SEVEN
publicações acadêmicas

Manufacturing process and acceptability research of special shaped bread with partial replacement of wheat flour by green banana flour in a small bakery

Mylena Lillyan Alves da Costa[1], Mauricio Johnny Loos[2].

ABSTRACT
By definition, bread is the product obtained by cooking, under technologically appropriate conditions, a dough, fermented or not, prepared with wheat flour and/or other flours that naturally contain gluten-forming proteins or added to them and water, and may contain other ingredients. Whole wheat bread, on the other hand, is defined as a product prepared with wheat flour and whole wheat flour and/or wheat fiber and/or wheat bran (BRASIL, 2000).

Keywords: Sliced bread, Wheat flour, Green banana flour, Bakery.

INTRODUCTION

By definition, bread is the product obtained by cooking, under technologically appropriate conditions, a dough, fermented or not, prepared with wheat flour and/or other flours that naturally contain gluten-forming proteins or added to them and water, and may contain other ingredients. Whole wheat bread, on the other hand, is defined as a product prepared with wheat flour and whole wheat flour and/or wheat fiber and/or wheat bran (BRASIL, 2000).

Bananas are one of the most consumed fruits in the world, being produced in most tropical countries (SOUSA et al., 2003), and represent the fourth source of energy after corn, rice and wheat.

When green, banana pulp has no flavor. It is a pasta with a high starch content and low content of sugars and aromatic compounds. Kayisu and Hood (1981) showed that green bananas have resistant starch (RA), defined as the sum of starch and starch degradation products that resist digestion in the small intestine of healthy individuals (ASP, 1992), although it can be fermented in the large intestine by the microflora present (ENGLYST and MACFARLANE, 1986; GEE, JOHNSON and LUND, 1992) and, presenting behavior similar to that of dietary fiber.

According to Nugent (2005), the physiological effects of RA are partially comparable to those of dietary fiber. Upon reaching the colon, the starch, which has not yet been digested, is used as a fermentation substrate by anaerobic bacteria for the production of short-chain fatty acids (SCFAs).

[1] FBUni – Farias Brito University Center - CE
Email: mylenalillyan@gmail.com
[2] FBUni – Farias Brito University Center - CE
E-mail: mauricioloos@hotmail.com

An alternative that has been gaining ground since the beginning of the 1970s consists of the use of certain fruits as raw material for the production of some foods that can be included in human consumption, such as banana pulp flour. This is, without a doubt, a plausible and concrete proposal, since this waste represents an extraordinary source of materials considered strategic for some Brazilian industries (OLIVEIRA et al., 2002).

With regard to eating habits, the low intake of fiber, vitamins and minerals is a constant in the population due to the low consumption of fresh vegetables. In an attempt to increase the consumption of these nutrients, several alternatives have been proposed, among them the production of new food items that may have a higher nutritional value than the original food, but that are, at the same time, accessible to the economically less favored classes. An alternative to this problem is the use of new ingredients that can act by increasing the nutritional value of traditional foods (VORAGEN, 1995).

In view of the growth in the supply of products in the bakery industry in Brazil, it is very important for companies in this field to develop new products, as this makes them more competitive in the market. One of the objectives of the PDP in companies is to correctly meet the needs of consumers at a low cost, which helps to ensure the survival of companies in an increasingly competitive market (ROZENFELD et al., 2005).

OBJECTIVE

The present work aimed to describe the Product Development Process (PDP) in a small bakery located on the outskirts of the city of Fortaleza. To this end, develop a product with high nutritional value, based on green banana flour; In addition, evaluate its acceptance with potential consumers, with the help of sensory tests. To fulfill its objectives, the work establishes the materials and methods, followed by the results and discussions, and finally its conclusions.

METHODOLOGY

This study was carried out through the development of bread formulations containing a partial replacement of wheat flour by green banana flour at levels of 5%, 10% and 20%, targeting people who seek to reduce sugar intake in their diet and benefit from functional foods. The breads were sensorially evaluated by 60 tasters in the following attributes: color, aroma, flavor, texture and overall impression, as well as purchase attitude and preference. Sensory tests of a nine-point Hedonic scale and purchasing attitude were applied in order to evaluate the 3 (three) samples.

DEVELOPMENT

Companies present in a competitive environment can be influenced by three forces (CLARK and FUJIMOTO, 1991). The first is due to the intense competition between many companies that seek to reduce their production costs, which allows an increase in interaction between companies, as well as their possibility of survival. On the other hand, the number of companies capable of operating in the market has also increased, making the development of new products the competitive advantage between these companies. The second force considered is that of fragmented markets that are driven by increasingly demanding customers, as the needs of consumers have become a decisive factor in the process of developing new products. The third force is the diversification of technology for the development of new products in several areas, especially in the area of new foods, expanding the options so that companies can meet the needs of new markets.

The objectives for the PDP belong to three basic categories: financial objectives, ensuring large financial returns; strategic objectives, which can be both offensive and defensive, keeping the company competitive in the market; tactical objectives, direct the company to achieve its goals (FULLER, 1994).

For the PDP in the food industry, the process is divided into three phases, namely: Pre-development, Development and Post-development (ZUIN and ALLIPRANDINI, 2006). In the first phase, Pre-development, the strategic objectives were defined, monitoring the needs of the consumer market, elaboration of the set of ideas for a new product and the elaboration of the product and packaging concepts.

In the Development phase, the product is implemented, following all the following steps:

RAW MATERIAL

The following ingredients were used to prepare the loaf breads: wheat flour, green banana flour, brown sugar, salt, powdered milk, additive and water, which were purchased in the shopping center of Fortaleza.

