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Supplement use and micronutrient intake among children aged 6 to 59 Months Receiving care at Basic Health Units

Uso de suplementos e aporte de micronutrientes entre crianças de 6 a 59 meses assistidas na Atenção Primária à Saúde

Abstract

Objective: To describe supplement use and micronutrient intake from food and supplementation among children aged 6 to 59 months receiving care at Basic Health Units of the Brazilian Unified Health System in Rio de Janeiro.

Methods: This cross-sectional study collected data on supplement use and dietary intake using a 24-h recall. Analyses were conducted in R. **Results:** Overall supplement use was 51.0%, including 14.1% for iron, 24.6% for vitamin A, and 36.2% for vitamin C. Mean micronutrient intake from both food and supplements exceeded the Estimated Average Requirement; however, 45.4% of children had inadequate calcium intake. **Conclusion:** Strengthening policies that promote adequate and healthy diets, increasing coverage of Ministry of Health supplementation programs, and discouraging the indiscriminate use of unnecessary supplements are essential.

Keywords: Food consumption. Nutritional supplements. Vitamins. Minerals. Survey.

Resumo

Objetivo: Descrever o uso de suplementos e o aporte de micronutrientes advindos da alimentação e suplementação de crianças de 6 a 59 meses assistidas em Unidades Básicas de Saúde do SUS no Rio de Janeiro. **Métodos:** Estudo transversal. Foram coletados dados sobre uso de suplementos e consumo alimentar (recordatório de 24 horas). As análises foram realizadas no software R. **Resultados:** A prevalência do uso de suplementos foi de 51,0%, sendo 14,1% para suplementos de ferro, 24,6% de vitamina A e 36,2%, de vitamina C. As médias de consumo de micronutrientes oriundos de ambas as fontes (alimentos e suplementos) foram superiores ao *Estimated Average Requirement*. Houve 45,4% de inadequação em relação às recomendações para o consumo de cálcio. **Conclusão:** É necessário ampliar políticas de promoção da alimentação adequada e saudável e a cobertura dos programas de suplementação implementados pelo Ministério da Saúde, e desencorajar o uso indiscriminado de suplementos desnecessários.

Palavras-chave: Consumo alimentar. Suplementos nutricionais. Vitaminas. Minerais. Inquérito

INTRODUCTION

Deficiencies in vitamin A, iron, iodine, and zinc are among the most prevalent nutritional deficiencies worldwide and therefore represent a major priority for public nutrition policies. Infants and preschool-aged children are particularly vulnerable due to their higher nutrient requirements. Micronutrient deficiencies lead to impaired growth and development, weakened immune function, and additional adverse health consequences. A key risk factor for these deficiencies is insufficient consumption of foods rich in these essential micronutrients.^{1,2}

In the first few years of life, it is possible to meet dietary recommendations using only fresh or minimally processed foods. However, evidence indicates that in certain contexts, meeting the recommendations for the micronutrients iron, zinc, vitamin D, and iodine can be challenging, which may necessitate supplementation.³ Studies have been implemented to assess the effectiveness of different supplementation strategies for preventing micronutrient deficiencies; however, the available results are not yet conclusive.⁴⁻⁶ Conversely, when intake of certain micronutrients is excessive, adverse effects can occur, such as diarrhea and other gastrointestinal disorders, and excess intake can also impair the absorption of other nutrients.⁷⁻⁹

The current context in Brazil presents significant challenges for children younger than 5 years in meeting dietary recommendations. The Estudo Nacional de Alimentação e Nutrição Infantil (National Study of Food and Nutrition in Children) (ENANI-2019) reported an inadequate dietary profile in this population, marked by low dietary diversity, insufficient consumption of fruits and vegetables, and frequent intake of ultra-processed foods.¹⁰

In Brazil, the Ministério da Saúde (Ministry of Health [MS]) approaches for controlling iron and vitamin A deficiencies (which have historically been more prevalent in the country) include initiatives to promote healthy eating and universal prophylactic supplementation programs for the most vulnerable age groups.^{11,12} Results from the ENANI-2019 study indicate insufficient coverage of programs aimed at preventing anemia and, conversely, the indiscriminate use of supplements not targeted by public policies.¹³

However, no studies in Brazil have assessed children's total micronutrient intake by incorporating consumption from supplements. Moreover, the few studies that have analyzed dietary micronutrient intake in children under 5 years of age were conducted in specific settings, such as daycare centers or hospitals,^{14,15} which limits their external validity.

