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Nutrition quality of packaged food and beverages in Costa Rica: an input for crafting harmonious school food environment policies

Calidad nutricional de alimentos y bebidas preenvasados en Costa Rica: Un insumo para el diseño de políticas alimentarias armoniosas

Melissa L. Jensen[1*], Tatiana Gamboa-Gamboa[1], Jaritza Vega-Solano[2], Karol Madriz-Morales[3], Adriana Blanco-Metzler[2]

1. Escuela de Nutrición, Universidad de Costa Rica, Costa Rica
2. Instituto Costarricense de Investigación en Salud y Nutrición (INCIENSA), Costa Rica
3. Ministerio de Salud de Costa Rica, Unidad de Planificación Sectorial, Costa Rica

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***Correspondence:** Melissa L. Jensen. Email: melissa.jensen@ucr.ac.cr

Abstract

The objective of this study was to compare the proportion and types of foods and beverages that would be subject to regulation according to two nutrient profiles: the Costa Rica School Decree (CRSD) and the Pan American Health Organization (PAHO) profile, and to provide recommendations for future policy design. The CRSD regulates the content of energy, sugar, total and saturated fats, and sodium, whereas the PAHO model regulates free sugar, total, saturated, and trans fats, sodium, and the presence of non-nutritive sweeteners. In this cross-sectional study, we analyzed the content of calories, sodium, sugars, and saturated fats in packaged products (n = 2,216) collected in 2015 and determined the proportion of non-compliant products according to both nutrient profiles. The agreement for non-compliant/compliant products was estimated, and the median number of nutrients in excess was compared. According to the Costa Rica School Decree, 85.2% of foods and 66.1% of beverages would be classified as non-compliant. A larger proportion of products was classified as non-compliant according to the PAHO profile (91.9% of foods and 70.9% of beverages). Chocolates and marshmallows, cookies, and crackers had the highest median number of nutrients in excess (three to four), followed by bakery items, nuts and seeds, and salty snacks (two to three). For beverages, the median number of nutrients in excess was one, according to both profiles. In conclusion, differences were found between the two nutrient profiles, which should be considered when discussing a future regulation on front-of-package (FOP) warning labels. In addition, the percentage of packaged products sold in Costa Rica that are excessive in critical nutrients, and therefore would be subject to a warning label, was high, representing a public health concern.

Keywords: Children. School food environment. Costa Rica. Nutrient profiles.

Resumen

El objetivo de este estudio fue comparar la proporción y tipos de productos preenvasados que estarían sujetos a regulación, de acuerdo con dos perfiles nutricionales: el Reglamento de Sodas Escolares vigente en Costa Rica (RSCR) y el de la Organización Panamericana de la Salud (OPS), y proveer recomendaciones para el diseño de políticas públicas futuras. El RSCR limita el contenido de energía, azúcares, grasas totales y saturadas, y sodio; mientras que el perfil de la OPS incluye límites para azúcares libres, grasas totales, saturadas y trans, sodio, y la presencia de edulcorantes. En este estudio transversal, se analizó el contenido de calorías, azúcar, sodio y grasas saturadas de productos preenvasados (n = 2.216), recolectados en 2015, y se determinó la proporción que cumplía con los criterios de los perfiles nutricionales. Se estimó el porcentaje de concordancia entre ambos perfiles y la mediana del número de nutrientes en exceso. De acuerdo con el RSCR, el 85,2% de los alimentos y el 66,1% de las bebidas se clasificarían como no conformes. Una mayor proporción de productos fue clasificada como no conforme utilizando el perfil de la OPS (91,9% de alimentos y 70,9% de bebidas). Los chocolates y malvaviscos, galletas dulces y saladas tuvieron la mediana más alta en el número de nutrientes en exceso (tres a cuatro), seguidos por productos de repostería, nueces y snacks salados (dos a tres). Para las bebidas, la mediana del número de nutrientes en exceso fue uno, de acuerdo con ambos perfiles. En conclusión, se encontraron diferencias en la identificación de alimentos y bebidas clasificados como no conformes entre ambos perfiles, lo cual debería considerarse al discutir una futura regulación sobre el etiquetado nutricional frontal de alimentos preenvasados. Además, el porcentaje de productos preenvasados vendidos en Costa Rica que son excesivos en nutrientes críticos, y que, por lo tanto, estarían sujetos a una etiqueta de advertencia, fue alto, lo cual representa un problema de salud pública.

Palabras clave: Niñez. Ambiente alimentario escolar. Costa Rica. Perfiles nutricionales.

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1. Introduction

The food environment has been defined as the "collective physical, economic, policy and sociocultural surroundings, opportunities, and conditions that influence people's food and beverage choices and nutritional status"[1]. The presence of food sources or products (i.e., availability) and marketing and regulation are two key elements of the external domain of the food environment[2], which affect people's acquisition and consumption patterns, as well as their health and nutrition outcomes.

Recently, there has been a considerable global increase in the availability and consumption of fast food and ultra-processed food products, which is associated with an increase in weight and development of non-communicable diseases[3]. For Costa Rica, between 2000 and 2013 there was an 11.0% increase in the per capita sales of ultra-processed products, specifically, increases of 19.5% in foods and 9.8% in drinks[4]. Furthermore, in Latin America the sales of these products were projected to increase by 7.8% per capita in the 2015-2019 period (data for Costa Rica, specifically not available)[3].

In response to the increase in availability and consumption of ultra-processed products, international organizations have recommended countries adopt measures to generate a food environment that facilitates healthy food choices[5]. Some measures that have been proposed to help decrease the purchase and consumption of ultra-processed products are front-of-pack (FOP) nutrition labelling, restrictions on child-directed food and beverage marketing, and fiscal measures[6]. Among these measures, FOP nutrition labelling has been recognized for its cost-effectiveness, as a simple, practical and effective tool to inform the public about products that may harm health and to help guide purchasing decisions[7]. FOP nutrition labelling systems are presented on the front of food or beverage packages, and present simple and often graphic information on the overall nutrition quality or on the nutrient content of products to complement the more detailed information usually provided on the back of packages[7,8].

