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Early-life sugar consumption and breastfeeding practices: a multicenter initiative in Latin America

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Abstract: The aim of this multicenter study was to explore the early-life sugar consumption and dietary practices in Latin America as well as to investigate the association between breastfeeding duration and the age at which foods and beverages with added sugars are introduced. A cross-sectional study was conducted with 805 1- to 3-year-old children from 10 Latin American countries, as a complementary study to the Research Observatory for Dental Caries of the Latin American Region (OICAL). A Food Frequency Questionnaire previously tested in different countries was applied to children's mothers and data on breastfeeding and age at introduction of sugary foods and beverages was collected. Statistical analysis included the Kruskal-Wallis test and Poisson regression with robust variance, with the calculation of crude and adjusted mean ratios (MR) and 95% of confidence intervals (CI). The average age at introduction of sugary foods and beverages was 10.1 months (95%CI 9.7–10.4) and 9.6 (95%CI 9.2–9.9) months, respectively, with a significant variation between countries ($p < 0.001$). The average daily frequency of sugary foods-beverages was 3.3 times per day (95%CI 3.1–3.5) and varied significantly between countries ($p = 0.004$). Breastfeeding duration of over six months was associated with an increase in the age of introduction of sweet drinks (16%; MR 1.16; 95%CI 1.05–1.28) and foods (21%; MR 1.21; 95%CI 1.10–1.33). In conclusion, most children from vulnerable settings in Latin America start consuming sugary products in the first year of life and a high frequency of consumption was reported through early childhood. Additionally, breastfeeding contributes to a delay in the introduction of sugary products.

Keywords: Sugars; Oral Health; Breast Feeding; Child; Dental caries.

Introduction

Dental caries remains a public health problem and the most common non-communicable disease (NCD) worldwide, starting in early childhood and being disproportionately prevalent in marginalized and vulnerable groups, with a negative impact on the quality of life of children and their families.[1-5] In early childhood, the disease is associated with high treatment costs and requires specialized treatment - under general anesthesia in many cases, which is prohibitively expensive for most families.[6-8] In Latin

American and Caribbean countries, the prevalence of early childhood caries (ECC) remains very high, affecting more than half of preschool children.[2,9,10]

The causal network of early childhood caries includes contextual and individual factors, especially socioeconomic, behavioral, and biological characteristics.[11,12] However, the pivotal factor for the occurrence of the disease is frequent sugar consumption, particularly during the first years of life.[12-14] The World Health Organization, the International Association of Pediatric Dentistry, and the Latin American Oral Health Association, recommend delaying the age of introduction of sugary foods and beverages, preferably after age two, to reduce the burden of dental caries and other non-communicable diseases such as obesity, cardiovascular diseases, and diabetes.[12,15,16]

Identifying the age of sugar introduction as well as the type of sugary foods and beverages consumed at early ages in vulnerable settings in the Latin American region is a pivotal for decision makers to plan local public health strategies to be tested in future studies.[10,12] Likewise, it is essential to understand children's behavior in relation to nutritious sucking habits in different communities, which may be associated with increased risk for ECC.[14,17] However, there are few studies that explore feeding practices during the first years of life, making it difficult to plan collective actions to promote healthy feeding practices and reduce dental caries and other non-communicable diseases.[18]

The objective of this multicenter study was to generate standardized data to understand early childhood sugar consumption and dietary practices of children from 1 to 3 years of age from vulnerable settings of ten Latin-American countries, focusing on age of introduction and frequency of consumption of sugary foods and beverages. Additionally, breastfeeding and its association with age of introduction of sugary foods and beverages was investigated.

Methodology

Study design and participants

The present cross-sectional study was carried out as a complementary arm of the Research Observatory for Dental Caries of the Latin American Region (OICAL), which is a project of the Regional Development Program of the International Association for Dental Research (IADR RDP LAR). Representatives from 10 IADR Divisions and Sections of Latin American countries (Brazil, Chile, Colombia, Costa Rica, Ecuador, Panama, Paraguay, Peru, Uruguay and Venezuela), 12 dental schools, and the Ministry of Health of Panama, met in Lima, Peru, in 2018. This meeting aimed to implement a theoretical and clinical training to standardize criteria for the collection of data on dietary practices, dental caries diagnosis (lesions detection), and quality of life of children and adolescents.