To inform the ongoing discussion of dietary micronutrient intake in children, policies to prevent micronutrient deficiencies, and the indiscriminate use of vitamin and mineral supplements, this study aims to describe supplement use and total micronutrient intake from both food and supplementation. The analysis focuses on children aged 6–59 months receiving care at Unidades Básicas de Saúde (Basic Health Units) of the Brazilian Unified Health System (SUS) in the city of Rio de Janeiro.

METHODS

A cross-sectional study was conducted with a representative probability sample of children aged 6–59 months cared for in the SUS in the city of Rio de Janeiro, Brazil, between June and December 2014. The children were selected through a two-stage process. In the first stage, the UBS were stratified by the number of visits by children younger than five, the number of child beneficiaries of the Bolsa Família program, and the proportion of registered children in each age group (6–23 months and 24–59 months). Following this stratification, 33 UBS were selected with a probability proportional to the size of their respective stratum. In

the second stage, 44 children at each UBS were recruited for the study via systematic sampling from a list of all registered children younger than 5 years at each selected unit. Further details on the study design, sample size calculations, and inclusion and exclusion criteria are described in Carneiro et al.¹⁶ At the UBS, each child's guardian completed a questionnaire assessing sociodemographic characteristics (sex, age group, maternal education level, family income, and receipt of government benefits), prematurity, use of medications or supplements, and the child's 24-h dietary recall consumption on the day preceding the interview. The data collection team received training prior to fieldwork and participated in periodic refresher sessions during data collection. Fieldwork was supervised on-site, and all procedures were standardized in a dedicated manual.

In this study, the term "micronutrient supplements" includes two categories of products: vitamin supplements (when the dosage does not exceed recommended daily intake values) and vitamin-based medicines (when the dosage exceeds these values).¹⁷ To characterize supplement use, consumption at the time of the survey or in the 4 months preceding the study was considered. To characterize the intake of micronutrients, however, only consumption at the time of the survey was considered. Information on the composition of the supplements was obtained from product leaflets and packaging, manufacturers' websites, and the registry of medicines available on the ANVISA website.

The supplements were classified into the following categories: those containing vitamin A, vitamin C, iron, zinc, or calcium; isolated vitamins (A or C); vitamin combinations (products containing more than one vitamin); isolated minerals (iron); vitamin–mineral combinations (products containing at least one vitamin and one mineral); and other supplements. In cases where "iron" intake was reported without specifying the product (n = 5), ferrous sulfate was imputed, as this is the supplement available through the public health system. In cases where the name of the vitamin C supplement was not specified (n = 14), the most frequently used brand of isolated vitamin C among the children in the study was imputed to calculate micronutrient intake. The estimated daily intake of micronutrients from supplements was calculated by multiplying the micronutrient concentration in the product by the frequency of consumption and, when required, dividing by the number of days the supplement was used.

The reported food portions were converted to grams using standardized utensils as part of the 24-h recall protocol. To determine the weight of the food replica portions used as visual aids during the 24-h recall, similar food items were purchased commercially and weighed on a precision scale. For nutritional composition, if a reported homemade dish was not listed in the food composition table or its recipe lacked sufficient detail, data were retrieved from standardized recipe sheets for preparations served in Rio de Janeiro municipal daycare centers or from technical literature.¹⁸ For ultra-processed foods, the nutritional composition provided by the manufacturer on the product label or website was used. If a specific brand or flavor could not be found, the nutritional data of the most frequently consumed similar product among the children in the study were used instead. The research team compiled a database of the ultra-processed foods reported by the guardians, including their respective brands. Missing data from the 24-h recalls were evaluated case by case. These situations included periods spent at daycare without dietary information, non-standard household measurements (e.g., "a small piece") not found in conversion tables, unquantified portions of items made for the whole family (e.g., sweetened coffee or juice), and other foods or meals with unspecified quantities.¹⁹ All 24-h recall data were double-entered into Microsoft Excel®. The consistency of this dual entry was verified using Epidata 3.1 software, and any discrepancies were corrected.

