

## **Confusion or fraud? Labeling of Stevia Sweeteners**

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### **Fiorella Geraldine Olazar**

Licenciada en Biotecnología

Institution: Universidad Nacional de Asunción

Address: Campus Universitario, San Lorenzo, Paraguay

E-mail: geraldineolazar@gmail.com

### **Eduardo Ramón Ferreira**

Licenciado en Biotecnología

Institution: Universidad Nacional de Asunción

Address: Campus Universitario, San Lorenzo, Paraguay

E-mail: eduramonfg@gmail.com

### **Victoria Valdovinos**

Licenciada en Tecnología de los Alimentos

Institution: Universidad Nacional de Asunción

Address: Campus Universitario, San Lorenzo, Paraguay

E-mail: victoria.valdovinos4@gmail.com

### **Sacchio Kanasawa**

Licenciado en Tecnología de los Alimentos

Institution: Universidad Nacional de Asunción

Address: Campus Universitario, San Lorenzo, Paraguay

E-mail: kanazawasachio@gmail.com

### **Ingrid Micaela Barua Stock**

Estudiante universitaria

Institution: Universidad Nacional de Asunción

Address: Campus Universitario, San Lorenzo, Paraguay

E-mail: ingridbarua@gmail.com

### **Nidia Benítez Candia**

Estudiante universitaria

Institution: Universidad Nacional de Asunción

Address: Campus Universitario, San Lorenzo, Paraguay

E-mail: nidiabbc@gmail.com

### **Danilo Fernández Ríos**

Maestría

Institution: Universidad Nacional de Asunción

Address: Campus Universitario San Lorenzo, Barrio Universitario, San Lorenzo, Paraguay

E-mail: dfernandez@facen.una.py

**Andrea Alejandra Arrua**

Doctorado

Institution: Universidad Nacional de Asunción

Address: Campus Universitario, San Lorenzo, Paraguay

E-mail: andrea.arrua@cemit.una.py

## **ABSTRACT**

Fraudulent labeling is an emerging problem in the food industry worldwide. Many Stevia sweeteners are marketed in Paraguay, and their labels can be confusing. For this reason, 21 packs of sweetener products were analyzed regarding their degree of compliance with the labeling regulations in force in the country. All of the analyzed containers complied with the MERCOSUR regulations on food labeling, and 95.2% complied with MERCOSUR regulations on nutritional labeling. Over half of the containers did not comply with the local regulation for the naming of Stevia products. This is the first study on possible fraudulent labeling carried out in Paraguay, and it highlights the need to monitor compliance of food labeling regulations in the country.

**Keywords:** sweetener, fraud, health.

## **1 INTRODUCTION**

One of the most important emerging problems affecting the food industry is food fraud (Johnson, 2014), defined as an intentional act of substitution, addition, manipulation or misrepresentation of the characteristics of food, its ingredients or packaging, and carried out for the purpose of financial gain. This type of act also represents a potential risk to public health (Soon et al., 2019).

Misleading or fraudulent labeling is framed within the so-called process integrity fraud, which includes those “value descriptors” such as indicating that a product is “natural” to increase the product’s economic value or change the consumer’s perception of the product in a favorable way (Manning, 2016). At the international level there are a series of regulations that aim to support and guide the consumer to understand the properties and content of prepackaged foods available in the market (Bareiro, 2021).

One of the most representative products of Paraguay worldwide is *Stevia rebaudiana*, popularly known simply as stevia or *ka'a he'ẽ* (Bogado-Villalba et al., 2021). This plant, native to the country, is a small perennial Asteraceae (Goyal et al., 2010). Its glycoside constituents, stevioside and rebaudioside, are 250 to 300 times sweeter than sucrose, and beneficial effects have been reported, such as being auxiliary in weight control and diabetes management (Ritu & Nandini, 2016), control of dental caries, and antifungal and antibacterial effects (Gamboa & Chaves, 2012; Paredes Vélez & Naranjo Sierra, 2016). In addition, it has been reported that it can be useful in the management of blood pressure and modulation of the immune system, and it is considered safe and non-toxic (Salvador-Reyes et al., 2014).

