Original article

Food intake and underweight markers in children under 6 months old monitored via the Food and Nutrition Surveillance System, Brazil, 2015

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Abstract

Objective: to investigate the frequency of exclusive breastfeeding, early introduction of other foods and association with prevalence of low weight in Brazilian children. **Methods:** we analyzed records of children under 6 months of age held on the Food and Nutrition Surveillance System for the year 2015; associations were investigated through Poisson Regression. **Results:** we found prevalence of 56.1% (95%CI 55.3;56.8) for exclusive breastfeeding, 8.1% (95%CI 7.7;8.5) for low weight for age, and 5.7% (95%CI 5.3;6.7) for low BMI for age; water or teas and infant formulas were the earliest foods introduced; underweight prevalence was lower (PR=0.73 – 95%CI 0.61;0.87) as was prevalence of low BMI (PR=0.69 – 95%CI 0.56;0.85) among exclusively breastfed infants; infant formula intake was associated with low weight (PR=1.35 – 95%CI 1.15;1.58). **Conclusion:** the importance of exclusive breastfeeding for adequate growth in the first 6 months of life was reinforced.

Keywords: Breast Feeding; Bottle Feeding; Nutritional Status; Nutritional Surveillance.

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Introduction

The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend that breastfeeding should begin in the first hour of life, continue without the provision of other foods or liquids for the first 6 months, and that it be continued together with complementary foods up until at least 2 years of age.[1] Maternal breastfeeding has countless benefits for infant and maternal health in the short, medium and long term and is recognized as being an intervention with the greatest potential for reducing infant morbidity and mortality.[2]

When considering the 'mother-baby' pair, breastfeeding is associated with lower risk of breast and ovarian cancer, as well as with lower risk of fractured bones and osteoporosis, less uterine bleeding following childbirth and more rapid return to pre-pregnancy weight; breastfed infants are less likely to contract communicable diseases, to be hospitalized, to suffer from nutritional status disorders, micronutrient deficiencies and chronic diseases.[2,3] Increasing breastfeeding frequency can prevent 823,000 infant deaths and 20,000 breast cancer deaths per year worldwide.[2] Promoting breastfeeding is not only an investment for improving children's health and saving lives; it is a strategy for broadening and developing human capacities, which are essential for promoting a country's socio-economic development.[4]

> *Breastfed infants are less likely to contract communicable diseases, to be hospitalized, to suffer from nutritional status disorders, micronutrient deficiencies and chronic diseases.*

In 2017, WHO released guidelines on child care in Primary Health Care facilities, with the aim of monitoring their nutritional status in the context of the double burden of malnutrition. The guidelines recommended that all children aged less than 5 years old should have both weight and height measured and should be classified according to current child growth standards.[5] Since the 1970s, Brazil has implemented and reinforced actions on child growth assessment. The first legal frameworks in support of Food and Nutrition Surveillance actions (FNS) within the Brazilian National Health System (SUS) were launched in the 1990s, with the institutionalization of the National Food and Nutrition Surveillance System (SISVAN) and the inclusion of nutrition surveillance and healthy eating guidance as part of SUS actions.[6]

FNS is one of the guidelines of the National Food and Nutrition Policy and consists of the continuous description and prediction of populational nutrition and food consumption trends and their determinants. The Ministry of Health recommends that FNS be comprehensive and consider information from population surveys, nutritional surveys of children during national vaccination campaigns (chamadas nutricionais), scientific research and integration of data from other health information systems.[7] In this sense, the SISVAN system stands out as an important health care tool, a national administration system for consolidating anthropometry and food consumption data of Primary Care service users, thus enabling monitoring and evaluation of their indicators.[6]

In 2015, a revised version of the food consumption markers evaluation module was incorporated into SISVAN. This instrument made it possible to assess breastfeeding practices of SUS Primary Health Care users according to the latest WHO recommendations,[8-10] adapted to the Brazilian population.[11] In view of the relevance of studying the nutritional status and food consumption of children using SUS services and, above all, given the social vulnerability that characterizes this population, as well as the absence of national up-to-data data on underweight and food consumed evaluated using the new markers, the purpose of this study was to investigate the frequency of exclusive breastfeeding and early introduction of other foods, and their association with underweight in Brazilian children based on SISVAN data.

