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Research Article

Prevalence and factors associated with iron use in children aged 6 to 24 months in a family health strategy

Prevalência e fatores associados ao uso de ferro em crianças de seis a 24 meses em uma estratégia de saúde da família

Prevalencia y factores asociados al uso de hierro en niños de seis a 24 meses en una estrategia de salud familiar

Júlia Lazzari Rizzi[1], Thaysi Carnet Figueiredo[1], Luciana Tornquist[2], Graziela Melz[3], Juliana da Rosa Wendt[4], Izadora Joseane Borrajo Moreira[4]

[1]Universidade de Santa Cruz do Sul, Graduate Program in Health Promotion – Santa Cruz do Sul (RS), Brazil.
[2]Universidade Federal de Pelotas, School of Physical Education and Physiotherapy – Pelotas (RS), Brazil.
[3]Universidade de Santa Cruz do Sul – Santa Cruz do Sul (RS), Brazil.
[4]Universidade Federal de Santa Maria, Graduate Program, Professional Master's Degree in Health Sciences – Santa Maria (RS), Brazil.

Abstract

Introduction: Iron deficiency is the leading cause of anemia in children, accounting for approximately 60% of cases. The most susceptible population groups are pregnant women and children under two years of age, who may experience impaired motor and cognitive development and face an increased risk of infant mortality. The Ministry of Health has strategies for preventing anemia in children, including the National Iron Supplementation Program. **Objective:** To identify the prevalence and factors that hinder adherence to the use of prophylactic iron among children aged 6 to 24 months. **Methods:** This is a cross-sectional study conducted within the primary health care network in the city of Santa Cruz do Sul (Rio Grande do Sul, Brazil), from February to October 2023. **Results:** The sample consisted of 45 children. Most of the children were over 12 months old, were male, and were white. The prevalence of prophylactic iron use among children aged 6 to 24 months was 35.5%. Of the 44 children who used it, only 16 used it daily, and 28 used it less frequently than recommended. Guidance on the indication for ferrous sulfate and its use was associated with adherence to iron supplementation. **Conclusions:** Adherence to daily use of prophylactic iron remains a challenge, with less than half of the children using it at the recommended frequency. Adequate guidance on the indication and use of ferrous sulfate proved crucial for improving treatment adherence.

Keywords: Iron; Prevalence; Medication Adherence; Family Health Strategy.

Corresponding author:
Júlia Lazzari Rizzi
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Resumo

Introdução: A deficiência de ferro é a principal causa de anemia em crianças, correspondendo a cerca de 60% dos casos. Os grupos populacionais mais suscetíveis são gestantes e crianças menores de dois anos, que podem sofrer com impactos no desenvolvimento motor e cognitivo e enfrentar maior risco de mortalidade infantil. O Ministério da Saúde conta com estratégias para a prevenção da anemia em crianças, entre elas o Programa Nacional de Suplementação de Ferro. **Objetivo:** Identificar a prevalência e os fatores que prejudicam a adesão ao uso de ferro profilático em crianças de seis a 24 meses. **Métodos:** Trata-se de estudo transversal realizado na rede de atenção básica à saúde da cidade de Santa Cruz do Sul–RS, no período de fevereiro a outubro de 2023. **Resultados:** A amostra foi composta por 45 crianças. A maioria das crianças tinha idade superior a 12 meses, era do sexo masculino e tinha a pele branca. A prevalência do uso de ferro profilático em crianças de seis a 24 meses foi de 35,5%. Dos 44 indivíduos que faziam uso, apenas 16 utilizavam diariamente, e 28 usavam com uma frequência menor que a preconizada. As orientações fornecidas sobre a indicação e o uso de sulfato ferroso estavam associadas à adesão à suplementação de ferro. **Conclusões:** A adesão ao uso diário de ferro profilático ainda é um desafio, com menos da metade dos indivíduos que fazem uso seguindo a frequência recomendada. A orientação adequada sobre a indicação e o uso do sulfato ferroso mostrou-se crucial para melhorar a adesão ao tratamento.

