

Complementary feeding patterns in the first year of life in the city of Rio de Janeiro, Brazil: time trends from 1998 to 2008

Padrões de alimentação complementar no primeiro ano de vida no Município do Rio de Janeiro, Brasil: tendência temporal (1998-2008)

Patrones de alimentación complementaria durante el primer año de vida en la ciudad de Río de Janeiro, Brasil: tendencias temporales (1998-2008)

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Abstract

This study aimed to analyze time trends in complementary feeding practices among children under one year of age in the city of Rio de Janeiro, Brazil, from 1998 to 2008. Based on comparable questions on food consumption in five surveys conducted in representative randomized samples of children in 1998 (n = 3,762), 2000 (n = 3,670), 2003 (n = 4,305), 2006 (n = 3,686), and 2008 (n = 2,621), 16 complementary feeding indicators were constructed. The percentage frequency of all indicators was estimated for each year of the study. Linear trend analyses were also conducted by means of multivariate regression models. All indicators of early complementary feeding decreased from 1998 to 2008. In the 6-11.9 month age group, there was a significant downward trend in the proportion of children receiving food with adequate consistency for their age, consumption of iron-rich foods, and overall adequacy of the diet. A significant upward trend in fruit consumption was observed. There was a decrease in the early complementary feeding, and generally a worsening of complementary feeding practices in children aged 6-11.9 months in Rio de Janeiro during the period studied.

Supplementary Feeding; Infant Nutrition; Temporal Distribution

Resumo

Este estudo objetivou analisar as tendências temporais das práticas de alimentação complementar entre crianças < 1 ano de idade na cidade do Rio de Janeiro, Brasil, de 1998 a 2008. Com base em questões comparáveis sobre o consumo de alimentos de cinco inquéritos realizados em amostras probabilísticas de crianças em 1998 (n = 3.762), 2000 (n = 3.670), 2003 (n = 4.305), 2006 (n = 3.686) e 2008 (n = 2.621), foram construídos 16 indicadores de alimentação complementar. A frequência percentual dos indicadores foi estimada para cada ano. Análises de tendências lineares foram realizadas por meio de modelos de regressão multivariada. Os indicadores de alimentação complementar precoce diminuíram de 1998 a 2008. No grupo de 6 a 11,9 meses de idade, houve tendência significativa do aumento no consumo de frutas e de queda na proporção de crianças que recebiam preparações com consistência adequada para sua idade, que consumiam alimentos ricos em ferro e que recebiam alimentação adequada. Durante o período estudado, houve queda da alimentação complementar precoce e, em geral, pioraram as práticas de alimentação complementar em crianças de 6 a 11,9 meses no Rio de Janeiro.

Suplementação Alimentar; Nutrição do Lactente; Distribuição Temporal

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Introduction

Complementary feeding is defined as supplying a currently breastfeeding child with any food other than breast milk¹. The beginning of this phase is considered an essential moment in the infant's care, acting as a direct determinant of the child's subsequent survival, growth, and development². The World Health Organization (WHO) recommends exclusive breastfeeding until the child reaches six months of age, and the continuation of breastfeeding until two years of age or older³. From six months of life on, exclusive breastfeeding is unable to supply all of the child's nutritional needs. At six months of life it is necessary to introduce complementary feeding with adequate consistency and frequency for the age bracket, with healthy foods that meet the following characteristics recommended by the Brazilian Ministry of Health: variety, taste, access, harmony, color, and safety^{4,5}.

The early introduction (before six months of age) of complementary foods produces disadvantages for the infant's nutrition and health. It often leads to a decrease in the duration of breastfeeding, interferes in the absorption of breast milk nutrients, increases the risk of contamination and allergic reactions, and reduces protection against diseases⁶. On the other hand, when complementary feeding is introduced late and/or inadequately, it can slow down the child's growth, increasing the risk of malnutrition and micronutrient deficiencies⁵.

Unlike breastfeeding, which has been monitored in recent decades in various countries^{2,7}, including in Brazil^{8,9,10}, research on and monitoring of the dynamics of complementary feeding patterns are still insufficient¹¹, and few studies have analyzed its time trends¹². The limited available data on complementary feeding patterns come from studies whose main theme is breastfeeding, basically reporting on the early introduction of foods other than breast milk and on some markers of complementary feeding patterns in the second semester of life, while failing to portray the theme's full complexity. In Brazil, these studies reveal the early introduction of complementary foods such as: milk (other than breast milk), porridge, family foods, water, tea, and fruit. Recent studies have also identified inadequate consistency and limited diversification of complementary feeding in the six to 11 month age group^{8,10}.