Methods

This was a cross-sectional study using administrative data retrieved from SISVAN Web, the online version of this system available in all Brazilian municipalities.

The data we analyzed correspond to the data recorded on SISVAN Web in 2015 and refer to anthropometric and food consumption assessments performed by Primary Health Care professionals in municipalities. The database was retrieved in June

2016, after the Ministry of Health had blocked data entry relating to the preceding year. The information recorded on SISVAN Web relates to a set of actions recommended by the Ministry of Health as part of Food and Nutrition Surveillance and enables information from all over the national territory to be brought together in a single online space.[6]

We obtained a dataset comprised of 22,313 records of children under 6 months old. Notwithstanding, we only included in the study children who had had both anthropometric and food consumption assessments. In the case of children who were not assessed for both items on the same day, we accepted a difference of up to 30 days between the two assessments. We did not include 2,846 records because the gap between assessments was greater than 30 days and the records were therefore not eligible for inclusion in the study.

We also did not take into consideration duplicated records for the same individual (n=255) or records with biologically implausible data (n=1,791) after classifying nutritional status according to Z-score using Anthro 3.2.2 software. This application uses lower and upper thresholds to identify potentially incorrect values and recommend their exclusion from the analyses in order to obtain consistent results. As such, we considered Z-scores ranging from -6 to +5 for the weight-for-age index, and ranging from -5 to +5 for the body mass index (BMI) for age.[12]

Taking the set of data included in the study, we compared their distribution by Brazilian macroregion and by the children's sex and the population projections made by the Brazilian Institute of Geography and Statistics (IBGE) for children under 1 year old in 2015.[13] The purpose of this comparison was to identify, indirectly, the proximity between the characteristics of the cases recorded on SISVAN and the characteristics expected for this population.

The outcome of interest was underweight and the exposure variables were those used to assess food consumption markers (Figure 1). Food consumption variables referred to the day prior to the interview, and the answer categories were 'yes or 'no'.[9,11] Our analysis also included: the Brazilian macroregions (Northeast; North; Midwest; Southeast; South), race/skin color (White and Asiatic; brown and Black; indigenous; no information), sex (female; male), age (in months) and attending day-care facilities (yes; no; no information).

We considered that there was exclusive breastfeeding (indicator 1) when the person responsible for child answered 'yes' to option '2.a' and 'no' to the remaining options for question 211 (Figure 1). Underweight was assessed based on the 'weight-for-age' and 'BMI-for-age' indices, categorized so as to take into consideration < -2 Z-scores, according to the growth curves published by WHO in 2006.[14,15]

The children's ages assessed by anthropometry and food consumption were represented by their mean value and respective standard deviations (SD), after checking their normality using the Shapiro-Wilk test.

1. Exclusive breastfeeding
2. Consumption on the preceding day of:
a) Mother's milk
b) Porridge
c) Water or tea
d) Cow's milk
e) Infant formula
f) Fruit juice
g) Fruit
h) Savory food (pan-cooked food, mashed food or soup)
i) Other food or drink

a) SISVAN: Food and Nutrition Surveillance System
Note: Exclusive breastfeeding was considered to have taken place when the person responsible for the child answered 'yes' to alternative 2.a and 'no' to all other options of this item.

Figure 1 – Food consumption markers used by SISVAN a to comprise the 'exclusive breastfeeding' indicator with effect from 2015

The difference between ages was verified using Student's t-test ($p<0.05$). Proportions and their 95% confidence intervals (95%CI) were calculated for the remaining characteristics.

