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Development of an acai-soymilk beverage: characterization and consumer acceptance

Desenvolvendo bebida de açaí e "leite" de soja: caracterização e aceitação do consumidor

Autores | Authors

Marco Antonio Monteiro de OLIVEIRA
Universidade Federal do Rio de Janeiro (UFRJ)
Escola de Química
Centro de Tecnologia
e-mail: marco@peq.coppe.ufrj.br

Mirian Ribeiro Leite MOURA
Universidade Federal do Rio de Janeiro (UFRJ)
Faculdade de Farmácia
Centro de Ciências da Saúde
Departamento de Produtos Naturais e Alimentos
e-mail: mirian.rlm@gmail.com

Ronoel Luiz de Oliveira GODOY
Embrapa Agroindústria de Alimento
e-mail: ronoel@ctaa.embrapa.br

Márcio NELE
Universidade Federal do Rio de Janeiro (UFRJ)
Escola de Química
Centro de Tecnologia
e-mail: nele@eq.ufrj.br

Rosires DELIZA
Embrapa Labex Europe
UMR CSGA
Dijon, França
e-mail: rosires.deliza@dijon.inra.fr

✉ **Ana Lúcia do Amaral VENDRAMINI**
Universidade Federal do Rio de Janeiro (UFRJ)
Escola de Química
Centro de Tecnologia
Av. Horácio Macedo, 2030
Bloco E, sala 203
CEP: 21941-909
Rio de Janeiro/RJ - Brasil
e-mail: alvendra@eq.ufrj.br

✉ *Autor Correspondente | Corresponding Author*

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Summary

Soybean is the most important agricultural commodity in Brazil. It is a highly nutritional food and soy/fruit juice beverages are extremely popular. Acai (*Euterpe oleracea* Mart.) is a tropical palm native to the Amazonian region, which contains considerable amounts of protein, fibre, oil, vitamin E, minerals and anthocyanins. This study aimed to evaluate the chemical properties and consumer acceptance of beverages based on soymilk and acai, using a mixture-based experiment to gauge consumer acceptance. The optimized beverage was characterized for its physicochemical properties, proximate composition, anthocyanins, total phenolic content (measured spectrophotometrically) and isoflavones (quantified by liquid chromatography). The statistical analyses showed the best model to be the adjusted Scheffé quadratic model, and the sugar content had an important effect on the consumer response. Although the resultant beverage reflected an adequate fit of the model, the score observed (4.8 for overall acceptability) may be considered low, although it is very close to the usual global acceptance for soy beverages with fruit juice. The optimized acai-soymilk beverage presented 3.52 g protein.250 mL^{-1} (14% of the Recommended Daily Intake), 4.35 ± 0.39 mg antocyanins.100 g^{-1} (value lower than initially estimated), 115.91 ± 2.78 mg total phenolics.100 g^{-1}, and high levels of isoflavones (53.84 ± 0.20 μg algycone equivalent.mL^{-1}). Some of these values were higher than the majority of soy-based fruit juice beverages sold in Brazil.

Key words: *Soymilk beverage; Acai (Euterpe oleracea Mart.); Consumer acceptance; Mathematical modelling; Nutritional composition.*

Resumo

A soja é a mais importante mercadoria da agricultura brasileira. É um alimento de alto valor nutricional, sendo as bebidas à base de soja/fruta bastante populares. Açaí (*Euterpe oleracea* Mart.), fruto de uma palmeira tropical nativa da região amazônica, apresenta consideráveis teores de proteína, fibra, óleo, vitamina E, minerais e antocianinas. O objetivo deste estudo foi avaliar as características químicas e a aceitabilidade de bebidas desenvolvidas com extrato hidrossolúvel de soja e açaí, através de experimentos de mistura para medir a aceitação do consumidor. A bebida otimizada foi caracterizada com base nas análises físico-químicas, na composição centesimal e no conteúdo de antocianinas e de fenólicos totais, determinados por espectrofotometria, enquanto o conteúdo de isoflavonas foi identificado e quantificado por cromatografia líquida. A análise estatística mostrou que o modelo quadrático ajustado proposto por Scheffé apresentou os melhores resultados, sendo o teor de açúcar o ingrediente de maior importância na avaliação do consumidor. Embora a bebida otimizada tenha refletido o modelo ajustado, o valor de aceitabilidade de 4,8 pode ser considerado baixo, mas parece ser próximo da aceitação global para bebidas de soja com suco de fruta. A bebida otimizada apresentou o teor de proteína de soja de 3,52g.250 mL^{-1} (14% da recomendação diária), 4,35 ± 0,39 mg de antocianinas.100 g^{-1} (valores abaixo do estimado estatisticamente), 115,91 ± 2,78 mg de fenólicos totais.100 g^{-1} e altos teores de isoflavonas (53,84 ± 0,20 μg de aglicona equivalente.mL^{-1}). Alguns destes valores são superiores aos encontrados na maioria das bebidas de soja adicionadas de sucos de frutas comercializadas no Brasil.

