SCIENCE AND
FOOD TECHNOLOGY

DOI: 10.12957/demetra.2020.45766

DEMETRA
Alimentação, Nutrição & Saúde

Giane Engel Montagner [1]
Cátia Regina Storck[2]

[1] Universidade Franciscana, Programa de Pós-Graduação em Nanociências. Santa Maria, RS, Brasil.

[2] Universidade Franciscana, Curso de Nutrição, Grupo de Pesquisa em Segurança Alimentar e Nutricional. Santa Maria, RS, Brasil.

Correspondence
Cátia Regina Storck
catia.sm@gmail.com

Ice cream made with water-soluble rice extract: physicochemical and sensory analysis

Sorvete com extrato hidrossolúvel de arroz: análise físico-química e sensorial

Abstract

Introduction: As there are many people with lactose intolerance, new dietary preparations with good sensory aspects and free from this disaccharide need to be proposed, which would ensure these individuals' well-being and quality of life. *Purpose*: To develop an ice cream made with water-soluble rice extract. ***Method:*** Ice creams were produced replacing 50% and 100% of cow milk with water-soluble rice extract, in two flavors (strawberry and chocolate). The methods for developing this study were based on the physicochemical analysis of the ice cream and the sensory analysis, to establish the degree of acceptability of the product, as well as the preference on the part of the consumers. ***Results***: Both the chocolate and the strawberry water-soluble rice extract ice creams had higher carbohydrate content and lower energy values, due to its lower protein and lipid content in comparison with cow milk ice cream. There was good acceptability; particularly, the 50% rice extract strawberry ice cream had no significant difference to the 100% cow milk ice cream, regarding preference. ***Conclusion***: It is concluded that the water-soluble rice extract ice cream is a product with good nutritional characteristics and good acceptability. It can be considered an alternative for people with lactose intolerance.

Keywords: Acceptability. Foods. Composition. Diet. Lactose Intolerance. Milk.

Resumo

Introdução: Devido ao fato de que muitas pessoas são intolerantes à lactose, novas propostas de preparações dietéticas com bons atributos sensoriais e isentas deste dissacarídeo são necessárias para garantir bem-estar e qualidade de vida para estes indivíduos. ***Objetivo***: desenvolver sorvete com extrato hidrossolúvel de arroz. *Método:* Foram produzidos sorvetes com 50% e 100% de substituição do leite bovino por extrato hidrossolúvel de arroz em dois sabores (morango e chocolate). Os métodos para o desenvolvimento deste estudo basearam-se na análise físico-química do sorvete, bem como a análise sensorial para definir o nível de aceitação do produto e preferência por parte dos consumidores. ***Resultados***: Os sorvetes de extrato hidrossolúvel de arroz, tanto de chocolate, como de morango obtiveram maiores teores de carboidratos e menores valores energéticos, devido ao fato de ter menor teor de proteína e lipídio, em comparação com o sorvete feito com leite bovino. Obteve-se boa aceitação, sendo que o sorvete de 50% extrato de arroz sabor morango não obteve diferença significativa do sorvete com 100% de leite de bovino, em relação à preferência. ***Conclusão***: Conclui-se que o sorvete com extrato hidrossolúvel de arroz é um produto com boas características nutricionais e tem boa aceitação, podendo ser uma opção para pessoas intolerantes à lactose.

Palavras-chave: Aceitação. Alimentos. Composição. Dieta. Intolerância à Lactose. Leite.

INTRODUCTION

According to Anvisa's (Brazilian Health Regulatory Agency) RDC-Resolution no. 266/2005,[1] ice creams are the frozen products obtained from an emulsion of fat and proteins or a mixture of water and sugar(s). Other ingredients – including cow milk – can be added, as long as they do not change the characteristics of the product. However, some people are intolerant to milk. Such is the case of individuals with absence or deficiency of lactase, an enzyme that digests lactose, the sugar found in milk. Due to such a deficiency, lactose is not hydrolyzed; this carbohydrate, then, is fermented by bacteria, which results in the production of organic acids and gases.[2] These gases cause colic, abdominal distensions, flatulence, and diarrhea in people intolerant to lactose.[3] Besides such an intolerance, there are people allergic to cow milk protein – an inflammatory disease secondary to the immunological response to the cow milk protein.[4]