All these characteristics make stevia an attractive product, especially when compared to other sweeteners such as aspartame or cyclamate, which have been questioned for their potential negative

effects on human health that include: diabetogenic effects (Shastry et al., 2012), urinary tract tumors, lymphoma, leukemia (Andreatta et al., 2008; Gultekin, 2015), and DNA damage (Zeynep & Sifa, 2014). Others, such as acesulfame, have been classified as safe, as there are currently no conclusive studies regarding their potential adverse effects (Chappell et al., 2020).

Stevia is one of the most important products in Paraguay, since it is the center of origin of this species (Hastoy et al., 2019; Soejarto et al., 1982). A wide variety of locally produced and imported sweeteners with or based on stevia are marketed in Paraguay, and many of these products have potentially confusing labels.

The institution in charge of label monitoring is the National Institute of Food and Nutrition (INAN), which depends on the Ministry of Public Health and Social Welfare (Ministerio de Salud Pública y Bienestar Social del Paraguay, 1996). The specific labeling for products with and based on stevia is governed by Resolution S.G. No. 339/16, which establishes quality and safety requirements for table sweeteners that contain steviol glycosides or stevia extract (*Stevia rebaudiana* Bertoni) in their composition (Poder Ejecutivo del Paraguay, 2016).

It is essential that consumers understand and demand the correct labeling of food so that they can make informed decisions about their purchases, and that the authorities enforce current regulations such as Law 1332/98 on Consumer and User Protection (Poder Legislativo del Paraguay, 1998), and establish specific laws that punish those who commit food fraud. Considering the above, the objective of this study was to know and compare the mandatory and specific information related to stevia present in the labeling of 21 sweeteners with and based on stevia marketed in Asunción and the Metropolitan Area, Paraguay.

## 2 METHODOLOGY

For the analysis of the labels, primary sources of information were considered. The type of research was quali-quantitative by observation. Convenience non-probability sampling was applied. The universe was defined as sweeteners with and based on stevia displayed on shelves in retail stores in the cities of Asunción, Luque, San Lorenzo, Fernando de la Mora, Limpio, Capiatá, Mariano Roque Alonso, Lambaré, Ñemby, Villa Elisa and San Antonio, corresponding to the Greater Asunción Metropolitan Area, Paraguay, an area with a population of approximately 2,750,000 inhabitants (Causarano, 2011). The products were purchased from March 1 to December 30, 2020. The sample size was 21 products from 13 sweetener brands with or based on stevia in its composition, liquid, in tablets, and powdered, with a Sanitary Registry of Food Products (RSPA) number granted by INAN (Poder Ejecutivo del Paraguay, 2018).

The products were coded and transported under suitable conditions to the Plant Biotechnology Laboratory of the Department of Biotechnology of the Faculty of Exact and Natural Sciences, National University of Asuncion, where photographic records were taken and descriptive tables were prepared to compile all the data from the labels. Data were taken on the brand, batch, form of presentation, origin, distinctive logo (free of wheat, oats, rye and barley; suitable for cooking; approved by the Paraguayan Diabetes Foundation, FUPADI), amount equivalent to one tablespoon of sugar, and sweeteners present in addition to those derived of stevia and established by current legislation.

A data collection instrument was prepared using a structured form with specifications according to the following regulatory instruments:

1. CODEX General Standard for the Labeling of Prepackaged Foods (Food and Agriculture Organization of the United Nations, 2001).
2. Resolution MERCOSUR / GMC / RES No. 26/03 “Mercosur Technical Regulation for Labeling of Packaged Foods” (Mercado Común del Sur, 2003b).
3. Resolution MERCOSUR / GMC / RES No. 46/03 “Mercosur Technical Regulation on the Nutritional Labeling of Packaged Foods” (Mercado Común del Sur, 2003c).
4. Resolution S.G. No. 339/2016 (Poder Ejecutivo del Paraguay, 2016).
5. Resolution S.G. No. 048/2021 (Poder Ejecutivo del Paraguay, 2021).

