DOI: 10.1590/S1413-70542015000500010

TAPIOCA AND RICE FLOUR COOKIES: TECHNOLOGICAL, NUTRITIONAL AND SENSORY PROPERTIES

Biscoito de farinhas de tapioca e de arroz: propriedades tecnológicas, nutricionais e sensoriais

Simone de Souza Montes[1], Laís Maciel Rodrigues[2], Ryzia de Cássia Vieira Cardoso[1], Geany Peruch Camilloto[2], Renato Souza Cruz[3]

ABSTRACT

Tapioca flour is derived from the starch extracted from manioc and is a widely used food product in Brazil. Rice flour is produced from grains of rice and is used in the production of bread, porridge, cakes and cookies, which are recommended for people with celiac disease. The goal of this work was to add value to the aforementioned products by developing cookies based on tapioca and rice flours. Five formulations were prepared: A 100:0, B 75:25, C 50:50, D 25:75 and E 0:100 to tapioca and rice flour respectively, with the addition of brown sugar, and analyses its technological, nutritional and sensory properties. The following physical, physicochemical and nutritional properties were analyzed: dough texture profile, cookie weight, diameter and volume, acidity, water activity, carbohydrates, lipids, proteins, dietary fiber, ash content and moisture. A sensory evaluation was held using an affective test with 90 judges and a structured nine-point hedonic scale ranging from 'like extremely' to 'dislike extremely' for the attributes scent, color, texture, taste and overall impression in addition to purchase intent. The results indicate that cookies made of tapioca and rice flours with the addition of brown sugar have technological, physicochemical and nutritional profiles within legal standards; however, the fiber contents were below recommendations. The sensory evaluation showed good acceptance of the cookies, with average scores above 7.0. This study is part of an attempt to raise further discussions regarding the production of new low-cost bakery products that are nutritionally enriched, viable and easily accessible to all, including to people with celiac disease.

Index terms: Starch; brown sugar; celiac disease.

RESUMO

A farinha de tapioca é oriunda de fécula extraída da mandioca, sendo um alimento largamente utilizado no Brasil. A farinha de arroz é produzida a partir de grãos de arroz, utilizada na elaboração de pães, mingaus, bolos e biscoitos, sendo recomendada para celíacos. O açúcar mascavo advindo do cozimento do caldo da cana-de-açúcar tem grande riqueza de ferro. O objetivo deste trabalho foi de agregar valor aos produtos supracitados, desenvolvendo biscoitos à base de farinha de tapioca e de arroz. Foram preparadas 5 formulações: A, com proporções de 100:0, B 75:25, C 50:50, D 25:75 e E 0:100 para farinha de mandioca e farinha de arroz, respectivamente adicionado de açúcar mascavo, analisando suas propriedades tecnológicas, nutricionais e sensoriais. As análises realizadas foram perfil de textura da massa, peso, diâmetro e volume, acidez, atividade de água, carboidratos, lipídios, proteínas, fibras alimentares, cinzas e umidade; avaliação sensorial através de teste afetivo com 90 julgadores, utilizando escala hedônica estruturada de nove pontos, com variação entre os termos 'gostei muitíssimo' e 'desgostei muitíssimo' para os atributos de aroma, cor, textura, sabor e impressão global, e intenção de compra. Os resultados indicaram que os biscoitos de farinhas de tapioca e de arroz adicionado de açúcar mascavo apresentou perfil tecnológico, físico-químico e nutricional dentro dos padrões legais, contudo os valores de fibra ficaram abaixo do recomendado. A avaliação sensorial correspondeu à boa aceitação do biscoito com as médias superiores a 7,0. Com este estudo, procurou-se despertar maiores discussões acerca da fabricação de novos produtos panificáveis de baixo custo, enriquecidos nutricionalmente, viáveis e de acesso fácil a todos, inclusive aos celíacos.