As substitutes to cow milk, the vegetable extracts, such as those of soybean and rice, are being widely used. They are feasible alternatives due to their nutritional values and low production cost. Using rice has some advantages in relation to soybean – e.g., it is hypoallergenic and does not have a disagreeable taste, which is commonly the case in soybean derivatives.[5]

Rice (*Oryza sativa* L.) is one of the most important sources of nutrients for approximately half of the six billion people in the world, and it is grown in 116 countries. In Brazil, it is grown in all the states, especially concentrated in the South and Central-West Regions.[6] One of its main advantages is the use of broken rice, a by-product of the grain that is broken after being polished. Broken rice is widely used as animal food but given its nutritional properties – the same of the regular grain – it can be used for human consumption.[5]

Since many people are intolerant to lactose or allergic to cow milk protein, new food preparations with good sensory appeal and free of this disaccharide need to be proposed, which would ensure these people's well-being and quality of life. Hence, this research aimed to develop an ice cream made with water-soluble rice extract.

MATERIALS AND METHODS

Materials

The ingredients used for the extract were polished broken rice, mineral water, salt, and vanilla extract. The ice cream was produced with the resulting extract, cow milk, sugar, emulsifier (brand: Emustab), flavoring (chocolate and strawberry), milk cream, soy cream, food coloring, and thickener. All the products were purchased from local businesses in Santa Maria, Rio Grande do Sul, Brazil.

Methods

Preparation of the water-soluble rice extract

The production process was based on Carvalho et al.,[6] with some modifications. First, the broken rice was washed to eliminate any dirt from the product. In the sequence, it was cooked, adding the grains and water 1:2 (v:v), 0.5g vanilla extract and 0.5g salt for every 50mL of grain, yielding 300% on average. The water was not wholly evaporated in the cooking time, which lasted five minutes on average. Then, the cooked product was homogenized in a blender (brand: ARNO, model: LN32) for three minutes, in the proportion of one part of cooked rice to two parts of water. The homogenized product was filtered through a fine knitted cotton cloth.

Before the analysis, the water-soluble rice extract was placed in a dehydrator with forced air circulation at 55ºC. The dry extract was then ground and stored in a closed recipient, away from light and at room temperature.

Preparation of the ice cream

The ice cream was prepared between March and November 2015, at the *Laboratório de Técnica Dietética da Universidade Franciscana* (Technical Food Laboratory of the Franciscan University), as described in Table 1.

Table 1. Ingredients used in preparing the products[a]. Santa Maria, RS, 2015.

Ingredients	Quantity					
	CI1	CI2	CI3	SI1	SI2	SI3
Cow milk (mL)	100	50	0	100	50	0
Rice extract (mL)	0	50	100	0	50	100
Sugar (g)	25	25	25	25	25	25
Emulsifier (g)	1	1	1	1	1	1
Chocolate flavoring (g)	5	5	5	-	-	-
Strawberry flavoring (g)	-	-	-	2	2	2
Coloring (drops)	1	1	1	1	1	1
Thickener (g)	1	1	1	1	1	1
Milk cream (g)	15	7.5	0	3.7	1.8	0
Soy cream (g)	0	7.5	15	0	1.8	3.7

[a]CI1 (chocolate ice cream, 100% milk); CI2 (chocolate ice cream, 50% rice extract); CI3 (chocolate ice cream, 100% rice extract); SI1 (strawberry ice cream, 100% milk); SI2 (strawberry ice cream, 50% rice extract); SI3 (strawberry ice cream, 100% water-soluble rice extract).

Chocolate and strawberry ice creams were developed in a process similar to the homemade dairy ice cream manufacturing. They were produced by mixing the ingredients in a blender (brand: ARNO, model: LN32) for three minutes and freezing the product for three to four hours. Then, it was cut in pieces and beat in a food mixer with the emulsifier, and once again frozen.

Physicochemical analyses

The centesimal composition and pH of both the extract and the ice cream were analyzed, following the procedures described by the Physicochemical Methods for Food Analysis of the *Instituto Adolfo Lutz* (Adolfo Lutz Institute).[7] The moisture content was established by placing the product in a dehydrator at 105°C for 24 hours. The crude protein content was obtained by using factor 5.95 (for the water-soluble rice extract) and 6.25 (for the ice creams) to convert nitrogen into protein. The ash content was established in a muffle furnace (manufactured by Quimis) at 550°C until the weight was constant. The lipid content of the water-soluble rice extract was quantified through the Soxhlet method, using petroleum ether as a solvent. The lipid content of the ice creams was established through the Rose-Gottlieb method. The dietary fiber content was established through the enzymatic-gravimetric method no. 985.29 and no. 991.42.[8] The carbohydrates were calculated from the difference to the other components. The energy value was calculated using the following Atwater conversion factors:[9] carbohydrates 4 kcal/g; proteins 4 kcal/g; lipids 9 kcal/g.