### **3 RESULTS AND DISCUSSION**

Of the 21 products analyzed, the following forms were present: one tablet, three powdered, and 17 liquid; 20 products were made in Paraguay and one product was made in Argentina.

As mentioned, in relation to stevia there are several regulations (Poder Ejecutivo del Paraguay, 2016, 2021; Poder Legislativo del Paraguay, 2013; Presidencia de la República del Paraguay, 2011) that justify and support the prioritization of label monitoring of packaged foods by INAN as a means to help consumers in choosing their foods. It is important to highlight that MERCOSUR regulations are mandatory, unlike the CODEX Alimentarius, which contains recommendations to guide countries in relation to their food regulatory frameworks and for governments to establish regulations.

The mandatory information required in Resolution MERCOSUR / GMC / RES. No. 26/03 includes the trade name of the food, list of ingredients, net content, identification of the origin, business name and address of the importer for imported foods, batch identification, date of expiry, and mode of preparation of the food when applicable.

In the analyzed packages, in terms of the sale denomination of the food, 100% complied with the MERCOSUR regulations. In their name they used words like tabletop sweetener, powdered tabletop

sweetener, liquid tabletop sweetener, *ka'a he'ē* sweetener, tabletop sweetener, sweetener, liquid sweetener. Many times the consumer recognizes the brand of the food without really knowing what it is they are consuming, generally people do not read the content of the labels unless they have a specific pathology that could be affected by some product component (Chatzipanagiotou et al., 2016; Foroudi et al., 2018)

All of the packages observed presented an ingredients list, one of the brands declared a single ingredient without mentioning other components, not even those that would be a product vehicle. In several of the products analyzed the steviol glycoside content was found in third or fourth place in the list of ingredients of the product. According to current regulations, the products in the list of ingredients must be in descending order from highest to lowest amount present; this could be an important indication for consumers of products with or based on stevia. All of the containers observed showed the net content, in milliliters, cubic centimeters, or grams (Mercado Común del Sur, 2003a). Ninety-five and two tenths percent of the packages complied with the regulations regarding the nutritional labeling of foods (Mercado Común del Sur, 2003b).

In relation to the identification of the origin, business name, and address of the importer, in the case of imported products, all of the containers had a brand, which is part of the denomination, and also serves as support to the business strategy. In addition, the Establishment Registry number and the Sanitary Registry of Food Products number were observed. Lot identification was observed in all of the containers studied, as well as the date of duration and the instructions for use (Mercado Común del Sur, 2003b).

Point 3 of Resolution MERCOSUR / GMC / RES. No. 26/03 deals with information that should not be on the label and that could mislead consumers by leading to confusion or inducing purchase: "These products must not have phrases, words, or images that could confuse or mislead consumers; that highlight their supposed therapeutic or medicinal properties or beneficial effects on health" (Mercado Común del Sur, 2003b). A fact worth highlighting is that all of the packages that were part of this study had images related to stevia plants; and 76.2% showed phrases related to their natural and beneficial properties; however, only 43.7 % of the products with these phrases were 100% stevia, thus the provisions of the aforementioned technical regulation are breached, since item 3.1, paragraphs a - g it mentions that it is not allowed to use the word stevia or *ka'a he'ē* if the product is not 100% steviol glycoside (Table 1).

The general CODEX standard for the labeling of prepackaged foods, in its general principles, indicates that "Prepackaged food shall not be described or presented on any label or in any labelling in a manner that is false, misleading or deceptive or is likely to create an erroneous impression regarding its character in any respect" and that "Prepackaged food shall not be described or presented on any label or in any labelling by words, pictorial or other devices which refer to or are suggestive either directly or indirectly, of any other product with which such food might be confused, or in such a manner as to lead

the purchaser or consumer to suppose that the food is connected with such other product”, referring in these specific points to misleading or fraudulent labeling (Food and Agriculture Organization of the United Nations, 2001). The Codex Guidelines on nutritional labeling indicate that it should be made easier for the consumer to access and understand the information on labels (Food and Agriculture Organization of the United Nations, 1985), ensuring that the nutritional label does not describe a product or present false, equivocal or misleading information.