FOP nutrition labelling can be classified by their purpose and information given; non-interpretive labels show information with no particular recommendation, whereas interpretive labels display nutrition information for one or more nutrients with guidance or judgement[9]. Lately, warning label systems (which are a type of interpretive label) have been implemented in different Latin American countries, including Chile, Ecuador, Peru, Uruguay, Argentina, Mexico, Venezuela, Colombia, Brazil, and Venezuela[9].

Even though warning label systems have been implemented in many Latin American countries over the past decade, in Costa Rica (and the rest of Central American countries) they have not been adopted[10]. A key consideration when different regulatory approaches have been proposed, is which nutrient profile should be used to determine product healthfulness.

Nutrient profiles are used as a tool to classify foods and beverages according to their content of critical nutrients, such as added sugar, sodium, and saturated fats, which are of public health concern because of their relationship with non-communicable diseases[7]. One nutrient profile that has gained considerable use and attention recently is the one designed by the Pan American Health Organization (PAHO) in 2015[11]. Furthermore, Costa Rica developed a nutrient profile with the objective of limiting the sales of foods that were high in sugar, fat and sodium in public schools, according to the National Decree No 36910-MEP-S (hereon referred to as 'CRSD' — Costa Rica School Decree)[12].

To our knowledge, there have been no studies evaluating or comparing the CRSD nutrient profile to other more commonly used ones, such as the PAHO's, and it is unknown what proportion of packaged foods and beverages available in the food supply would be considered compliant, according to these two profiles. Comparing these two profiles specifically is important, mainly because PAHO is the profile that has been more recently recommended for adoption in public health measures, whereas the CRSD nutrient profile is the one currently implemented in Costa Rica's school system. Harmony within policies is critical, especially when creating mutually reinforcing policies that can have a stronger impact on populations' diets[6]. A more in-depth explanation is provided in the Methods section of this paper.

The objective of this study was to compare the proportion and types of food products that would be subject to a regulation according to two nutrient profiles: CRSD and PAHO's and to provide recommendations for future policy design.

2. Materials and methods

2.1 Study Design and Setting

This cross-sectional study analyzes nutrition facts panel (NFP) data from packaged foods and non-alcoholic beverages sold in one of the most widespread and popular supermarket chains in San José and Cartago, Costa Rica. The NFP dataset was created as part of Costa Rica's National Salt Reduction Program[13,14] and as part of a collaborative effort with the global initiative of the Food Monitoring Group, led by the George Institute for Global Health Australia[15,16].

2.2 Data Collection

Data collection procedures have been previously described[17]. Pictures were taken in 2015 by trained research assistants, who visited one of the most popular supermarket chains and photographed all packaged products (except alcoholic beverages), using "Data Collector", a smartphone application designed for this purpose[18]. Pictures were taken within the app, and immediately stored in the cloud, for later data extraction. The NFP information was entered into a dataset, specifying nutrient and energy content per 100 grams (g), 100 milliliters (mL), or per serving, depending on what was displayed on the label. Information, such as serving size and product origin, were also entered when available.

2.3 Study Sample

Figure 1 summarizes the data cleaning and sample selection process for the study. A total of 7,943 packaged products (original dataset) were examined. We first excluded