Micronutrient estimates were calculated using the household measures and nutritional composition tables from the POF 2008-2009,² along with information from the labels of ultra-processed products. These procedures were conducted using SAS® University Edition (online version).

The micronutrients assessed were vitamin A, vitamin C, iron, zinc, and calcium. Total nutrient intake was determined by combining the amount derived from supplements being used at the time of the study with the amount estimated from the 24-h dietary recall.

The prevalence of supplement intake was reported as point estimates with 95% confidence intervals (95% CIs). We also estimated the mean total intake (and 95% CI) of each micronutrient (food plus supplements). Furthermore, we calculated the prevalence of intake below the Estimated Average Requirement (EAR).⁷⁻⁹ This prevalence was assessed based on dietary sources alone and on the total intake for each micronutrient of interest. Reference values for EAR and Tolerable Upper Intake Level (UL)⁷⁻⁹ are presented to facilitate comparison with the children's estimated intake. All estimates were produced for the total sample and stratified by age group (6–23 and 24–59 months). To evaluate the precision of these estimates, coefficients of variation (CVs) were calculated. The CV, a relative measure of precision, is the ratio of the standard error to the estimated value, where a lower value indicates greater precision. Statistically significant differences were inferred when the 95% CIs for the prevalence or mean estimates did not overlap. All analyses were performed in R (version 3.2.3) using the "survey" package. Sample weights were calculated and included in all reported estimates.

RESULTS

Of the 536 participants, 529 were included in the analysis. Seven were excluded: two because the 24-h dietary recall data were incomplete, three because guardians were unable to stay to complete the questionnaire, and two because the accompany in guardian could not provide information on the child's diet from the previous day.

Most children (79.4%) had mothers with at least a primary school education; 38.2% lived in households with a monthly family income of at least two minimum wages; and 37.5% lived in households that received government benefits (Table 1). Approximately half (51.0%) of the children were using a supplement or had used one in the 4 months preceding the study. The most commonly consumed types of vitamin and mineral supplements among children aged 6–59 months were multivitamin (24%) and single-vitamin supplements (16.2%), followed by single-mineral supplements (11.7%). The prevalence of supplement use was higher among children aged 6–23 months than among those aged 24–59 months, particularly for supplements containing vitamin A, vitamin C, or iron, as well as for multivitamins and iron-only supplements (Table 2).

Table 1. Sociodemographic, economic, and prematurity characteristics of children aged 6–59 months receiving care in Basic Health Units in Rio de Janeiro, RJ, Brazil, 2014 (n = 529).

	Prevalence (%)	95% Confidence interval
Sex		
Female	49.1	43.9–54.2
Male	50.9	45.8–56.1
Age groups		
6–11 months	7.5	5.0–10.1
1–1.9 years	23.7	20.8–26.7
2–2.9 years	24	19.5–28.4
3–3.9 years	22.1	18.1–26.2
4–4.9 years	22.7	18.4–26.9

Table 1. Sociodemographic, economic, and prematurity characteristics of children aged 6–59 months receiving care in Basic Health Units in Rio de Janeiro, RJ, Brazil, 2014 (n = 529).9. (Continues)

	Prevalence (%)	95% Confidence interval
Maternal education		
Incomplete primary school	20.6	16.3–25.0
Completed primary school	33.8	28.9–38.7
Completed high school	42.3	37.1–47.3
Completed higher education	3.3	1.6–5.1
Family income (in minimum wages)		
<0.5	5.9	3.2–8.7
0.5–0.9	9.2	6.4–11.9
1–1.9	46.7	41.3–52.1
2–2.9	23.3	18.6–28.1
3 or more	14.9	11.2–18.6
Receipt of government benefits		
Yes	37.5	32.5–42.5
No	62.5	58.4–66.6
Prematurity		
Yes	9.5	6.4–12.7
No	90.5	87.3–93.6

Table 2. Prevalence of vitamin and mineral supplement use among children aged 6–59, 6–23, and 24–59 months receiving care in Basic Health Care Units in Rio de Janeiro, RJ, 2014 (n = 529).