Resolution S.G. No. 339/2016 in item 2.3 indicates that sweeteners are classified into three types: a) those made only with steviol glycosides and / or stevia extract, b) those made only with steviol glycosides and / or stevia extract and added nutritive sugars (mono and disaccharides) and c) those made by mixing steviol glycosides and / or stevia extract with other non-nutritive sweeteners permitted by current legislation with or without the addition of nutritive sugars. In item 2.6.1, the same resolution mentions a) only those products that comply with item 2.3.a can carry in its trade name the word “stevia”, that is, those that are 100% steviol glycosides. This means that of the 21 products analyzed, 7 (33.3%) complied with this rule, and 14 (66.6%) did not. A product of Argentine origin was at fault, since despite declaring 97400 mg / 100g of sugar on its nutrition facts table, said composition was not declared in its name as indicated by the regulations that it should be.

### 3.1 SPECIAL LABELS

Regarding special labels, 13 products presented the gluten-free seal; 9 declared to be suitable for cooking, and 5 were approved by FUPADI. Currently there is no regulation in Paraguay regarding special labels and their associated images, so the companies that use them do so through agreements with the Paraguayan Celiac Foundation (FUPACEL) (Fundación Paraguaya de Celiacos, 2021) and the Paraguayan Diabetes Foundation (FUPADI) (Fundacion Paraguaya De Diabetes, 2021).

### 3.2 LABELING REFERRING TO SWEETENERS WITH OR BASED ON STEVIA

Regarding the composition of the sweetener, all of the products mentioned on their label the presence of steviol glycosides in variable levels declared in different units of measurement, such as percentage, milligrams per gram, milligrams per milliliter, or milligrams per hundred milliliters. Of the 21 packages observed, only one (4.8%) did not declare the steviol glycoside content on its label. Seven products declared to be 100% stevia and 14 declared to have at least one more sweetener in addition to steviol glycosides. Twenty products indicated the equivalent of a tablespoon of sugar on the label, while one product did not. In relation to the steviol glycoside contents declared in the products, these were

variable. The lowest declared content was 12 mg / 100 mL, and the highest 33,520 mg / 100 g, in liquid and both in tablet form respectively.

In relation to the amount of sweeteners declared on product labels in addition to steviol glycosides, 4 brands declared that they contain at least one more sweetener; 7 declared two more sweeteners; and 2 brands declared 3 and 5 more sweeteners respectively. One brand did not claim any component other than steviol glycosides, however it did not claim to be 100% stevia; and 7 brands claimed to be 100% stevia.

Regarding the types of sweeteners added to the products in addition to steviol glycosides, one brand declared that it contains sugar; one brand declared the presence of Acesulfame; two brands sorbitol; six brands sucralose and eight brands cyclamate and saccharin respectively.

In reference to section 2.6.c of Resolution S.G. No. 339/2016 which indicates that the sweeteners that contain in their composition steviol glycosides and / or stevia extract mixed with other sweetening principles must include on the label next to the trade name the name of all the sweeteners it contains with the same emphasis and visibility, none of the mixed products analyzed complied with the provisions of the current regulations, since they did not declare in their trade name the all the sweeteners present (Table 1) (Poder Ejecutivo del Paraguay, 2016).



Table 1. Description of sweeteners by brand.

Brand	Type	Image of Stevia	Stevia or health-related phrase	Sugar	Steviol glycosides	Sucralose	Aspartame	Saccharin	Cyclamate	Sorbitol	Acesulfame	Suitable for cooking	Wheat, oats, rye and barley-free	FUPADI
A	Powdered sweetener	x	x	x	x	x							x	
B	Stevia sweetener	x	x		x							x	x	
C	Liquid tabletop sweetener	x			x			x	x					
D	Liquid tabletop sweetener mix	x			x			x	x				x	
E	Liquid tabletop sweetener	x	x		x			x	x	x		x	x	x
F	Liquid tabletop sweetener	x			x	x					x	x	x	x
G	Tabletop sweetener	x			x	x		x	x	x		x	x	x
H	Liquid tabletop sweetener	x	x		x									
I	Liquid tabletop sweetener, liquid sweetener	x	x		x	x						x		
J	Powdered tabletop sweetener	x	x		x	x						x		
K*	Tablet tabletop sweetener	x	x		x								x	
L	Sweetener	x	x		x				x			x		
M*	Liquid tabletop sweetener	x	x		x								x	
N	Tabletop sweetener	x	x		x									
O	Tabletop sweetener mix	x	x		x			x	x			x	x	x