With the aim of contributing to knowledge in this area, the current study proposed to analyze time trends in complementary feeding patterns among infants (< 1 year of age) in the city of Rio de Janeiro, Brazil, from 1998 to 2008.

Methods

This is a time trends study based on surveys on feeding practices in the first year of life, conducted during the National Poliomyelitis Immunization Campaigns (NPIC) in Rio de Janeiro by the Municipal Secretariat of Health (SMS/RJ), in partnership with academic institutions. The databanks used here were from the surveys in 1998 (n = 3,762), 2000 (n = 3,670), 2003 (n = 4,305), 2006 (n = 3,686), and 2008 (n = 2,621), which, at the time of writing this article in 2013, was the latest survey conducted. The NPIC aims to maintain smallpox eradication through the establishment of collective protection by spreading vaccine viruses in the environment. Its goal is to vaccinate children under five years of age throughout Brazil.

The study population for all the surveys consisted of children younger than one year vaccinated during the NPIC in Rio de Janeiro (with a mean coverage of 98.9% in the study period). For each year, a representative self-weighted probabilistic cluster sample (by immunization station) of this population was selected, calculated according to the number of infants (< 1 year of age) vaccinated in each immunization station in the previous year. The immunization stations included: health centers, schools, churches and other places in the communities that were appropriate for the immunization procedures during the NPIC.

The data were collected using closed questionnaires completed by the children's mothers, fathers, or other accompanying persons while they waited for their children to be vaccinated. The questionnaires included questions about the consumption of breast milk, other types of milk and other foods, including other liquids, fruits, beans and meat. It also included questions about sociodemographic variables (e.g. mother and schooling). The total amount of questions varied from 49 (in 2008) to 56 (in 2003). The questionnaire is simple enough to be applied by non-specialists, such as health officers, college students and even high school students. The data collection was conducted by previously trained volunteers, mostly undergraduate nutrition students from various universities in Rio de Janeiro and the surrounding area, supervised by the SMS/RJ and professors from partner universities. The interview lasted three minutes on average.

The questions used to construct the complementary feeding indicators referred to the child's feeding on the day prior to the data collection ("current status")¹³. In order to ensure the comparability between years, we only used questions that had been included in all the surveys. There

were cases in which the question's structure had been changed so extensively over the years that it compromised the construction of comparable indicators between the surveys. In these situations, indicators were only generated for the years whose questions were comparable.

The indicators adopted in the current study were adapted from a WHO publication that presents 15 indicators for evaluation of the adequacy of feeding practices in children 0 to 23 months of age, six of which refer to or include complementary feeding issues and are directed to children aged between 6 and 23 months¹⁴. Of these, three provided the basis for most of the indicators constructed in the current study: consumption of solid, semi-solid, and soft foods among children six to eight months of age (6-8.9 months); consumption of iron-rich foods among children 6 to 11.9 months of age (6-11.9 months); and minimum dietary diversity among children 6-11.9 months of age. The other three, which discuss frequency of milk supply to non-breastfed children, minimum frequency of meals, and the combination of the latter with dietary diversity, were ruled out because the questionnaires used in the surveys did not include questions on the number of times that given foods or meals were offered. On the other hand, we included an indicator specific for fruit pieces or mashed fruit, an indicator for each food group that composed the dietary diversity indicator and two indicators that combined consistency of meals with minimum dietary diversity. Given the importance of this issue for child health, we also developed indicators directed to the early introduction of complementary feeding, which had not been considered by the WHO.

All the indicators constructed here were calculated by dividing the number of children in a given age bracket that met a given condition (e.g., having drunk water, tea, or juice the previous day) by the total number of children in that age bracket. When we display the indicators as constructed, we will focus on describing the foods or meals and the age bracket covered by each, without exhaustively repeating that they refer to the proportion of children that met that condition.

In order to evaluate early complementary feeding, we analyzed food consumption in infants younger than six months. The foods or food groups used to construct indicators of early complementary feeding were: water, water with sugar, or tea (for the indicator water-or-tea < 6); fruit or fruit juice (fruit-or-juice < 6); milk other than breast milk (any-other-milk < 6); and foods other than breast milk (any-other-food < 6).

The indicators for the evaluation of complementary feeding practices among children from

6 to 11.9 months aimed to cover the following aspects of complementary feeding guidelines: energy density (measured indirectly as adequacy of consistency of foods offered according to the child's age bracket) and quality of the diet (estimated by three markers: supply of fruit; supply of dietary iron sources, and minimum dietary diversity). The foods, food groups, or meals that constituted the indicators for energy density, fruit supply, and iron sources were: family foods, vegetable soup or pap [for the indicator solid-semi-soft (6-8.9)]; family foods [solid (9-11.9)]; fruit pieces or mashed fruit [fruit (6-11.9)]; soup or pap with meat or family foods with meat or beans [iron (6-11.9)].