Sensory analyses

The sensory analyses of the chocolate and strawberry ice creams were conducted in individual booths with 50 untrained tasters of both genders – according to Dutcoski,[10] this number is sufficient for the result to be significant. As the research involved humans, the project was submitted to the Research Ethics Committee of the *Universidade Franciscana*, accredited by the *Conselho Nacional de Saúde* (National Health Council) and approved under number 1.161.784. It also complied with the ethical criteria stipulated by Resolution 466/2012[11] of the *Conselho Nacional de Saúde*. The participants were given the informed consent form (ICF), which they signed. The individuals included in the sensory analysis were those who agreed to participate and were not allergic to the ingredients used in the preparation. Individuals allergic to the ingredients used in the ice cream were excluded.

First, the acceptability test for the ice cream made with 100% rice extract in chocolate and strawberry flavors was conducted. It used the hedonic scale structured with seven points, ranging from "I liked it very much" (7) to "I disliked it very much" (1), for color, smell, taste, and texture.[10] To assess purchase intention, a scale ranging from "I would certainly buy it" (5) to "I would certainly not buy it" (1) was used.[7]

Then, the order of preference of the three compositions (100% milk; 50% milk and 50% rice extract; 100% rice extract), was tested (in separate days) also in the two flavors. The tasters placed the samples in descending order of preference (first, the one they liked the most, and last, the one they liked the least).[10] The samples were coded with three-digit random numbers and presented simultaneously, in balanced and random order.

Statistical analysis

The results obtained were entered into a Microsoft Excel spreadsheet and analyzed through the Statistica 7.0 software.[12] The variance analysis (ANOVA) and means comparison test (Tukey) were conducted.

The results of the sensory analysis were entered into a spreadsheet and analyzed by bilateral ordering using Friedman's test. It was compared with a defined minimum critical value ($p = 0.05$) to verify whether there was a significant difference between the samples. Christensen et al.'s table[13] was used for multiple comparisons between the samples.

RESULT AND DISCUSSION

Water-soluble rice extract

The finished water-soluble rice extract yielded 800% (8x) – i.e., 100g of broken rice yielded 800mL of extract. The pH found in the extract was 6.27. The paper by Carvalho et al.,[6] on which the extract methodology was based, found the values of 6.54, 6.77, and 6.75 for the extracts of broken rice, brown rice, and soybean, respectively. Barros & Venturini Filho[14] found pH 6.6 for water-soluble soybean extract. These values are similar to the one found in the analysis of the present study.

The centesimal composition of the water-soluble rice extract is verified in Table 2. Carvalho et al.[6] evaluated extracts of broken rice, brown rice, and soybean, and found 95.11%, 94.89%, and 92.98% of moisture, respectively, which were higher values than the one found in this study. Barros & Venturini Filho[14] analyzed water-soluble soybean extract and found 93.7% to 95.2% of moisture, which was also higher than the value for the water-soluble rice extract. Comparing with cow milk, whose moisture is 87.7%,[15] a similarity to rice extract is noticed.

Table 2. Centesimal composition of the water-soluble broken rice extract (mean ± standard deviation). Santa Maria, RS, 2015.

Component	Water-soluble rice extract
Moisture (%)	89.0 ± 0.01
Lipids (%)	0.04 ± 0.02
Protein (%)	0.94 ± 0.02
Ash (%)	0.17 ± 0.02
Dietary fiber (%)	1.06 ± 0.10
Carbohydrates (%)	8.77 ± 0.12
Energy value (kcal)	39.2 ± 0.41

The lipid content found was of 0.04%, which is due to rice's having a low lipid content, and the product's being diluted in water. Carvalho et al.[6] found higher lipid content in their analysis of broken rice extract (0.41%), whereas Barros & Venturini Filho[14] found 1.4% of lipids in the water-soluble soybean extract. According to the IBGE's (Brazilian Institute of Geography and Statistics) Food Composition Table,[15] cow milk has from 0.8 to 3.25% of lipids, depending on whether it is skimmed or not.

