



Complementary feeding, consumption of industrialized foods and nutritional status of children under 3 years old in Pelotas, Rio Grande do Sul, Brazil, 2016: a descriptive study*

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Alice Magagnin Neves¹ –  orcid.org/0000-0003-3201-3415

Samanta Winck Madruga¹ –  orcid.org/0000-0001-7717-3952

¹Universidade Federal de Pelotas, Programa de Pós-Graduação em Nutrição e Alimentos, Pelotas, RS, Brasil

Abstract

Objective: to verify how and when complementary feeding (CF) begins, its profile, consumption of processed foods and nutritional status of children aged 1-3 years. **Methods:** children enrolled at public schools in Pelotas, RS, Brazil, were evaluated; length/height-for-age and weight-for-age scores, and body mass index (BMI)/age were used, and a structured questionnaire was administered to parents/caregivers; CF was considered early when started before the age of six months; data were presented in a descriptive way. **Results:** 79 children were evaluated, of whom 13 were overweight and 6 obese; 11 had high weight-for-age; mean age for beginning CF was 5.3 months; when aged <6 months, 43% received gelatin, and 12.7% juice from cartons; when aged 6-24 months, 96.2% received filled biscuits and 91.1% salty snacks. **Conclusion:** CF and consumption of processed foods began early; obesity and overweight were more prevalent than malnutrition.

Keywords: Infant Nutritional Physiological Phenomena; Industrialized Food; Nutritional Status; Observational Study.

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Correspondence:

Samanta Winck Madruga – Universidade Federal de Pelotas, Programa de Pós-Graduação em Nutrição e Alimentos, Rua Gomes Carneiro, No. 1, Centro, Sala 227, Bloco A, Pelotas, RS, Brazil. Postcode: 96010-610
E-mail: samantamadruga@gmail.com

Introduction

The first 1.000 days of a child's life, a period considered from the first day of pregnancy up until 2 years of age, are of primary importance for and impact on its biological character (growth/development) right through to its intellectual and social character.¹ Moreover, studies²⁻⁴ demonstrate the relationship between lifelong health and feeding practices during the first two years of human existence. With effect from six months of life, when the provision of breast milk alone is not sufficient to meet all their nutritional requirements, infants gradually begin to receive other foods. Such feeding, in addition to breast milk during this period, is called complementary feeding (CF).⁵

Complementary feeding often has less nutritional quality than breast milk and is often given in inadequate quantities.

The introduction of CF presupposes the presence of different food groups (vegetables/legumes, grain/tubers, beans and meat/offal/egg), initially in paste/mashed form, followed by a gradual increase in meal consistency and frequency, without the inclusion of sugar or items such as salty snacks, sweets and processed foods.^{6,7} In this period up to the age of 2 years, when the child grows and develops rapidly, the role of nutrients is crucial, including as a way of establishing healthy eating habits both at this time and as an investment in its future.^{2,5}

Despite the recommendations of the World Health Organization (WHO)⁵ and guides published by the Brazilian State,^{6,7} some studies⁸⁻¹¹ and national surveys^{12,13} demonstrate that CF begins early for a significant number of children,⁸ in a period when they are vulnerable from the point of view of their food intake. CF often has less nutritional quality than breast milk and is often given in inadequate quantities.⁵

The 'II Study of breastfeeding prevalence in Brazilian state capitals and Federal District'¹² found that during the preceding 24 hours (i) 4.9% of children aged 6-9 months and 11.6% of children aged 9-12 months consumed sparkling soft drinks and (ii) 8.9% of those aged 3-6 months, 46.4% aged 6-9 months and 71.7% aged 9-12 months consumed biscuits and salty snacks. The 'National Survey on Demographics and Health of Children and Women - 2006' (PNDS-2006)¹³ showed

that only 17.3% of children between 6 and 11 months of age were given meat daily.

The objective of this study was to verify how and when complementary feeding begins, its profile, consumption of processed foods by children under 2 years old and nutritional status of children aged 1-3 years.

Methods

This is a descriptive observational study. Data collection took place from September to December 2016. In that year, the municipality of Pelotas had 27 municipal pre-primary schools. Six of these were covered by the School Health Program (PSE) and were attended by children in the age range defined for the study, namely 1-3 years. Owing to the impossibility of assessing all 27 preschools in the municipality, and taking into account the health promotion actions provided by the Program, a convenience sample was defined comprising the six schools covered by PSE.