Palavras-chave: Ferro; Prevalência; Adesão à Medicação; Estratégia da Saúde da Família.

Resumen

Introducción: La deficiencia de hierro es la principal causa de anemia en los niños, representando alrededor del 60% de los casos. Los grupos poblacionales más susceptibles son las mujeres embarazadas y los niños menores de dos años, quienes pueden sufrir afectaciones en el desarrollo motor y cognitivo y riesgo de mortalidad infantil. El Ministerio de Salud cuenta con estrategias para prevenir la anemia en los niños, incluido el Programa Nacional de Suplementación de Hierro. **Objetivo:** Identificar la prevalencia y los factores que dificultan la adherencia al uso de hierro profiláctico en el grupo de edad entre seis y 24 meses. **Métodos:** Estudio transversal realizado en la red de atención primaria de salud de la ciudad de Santa Cruz do Sul (Rio Grande do Sul, Brasil), de febrero a octubre de 2023. **Resultados:** La muestra estuvo compuesta por 45 niños. La mayoría de los niños tenían más de 12 meses, eran varones y blancos. La prevalencia del uso profiláctico de hierro en niños de seis a 24 meses fue del 35,5%. En cuanto a la prevalencia del uso profiláctico de hierro, de los 44 individuos que lo utilizan, solo 16 lo utilizan diariamente y 28 lo utilizan con menor frecuencia de lo recomendado. Las orientaciones brindadas sobre la indicación del sulfato ferroso y respecto a su uso se asociaron con la adherencia al uso del hierro. **Conclusiones:** Se concluye que la adherencia al uso diario de hierro profiláctico sigue siendo un desafío, siendo menos de la mitad de los individuos que lo utilizan siguiendo la frecuencia recomendada. Una orientación adecuada sobre la indicación y el uso del sulfato ferroso resultó crucial para mejorar la adherencia al tratamiento.

Palabras clave: Hierro; Prevalencia; Cumplimiento de la Medicación; Estrategia de Salud Familiar.

INTRODUCTION

Iron-deficiency anemia is the leading cause of anemia in children, accounting for approximately 60% of cases. It represents one of the most serious public health problems and results from complex networks of determinants. Within the context of diet and nutrition, these include food insecurity, inadequate food intake, poor nutritional quality, and the bioavailability of micronutrients.[1] The World Health Organization (WHO) defines anemia as a hemoglobin level <11 g/dl for children aged 6–60 months and 11.5 g/dl for children aged 5–11 years.[2]

Brazil saw a decline in the prevalence of anemia from 20.9% in 2006 to 10.0% in 2019, with the highest prevalence among children aged 6–23 months (19.0%), according to the 2019 National Study on Child Feeding and Nutrition. Currently, the Ministry of Health (MS) has three initiatives aimed at addressing and preventing micronutrient deficiencies and promoting healthy eating. These are:

- the Fortification of infant foods with powdered micronutrients (NutriSUS);
- the National Iron Supplementation Program (PNSF); and
- the National Vitamin A Supplementation Program (PNSVA).

It is important to emphasize the role of exclusive breastfeeding through the sixth month and continued breastfeeding through age 2 or beyond, as well as a varied diet, as protective and preventive factors against mineral deficiency and anemia in childhood.[3]

Prophylactic iron supplementation is one of the main strategies for combating anemia.[2] The National Iron Supplementation Program (PNSF), through Ordinance No. 1,555 of July 30, 2013, and Consolidation Ordinance No. 5 of September 28, 2017, recommends prophylactic supplementation with ferrous sulfate for children aged 6–24 months who are not covered by the NutriSUS strategy.[4,5]

The use of medication-based supplementation, food fortification, and nutrition education initiatives are widely used strategies for preventing and treating iron deficiency. As such, these resources are available free of charge through the primary healthcare system.[6] Given the above, considering the divergent views in the literature on this topic and the lack of published studies, this study aimed to identify the prevalence of and factors associated with adherence to prophylactic iron supplementation among children in the age group 6–24 months living in an area covered by the Family Health Strategy.