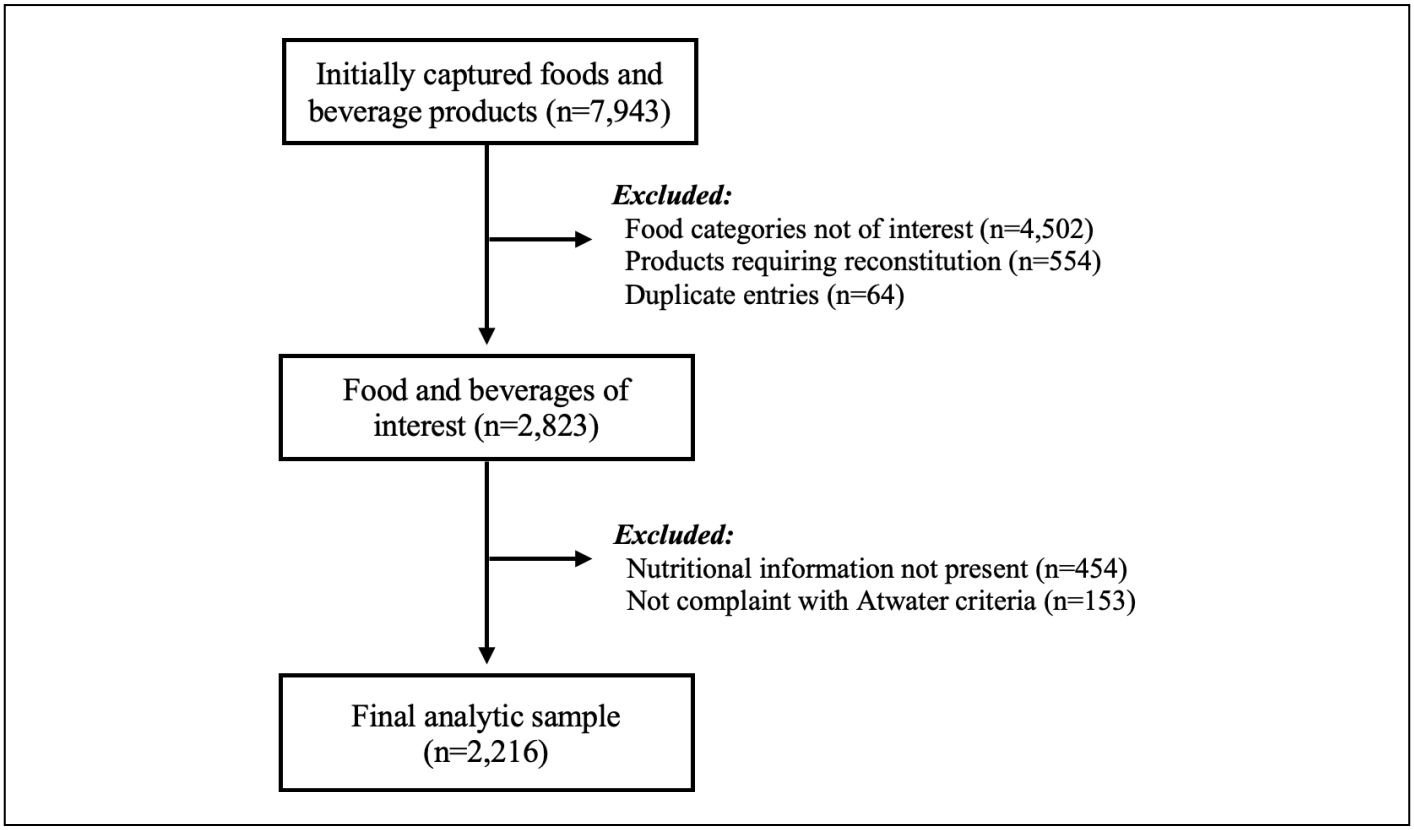

Figure 1. Flow chart displaying selection of study sample.

products from food and beverage categories that were not of interest for the study objectives (n=4,502), mostly products that were unlikely to be sold in the school food environment or products to which the PAHO nutrient profile does not apply, including culinary ingredients, such as oils and fats, sugars, salts, herbs, and spices with no added ingredients[11]. **Table 3** presents a description and examples of each of the food and beverage groups used for classification in the analyses. We then excluded products that required reconstitution (such as drink powders) because package information with preparation instructions were unavailable in the dataset (n=554). Following this, we excluded duplicate entries (n=64).

Of the remaining food and beverages of interest (n=2,823), we excluded products for which no nutritional information was available in the dataset (n=454), and those for which a greater than 20% difference was detected between the declared energy content and the energy content calculated with Atwater factors[19] for macronutrients (n=153). Our final analytic sample consisted of 2,216 products, which represents 79.5% of the foods and beverages of interest.

Table 4 displays the proportion of each food and beverage category excluded due to missing data and/or data quality concerns. Of note, some food and beverages categories were more likely to be excluded than others, which should be considered when interpreting the results. The percent of excluded products was highest for bakery (68.0%) and gelatin desserts (61.4%), followed by carbonated drinks (32.6%), and chocolates and marshmallows (28.0%). For the remaining categories, the percent of excluded products ranged from 6.5% (sports drinks) to 21.3% (ice cream).

2.4 Measures

Our variables of interest were energy (kilocalories), total sugars (g), total fat (g), saturated fat (g), and sodium (mg); of note, we did not have access to the ingredient lists of our product sample, which limited our ability to fully assess both profile models (more details presented below).

The CRSD includes a section for pre-packaged food and beverage products with specific nutrient cut points per 100 grams or 100 milliliters. These cut points are established for energy, sugar (does not specify if total or added), fats, saturated fats, and sodium, and are different for foods, non-dairy beverages and dairy beverages (**Table 5**). In addition, beverages without added sugar or non-nutritive sweeteners are excluded from the regulation, and all carbonated and energy drinks should not be sold in schools, regardless of their nutrient content. The guidelines were implemented in 2012, with the cut points becoming slightly more stringent in 2013 and 2014 (cut points used in this study). When assessing the CRSD in this study: (i) All carbonated and energy drinks were classified as non-compliant, regardless of nutrient content. (ii) We could not determine which beverages did not contain added sugars or non-nutritive sweeteners, and therefore they were all assessed.

The PAHO Nutrient Profile establishes limits in free sugars, fats, saturated fats, and trans-fats. Different from the CRSD, in which cut points are set per quantity of the product, the PAHO model establishes the limits as a proportion of the total energy of the product[11]. We made some adaptations to implement the PAHO model with the data available in the Costa Rican context: (i) Trans fats'

information was not available in our dataset, and therefore it was not assessed. (ii) The PAHO model recommends identifying products containing non-nutritive sweeteners. However, this information was not available in our dataset because we lacked the ingredient lists, and therefore it was not assessed. (iii) We assessed total sugar, and not free sugars, which are defined as mono and disaccharides added to products during processing, as well as natural sugars present in honey and fruit juices. Added sugars are rarely declared in nutrition labels in Costa Rica, and we did not have access to ingredient lists to determine whether products contained them or not. (iv)The PAHO model excludes unprocessed or minimally processed products, as well as culinary ingredients, from the assessment. Because plain milk is considered minimally processed, all products in this category were classified as compliant, regardless of nutrient content.

2.5 Data Analyses

2.5.1 Critical Nutrients

We first determined the number of products for each food and beverage group, as well as the medians (P50), percentile 25 (P25) and percentile 75 (P75) for each critical nutrient within each group. If a product did not report a specific nutrient, it was excluded from the calculation involving such nutrient. **Table 6** presents the number of products that were excluded from this nutrient-specific analysis.

2.5.2 Compliance with Nutrient Profiles

The proportion of products that would be prohibited from sales in schools (i.e. non-compliant) for each food and beverage group of interest was determined, as well as the number of nutrients in excess each product would have. This process involved comparing the product content of each nutrient to the defined nutrient thresholds according to CRSD[12] and the PAHO model[11]. Due to missing nutrient information, in some cases it was not possible to determine a product's classification. If there was least one nutrient in excess, the product was classified as non-compliant. However, if a product had no nutrients in excess, but was missing nutrition information from at least one nutrient, it was classified as undetermined.

The agreement for non-compliant/compliant products was estimated, utilizing the following formula: [(# of products classified as non-compliant by both profiles+ # of products classified as compliant by both profiles)/ total products classified by both profiles]. The objective of this analysis was to display categories in which there was a higher likelihood of profiles classifying products different, which could pose a barrier to successful policy implementation.

2.5.3 Critical Nutrients in Excess

Finally, the median, percentiles 25 (P25) and 75 (P75) for the number of nutrients in excess each food and beverage category would have according to both profiles were estimated. Wilcoxon rank-sum test was used to determine differences in the median number of nutrients in excess between PAHO Profile and the CRSD, stratified by foods and beverages (one test for foods, one test for beverages. Analyses were done in Stata version 16.0[20] and the significance level was set to 0.05.

