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## Abstract

The formulation of innovative edible ice cream depends on the quality and differentiation of the ingredients used in order to confer its sensory and functional properties. The Brazilian ice cream market has grown almost 80% in ten years. Brazil is now the fourth largest ice cream market in the world, behind the USA, China and Japan. In this sense, this paper aimed to employ differentiated ingredients, among which is the rebaudioside A extracted from Stevia leaves pre-treated with ethanol, as a sweetening and functional agent, and fruits like strawberry and guava, rich in anthocyanins and widely used in the formulation of functional food products, due to the health benefits of their compounds. Five formulations were made, using as sweetening agent: sucralose (formulation 1 - F1), sucrose (formulation 2 - F2), rebaudioside A (formulation 3 - F3). In order to standardize the formulation, two new ice creams were made by changing only the amount of concentrated guava juice in the sucralose and sucrose formulations (formulations 4 and 5). The ice creams were analyzed chemically, and the results showed that the reb A extracted from pre-treated leaves has great potential to sweeten ice cream formulations when compared to sucrose and sucralose, since the results suggest that there was no loss of sweet taste quality. Thus, rebaudioside A can be an alternative for replacing sugar, which is caloric, and also the sweetener sucralose, which, although it is not caloric, is synthetic, which can bring risks to the consumer's health.

## Introduction

The use of rebaudioside A (RebA) and stevia products as a sweetening agent in food products may vary from country to country, depending on the legislation adopted. Stevia (*Stevia rebaudiana* Bert.) is a perennial shrub known worldwide for containing natural sweeteners, such as RebA, in its leaves. These sweeteners have shown high functionality, such as antioxidant activity, antidiabetic, insulinotropic, anticariogenic, acting mainly in metabolic syndromes such as diabetes and obesity (Samuel et al. 2018).

A recent publication describing the bioeconomic prospects of natural stevia sweeteners (CIRIMINNA et al. 2018), highlights the innovative aspect of the process developed by the Center for Studies in Natural Products that allows to selectively remove substances that compromise the sensory profile of stevia extracts, enabling the development of new food products with high sensory quality (FORMIGONI et al 2018).

Thus, this paper aimed to develop formulations of ice cream sweetened with rebaudioside A in replacement of sucrose and sucralose.

## Materials and methods



Formulation 1 (F1) was sweetened with 800 mg of sucralose (synthetic high intensity sweetener), formulation 2 (F2) was sweetened with 20 g of sucrose (sugar), and formulation 3 (F3) with 200 mg of rebaudioside A (Table 1). In order to standardize the amount of concentrated guava juice, aiming to evaluate only the sweetness and the differences between high intensity sweeteners and sucrose, two other formulations were prepared, F4 and F5, in which the amount of concentrated juice was the same (30g) used in the formulation sweetened with rebaudioside A.

**Table 1.** Formulations used in the preparation of edible ice creams.

Ingredientes	F1	F2	F3	F4	F5
Strawberry (g)	75	75	75	75	75
Pasteurized and standardized whole milk (mL)	65	65	65	65	65
Palm Oil (g)	4	4	4	4	4
Skim milk powder (g)	4	4	4	4	4
Emulsifier (g)	2	2	2	2	2
Guava juice concentrate (g)	10	10	30	30	30
Calcium Chloride(mg)	50	50	50	50	50
Sodium Chloride(mg)	30	30	30	30	30
Sucralose (mg)	800	-	-	800	-
Sucrose (g)	-	20	-	-	20
Rebaudioside A (mg)	-	-	200	-	-

F1=Ice cream sweetened with sucralose; F2=Ice cream sweetened with sucrose; F3=Ice cream sweetened with rebaudioside - A. F4=Ice cream sweetened with sucralose and 30g of guava juice; F5=Ice cream sweetened with sucrose and 30g of guava juice.

The formulations were submitted to quantification of compounds and antioxidant capacity by inhibition of the DPPH radical.

## Results and discussion

The formulation with rebA in the preliminary sensory tests (results not shown) indicated in principle that the tested stevia sweetener has the potential to replace sucrose and sucralose in the tested formulations. However, (F3) contained a larger amount of guava juice concentrate, which could have influenced the taste. Thus, new formulations were prepared with the same amount of concentrated guava juice in all formulations.

The results showed a difference only in F2, because when the juice concentration was increased, the sweetness potential of sucrose was significantly reduced, not presenting sweetness equivalence with the other formulations. Thus, it would be recommended to adjust the addition of sucrose to obtain the equivalent sweetness.

Regarding the analyses of possible phenolic compounds and antioxidant capacity, the results showed that there was no difference between the formulations (Table 2).

**Table 2** Total phenolic compounds and antioxidant activity of the edible ice cream formulations.

Formulation	Phenolic compounds (µg/mL)	Antioxidant capacity (%)
F1	627,45 ± 13,7	81,04 ± 3,0
F2	650,12 ± 17,5	70,77 ± 4,6
F3	619,96 ± 8,8	74,45 ± 4,4
F4	551,97 ± 9,1	81,83 ± 0,1
F5	650,29 ± 9,5	70,76 ± 2,0

F1=Ice cream sweetened with sucralose; F2=Ice cream sweetened with sucrose; F3=Ice cream sweetened with rebaudioside - A. F4=Ice cream sweetened with sucralose and 30g of guava juice; F5=Ice cream sweetened with sucrose and 30g of guava juice.

Even not presenting differences between the formulations, in relation to the content of phenolic compounds and antioxidant capacity, the ice cream formulation with rebaudioside A can be considered functional for consumption mainly by individuals who consume a balanced diet, with reduced sugar, or by diabetic and obese patients who have dietary restrictions. As the change in the formulation was only the substitution of sugar for sweeteners, these results were already expected.



The use of rebA may be a nutritious alternative for sweet-tasting products, because besides reducing the consumption of sugar and consequently reducing the risk of metabolic syndromes, rebA presents several nutritional benefits, which the literature describes as anti-inflammatory, insulinotropic, antihyperglycemic, anticariogenic, and anti-atherogenic effects, among others.

## Conclusion

Rebaudioside A has the potential to be used as a high-intensity sweetener in ice cream formulations developed as a substitute for sucrose and sucralose, without loss of sweet flavor quality, thus constituting an alternative for replacing sugar, which is caloric, and also the sweetener sucralose, which, although it is not caloric, is synthetic, which can pose health risks to consumers.

## Recommendations

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