The present study investigated eating habits in the first years of life. The sample consisted of children aged one to three years from the ten countries participating in the OICAL Project. Only Argentina, where another local project is ongoing, did not participate in the research. For each country, cities were selected by convenience (8 capital cities and 2 large urban centers) based on the place of work of each representative. Children were enrolled in public preschools in suburban areas in selected cities, characterized by low socioeconomic level. The nurseries were selected based on convenience using a roster of all sampling elements obtained from the city administration.

The sample size calculation parameters for children aged 1 to 3 years were based on the main objective for this age group, which was to investigate the impact of dental caries on oral health-related quality of life (OHRQoL): proportion of exposed individuals (26%), impact prevalence of 13.2% in unexposed children and 29.0% in exposed children, 80% power, and 95% significance level.[19] Considering a design effect of 1.5 and an addition of 20% for multivariate analysis, the required number of children was 647. The number of participants recruited and data collected determined the sample size of the present study. Post-hoc power calculation showed a power of 98% to detect a 3-month difference in the mean age of introduction of sugar in the pairwise comparison among countries and a power greater than 96% to detect a difference of 2 months in the age of sugar introduction between children

with shorter and longer breastfeeding duration, considering a standard deviation of 5.1 months (2-tailed alpha = 0.05).

Data collection

Data collection on feeding practices was performed through a Food Frequency Questionnaire. The standardized instrument was previously used in an interview on eating practices among children of similar age.[13,14] Mothers or caretakers were asked about breastfeeding (duration in months and current frequency) and age (in months) of introduction and frequency of consumption of sugary foods and beverages. The instrument included specific closed-ended questions on sugary products added to milk (in the bottle or cup) such as sugar or chocolate (brand names were used as examples) and sweet drinks (tea, artificial juice, flavored powdered drinks, dairy drinks, soft drinks); sweet foods like cookies, petit suisse, candies, sandwich cookies with filling, chocolate, honey, and ice cream. In addition, open-ended questions were asked to allow mothers or caregivers to describe foods or drinks that were not included in the instrument.

To apply the instrument, the representatives were specifically trained by an expert in the Spanish and Portuguese versions. Considering the cultural diversity in Latin America, the instrument was previously tested in a pilot study in each country. Among the response options, items with sugar and terminology characteristics were adapted to the local culture. To facilitate the identification of sugar products consumed by each child, a printed color diagram with images of each product was shown to parents. In addition, local representatives from each country received a manual to improve the training and application of the data collection instrument.

The primary outcomes of the present study were age of introduction of sugary products and daily consumption frequency. To calculate the daily frequency of consumption of sugary products, parents or guardians were asked about the frequency of consumption of a) sugary drinks in bottle; b) sugary drinks in a cup or glass; c) foods with added sugar. The response options considered the daily frequency (quantitative variable) and included the options: < 1/week, 1/week, 2-4/week, and 5-6/week, 1/day or more. Such options were transformed into the proportional scores 0.1, 0.15, 0.3, and 0.5, respectively. The three variables were described separately and then added and divided into three categories, representing low, medium, and high frequency of consumption of sugary beverages or foods.

Data analysis

The statistical analysis was performed using Statistical Package for the Social Sciences, version 20.0 (IBM Statistics Inc, Chicago, USA). Initially, the absolute and relative frequencies of qualitative variables and measures of central tendency and dispersion of quantitative variables of dietary practices were described. Daily breastfeeding frequency and consumption of sugary products were categorized into three categories. Differences in dietary practices among countries were calculated using the chi-square test (qualitative variables) and the Kruskal-Wallis test (quantitative variables), considering an asymmetric data distribution. To investigate the association between duration of total breastfeeding (categorized into ≤ 6 months and > 6 months)[20] and age at introduction of sugary foods and beverages, the Mann-Whitney test was used and Poisson regression with robust variance was performed. Crude and adjusted (for age, gender, and country) mean ratios and 95% confidence intervals were calculated.

Ethics

This multicenter study was approved by the Human Research Ethics Committee of the San Martin de Porres University in Lima, Peru and then submitted and approved by the Ethics Committees of the co-participating universities. One parent of each child gave a written informed consent prior to research procedures. The children's parents/caretakers received clarifications regarding the study and signed a statement of informed consent in all the phases of data collection.