3. Results

Table 1 displays the content of energy, total sugar, total fat, saturated fat and sodium of food and non-alcoholic beverage products, as well as the number of products in each category. Medians, P25 and P75 per 100 grams of product, are presented. The most prevalent food products in our sample corresponded to cookies and crackers (19%), followed by salty snacks (17%) and candy and gum (14%). For beverages, fruit-flavored and iced tea were the most prevalent (29%), followed by juices and nectar (24%), and liquid yogurts (12%). Nuts and seeds were the most energy dense food products (Median=563 kcal/100 g), followed by salty snacks (Median=500 kcal/100 g) and chocolates (Median=500 kcal/100 g).

Table 2 presents food and non-alcoholic beverage products classified as non-compliant, compliant, or undetermined, according to both nutrient profiles (CRSD and PAHO Profile). According to the CRSD, 85.2% of food products and 66.1% of beverage products would be classified as non-compliant because they exceeded at least one of five nutrient thresholds assessed. A larger proportion of products were classified as non-compliant according to the PAHO Profile (91.9% of food products and 70.9% of beverage products).

Table 2 also presents the percentage of the agreement for products classified under both profiles. For food products overall, this agreement was 95.3%, whereas for beverages it was 74.4%. For most food categories, agreement was over 90%, with the exception being Gelatin desserts (32% agreement) and yogurts (6.9%). These two categories had the lowest agreement, due mostly to the difference in the criteria for considering a product high in sugar between both profiles. For beverages, the percent agreement was 74.2%. Agreement proportion was lower for sport drinks (0.0%), plain vegetable milk (45.4%), fruit-flavored and iced tea (64.8%) and plain milk (71.9%).

Of note, for six of the eleven food categories, the proportion of non-compliant products surpassed 90% (cereal and granola bars, chocolates and marshmallows, cookies and crackers, nuts and seeds, bakery, and salty snacks). For beverages, categories with the largest proportion of non-compliant products when assessing nutrients include juice and nectar (80.6%), liquid yogurts (77.5%) and flavored milk (64.9%).

Figure 2 displays the distribution of products according to the median number of nutrients in excess by each nutrient profile and by product category. Chocolates and marshmallows, cookies and crackers had the higher median number of nutrients in excess (three to four), followed by bakery, nuts and seeds, and salty snacks (two to three). For beverages, the median number of nutrients in excess was one, according to both profiles.

4. Discussion

This study compares the proportion and types of products that would be subject to a regulation according to two nutrient profiles: CRSD and PAHO's. PAHO's nutrient profile

Table 1. Content of critical nutrients in food and beverage products (N=2,216).

Category	Total products	Energy (kcal)			Total Sugars (g)			Saturated Fat (g)			Total fat (g)			Sodium (mg)		
	n (%)	P50	P25	P75	P50	P25	P75	P50	P25	P75	P50	P25	P75	P50	P25	P75
Foods	**1,643 (100,0)**															
Cookies and crackers	317 (19.3)	467	434	495	25.9	11.7	33.1	8.0	5.0	10.8	19.0	14.7	23.1	321	208	467
Salty snacks	272 (16.6)	501	464	536	1.0	0.0	3.6	8.3	4.0	12.0	26.0	20.0	32.1	587	375	800
Candy and gum	224 (13.6)	358	333	406	55.6	34.7	69.4	0.0	0.0	1.1	0.0	0.0	5.0	11	0	68
Ice cream	207 (12.6)	220	183	254	21.2	16.1	23.1	6.7	3.5	9.4	12.9	10.0	14.3	69	47	92
Chocolates and marshmallows	206 (12.5)	500	454	538	51.0	40.0	56.0	15.0	10.0	17.6	27.5	19.8	32.0	80	55	125
Nuts and seeds	100 (6.1)	563	500	607	10.0	3.6	20.0	7.1	5.0	9.4	40.0	25.0	50.0	161	33	411
Yogurts	91 (5.5)	86	53	106	10.7	5.4	13.3	1.0	0.0	1.3	1.7	0.3	2.6	44	39	50
RTE Breakfast cereals	89 (5.4)	387	367	400	27.3	16.8	36.0	0.8	0.0	2.0	4.0	1.7	7.0	417	288	533
Bakery	72 (4.4)	382	354	432	26.6	16.0	37.5	7.3	4.1	10.0	16.2	11.7	22.0	260	180	412
Cereal and granola bars	33 (2.0)	417	391	443	31.6	28.6	34.3	3.9	2.9	7.8	11.4	7.4	15.8	271	148	381
Gelatin desserts	32 (1.9)	48	30	145	6.0	6.0	20.7	0.0	0.0	0.5	0.0	0.0	5.2	60	55	130
Beverages	**573 (100.0)**															
Fruit-flavored and iced tea	166 (29.0)	29	23	40	7.1	5.0	9.8	29.2	23.2	40.4	0.0	0.0	0.0	4	1	10
Juices and nectar	139 (24.3)	53	44	64	12.0	9.6	14.5	0.0	0.0	0.0	0.0	0.0	0.0	10	6	20
Liquid yogurts	71 (12.4)	85	78	96	10.6	10.0	11.3	85.0	78.4	96.0	1.7	1.0	1.9	47	43	50
Carbonated drinks	58 (10.1)	40	33	45	10.0	8.2	11.5	0.0	0.0	0.0	0.0	0.0	0.0	10	5	14
Flavored milk	37 (6.5)	63	60	76	8.4	4.0	9.3	0.7	0.6	0.8	1.6	1.1	1.8	42	33	55
Plain milk (animal)	34 (5.9)	50	36	55	4.8	4.4	4.8	0.9	0.1	1.2	2.0	0.2	2.3	39	35	50
Sports drinks	29 (5.1)	22	21	28	5.8	5.6	5.8	0.0	0.0	0.0	0.0	0.0	0.0	44	32	48
Energy drinks	28 (4.9)	47	39	50	10.8	7.6	12.5	0.0	0.0	0.0	0.0	0.0	0.0	12	2	40
Plain milk (vegetable)	11 (1.9)	50	38	58	4.2	2.5	6.3	0.2	0.0	0.2	1.7	1.0	2.1	46	35	58

Table 2. Assessment of food and beverage products according to Costa Rican (CR) School Decree and Pan American Health Organization (PAHO) profile, by category.