METHODS

A cross-sectional study was conducted in the primary health care system of the city of Santa Cruz do Sul, Rio Grande do Sul, Brazil, from February to October 2023. The study sample consisted of 45 children aged 6–24 months living in an area covered by a Family Health Strategy (FHS). A sample size calculation was performed, assuming a 10% sampling error and a 90% confidence interval, resulting in a minimum sample size of 42 research subjects, based on the 109 children enrolled in the FHS within the age group of the study.

Participants were selected on a convenience basis, according to the subjects' attendance at the FHS for occasional reasons (such as seeking walk-in care, vaccinations, scheduled appointments, etc.), following guidance, provision and reading of the study materials, clarification of any questions, and the guardian's signature on the informed consent form (ICF) for participation in the study.

The inclusion criteria for the study were: guardians of children between 6–24 months of age, enrolled in the Alcemiro Manoel dos Santos FHS – teams I and II, who agreed to participate in the study by signing the informed consent form. Guardians under the age of 18 at the time of data collection and study participants who withdrew their consent at any point during the study were excluded from the sample. This study complies with Resolution 466/2012 of the National Health Council and was approved by the Santa Cruz do Sul Health Department and by the Ethics Committee of the Santa Cruz do Sul University under approval no. 139427/2022, CAAE: 65931322.0.0000.5343, on February 8, 2023.

Data were collected using a structured questionnaire containing 37 multiple-choice questions covering socioeconomic data, prenatal care, well-child care visits, anthropometric data, and questions regarding the use of ferrous sulfate and factors that may be associated with adherence to its use.

Analyses were performed using Stata (version 15.0, StataCorp). The normality of the variables was tested using the Shapiro-Francia test. Parametric numerical variables were described by mean and standard deviation, and the results for categorical variables were described in terms of absolute and relative frequencies. Comparisons between the group of children who were prescribed iron supplementation and those who were not were performed using Fisher's exact test and the chi-square test. A significance level (α)<0.05 was adopted.

RESULTS

The sample consisted of 45 children with a mean age of 13.2, standard deviation (±)4.92 months, and the mean age of the children's caregivers was 29.93±7.68 years. Of the 45 interviews, 43 were conducted with the child's mother, one with the maternal grandmother, and one with another caregiver. The characteristics of the sample are described in Table 1. Most of the children were older than 12 months, male, and white. Regarding the caregivers, most were under 30 years of age, had completed elementary school or had not completed high school, and had a household income of less than two minimum wages.

Among the respondents, 34 children were prescribed iron, and the mean age at the start of iron supplementation was 4.62±3.06 months. Regarding the prevalence of iron use, 44 caregivers reported offering the medication, and one reported never offering it. As shown in Figure 1, of the 44, 16 used it daily, and 28 used it less frequently. The majority (n=26) used it 4–5 times a week.

Table 2 presents the prevalences in the sample regarding characteristics of prenatal care, birth, and childcare. Most of the sample attended 7 to 10 prenatal visits. Only seven mothers did not take iron supplements during pregnancy. Eight children were born preterm, and four interviewees reported other medical conditions during pregnancy, including heart disease, neonatal sepsis, gestational diabetes mellitus, and renal dilatation.