Results

The final sample consisted of 805 children, 420 (52.2%) male and 385 (47.8%) female. Ages ranged

Table 1. Prevalence, total duration, and frequency of breastfeeding (BF) in 1- to 3-year-old children in 10 Latin American countries.

Variable	Total	Brazil	Chile	Colombia	Costa Rica	Ecuador	Panama	Paraguay	Peru	Uruguay	Venezuela	p-value*
	(n = 805)	(n = 110)	(n = 33)	(n = 100)	(n = 100)	(n = 100)	(n = 111)	(n = 49)	(n = 101)	(n = 67)	(n = 34)	
Age (months)												
Mean (SD)	28.4 (6.7)	27.4 (5.5)^{b}	34.5 (10.3)^{c}	28.6 (5.3)^{b}	28.5 (6.0)^{b}	27.2 (7.5)^{b}	25.5 (5.6)^{a}	23.4 (5.4)^{a}	31.3 (3.9)^{c}	26.9 (5.9)^{a,b}	38.8 (4.3)^{b,c}	< 0.001
BF 12 months (%)	(65.8)	(52.8)^{a,b}	(64.5)^{a,b}	(72.3)^{b,c}	(73.3)^{b,c}	(68.0)^{b,c}	(66.7)^{b}	(43.8)^{a}	(79.2)^{c}	(61.2)^{b}	(61.8)^{b,c}	< 0.001
BF currently (%)												
1 year	(42.4)	(13.8)	(83.3)	(47.4)	(80.8)	(25.7)	(46.5)	(31.0)	(42.9)	(52.2)	X	< 0.001
2 to 3 years	(19.3)	(10.0)	(18.5)	(27.2)	(24.7)	(7.7)	(17.6)	(21.1)	(30.9)	(20.5)	(2.9)	0.001
Mean (BF)	12.6 (7.8)	11.8 (7.8)^{b}	15.9 (13.2)^{b,c}	13.3 (8.2)^{b}	12.9 (8.4)^{b}	12.7 (4.7)^{b}	11.0 (6.0)^{b}	7.9 (6.3)^{a}	15.6 (8.0)^{c}	11.5 (8.4)^{b}	15.5 (8.6)^{c}	
(95% CI)	(12.0-13.2)	(10.2-13.3)	(9.9-21.9)	(11.2-15.3)	(10.5-15.3)	(11.7-13.7)	(9.7-12.4)	(5.7-10.0)	(13.7-17.5)	(9.0-14.0)	(12.5-18.6)	
> 18 months (%)	(20.4)	(19.8)^{b}	(38.1)^{b}	(22.2)^{b}	(29.4)^{b}	(8.1)^{a}	(7.6)^{a}	(8.6)^{a}	(34.8)^{c}	(21.7)^{b}	(36.4)^{b,c}	< 0.001
BF daily frequency**												
1 to 3	31.6	(50.0)	(30.0)	(57.7)	(11.8)	(20.0)	(28.1)	(21.4)	(37.5)	(25.0)	(66.7)	
4 to 6	35.8	(33.3)	(20.0)	(26.9)	(50.0)	(50.0)	(28.1)	(35.7)	(46.9)	(20.0)	(33.3)	
≥ 7	32.6	(16.7)	(50.0)	(15.4)	(38.2)	(30.0)	(43.8)	(42.9)	(15.6)	(55.0)	(0.0)	

* Chi-square test for qualitative outcomes; ANOVA/t test for age and Kruskal-Wallis/Mann-Whitney test for total duration of breastfeeding (BF). Different superscript letters indicate a statistically significant difference among countries ($p < 0.05$). **Total who suspended BF: n=579; 18 missing for not knowing how to inform.** Total that continue with BF: n = 189; missing for not knowing how to inform.

from 15 to 47 months, with a mean (SD) of 28.4 (6.7) months and a median (P25–P75) of 29 (23–33) months, stratified according to age as follows: 219 (27.2%) 1-year-old, 512 (63.6%) 2-year-old, and 74 (9.2%) 3-year-old children.

Approximately two-thirds of the children in the sample showed a total breastfeeding duration of at least 12 months, with a significant difference between countries ($p < 0.001$). In Peru, Costa Rica, and Colombia more than 70% of children reached at least 12 months of breastfeeding, while Paraguay was the only country where less than half of children reached this duration. The BF prevalence in children aged one year and two years of age or older was 42.4% and 19.3%, respectively, differing significantly between countries ($p < 0.001$). Peru and Colombia were the countries with the highest prevalence of breastfeeding in children aged 2-3 years.