Use and type of supplement ^a	Prevalence (%) for age group 6– 59 months	95% confidence interval (CI)	Prevalence (%) for age group 6– 23 months	95% CI	Prevalence (%) for age group 24–59 months	95% CI
Any supplement	51	45.9–56.0	72.1	64.7–79.5	41.5	35.2–47.8
Vitamin A supplements	25.6	21.2–30.0	43.2	34.5–51.8	17.7	12.8–22.7
Vitamin C supplements	35.3	30.5–40.1	55.2	46.5–63.9	26.4	20.8–32.0
Iron supplements	14.7	11.1–18.3	26.5	18.5–34.6	9.4	5.8–13.0
Zinc supplements	4.6	2.7–6.5	5.1	1.2–8.9 ^e	4.4	2.2–6.5
Calcium supplements	4.6	2.7–6.5	5.1	1.3–9.0 ^e	4.4	2.2–6.5
Multivitamin supplements ^b	24	19.8–28.3	42.1	33.5–50.8	15.9	11.2–20.6
Isolated vitamin C supplements	16.2	12.5–20.0	23.7	16.2–31.2	12.9	8.7–17.2
Isolated iron supplements	11.7	8.5–14.8	25.2	17.2–33.2	5.6	3.0–8.2
Vitamin and mineral supplements	7	4.5–9.5	6.4	2.3–10.5 ^e	7.3	4.1–10.5
<i>Other</i>						
Other micronutrients ^c	1.8	0.6–3.1 ^e	2.2	0.2–4.2 ^e	1.6	0.1–3.2 ^e
B complex + vitamin C + Cyproheptadine ^d	2.4	0.7–4.0 ^e	0.6	0.0–1.8 ^e	3.1	0.9–5.4 ^e

^a Use of a vitamin and/or mineral supplement during the study or within the 4 preceding months.

^b Supplements containing more than one vitamin (multivitamins).

^c Isolated or combined supplements of vitamin A or D, calcium, or vitamin B-complex.

^d Appetite-stimulating drug.

^e Coefficient of variation > 30%

Para todos os micronutrientes e faixas etárias, as médias de consumo de micronutrientes oriundos tanto de alimentos quanto de suplementos indicam quantidade consumida superior ao EAR. Uma provável exceção é o consumo de cálcio por crianças de quatro anos: na faixa etária em que elas estão incluídas (24-59 meses), a média de consumo de cálcio foi de 688,5 mg, enquanto a EAR que engloba a idade de 4 anos (e vai até 8 anos de idade) é de 800 mg (Tabela 3).

Table 3. Average micronutrient intake from food and supplements among children aged 6–59, 6–23, and 24–59 months receiving care in Basic Health Units in Rio de Janeiro, RJ, by supplement use, 2014 (n = 529).