These schools are monitored by teams of health professionals - who may use the data provided by this study to inform project design. The six schools were invited to participate by telephone contact with their head teachers which included an explanation of the logistics of the study. If they accepted, a visit was scheduled to present the project and verify the number of eligible students to form the target population, namely children aged between 1-3 years who attended these schools. We defined the age range as being 1-3 years with the purpose of reducing possible memory bias, given the retrospective nature of the questionnaire. Children for whom the questionnaire had not been administered or who had not undergone anthropometric assessment were excluded from the study.

The outcomes evaluated were the introduction of CF and the nutritional status of children aged 1-3 years enrolled at public pre-primary schools covered by PSE. First of all, information on CF introduction was collected using a structured retrospective questionnaire for parents/guardians which was based on 'Ten steps for a healthy diet - a Guide to feeding children under 2 years old'.⁶ The questionnaire also asked about breastfeeding and socioeconomic variables and was administered at the school itself.

Parents/guardians considered to be eligible to answer the questionnaire had to be more than 18 years and had to confirm having participated and/or played a defining role in the introduction of complementary foods to the child. CF introduction was considered to be early when initiated before 6 months of age, this being the threshold adopted by WHO⁵ and the Ministry of Health.⁶ Late CF was defined as starting at 8 months of age or older.

Based on the questionnaire data, we adopted the following indicators proposed by WHO in 2008:¹⁴

- a) Introduction of solid, or semi-solid foods: proportion of children starting CF with solids or semi-solids;
- b) Minimum dietary diversity: proportion of children who consume at least four of the following food groups: grains, roots and tubers; legumes and nuts; dairy products; meat; eggs; fruit and vegetables rich in vitamin A; other fruit and vegetables;
- c) Minimum meal frequency
 - proportion of children aged 6-8 months who receive at least two meals/day;
 - proportion of children aged 9-23 months who receive at least two meals/day;
- d) Minimum acceptable diet: proportion of children aged 6-23 months who receive minimum dietary diversity and receive at least four meals/day;
- e) Consumption of foods rich in iron: proportion of children 6-12 months who eat food from the meat groups; and
- f) Bottle feeding proportion of children aged 6-24 months who are fed with a bottle.

The 'Introduction of solid or semi-solid food', 'minimum meal frequency' and 'minimum acceptable diet' indicators were adjusted to take into account the way the questionnaire explored some of the points of interest of the study. The indicators were evaluated without distinction between breastfed and non-breastfed children.

Given that WHO does not provide indicators that evaluate consistency and consumption of industrialized foods, we used the model proposed by Oliveira et al. to this end.¹⁵ Their model evaluates energy density (taking a frequency of three meals/day over six months; and adequate CF consistency (pasty) over six months) and consumption of the following processed foods between 0-6 months and 6-23 months+29 days of age: sparkling soft drinks, salty snacks, filled biscuits, ice cream, sweets, chocolate, chocolate milk, margarine,

instant noodles, cream cheese, canned food, chicken 'nuggets', powdered juice, juice from cartons, hot dog sausage and gelatin. For this item, parents or guardians were asked whether the child had received some of these foods at least once, before completing six months, and/or between 6 and 24 months of life.

The sociodemographic variables collected via the questionnaire were:

- a) sex of the child (male; female);
- b) child's weight at birth (in grams);
- c) age of parents/guardians (in years);
- d) education level of parents/guardians (in years of study);
- e) mother smoker (smoker or non-smoker/former smoker [former smoker: if they had already stopped smoking when starting CF for their child]);
- f) mother works outside the home (yes; no);
- g) number of siblings (none; 1; 2; ≥ 3); and
- h) ethnicity/skin color (white; non-white).

In the next step we evaluated the children's nutritional status. This was also done in the classroom. Weight was measured with the children wearing the minimum possible amount clothing. Children aged 2 years or more were weighed alone, standing up; those aged under 2 years were weighed in the teacher's lap, less the teacher's weight - the teacher was weighed before the child using the same scales.

When measuring height, all children took their shoes off and any adornments in their hair or on their head were removed. Children over 2 years old were measured standing up, while those aged under two were measured lying down. We used portable digital scales (Tanita®) and a portable stadiometer (Wood®) for children aged 2 years or more, and a portable infant stadiometer (Sanny®) for children under 2 years of age. Measurements of weight (kg) and height (cm) were taken by trained interviewers using standardized procedures.

The indices adopted for the assessment of nutritional status were 'Height-for-age', 'weight-for-age' and 'BMI for age', using the Z-score classification, according to cutoff points established by WHO.¹⁶ The score was calculated using Anthro 2011 software.