Children from the countries with the longest average duration of breastfeeding were Chile (15.9 months), Peru (15.6 months), and Venezuela (15.5 months), with more than a third of the children with breastfeeding duration beyond 18 months. Paraguay had the shortest average duration of breastfeeding (7.9 months). Regarding the frequency of BF, two distinct patterns were observed: a group of 6 countries - Chile, Costa Rica, Ecuador, Panama, Paraguay, and Uruguay, in which at least 30% of the children had a high frequency of breastfeeding (7 or more times per day), and in two of them (Chile and Uruguay) approximately half of the children had high frequency; in the remaining four countries, the high frequency of breastfeeding in children included in the study ranged from 0% (Venezuela) to 16.7% (Brazil).

Almost all children in the sample had previously consumed a sugary drink (99.3%; n = 798/804) or food (97.3%; n = 783/805). Table 2 shows that the average age of introduction of sugary drinks was 9.6 months (95%CI 9.2–9.9) and that it occurred up to a maximum of 12 months in all countries. A significant difference in age of sugary drink introduction was observed among countries ($p < 0.001$), being earlier in Costa Rica and Paraguay. There was a significant difference in the type of sugary drinks consumed for the first time among children from different countries ($p < 0.001$), with a predominance of artificial juice or sugar. The average age of introduction of foods with sugar was 10.1 months (95%CI 9.7–10.4), being less than 12 months in almost all countries. The age of introduction of sugary foods differed across countries ($p < 0.001$), and the first sweet foods consumed were cookies in half of the countries.

Table 3 shows a prevalence of consumption of sugary drinks in a bottle of 41% and in a cup/glass of 87.9%, with significant differences across countries. The mean daily frequency was the same for both modes, 1.3 times per day each (95%CI 1.2–1.4). The average daily frequency of consumption of sugary foods (0.8; 95%CI 0.7–0.8) was lower than the average frequency of beverages with sugar in a bottle or cup/glass ($p < 0.001$). In total, the average daily frequency of sugary foods and beverages was 3.3 times per day (95%CI 3.1–3.5) and varied significantly across countries ($p = 0.004$). The countries with the highest average daily frequency of consumption of sugary foods and drinks were Uruguay, Venezuela, Colombia, and Peru. In Uruguay, Chile, Peru, and Venezuela more than one third of children consumed sugary foods and drinks five or more times a day.

Table 4 shows that children with a shorter duration of total breastfeeding were introduced to sugary drinks almost two months earlier and to sugary foods more than two months earlier than children with longer breastfeeding duration ($p < 0.001$). Multivariate analysis showed breastfeeding for longer than 6 months provided an increase of 16% (MR 1.16; 95%CI 1.05–1.28) and 21% (RM 1.21; 95%CI 1.10–1.33), respectively, in the age of introduction of sweet drinks and foods.

Discussion

The present study investigated dietary practices during the first years of life in children from vulnerable settings in ten Latin American countries. The most relevant result of the study was that participants in all the included countries introduced sugary foods and beverages to children at a very early age and maintained a high frequency throughout early childhood, with some regional differences. In addition, breastfeeding for longer than six months

Table 2. Age of introduction and type of sugary beverages and foods consumed in 10 Latin American countries.