The protein percentage was 0.94%, which was higher than the broken rice extract developed by Carvalho et al.[6] (0,73%). Barros & Venturini Filho[14] found higher values in the soybean extract (2.7 – 3.1%), although lower than that of cow milk (3.22%).[15] The mean carbohydrate found in the broken rice extract was 9.72%. It was higher than that found by Carvalho et al.[6] – whose analysis of broken rice extract resulted in 3.17% of total carbohydrates – and the value found for cow milk (4,52%).[15] Barros & Venturini Filho,[14] in their turn, found quite lower values (0.4 – 1.5%) in soybean extract.

The percentage of ash was 0.17%, lower than those found by Carvalho et al.[6] (0.58%) and Barros & Venturini Filho[14] (0.3 – 0.4%). The dietary fiber content was 0.11%. According to IBGE's table,[15] cow milk does not have fibers; therefore, there is an advantage in using it in foods. The energy value found in 100g of water-soluble rice extract was 43 Kcal, whereas in milk it is 60.03 Kcal.[15] Barros & Venturini Filho[14] found from 25 kcal to 30.5 kcal in the water-soluble soybean extract.

Hence, the water-soluble rice extract developed in this study has nutritional characteristics different from other extracts. It can be used in food products, decreasing the lipid and protein contents while increasing the carbohydrate content when compared to cow milk.

There is little information in the bibliography regarding water-soluble rice extract. Nevertheless, comparing the results with other vegetable extracts is important, as they are all milk substitutes for people who cannot consume it. Moreover, that are noticeable differences between the extracts of various sources.

Ice cream with and without water-soluble rice extract

The cow milk ice cream yielded 200% – i.e., one liter of cow milk yielded two liters of ice cream. As for the ice cream made with 50% cow milk and 50% extract, it yielded a little less (190%), and that with 100% extract yielded 180%.

The centesimal composition found in the chocolate and strawberry ice creams is verified in Table 3. In both flavors, the lipid content decreased significantly when milk was substituted with water-soluble rice extract, as the extract is poor in lipids – which is an advantage in relation to cow milk ice cream. Ahsan et al.[16] found similar values to the chocolate extract ice cream. They developed ice creams based on soybean extract and

found lipid values between 2.53% and 2.77%. Aboulfazli F & Sba MM[17] also developed an ice cream with soybean extract and found 10.5% lipids. Such a value was higher than what was found in the present study because they used butter to prepare their ice cream.

Table 3. Centesimal composition of the chocolate and strawberry ice creams developed with and without water-soluble rice extract (mean ± standard deviation). Santa Maria, RS, 2015.

Component	Chocolate flavor			Strawberry flavor		
	CI1	CI2	CI3	SI1	SI2	SI3
Moisture (%)	$67.3^{c} \pm 0.11$	$67.9^{b} \pm 0.06$	$70.4^{a} \pm 0.03$	$70.3^{a} \pm 0.05$	$70.5^{a} \pm 0.13$	$70.0^{b} \pm 0.05$
Lipids (%)	$14.4^{a} \pm 0.59$	$6.1^{b} \pm 0.51$	$2.7^{c} \pm 0.35$	$8.8^{a} \pm 0.37$	$3.8^{b} \pm 0.36$	$0.8^{c} \pm 0.13$
Protein (%)	$4.8^{a} \pm 0.40$	$3.0^{b} \pm 0.25$	$1.4^{c} \pm 0.37$	$2.7^{a} \pm 0.09$	$2.2^{b} \pm 0.07$	$0.7^{c} \pm 0.19$
Ash (%)	$2.3^{a} \pm 0.44$	$1.8^{a} \pm 0.46$	$1.7^{a} \pm 0.44$	$2.1^{a} \pm 0.20$	$2.1^{a} \pm 0.32$	$1.5^{a} \pm 0.40$
Carbohydrates (%)	$11.2^{c} \pm 0.71$	$21.0^{b} \pm 0.20$	$23.6^{a} \pm 0.70$	$16.1^{c} \pm 0.26$	$21.4^{b} \pm 0.02$	$27.0^{a} \pm 0.16$
Energy value (kcal)	193.6	150.9	124.3	154.4	128.6	118

Means followed by the same letters in the different ice cream flavors have no significant differences ($p < 0.05$), according to Tukey's test.

