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TECHNOLOGICAL USE OF KIWI (CV. HAYWARD) SHELL FOR ELABORATION OF COOKIE-TYPE BISCUITS

[1]Newton Carlos Santos, [1]Ênio Rafael de Medeiros Santos, [2]Sâmela Leal Barros, [3]Renata Duarte Almeida, [1]Raphael Lucas Jacinto Almeida, [4]Virgínia Mirtes de Alcântara Silva, [4]Victor Hebert de Alcântara Ribeiro, [5]Isabela Alves dos Santos, [6]Tamires dos Santos Pereira and [6]Amanda Priscila Silva Nascimento

[1]Department of Food Science and Technology, Federal Institute of Rio Grande do Norte (IFRN), Manoel Lopes Filho St, 773, 59380-000, Currais Novos, Rio Grande no Norte, Brazil

[2]Department of Agricultural Engineering, Federal Universityof Campina Grande (UFCG), Aprígio VelosoSt, 882 - Universitário, 58429-900, Campina Grande, Paraíba, Brazil

[3]Department of Food Engineering, Federal Universityof Campina Grande (UFCG), Aprígio VelosoSt, 882 - Universitário, 58429-900, Campina Grande, Paraíba, Brazil

[4]Department of Natural Resources, Federal Universityof Campina Grande (UFCG), Aprígio VelosoSt, 882 - Universitário, 58429-900, Campina Grande, Paraíba, Brazil

[5]Department of Chemical Engineering, Federal Universityof Ceará (UFCG), Aprígio VelosoSt, 882 - Universitário, 58429-900, Campina Grande, Paraíba, Brazil

[6]Department of Process Engineering, Federal Universityof Campina Grande (UFCG), Aprígio VelosoSt, 882 - Universitário, 58429-900, Campina Grande, Paraíba, Brazil

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ABSTRACT

The objective of this work was to elaborate cookie-type biscuits with the addition of kiwi shell flour (KPF), to characterize and evaluate the effect of the addition of kiwi bark flour on the physical-chemical characteristics, texture profile, physical properties and microbiological quality. Fresh and dehydrated kiwi shells (35 °C/72h) were physicochemically characterized. The biscuits were prepared in 5 formulations (0, 5, 10, 15 and 20%), using the kiwi shell meal (KPM), being determined their composition centesimal, water activity and energy value, as well as their profile texture, physical properties and microbiological quality. The drying process allowed the kiwi bark flour to be stored and used for a longer period of time; in addition, its use in the preparation of biscuits reduced the lipid content and its energetic value, and increased the protein content of the same. The formulation with 20% FCK presented greater firmness and greater fracturability. The physical parameters presented statistical differences before and after the cookie delivery. Microbiological analyzes showed that the biscuits were suitable for consumption and presented no health risks to the consumer. Therefore, the preparation of the biscuit becomes feasible to reduce expenses with food and minimize the country's environmental impacts, caused by the disposal of unconventional parts of food.

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INTRODUCTION

The development of food products with the use of alternative raw materials has intensified with the aim of improving the nutritional quality of food. Among these products, we highlight the cookie-type biscuits, characterized as products that have high sugar and fat contents, and low water content (Oliveira *et al*., 2017).

According to Dias *et al*. (2016) biscuit is the product acquired by kneading and baking the dough prepared with flour, starch, fermented or not and other food substances. Its quality is related to flavor, texture, appearance, among other factors, and in the last years it has stood out as a product of great commercial interest due to its practicality in the production, commercialization and consumption, besides having a long commercial life. According to Oliveira *et al*. (2018) cookie-type biscuit is accepted and consumed by people of any age, has drawing power, especially for children. For these and other reasons the biscuits are a viable means of replacing wheat flour with flours from other sources such as fruit shells. The kiwi is a citrus fruit originating in China, belonging to the Actinidiaceae family that was introduced in Brazil only in the 70's, arousing great interest in the market due to good prices, high productivity and low production costs (Farias *et al*., 2017). It is an excellent regulator of intestinal function due to the presence of fibers, besides presenting vitamins such as ascorbic acid and beta-carotene and being rich in potassium, a vital mineral for the body, whose deficiency can provoke problems of blood pressure, digestive dysfunctions, stress and depression (Iesen *et al*., 2013). The reuse of unconventional parts of food can reduce food costs and the country's environmental impacts, as well as collaborate in the development of new products and raw materials. Therefore, this study aimed to prepare cookie-type biscuit with addition of kiwi shell flour (KPF), characterize and evaluate the effect of adding the kiwi shell flour on the physico-chemical characteristics, texture profile, physical properties and microbiological quality.