P	Powdered tabletop sweetener mix	x			x			x	x			x	x	
Q	Powdered tabletop sweetener	x	x		x									
R	Tabletop sweetener	x	x		x									
S	Sweetener	x	x					x	x				x	
T	Liquid tabletop sweetener	x	x		x									
U	Sweetener**	x	x		x								x	

\*With certificate of origin, stevia of Parag uayan origin. \*\*Does not declare percentage of steviol glycosides or other products.

The current specific regulation for this type of product, Resolution S.G. N° 339/2016 (Poder Ejecutivo del Paraguay, 2016) makes no mention of images. All the products analyzed in this study had the image of stevia leaves or plants on the label; in the case of mixed products I and J, the images virtually occupied the entire package.

These images and phrases or paragraphs about the properties of stevia in products that are not 100% stevia may confuse the buyer and induce them to purchase a product that does not correspond to what the label implies, which indicates that the regulations should include the use of images alluding to the stevia plant. The current regulations also do not refer to the use of the word "mix" to indicate that the product is a mixture of sweeteners (Poder Ejecutivo del Paraguay, 2016).

Chapter V "Standards for Food Labeling and Advertising" of Argentina's Food Code mentions aspects related to misleading or fraudulent food labeling (Administración Nacional de Medicamentos Alimentos y Tecnología Médica, 2021). The United States has a Final Rule for Mitigation Strategies to Protect Food Against Intentional Adulteration, the Food Safety Modernization Act (FSMA), in addition to regulations, guidelines, tools, resources, and educational materials concerning food fraud and defense (U.S. Food and Drug Administration, 2021c, 2021b, 2021a). Spain deals with food fraud in item 9 of its Law 28/2015 "for the defense of food quality", Title III, Article 14, on serious offenses (Ministerio de la Presidencia Relaciones con las Cortes y Memoria Democrática, 2015).

Reports indicate that up to 55% of the analyzed products sold in some markets are incorrectly labeled, as they do not match their product specifications (Di Pinto et al., 2019).

Food fraud is an ethical issue that affects both ethical manufacturers and consumers, and the authenticity of the food supply is a resource that can have implications beyond consumer health and industry bottom lines (Everstine et al., 2018). Food fraud can affect consumers' perceptions of the accuracy of labeling of all the products they consume (Meerza & Gustafson, 2018).

Because of this, the need for monitoring by regulatory bodies and efficient implementation of food safety management systems is emphasized (Di Pinto et al., 2019). Reports indicate that food fraud costs the food industry approximately \$10 to \$15 billion per year, and that the associated incidents cause secondary effects that include loss of public confidence in the system's efforts to ensure the safety of the food supply and the effectiveness of regulatory systems (Everstine et al., 2018).

It is a mandate of MERCOSUR that nutritional labeling shall be complemented with health strategies and policies of the Member States for the sake of consumer health (Mercado Común del Sur, 2003a). It is essential to carry out consumer education campaigns so that consumers understand the information contained on the labels and know how to use it.

#### **4 CONCLUSIONS**

All of the packages analyzed complied with the MERCOSUR regulations regarding food labeling. Ninety-five and two tenths percent of the packages complied with MERCOSUR regulations on nutritional food labeling. All of the packages contained images alluding to stevia, in infringement of the recommendation by the Codex Alimentarius. A total of 76.2% of the products contained phrases alluding to their beneficial properties, and 56.25% did not comply with the labeling regulations in force in Paraguay, which constitutes misleading labeling.

This is the first study on fraudulent labeling carried out in Paraguay, and demonstrates the need for similar studies to detect different types of fraud in food products, especially products that are representative of the country at the international level, such as stevia.

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