Category	Total products	CR School Decree (%)			PAHO Profile (%)			% Agreement
	n (%)	Non-compliant	Compliant	ND	Non-compliant	Compliant	ND	
Foods								
Cookies and crackers	317 (19.3)	97.8	0.9	1.3	95.6	0.9	3.5	98.7
Salty snacks	272 (16.6)	98.5	1.1	0.4	96.3	0.7	2.9	98.9
Candy and gum	224 (13.6)	81.7	13.4	4.9	81.7	14.3	4.0	97.2
Ice cream	207 (12.6)	76.3	1.0	22.7	93.7	0.0	6.3	98.7
Chocolates and marshmallows	206 (12.5)	94.2	1.0	4.9	94.2	2.4	3.4	99.0
Nuts and seeds	100 (6.1)	100.0	0.0	0.0	100.0	0.0	0.0	100.0
Yogurts	91 (5.5)	0.0	31.9	68.1	67.0	2.2	30.8	6.9
Breakfast cereals	89 (5.4)	88.8	6.7	4.5	94.4	0.0	5.6	92.0
Bakery	72 (4.4)	94.4	4.2	1.4	98.6	0.0	1.4	95.8
Cereal and granola bars	33 (2.0)	93.9	0.0	6.1	93.9	0.0	6.1	100.0
Gelatin desserts	32 (1.9)	28.1	53.1	18.8	84.4	0.0	15.6	32.0
Overall foods	**1,643 (100)**	**85.2**	**5.8**	**9.0**	**91.9**	**2.7**	**5.4**	**95.3**
Beverages								
Fruit-flavored and iced tea	166 (29.0)	51.2	35.5	13.3	82.5	3.6	13.9	64.8
Juices and nectar	139 (24.3)	80.6	6.5	12.9	84.2	0.7	15.1	91.4
Liquid yogurts	71 (12.4)	77.5	2.8	19.7	54.9	0.0	45.1	93.1
Carbonated drinks[1]	58 (10.1)	100.0	0.0	0.0	51.7	6.9	41.4	88.2
Flavored milk	37 (6.5)	64.9	13.5	21.6	75.7	0.0	24.3	77.3
Plain milk (animal)	34 (5.9)	26.5	67.6	5.9	0.0	100.0	0.0	71.9
Sports drinks	29 (5.1)	10.3	75.9	13.8	82.8	10.3	6.9	0.0
Energy drinks[2]	28 (4.9)	100.0	0.0	0.0	71.4	0.0	28.6	--
Plain milk (vegetable)	11 (1.9)	45.5	54.5	0.0	100.0	0.0	0.0	45.4
Overall beverages	**573 (100)**	**66.1**	**22.0**	**11.9**	**70.9**	**8.4**	**20.8**	**74.4**

[1,2] According to Art. 15 of Decree 36910, carbonated drinks (including "light" or "diet") and energy drinks should not be sold in schools, regardless of their nutrient content.

Table 3. Food and beverage groups used for classification in analysis.

Group	Description	Product/brand examples
Foods		
Bakery	Cakes and sponges, pies and pastries, baked and cooked desserts	Bimbo cinnamon rolls, Merendina Flip cake, Pillsbury toaster strudel pastries
Candy and gum	Sugar confectionary, chewing gum and bubble gum, caramels, sweets	Arcor butter toffees, Skittles Original, Super Trululu gummies
Cereal and granola bars	Cereal and granola bars	Bimbo bran fruit bars, Kellogg's Special k bars, Nature Valley granola bars
Chocolates and marshmallows	Chocolate confectionary, marshmallows	Britt chocolates, Gallito chocolates, Hershey's kisses
Cookies and crackers	Savory crackers, cookies/sweet biscuits	Keebler cookies, Nabisco Oreo, Pozuelo Tosh
Gelatin desserts	Gelatin desserts	Gela-kin, Royal jello
Ice cream	Dairy and plant-based ice creams, water-based ices (including sorbets), frozen yogurts	Díaz, Dos Pinos, Pops, Sarita
Nuts and seeds	Almonds, peanuts, walnuts	GetNuts, Planters Deluxe, Rumba, peanuts, Sabemás nuts
Breakfast cereals	Shredded, flaked, puffed, and extruded cereals	Jack's Naranjitas, Kellogg's corn flakes, Nestlé Honey Nut Cherrios
Salty snacks	Potato, plantain, vegetable, and grain chips	Cosecha Dorada Palitos, Jack's Mejitos, Pringles Original
Yogurts	Plain and flavored yogurt (not liquid/ drinking yogurts)	Coopeleche, Dannon, Dos Pinos, Yoplait
Beverages		
Carbonated drinks	With and without added sugar	Coca Cola, Fanta, Jones, Mirinda
Energy drinks	Beverages containing caffeine or other stimulants such as guarana and taurine	Ciclon, Monster, Red Bull
Flavored milk	Sweetened dairy milks (chocolate, vanilla, strawberry, etc.)	Coronado, Frescoleche, Pinitos
Fruit-flavored and iced tea	Still water-based flavored drinks, including fruit-flavored and iced teas	Arizona, Fuze Tea, Té Frío Dos Pinos, Tropical
Juices and nectar	100% fruit and vegetable juices (including juices reconstituted from concentrate) Drinks labeled as fruit nectar	Del monte, dos pinos, kerns
Liquid yogurts	Flavored liquid yogurts	Coopeleche, Dannon, Dos Pinos, Yoplait
Plain milk (animal)	Skim, partially skimmed and whole milk	Centrolac, Coronado, Dos Pinos
Plain milk (vegetable)	Soy and almond milk	Edensoy, Pacific, Silk
Sports drinks	Flavored water-based drinks with added electrolytes	Gatorade, Powerade, New Shape

Table 4. Percent of products excluded from study due to missing nutrition data, by product category.

