of vitamin C in the jenipapo pulp was 22.5 mg/100 g, lower than that of the bacuri pulp, whereas the pequi pulp (91.89 mg/100 g) presented a higher value, according to Pacheco *et al.* (2014) and Rodrigues *et al.* (2007). Bacuri flour presented higher values of this vitamin compared to pumpkin seed meal (5.6 mg/100 g) and graviola residue meal (84 mg/100 g) (Silva, 2012; Souza, 2015). In a cereal bar with 12.5% of acerola bagasse flour, the amount of vitamin C found in 30 g of formulation was 0.33 mg, lower than the formulations using bacuri flour of this study (Marques, 2013). Therefore, both can be used as alternative sources of vitamin C to enrich preparations, adding antioxidant potential and serving as a strategy to reduce the oxidative stress caused by physical exercise (Padovani, 2006).

Microbiological analysis: The result of the microbiological analysis was satisfactory and negative for pathogenic microorganisms, as presented in Table 6. Considering the need for a constant improvement of sanitary control actions in the food sector and aiming to protect the health of the population, microbiological analyses become important to offer the public foods free of pathogenic microorganisms (Brasil, 2001).

Sensory analysis: Table 7 shows the characterization of the profile of sport practitioner tasters, evidencing that 77.57% of the total sample size were males and 22.43% females, and more than half consumed cereal bars. The bacuri fruit was unknown to 74.8% of the individuals, which evidences the importance of new studies to disseminate its nutritional potential and applicability to several types of products. Cereal bars meet the needs of healthy eating consumers, such as sport practitioners and athletes, since they are energy sources containing vitamins, minerals and fibers and are considered ideal as pre- or post-workout snacks (Costa *et al.,* 2016). Degáspari *et al.* (2008) discussed the nutritional profile of the consumer of cereal bars, where 232 people were interviewed, 148 were consumers of cereal bars. Most interviewees consumed cereal bars because they considered them a healthy and practical product. Table 8 shows the means and the acceptability index of the attributes evaluated by affective sensory acceptance and intention to buy.

According to Table 8, the formulation F2 (10% bacuri flour) obtained a greater acceptability for the attributes appearance and color, but it did not differ significantly from F3 (20% bacuri flour). Regarding the attributes aroma and intention to buy, the F3 formulation was significantly lower than the F1 (standard) and F2 samples, which did not differ. Regarding texture, flavor, sweetness and overall acceptance, the F2 formulation was significantly superior to the others, and there was no significant difference between the formulations F1 and F3. Regarding the overall acceptance of the cereal bars, the acceptability index ranged from 6.4 to 7.4. Higher values were found by Munhoz (2013) for cereal bars using bocaiuva flour (the score varied between 7.28 and 7.92 for global acceptance) and by Scharammel and Ribeiro (2014) for cereal bars using açaí and cupuaçu (the values obtained were between 7.22 and 7.38). Regarding intention to buy, Furtado (2011) obtained values between 4 and 4.35 in a study on bars using mixed dehydrated fruits, values which were close to the formulations F1 and F2. Gutkoski *et al.* (2007), prepared oat-based cereal bars with a high dietary fiber content, and the values reported were 3.30-4.47 for intention to buy, i.e., values close to the cereal bars prepared here. Such results indicate that the cereal bar F2 (10% bacuri flour) was the most accepted among tasters, but the F1 (without addition of bacuri flour) and the F3 (20% bacuri flour) showed no significant differences. According to Dutcosky (2011), a sample is considered well accepted when it presents an Acceptance Index (AI) greater than or equal to 70%. The addition of bacuri flour did not change the acceptability index of cereal bars since all formulations presented an AI above 70% for all attributes.

CONCLUSION

Cereal bars made with 10% and 20% bacuri flour have all the requirements to characterize them as a compensating food for physical activity practitioners and/or athletes. They are sources of carbohydrates, protein with a high biological value, fibers, antioxidants and good caloric content. Therefore, they may be consumed before or after sports to partially meet the immediate requirements for calories and nutrients. The search for foods produced by more sustainable production systems, such as Cerrado fruits, is a tendency that has been strengthening and consolidating worldwide. New studies are needed on the use of raw materials obtained from regional ingredients, contributing to new studies in the area, generating innovation and nutritionally benefiting consumers' health.

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