Termos para indexação: Fécula; açúcar mascavo; celíaco.

INTRODUCTION

In many countries, the names *cassava starch, tapioca flour* and *tapioca starch* are often mistaken as denoting tapioca flour while actually denote manioc starch (*Manihot esculenta*, Crantz), which is a different product (Milde et al., 2010; Poongodi, Vijayakumar; Boopathy, 2012; Silva et al. 2013). Tapioca flour is defined as a product obtained in granulated form manioc starch, and when subjected to the appropriate technological processing, it is found in the form of irregular, polyhedral or spherical granules (Brasil, 2005a). However, tapioca flour has several advantages for

[1]Universidade Federal da Bahia/UFBA – Faculdade de Farmácia – Departamento de Análises Bromatológicas – Salvador – BA – Brasil
[2]Universidade Estadual de Feira de Santana/UEFS – Departamento de Tecnologia/DTEC – Feira de Santana – BA – Brasil
[3]Universidade Estadual de Feira de Santana/UEFS – Departamento de Tecnologia/DTEC – Av. Transnordestina – s/n – 44036-900 – Feira de Santana – BA – Brasil – cruz.rs@gmail.com
Received in may 28, 2015 and approved in july 20, 2015

consumption because it is produced throughout most of Brazil, has a relatively low-cost production chain, is quite palatable, has a long shelf life and is used in the preparation of many foods. Rice flour (*Oryza sativa*, L.) is obtained from milling polished or whole rice and contains large amounts of starch and dietary fiber, which are sources of energy and important for intestinal maintenance, respectively. Tapioca and rice flours do not contain gluten and, when used together, can boost the production of bakery products, such as gluten-free cookies, that are recommended for individuals with celiac disease. Cereda (2002) states that starch can be added to cookies to standardize the gluten content of the flour in a proportion of 15 to 20% of the weight of wheat flour. This process does not cause technological problems or alter the appearance or other fundamental characteristics of the cookies. In general, cookies made with mixed flour—such as the tapioca and rice flour mixture in this study are better accepted by the public because they taste better and are lighter than conventional cookies. The nutritional value of tapioca can be boosted by adding brown sugar and rice flour during cookie production, which may make the cookies nutritionally richer in addition to providing an easily accessible and long-lasting product. At the same time, by boosting the nutritional value of these products, the identity, economy and culture of Brazilians are strengthened. In addition to the nutritional improvement, taking into consideration the addition of iron from the brown sugar, the present study aims to contribute to increase the availability of gluten-free products. People with gluten intolerance, called celiac disease, number 25 million worldwide which justifies research into alternatives to replace wheat in bakery products.

MATERIAL AND METHODS

The experimental design was random with a mixture of two factors (tapioca and rice flours), with five replicates for each analysis and three repetitions. The formulations and physical analysis of the cookies were performed in the Food Technology Laboratories of the State University of Feira de Santana (Universidade Estadual de Feira de Santana – UEFS), Bahia, Brazil. The protein analysis was conducted in the Bromatology Laboratory of the State University of Bahia (Universidade do Estado da Bahia - UNEB), Bahia, and a dietary fiber analysis was conducted at the Federal University of Viçosa (Universidade Federal de Viçosa - UFV), Minas Gerais, Brazil.

Technological development of the cookies

The ingredients for preparing the cookies were tapioca flour bought at an open-air market in the city of Salvador. Rice flour (Dular brand), brown sugar (Dular brand), eggs, vegetable shortening (margarine with 60% lipids, Deline brand) and sodium chloride were obtained from local markets of Feira de Santana city . The granulated variety of tapioca flour was chosen because it is easier to manipulate, is widely used by the population and provides the best sensory and visual qualities for cookie production. However, the influence of finer flours' grain granulometry is not a synonym of quality, and its mechanism is not fully understood (Borges et al., 2006). The tapioca flour and brown sugar were passed through a cloth sieve with 1.19 mm openings (Bertel brand). All the ingredients were weighed with a Shimadzu semi-analytical scale (except for the eggs).