In order to evaluate the minimum dietary diversity of the complementary feeding offered to the child, we constructed the indicator diversity (6-11.9), which corresponded to feeding at least four of the five food groups (vegetables, fruit, legumes, meat, and dairy products). In order to learn about their components, other indicators were created for the above-named food groups. These consisted of the following foods or meals: food with beans [for the indicator legumes (6-11.9)]; vegetable soup or pap [vegetables (6-11.9)]; breast milk, powdered milk, other milk, milk-based porridge [dairy (6-11.9)]; soup or pap with meat, food with meat [meat (6-11.9)]; fruit juice, fruit pieces, or mashed fruit [fruit-or-juice (6-11.9)].

To analyze the adequacy of the diet's consistency, two indicators were constructed, one for children 6-8.9 months of age and the other for children 9-11.9 months of age. This procedure was intended to capture differences in the recommendations on the consistency of the food for these two age groups⁵, since solid foods are only considered indispensable for the latter.

Indicators were also constructed to summarize the adequacy of complementary feeding practices by combining consistency of meals with minimum dietary diversity. The first indicator referred to adequate consistency for age and consumption of at least four of the five target food groups – [ADEQ-A (6-11.9)] and the second one, to adequate consistency for age and consumption of all five food groups [ADEQ-B (6-11.9)].

In the year 2008, the questions on the consumption of vegetable soup or pap and family foods were combined. This made the year's survey incomparable with those of the previous years for the following indicators: solid (9-11.9); iron (6-11.9); legumes (6-11.9); vegetables (6-11.9); diversity (6-11.9); ADEQ-A (6-11.9); and ADEQ-B (6-11.9). Thus, these indicators were not generated for 2008. For the same year, we thus chose not to present the other components of

the indicator diversity (6-11.9), namely: dairy (6-11.9), meat (6-11.9), and fruit-or-juice (6-11.9).

Although the proportion of missing information for each question on the questionnaire was low (varying from 0 to 8.6% in the surveys included in this study), the missing data were imputed in order to avoid loss of individuals from the sample. Given that all the variables to be imputed were dichotomous, for each missing datum we chose to assign the most frequent condition observed in children of the same age (in months) as a whole and from the same survey that had information on that question¹⁵.

When examining the time trends in the indicators, for each year we estimated the percentage frequency (and calculated the respective standard error) for each of the 16 indicators described previously, taking the cluster sample design into account.

We also conducted linear trend analyses for each of the complementary feeding adequacy indicators by means of logistic regression models, with significant trend defined as the year variable presenting a p-value of < 0.05 according to the Wald statistic. Two sets of models were generated. In the first, which included the univariate regression models, the dependent variable was each of the complementary feeding indicators, and the independent variable was the study year. The second set, which included multivariate regression models, aimed to control the possible effect that changes in maternal characteristics: age (< 20, 20-24, 25-29, 30-34 e \geq 35 years), schooling (< 7, 8-10 e \geq 11 years), primiparity (yes/no), and work (yes/no); might have on the estimated proportions. Such maternal characteristics were elected as possible confounding variables due to their association with feeding practices in children < 1 year, as described in other studies^{13,16,17,18}.

The databanks were constructed with Epi Info version 6.04 (Centers for Disease Control and Prevention, Atlanta, USA), and statistical analysis of the data used SPSS version 13.0 (SPSS Inc., Chicago, USA).

The surveys were conducted according to the ethical standards required by the *Declaration of Helsinki* and *Ruling n. 196/96* of the Brazilian National Health Council. Beginning in 2003, the study protocols were approved by the Institutional Review Board of the SMS/RJ. The 2008 survey was part of a multi-center study that included the Brazilian State capitals and Federal District¹⁰.

Results

Table 1 shows the distribution of the children studied each year according to age and maternal characteristics. As for the latter, during the study period as a whole there was a decrease in the proportion of teenage mothers and an increase in mothers 35 years or older; an increase in maternal schooling; and a decrease in the proportion of working mothers.

As for early complementary feeding (Table 2), there was a significant downward trend in the proportions of the four target indicators, with different intensities in the variation: from 26% for milk other than breast milk < 6 to 44% water-or-tea < 6. Despite the observed reduction, the early introduction of any food other than breast milk before six months was observed in more than half of the children at the end of the period (any-other-food < 6 = 56.3%).

As for complementary feeding among children 6-11.9 months of age, there was a decrease in the proportion of complementary feeding containing iron-rich foods (84.4 to 81.3%) and meals with adequate consistency for age (88.7 to 86.7% among children 6-8.9 months of age and 81 to 60.3% among children 9-11.9 months of age) (Table 3). The opposite was true for the proportion of children that ate fruit, which showed an increase during the period (64.1 to 72.8%). All of these trends were significant after controlling for possible confounders.