BREAD PROCESSING

The process of obtaining the breads was carried out in the small bakery located on the outskirts of the city of Fortaleza, state of Ceará. The following utensils were used for processing: plastic containers for weighing the ingredients, polyethylene spoons, commercial scales, stainless steel molds and wood-fired oven.

The formulations were developed by modifications of the standard formulation, as shown in Table 1, for loaf breads, used in the bakery where the breads were produced.

Table 1 – Basic formulation of breads.

Ingredients	Quantities
Wheat flour	500 g
Water	250 ml
Caster sugar	25 g
Milk powder	5 g
Salt	5 g
Additive	1.3 g

Source: The authors.

From the formulation presented, three loaves of bread were prepared, with partial replacement of wheat flour by green banana flour (FBV) in three different concentrations: 5% (sample A), 10% (sample B) and 20% (sample C), as shown in table 2.

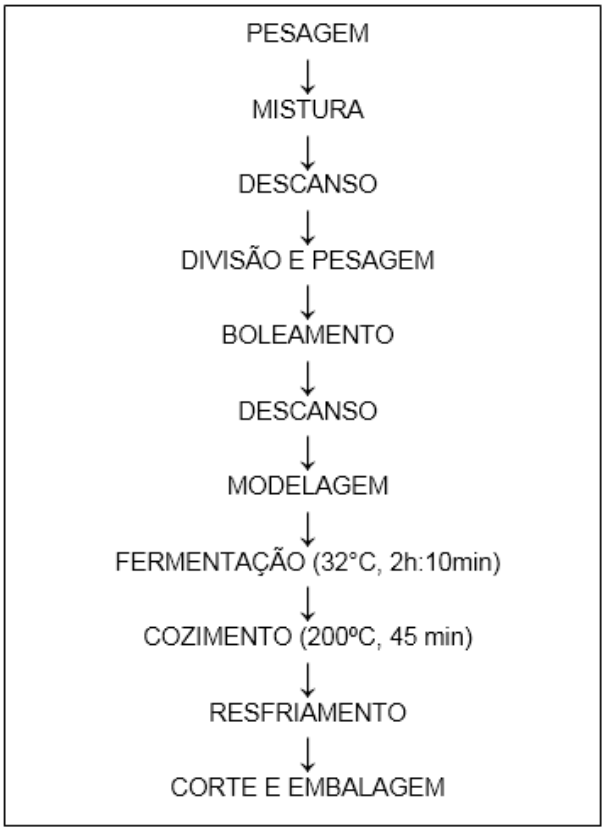
Table 2 – Formulations developed for the preparation of loaf breads.

Ingredient	Standard F 5 (5% FBV) F 10 (10% FBV) F 20 (20% FBV)			
Wheat flour	500 g	475 g	450 g	400 g
Green banana flour	0	25 g	50 g	100 g
Water	250 ml	250 ml	250 ml	250 ml
Caster sugar	80 g	0	0	0
Brown sugar	0	80 g	80 g	80 g
Milk powder	5 g	5 g	5 g	5 g
Will	5 g	5 g	5 g	5 g
Additive	1.3 g	1.3 g	1.3 g	1.3 g

Source: The authors.

The processing of the loaves occurred as described in figure 1.

Figure 1 – Flowchart of the processing of loaf breads.



Source: The authors.

In the last phase, the set of studies that took place before the product was finally made available to the consumer was carried out. In the internal environment, investigations were carried out regarding the conformity of the product regarding the efficient mode of the manufacturing process. In the external environment, sensory research was carried out in order to obtain information regarding the evaluation of the product's success forecast with the consumer.

SENSORY ANALYSIS

IDENTIFICATION OF SAMPLES

The three samples are:

- A = Sliced bread made with 5% green banana flour;
- B=Loaf of bread made with 10% green banana flour;
- C=Sliced bread made with 20% green banana flour.

SAMPLE PREPARATION

The samples were sent to the Sensory Analysis Laboratory of the Department of Food Technology of the Federal University of Ceará, in sealed plastic packaging and inside a plastic container, previously sanitized and capped.

The three samples of loaves of bread shown in figure 2 had their shells completely removed and cut into sizes of approximately 10g for tasting. The bread crusts were also served with an approximate size of 2cm2, for color evaluation, on paper napkins duly coded with 3 (three) random digits, following a random number suggestion table. The samples were served at room temperature.

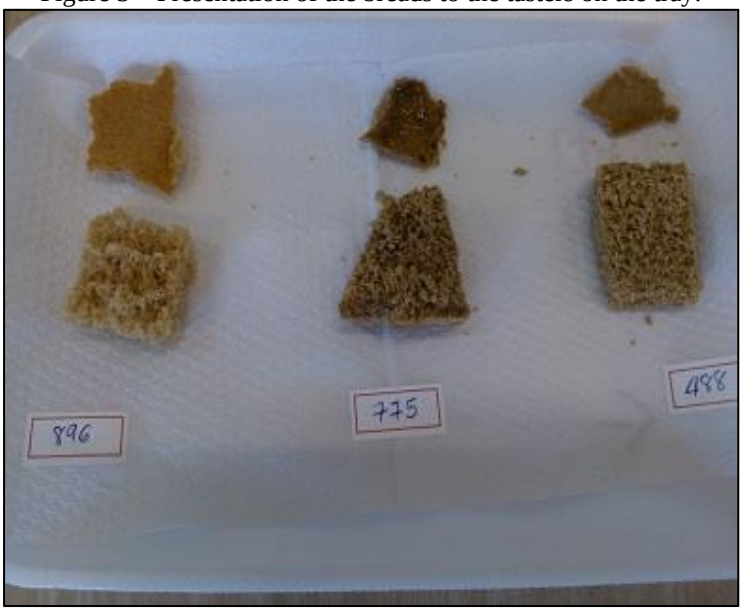
Figure 2 – Loaves of bread, samples A, B and C, respectively.