The cookies formulations are show in Table 1.

Steps in the production of the tapioca and rice flour cookies

To produce the cookies, the 'creaming' method (Dendry; Dobraszczyk, 2001) was used, with the following

Table 1: Amount of each ingredient, in baker´s percentage, used to prepare the formulations.

Ingredients	Formulations (%)					
	A	B	C	D	E	CF
Wheat flour	-	-	-	-	-	100
Tapioca flour	100	75	50	25	-	-
Rice flour	-	25	50	75	100	-
Brown sugar	40	40	40	40	40	40
Vegetable shortening	35	35	35	35	35	35
Egg	18	18	18	18	18	18
Salt	0.5	0.5	0.5	0.5	0.5	0.5

steps: selecting and weighing of the ingredients, except eggs; mixing brown sugar and vegetable shortening to obtain a homogeneous cream; adding the tapioca and rice flours to obtain a homogenous dough; and then adding the eggs and kneading by hand for five minutes to obtain a firm dough. After the mixture was ready, it was stretched with a rolling pin and cut with a standard mold into 1 cm high and 4.4 cm diameter cookies. After being cut, the cookies were placed on rectangular aluminum trays and baked in an electric oven (Progas brand) at 150 ºC for 15 minutes.

Sample treatment

To conduct the technological, nutritional and sensory analyses, the baked samples were taken in significant and representative amounts, homogenized and, in some cases, crushed in a mortar with a porcelain pestle and then sieved. The samples were kept away from light and humidity and free from biological contamination.

Technological analyses

Physical analyses

The cookie physical characteristics were assessed according to the 10-50D Method (American Association Of Cereal Chemists - AACC, 2000) cited by Moraes et al. (2010). The weight was determined using a Shimadzu semianalytic digital scale, before baking, and expressed in grams. The diameter was determined using a caliper after baking and expressed in centimeters. The specific volume was calculated as the ratio between the apparent volume (determined by the method of millet seed [*Panicum miliaceum* L.] displacement) and the cookie's weight after baking; the expansion factor was calculated as the ratio between the diameter of the unbaked dough and the cookie's diameter after baking.

The texture profiles of the unbaked dough and the baked cookies were analyzed with a TA.XT.plus texturometer and the Exponent software from Stable Micro Systems. The following dough parameters were measured: hardness, adhesiveness, elasticity, cohesiveness, gumminess and chewability, according to the methodology described by Assis et al. (2009) and Moraes et al. (2010). The following parameters were measured using the baked cookies: hardness and fracturability according to Assis et al. (2009) and Moraes et al. (2010).

Physicochemical and nutritional analyses

The moisture content of the cookies was determined in a drying oven at 105 °C until a constant weight was obtained, according to the methodology of the Adolfo Lutz Institute (2004). The water activity was assessed using an AquaLab device. The titratable acidity was assessed according to the methodological guidelines of the Adolfo Lutz Institute. The ash content analysis was performed according to the American Association of Cereal Chemists (AACC) 08-01 method (2000) by burning in a muffle furnace at 600 °C. The levels of lipids were analyzed with Soxhlet extraction by the Association of Official Analytical Chemists (AOAC) method #31.4.02 (2005); proteins were analyzed using the AOAC (2005) Kjeldahl method no. 920.87, with a nitrogen-protein factor of 6.25; dietary fiber analysis was conducted using the Association Of Official Analytical - AOAC (2005) enzymatic-gravimetric method; and a carbohydrates were quantified by difference.