In order to investigate association between the outcome (underweight) and exposures (food consumption), we used a theoretical model in which exclusive breastfeeding and early introduction of other foods could be associated with underweight at this stage in life, either as protection or risk, respectively. Within this context, we took into consideration that race/skin color (a proxy for socioeconomic status), sex and age (distinct nutritional requirements) could be confounders regarding this association, as possible variables needed to adjust the model.

We used Poisson regression with robust variance to build the multivariate models; exposure variables with $p<0.20$ in the crude analysis were included at the same time in the model and at the end those with $p<0.05$ were kept in the model. We adjusted the multivariate models for the potential confounding variables: child's sex, race/skin color and age. The analyses were performed using Stata version 15.1 (Statacorp, College Station, Texas, United States).

Data was retrieved from SISVAN ensuring the anonymity of all subjects, so that no personal characteristics were revealed, as required by the Access to Information Act (Law No. 12527, dated November 18th 2011), in relation to the protection of personal information.[16] The names of the municipalities comprising the database were also not revealed. Given its nature and the use of non-identified data, the study project was exempt from appraisal by a Research Ethics Committee, as per National Health Council (CNS) Resolution No. 510, dated April 7th 2016.[17] Authorization for analyzing and publicizing the results was obtained from the Ministry of Health General Food and Nutrition Coordinating Department, which manages SISVAN at the federal level, upon commitment by the analysts involved to ensure confidentiality and good use of the information.

Results

We assessed 17,421 records that met the eligibility criteria. Mean age – in months – of the children according to the food consumption assessment was 2.61 (SD=1.76), while according to the nutritional status assessment it was 2.63 (SD=1.76; p=0.193). The comparison between cases retrieved from SISVAN and the IBGE population estimates for the reference year, 2015, by sex and Brazilian macroregion is shown in Table 1. Low weight-for-age prevalence was 8.1% (95%CI 7.7;8.5) while low BMI-for-age prevalence was 5.7% (95%CI 5.3;6.7); the remaining characteristics of the children included in the study and the distribution of the variables of interest are shown in Table 2.

With regard to food consumption on the day prior to the interview, 88.3% of the children assessed had consumed mother's milk; although only 56.1% had done so exclusively. Among the food items of early introduced and most mentioned by the respondents, water or tea was reported for 28.9% of the children, followed by infant formula which was consumed by 25% of them. It

Table 1 – Children under 6 months old monitored via SISVAN[a] and IBGE[b] population estimate of children under 1 year old, by sex and macroregion, Brazil, 2015

Macroregion	SISVAN[a] Sample			IBGE[b] Population Estimate		
	Male	Female	Total	Male	Female	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Northeast	907 (5.2)	879 (5.0)	1,786 (10.3)	449,408 (15.6)	428,736 (14.9)	878,144 (30.5)
North	863 (5.0)	890 (5.1)	1,753 (10.1)	166,582 (5.8)	159,121 (5.5)	325,703 (11.3)
Midwest	1,487 (8.5)	1,465 (8.4)	2,952 (16.9)	114,314 (4.0)	109,102 (3.8)	223,416 (7.8)
Southeast	3,736 (21.4)	3,686 (21.2)	7,422 (42.6)	555,504 (19.3)	530,002 (18.4)	1,085,506 (37.7)
South	1,802 (10.3)	1,706 (9.8)	3,508 (20.1)	187,115 (6.5)	178,460 (6.2)	365,575 (12.7)
Brazil	8,795 (50.5)	8,626 (49.5)	17,421 (100.0)	1,472,923 (51.2)	1,405,421 (48.8)	2,878,344 (100.0)

a) SISVAN: Food and Nutrition Surveillance System.
b) IBGE: Brazilian Institute of Geography and Statistics.

is noteworthy that the highest prevalence of low weight-for-age was found among children who consumed infant formula. Regarding the consumption of other foods, underweight frequency was similar in the strata studied for both indicators (Table 3).