Meanwhile, minimum dietary diversity remained stable from 1998 to 2006 (71.9 to 72.5%), as did its components (Table 4). Although legumes (6-11.9) and vegetables (6-11.9) showed a significant upward trend, this increase was not maintained in the model that adjusted for maternal characteristics. In 2006, the proportions of children receiving legumes, vegetables, dairy products, meat and fruits (including fruit juices) were, respectively: 61.3, 79.4, 99.9, 74.6 and 83.5%.

On the other hand, there was a significant downward trend in the proportion of children with adequate complementary feeding from 1998 to 2006 for the two respective indicators ADEQ-A (6-11.9) and ADEQ-B (6-11.9) (Table 5). In 1998, about two-thirds (67.7%) and one-third (33.2%) of the children, respectively, met the criteria for adequacy (minimum dietary diversity and appropriate consistency) for both indicators, but by 2008 slightly more than half (56.5%) and about one-quarter (25.2%), respectively, met these same criteria. Importantly, in all the surveys, the proportion of children with adequate complementary feeding dropped by half when the presence of all five food groups (rather than at

Table 1

Distribution of the study population according to the infant's age and maternal characteristics, by year of study. Rio de Janeiro, Brazil, 1998-2008.

Variable	Survey year										p-value *
	1998		2000		2003		2006		2008		
	n	%	n	%	n	%	n	%	n	%	
Infant's age bracket (months)											
< 4	1,201	31.9	1,272	34.7	1,493	34.7	1,275	34.6	923	35.2	0.011
4-5.9	654	17.4	647	17.6	741	17.2	566	15.4	428	16.3	
6-11.9	1,907	50.7	1,748	47.6	2,071	48.1	1,845	50.1	1,270	48.5	
Maternal age bracket (years)											
< 20	724	19.3	670	18.3	602	16.9	600	16.4	358	16.4	0.045
20-24	1,054	28.1	1,025	28.0	1,007	28.3	986	26.9	568	26.1	
25-29	911	24.3	894	24.4	883	24.8	899	24.6	571	26.2	
30-34	641	17.1	656	17.9	636	17.9	689	18.8	366	16.8	
≥ 35	416	11.1	414	11.3	432	12.1	487	13.3	316	14.5	
Maternal schooling (complete years of school)											
≤ 7	1,410	38.4	1,474	42.0	1,198	35.1	1,049	33.8	627	29.2	0.000
8-10	1,179	32.1	927	26.4	933	27.3	930	30.0	589	27.4	
≥ 11	1,083	29.5	1,111	31.6	1,281	37.5	1,123	36.2	934	43.4	
Primiparity	3,669	47.6	3,660	46.4	4,254	45.3	3,643	48.5	2,173	46.9	0.106
Maternal work	3,662	24.4	3,634	21.3	4,249	23.3	3,636	26.7	2,167	21.3	0.003

* For linear trend of infants' and mothers' characteristics.

Table 2

Time trends in indicators of complementary feeding in infants less than 6 months of age. Rio de Janeiro, Brazil, 1998-2008.

Indicators of early complementary feeding	Survey year										Δ (%) *	p-value **	p-value ***
	1998		2000		2003		2006		2008				
	%	SE	%	SE	%	SE	%	SE	%	SE			
Water or tea	71.5	1.5	66.3	1.0	64.0	1.3	50.4	1.7	39.7	1.6	(-) 44.0	< 0.001	< 0.001
Fruit or fruit juice	40.6	1.3	36.5	1.4	36.0	1.2	27.9	1.1	25.1	1.3	(-) 38.0	< 0.001	< 0.001
Milk other than breast milk	56.8	1.3	53.7	1.2	48.5	1.0	44.5	1.4	42.0	1.4	(-) 26.0	< 0.001	< 0.001
Any food other than breast milk	81.3	1.2	77.4	0.9	73.8	1.1	63.4	1.5	56.3	1.6	(-) 31.0	< 0.001	< 0.001

SE: standard error of estimate.

* Percentage variation of proportion from 1998 to 2008;

** For linear trend, not adjusted for maternal characteristics;

*** For linear trend, adjusting for maternal characteristics (age, schooling, parity, and work).

least four) was used as the marker for minimum dietary diversity.

Discussion

The current study showed a reduction in the proportion of children with early introduction of complementary feeding, which nevertheless continued to occur in more than half of the chil-

dren in the last year of the period under study. Children 6 to 11.9 months of age showed: a decrease in the proportion of children receiving appropriate consistency of the diet, with overall adequacy of the diet, and receiving iron-rich foods; stability in the proportion of children with minimum dietary diversity; and an increase in the proportion of children receiving fruits.