METHODOLOGY

The work was developed in the Laboratory of Food Engineering of the Federal University of Campina Grande, Campina Grande, Brazil. The kiwis cv. Hayward (*Actinidiadeliciosa*) used were purchased in the local market of the city of Campina Grande, Paraíba, Brazil.

Flour obtaining: The kiwifruit were selected, washed in 200 ppm sodium hypochlorite solution, for 15 min and subsequently rinsed under running water. The shelling took place manually, with the aid of a domestic knife. The drying of the bark was carried out in an air circulation oven with an air velocity of 1.5 m.s-1 at a temperature of 35 ° C for 72 h, in which the samples were evenly distributed in trays. After drying, the product was subjected to the grinding unit operation, using a knife mill (Manufacturer BOTINI). After drying and milling, the kiwi shell flour was packed in airtight containers and kept at room temperature.

Cookie obtaining: Cookies were prepared in 5 formulations, using the kiwi shell flour (FCK), all the ingredients used are described in Table 1.

Table 1. Formulation for the production of cookies

Ingredients	Quantity (g/100g)				
	F0	F1	F2	F3	F4
Wheat flour	100	95	90	85	80
Kiwi shell flour	0	5	10	15	20
Refined sugar (g)	30	30	30	30	30
Salt (g)	1	1	1	1	1
Sodium bicarbonate (g)	0,2	0,2	0,2	0,2	0,2
Vegetable fat (g)	50	50	50	50	50
Maize starch (g)	14	14	14	14	14

Note: Base percentage of flour

The mixing of the ingredients was performed using a planetary mixer, mixing time was 12 min, until a homogeneous mass was obtained. Then the biscuits were shaped into circular shapes and then were arranged in steel shapes to start the oven process. The baking was carried out in a preheated domestic oven at 180 °C for approximately 25 min. After baking (Figure 1), the biscuits were packed in hermetically sealed packages.

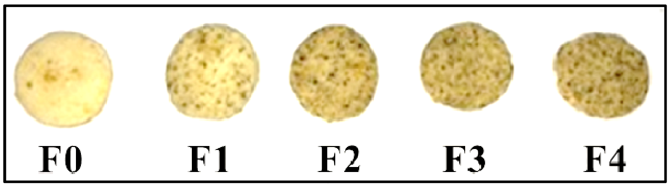

Figure 1. Biscuits produced after baking

Physical-chemical characterization: The physical-chemical characterization of the shells (in natura and dehydrated) and biscuits were performed: moisture, total solids, ash, lipids, proteins according to the methodology proposed by the Adolfo Luttz Institute (Brazil, 2008); the water activity (Aw) was determined using the Decagon® Aqualab CX-2T device at 25 ° C; the total carbohydrate content was calculated by difference to obtain 100% of the total composition (FAO, 2003); the energy value of the biscuits was calculated according to Santos *et al*. (2011).The other determinations were performed only in the in natura and dehydrated shells, such as: pH, titratable acidity, the results being expressed in citric acid, ascorbic acid content (Vitamin C), the results being expressed as mg of ascorbic acid / 100g sample , determined according to the methodology proprotas by the Adolfo Luttz Institute (Brazil, 2008); the chlorophyll and carotenoid dermations followed the methodologies proposed by Lichtenthaler (1987).

Texture Profile: The firmness and fracturability of the biscuits were evaluated in the TA-XT plus - Texture Analyzer of the manufacturer Stable Micro Systems equipped with the Exponent Stable Micro Systems software. The parameters used in the tests were: pre-test velocity = 1.0 mm / s, test velocity = 3.0 mm / s, post-test velocity = 10.0 mm/s, 5.0 mm distance, with compression force measurement. The results of firmness and fracturability (product of gum and elasticity) were expressed in newtons (N) and millimeters (mm).

Physical analysis: The thickness and diameter of the biscuits were determined before and after delivery with a digital caliper. The expansion factor was determined by the ratio between the average diameter and the thickness of the biscuits, as described by Sharma *et al*. (2013). The mass was determined on an analytical balance.