Category	Total products	Excluded products[1]	Analytic sample
	n (%)[2]	n (%)[3]	n (%)[2]
Foods			
Cookies and crackers	390 (18.0)	73 (18.7)	317 (19.3)
Salty snacks	306 (14.1)	34 (11.1)	272 (16.6)
Candy and gum	241 (11.1)	17 (7.1)	224 (13.6)
Ice cream	263 (12.1)	56 (21.3)	207 (12.6)
Chocolates and marshmallows	286 (13.2)	80 (28.0)	206 (12.5)
Nuts and seeds	125 (5.8)	25 (20.0)	100 (6.1)
Yogurts	101 (4.7)	10 (9.9)	91 (5.5)
Breakfast cereals	104 (4.8)	15 (14.4)	89 (5.4)
Bakery	225 (10.4)	153 (68.0)	72 (4.4)
Cereal and granola bars	41 (1.9)	8 (19.5)	33 (2.0)
Gelatin desserts	83 (3.8)	51 (61.4)	32 (1.9)
Overall foods	**2,165 (100)**	**522 (24.1)**	**1643 (100)**
Beverages			
Fruit-flavored and iced tea	183 (27.8)	17 (9.3)	166 (29.0)
Juices and nectar	155 (23.6)	16 (10.3)	139 (24.3)
Liquid yogurts	78 (11.9)	7 (9.0)	71 (12.4)
Carbonated drinks	86 (13.1)	28 (32.6)	58 (10.1)
Flavored milk	43 (6.5)	6 (14.0)	37 (6.5)
Plain milk (animal)	39 (5.9)	5 (12.8)	34 (5.9)
Sports drinks	31 (4.7)	2 (6.5)	29 (5.1)
Energy drinks	31 (4.7)	3 (9.7)	28 (4.9)
Plain milk (vegetable)	12 (1.8)	1 (8.3)	11 (1.9)
Overall beverages	**658 (100)**	**85 (12.9)**	**573 (100)**
Total	**2,823 (100)**	**607 (21.5)**	**2,216 (78.5)**

[1] Includes products excluded due to missing all nutrition data (n=454) and those non-compliant with Atwater criteria (n=153).
[2] Represents percent of total for the column (e.g., 18.0% of foods were cookies and crackers).
[3] Represents percent of total for the row (e.g., 18.7% of cookies and crackers were excluded).

Table 5. Comparison of Nutrient cut points for the Costa Rica and PAHO nutrient profile.

Component	Costa Rica School Kiosk Regulation[1]			PAHO Profile[11]
	Foods (100 g)	Beverages (100 mL)		
		Non-dairy	Dairy	
Energy (kcal)	400	60	70	NA
Sugar (g)	20	6	6	10% of total energy
Total fat (g)	12	2	2	30% of total energy
Saturated fat (g)	6	1	1.3	10% of total energy
Trans fat	NA	NA	NA	1% of total energy
Sodium (mg)	400	50	70	1 mg/1 kcal

[1] Values for 2014 cut points according to decree No. 36910 for packaged foods sold in schools.

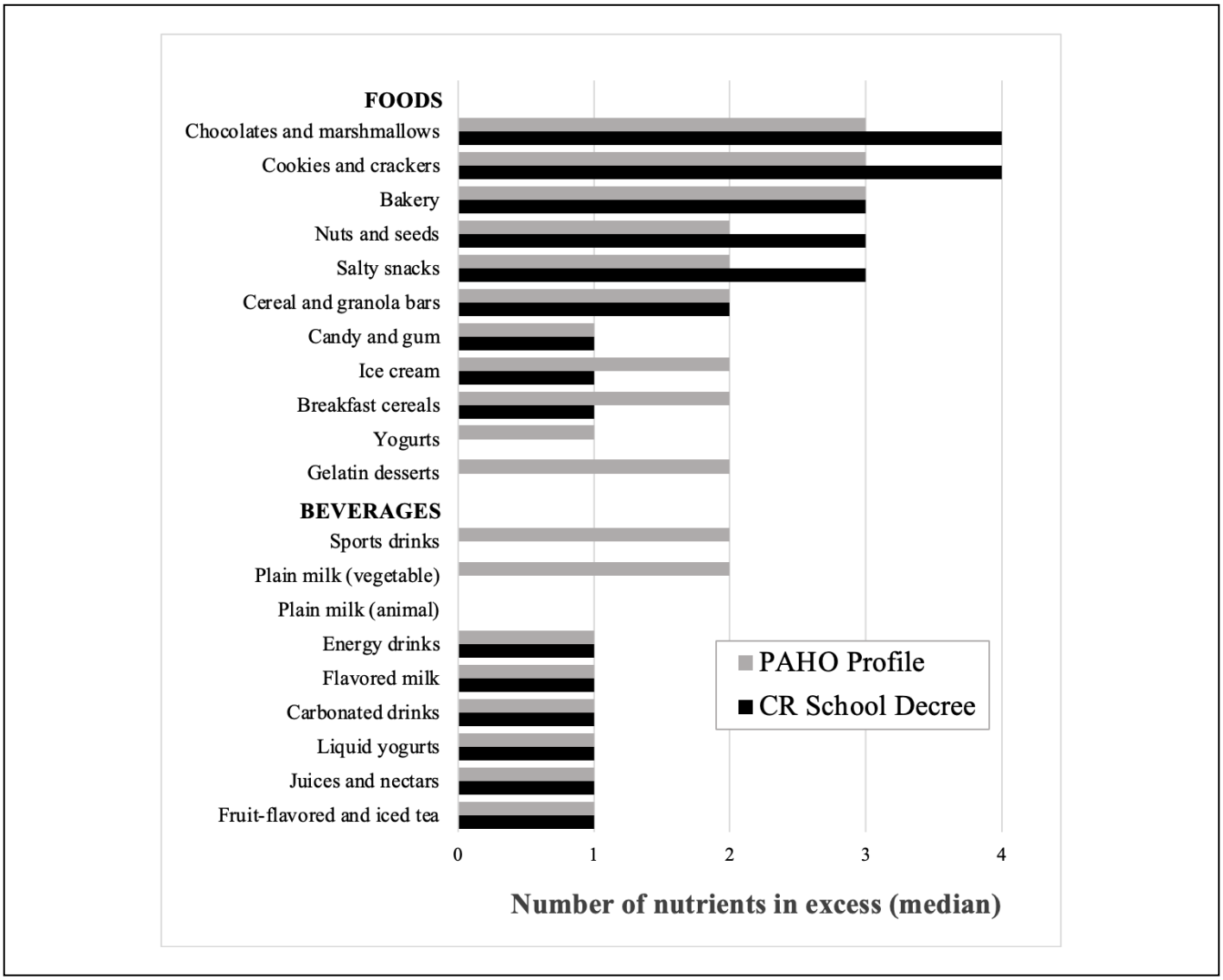

Figure 2. Median number of nutrients in excess according to Costa Rican (CR) School Decree and Pan American Health Organization (PAHO) profile, by category.