Source: The authors.

The sensory evaluations of the samples were carried out by 60 volunteer tasters without previous training, of both sexes and of different age groups.

Sixty untrained tasters evaluated the three samples of loaves of bread with the addition of green banana flour (samples A, B and C). The identification of the tasters was carried out through an initial identification form where the following were considered: gender, age, degree of liking sliced bread and frequency of consumption. The samples were presented in a randomized manner among the tasters, as shown in Figure 3. A test was applied with a nine-point Hedonic Scale (9=very much liked to 1=very disliked) and buying attitude (from 1 to "would certainly buy" to 5 to "certainly would not buy").

Figure 3 – Presentation of the breads to the tasters on the tray.



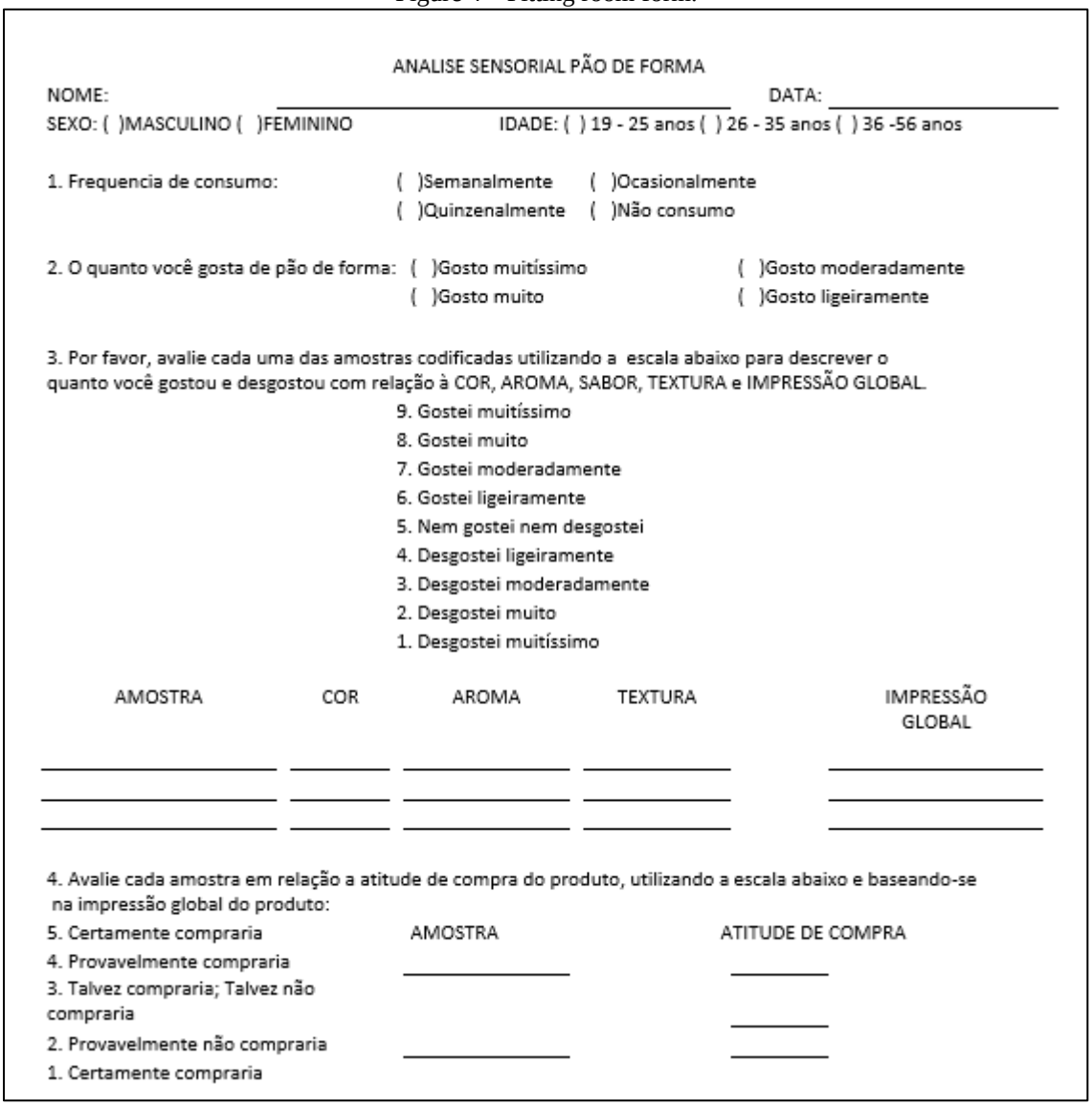
Source: The authors.

In the Hedonic Scale test presented in figure 4, i.e., the acceptance test, each sample was presented in a monadic way to the taster for evaluation. The tasters were instructed to taste only half of the sample at this first moment (so that there would be no comparison between the samples during this test). An acceptance test was performed with the three samples of wholemeal bread, in relation to the attributes aroma, flavor, color, texture and overall impression. Tests of a 9-point hedonic scale were applied, with 60 tasters, consumers of wholemeal bread.

In addition, the intention to purchase on the part of consumers was verified in relation to the three samples studied. A 5-point scale was used, where:

- 5 – I would certainly buy it;
- 4 – I would probably buy it;
- 3 – Maybe I would buy it; perhaps he would not buy;
- 2 – I probably wouldn't buy it;
- 1 – I certainly wouldn't buy it.

Figure 4 – Fitting room form.