Palavras-chave: *Bebida de soja; Açaí (Euterpe oleracea Mart.); Aceitação de consumidor; Modelo matemático; Composição nutricional.*

1 Introduction

Recently, more people have become more health-conscious and hence diet is playing an increasingly important role. Such consumers are looking for healthier and more natural products, and may often avoid artificial ingredients when choosing products (DELIZA et al., 2005). They are thus likely to include products making health claims in their diets. Moreover, since nowadays many studies have demonstrated the beneficial effects that the consumption of selected foods can bring, it is very important that consumers have access to good, trustworthy information in order to help them make decisions regarding changes in their diet (MILNER, 1999).

Soy foods are not traditionally consumed by occidental populations. However, the spread of knowledge regarding the health benefits associated with soy consumption has contributed to a significant growth in the consumption of this legume in occidental countries, and soy/fruit juice beverages have recently become popular in Brazil (GENOVESE and LAJOLO, 2002). Nevertheless, the flavour of soy is still the main characteristic responsible for its low acceptability in occidental countries (CARRÃO-PANIZZI et al., 1999), and soy-based products are often described as bitter, rancid and astringent. This perception is mainly caused by the action of lipoxygenase enzymes naturally present in soybeans. However their use has been proposed as a promising alternative therapy for many hormone-dependent conditions, such as cancer, osteoporosis, cardiovascular diseases and menopausal symptoms due to the isoflavones contents (SETCHELL and CASSIDY, 1999; JACKSON et al, 2002).

Acai (*Euterpe oleracea* Mart.), also known as the cabbage palm, is a tropical palm, native to, and cultivated in, the Amazonian region, where it is of great local economical impact. The fruit of this plant, (also known as acai) is a purplish black berry containing high levels of anthocyanin pigments (GALLORI et al., 2004; COÏSSON et al., 2005). Since it contains considerable amounts of protein, fibre, oil, vitamin E, minerals and anthocyanins (ALEXANDRE et al., 2004), acai is also regarded as a nutritional fruit and a highly caloric food. International interest in acai has been rising continuously due to its high levels of anthocyanin pigments, which are well established anti-oxidants that combat the negative effects of free radicals (GALLORI et al., 2004; COÏSSON et al., 2005). In addition these pigments could provide a safer alternative to the use of synthetic food dyes for the consumers more concerned about their health (DEL POZO-INSFRAN et al., 2004).

Considering this scenario, soy beverages, especially those that are blended with fruit juices, appear to be a convenient way of including soy protein in the consumer diet (POTTER et al., 2007). Despite a dearth of accurate information, it is probable that the amount of soymilk in these beverages does not exceed 30% of the total formulation, which limits the amount of healthy soy-derived substances in the beverage. The companies who market soy beverages concentrate their investment on products based on fruits traditionally used in beverages, such as oranges, apples, grapes and peaches, and as yet, soy beverages blended with tropical fruits like acai are not available on the Brazilian or international markets.

This study aimed at developing and chemically characterizing a beverage with a significant content of soy protein and isoflavones based mainly on soymilk and acai, using a mixture-based experimental design and consumer preferences. Mixture-based experimental designs are widely used in the food technology industry to develop and optimize products. As observed by Næs et al. (1999), the use of this statistical method provides results that are more relevant and easier to interpret.