was slightly more restrictive than the CRSD, both for foods and beverage products, with agreements that varied widely between product categories. These differences should be considered when discussing the nutrient profile model to be adopted in a future FOP nutrition labelling regulation.

Nutrient profiles have been compared in different Latin American contexts, including Brazil, Mexico, Peru, and Colombia. Andrade et al.[21] compared the Brazilian nutrient profile model with the Mexican one (which is based on PAHO) in about 3,000 products, and found that under the Brazilian model 57% of products were "high in" critical nutrients, compared to 97% under the Mexico regulation. Another study, that assessed products using the Peruvian legislation cut points, found that 95.2% of the products would carry at least one "excess in" warning label[22]. A study in Mexico[23] also found that the PAHO model classified more products as non-compliant (97.7%). Of note, this study included only some product categories in their analyses, and therefore the results might not be comparable to ours. And finally, a study done in Colombia, found that under the PAHO nutrient profile 80.2% of products would be subject to regulation, compared with 66.4% using cut points of Chilean FOP regulation[24]. Our results are very much in line with these studies, for which the PAHO nutrient profile is more restrictive. One of the main reasons more products tend to be classified as non-compliant under the PAHO model is that cut points are established as a percent contribution to total energy, instead of a limit on product quantity. For example, a fruit-flavored drink containing 12 grams of sugar in 250 mL (4.8 g/100 mL), would be considered compliant under CRSD (the limit is 6 grams/100 mL). However, PAHO profile limits sugar to 10% of total product energy. If the drink contains 60 kcal/250 mL, to be compliant with PAHO no more than 6 kcal from sugar (slightly over 1 gram) would be warranted.

Of note, many product categories had a large proportion of products classified as "undetermined" due to missing nutrient information. For foods, this percentage was highest in yogurts (30.8-68.1%), whereas for beverages, it was highest in flavored milk (21.6-24.3%) and liquid yogurts (19.7-45.1%). In these products, the nutrient that tended to be missing for the most part was sugar. According to the current regulations from Central American countries (including Costa Rica)[25], nutrition labelling only becomes mandatory when a product has nutrient or health claims on its package, which translates into many products not having labels at all, or having them but not having the nutrients declared standardized. **Table 6** shows that even among the products that do have NFP, not all nutrients are declared. Of note, 24.6% of foods and 25.7% of beverages were missing information for total sugars.

Because our study was unable to identify when a product had added nutrients of concern versus when the nutrients were naturally occurring, there might have been an overestimation of products classified as "non-compliant" for some categories. For example, 100% of nuts and seeds were classified as "non-compliant", but in some cases, these products would have no added fats or salt, and therefore, under PAHO nutrient profile, would not be subject to assessment. Likewise, for products that contain a mix of naturally occurring sugars and added sugars, such as yogurts, liquid yogurts and some fruit-flavored drinks, there might have been an overestimation of those classified as "non-compliant".

Policy implications

FOP warning labels have been implemented recently throughout countries in Latin America[9]. Costa Rica has been discussing potential FOP warning labels legislation for at least 3 years. In July 2020, Bill 22.065[26] was introduced to the Legislative Assembly; however, it was a voted negatively and archived in October 2021. In June 2023, the Ministry of Health mandated that FOP warning labels from imported products should be covered, allegedly to avoid consumer confusion[27]. Shortly after the Ministry's mandate, a new bill (23.861) "Law of Front-of-Package Warning Labels for Foods and Non Alcoholic Beverages" was presented to the Legislative Assembly, and it is currently discussed[28]. This bill proposes using PAHO's nutrient profile to determine which products would carry black warning octagons, specifically for sodium, free sugars, fat, saturated fat, and trans fats. This is in line with a recent recommendation position statement from nutrition experts in Central America and the Dominican Republic[10].

However, it is well-known that the existence of a policy or regulation does not guarantee its adequate implementation[30]. For example, in Costa Rica, despite the existence of the school food regulation analyzed in this paper, low compliance was found, and one of the key barriers to implementation was a lack of understanding of the policy, including that the nutrient profile cut points were poorly understood by those involved in policy implementation[31]. A primary potential barrier for effective policy implementation, is that in Costa Rica nutrition labelling is not mandatory for all products.

As of December 2023, an update to the Central American Technical Regulations on Nutritional Labeling (which makes nutritional labelling mandatory) is expected to advance positively. This would allow monitoring and evaluating the implementation of FOP nutritional labelling possible. Otherwise, if a product does not carry the FOP warning label, and also does not have a nutrition label, it would be impossible to determine if the absence of the FOP warning label is due to the product complying with cut points or due to no analysis present. Costa Rica has the installed capacity to produce food composition data[29] and we consider that a key steppingstone in labelling efforts in the Central American region would be for nutrition labelling to be mandatory for all products.

In addition, some products sold in Costa Rica carry a label that reads "Complies with the School Kiosk Regulation". Given our results, it is important to discuss how the current School Decree would relate to FOP regulation, if approved, and consider whether modifying the School Decree in accordance with the FOP regulation is necessary. For example, it would be confusing for consumers to display a "high in sugar" and "high in fat" FOP label, on the same product as one carrying the "Complies with the School Kiosk Regulation" label. Determining adequate cut points for a FOP regulation is a process that involves discussion and negotiations with key stakeholders, including government, academia, and the food industry, as has been the case in other contexts[32].