ANALISE SENSORIAL PÃO DE FORMA

NOME: _____ DATA: _____

SEXO: ( )MASCULINO ( )FEMININO IDADE: ( ) 19 - 25 anos ( ) 26 - 35 anos ( ) 36 -56 anos

1. Frequencia de consumo: ( )Semanalmente ( )Ocasionalmente
( )Quinzenalmente ( )Não consumo

2. O quanto você gosta de pão de forma: ( )Gosto muitíssimo ( )Gosto moderadamente
( )Gosto muito ( )Gosto ligeiramente

3. Por favor, avalie cada uma das amostras codificadas utilizando a escala abaixo para descrever o quanto você gostou e desgostou com relação à COR, AROMA, SABOR, TEXTURA e IMPRESSÃO GLOBAL.

9. Gostei muitíssimo
8. Gostei muito
7. Gostei moderadamente
6. Gostei ligeiramente
5. Nem gostei nem desgostei
4. Desgostei ligeiramente
3. Desgostei moderadamente
2. Desgostei muito
1. Desgostei muitíssimo

AMOSTRA	COR	AROMA	TEXTURA	IMPRESSÃO GLOBAL

4. Avalie cada amostra em relação a atitude de compra do produto, utilizando a escala abaixo e baseando-se na impressão global do produto:

5. Certamente compraria
4. Provavelmente compraria
3. Talvez compraria; Talvez não compraria
2. Provavelmente não compraria
1. Certamente compraria

AMOSTRA	ATITUDE DE COMPRA

Source: The authors.

The results were analyzed through graphs (histograms), which will be presented below.

RESULTS AND DISCUSSION

With the results obtained for the hedonic scale test, histograms of the percentage of responses were constructed as a function of the hedonic values for each attribute.

For a product to be considered accepted, in terms of its sensory properties, it is necessary to obtain an acceptability index of at least 70%. The results of the Hedonic Scale test are presented in bar histograms. Regarding the color attribute, as shown in Figure 5, the three samples obtained different accumulated frequencies in the acceptance range (scores from 6 to 9).

Sample A in this range reached 80%; B= 48% and C= 38%, i.e., only the color of sample A obtained an index above the minimum necessary for its acceptability.

Figure 5 – Histogram of the results of the sensory analysis of special bread "prepared with the partial replacement of wheat flour by green banana flour", in relation to the frequency of the hedonic values attributed to the Color (1 = I disliked it very much, 5 = neither liked nor disliked it and 9 = I liked it very much).

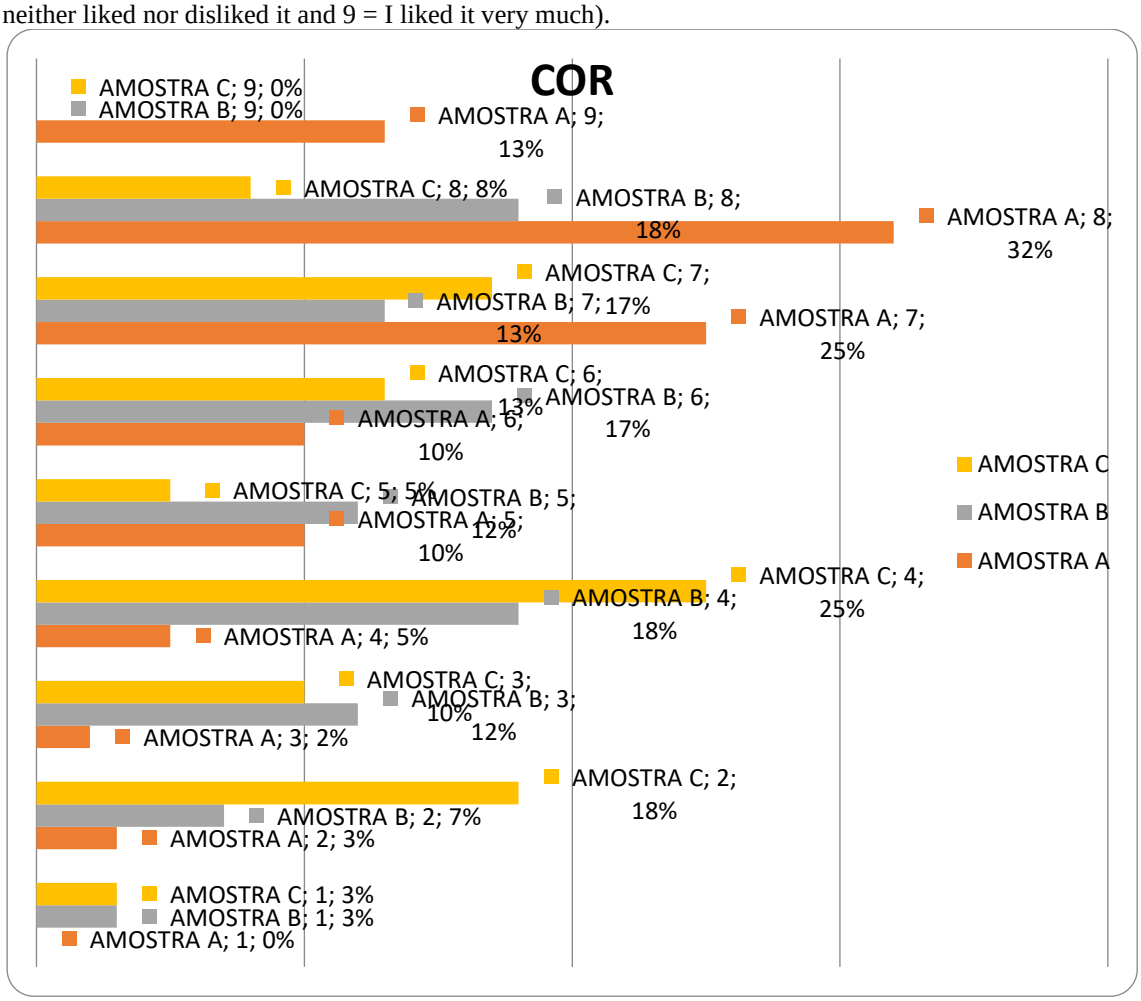


Figure 6 provides the percentage of acceptability in relation to the aroma attribute and shows that once again only sample A exceeded 70% of the acceptability index, reaching 84%, and the other samples did not reach the minimum index to be accepted, with the following percentages: 62% and 57%, respectively. Sample A had a higher percentage of scores in the range of 8 ("I liked it a lot").