Although few studies have described time trends in indicators of early complementary

Table 3

Time trends in indicators of complementary feeding in infants from 6 to 11.9 months of age. Rio de Janeiro, Brazil, 1998-2008.

Complementary feeding indicators in infants above six months of age	Survey year										Δ (%) *	p-value **	p-value ***
	1998		2000		2003		2006		2008				
	%	SE	%	SE	%	SE	%	SE	%	SE			
Solid, semi-solid, or soft food consistency among infants 6 to 8.9 months of age	88.7	1.1	92.7	1.0	86.8	1.2	87.6	1.1	86.7	1.4	(-) 2.0	0.004	0.001
Solid consistency food among infants 9 to 11.9 months of age	81.0	1.7	74.5	2.1	76.8	1.6	60.3	1.9	NA	NA	(-) 26.0	< 0.001	< 0.001
Pieces of fruit or mashed fruit among infants 6 to 11.9 months of age	64.1	1.6	65.9	1.7	67.2	1.2	66.0	1.3	72.8	1.6	(+) 14.0	0.003	0.003
Iron-rich foods among infants 6 to 11.9 months of age	84.4	1.1	84.8	1.1	83.1	1.1	81.3	1.2	NA	NA	(-) 4.0	0.121	0.001

NA: it was not possible to generate the indicator for this year; SE: standard error of estimate.

* Percentage variation of proportion from 1998 to 2008;

** For linear trend, not adjusted for maternal characteristics;

*** For linear trend, adjusting for maternal characteristics (age, schooling, parity, and work).

Table 4

Time trends in the indicator for minimum dietary diversity and the component food groups among infants 6 to 11.9 months of age. Rio de Janeiro, Brazil, 1998-2006.

Complementary feeding indicators for infants above 6 months of age	Survey year *								Δ (%) **	p-value ***	p-value #
	1998		2000		2003		2006				
	%	SE	%	SE	%	SE	%	SE			
Consumption of at least four food groups	71.9	1.6	71.7	1.6	71.2	1.5	72.5	1.4	(-) 1.0	0.927	0.281
Food groups comprising the above indicator											
Legumes	56.9	1.6	54.6	1.8	56.6	1.5	61.3	1.7	(+) 8.0	0.043	0.135
Vegetables	74.6	1.4	76.9	1.4	73.8	1.4	79.4	1.2	(+) 6.0	0.011	0.109
Dairy products	99.5	0.2	99.5	0.2	99.9	0.1	99.9	0.1	0.0	0.109	0.184
Meat	72.7	1.6	73.9	1.5	72.0	1.5	74.6	1.2	(-) 3.0	0.564	0.525
Fruit ##	83.3	1.2	83.4	1.3	85.8	0.9	83.5	1.0	0.0	0.249	0.165

SE: standard error of estimate.

* It was not possible to generate the indicators for the year 2008;

** Percentage variation of proportion from 1998 to 2006;

*** For linear trend, not adjusted for maternal characteristics;

For linear trend, adjusting for maternal characteristics (age, schooling, parity, and work);

Including fruit juice.

feeding, the last decade has witnessed an increase in the frequency of exclusive breastfeeding among infants under four months of age in Brazilian State capitals as a whole (from 35.5% in 1999 to 51.2% in 2008). The same trend was observed in Rio de Janeiro (from 16.9% in 1998 to 40.7% in 2008) ¹⁰. Nonetheless early complementary feeding it is still common in Brazil ^{19,20}.

Meanwhile, it is not easy to compare our findings with those from the literature on indicators of complementary feeding patterns among chil-

dren from 6 to 11.9 months of age, given that the few studies providing information on complementary feeding patterns use different indicators from ours, and do not present time trends for complementary feeding patterns in the second semester of life ^{10,13,21}.

The *2nd Survey on Prevalence of Breastfeeding in Brazilian State Capitals and the Federal District*, with a sample of 34,366 children under one year of age, adopted methodological procedures that are comparable to those in the surveys used

Table 5

Time trends in the summary indicators for adequate complementary feeding among infants 6 to 11.9 months of age. Rio de Janeiro, Brazil, 1998-2006.

Summary indicators for complementary feeding among infants above 6 months of age	Survey year *								Δ (%) **	p-value ***	p-value #
	1998		2000		2003		2006				
	%	SE	%	SE	%	SE	%	SE			
Consumption of at least four of five food groups ## and appropriate consistency for age	67.7	1.7	64.4	1.9	64.6	1.5	56.5	1.4	(-) 17.0	< 0.001	< 0.001
Consumption of the five food groups and appropriate consistency for age	33.2	1.7	31.7	1.8	34.4	1.5	25.2	1.4	(-) 24.0	< 0.001	< 0.001

SE: standard error of estimate.