2 Material and methods

2.1 Material

Soybeans of the variety BRS-213, especially developed for human consumption by EMBRAPA (The Brazilian Agricultural Research Corporation), were provided by Sementes Paraná Ltda. Frozen pasteurized acai (*Euterpe oleracea* Mart.) pulp was provided by IceFruit Ltda and the sugar was purchased at the local market.

2.2 Experimental design

In the present study, the samples were prepared according to an experimental mixture design proposed by Scheffé (1958, 1963), in keeping with the experimental design methods presented by other authors (KHURI and CORNELL, 1987; LIMA et al., 1998). A 3-component experimental design may be represented by a triangle whose vertices correspond to the pure ingredients (soymilk, acai, sugar). In order to investigate the composite effects of the beverage ingredients on consumer acceptability, a simplex-centroid design, centred on a defined composition point (soymilk/acai/sugar = 0.65/0.25/0.10), was used to create a constrained region within the mixture space. In attempting to obtain a beverage with a significant content of soy protein and isoflavones, a second constraint was used: the minimum level of soymilk in the beverage formula had to be at least 0.60. The beverage mixture proportions are shown in Table 1.

2.3 Beverage preparation

Preparation began by soaking the soybeans in order to prepare the soymilk. Following the methods described by Carrão-Panizzi et al. (1999) and Kao et al. (2004) for the soaking process, each 100 g soybean was mixed with 300

Table 1. Beverage mixture proportions.

Sample	Pseudo-compositions			Nominal compositions		
	Z_1	Z_2	Z_3	Soymilk	Acaí	Sugar
A	1	0	0	0.75	0.20	0.05
B	0	1	0	0.60	0.35	0.05
C	0	0	1	0.60	0.20	0.20
AB	0.5	0.5	0	0.675	0.275	0.05
AC	0.5	0	0.5	0.675	0.20	0.125
BC	0	0.5	0.5	0.60	0.275	0.125
ABC	0.333	0.333	0.333	0.65	0.25	0.10

Z_1 = soymilk, Z_2 = *açaí* and Z_3 = sugar.

mL potable water at room temperature. The soaking time was between 12-16 h and the soymilk was prepared using a Sojamac MJ-720 (InnoMach Inc., Munich, Germany). The açaí pulp was thawed and filtered using a Büchner filter and a vacuum pump. Preparation of the beverage consisted of mixing the prescribed proportions of soymilk, filtered acai pulp and sugar using an overhead stirrer for 10 min at 450 rpm and 15 (± 2) °C. The proportion of each ingredient was defined by the composition shown in Table 1. All the beverage formulations were refrigerated at 5 (± 2) °C until used for the sensory evaluation or chemical analyses.

2.4 Consumer evaluation

The evaluation of consumer acceptance was carried out in two steps. Firstly, 72 consumers evaluated the overall acceptability of the seven samples using a nine-point structured hedonic scale varying from "disliked extremely" to "liked extremely" (PERYAM and PILGRIM, 1957). They also evaluated "buying intention" using a seven-point scale varying from ''definitively would not buy'' to ''definitively would buy'' (MEILGAARD et al., 1991). Consumers from 18 to 40 years old evaluated the samples in individual sensory booths under white lighting. The samples were coded with three digit numbers and presented to consumers one at a time (monadically) in 50 mL plastic cups at 8 °C. The sample presentation order followed a balanced design proposed by MacFie et al. (1989) to avoid carry-over effects. Mineral water at room temperature and unsalted cream crackers were provided to rinse the mouth between samples.

After obtaining the responses from the predictive models, a second sensory trial was carried out to validate the models calculated. In this second test only one beverage formulation - the optimized formulation - was evaluated, and a dummy formulation (the same as formula ABC in the first test – Table 1) was presented to participants in order to minimize the first sample effect. One hundred consumers evaluated these two formulations using the same procedure presented before, except with respect to presentation order. All the acceptability tests were carried out in the Sensory Evaluation Laboratory at EMBRAPA Food Technology.