Sensory analysis

The sensory analysis of the cookies was conducted through affective testing using a nine-point structured hedonic scale varying between the terms 'like extremely' and 'dislike extremely' and an indication of purchase intention. The test was conducted in individual booths adequately lit for this purpose, with a set of 90 untrained judges varying between 18 and 50 years of age. Before beginning the test, the judges read and signed an informed consent form. Next, the judges were given samples in sequence, i.e., the judge evaluated and analyzed the first sample and only then was given the second sample. Both of the samples were identified by three Hindu-Arabic digits without repetition. The cookies were presented in balanced stacks, served on a disposable white plate with a glass of water for mouth rinsing before the next test. Two samples were tested, which were chosen according to the best technological profile, i.e., according to the physical and texture profile analyses.

Data analysis

The experiment was carried out three times in a completely randomized design and data were analyzed using analyses of variance (ANOVA), and the mean values were compared with Tukey's test at 5% significance using the SAS software version 9.0.

RESULTS AND DISCUSSION

Technological analyses

Physical analyses

The physical analyses should measure weight, weigtht loss, expansion factor and specific volume. Table 2 present the results of the physical analyses and show which samples had the most significant results.

Table 2: Technological assessment of tapioca and rice flour cookies.

FORMULATION	PROPERTIES		
	EF (cm)	SV (mL.g^{-1})	BDW
A	0.96±0.02b	1.37±0.05b	10.79±0.68b
B	0.98±0.02b	1.41±0.05b	11.35±0.30b
C	1.02±0.01a,b	1.78±0.09a	10.88±0.65b
D	1.03±0.03a,b	1.42±0.11b	11.43±0.50b
E	1.09±0.03a	1.79±0.05a	11.50±0.80b
CF	0.97±0.01b	0.94±0.06c	13.90±0.56a

BDW – Baked dough weight (g); Expansion factor (EF) and specific volume (SV). Mean values followed by the same letter in each column do not differ from one another based on Tukey's test ($p > 0.05$).

Regarding specific volume, the value of the control sample was smaller and very close to 1, meaning there was a balance between weight and volume. The cookies made using tapioca and rice flours had higher values than the control, indicating a smaller weight and a larger increase in volume after baking (Table 2). Assis et al. (2009), using oat flour and rice flour parboiled, found specific volumes between 0.92 and 1.76 mL.g^{-1}, similar to what was found in this study. This increase is due to the presence of more rice flour and consequently greater water absorption and expansion during the starch gelatinization that takes place in the oven. On the other hand, weight loss did not differ significantly among the formulations ($p > 0,05$). Regarding the expansion factor, sugar and vegetable shortening exert great influence because, in addition to conferring pleasant taste and texture, these ingredients favor spread and viscosity and reduce the cookies' thickness (Moraes et al. 2010.). Sample E had the lowest expansion factor and differed significantly from sample A ($p < 0.05$). This difference is due to the increased quantity of fiber in rice bran, which reduced the cookie expansion. It is possible that the greater water absorption by the fibers causes a reduction in absorption by the starch, and, as a consequence, less gelatinization. This process was also reported by Feddern et al. (2011) for cookies made from wheat bran and rice flour: the expansion factors reported in that study were between 2.11 and 3.09, respectively, and differed from the values found in this work (0.93 and 1.04, respectively). Additionally, the behavior of tapioca flour compared to rice flour, present in a larger proportion in sample A, tended to reduce the cookie expansion factor. This decrease did not occur in sample E.

Texture profile analysis

Raw dough texture profile

The texture profile of raw dough was assessed using a TA.XT Plus texturometer and the profiles for hardness, adhesiveness, cohesiveness and chewability for the raw dough are shown in Table 3 . The elasticity and gumminess profiles did not differ significantly among the formulations.