Microbiological analysis: For the microbiological evaluation, a 25 g portion of each cookie was homogenized in 225 mL of saline solution. From this initial dilution, serial dilutions were prepared using the same diluent. The determination of coliforms at 35 ° C (total) was performed by determining the most probable number (MPN) of coliforms using the bright bile green lactosate broth broth 2% using the multiple tube technique. For the confirmation of Coliforms at 45 ºC (thermotolerant) the EC broth culture medium was used, performing a peal from the positive tubes of bright bile green lactose broth in an oven at 45 ºC for 24 h. For analysis of *Staphylococcus* spp., 0.1 ml aliquots were transferred to Petri dishes containing Mannitol agar for surface seeding. After sowing, the plates were incubated at a temperature of 36 ± 1 °C for 48 h. In the Salmonella sp. Test, a 25 g portion of the sample was contained in the peptone saline water and incubated at 35 °C for 24 h. After incubation 0.1 mL aliquots of the sample in saline solution was transferred to Petri dish and incubated at 35 °C for a period of 24 h (Brazil, 2003).

Statistical analyzes: The experimental data were analyzed in triplicate and the results submitted to the analysis of single-factor variance (ANOVA) of 5% of probability and the significant qualitative responses were submitted to the Tukey test adopting the same level of 5% of significance. For the development of the statistical analyzes, the software Assistat 7.7 was used (Silva and Azevedo, 2016).

RESULTS

Table 2 shows the mean values of physico-chemical characterization for the kiwi shell (*Actinidiadeliciosa*) *in natura* and convectively dehydrated in a greenhouse with air circulation.

Table 2. Characterization of the kiwi shell before and after the drying process

Parameters	Kiwi shells	
	In natura[1]	Dehydrated[2]
Moisture (g/100g)	84.17 ± 0.07	11.06 ± 0.06
Total solids (g/100g)	15.83 ± 0.07	88.94 ± 0.06
Water activity (Aw)	0.983 ± 0.003	0.431 ± 0.001
Ashes (g/100g)	0.76 ± 0.04	4.04 ± 0.07
Lipods (g/100g)	0.32 ± 0.06	2.15 ± 0.26
Proteins (g/100g)	4.8 ± 0.10	4.42 ± 0.09
Carbohydrates (g/100g)	9.95 ± 0.11	78.33 ± 0.35
pH	3.79 ± 0.05	4.03 ± 0.15
Acidity (% ácido cítrico)	0.248 ± 0.001	0.196 ± 0.07
C Vitamin (mg of ascorbic acid/100g sample)	51.23 ± 1.14	49.04 ± 1.82
Chlorophyll a (mg/100g)	0.145 ± 0.038	0.253 ± 0.09
Chlorophyll b (mg/100g)	0.028 ± 0.012	0.088 ± 0.04
Chlorophyll total (mg/100g)	0.173 ± 0.016	0.341 ± 0.012
Total carotenoids (mg/100g)	0.101 ± 0.21	0.291 ± 0.37

Note: [1]wet base; [2]dry base;*in natura:* peels of fresh kiwi.

The moisture content obtained for the kiwi *shell in natura* was 84.17 g/100g, the drying process caused a reduction of this content to 11.06 g/100 g, this being the maximum value stipulated by the legislation (BRASIL, 2005) for flours, which is 15.0 g/100g. It was further verified that the total solids amount was higher for dehydrated shell, such growth is caused by the reduction in water content. Santos *et al*. (2019) obtained for the pitomba'sshell*in natura*a moisture content of 66.50 g/100g and for the shell dehydration at 50 °C, 10.53 g/100g, however, for the total solids content the values were 33.50 g/100g and 89.47 g/100g, respectively. There was a 43.85% reduction in the water activity of the shell*in natura* for the dehydrated shell. According to Felows (2006) water activity is an important factor for controlling the rate of deterioration of the product; generally, foods with water activity above 0.95, as obtained for fresh kiwi shell, are classified as fresh food that is highly perishable, so they tend to deteriorate rapidly, requiring the application of drying to reduce this content and increase its conservation for longer. It was observed an increase in ash, lipid and carbohydrate contents when the kiwi shell was dehydrated, except for the protein content that presented a small degradation from 4.8 to 4.42 g/100g. Vasconcelos *et al*. (2019) obtained and analyzed the guava residue meal (dehydrated at 60 °C for 16 h), obtained an ash content of 1.68 g/100 g, being lower than the kiwi shell of the present study. Lower values of proteins were observed by Garmus *et al*. (2009) in the potato shell flour (2.5 g/100g). It can also be observed an increase in pH and reduction of the acidity of dehydrated shells, a fact also observed by Lima *et al*. (2015) when dehydrating the watermelon bramble to obtain flour. A small degradation of Vitamin C was observed when the kiwi shells were submitted to the drying process, reducing to only 2.19 mg of ascorbic acid/100g sample. According to Rebouças *et al*. (2013) and Silva *et al*. (2018) vitamins are very sensitive compounds and can be degraded by several factors, such as temperature, oxygen presence, light, humidity, pH, duration of the treatment to which the food was submitted, among others.