2.5 Statistical analysis and optimization

In the Scheffé-type canonical equation (Equation 1) for three components, a special cubic polynomial known as

$$\eta = \sum_{i=1}^{3} \delta_i Z_i + \sum_{\substack{i=1 \\ i<j}}^{3} \sum_{j=1}^{3} \delta_{ij} Z_i Z_j + \sum_{\substack{i=1 \\ i<j<k}}^{3} \sum_{j=1}^{3} \sum_{k=1}^{3} \delta_{ijk} Z_i Z_j Z_k \qquad (1)$$

was used in order to fit with the experimental data, where η is the consumer response and δ_i is the polynomial coefficient for the pseudo-composition. The parameters δ_i (i = 1, 2 and 3) we are interpreted as the influence of the variable Z_i in the response (η) and δ_{ij} (i, j = 1, 2 and 3, i < j) as the deviation of the response due to non-linear binary interaction of the pseudo-components (LIMA et al., 1998). An Analysis of Variance was performed on the data and response surfaces were generated for each response using a predictive models. The fitted model for overall acceptability and for buying intention was used to optimize the beverage formulation by applying the desirability functions proposed by Derringer and Suich (1980).

The optimized formulation selected to verify the proposed models was the one presenting the highest score for overall acceptability and for buying intention. Since more than one possible formulation scored the maximum value, the formula containing the lowest level of acai was selected, since this was the most expensive ingredient in the beverage.

2.6 Chemical analyses

The physicochemical attributes (pH, °Brix and titratable acidity), moisture, oil and ash were determined using the standard methods of the Instituto Adolfo Lutz (2005). The protein content was determined by the Kjeldahl method, using a factor of 6.25 (HOROWITZ, 1984) and the carbohydrate content was calculated by difference. All the analyses were carried out in triplicate.

The anthocyanins were extracted from the optimized beverage and from the filtered acai pulp in duplicate using acidified methanol as described by Potter et al. (2007), with some minor experimental adaptations. Approximately 1 g of sample was extracted with 10 mL of 80% aqueous methanol (MeOH) containing 1 mL.100 mL^{-1} HCl for 1 h at room temperature, with continuous stirring using a light-protected stir/bar plate. The samples were then centrifuged at 3200 rpm for 15 min, the supernatant decanted, and the pellet re-extracted under the same conditions, combining the two supernatants. All the supernatant samples were stored in capped amber glass vials at 5 (2 °C).

The total monomeric anthocyanin pigment content of the samples was measured by spectrophotometer using the pH differential method (GIUSTI and WROLSTAD, 2001). The absorbance at 510 nm and 700 nm was measured using a UVmini-1240 spectrophotometer (Shimadzu Corp., Kyoto, Japan). Cyanidin-3-glucoside with a molar extinction coefficient of 26,900 L.cm^{-1}.mol^{-1} and molecular weight of 449.2 g.mol^{-1} was used as the reference.

Using the extracts obtained from the anthocyanin analysis, the total phenolics were estimated as described by Velioglu et al. (1998), with some experimental adaptations, using a ferulic acid standard to generate a standard curve. 1 mL of extract was mixed with 7.5 mL of Folin-Ciocalteu reagent (previously diluted 10-fold with distilled water) and allowed to stand at 22 °C for 5 min. An aliquot of 7.5 mL of a sodium bicarbonate (60 g.L^{-1}) solution was then added to the mixture, followed by another stabilization period (90 min at room temperature). The absorbance was measured at 725 nm in a spectrophotometer and the results expressed as mg.100 g^{-1} of ferulic acid equivalents.

The isoflavones were extracted from the optimized beverage and from the soymilk and quantified in duplicate according to Klump et al. (2001), with a minor experimental adaptation. Instead of weighing the sample, 10 mL of sample were extracted at 65 °C using 80% aqueous methanol (MeOH), followed by a mild saponification step with NaOH 2 mol.L^{-1} at room temperature. The HPLC apparatus consisted of a W600 analytical pump, a Waters 717 plus autosampler, a Waters PDA 996 photodiode array detector and a YMC-pack ODS-AM (4.6 mm x 250 mm) C18 reverse phase column with a 5 µm particle size (Waters Corp., Milford, M.A., U.S.A.). The injection volume used was 25 µl and the flow rate was 1.3 mL.min^{-1}. Mobile phase A was composed of water-methanol-acetic acid (88 + 10 + 2) and mobile phase B of methanol-acetic acid (98 + 2). The UV detector wavelength was set at 260 nm. A stock standard solution was prepared containing six isoflavone standards (daidzin, glycitin, genistin, daidzein, glycitein and genistein; Sigma-Aldrich Corp., St. Louis, Mo., U.S.A.) and the final results were expressed as µg aglycone equivalents.mL^{-1}.