The elasticity values for cookies produced by Assis et al. (2009) also did not display significant difference ($p > 0.05$) among samples. Increasing the amount of rice flour from reduced the hardness. This pattern may be explained by the amount of fiber present in rice flour, which absorbs more water. This pattern was also observed by Assis et al. (2009), who observed that raw cookie dough containing rice flour displayed lower hardness. For adhesiveness, samples D was significantly different from CF. Regarding cohesiveness, the value for the CF was higher than those of all the other formulations because the CF contained 100% wheat flour, suggesting that the viscoelastic characteristics of gluten's protein chains may resist a second deformation relative to the behavior of a previous deformation, i.e., tensile strength is greater due to the presence of gliadin or glutenin molecules. The CF formulation was significantly different in chewability from all the other formulations exception sample A. The rice flour has a smaller amount of fiber, leaving the cookies more chewable.

Cookie texture profile

The cookies from the A, B, C, D and E formulations displayed very similar hardness values (Table 4). Whereas the hardness of the CF formulation was higher, which may be attributed to gluten's strong proteic network and the fact that the CF cookies contained only wheat flour. Alternatively, the reduction in hardness for tapioca and rice flour cookies might be associated with the product's lipid content, which grants more softness and palatability (Moraes et al*.,* 2010).

Table 3: Parameter values for hardness, adhesiveness, cohesiveness and chewability for the raw dough texture profile of tapioca and rice flour cookies.

FORMULATION	PROPERTIES			
	Hardness (N)	Adhesiveness	Cohesiveness	Chewability
A	264.71±81.60a	-25.31±12.01a,b	0.14833±0.01b,c	13.715±3.846a
B	126.36±16.38b	-33.82± 7.97a,b	0.17867±0.04b	7.720±1.662b
C	160.74±28.07a,b	-22.75± 7.87a,b	0.14800±0.03b,c	8.166±2.45b
D	119.39± 6.71b	-19.03± 5.38a	0.10833±0.01c	3.065±0.45c
E	136.40±43.82b	-27.80±10.14a,b	0.11700±0.02c	9.687±1.30b
FC	177.90±37.07a,b	-55.96±23.72b	0.29800±0.03a	24.640±4.56a

Mean values followed by the same letter in each column do not differ from one another based on Tukey's test (p > 0.05).

Table 4: Cookie hardness and fracturability parameters.

FORMULATION	PROPERTIES	
	Hardness (N)	Fracturability (mm)
A	326.80± 29.10b	0.59±0.14b
B	357.2 ± 114.16b	0.46±0.02b
C	190.35± 70.93b	6.06±3.57a
D	348.07± 95.33b	8.81±0.69a
E	73.42± 6.15b	8.25±0.46a
CF	3,070.38±1,800.33a	0.88±0.15b

Mean values followed by the same letter in each column do not differ from one another based on Tukey's test at 5% significance.

In regard to fracturability, there were significant differences among formulations: formulations A, B and CF did not significantly differ in fracturability, nor did formulations C, D and E differ from each other. However, the values of the latter formulations were higher than those for A, B and CF because, as the proportion of tapioca flour was reduced and that of rice flour was increased to 50%, 75% and 100% in C, D and E, respectively, fracturability increased. Another important aspect in regard to fracturability is the lipid content. A fat content between 30 and 38% leads to less fracturable cookies (Moraes et al*.,* 2010). In this study, the lipid content was 35%, producing softer cookies. Lower hardness values were observed in comparison to CF as well as increased cookie fracturability as the proportion of rice flour in the cookie formulations exceeded 50%. The control formulation (100% wheat flour) displayed the greatest hardness, but its fracturability was the same as those of samples A and B.