There was an increase in chlorophyll a, total chlorophyll and total carotenoids, in relation to the contents obtained for *in natura*shell (Table 2); however, only the chlorophyll b parameter presented different behavior, since it decreased when the shells were dehydrated. It was observed by Santos *et al*. (2019) that these same parameters presented a reduction in relation to the *in natura* and lyophilized okra, in which, respectively, they obtained the following chlorophyll a (14.21 and 8.90 mg/100g), chlorophyll b (25.44 and 2.20 mg/100g), total chlorophyll (38.56 and 16.06 mg/100g) and total carotenoids (18.62 and 3.43 mg/100g). Table 3 shows the results obtained for the centesimal composition, water activity and energetic value of the cookie-type biscuits elaborated with the addition of the flour of the kiwi shell.

The cookies had moisture content specified by Brazilian legislation, which establishes a moisture content of less than 14.0 g / 100g. However, only the formulation (F3) with addition of 10% of the kiwi shell flour (KPF) differed from the other formulations elaborated. Dias *et al*. (2016) obtained moisture content ranging from 2.0 to 4.9% for cookies made with different concentrations of oats. To ensure shelf life and ensure the quality of the cookies it is necessary to be aware of the water activity, the elaborated cookies presented low values of water activity, in which only the formulations F3 and F4 present statistical difference. Regarding ash content, there was an increase of 1.02% as the concentration of KPF was increased. The formulation (F5) with addition of 20% of KPF presented higher content for this parameter. Statistically the formulations F3, F4 and F5 presented significant differences. Similar behavior was observed by Ikechukwu *et al*. (2018) when making biscuits with different concentrations of flour of the watermelon seed, obtained ash content that varied from 1.79 to 4.60% when the concentration ranged from 20 to 50%.

A reduction in lipid content was observed when there was an increase in KPF concentration, with the formulation having a 20% increase in KPF with a lower percentage (22.53%) differing statistically only from the formulation (F1) without addition of KPF. Santos *et al*. (2011), analyzing biscuits with addition of "buriti" flour with oats obtained a lipid content of 22.46 g / 100g.There were significant differences in protein content, in which the F1 formulation did not differ from F2, but differed from F3, F4 and F5. Differently from that observed for lipid content, protein content increased with increasing addition of KPF. Close values were observed by Albuquerque *et al*. (2016), which was 5.56 g/100 g, analyzing cookies made with addition of 30% of "seriguela". The carbohydrate content varied from 62.41% (F1) to 64.78% (F5), with statistical differences only in the formulation (F2). Higher values were observed by Pereira *et al*. (2016) when making cookies with different concentrations of jatobá flour, in which they ranged from 70.77 to 74.69%. Regarding the energy value, it can be seen in Table 3 that the addition of KPF reduced the value by up to 27.85 Kcal / 100g. The formulation F1 having the highest value (512.24 Kcal / 100g) and the formulation F5 with the lowest value (484.39 Kcal / 100g). For this same parameter, all formulations presented a statistically significant difference. Values close to the present study were obtained by Santos *et al*. (2011) (460.53 to 487.82 Kcal / 100g) for cookies with buriti flour. And higher than those obtained by Silva *et al*. (2018) (429.63 to 429.82 Kcal / 100g) for cookies made with pequi flour. Analyzing Table 4, it was verified that there were significant changes in the firmness parameter, however the formulations F3 and F4 did not differ among themselves in a level of 5% of probability; The firmness of the cookies increased as the concentration of KPF in its formulation increased. There was an increase of 13,018 N when the concentration varied by up to 20%. As the formulation with 20% presented higher value for this parameter (27,532 N). with increase of the addition of the KPF. Since the addition of 5% of KPF (F2), did not present statistical difference between the formulations (F1 and F4). However, the formulations (F3 and F5) had the highest values for this parameter, and also did not present statistical difference between them. This higher value obtained may be related to the water activity of the cookie, since (Table 3) the two formulations had the highest values of water activity, a fact also observed by Gusmão *et al*. (2018) when evaluating the fracturability of cookies with addition of the algaroba flour during 120 days of storage. Table 5 shows the results obtained from the physical characteristics of the cookies before and after the baking step. The biscuit mass before baking varied from 13.02 to 13.41 g, and after baking varied from 11.16 to 11.84 g, showing