Figure 6 – Histogram of the results of the sensory analysis of special bread "made with the partial replacement of wheat flour by green banana flour", in relation to the frequency of the hedonic values attributed to Aroma (1=I disliked it very much, 5=I neither liked nor disliked it and 9=I liked it very much).

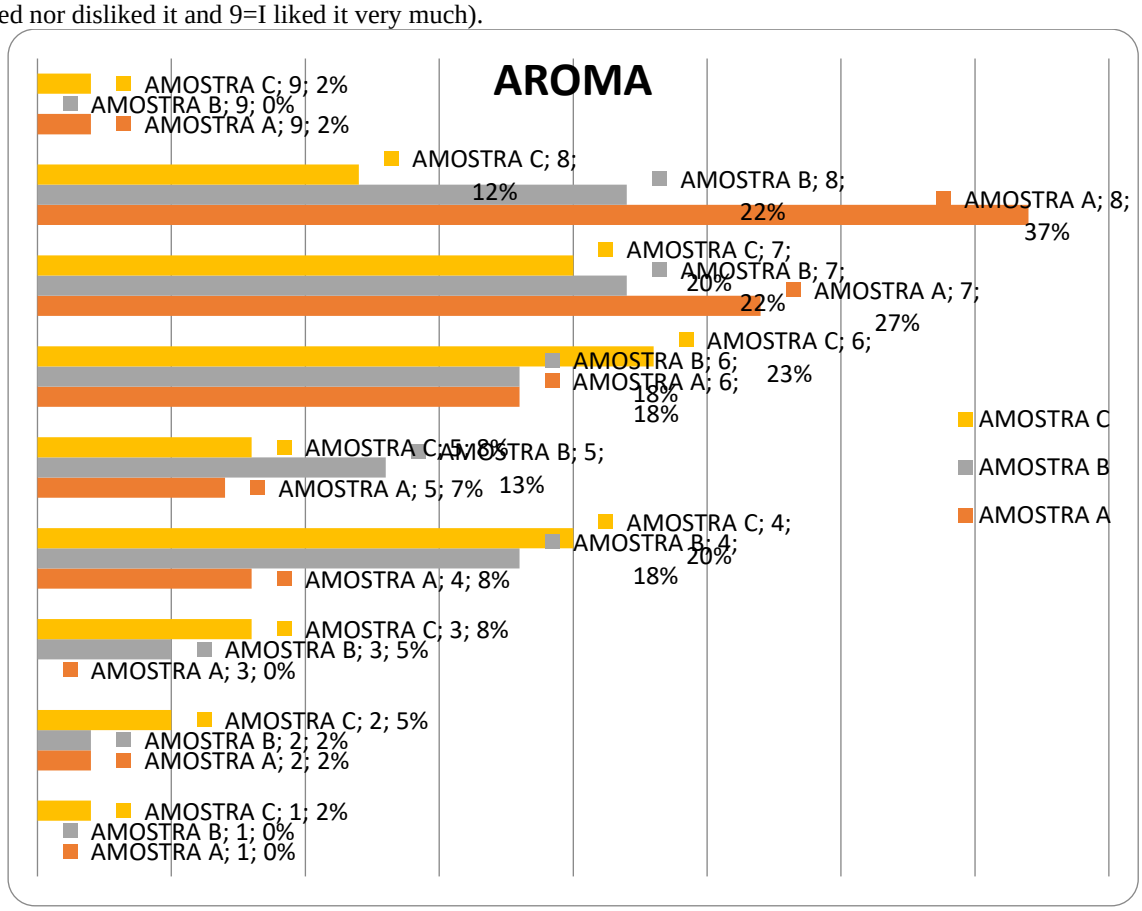


Figure 7 shows the acceptability of the samples with reference to the flavor attribute, and it was found that sample A reached 83%; B= 54% and C= 47%, where samples B and C presented lower acceptance percentages in band 8, that is, once again, only sample A reached the necessary index for its acceptability of 70%.

Figure 7 – Histogram of the results of the sensory analysis of special bread "prepared with the partial replacement of wheat flour by green banana flour", in relation to the frequency of the hedonic values attributed to Sabor (1 = I disliked it very much, 5 = neither liked nor disliked it and 9 = I liked it very much).