As for the analysis of factors associated with underweight, with regard to the weight-for-age index, all food consumption markers were kept in the final model because they showed p<0.20. In the multivariate analysis, we found greater prevalence of underweight among children who consumed infant formula (PR=1.35 – 95%CI 1.15;1.58). Exclusive breastfeeding, in turn, was found to be a protection factor in relation to the 'underweight' outcome (PR=0.73 – 95%CI 0.61;0.87). A similar effect was found for water or tea consumption (Table 4).

When studying factors associated with low weight according to BMI-for-age, we did not keep 'cow's milk', 'fruit juice' or 'fruit' food items in the final model because they showed p>0.20 in the first round of analysis. In the multivariate analysis, exclusive breastfeeding was found to be associated with lower underweight prevalence, as per the BMI-for-age index (PR=0.69 – 95%CI 0.56;0.85) (Table 4).

Table 2 – Characteristics of children under 6 months old (N=17,421) with data on anthropometry and food consumption included on SISVAN,[a] Brazil, 2015

Characteristics	Frequency % (95%CI[c])	Low weight-for-age % (95%CI[c])	Low BMI[b] for age % (95%CI[c])
Sex			
Female	49.5 (48.7;50.2)	7.6 (6.9;8.1)	5.1 (4.6;5.5)
Male	50.5 (49.7;51.2)	8.7 (8.1;9.3)	6.3 (5.8;6.8)
Age (in months)			
<1	25.2 (24.5;25.8)	8.2 (7.4;9.1)	5.6 (4.5;5.8)
1	16.6 (16.1;17.2)	11.9 (10.8;13.2)	7.8 (6.8;8.8)
2	16.5 (15.9;17.0)	9.6 (8.6;10.7)	6.3 (5.4;7.2)
3	13.6 (13.1;14.2)	6.9 (5.9;8.0)	5.6 (4.8;6.6)
4	15.7 (15.1;16.2)	6.0 (5.2;6.9)	4.6 (3.9;5.5)
5	12.4 (11.9;12.9)	4.9 (4.1;5.9)	4.9 (4.1;5.9)
Race/skin color			
White and Asiatic	48.8 (48.1;49.5)	8.7 (8.0;9.2)	5.7 (5.2;6.2)
Brown and Black	40.6 (39.8;41.3)	7.4 (6.7;8.0)	6.0 (5.4;6.6)
Indigenous	0.4 (0.3;0.5)	5.8 (2.1;14.5)	2.8 (0.7;10.9)
No information	10.2 (9.7;10.6)	8.8 (7.5;10.2)	4.7 (3.8;5.7)
Attends crèche			
Yes	17.7 (17.1;18.3)	8.1 (7.1;9.0)	6.1 (5.2;6.9)
No	81.5 (80.8;82.0)	8.2 (7.7;8.6)	5.7 (5.2;6.0)
No information	0.8 (0.6;0.9)	5.6 (2.8;10.8)	3.5 (1.4;8.1)
Brazilian macroregion			
Northeast	10.3 (9.8;10.7)	5.7 (4.7;6.8)	6.3 (5.2;7.5)
North	10.1 (9.6;10.5)	5.9 (4.9;7.1)	6.0 (4.9;7.2)
Midwest	16.9 (16.3;17.5)	5.6 (4.8;6.5)	4.7 (3.9;5.4)
Southeast	42.6 (41.8;43.3)	9.6 (8.9;10.3)	6.0 (5.3;6.4)
South	20.1 (19.5;20.7)	9.5 (8.6;10.6)	6.0 (5.2;6.8)

a) SISVAN: Food and Nutrition Surveillance System.
b) BMI: body mass index.
c) 95%CI: 95% confidence interval.

Discussion

This study was the first to analyze SISVAN administrative data related to food consumption in children aged under 6 months old based on the new Ministry of Health recommended markers.[11] The incorporation of the consumption module reviewed in 2015 into SISVAN has provided a tool for surveillance, care and management of food and nutrition actions in the territories covered by Primary Health Care; analysis of this data can inform the planning of actions to promote adequate and healthy eating habits. The main findings of this analysis were the protective effect of breastfeeding on children's nutritional status and the high frequency of provision of other forms of food before age 6 months.