Physicochemical and nutritional analyses

The formulations B and C displayed similar results to those found in the scientific literature in terms of percentage composition (Table 5). The values for moisture (2.97 and 2.96), titratable acidity (0.18 and 0.19) and water activity (0.30 and 0.30) for samples B and C, respectively, did not vary significantly ($p<0,05$) from each other but are in accordance with the parameters recommended in the legislation (Brasil, 2005b). The low moisture contents and water activity indicate a product that inhibits microbial growth in conjunction with containing significant carbohydrate concentrations, which also make the medium inhospitable for microbial reproduction. The following results were obtained for formulations B and C, respectively: ash content (0.77 and 0.83); proteins (2.56 and 3.52); lipids (19.07 and 15.64); carbohydrates (73.77 and 76.14); and fiber (0.86 and 0.91). Regarding nutritional value, similar values for ash, proteins, lipids, carbohydrates and fiber were obtained compared to the results found by the following authors: Moraes et al. (2010) in their evaluation of cookies made with wheat flour and different sugar and fat contents; Santos et al. (2011) with cookies made from buriti flour with or without oat; Vieira et al. (2010) in the production of sweet cookies using manioc starch; Fasolin et al. (2007) with cookies made from banana flour; Rodrigues, Caliari and Asquieri (2011) with biscuits made from manioc bran; Lacerda et al. (2009) with cookies made from extruded rice bran in place of wheat flour and manioc starch; and Assis et al. (2009) with cookies made with oat and rice flour. Comparing this information, the values found in this study are compatible with those previously published. Within this context, formulations B and C contain important nutrients for human diets. Despite their low fiber content, these cookies are still nutritious because they are complete in their nutritional composition and they contain macroproteins and mineral residue (ash) in addition to the caloric load provided by the carbohydrates and lipids.

Sensory analysis

Results for the acceptability index per cookie attribute can be seen in Figure 1. The sensory evaluation was conducted only for samples B and C because these formulations showed better technological profiles during the raw and baked dough texture tests. Moreover, were the samples showed better performance in the cookies preparation. Samples B and C were significantly different ($p < 0.05$) from one another in all the studied sensory attributes. Sample B had higher acceptability means than sample C, including the flavor attribute, in which it scored 7.79. All the mean values obtained in the sensory analysis, for both the B and C samples, were between the hedonic values of 6 and 8, corresponding to 'like slightly' and 'like very much'.

For the scent, color, texture, flavor attributes and overall evaluation, the mean values of formulation B were significantly higher than those for formulation C. This predilection may be related to the sample B have more tapioca flour (75%) than sample C (50% and presentation more flavorful. Regarding purchase intention, 45.56% of the judges responded that they would most likely buy cookie B, and 43.34% indicated similar purchase intent for cookie C. However, 33.34% of the judges said they would certainly buy cookie B, and 14.45% said they would certainly buy cookie C. In addition, 20% of the judges reported that they had doubts regarding whether they would buy sample B, in comparison to 32.23% for sample C (Figure 2).

Table 5: Physicochemical evaluation of cookies made from tapioca and rice flour.

PHYSICOCHEMICAL PARAMETER (% / 100 g)	FORMULATION		
	B	C	Legal Standard
Moisture	2.97±0.06a	2.96±0.04a	Max. 14.00% (Brasil, 2005b)
Titratable Acidity	0.18±0.02a	0.19±0.00a	Max. 2.00 mL (Brasil, 2005b)
Water Activity at 24.4ºC	0.30±0.00a	0.30±0.00a	-
Ash	0.77±0.09a	0.83±0.02a	Max. 3.00% (Brasil, 2005b)
Proteins	2.56±0.08b	3.52±0.21a	-
Lipids	19.07±1.81a	15.64±0.10b	-
Carbohydrates	73.77±0.00b	76.14±0.00a	-
Fiber	0.86±0.02b	0.91±0.04a	Min. 3.00 g (Brasil, 2003)