All children who met the inclusion criteria were invited to participate in the study. As the questionnaire examined retrospective data, there could be recall bias. To control/reduce this bias, questions capable of causing doubts were begun with an explanation and depending on the first answer these questions

were asked again. For example, on the issue of the duration of exclusive breastfeeding, first of all it was explained to the mother what exclusive breastfeeding meant, and, after the mother's first answer she was asked again if during the period in question her child really had not received water, tea or another type of milk. All parents/guardians were interviewed in the same school environment where the anthropometric evaluation of the children was performed.

The results of the study were presented in descriptive form. SPSS 18.0 was used to calculate food group mean values and standard deviation, according to age and continuous variables.

The study protocol was approved by the Pelotas Municipal Education and Sport Department; and also by the Research Ethics Committee of the Federal University of Pelotas (UFPel) Faculty of Medicine as per Opinion No. 2.079.371. The authors of the study followed the ethical principles for research involving human beings, as recommended by National Health Council (CNS) Resolution No. 466, dated 12 December 2012. All participants signed a Free and Informed Consent Form.

Results

Six schools agreed to participate in the project. Of the total of 105 children, 79 were evaluated. The selection of the children - and losses - are described in Figure 1.

The characteristics of the sample are shown in Table 1. In relation to parents or guardians who answered the questionnaire, the vast majority (55) were

mothers, followed by 12 fathers, 8 grandparents and 4 persons in charge, who were almost always a sibling or neighbor of the child. Average age of the children was 2.3 years; average age of parents/guardians was 32 years old, their mean schooling was 9 years and their average monthly income was BRL 1,856.00. Average weight at birth of the children evaluated was 3.390g. This information is not shown in the Tables.

The median for exclusive breastfeeding (EBF) was 90 days. Of the total number of children, only 7 were never breastfed and 15 received EBF for six months. On average CF began at 5.3 months (standard deviation [SD]=1.5). Early CF occurred in 40 children, 29 started CF at exactly 6 months and only 4 started CF late (Table 1).

Table 1 also illustrates the first food offered, among which the most prevalent was mashed fruit (n=26), followed by carbohydrates + bean broth (n=13), and fruit juice (n=11). Table 2 shows the age at which the food groups were provided: 'meat' was the latest provided food (mean=8.0; SD=2.67), while 'other vegetables and fruit' was the earliest group provided (mean=5.82; SD=1.88).

Table 3 shows the values of the indicators proposed by WHO and by Oliveira et al. for evaluating CF.^{14,15}

Regarding the indicator for the consumption of industrialized foods before 6 months, 43% had already consumed gelatin, following by juice from cartons which was consumed by 12.7% of the children by that age. Figure 2 shows that among children aged 6-24 months, 96.2% had already consumed filled biscuits, followed by 91.1% who had already consumed salty snacks.

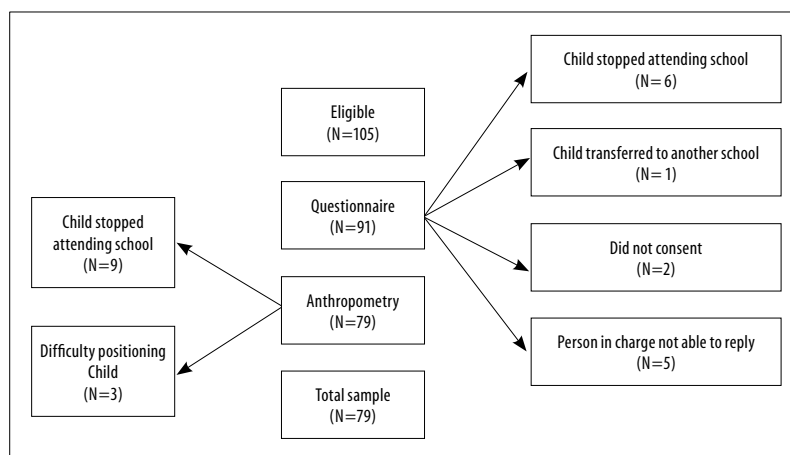


Figure 1 – Flow diagram showing losses occurred in Pelotas, Rio Grande do Sul, 2016 (n=79)

Table 1 – Sociodemographic and anthropometric indicators and first foods provided to children aged 1-3 years enrolled at public schools (N=79), Pelotas, Rio Grande do Sul, 2016