The most recent national Brazilian survey having valid anthropometric data, used as the basis for assessing underweight frequency in children under 12 months old, was carried out in 2006 and did not produce data on the age range we studied, nor data on 'BMI-for-age', thus hindering comparison. However, the frequency of low weight-for-age found by that survey was 2.9% (standard error: 0.8%). Despite the comparison limitations, owing to age range and time elapsed, that survey found that underweight prevalence increased as family income decreased, and was around 2.5 times greater in the lowest stratum in relation to the highest stratum. Given that the majority of children monitored via SISVAN are in situations of social vulnerability,[18] it can be expected that the underweight frequencies found in our study, which are greater than those of the national survey, are close to the frequency expected for this population in 2015.[19]

Underweight frequency was greater among children under 3 months old, considering both anthropometric indices assessed, when compared to the rest of the children. A possible justification for this finding is that some of these children were born small in relation to gestational age (birth weight lower than 2,500g) and had not had sufficient time for recovery at the time they were assessed. Another possibility to be considered is that the younger children lost biological weight shortly after they were born, given that 45.0% of the children under 3 months old were actually aged under 1 month old (data not shown).[20]

The anthropometric indices we used complement each other: BMI takes the child's height into consideration, marking cases of children who were born smaller than the mean for this population, while weight is a indicator that is more sensitive to acute malnutrition, this being a common situation in this age range, while the family seeks alternatives in the face of barriers and difficulties in achieving exclusive breastfeeding.[21] More than the frequencies of these indicators, one should bear in mind their particularities when studying the associations found.

Table 3 – Consumption of mother's milk and other food by children under 6 years old monitored via SISVAN,[a] Brazil, 2015

Food consumption indicator[b]	Frequency	Low weight-for-age	Low BMI[c] for age
	% (95%CI[d])	% (95%CI[d])	% (95%CI[d])
Exclusive breastfeeding	56.1 (55.3;56.8)	7.6 (7.0;8.0)	5.2 (4.7;5.5)
Mother's milk	88.3 (87.8;88.8)	7.9 (7.4;8.2)	5.6 (5.2;5.9)
Porridge	10.9 (10.4;11.3)	7.0 (5.8;8.1)	6.5 (5.4;7.6)
Water or tea	28.9 (28.2;29.5)	7.4 (6.6;8.0)	6.1 (5.4;6.7)
Cow's milk	10.5 (10.0;10.9)	7.0 (5.8;8.1)	6.3 (5.1;7.3)
Infant formula	25.0 (24.3;25.6)	10.5 (9.5;11.3)	6.5 (5.8;7.2)
Fruit juice	13.0 (12.4;13.4)	6.2 (5.2;7.1)	5.6 (4.6;6.5)
Fruit	11.5 (11.0;11.9)	6.0 (5.0;7.0)	5.2 (4.2;6.2)
Savory food	9.0 (8.5;9.4)	6.1 (4.9;7.2)	4.7 (3.6;5.7)
Other food or drink	6.8 (6.3;7.1)	6.7 (5.2;8.1)	4.8 (3.6;6.0)

a) SISVAN: Food and Nutrition Surveillance System.
b) Both indicators were estimated based reported prior day consumption.[12]
c) BMI: body mass index.
d) 95%CI: 95% confidence interval.