3 Results and discussion

The first sensory trial was carried out in an attempt to evaluate the effect of each component on the responses. For both responses, the reduced polynomial model that best fitted the data was the adjusted Scheffé quadratic model (Equations 2 and 3).

$$\eta_{acceptability} = 2.77Z_1 + 2.83Z_2 + 4.47Z_3 + 4.59Z_1Z_3 + 5.19Z_2Z_3 \quad (2)$$

$$\eta_{purchase} = 1.92Z_1 + 2.07Z_2 + 3.30Z_3 + 4.01Z_1Z_3 + 4.59Z_2Z_3 \quad (3)$$

These equations indicate that the most important effects were due to interactions between the components soymilk*sugar (Z_1Z_3) and acai*sugar (Z_2Z_3), followed by the pseudo-component Z_3 (sugar). This shows that sugar had an important effect on the consumer response, especially when this component was combined with other beverage ingredients.

Using the models constructed for the responses and the desirability function of Derringer and Suich (1980), a new formulation composed of 0.61 soymilk, 0.24 acai and 0.15 sugar (0.07/0.25/0.68 in pseudo-component terms) was proposed. This formulation was referred to as the 'optimized beverage' and was also used to validate the models used in the second sensory trial. As shown in Table 2, the scores predicted by the fitted models agreed well with the mean and confidence intervals estimated for the consumer responses to the optimized beverage in the second sensory trial. However, the optimized beverages showed low acceptance, since the average score reached for overall acceptability and buying intention was close to the middle of the scales used in the experiments.

The scores observed (4.8 ± 2.4 for overall acceptability) were very close to the global acceptance for soy beverages with juice or fruit flavor. Valim et al. (2003) studied the overall acceptability of soy beverages with orange juice, and reported scores varying from 4.3 to 7.6. Potter et al. (2007) showed that the global acceptance of different formulations of a soy beverage with blueberry juice (Vaccinium angustifolium Ait.) varied between 3.8 and 6.3 on a 9-point hedonic scale.

Soy products are often perceived as having too many undesirable flavours – one of the most important

Table 2. Predicted and observed response for consumer evaluation.

Response	Predicted mean	Observed mean	Std. Dev.
Overall acceptability§	5.0	4.8	2.4
Intention to purchase§§	3.9	3.7	2.1

§Structured 9-point hedonic scale, varying from 1: disliked extremely to 9: liked extremely. §§Structured 7-point scale, varying from 1: definitively would not buy to 7: definitively would buy.

reasons for the low acceptance of these products in occidental countries (TORRES-PENARANDA et al., 1998; CARRÃO-PANIZZI et al., 1999; POTTER et al., 2007). The production of these undesirable flavours is directly related to the action of the lipoxygenase enzymes naturally present in soybeans (TORRES-PENARANDA et al., 1998). In an attempt to minimize the formation of undesirable "beany" flavours, the lipoxygenase-free BRS 213 cultivar was used to obtain the soymilk. However another sensory attribute also seems to have influenced consumer acceptance. The participants optionally made comments on the characteristics of the formulas they liked the most and those they disliked the most. Not all consumers made such comments, but most of the participants complained about the low viscosity of the beverage, suggesting that improvements in consistency could enhance overall product acceptance. This is perfectly justified since none of the formulations tested, not even the optimized beverage, contained any kind of additive. In addition, in most regions of Brazil, acai is consumed as the pulp – served cold and with a very high viscosity.