* It was not possible to generate the indicators for the year 2008;

** Percentage variation of proportion from 1998 to 2008;

*** For linear trend, not adjusted for maternal characteristics;

For linear trend, adjusting for maternal characteristics (age, schooling, parity, and work);

Legumes, vegetables, dairy products, meat, and fruit.

in the current study¹⁰. The 2nd Survey on Breast-feeding produced two indicators that are comparable to ours: consumption of family foods by children 6-8.9 months of age and consumption of fruit (pieces/slices or mashed fruit) by children 6-11.9 months of age.

As for the former indicator (family foods in the 6-8.9 month group), Rio de Janeiro showed the highest proportion (86.7%) among the State capitals in the Southeast region of Brazil, exceeding both the national average (73.2%) and the averages for each of the country's major geographic regions. For the latter indicator (fruit in the 6-11.9 month group), the proportion in Rio de Janeiro (72.8%) was lower than the overall national average (74.5%) and the averages for the South, Central, and Southeast regions (82, 81.8, and 77.5%, respectively), surpassing only the mean proportions in the Northeast (67.5%) and North (67.1%).

At the international level, based on the *Demographic and Health Surveys* (DHS) conducted from 2002 to 2008, WHO supplied information from 46 countries for indicators of dietary consistency in children 6-8.9 months of age and minimum dietary diversity in children 6-23 months of age⁷. We compared the results with those from Rio de Janeiro, even though the age bracket considered by WHO for this last indicator is different from the one adopted in this study (6-11.9 months). For the solid-semi-soft indicator (6-8.9), the proportion in Rio de Janeiro in 2008 (86.7%) puts the city in sixth place as compared to the 46 countries, following Zimbabwe, the Philippines, Zambia, Haiti, and Indonesia (with rates ranging from 91.5 to 87.3%).

The same position was observed for the indicator diversity (6-11.9), since the proportion

in Rio de Janeiro (72.5%) was only exceeded by that of Moldavia (83.9%), Peru (81.4%), Jordan (75.1%), Bolivia (73.6%), and the Dominican Republic (73.2%). In comparison to the Latin American countries studied by WHO, the city of Rio de Janeiro occupied second place for the indicator solid-semi-soft (6-8.9), after Haiti (87.4%), and fourth place for the indicator diversity (6-11.9), after Peru (81.4%), Bolivia (73.6%) and the Dominican Republic (73.2%).

In terms of implications of these findings for the food and nutrition public policy agenda, it should be noted that the decline in early complementary feeding is consistent with the increase in exclusive breastfeeding in Rio de Janeiro^{10,15}. This in turn has resulted from a consistent public policy to promote, support, and protect breastfeeding practice in Brazil as a whole, including the city of Rio de Janeiro. This policy combines various initiatives, for example the Baby-Friendly Hospital Initiative, Breastfeeding-Friendly Primary Care Initiative, National Strategy for Healthy Complementary Feeding, media campaigns, specific official publications on the theme, partnerships between government and civil society, and others^{5,22,23,24}. One can thus assume that the expansion and intensification of such initiatives could lead to improvements in early complementary feeding indicators.

Meanwhile, the time trends in complementary feeding indicators presented here for children 6-11.9 months of age generally show the persistence or worsening of feeding practices observed in 1998, a finding consistent with the absence of effective public policies in this area. This raises a huge challenge for Brazil's incipient public policies targeting the promotion of healthy comple-

mentary feeding patterns, which need to be intensified and expanded in light of the right to adequate food, as laid out in the *Brazilian Constitution*. They should include the reinforcement of health professional capacity building, the development of practical approaches to the theme directed at the population, and monitoring procedures for complementary feeding practices with better instruments than the ones that were used up until 2008.

As for methodological issues, a possible limitation of the study could arise from difficulties in conducting surveys on vaccination campaigns, considering the short time for the interviews and the number of people to be interviewed. These difficulties were circumvented by adopting simplified instruments for data collection and by recruiting a significant number of field researchers in each survey (about 200 in each study).

Another methodological aspect to be considered is the extent to which changes in the structure of some questions and the lack of a greater range of foods may have compromised the indicators' composition or their comparability between years. We will now discuss this issue in detail for the indicators on consistency of foods, consumption of iron-rich foods, and minimum dietary diversity.

The wording in the question on family foods changed over the years. In 1998, the question in Portuguese mentioned "comidinha com sal" (literally "little food with salt"); in 2000 and 2003, the expression was changed to "comida com sal" ("food with salt"), and in 2006 to "comida de panela" ("food from the pot"). This may partially explain the lower proportion of the indicator for solid food (9-11.9) in 2006 as compared to previous years, since interviewees may have had a different understanding of the meals implied in the question.