Variable	Total	Brazil	Chile	Colombia	Costa Rica	Ecuador	Panamá	Paraguay	Peru	Uruguay	Venezuela	p-value*
Introduction of sugary beverage: age (months)												< 0,001*
Mean (SD)	9.6 (4.9)	9.7 (5.0)[b]	12.0 (6.4)[b]	8.9 (5.0)[a,b]	7.7 (3.7)[a]	11.0 (4.6)[c]	8.7 (3.9)[a,b]	8.1 (3.9)[a]	11.2 (5.0)[c]	9.2 (5.2)[a,b]	10.6 (6.1)[a,b]	
(95%CI)	(9.3-9.9)	(8.7-10.7)	(9.6-14.4)	(7.9-10.0)	(6.9-8.5)	(10.1-12.0)	(7.9-9.4)	(6.9-9.3)	(10.2-12.2)	(7.9-10.5)	(8.4-12.9)	
Introduction of sugary beverage:												< 0.001**
Artificial juice	(37.5)	(63.0)	(24.2)	(38.6)	(43.2)	(21.9)	(22.0)	(27.7)	(40.6)	(21.2)	(84.4)	
Lacteous drink	(26.7)	(12.0)	(27.3)	(35.2)	(18.9)	(11.5)	(69.7)	(23.4)	(13.9)	(34.8)	(3.1)	
Soda	(14.3)	(8.3)	-	(19.3)	(13.7)	(28.1)	(3.7)	(27.7)	(10.9)	(24.2)	(3.1)	
Tea	(12.0)	(13.0)	(42.4)	-	(23.2)	(5.2)	(2.8)	(10.6)	(24.8)	(7.6)	-	
Natural fruit juice	(8.5)	(3.7)	(6.1)	(3.4)	(1.1)	(33.3)	(1.8)	(10.6)	(6.9)	(12.1)	(6.3)	
Other	(1.0)	-	-	(3.4)	-	-	-	-	(2.9)	-	(3.1)	
Introduction of sugary snacks: age (months)												< 0,001*
Mean (SD)	10.1 (4.9)	12.5 (6.1)[e]	11.7 (5.2)[d]	9.1 (4.3)[b,c]	8.0 (3.0)[b]	11.8 (5.1)[e]	9.6 (3.8)[c,d]	9.3 (5.2)[c,d]	10.5 (5.0)[d]	7.1 (2.9)[a]	10.7 (5.7)[c,d]	
(95%CI)	(9.7-10.4)	(11.3-13.7)	(9.8-13.5)	(8.2-9.9)	(7.3-8.6)	(10.8-12.9)	(8.9-10.3)	(7.6-11.1)	(9.5-11.5)	(6.4-7.8)	(8.6-12.8)	
Introduction of sugary snacks: types												
	Cookie	Cookie	Cookie	Compote	Cookie	Candy	Cookie	Cookie	Cake	Milk caramel	Cake	
	(26.7)	(40.8)	(67.7)	(35.5)	(53.0)	(42.3)	(45.8)	(35.9)	(25.0)	(39.1)	(28.6)	

*Kruskal-Wallis test; **Chi-square test. Different superscript letters indicate a statistically significant difference among countries ($p < 0.05$).

Table 3. Sweet beverage and food consumption in a bottle or cup by 1- to 3-year-old children in 10 Latin American countries.

Variable	Total	Brazil	Chile	Colombia	Costa Rica	Ecuador	Panamá	Paraguay	Peru	Uruguay	Venezuela	p-value*
Sweet drink in bottle												< 0.001*
Yes (%)	(41.0)	(26.4)	(21.2)	(38.4)	(54.0)	(57.3)	(27.3)	(57.1)	(50.5)	(26.9)	(51.5)	
Sweet drink in bottle/day frequency												< 0.001**
Mean (SD)	1.3	0.9	1.1	1.1	1.2	1.4	1.2	1.2	1.6	1.5	1.5	
(95%CI)	(1.2-1.4)	(0.6-1.1)	(0.7-1.5)	(0.8-1.4)	(0.9-1.6)	(1.1-1,7)	(0.9-1.5)	(0.8-1.5)	(1.3-2.0)	(1.2-1.8)	(0.9-2.1)	
Sweet drink in cup												< 0.001*
Yes (%)	(87.9)	(85.5)	(87.9)	(91.8)	(84.8)	(85.6)	(84.7)	(63.3)	(84.2)	(100.0)	(87.9)	
Sweet drink in cup/day frequency												0.006**
Mean (SD)	1.3	1.5	1.3	1.7	1.3	1.0	0.9	1.1	1.2	1.6	1.1	
(95%CI)	(1.2-1.4)	(1.1-1.8)	(0.9-1.7)	(1.3-2.1)	(1.0-1.6)	(0.8-1.3)	(0.7-1.1)	(0.7-1.4)	(0.9-1.5)	(1.2-2.0)	(0.5-1.6)	
Sweet foods /day frequency												< 0.001**
Mean (SD)	0.8	0.8	0.9	0.8	0.7	0.7	0.6	0.7	0.6	1.1	1.2	
(95%CI)	(0.7-0.8)	(0.6-1.0)	(0.6-1.2)	(0.5-1.0)	(0.5-1.0)	(0.4-0.9)	(0.5-0.7)	(0.3-1.1)	(0.5-0.8)	(0.8-1.4)	(0.5-2.0)	
Sweet drink and food/day frequency												0.004**
Mean (SD)	3.3	$3.2^{a,b}$	$3.3^{a,b}$	$3.6^{b,c}$	$3.3^{a,b}$	$3.1^{a,b}$	2.7^{a}	$2.9^{a,b}$	$3.5^{b,c}$	4.3^{c}	$3.8^{b,c}$	
(95%CI)	(3.1-3.5)	(2.6-3.7)	(2.6-4.0)	(2.8-4.3)	(2.7-3.8)	(2.6-3.6)	(2.3-3.1)	(2.2-3.7)	(3.0-4.0)	(3.6-4.9)	(2.8-4.9)	
Sweet drink and food/day frequency												0.197*
< 2	(34.5)	(39.1)	(36.4)	(35.5)	(38.0)	(35.4)	(42.3)	(36.7)	(26.7)	(19.4)	(28.1)	
2–4	(35.3)	(32.7)	(27.3)	(36.0)	(34.0)	(36.4)	(37.8)	(34.7)	(37.6)	(34.3)	(37.5)	
> 4	(30.2)	(28.2)	(36.4)	(29.0)	(28.0)	(28.3)	(19.8)	(28.6)	(35.6)	(46.3)	(34.4)	