Indicators and food data	N	%
Child's sex		
Male	40	51
Female	39	49
Ethnicity/skin color		
White	38	48
Not white	41	52
Siblings		
0	27	34
1	28	35
2	13	17
≥3	11	14
Smoking mothers^a		
Yes	13	26
No	37	74
Mothers work outside the home^a		
Yes	27	42
No	37	58
Age complementary feeding began (in months)		
<6	40	40
6	29	29
≥8	4	4
Body mass index (BMI)/age^b		
Eutrophic	40	51
Risk of overweight	20	25
Overweight	13	17
Obesity	6	7
Weight/age^b		
Appropriate weight	68	86
High Weight	11	14
First foods		
Mashed Fruit	26	33
Carbohydrate + bean broth	13	16
Soup stock	10	13
Fruit Juice	11	14
Bean broth	7	8
Processed food	3	4
Blended soup	3	4
Do not know or do not remember	7	8

a) Variables evaluated only when parents answered the questionnaire.

b) World Health Organization (WHO)¹⁶

Taking the BMI/age indicator we found that 20 children were at risk of becoming overweight, 13 were overweight, 6 were obese while 40 had adequate weight for age. Taking the weight/age index, 68 had adequate weight for age, and 11 had high weight for age (Table 1). None of the children were classified as underweight or as having severe emaciation. In relation to height/age, only two had low height for age (data not shown in the Tables).

Discussion

Our study found median EBF of 90 days, this being a longer period than those found in recent national surveys.^{12,13} This may possibly be a reflection of campaigns conducted by the Ministry of Health to promote breastfeeding. CF began at an early age among approximately half of the children (n=40) evaluated, at an average of 5.3 months of life. Among the first food provided, mashed fruit was more frequent than fruit juice, reflecting greater awareness and preference for CF with paste/mashed consistency. However, none of the children received all five food groups in their first meal. The last food to be offered was meat, even though it is an important source of iron. Consumption of industrialized foods was high, including among those aged under 6 months, contrary to WHO⁵ and Ministry of Health^{6,7} recommendations. As also demonstrated by national surveys,¹³ overweight/obesity prevalence was greater than thinness or low weight for age.

Among the possible limitations of this study are: (i) the fact that the sample is small and a convenience sample, whereas the majority of comparative studies have representative population samples; (ii) it is an observational study and therefore does not allow follow-up of these children; (iii) and as the

questionnaire is retrospective this may result in some parent/guardian memory bias for one or more of the items of information requested.

In the first two years of life a child's growth and development is intense.^{6,7} Among the various skills acquired during this phase, are receiving, chewing and digesting food, as well as self-control of the process of food ingestion, until reaching adult feeding patterns; a child grows on average 25 cm in the first year and 12 cm in the second.^{6,7} The importance of adequate and healthy nutrition at the beginning of life is therefore unquestionable.

Clayton et al.,¹⁷ in a cohort study with American children, found that 40.4% of them had already received some type of food before being 4 months old. Similarly, in a population sample in the United Kingdom Armstrong et al.⁹ found that 51% of children of the same age were provided with CF. Lin et al.¹⁸ found that 21% of children from a cohort representative of the population of Hong Kong were given food at 3 and 4 months. In a cohort study with 3,427 Brazilian children, Bielemann et al.¹⁹ found that 41.6% of children received semi-solids and 45.4% received solids before they were 6 months old, starting CF on average at 5 and 4 months old, respectively. When evaluating CF surveys conducted in the municipality of Rio de Janeiro in 1998, 2000, 2003, 2006 and 2008, Oliveira et al.²⁰ concluded that there was a significant reduction ($p < 0.001$) in the early introduction of foods between 1998 and 2008, although the provision of some kind of food apart from breast milk before 6 months was found among more than half of the children (56.3%), in the last year of that assessment. The PNDS-200613 found that 14% of children received food before the age of 2 months, and more than 30% received it at 3 and 4 months.