Nutrients	EAR ^a 1–3/4–8y	UL ^b 1–3/4–8y	6–59 months			6–23 months			24–59 months		
			Overall mean intake (all children) (95% confidence interval [CI])	Mean intake (supplement users) (95% CI)	Mean intake (non-users) (95% CI)	Overall mean intake (all children) (95% confidence interval [CI])	Mean intake (supplement users) (95% CI)	Mean intake (non-users) (95% CI)	Overall mean intake (all children) (95% confidence interval [CI])	Mean intake (supplement users) (95% CI)	Mean intake (non-users) (95% CI)
Vitamin A (µg)	210/275	600/ 900	849.5 (725.5–973.5)	1,389.8 (1041.7–1737.9)	789.8 (658.1–921.5)	864.6 (743.3–986.0)	1,225.4 (999.9–1450.9)	765.7 (629.9–901.6)	842.7 (671.6–1013.8)	1,721.4 (733.7–2709.1)	798.6 (625.5–971.8)
Vitamin C (mg)	13/ 22	400/ 650	72.2 (65.5–78.9)	155.6 (133.4–177.7)	57.5 (51.7–63.4)	95.9 (82.5–109.3)	149.8 (123.4–176.2)	72.9 (60.9–85.0)	61.6 (54.0–69.2)	164.9 (124.7–205.0)	52.3 (45.7–58.9)
Iron (mg)	3/ 4.1	40/ 40	11.3 (10.5–12.1)	22.1 (17.9–26.3)	10.5 (9.7–11.2)	14.5 (12.6–16.4)	24.6 (20.6–28.5)	12.3 (10.6–14.1)	9.9 (9.1–10.6)	14.3 (6.3–22.2)	9.8 (9.0–10.5)
Zinc (mg)	2.5/ 4	7/ 12	7.4 (47.0–7.8)	10.2 (8.7–11.6)	7.3 (6.9–7.7)	7 (6.2–7.8)	8.4 (8.7–11.6)	6.9 (6.1–7.7)	7.6 (7.1–8.1)	11.1 (9.5–12.8)	7.5 (7.0–8.0)
Calcium (mg)	500/ 800	2,500/ 2.5	660.2 (619.1–701.2)	832.7 (688.0–977.4)	655 (613.1–696.9)	596.7 (525.2–668.3)	780.6 (495.5–1065.6)	590.8 (518.1–663.5)	688.5 (638.6–738.5)	858.9 (690.5–1027.4)	683.7 (632.6–734.7)

95% CI: 95% confidence interval

^a Estimated Average Requirement

^b Tolerable Upper Intake Level (UL)

^c Micronutrient intake from food sources and supplements

Notably, the average intakes of vitamins A, C, iron, and zinc surpassed the EAR for children, regardless of supplement use. For vitamin A, the average intake among children aged 6–23 months (864.6 µg) exceeded the tolerable upper intake level (600 µg). When the population was stratified by vitamin A supplement use, the average intake for this age group remained above this level for supplement users (1,225.4 µg) and non-users (765.7 µg).

A comparison of mean intakes between children who used supplements and those who did not showed that, in the overall sample and for the 6–23 months subgroup, intakes of vitamins A and C, iron, and zinc were statistically higher among supplement users. In the 24–59-month subgroup, only vitamin C and zinc intakes were significantly higher among children who used supplements compared with non-users.

Analysis of the total micronutrient intake from food and supplements revealed that children aged 6–23 months had higher intakes of vitamin C and iron compared to those aged 24–59 months. The same pattern was found for children who did not take supplements, with these differences being statistically significant (Table 3). The prevalence of inadequate intake ranged from 6.6% to 7.9% for iron, 9.1% to 11.9% for zinc, 7.8% to 22.3% for vitamin C, 21.7% to 26.7% for vitamin A, and 45.1% to 45.6% for calcium, depending on the child's age group and the inclusion of intake from supplements. No statistically significant differences were found in the prevalence of inadequate nutrient intake when comparing age groups or when comparing total micronutrient intake (food plus supplements) with intake from food alone (Table 4).

Table 4. Prevalence of inadequate micronutrient intake: dietary intake alone versus total intake (diet and supplements) among children aged 6–59 months receiving care in Basic Health Units in Rio de Janeiro, RJ, 2014.