CI1 (chocolate ice cream, 100% milk); CI2 (chocolate ice cream, 50% rice extract); CI3 (chocolate ice cream, 100% rice extract); SI1 (strawberry ice cream, 100% milk); SI2 (strawberry ice cream, 50% rice extract); SI3 (strawberry ice cream, 100% water-soluble rice extract).The protein content also decreased significantly when cow milk was replaced with rice extract, as it has a lower content of this nutrient. Ahsan et al.[16] found from 3.89 to 4.02% of protein. As for the mineral content, there was no significant difference between the samples. Ahsan et al.[16] found similar values for minerals (1.73 to 1.77%).

The carbohydrates mean values increased because rice has lower protein and lipid contents; consequently, it has more carbohydrates. The energy value decreased when rice was used as a substitute for milk – which is a positive aspect, as fewer calories are consumed in the same amount of ice cream.

The test for the ice creams developed only with water-soluble rice extract revealed good acceptability regarding color, smell, texture, and taste. No significant difference was found between the chocolate and strawberry ice cream developed with water-soluble rice extract (Table 4). Silva et al.[18] developed a strawberry ice cream with soybean extract, also having good acceptability: 73% said they liked it very much, in an overall evaluation of the ice cream. Aboulfazli F & Sba MM[17] evaluated color, texture, and taste as well, which scored 3.12 (1-5 scale) for color, 3 (1-5 scale) for texture, and 5.08 (1-10 scale) for taste.

Table 4. Acceptability of the chocolate and strawberry ice creams developed with water-soluble rice extract. Santa Maria, RS, 2015

Aspect	Chocolate	Strawberry	p-value
Color	6.12 ± 0.94	6.12 ± 0.80	1.000^{ns}
Smell	5.58 ± 1.18	5.52 ± 0.97	0.782^{ns}
Texture	5.20 ± 1.21	4.82 ± 1.32	0.137^{ns}
Taste	5.70 ± 1.03	5.56 ± 1.07	0.258^{ns}

ns = not significant ($p > 0.01$), according to variance analysis (ANOVA).

In the ordering test (Table 5), in which the three samples were offered, the order of preference for chocolate flavor was: ice cream with 100% milk; ice cream with 50% milk and 50% extract; ice cream with 100% extract. As for strawberry flavor, there was no difference between the samples with 100% milk and with 50% rice extract.

In the purchase intention test, 58% (score of 4.38 ± 0.49) of people would buy the strawberry ice cream with 100% water-soluble broken rice extract, while only 10% (2.00 ± 0.00) would not. Regarding the chocolate one, 68% (4.35 ± 0.49) of people would buy the ice cream made with water-soluble broken rice extract, while 6% (1.67 ± 0.58) would not. Silva et al.,[18] in a purchase intention test, verified that only 3% of the people who tried the strawberry ice cream made with soybean extract would not buy it.

Table 5. Order of preference test for the ice creams developed with and without water-soluble rice extract. Santa Maria, RS, 2015.

Ice cream	MI	MEI	EI
Chocolate flavor	68^{c}	97^{b}	135^{a}
Strawberry flavor	74^{b}	93^{b}	133^{a}

Sums followed by different letters in the different ice cream flavors have a significant difference ($p < 0.01$), according to Tukey's test.
MI (100% milk ice cream); MEI (50% rice extract ice cream); EI (100% rice extract ice cream).

CONCLUSION

The water-soluble rice extract presented good nutritional characteristics, especially the lower lipid content, and it proved to be feasible for use in the production of ice cream. The ice cream developed with water-soluble rice extract has lower lipid, protein, and energy values when compared with the traditional one made with cow milk. It achieved good acceptability; regarding preference, the strawberry ice cream made with 50% extract had no significant difference to the one made with cow milk. The ice cream made with rice extract proved to be a good alternative for consumers who seek a differentiated cow milk-free product.