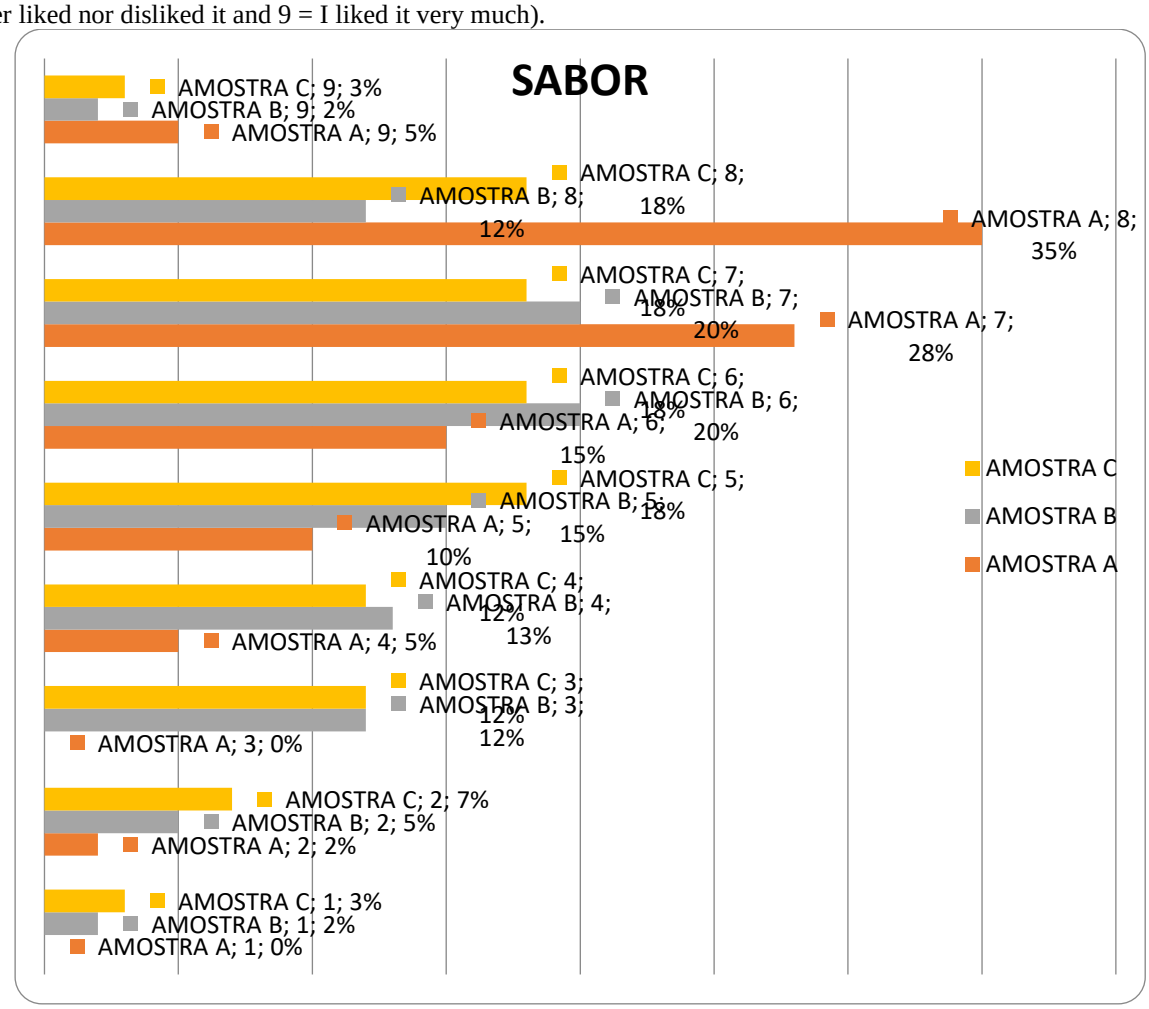


Figure 8 shows the percentage in relation to the texture attribute, and the three samples obtained the following frequencies accumulated in the acceptance range (scores from 6 to 9): sample A reached 82%; B= 40% and C= 42%, respectively. And once again, only sample A obtained an index above the minimum necessary for its acceptability.

Figure 8 – Histogram of the results of the sensory analysis of special bread "prepared with the partial replacement of wheat flour by green banana flour", in relation to the frequency of the hedonic values attributed to the Texture (1 = I disliked it very much, 5 = neither liked nor disliked it and 9 = I liked it very much).