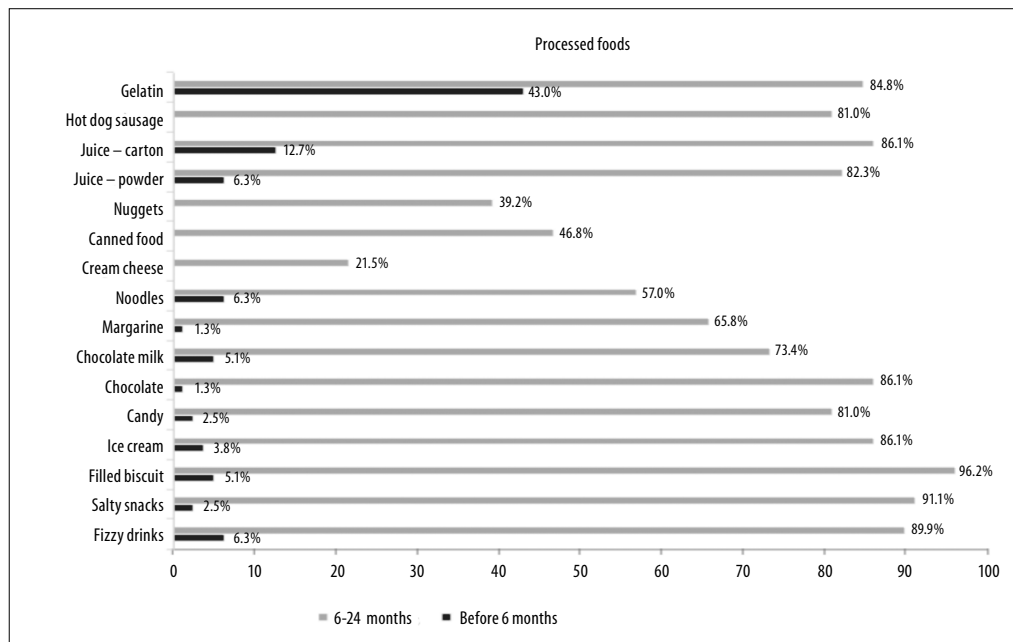
Table 2 – Age of food introduction by food group for children aged 1-3 years enrolled at public schools (n=79), Pelotas, Rio Grande do Sul, 2016

Food group	Age of food introduction (in months)				μ	Standard deviation
	<6	6-7	8-11	≥ 12		
Meat	6	33	23	17	8.00	2.67
Vegetables	18	39	19	3	6.73	2.08
Grains, roots and tubers	16	41	15	7	6.90	2.42
Fruit and vegetables rich in vitamin A	15	36	8	4	6.42	2.11
Other fruit and vegetables	28	43	5	3	5.82	1.88

Table 3 – Indicators of complementary feeding of children aged 1 to 3 years enrolled at public schools (n=79), Pelotas, Rio Grande do Sul, 2016

Indicators	%
Introduction of solid or semi-solid food ¹	30
Minimum dietary diversity ²	54
Minimum meal frequency	
Children between 6 and 8 months who received at least two meals ³	86
Children between 9 and 23 months who received at least two meals ⁴	94
Minimum acceptable diet ⁵	46
Consumption of foods rich in iron ⁶	77
Energy density ⁷	33
Bottle feeding ⁸	94

a) World Health Organization (WHO);¹⁴ Oliveira et al.¹⁵

**Figure 2 – Proportion of children aged 1-3 years enrolled at public schools (n=79) who, at the ages of 6 months or 6-24 months, consumed all of industrialized foods evaluated, Pelotas, Rio Grande do Sul, 2016**

Returning to our study, with regard to the first food provided to children, the majority received mashed fruit (33%), followed by carbohydrates with bean broth (16%); however, 36% of children still began CF with liquid foods (soups/fruit juices). Oliveira et al.²⁰ found that the provision of fruit juice reduced significantly from 40.6% in 1998 to 25.1% in 2008 ($p < 0.001$). In a study conducted in South Africa, Budree et al.²¹ found that 13% of children aged 6

months consumed juice daily; the PNDS-2006,¹³ in turn, found that 9.8% of Brazilian children at this age had received juice of some sort. WHO²² does not recommend starting CF with liquid foods, considering the low amount of nutrients and energy present in these foods which is insufficient for meeting all the needs of a child with small stomach capacity. The Ministry of Health follows the same recommendation.⁷ Consumption of liquid foods can also increase the risk

of malnutrition, slow growth and dental caries.^{22,23} Up until 2017, the American Academy of Pediatrics recommended avoiding the consumption of juice only for children aged under 1 year old; today, that institution recommends that children younger than 1 year old should not be given juice at all.²³

Regarding food groups, meat was provided later (average of 8 months old; SD=2.67). Carletti et al.²⁴ reported fruit as being the first foods given to Italian children – at a median of 170 days, while the median for introducing meat was 197 days; the authors also cited honey and oilseeds as being the last food to be provided, at a median of 365 and 484 days respectively. Budree et al.²¹ found that 77% of South African children observed in their study only received meat for the first time at 1 year of age.