Table 3. Centesimal composition, water activity and energy value of cookie-type biscuits

Parameters	Formulations				
	F1	F2	F3	F4	F5
Moisture (g/100g)	4.46^{b}	4.40^{b}	5.02^{a}	4.57^{b}	4.62^{b}
Water activity (Wa)	0.099^{c}	0.096^{c}	0.170^{a}	0.130^{b}	0.154^{ba}
Ashes (g/100g)	1.43^{d}	1.55^{d}	1.84^{c}	2.15^{b}	2.45^{a}
Lipids (g/100g)	27.16^{a}	26.06^{ba}	25.85^{ba}	25.28^{ba}	22.53^{b}
Proteins (g/100g)	4.54^{c}	4.90^{bc}	5.19^{ba}	5.33^{ba}	5.62^{a}
Carbohydrates (g/100g)	62.41^{ba}	63.09^{a}	62.10^{b}	62.67^{b}	64.78^{ba}
Energetic value (Kcal/100g)	512.24^{a}	506.50^{b}	501.81^{c}	499.52^{d}	484.39^{e}

Note: F1 = 0% FCK; F2 = 5% FCK; F3 = 10% FCK; F4 = 15% FCK; F5 = 20% FCK. Means followed by the same letter, in the same line, do not differ statistically from each other by the Tukey test at the 5% probability level.

Table 4. Texture profile of cookies

Formulations	Parameters	
	Firmness (N)	Fracturability (mm)
F1	14.514^{d}	1.105^{bc}
F2	17.417^{c}	0.769^{c}
F3	20.744^{b}	1.380^{ab}
F4	21.431^{b}	1.048^{bc}
F5	27.532^{a}	1.624^{a}

Note: Means followed by the same letter, in the same column, do not differ statistically from each other by the Tukey test at the 5% probability level.

Table 5. Mass, diameter, thickness and expansion factor of cookie type cookies before and after baking

Formulations	Parâmetros			
	Mass(g)	Thickness (mm)	Diameter (mm)	Expansion factor
F1 AF	13.02^{d}	10.27^{cd}	41.16^{fg}	4.01^{a}
F2 AF	13.41^{a}	10.21^{cd}	41.12^{g}	4.03^{a}
F3 AF	13.24^{bc}	10. 29^{c}	41.38^{d}	4.02^{a}
F4 AF	13.16^{cd}	10.12^{d}	41.24^{ef}	4.07^{a}
F5 AF	13.36^{ab}	10.22^{cd}	41.26^{de}	4.04^{a}
F1 DF	11.16^{g}	10.69^{b}	41.66^{bc}	3.89^{a}
F2 DF	11.84^{e}	10.94^{a}	41.64^{bc}	3.81^{a}
F3 DF	11.52^{f}	10.87^{a}	41.86^{a}	3.85^{a}
F4 DF	11.26^{g}	10.38^{c}	41.59^{c}	4.01^{a}
F5 DF	11.63^{f}	10.67^{b}	41.72^{b}	3.91^{a}

Note: Means followed by the same letter in the same column, do not differ statistically by the Tukey test at 5% probability.

Table 6. Microbiological analyzes of cookie-type biscuits

Microorganisms	Formulations					RDC nº12 (ANVISA, 2001)
	F1	F2	F3	F4	F5	
Total coliforms (NMP/g)	10	4.4	5.7	3.6	4.8	-
Thermotolerant coliforms (NMP/g)	<3.0	<3.0	<3.0	<3.0	<3.0	Max. 10 (NMP/g)
Staphylococcus spp. (UFC/g)	1.5 x 10^{1}	1.1 x 10^{1}	1.4 x 10^{1}	2.5 x 10^{1}	1.9 x 10^{1}	Max. 5 x 10^{2} (UFC/g)
Salmonella sp.	Absent	Absent	Absent	Absent	Absent	Absent

Note: NMP = Most Likely Number of Microorganisms; UFC = Colony Forming Units.