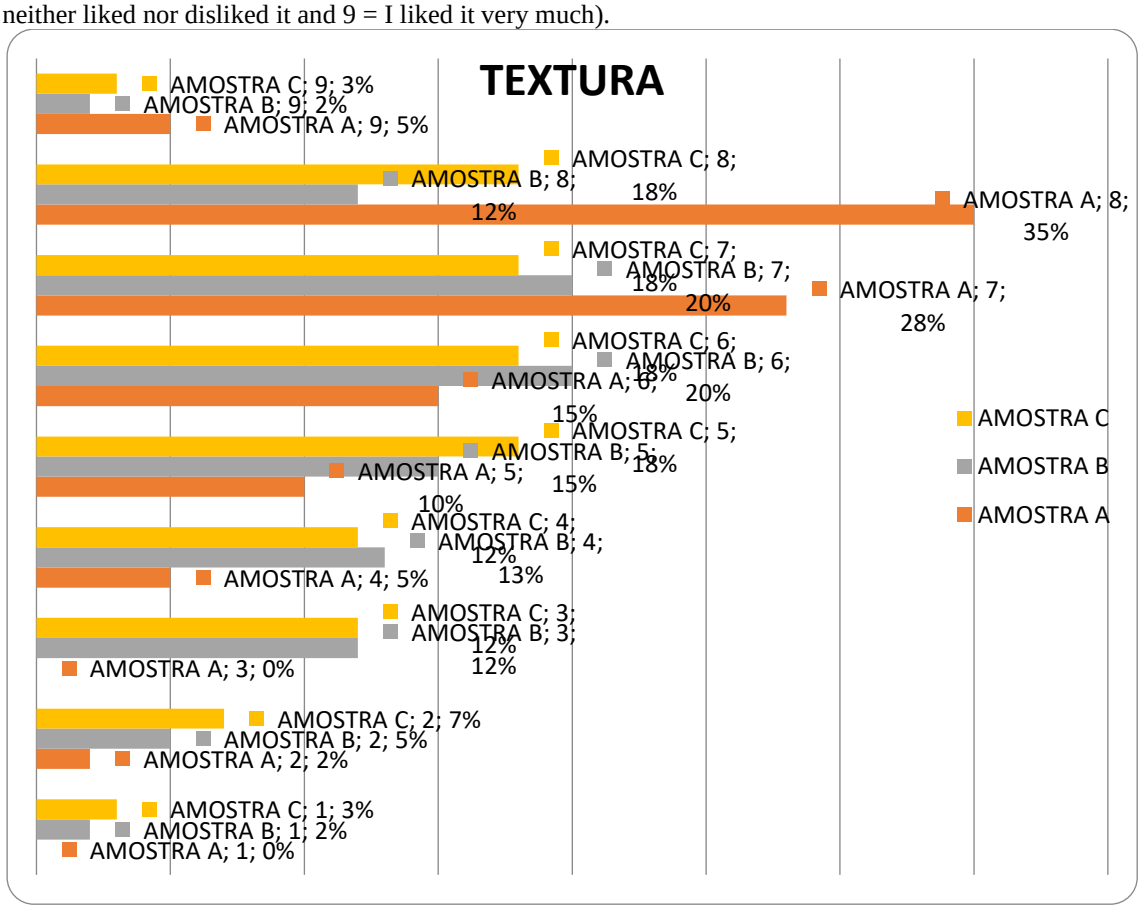
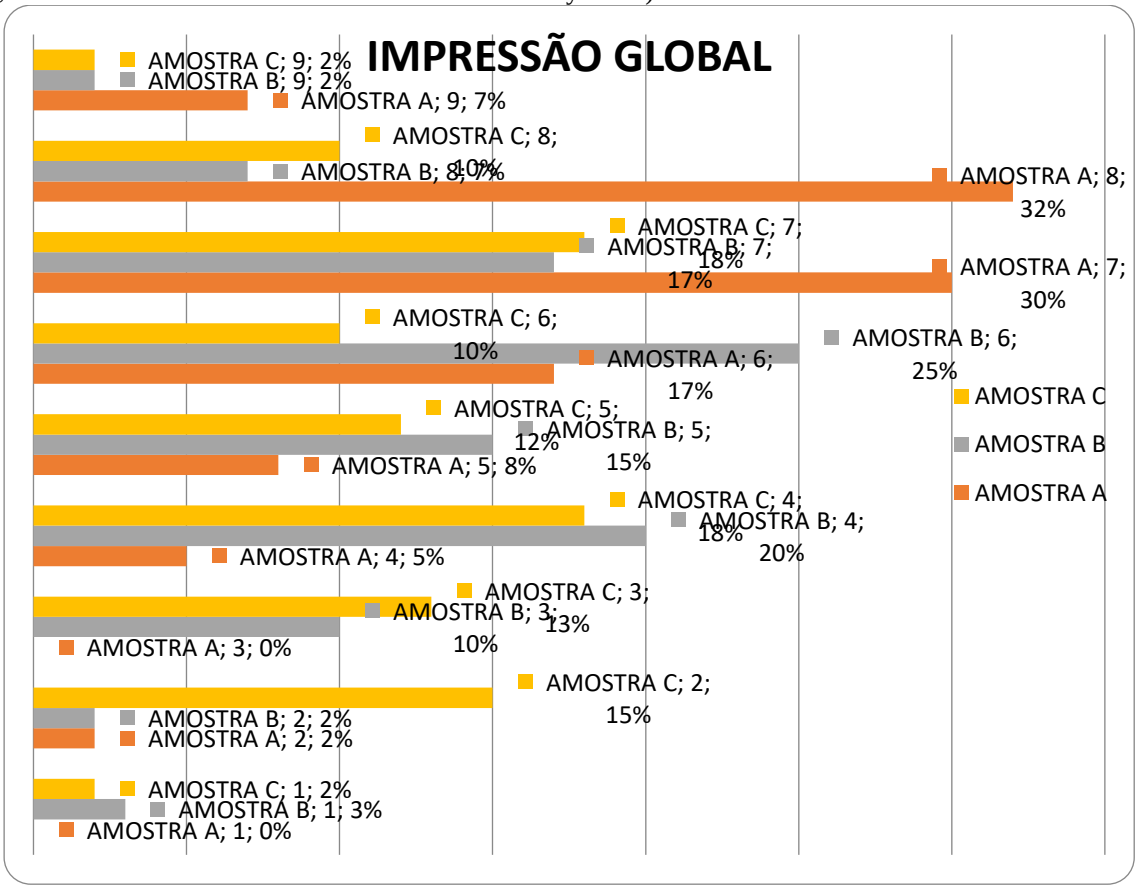


Figure 9 shows the acceptability of the samples in relation to the overall impression, where it was again verified that only sample A obtained an index above the minimum necessary for its acceptability. The indices obtained were 86%, 51% and 40%, for the global printing of the three samples, A, B and C, respectively.

Figure 9 – Histogram of the results of the sensory analysis of special bread "made with the partial replacement of wheat flour by green banana flour", in relation to the frequency of the hedonic values attributed to the Global Impression (1 = I disliked it very much, 5 = neither liked nor disliked it and 9 = I liked it very much).



According to figure 10, sample A presented a higher frequency of purchase expectation within the purchase attitude classified as "would certainly buy". It obtained more than 50% in the sum of its purchase expectation percentages.

Figure 10 – Histogram of the results of the purchase attitude related to the percentage of responses. (5-point scale, where: 5 – Would certainly buy; 4 – Would probably buy; 3 – Maybe would buy; maybe not buy; 2 – Probably wouldn't buy; 1 – Certainly wouldn't buy).