Micronutrients	Micronutrient intake inadequacy			
	Total intake (diet + supplements)		Dietary intake alone	
	Prevalence (%)	95% CI	Prevalence (%)	95% CI
6–59 months				
Vitamin A	23.4	18.9–28.4	24.7	20.2–29.8
Vitamin C	18.6	14.3–23.7	20.1	15.7–25.2
Iron	7.5	5.0–11.1	7.9	5.3–11.5
Zinc	11.2	7.9–15.6	11.2	7.9–15.6
Calcium	45.4	40.1–50.9	45.4	40.1–50.9
6–23 months				
Vitamin A	21.7	14.1–31.8	26.7	18.5–36.8
Vitamin C	7.8	3.2–17.7	13	7.2–22.5
Iron	6.6	3.2–13.3	7.9	4.2–14.5
Zinc	9.1	5.0–15.8	9.1	5.0–15.8
Calcium	45.4	35.3–55.1	45	35.3–55.1
24–59 months				
Vitamin A	23.9	18.7–30.0	24	18.9–30.1
Vitamin C	22.1	16.8–28.4	22.3	17.1–28.7
Iron	7.8	4.9–12.4	7.8	4.9–12.4
Zinc	11.9	7.9–17.5	11.9	7.9–17.5
Calcium	45.1	39.2–52.0	45.6	39.3–52.0

DISCUSSÃO

The key results of this study were as follows: supplement use among approximately half of the enrolled children, recurrent use of supplements outside Ministry of Health programs, low prevalence of adherence to recommended supplementation, and a high prevalence of inadequate calcium intake.

Despite the Ministry of Health recommendation for universal iron supplementation for children aged 6–23 months, its use was reported in only 26.4% of this group. These outcomes are consistent with national surveys conducted between 2006 and 2019. According to the National Demographic and Health Survey (PNDS-2006),²⁰ a proportion of children aged 12–23 months had used a medication containing iron in the 6 months preceding the study. The National Health Survey (PNS-2013)²¹ reported that 57.9% of children aged 6–24 months had consumed ferrous sulfate. The National Survey on Access, Use, and Promotion of Rational Use of Medicines (PNAUM-2013–14)²² showed that 8.5% of Brazilian children aged 0–11 months and 5.6% of those aged 12–24 months had consumed iron salts in the 15 d prior to the survey. The National Study on Infant Food and Nutrition (ENANI-2019)²³ found a 35.5% prevalence of the use of iron-containing supplements among children aged 6–23 months in the 6 months before the survey. However, the prevalence of anemia has decreased in recent years, falling from 20.9% in 2006 to 10.1% in 2019.^{13,20} Regarding the consumption of dietary iron, these sources were consumed by 80% of Brazilian children in 2019.¹⁰ This result aligns with our study, which revealed a prevalence of inadequate iron intake between 6.6% and 7.9%, with no statistically significant differences between children who used supplements and those who did not.

Regarding vitamin A, the Ministry of Health recommendation at the time of the study was for mega dose supplementation to be administered every 6 months in regions where the prevalence of vitamin A deficiency (VAD) surpassed 20%. According to the PNDS-2006, this was the case in the Southeast Region (21.6%).²⁰ However, based on the outcomes of the larger survey that this study is part of—which found a VAD prevalence of 13%¹⁹—the city of Rio de Janeiro did not implement this measure. Additionally, our results indicate that the prevalence of inadequate vitamin A intake was over 20%, even among children taking supplements. Although dietary intake is a key determinant of blood micronutrient concentrations, this relationship is not one-to-one and can be influenced by various factors.²⁴

The result that the average vitamin A intake from food sources in children aged 6–23 months, and possibly in those aged 24–48 months, exceeds the Tolerable Upper Intake Level (UL) should be interpreted with caution, as the calculation included plant and animal-based sources of the vitamin. According to the Institute of Medicine (IOM),^{7,8} the UL should be calculated solely using vitamin A from animal sources, supplements, and fortified foods. This is because excessive carotenoid intake from food has not been associated with adverse effects other than benign carotenodermia.