According to Gusmão *et al*. (2018) and Pereira (2016), the fracturability parameter is the tendency of a material to fracture, break or disintegrate as it undergoes the application of a relatively small amount of force or impact. It can be observed that there was no direct relation of the fracturability statistical differences between the baking process, reducing on average 1.756 g of its mass (approximately 14%). There was a mean increase in biscuit thickness of approximately 0.49 mm after the time of delivery. Prior to delivery, only the formulations (F3 and F4) presented statistical differences; (F1 and F5) as well as (F2 and F3) did not show any differences between them at a 5% probability level. Thus, as observed for the thickness the average diameter of the biscuits also increased, ranging from 41.12 to 41.26 mm and 41.59 to 41.86 mm, before and after the baking, respectively. The expansion factor decreased after the baking process, with no significant difference for all formulations before and after the process. This behavior was also observed by Lima *et al*. (2015) for cookies made with watermelon bramble flour. In general, the biscuit expansion decreases whenever the level of substitution of wheat flour increases (Zucco *et al*., 2011; Chung *et al*., 2014), relationship not observed in the present study. The Table 6 shows the values obtained for the microbiological evaluation of biscuits. Current legislation does not establish standards for total coliform counts (35 ºC), but the study of this group of microorganisms is important, since it is considered an indicator of hygiene conditions. In the determination of this group of microorganisms we obtained values ranging from 3.6 to 10 NPM / g, the formulation (F1) being the most likely number of this microorganism. The high number of Coliforms may not mean direct contamination with fecal material. Thermotolerant coliforms are used to determine hygienic-sanitary conditions in food production, so high counts of this group indicate hygienic failures throughout the process. The values found for thermotolerant coliforms are in accordance with the standards established by resolution 12/2001. Massarollo *et al*. (2016) when analyzing agribusiness bakery products located in the city of Francisco Beltrão-PR, all cookies evaluated also did not present a count for the group of thermotolerant coliforms (45ºC).

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Conclusion

The drying process decreased the moisture and water activity of the kiwi shell and can be stored and used for a longer period of time; in addition, its use in the preparation of biscuits reduced the lipid content and its energetic value, and increased the protein content of the same. The formulation with 20% KPF presented greater firmness and greater fracturability. The variation of the flour content of the kiwi shell in the biscuit formulation generated significant differences for the physical parameters between the experiments before and after the delivery. The results of the microbiological analyzes showed that the biscuits were suitable for consumption, presenting no risks to the health of the consumer, attesting to the efficiency and hygiene in the preparation of the product.

REFERÊNCIAS

Albuquerque, J. G., Duarte, A. M., Conceição, M. L., andAquino, J. S. 2016. Integral utilization of seriguela fruit (*Spondiaspurpurea* L.) in the production of cookies. Revista Brasileira de Fruticultura, 38(3), pp.1-7 doi:http://dx.doi.org/10.1590/0100-29452016229.

Barros, S. L., Santos, N. C., Almeida, R. L. J., Nascimento, A. P. S., and Silva, V. M. A. 2019. Evaluation microbiological of cookies prepared with added of residue dry from pineapple shells. Revista Higiene Alimentar, 33, pp.2720-2724

Brasil, Instituto Adolfo Lutz. 2008. Métodos físico-químicos para análise de alimentos, Instituto Adolfo Lutz, Vol 1, 4th ed., São Paulo (SP), Brasil.

Brasil. 2001. Lei dos Padrões Microbiológicos Sanitários para Alimentos n. 12, de 02 de janeiro de 2001. Agência Nacional de Vigilância Sanitária.Diário Oficial da União, Brasília, DF, 10 jan. 2001.