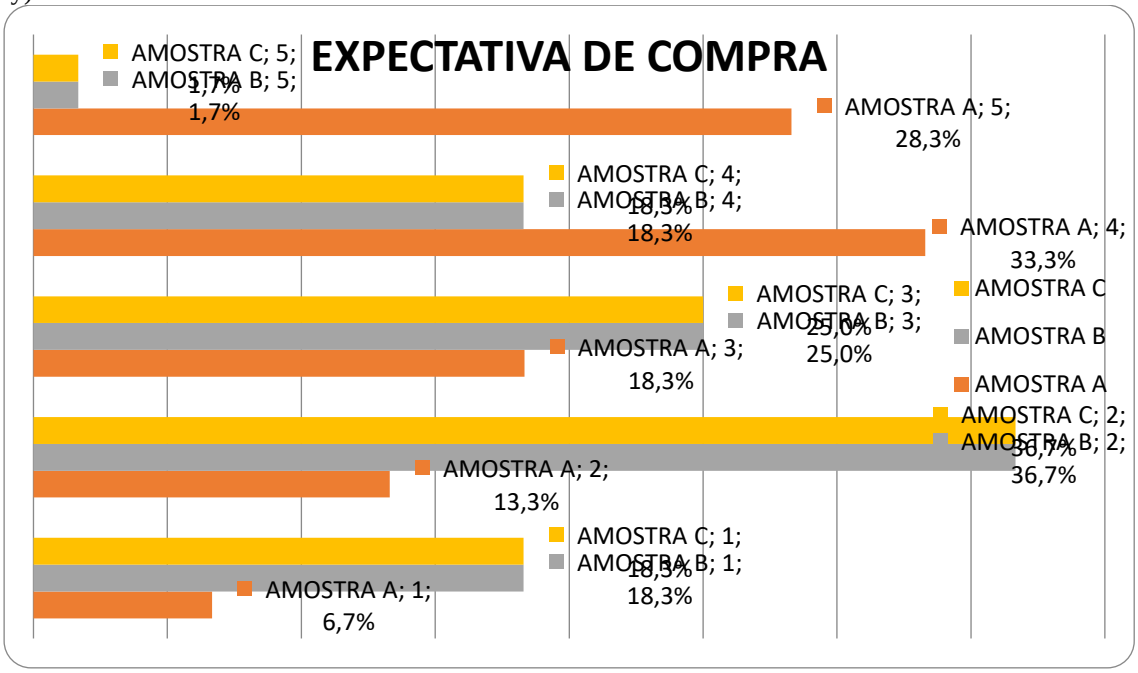


Figure 10 also shows that samples B and C showed greater doubt in relation to the purchase attitude: "maybe I would buy; maybe I wouldn't buy it." Samples B and C showed a higher rejection in relation to the purchase attitude "I would certainly not buy", both with a 36.67% rejection rate.

FINAL CONSIDERATIONS

In the company in question, the PDP proved to be quite organized, being considered simple and structured. The family-owned company is currently engaged in product development in order to launch itself into an increasingly promising, yet more competitive and globalized market for functional products.

Based on the results, it is concluded that the special shaped bread made with the replacement of wheat flour by green banana flour made with the formulation "A" can be consumed as another functional food option, because in all aspects evaluated this sample presented a good level of acceptability.

REFERENCES

Asp, N. G. (1992). Resistant starch. Proceedings from the second plenary meeting of EURESTA: European Flair Concerned Action 11, on physiological implications of the consumption of resistant starch in man. European Journal of Clinical Nutrition, 46(Suppl. 2), S1-S148.

Brasil. (2000). Portaria RDC nº 90, de 18 de outubro de 2000. Aprova regulamento técnico para fixação de identidade e qualidade do pão. Agência Nacional de Vigilância Sanitária. http://www.anvisa.gov.br/alimentos/legis/especifica/regutec.htm

Clark, K. B., & Fujimoto, T. (1991). Product development performance: Strategy, organization, and management in the world auto industry. Boston, MA: HBS Press.

Englyst, H. N., & Macfarlane, G. T. (1986). Breakdown of resistant and readily digestible starch by human gut bacteria. Journal of the Science of Food and Agriculture, 37, 699-706.

Fuller, G. W. (1994). New food product development: From concept to marketplace. Florida: CRC Press LLC.

Gee, J. M., Johnson, I. T., & Lund, E. K. (1992). Physiological properties of resistant starch. European Journal of Clinical Nutrition, 46(Suppl. 2), S125.

Kayisu, K., & Hood, L. F. (1981). Molecular structure of banana starch. Journal of Food Science, 46(6), 1894-1897.

Nugent, A. (2005). Health properties of resistant starch. Nutrition Bulletin, 30(1), 27-54. British Nutrition Foundation.

Oliveira, L. F., Nascimento, M. R. F., Borges, S. V., Ribeiro, P. C. N., & Ruback, V. R. (2002). Aproveitamento alternativo da casca do maracujá-amarelo (Passiflora edulis F. flavicarpa) para produção de doce em calda. Ciência e Tecnologia de Alimentos, 22(3), 259-262.

Rozenfeld, H., et al. (Eds.). (2005). Gestão de desenvolvimento de produtos: Uma referência para a melhoria do processo (1st ed.). São Paulo: Editora Saraiva.

Sousa, P. H. M., et al. (2003). Influência da concentração e da proporção fruto: xarope na desidratação osmótica de bananas processadas. Ciência e Tecnologia de Alimentos, 23(Supl), 126-130.

Voragen, A. G. J. (1998). Technological aspects of functional food-related carbohydrates. Trends in Food Science & Technology, 9(8), 328-335.

Zuin, L. F. S., & Alliprandi, D. H. (2006). Gestão da inovação na produção agropecuária (GIPA). In L. F. S. Zuin & T. R. Queiros (Eds.), Agronegócios: Gestão e inovação (1st ed., pp. 252-278). São Paulo: Saraiva.