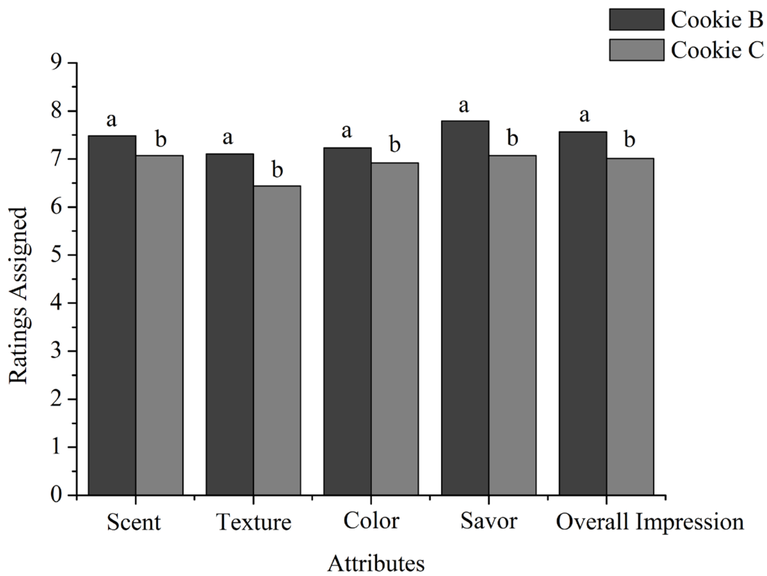

Figure 1: Sensory evaluation of samples B and C. Means of the ratings given to the sensory aspects scent, texture, color, flavor and overall impression.

Mean values followed by the same letter in each column are not different from each other based on Tukey's test (p > 0.05).

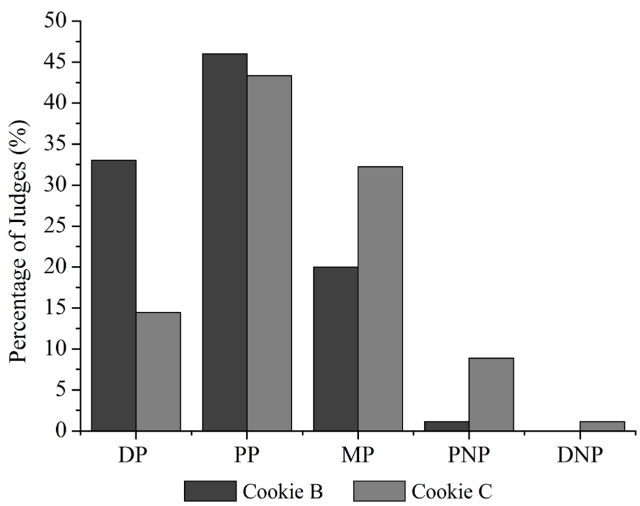

Figure 2: Purchase intent for cookies B and C. Percentage data for purchase intent based on a sample of 90 judges.

Legend: DP (Definitely Purchase); PP (Probably Purchase); MP (Maybe Purchase); PNP (Probably Not Purchase); DNP (Definitely Not Purchase).

CONCLUSIONS

The results obtained in this study indicate viability in producing cookies from tapioca and rice flours from technological, nutritional and sensory standpoints because the cookies' acceptance was satisfactory given a considerable sample (n=90). The technology involved in cookie production and subsequent commercialization does not generate a high demand for resources, time or labor. Therefore, it is noteworthy that mixed flours are a good option for manufacturing new bakery products and similar products because mixed flours do not negatively affect the partial or complete substitution of wheat flour. However, other factors may interfere in the sensory quality of the products, such as the quality of the flours, moisture contents, excess and/or scarcity or inadequate choice of the type of sugar and fat or any structural ingredient of the dough. Another evident benefit of mixed flours is that they allow people with food restrictions to eat gluten-free foods that have good sensory and nutritional quality.

REFERENCES

AOAC - ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS. **Official methods of analysis**. 18th ed. Gaithersburg, Maryland, 2005. 1298 p.

AMERICAN ASSOCIATION OF CEREAL CHEMISTS – AACC. **Approved methods of the American Association of Cereal Chemists**. 9th. Saint Paul, MN, 2000. 1200p.

ASSIS, L. M. et al. Propriedades nutricionais, tecnológicas e sensoriais de biscoitos com substituição de farinha de trigo por farinha de aveia ou farinha de arroz parboilizado. **Alimentos e Nutrição**. 20(1):15-24, 2009.