In terms of overall composition (Table 3), the optimized beverage presented about 15% of carbohydrate. This concentration is almost completely due to the sugar added to the optimized formula. In nutritional terms, this percentage of sugar can be considered to be a bit high for the soy beverages sold in Brazil (generally 12% of carbohydrate - reference Ades® Unilever).

Using a proportion of 0.61 soymilk in the formulation, the optimized beverage probably presented about 1.41 g.100 g^{-1} of soy-derived protein. If this is compared with other commercial soy-based fruit juice beverages available in Brazil, as reported by Genovese and Lajolo (2002), the optimized beverage presented at least the same soy protein content, and in some cases twice as much, such that a daily consumption of 250 mL of the optimized beverage would represent an intake of about 14% of the recommended daily ingestion of protein, and 192.5 Kcal (approximately 9.2% of the daily values based on a diet of 2,000 Kcal).

In terms of anthocyanins, the optimized beverage presented a concentration of 4.35 ± 0.39 mg.100 g^{-1}, a value lower than the 10.4 mg.100 g^{-1} initially estimated. Possibly degrading reactions, such as interactions of the anthocyanins with other beverage components, could have caused the observed loss. Coïsson et al., (2005) noted that the colour properties of acai, due mainly to anthocyanins, were drastically affected by enzymatic oxidation and also by polymerization reactions with phenolic composites. The filtered acai pulp presented an anthocyanin concentration of 43.82 ± 2.17 mg.100 g^{-1}. This concentration seems to be consistent with the data reported by Lichtenthäler et al. (2005), who found anthocyanin concentrations of between 13 and 463 mg.L^{-1} in acai pulp samples, with cyanidin-3-rutinoside as the predominant pigment when using an HPLC based method.

Anthocyanin concentrations vary with different fruit production-chain parameters including crop source, differences in cultivars, season, time of harvest, cultural conditions, storage and processing (WANG and MURPHY, 1996). These factors directly influence the concentration of anthocyanins present in acai-derived products. Del Pozo-Insfran et al. (2004) reported a concentration of 1,040 mg.L^{-1} of cyanidin-3-glucose in pasteurized acai pulp and Coïsson et al. (2005) reported cyanidin-3-glucose concentrations above 1,600 mg.kg^{-1} in acai juice. Apart from production-chain related factors, differences in the method used to analyze the samples also exist. Although the differential pH method is widely used to obtain an estimate of the anthocyanin content, the method generally gives higher values as compared with HPLC methods.

In relation to the total phenolic content, the optimized beverage presented a concentration of 115.91 ± 2.78 mg.100 g^{-1}. The filtered acai pulp presented values of 480.42 ± 14.9 mg.100 g^{-1} – higher than the 136.8 mg.100 g^{-1} reported by Kuskoski et al. (2006). Although a specific test has yet to be run to evaluate the real anti-oxidant capacity, the total phenolic content could provide an estimate of the food's potential anti-oxidant capacity. Unfortunately, this approach cannot be used for

Table 3. Overall composition of the optimized beverage, soymilk and *acai*.

Parameter§	Optimized beverage	Soymilk	Acai*
Moisture (g.100 g^{-1})	81.52 ± 0.16	95.68 ± 0.17	98.20 ± 0.02
Protein (g.100 g^{-1})	2.31 ± 0.03	3.08 ± 0.05	1.09 ± 0.03
Oil (g.100 g^{-1})	0.77 ± 0.04	1.15 ± 0.07	0.13 ± 0.07
Ash (g.100 g^{-1})	0.22 ± 0.01	0.19 ± 0.07	0.16 ± 0.01
Carbohydrates (g.100 g^{-1})	15.18 ± 0.16	0.00 ± 0.17	0.41 ± 0.08
pH	5.99 ± 0.02	6.70 ± 0.03	4.47 ± 0.00
°Brix	19.07 ± 0.29	5.41 ± 0.29	2.66 ± 0.00
Titratable acidity (g.100 g^{-1} citric acid)	0.05 ± 0.01	0.05 ± 0.00	0.12 ± 0.00

§mean values ± standard deviation (n = 3); * Reference of filtered acai pulp used to prepare the beverages.

samples that contain anthocyanins, since Velioglu et al. (1998) demonstrated a strong positive correlation between the total phenolic content and the antioxidant activity, despite the fact that the samples rich in anthocyanins presented a low statistical correlation for this effect. In another study, however, Kuskoski et al. (2006) reported a strong correlation between the total phenolic and anthocyanin content, and the antioxidant activity of fruits and fruit pulps.