REFERENCES

1. Brasil. Ministério da Saúde. Agência Nacional de Vigilância Sanitária – Resolução RDC nº 266, de 22 de setembro de 2005. Aprova o regulamento técnico para gelados comestíveis e preparados para gelados comestíveis. – Diário Oficial da União, Brasília, DF, 23 de setembro de 2005.
2. Sá PTM, Delani TCO, Ferreira AA. Aspectos etiológicos da hipolactasia. Rev. Uningá Rev. 2014; 20(2):123-128. Acesso em: 26 de março de 2016. Disponível em: https://www.mastereditora.com.br/periodico/ 20141001_083741.pdf.
3. Galego M, Oliveira V, Pintinha ME, Ricci G. Estudos sobre intolerância à lactose. Rev. Uningá Rev. 2015; 22(1):24-27.
4. Pinto JHP, Toledo RL, Franquelo WP. Alergia à Proteína do Leite de Vaca Persistente em adultos: Relato de caso. Rev. Cien. Saud. 2015; 5(4).
5. Jaekel LZ, Rodrigues RS, Silva AP. Avaliação físico-química e sensorial de bebidas com diferentes proporções de extratos de soja e de arroz. Cien. Tecnol. Alim. 2010;30(2):342-348. http://dx.doi.org/10.1590/S01012061201000020009.
6. Carvalho WT, Reis RC, Velasco P, Soares Júnior MS, Bassinello PZ, Caliari M. Características Físico-Químicas De Extratos De Arroz Integral, Quirera De Arroz E Soja. Pesq. Agrop. Trop. 2011;41(3):422-429. http://dx.doi.org/10.5216/ pat.v41i3.9885.
7. Instituto Adolfo Lutz (São Paulo – Brasil). Métodos físico-químicos para análise de alimentos. 4. ed. [1. ed. digital]. São Paulo (SP): Instituto Adolfo Lutz; 2008. Acesso em: 14 de setembro de 2014. Disponível em: http://www.ial.sp.gov.br/ resources/editorinplace/ial/2016_3_19 /analisedealimentosial_2008.pdf.
8. AOAC. Official Methods of Analysis of the Association of Official Analytical Chemists. 16th h., Washington, DC, 1995.

9. Mendez MHM, Derivi SCN. Tabela de Composição de Alimentos. Niterói: Editora da Universidade Federal Fluminense; 1995.
10. Dutcosky SD. Análise Sensorial de Alimentos. 3ª ed. Curitiba: Champagnat; 2011.
11. Brasil. Ministério Da Saúde. Conselho Nacional de Saúde. Resolução 466, de 12 de dezembro de 2012. Diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Diário Oficial da União, Brasília, DF, 13 de junho de 2013.
12. Statsoft INC. Statistica for Windows, Version 6.0, 2300 East 14th Street, Tulsa, OK, 74104, USA; 1998.
13. Christensen ZT, Ogden LV, Dunn ML, Eggett DL. Multiple comparasion procedures for analysis of ranked data. Jour. Text. Stud. 2006; 71(2): 132-143. https://doi.org/10.1111/j.1365-2621.2006.tb08916.x.
14. Barros EA, Venturini Filho WG. Caracterização físico-química e sensorial de extrato hidrossolúvel de soja obtido por diferentes métodos de processamento. Rev. Bra. Tecnol. Agroind. 2016;10(1):2017-2028. http://doi.org/10.3895/rbta. v10n1.2016.
15. Instituto Brasileiro De Geografia E Estatística – IBGE. Pesquisa de Orçamentos Familiares 2008-2009: Tabelas de Composição Nutricional dos Alimentos Consumidos no Brasil. Rio de Janeiro, 2011.
16. Ahsan S, Zahoor T, Hussain M, Khalid N, Khaliq A, Umar M. Preparation and quality characterization of soy milk based non-dairy ice cream. Inter. Jour. Food Allied Sci. 2015; 1(1). http://dx.doi.org/10.21620/ijfaas.2015125-31.
17. Aboulfazli F, Sba MM. Effect of vegetable milks on the physical and rheological properties of ice cream. Food Sci. Tech. Res. 2014; 20(5):987-996. http://doi.org/10.3136/ fstr.20.987.
18. Silva ACAS, Rangel CI, Pinto FR, Pereira GR, Mantoano RACO, Cardozo TSF, *et al*. Sorvete de morango à base de extrato de soja. Saud. Amb. Rev. 2011; 6(2):46-50.

Contributors

Montagner GE worked in all the stages, from designing the research to carrying out the practical aspects of the project, interpreting the results, and writing and revising the article. Storck CR worked on designing the research, supervising and advising the project, analyzing and interpreting the results, and revising and approving the final version of the article.

Conflict of Interest: The authors report no conflict of interest.

Received: October 4, 2019.
Accepted: April 2, 2020.