The questionnaires did not exhaustively cover the various iron-rich foods. For example, until 2003 they only asked about beans as part of the "food". In 2006 they also asked about beans as an ingredient in the "soup or pap". In the time trend analysis, we left out this second question in order to avoid compromising the comparability with previous years, but for the purposes of the current reflection we did recalculate the iron indicator (6-11.9) and included questions on beans in soup or pap as well. This altered the proportion

of iron-rich foods in 2006 from 81.3% to 86.2%. This finding suggests that for the indicator iron (6-11.9) and the indicators on minimum dietary diversity and adequacy that include this question in their composition, the proportions obtained in the surveys covered in this study may be underestimated. Besides this, questionnaires did not include questions regarding iron-fortified foods.

The questionnaires also failed to exhaustively approach the possibilities for supplying foods from each group comprising the indicator on diversity (6-11.9) (fruit, vegetables, legumes, meat, and breast milk and/or dairy products). This may have led to an underestimation of this indicator and consequently that of the summary indicators on adequacy of diet.

Given that the questionnaires used in the current study have been adopted on a wide scale in Brazil^{10,13,15} and that they represent a potential source of information for measures to promote healthy complementary feeding currently in the implementation phase in the country, there is a clear need to revise them in order to allow more adequate construction of complementary feeding indicators. The WHO has recently published a proposal for a questionnaire²⁵ to be adapted by the countries for studies on complementary feeding patterns. The proposal covers the range of indicators on feeding in the first two years of life proposed two years earlier¹⁴. However, the proposed instrument fails to contemplate inadequate feeding practices, such as markers of unhealthy foods in the child's diet (candy, ultra-processed foods, etc.). In addition, the large number of questions in the questionnaire prevents its use in conjunction with National Immunization Campaigns.

The current study, the first report on time trends in complementary feeding patterns in infants (under one year of age), identified a decrease in the early introduction of complementary foods in children under six months and an overall worsening of complementary feeding practices in children 6-11.9 months of age in Rio de Janeiro from 1998 to 2008. It also highlighted the relevance of monitoring complementary feeding practices to provide input for feeding and nutrition practices targeting children, besides identifying the need to develop more adequate instruments for surveys on this theme.

Resumen

Se analizaron las tendencias temporales de las prácticas de alimentación complementaria en niños < 1 año de edad en la ciudad de Río de Janeiro, Brasil, de 1998 a 2008. En base a preguntas comparables acerca del consumo de alimentos en cinco encuestas, basadas en muestras aleatorias de niños en 1998 (n = 3.762), 2000 (n = 3.670), 2003 (n = 4.305), 2006 (n = 3.686) y 2008 (n = 2.621), se construyeron 16 indicadores de alimentación complementaria. Se calculó para cada año la frecuencia porcentual de los indicadores. Los análisis de tendencia lineal se realizaron por medio de modelos de regresión multivariable. Los indicadores de alimentación complementaria precoz disminuyeron. En niños con 6 a 11,9 meses de edad, hubo una tendencia significativa de aumento del consumo de frutas y una caída en la proporción de los que recibieron papillas con una consistencia adecuada para su edad, que consumieron alimentos ricos en hierro y que recibieron una alimentación adecuada. Durante el período de estudio, hubo una disminución de la alimentación complementaria precoz y, en general, un deterioro de las prácticas de alimentación complementaria en niños de 6 a 11,9 meses de edad en Río de Janeiro.

Alimentación Suplementaria; Nutrición del Lactante; Distribución Temporal

Contributors

D. A. Oliveira and I. R. R. Castro contributed to the study conception and design, data collection, analysis and interpretation; they also participated in writing up the article, and approved of the final version for publication. P. C. Jaime collaborated in the study conception, analysis and interpretation of data, and participated in the article write-up.

Acknowledgments

The authors would like to thank the Municipal Secretariat of Health of Rio de Janeiro for financing the surveys and the Annes Dias Institute of Nutrition for their support throughout the entire research.