Brasil. 2003. Ministério da Agricultura, Pecuária e Abastecimento. Instrução normativa n. 62 de 27 de agosto de 2003. Métodos analíticos oficiais para análises microbiológicas para controle de produtos de origem animal e água. Diário Oficial da União, n.181, 18 set. 2003. Seção 1, pp.14-51

Brasil. 2005. Agência Nacional de Vigilância Sanitária. Resolução nº263, de 2005. Aprova o Regulamento Técnico para Produtos de Cereais, Amidos, Farinhas e Farelos. Available online at: <https://www.saude. rj.gov.br/comum/ code/MostrarArquivo.php?C=MjIwMw%2C%2C>

Chung, H. J., Cho, A., Lim, S. T., and Morales, F. J. 2014. Utilization of germinated and heat-moisture treated brown rices in sugarsnap cookies. Food Science and Technology, 57, pp.260-266

Dias, B. F., Santana, G. S., Pinto, E. G., and Oliveira, C. F. D. 2016. Caracterização físico-química e análise microbiológica de cookie de farinha de aveia. Revista de AgriculturaNeotropical, 3(3), pp.10-14

FAO. Food and Agriculture Organization of the United Nations. 2003. Food Energy: Methods of Analysis and Conversion Factors. Report of a Technical Workshop; Food and Nutrition Paper, Vol 77, FAO, Italy.

Farias, B., Wurz, D. A., Allebrandt, R., Reinehr, J., Fagherazzi, M. M., andKretzschmar. 2017. Evaluation of three varieties of kiwi with cultural potential in lages city - Santa Catarina state. Revista da Jornada da Pós-Graduação e Pesquisa, 14(14), pp.804-812

Fellows, P. J. 2006. Tecnologia do Processamento de Alimentos - Princípios e práticas, Vol 3, Artmed, Brasil.

Garmus, T. T., Bezerra, J. R. M. V., Rigo, M., & Cordova, K. R. V. 2009. Elaboration of cookie with potato skin flour (*Solanumtuberosum L*.). Revista Brasileira de Tecnologia Agroindustrial, 3(2), pp.56-65

Goes, E. S. R., Feiden, A., Veit, J. C., Finkler, J. K., Goes, M. D., andBoscolo, W. R. 2017. Development of cookies with inclusion of fish. Revista Agrarian, 10(36), pp.245-253

Gusmão, R. P., Gusmão, T. A. S., Moura, H. V., Duarte, M. E. M., andCavalcanti-Mata, M. E. R. M. 2018. Technological characterization of cookies made with different concentrations of mesquite flour during 120 days of storage. *Brazilian Journal of Food Technology,* 21, pp. 1-9doi:http://dx.doi.org/10.1590/1981-6723.11617

Iesen, D., Santos, V., Quast, E., Quast, L. B., and Raupp, D. S. 2013. Desenvolvimento de Geleia de Kiwi: Influência da Polpa, Pectina e Brix na Consistência. *Journal of Health Science*, 15, pp.369-375doi: http://dx.doi.org/10.17921/2447-8938.2013v0n0p%25p

Ikechukwu, A. I. P., Omeire, G. C., Kabuo, N. O., Eluchie, C. N., Amandikwa, C., and Odoemenam, G. I. 2018 Production and Evaluation of Biscuits Made From Wheat Flour and Toasted Watermelon Seed Meal as Fat Substitute. *Journal of Food Research*, 7(5), pp.112-123.

Lichtenthaler, H. K. 1987. Cholorophylls and carotenoids: pigments of photosynthetic biomembranes. Methods in Enzymology. London, 148, pp.350-382.

Lima, J. P., Portela, J. V. F., Marques, L. R., Alcântara, M. A., and El-Aouar, A. A. 2015. Watermelon flour rind in gluten-free cookies. Ciência Rural, 45(9), pp.1688-1694 doi:http://dx.doi.org/10.1590/0103-8478cr20130209

Lima, T. M. F. G., Rios, D. A. S., and Silva, L. M. R. 2017. Microbiological quality of acarajés marketed in the city of Fortaleza (CE). *Revista Higiêne Alimentar,* 31, pp.2256 – 2260

Massarollo, M. D., Gularte, M. A., Vieira, A. P., andCórdova, K. R. V. 2016 Análise microbiológica de produtos de panificação de agroindústrias de Francisco Beltrão, PR. Revista Biosaúde, 18(1), pp.1-8

Oiveira, F. C., Xavier, L. C. A., and Braga, M. C. A. 2018. Biscoitos enriquecidos com diferentes composições de farinha mista: análise química, física e sensorial. Jounal Business and Technology, 5(1), pp.83-86

Oliveira, D. L., Kolakowski, A. P., Simões, D. R. S., Los, P. R., and Demiate, I. M. 2017. Biscoitos tipo cookie sem glúten formulados com farelo de feijão, farinha de arroz e amido de mandioca. *Revista brasileira de Tecnologia Agroindustrial,* 11(2), pp.2484-2501