Table 6. Percent of products excluded from nutrient-specific analyses due to missing nutrition data, by product category[1].

Category	Analytic sample	Energy	Total sugars	Saturated fats	Total fats	Sodium
	n(%)[2]	n(%)[3]	n(%)[3]	n(%)[3]	n(%)[3]	n(%)[3]
Foods						
Cookies and crackers	317 (19.3)	1 (0.3)	33 (10.4)	17 (5.4)	1 (0.3)	8 (2.5)
Salty snacks	272 (16.6)	0 (0.0)	78 (28.7)	18 (6.6)	5 (1.8)	11(4.0)
Candy and gum	224 (13.6)	4 (1.8)	7 (3.1)	12 (5.4)	3 (1.3)	9 (4.0)
Ice cream	207 (12.6)	0 (0.0)	137 (66.2)	33 (15.9)	1 (0.5)	37 (17.9)
Chocolates and marshmallows	206 (12.5)	6 (2.9)	12 (5.8)	12 (5.8)	2 (1.0)	13 (6.3)
Nuts and seeds	100 (6.1)	0 (0.0)	49 (49.0)	3 (3.0)	0 (0.0)	1 (1.0)
Yogurts	91 (5.5)	2 (2.2)	61 (67.0)	20 (22.0)	0 (0.0)	9 (9.9)
Breakfast cereals	89 (5.4)	1 (1.1)	7 (7.9)	6 (6.7)	1 (1.1)	0 (0.0)
Bakery	72 (4.4)	3 (4.2)	6 (8.3)	5 (6.9)	0 (0.0)	5 (6.9)
Cereal and granola bars	33 (2.0)	0 (0.0)	8 (24.2)	7 (21.2)	0 (0.0)	1 (3.0)
Gelatin desserts	32 (1.9)	1 (3.1)	6 (18.8)	4 (12.5)	0 (0.0)	6 (18.8)
Overall foods	**1,643 (100)**	**18 (1.1)**	**404 (24.6)**	**137 (8.3)**	**13 (0.8)**	**100 (6.1)**
Beverages						
Fruit-flavored and iced tea	166 (29.0)	0 (0.0)	18 (10.8)	0 (0.0)	0 (0.0)	16 (9.6)
Juices and nectars	139 (24.3)	0 (0.0)	17 (12.2)	0 (0.0)	0 (0.0)	25 (18.0)
Liquid yogurts	71 (12.4)	0 (0.0)	55 (77.5)	31 (43.7)	1 (1.4)	14 (19.7)
Carbonated drinks	58 (10.1)	1 (1.7)	27 (46.6)	0 (0.0)	0 (0.0)	3 (5.2)
Flavored milk	37 (6.5)	0 (0.0)	10 (27.0)	19 (51.4)	0 (0.0)	6 (16.2)
Plain milk (animal)	34 (5.9)	0 (0.0)	26 (76.5)	11 (32.4)	0 (0.0)	3 (8.8)
Sports drinks	29 (5.1)	0 (0.0)	3 (10.3)	0 (0.0)	0 (0.0)	1 (3.4)
Energy drinks	28 (4.9)	0 (0.0)	9 (32.1)	1 (3.6)	0 (0.0)	3 (10.7)
Plain milk (vegetable)	11 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Overall beverages	**573 (100)**	**1 (0.2)**	**165 (28.8)**	**62 (10.8)**	**1 (0.2)**	**71 (12.4)**
Total	**2,216 (100)**	**19 (0.9)**	**569 (25.7)**	**199 (9.0)**	**14 (0.6)**	**171 (7.7)**

[1] These had at least energy or one nutrient reported in the Nutrition Facts Panel data.
[2] Represents percent of the total for the column (e.g., 19.3% of foods were cookies and crackers).
[3] Represents percent of total for the row (e.g., 0.3% of cookies and crackers were missing energy value).

Another area for discussion during FOP warning labels policy design is the use of nutrient and health claims or declarations. Current labelling regulations[25,33] allow the use of comparative nutrient claims when a product contains fewer nutrients of concern than the original product. For example, if a yogurt of a specific brand contains less sugar than the original yogurt of the same brand, it can carry the claim "less sugar". However, this same product could carry the FOP label "high in sugar", which could lead to further consumer confusion. In this sense, it would be important to include provisions in the law by which products carrying a warning label cannot carry nutrient or health claim declarations.

Strengths and limitations

This is the first study to compare countrywide regulations currently in place, with the PAHO nutrient profile, which is the one being proposed in the Legislative Assembly at the moment. It assesses not only the percent of products subjects to regulation, but also the percent of agreement, visualizing therefore product categories that might be more problematic.

Despite these strengths, there are some limitations. The dataset used was collected in 2015, and changes might have occurred since, including product reformulation and new product development. Additionally, given our study

objectives, we excluded product categories that might be subject to FOP warning labels if implemented, but that are not typically sold in schools. Furthermore, of the 2,823 products of interest, we excluded 21.5% due to missing data, and these were unevenly distributed across food and beverage groups. Therefore, it is likely that our results slightly underestimate the percent of products that would be considered non-compliant, and the number of nutrients of concern in excess.

Finally, we were unable to assess the PAHO's nutrient profile model completely, primarily due to the lack of information regarding the products' ingredient lists. This might have resulted in an underestimation of products that would be considered non-compliant, regarding those with non-nutritive sweeteners. However, because we also did not distinguish between total and free sugars, our results must be interpreted conservatively.

5. Conclusion

The percentage of packaged foods and non-alcoholic beverages sold in Costa Rica that are excessive in critical nutrients and would be subject, therefore, to a FOP warning label was high, a public health concern. To improve the feasibility of FOP warning labels monitoring and evaluation, it is crucial that NFP declaration be mandatory for all prepackaged products. Finally, differences were found between both nutrient profiles in the identification of foods and beverages classified as non-compliant. These differences should be considered when discussing a future regulation on FOP warning labels to avoid difficulties in the implementation of the policy and to improve its effectiveness.

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Conflict of interest

The authors declare no conflict of interest.

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