The chromatographic analyses defined the distribution profile of the isoflavones (Figure 1). More than 75 % of the isoflavones were quantified as the glucoside derivatives daidzin, glycitin and genistin in both beverages (optimized and soymilk). According to Genovese and Lajolo (2002), the glucoside derivatives seem to be more abundant in soy based beverages. Despite this, the mild saponification step used during the HPLC analysis certainly contributed to an increase in the level of glucoside derivatives in relation to the aglycone derivatives. The total concentration of isoflavones in the optimized beverage was estimated considering in 53.84 ± 0.20 in 54 μg aglycone equivalents.mL^{-1}. This value was higher than that in the majority of soy-based fruit juice beverages sold in Brazil. The soymilk presented 80.27 ± 0.08 μg aglycone equivalents.mL^{-1} of total isoflavones – the same level as the Ades® (Unilever) product, which contains 82.9 mg.L^{-1} of isoflavone (expressed as aglycone) and 2.5 g.100 mL^{-1} of protein, as reported by Genovese and Lajolo (2002).

The minimum amount of isoflavone that should be ingested daily to have a positive effect on the health depends mainly on the type of isoflavone, and also on the effect expected. Setchell and Cassidy (1999) noticed that healthy pre-menopausal women presented endocrinal effects with doses of 50 mg/day of aglycones. For Setchell and Cole (2003) a consumption approaching 6-16 mg aglycone equivalents should be sufficient for a long-term protection against cardiovascular disease. Relating the above data with the concentration of isoflavone in the optimized beverage, a consumption of 250 mL would yield about 13.46 mg isoflavone (expressed as the aglycone).

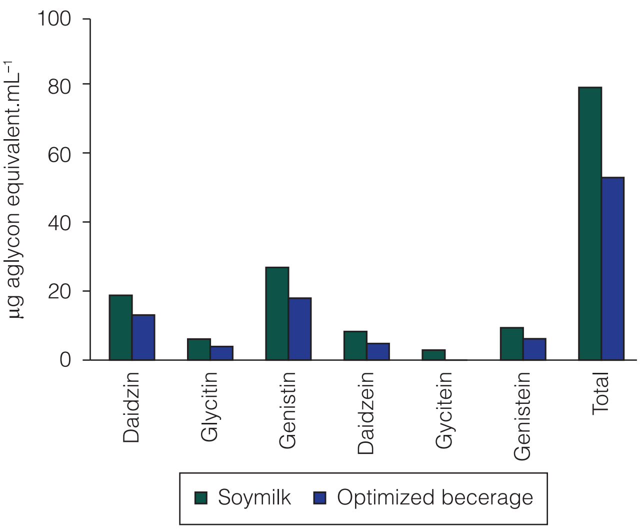

Figure 1. Distribution profile of isoflavone derivatives.

4 Conclusions

The optimized beverage developed, based mainly on soymilk and acai, presented low acceptability amongst the consumers. This was probably due to the low evident viscosity in the formulations tested. Further studies should be carried out to improve the beverage viscosity, and bring it more into line with consumer desires. In addition, the high proportion of soymilk in the beverages tested (more than 60%) certainly contributed to a diminished acceptance amongst the consumers, even though a special cultivar of soybean was used. With respect to the nutritional composition, the optimized acai-soymilk beverage presented 3.52 g protein.250 mL^{-1} (14% of the recommended daily intake), 4.35 ± 0.39 mg anthocyanins.100 g^{-1}, 115.91 ± 2.78 mg total phenolics.100 g^{-1} and high levels of isoflavones (53.84 ± 0.20 μg algycone equivalent.mL^{-1}), which could probably provide the beverage with a functional use. Some of these values were higher than the majority of soy-based fruit juice beverages sold in Brazil and represent a way of including the benefits of soy and acai into the diet of the Brazilian consumer.

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