The PNDS¹³ found that only 17.3% of the children received meat between 6 and 11 months, and that less than 40% received this food 2 to 3 times a week, contrary to the recommendation of the 'Feeding Guide for children under two years',⁶ namely 1 daily portion at 6 months and 2 daily servings after 7 months. The meat group of foods is the best source of iron and zinc, which is why they should be provided daily to children older than 6 months.^{5-7,22} Prevalence of anemia among children under 5 years of age in Brazil is 20.9%,¹³ and delay in introducing meat group foods may be related to this outcome.

In addition to meeting nutritional needs and providing adequate growth and development, CF has the role of progressively bringing the child closer to its family's eating habits, stimulating knowledge of new flavors, colors, aromas and textures, and shaping their future eating habits.⁷ Beginning CF with processed foods and sugars can induce greater preference for them.⁷

However, consumption of processed foods appears to be common among children, including children under 2 years old. According to the study conducted by Budree et al.²¹ mentioned above with a cohort of South African children with follow-up from birth until 1 year of life, 32% of them already consumed fries and 54% consumed sparkling soft drinks daily, while 51% and 32% had daily consumption of sugary foods (chocolates and sweets) and fried foods, respectively. Miles and Siega-Riz²⁵ found that among American children aged between 6 and 11 months, ingestion of sugary drinks, sweets and ready-to-eat food decreased from 62.0% (2005-2008) to 50.5% (2009-2012)

($p < 0.05$); however, for those aged between 12 and 23 months prevalence of consumption of these foods remained unchanged. In addition, among those aged under 6 months, consumption of fruit juice reduced from 12.8 to 6.6%.

Huffman et al.²⁶ evaluated the proportion of children aged 6 to 23 months who consumed processed foods containing sugar in 18 countries in Africa and Asia. They found that consumption of these foods increases as the child's age increases, it is higher in urban areas (in relation to rural areas), and also in 1/3 of the countries assessed, 20% of children between 6 and 8 months old had already consumed some kind of processed food. Bielemann et al.¹⁹ found that when they were six years old children who had started CF after 4 months of life would receive a smaller proportion of total energy value from industrialized food, when compared to other 6-year-old children who began CF before they were 4 months old.

Dallazen et al.,²⁷ in a sample of 1,567 children living in Southern Brazil and who were registered with the Brazil without Extreme Poverty program, found that among those up to 4 months old, 35.5% were given sugar and 47.8% were given unrecommended foods, including gelatin (13.8%), sweetened yogurt (24.8%) and biscuits/salty snacks (20.4%). In our study sample we found high consumption of processed foods such as gelatin (43%) and juice from cartons (12.7%) in infants under 6 months old; moreover after 6 months old consumption of processed foods increased among the children we observed.

Ng et al.²⁸ evaluated some of the WHO¹⁴ indicators in relation to Indonesian children and found that 87.3% of them had received solid and semi-solid foods at between 6 and 8 months, while at between 6 and 11 months 47.7% of the children assessed received minimum dietary diversity, 62.3% received minimum meal frequency and 35.4% had minimum acceptable diet. Our study found lower values for the introduction of solid foods (30%), which may indicate a local problem regarding food consistency; however, our study's indicators showed higher meal frequency among the children analyzed.

Brazil has witnessed a considerable increase in overweight and obesity prevalence in the general population, even though the country has high levels of malnutrition and micronutrient deficiencies.¹⁵ Obesity is one of the most important risk factors for

non-communicable diseases, including cardiovascular diseases and diabetes.²⁹ The current pattern of food consumption has excessive intake of high-energy-density foods, rich in sugars, saturated fat, sodium and preservatives, and poor in fiber and micronutrients.²⁹ This pattern appears at increasingly earlier ages, as demonstrated by the high consumption of sugar and industrialized foods in children in Pelotas.

According to PNDS-2006 data,¹³ weight/height *deficits* were found in 1.4% of children but did not reach 3% in all strata of the population evaluated. This indicates an appropriate balance between children's accumulation of body mass and linear growth; i.e., acute forms of child malnutrition in Brazil are being controlled. Also according to PNDS-2006, 7.3% of children had excess weight for their height, characterizing moderate exposure to the risk of obesity in childhood.¹³ Moreover, the frequency of weight/age *deficits* in the total number of children assessed was not higher than expected for healthy children (1.9%).¹³ Our study did not find any children with below ideal weight, and only two had low height for age, while 19 were classified as overweight or obese and 20 with risk of overweight.

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