*Chi-square test; ** Kruskal-Wallis test. Different superscript letters indicate a statistically significant difference among countries ($p < 0.05$).

Table 4. Mean (95%CI) age and Mean Ratio (MR) for the introduction of sugary drinks and foods according to duration of total breastfeeding (BF).

Variable	Age (months)		Crude analysis			Adjusted analysis**			p-value
	Mean	(95%CI)	p-value*	MR	(95%CI)	p-value	MR	(95%CI)	
Introduction of sugary drinks									
BF duration									
≤ 6 months	8.6	(7.8–9.4)	< 0.001	1.00		< 01	1.00		0.004
> 6 months	10.5	(10.0–11.0)		1.22	(1.10–1.35)		1.16	(1.05–1.28)	
Introduction of sugary foods									
BF duration									
≤ 6 months	8.7	(7.9–9.5)	< 0.001	1.00		< 0.001	1.00		< 0.001
> 6 months	11.0	(10.5–11.5)		1.27	(1.15–1.40)		1.21	(1.10–1.33)	

*Mann-Whitney; **Adjusted by gender, age, and country.

was associated with a delay in the introduction of sugary foods and beverages.

Both the World Health Organization (WHO) and UNICEF recommend exclusive breastfeeding for the first 6 months of life and introduction of adequate and safe complementary solid food from 6 months, preferably continuing with breastfeeding to reduce the risk of mortality due to diarrhea or pneumonia, as well as to reduce the risk of obesity and type 2 diabetes.[20] Among the WHO indicators of dietary practices, the proportion of children who were still breastfed at 12 months of age stands out. International data show that this prevalence is less than 20% in most high-income countries, while the highest prevalence is found in sub-Saharan Africa, South Asia, and parts of Latin America.[20] The results of the present study showed that, with the exception of Paraguay, the Latin American countries included in the study have a prevalence of breastfeeding at 12 months of more than 50%, being greater than 70% in Peru, Costa Rica, and Colombia. These data corroborate previous studies with low-middle and upper-middle income countries, including a recent Brazilian study with representative data from the country, and demonstrate that most children are exposed to this important health-promoting factor early in life.[20,21]

Furthermore, breastfeeding for more than six months was associated with a delay in the introduction of sweet foods and beverages by approximately two months. However, it is not possible to estimate whether this difference has an impact on clinically relevant outcomes. A lower sugar consumption early in life has previously been correlated with children who are breastfed in the first hours of life[22] and children breastfed for at least 3 months in Australia.[23] On the other hand, birth cohort studies in different communities around the world have indicated that a high daily frequency of breastfeeding from 12 to 18 months of age is a risk factor for early childhood caries.[12,17,24-26] In this sense, it is noteworthy that in most assessed Latin American countries, at least 30% of children 1 and 3 years of age had a breastfeeding frequency greater than or equal to 7 times per day between. Reducing the frequency of breastfeeding in these children to 2 to 3 times per day after the first anniversary could contribute to a reduction in the risk of caries,[11,12] while improving dietary diversity, which is important for growth and development.[17]