Pereira, A. P. A. 2016. Efeito da adição de amoras-pretas (Rubus sp.) em cookies de grãos inteiros, avaliação das propriedades funcionais, tecnológicas e sensoriais. Dissertationin Food Engineering. State Universityof Campinas, Campinas (SP) Brazil

Pereira, M. M., Oliveira, E. N. A., Almeida, F. L. C., and Feitosa, R. M. 2016. Processamento e caracterização físicoquímica de biscoitos amanteigados elaborados com farinha de jatobá. *Revista Brasileira de Tecnologia Agroindustrial,* 10(2), pp.2137-2149

Rebouças, T. N. H., Valverde, R. M. V., and Teixeira, H. L. 2013. Bromatologia da pimenta malagueta in natura e processada em conserva. Horticultura Brasileira, 31, pp.163-16doi: https://doi.org/10.1590/S0102-05362013 000100026

Santos, C. A., Ribeiro, R. C., Silva, E. V. C., Silva, N. S., Silva, B. A., Silva, G. F., and Barros, C. V. 2011 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, pp.262-273doi: 10.3895/S1981-3686201100010000

Santos, C. A., Ribeiro, R. C.; Silva, E. V. C.; Silva, N. S.; Silva, G. F., and Barros, B. C. V. 2011. Elaboration of biscuit flour buriti (*Mauritiaflexuosa L. f*) without added oat (Avena sativa L.). Revista Brasileira de Tecnologia Agroindustrial, 05(01), pp.262-273

Santos, F. S., Figueirêdo, R. M. F., Queiroz, A. J. M., Lima, T. L. B., and Moreira, I. S. 2019. Effect of Dehydration Methods on Okra Chemical and Physical Composition. *Journal of Agricultural Science,* 11(5), pp.236-249doi:https://doi.org/10.5539/jas.v11n5p236

Santos, N. C., Barros, S. L., Almeida, R. L. J., Nascimento, A. P. S., and Almeida, R. D. 2019. Influence of temperature in the centesimal composition of pitomba shell (*Talisiaesculenta*). Revista Higiene Alimentar, 33, pp.1477-1481

Sharma, P., Velu, V., Indrani, D., and Singh, R. P. 2013. Effect of dried guduchi (Tinosporacordifolia) leaf powder on rheological, organoleptic and nutritional characteristics of cookies. FoodResearchInternational, 50(2), pp.704-709doi: http:// dx.doi.org/10.1016/j.foodres.2012.03.002

Silva, C. L. M., Santos, T. C.; Oliveira, M. L. P., Silva, L. M. S. F., Araújo, C. I. A., Jesus, C. A., and Vieira, C. R. 2018. Composição centesimal de biscoitos tipo cookies adicionados de farinha de Caryocar brasiliense Camb. (Caryocaraceae). Caderno de Ciências Agrárias, 10(2), pp.78–82

Silva, F. A. S., and Azevedo, C. A. V. 2016. The Assistat Software Version 7.7 and its use in the analysis of experimental data. *AfricanJournalAgriculturalResearch,* 11, pp. 3733-3740 doi: https://doi.org/10.5897/AJAR 2016.11522

Silva, S. N., Matos, J. D. P., Silva, P. B., Costa, Z. R. T., Gomes, J. P., Silva, L. P. F. R., Vieira, A. F., Melo, B. A., Primo, D. M. B., and Alexandre, H. V. 2018. Prediction of Mathematical Models of the Drying Kinetics and Physicochemical Quality of the Chili Pepper. *Journal of Agricultural Science,* 10(12), pp. 377-384 https://doi.org/10.5539/jas.v10n12p377

Vasconcelos, R. F., Melo, E. M. M., Correia, A. G. S., Sousa, J. S., and Silva, C. S. B. 2019. Incorporation of flour manufactured from goiaba (*psidiumguajava*) pulp processing residue in cookies. Revista Higiene Alimentar, 33, pp.3455-3459

Zucco, F., Borsuk, Y., and Arntfield, S. D. 2011. Physical and nutritional evaluation of wheat cookies supplemented with pulse flours of different particle sizes. Food Science and Tchonogy, 44(10), pp.2070-2076 doi: http://dx.doi.org/10.1016/j.lwt.2011.06.007

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