Table 4 – Association between exclusive breastfeeding, early food consumption and underweight among children under 6 months old monitored via SISVAN,[a] Brazil, 2015

Food consumption indicator[b]	Low weight-for-age		Low BMI[c] for age	
	Crude prevalence ratio (95%CI[d])	Adjusted prevalence ratio[e] (95%CI[d])	Crude prevalence ratio (95%CI[d])	Adjusted prevalence ratio[e] (95%CI[d])
Exclusive breastfeeding	0.85[f] (0.77;0.94)	0.73[g] (0.61;0.87)	0.80[f] (0.71;0.90)	0.69[f] (0.56;0.85)
Mother's milk	0.77[f] (0.67;0.89)	0.87 (0.75;1.02)	0.80[g] (0.68;0.95)	0.90 (0.74;1.09)
Porridge	0.86[g] (0.77;0.97)	1.01 (0.82;1.24)	1.16[h] (0.97;1.39)	1.22 (0.98;1.52)
Water or tea	0.87[h] (0.78;0.97)	0.81[g] (0.69;0.94)	1.10[h] (0.97;1.25)	0.93 (0.77;1.13)
Cow's milk	0.84[h] (0.71;1.00)	0.92 (0.75;1.14)	1.11 (0.92;1.34)	–
Infant formula	1.42[f] (1.28;1.58)	1.35[f] (1.15;1.58)	1.20[g] (1.05;1.37)	1.00 (0.83;1.20)
Fruit juice	0.74[f] (0.62;0.87)	0.89 (0.69;1.14)	0.98 (0.82;1.17)	–
Fruit	0.72[f] (0.60;0.86)	0.85 (0.65;1.13)	0.91 (0.74;1.10)	–
Savory food	0.73[f] (0.60;0.90)	1.01 (0.76;1.35)	0.81[h] (0.64;1.02)	0.78 (0.58;1.04)
Other food or drink	0.81[h] (0.65;1.01)	0.90 (0.75;1.02)	0.84[h] (0.64;1.09)	0.77 (0.57;1.06)

a) SISVAN: Food and Nutrition Surveillance System.
b) Both indicators were estimated based reported prior day consumption.[12]
c) BMI: body mass index – low weight-for-age and low BMI-for-age, < -2 Z-score, according to World Health Organization reference curves.[15]
d) 95%CI: 95% confidence interval.
e) The model was adjusted for sex, age and race/skin color.
f) p<0.001.
g) p<0.05.
h) <0.20.

In our study, exclusive breastfeeding prevalence was higher than the prevalence rates found in three national studies on this theme: 36.0% in 2006, 41.0% in 2009 and 37.1% in 2013.[22] In relation to children under 6 months old who received mother's milk on the previous day, prevalence was also higher than the rates found in the earlier studies, namely 52.1% in 2006 and 56.3% in 2013 (for children under 24 months old).[22] Despite possible selection bias present in studies like this one, one of the explanations for the higher frequency may lie in the product of the actions undertaken may lie in the product of breastfeeding promotion actions undertaken by the Primary Health Care teams.[23-25] Studies conducted in the city of Rio de Janeiro solely with children monitored in Primary Health Care facilities found 58.1% prevalence of exclusive breastfeeding in 2010 and 50.1% in 2013 – these prevalence rates are closer to the ones we found.[23,25] Early introduction of food other than mother's milk before six months of age has also been identified in other studies,[19,26] in particular water and tea, which had the highest frequency among children in the municipality of Goiânia, in the state of Goiás.[26]

Exclusive breastfeeding was confirmed as a protection factor against underweight. Besides reducing morbidity and mortality in children under 6 months old,[1,3,27] this finding relates breastfeeding to lower underweight prevalence rates; and it is in line with the results of the investigation carried out by Vesel et al.[20] into association between exclusive breastfeeding and reduction in malnutrition prevalence among Peruvian and Indian children.

The final model of our study brought other relevant data for analysis, such as the fact of (i) non-exclusive consumption of mother's milk not having the same protection effect as exclusive consumption for the outcomes analyzed, and (ii) consuming infant formula being a risk factor. With regard to this latter result, it cannot be ascertained that infant formula is related to the causes of underweight, or that its use is a strategy commonly used by health workers to recover children's weight and adequate growth for age. According to a cohort study that monitored the speed of weight gain in children under 6 months old in Viçosa, in the state of Minas Gerais, however, children who consumed infant formula gained less weight when compared to those who did not consume this type of food in nearly all evaluation stages,[28] indicating that our results may have represented reality.