Very early introduction and high consumption frequency of sugary foods and beverages was a common finding in all investigated countries. The fact that sugary foods and beverages are mostly consumed before twelve months of age has already been reported in Australia, Finland, Mexico, and Brazil.[15,21,22,27] The early introduction of sugar shapes the taste perception of the child who craves such foods and also establishes the conditions for the implantation of a cariogenic biofilm.[28,29] In addition, a high frequency of sugar consumption in subsequent years, previously reported in two birth cohort

studies in Brazil,[22,30] indicates that children from vulnerable settings in Latin America are highly exposed to non-communicable diseases such as obesity,[15] cardiovascular disease,[16] asthma,[31] type-2 diabetes,[12] and dental caries.[11]

Artificial juices and cookies were the most common first sugary products, but there are differences across Latin American countries, which reflect cultural differences and point to possible intervention priorities. At the same time, this may not indicate a difference in caries risk between countries. It was previously demonstrated in a birth cohort study that the occurrence of early childhood caries is associated with the number of sugary products consumed in the first year of life, but is independent of the most consumed item.[13]

On average, sugary beverages were introduced before sugary foods and were responsible for the highest frequency of consumption of such products. Although almost 90% of children drink sweet drinks from cups or bowls, the results showed that bottle feeding was associated with a specific pattern of caries lesions in maxillary anterior teeth.[14,24] Consumption of sweet drinks is widespread in Latin America, being greater than 50% in half of the countries surveyed. On the other hand, two-thirds of children consumed sugary foods and beverages at least twice a day, and around 30% of children consumed at least 5 times a day, with no difference between countries, suggesting frequent consumption of these products in Latin American children.

Together, these data explain the origin of the high sugar consumption reported in adults in different Latin American countries.[33] More emphasis should be place on the urgent need for actions to reverse the high risk that children in this region are exposed of non-communicable diseases, including dental caries, which occurs first and most often in early childhood. Randomized clinical trials have shown that healthy eating interventions in the first year of life can reduce sugar consumption in the short and medium term and reduce the occurrence of early childhood caries.[34,35] However, the positive effect depends on the intensity of the intervention and may not last in the long term.[34,36] The main barriers of behavior change include the strong family culture focused on sugar consumption and availability of low-cost sugar products, aimed at all ages, but especially children.[37,38]

Thus, the international literature has increasingly investigated the effect of broader policies that act on the availability, regulation, legislation, and price of sugary products, potentially more effective actions for reducing inequalities.[8,18,38,39] Some countries have already established policies in this regard, such as banning or reducing the sale of sugary foods and beverages in schools (Brazil, Chile, Costa Rica, Mexico, Uruguay, and Australia), increasing the taxation of sweet drinks (Mexico, United Kingdom, France, Ireland, Thailand), regulating sugar product packaging, including warnings on sugar content (Chile, Peru, Uruguay, Ecuador and Mexico), and regulating the sugar content of industrialized products (UK).[40,41] Although most of these measures have only been adopted in recent years, some positive results have already been described, such as an 11%, 12%, and 24% reduction in sugary drink consumption in Ireland, Mexico, and Chile, respectively.[40,42]

Among the limitations of the study, the cross-sectional design stands out, which can add some degree of information bias on eating behaviors during the first year of life. However, data were collected in children aged 1 to 3 years, reducing recall bias. In addition, the sample was obtained by convenience and it was not representative of the socioeconomic strata of the different countries. Thus, it is possible that these data do not reflect the parameters of the source populations in each country. However, the objective was specifically to provide a baseline of sugary product consumption in a vulnerable population, for which the findings of the present study can be generalized. Such populations are more exposed to risk factors and should be the focus of public health policies.

Conclusion

This multicenter initiative in Latin America revealed a very early introduction of sugary foods and beverages and their high consumption frequency through early childhood. Breastfeeding duration of more than 6 months contributed to a

delay in the introduction of sugary products. Thus, complementary actions to promote a healthy diet by health professionals and policies to regulate the availability, content, price, and advertising of sugary products are urgently needed.

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