Studies have shown that the indications for universal supplementation depend on the prevalence of deficiency in the population. Therefore, this approach should be recommended in contexts where the prevalence is considered a public health problem.^{25,26} In light of this information—along with the reductions in anemia and VAD in Brazil documented by the ENANI-2019 study¹³ and the recommendations of the World Health Organization,^{25,26}—the Ministry of Health has proposed a reformulation of national supplementation policies.¹¹

In addition to national prophylactic micronutrient supplementation programs, other supplements, including vitamin C supplements, have been widely used. Although the Ministry of Health recommends vitamin C supplementation only for non-breastfed infants up to 4 months of age, its use in the study population reached 35%, 55.2%, and 26.4% among children aged 6–59 months, 6–23 months, and 24–59 months, respectively.²⁷

In the present study, the prevalence of inadequate vitamin C intake was approximately 20%. Thus, it is important to emphasize the role of a healthy diet in preventing micronutrient deficiencies. Considering children's low requirement for this nutrient and its high availability in fresh foods, supplementation is not considered necessary. Moreover, supplements usually contain high concentrations of this nutrient, and excessive intake has been linked to adverse effects such as diarrhea and other gastrointestinal disorders, increased oxalate excretion and kidney stone formation, and reduced vitamin B12 and copper status.⁷

Regarding micronutrient intake, our results are consistent with those of a systematic review¹⁵ that evaluated the dietary consumption of Brazilian children aged 10 and under and found that the average intake of several micronutrients exceeded the EAR in most children.

The present study also found a low frequency of calcium supplement intake and a high prevalence of inadequate intake of this mineral. This inadequacy may be overestimated, particularly for children younger than 24 months, since their breast milk intake was not measured.

Another aspect that may explain this finding is that international recommendations for daily calcium intake may be overestimated, as the process for establishing them was influenced by the dairy industry.²⁸

Moreover, calcium intake from food may have been affected by the fact that many families give their children powdered milk that is more diluted than recommended. Furtado et al.²⁹ analyzed data on the consumption of dairy preparations in children aged 6–23 months who participated in the survey that originated the present study. They observed that the average reconstitution of powdered milk preparations (excluding infant formulas) was 62% of the manufacturer-recommended concentration.

Intake of supplements containing zinc was infrequent. However, since the prevalence of inadequate intake of this mineral was also low, supplementation does not appear to be required for the study group.

The study's limitations include a discrepancy between the age groups proposed by the IOM⁷⁻⁹ and those analyzed in this study, which warrants caution when comparing average intake against reference values to avoid misleading interpretations. Furthermore, the prevalence of inadequacy is based on reference values derived from older studies, mostly conducted between the 1960s and 1990s, and often with small sample sizes, which may compromise the external validity of the results. The use of a single 24-h recall is another limitation, as it precludes statistical correction for intra-individual variability. This could distort the intake distribution, consequently leading to an under- or overestimation of inadequacy prevalence and percentiles. A further limitation is the lack of data on nutrient intake from human milk, which may have led to an overestimation of the prevalence of inadequacy. Finally, although our study is limited to children who received care in the SUS in a single large Brazilian city, its scope is broader than that of previous studies, which have typically been confined to children in daycare centers and schools.

Conversely, the study's strengths include its novel quantification of micronutrient intake from supplements, which allows a pioneering analysis in Brazil of total micronutrient consumption and a comparison between supplemented and non-supplemented children. Furthermore, the qualitative profile of supplement use in the municipality of Rio de Janeiro was not previously known in detail—a knowledge gap that extends to many other Brazilian cities. These findings are highly valuable for guiding programs to prevent and control micronutrient deficiencies, which recommend supplementation as a key strategy. Finally, the study employed a probabilistic sample with outcomes representative of children using SUS in a major city, suggesting that results from metropolises with similar characteristics are likely to be comparable. It is also worth noting that the National Study of Child Food and Nutrition, a nationwide household survey from 2019,³⁰ has collected but not yet released its results on micronutrient intake by supplementation status, which highlights the relevance and timeliness of the present study.

The results reveal the underuse of iron supplements and indiscriminate use of other supplements, as well as challenges in achieving a suitable and healthy diet among children. This highlights the need to strengthen nutritional education initiatives in Primary Care, disseminate and implement new recommendations for supplement use, and develop structural public policies to guarantee food and nutritional security in Brazil

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Contributors

Carneiro LBV, Cardoso LO, Maia PA, and Rugani IRR contributed to the study's conception and design, data analysis and interpretation, and the revision and approval of the final manuscript. Schincaglia RM contributed to data analysis and interpretation, as well as the revision and approval of the final version.

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