Consuming water or tea was associated in a protective manner with underweight, when assessed

according to the 'weight-for-age' index. A hypothesis for this unexpected finding would be the fact that in Brazil people have the habit of sweetening tea with sugar and, consequently, consuming large amounts of it is capable of causing rapid weight recovery or greater weight gain by children, although it does not benefit linear growth. As this issue refers to both items, we were unable to qualify the analysis in order to corroborate this hypothesis.

Adequate physical growth (including increased weight and height) of a child under 6 years old is of fundamental importance for its full development. Likewise, exclusive breastfeeding is the main basis for a child achieving its full potential.[1,28] Moreover, exclusive breastfeeding has a protective effect against excessive weight gain at this age and is associated with healthy body weight throughout life.[1,29] Monitoring child growth and development in Primary Health Care using FNS, has already shown a positive effect in a previous study with socially vulnerable children.[18] Our study reinforces the importance both of monitoring and also of actions to promote exclusive breastfeeding. Both actions can explain, albeit partially, breastfeeding prevalence and its contribution to the adequate growth of this population.

As is the case of any analysis conducted based on administrative information systems, there are certain limitations to be considered when interpreting the evidence produced. These include lack of representativeness, characteristic of studies with predefined sample designs, and the impossibility of measurement standardization, whereby measurements may vary from one health center to another, even though a national recommendation exists for measurement.[30] The cross-sectional design of the study also prevents causal inference in relation to exposures and outcomes.

With regard to the comparison between the sample analyzed and the IBGE population projection, we found a similar distribution in stratification by sex for Brazil as a whole, although it differed in the country's macroregions. With regard to the composition of cases on SISVAN, the Southeast and Southern regions had the largest number of monitored children, differently to the IBGE population estimate of greater numbers in this age group in the Southeast and Northeast regions. This result points to the limitations of the frequencies found for these regions and the impossibility of stratifying the analysis of the association between breastfeeding and underweight. In relation to the limitations of the instrument used to evaluate the food consumption markers, the variety of food covered by it is restricted. This may be prejudicial to the comprehensive identification of the feeding possibilities of this population as well as the inability to quantify consumption. Moreover, a marker evaluation instrument is not capable of assessing an individual's usual consumption.

Despite these limitations, the result we obtained collaborates with the body of national evidence related to the importance of exclusive breastfeeding in children under 6 months old. This approach is pioneer in Brazil. A further positive point of the study is its great capillarity: i.e. the inclusion of data collected in all of the Brazilian regions and relating to more than 600 municipalities (data not shown). It is our understanding that apart from reinforcing the importance of exclusive breastfeeding for child growth, the information presented points to the possibility of using SISVAN as an active surveillance tool, complementing, with greater periodicity and resource savings, information obtained through population surveys

The practice of exclusive breastfeeding was found in just over half the children assessed. Water, tea and infant formula were the main forms of food consumed early. The associations we found reinforce breastfeeding as a protection factor for growth in the first months of life, when breastfeeding is exclusive, and the lack of this factor when breastfeeding is not exclusive. Infant formula consumption led to a 35% increase in the prevalence of low weight-for-age. We highlight the importance of developing Food and Nutrition Surveillance actions and promoting exclusive breastfeeding during the first six months of life, with these actions being undertaken by Primary Care, with the aim of ensuring adequate weight gain and healthy growth among Brazilian children.

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Authors' Contribution

Gonçalves VSS, Silva SA, Andrade RCS and Spaniol AM took part in conceiving the study design, data analysis and interpretation, as well as preparing and critically reviewing the contents of the manuscript. Nilson EAF and Moura IF took part in conceiving and designing the study and critically reviewing the contents of the manuscript. All the authors took part in writing the manuscript and approved the final version thereof. They declare that they are responsible for all aspects of the manuscript, ensuring its accuracy and integrity.

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