BORGES, J. T. S. et al. Utilização de farinha mista de aveia e trigo na elaboração de bolos. **Boletim do CEPPA**. 24(1):145-162, 2006.

BRASIL. Ministério da Agricultura, Pecuária e Abastecimento. Instrução Normativa nº 23, de 14 de Dezembro de 2005. Regulamento Técnico de Identidade e Qualidade dos Produtos Amiláceos Derivados da Raiz de Mandioca. **Diário Oficial [da] República Federativa do Brasil**, Brasília, DF, 2005a. 5p.

BRASIL. Ministério da Agricultura, Pecuária e Abastecimento. Instrução Normativa nº 8, de 02 de Julho de 2005. Regulamento Técnico de Identidade e Qualidade de Farinha de Trigo. **Diário Oficial [da] República Federativa do Brasil**, Brasília, DF, 2005b. 5p.

BRASIL. Ministério da Saúde. Portaria nº 27, de 13 de Janeiro de 1998. Regulamento Técnico referente à Informação Nutricional Complementar. **Diário Oficial [da] República Federativa do Brasil**, Brasília, DF, 1998. 9p.

CEREDA, M. P. **Propriedades Gerais do Amido**. São Paulo: Fundação Cargill, 2002. 221p.

DENDRY, D.A.V.; DOBRASZCZYK, B. J. **Cereal and cereal products**: chemistry and technology. Gaithersburg, Maryland: Aspen Publishers, 2001. 429p.

FASOLIN, L.H. et al. Biscoitos produzidos com farinha de banana: avaliações química, física e sensorial. **Ciência e Tecnologia de Alimentos**. 27(3):524-529, 2007.

FEDDERN, V. et al. Avaliação física e sensorial de biscoitos tipo cookie adicionados de farelo de trigo e de arroz. **Brazilian Journal of Food Technology**. 14(4):265-272, 2011.

INSTITUTO ADOLFO LUTZ. **Normas analíticas do Instituto Adolfo Lutz**. Métodos físico-químicos para análise de alimentos. 4 ed. São Paulo: 2004, 1004 p.

LACERDA, D. B. C. L. et al. Qualidade de biscoitos elaborados com farelo de arroz extrusado em substituição à farinha de trigo e fécula de mandioca. **Archivos Latinoamericanos de Nutricion**. 59(2):199-205, 2009.

MILDE, B.L. et al. Gluten-free bread based on tapioca starch: texture and sensory studies. **Food and Bioprocess Technology**. 5(3): 888-896, 2010.

MORAES, K. S. et al. Avaliação tecnológica de biscoitos tipo *cookie* com variações nos teores de lipídio e de açúcar. **Ciência e Tecnologia de Alimentos**. 30(1): 233-242, 2010.

POONGODI VIJAYAKUMAR, T.; BOOPATHY, P. Optimization of ingredients for noodle preparation using response surface methodology. **Journal of Food Science and Technology**. 47(4):870-874, 2012.

RODRIGUES, J. P. M.; CALIARI, M.; ASQUIERI, E. R. Caracterização e análise sensorial de biscoitos de polvilho elaborados com diferentes níveis de farelo de mandioca. **Ciência Rural**. 41(12), 2011.

SANTOS, C. A. et al. Elaboração de biscoito de farinha de buriti (*Mauritia Flexuosa* L. F) com e sem adição de aveia (*Avena Sativa* L.). **Revista Brasileira de Tecnologia Agroindustrial**. 5(1):262-273, 2011.

SILVA, P. A. et al. Caracterização de farinhas de tapioca produzidas no estado do Pará. **Ciência Rural**. 43(1), 2013.

VIEIRA, J. C. et al. Qualidade física e sensorial de biscoitos doces com fécula de mandioca **Ciência Rural**. 40(12), 2010.