References

1. Giugliani ERJ, Victora CG. Alimentação complementar. *J Pediatr (Rio J)*. 2000; 76:253-62.
2. World Health Organization. Complementary feeding of young children in developing countries: a review of current scientific knowledge. Geneva: World Health Organization; 1998.
3. World Health Organization. Assembly resolution: infant and young child nutrition. Geneva: World Health Organization; 2001.
4. World Health Organization. Evidence on the long-term effects of breastfeeding: systematic review and meta-analyses. Geneva: World Health Organization; 2007.
5. Ministério da Saúde. Saúde da criança, nutrição infantil. Aleitamento materno e alimentação complementar. Brasília: Ministério da Saúde; 2009. (Caderno de Atenção Básica, 23). (Séria A. Normas e Manuais Técnicos).
6. Van Odjik J, Kull I, Borres MP. Breastfeeding and allergic disease: a multidisciplinary review of the literature (1966-2001) on the mode of early feeding and its impact on later atopic manifestations. *Allergy* 2003; 58:833-43.
7. World Health Organization. Indicators for assessing infant and young child feeding practices: part 3. Country profiles. Geneva: World Health Organization; 2010.

8. Ministério da Saúde. Prevalência de aleitamento materno nas capitais brasileiras e no Distrito Federal. Brasília: Ministério da Saúde; 2001.
9. Ministério da Saúde. Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher. Brasília: Ministério da Saúde; 2008.
10. Venâncio SI, Escuder MM, Saldiva SR, Giugliani ER. Breastfeeding practice in the Brazilian capital cities and the Federal District: current status and advances. *J Pediatr (Rio J.)* 2010; 86:317-24
11. Ferreira CS, Cherchiglia ML, César CC. The Food and Nutrition Surveillance System as a tool for monitoring the National Strategy for Healthy Complementary Nutrition. *Rev Bras Saúde Matern Infant* 2013; 13:167-77.
12. Lin JR, Tzeng MS, Kao MD, Yang YH, Pan WH. Practice to introduce complementary foods to infants in Taiwan: changes from 1997 to 2008. *Asia Pac J Clin Nutr* 2011; 20:337-45.
13. Venâncio SI, Escuder MML, Kitoko P, Rea MF, Monteiro CA. Frequência e determinantes do aleitamento materno em municípios do Estado de São Paulo. *Rev Saúde Pública* 2002; 36:313-8.
14. World Health Organization. Indicators for assessing infant and young child feeding practices. Conclusions of a consensus meeting held 6-8 November 2007 in Washington DC, USA. Geneva: World Health Organization; 2008.
15. Castro IRR, Engstrom EM, Cardoso LO, Damião JJ, Rito RVFV, Souza MA, et al. Amamentação na cidade do Rio de Janeiro: tendência temporal entre 1996-2006. *Rev Saúde Pública* 2009; 43:1021-9.
16. Saldiva SR, Escuder MM, Mondini L, Levy RB, Venâncio SI. Práticas alimentares de crianças de 6 a 12 meses e fatores maternos associados. *J Pediatr (Rio J.)* 2007; 83:53-8.
17. Campagnolo PDB, Louzada MLC, Silveira EL, Vito-lo MR. Práticas alimentares no primeiro ano de vida e fatores associados em amostra representativa da cidade de Porto Alegre, Rio Grande do Sul. *Rev Nutr PUCCAMP* 2012; 25:431-9.
18. Cruz, MCC, Almeida JAG, Engstrom EM. Práticas alimentares no primeiro ano de vida de filhos de adolescentes. *Rev Nutr PUCCAMP* 2010; 23:201-10.
19. Bernardi JLD, Jordão RE, Barros Filho AA. Alimentação complementar de lactentes em uma cidade desenvolvida no contexto de um país em desenvolvimento. *Rev Panam Salud Pública* 2009; 26:405-11.
20. Caetano MC, Ortiz TTO, Silva SGL, Souza FIS, Sarni ROS. Alimentação complementar: práticas inadequadas em lactentes. *Arch Pediatr Urug* 2012; 83:226-32.
21. Almeida PC, Castro LMC, Damião JJ. Alimentação complementar oportuna e consumo de alimentos ricos em ferro e facilitadores de sua absorção no município do Rio de Janeiro. *CERES: Nutrição & Saúde* 2010; 5:5-17.
22. Rea MF. Reflexões sobre a amamentação no Brasil: de como passamos a 10 meses de duração. *Cad Saúde Pública* 2003; 19 Suppl 1:S37-45.
23. Departamento de Atenção à Saúde, Secretaria de Atenção à Saúde, Ministério da Saúde. Dez passos para uma alimentação saudável, guia alimentar para crianças menores de dois anos. Um guia para o profissional de saúde na atenção básica. 2ª Ed. Brasília: Ministério da Saúde; 2010. (Série A. Normas e Manuais Técnicos).
24. Ministério da Saúde. Estratégia nacional para a alimentação complementar saudável: caderno do tutor. Brasília: Ministério da Saúde; 2010.
25. World Health Organization. Indicators for assessing infant and young child feeding practices: part 2. Measurement. Geneva: World Health Organization; 2010.

Submitted on 28/Jun/2013

Final version resubmitted on 20/Nov/2013

Approved on 06/Jan/2014