Table 1. General characteristics of the sample. Santa Cruz do Sul (Rio Grande do Sul, Brazil), 2023.

	n	%
Age		
6–12 months	22	48.89
13–23 months	23	51.11
Sex		
Female	18	40.00
Male	27	60.00
Skin color		
White	31	68.89
Brown/Black	14	31.11
Age of the guardian		
18–29 years	24	53.33
30–39 years	17	37.78
≥40 years	4	8.89
Guardian's educational level		
Incomplete elementary school	9	20.00
Completed elementary school / Incomplete high school	17	37.78
Completed high school / Incomplete higher education	16	35.56
Completed higher education / Graduate studies	3	6.67
Family income		
Up to 2 minimum wages	27	60.00
≥3 minimum wages	18	40.00
Recommendation for iron supplementation		
Yes	34	75.56
No	11	24.44

Categorical variables expressed as n (%).

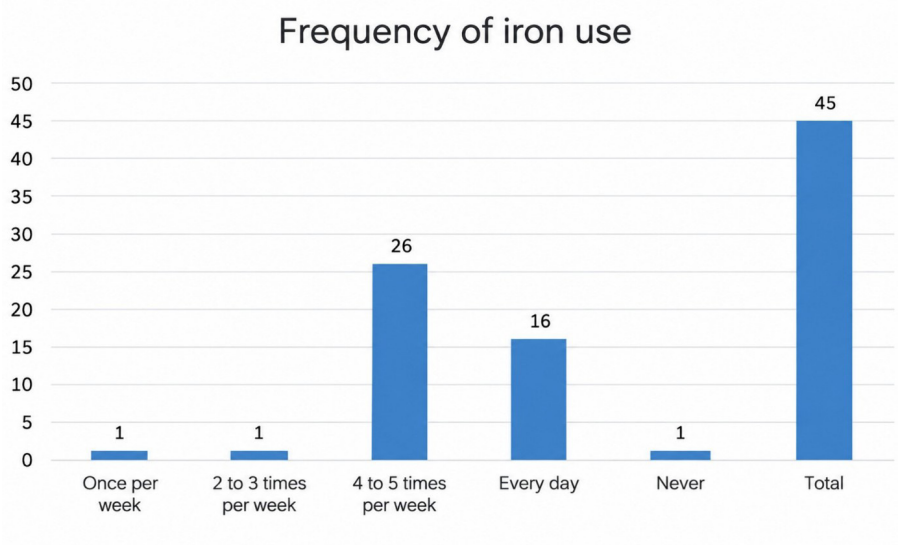


Figure 1. Frequency of iron supplementation in children aged six to 24 months.

The mean gestational age of the children in the study was 38.4±2.26 weeks, with eight children born preterm. The mean birth weight of the children was 3.19±0.54 kg, and their mean birth length was 47.64±2.59 cm. Fifteen children had low birth weight or insufficient birth weight. The mean head circumference of the sample was 33.5±1.65 cm, and 16 children had measurements below the recommended threshold (>33 cm). Thirty-two children were exclusively breastfed.

The average number of pediatric visits during the first year was 5.71±2.77 visits. Thirty-three respondents reported receiving guidance on iron supplementation. For four respondents, this guidance pertained to the use of iron in children with risk factors, such as prematurity and low birth weight. For 21 of them, the guidance on iron supplementation was related to the prevention of anemia, and for eight, it was related to the treatment of anemia.

In addition, 35 respondents reported receiving guidance on the use of iron. Regarding the type of guidance, 33 were related to the dosage in drops, 27 to the number of times per day to administer it, ten to administering it with orange juice, three to administering it during a fasting period, three to administering it with milk or yogurt, and 15 respondents received guidance on the duration of use. For 12 respondents, this guidance was provided verbally; for ten, in writing; and for 13, in both forms.

Regarding difficulties related to supplementation, 11 interviewees reported one or more difficulties, including:

- side effects, such as nausea and dark stools (2);
- poor acceptance by the child (1);
- lack of availability through the Unified Health System (SUS) (1);
- difficulties with forgetfulness (1);
- inadequate guidance (1);
- lack of professional follow-up (3); and
- refusal by family members (2).

Table 3 presents the associations between the recommendation for iron supplementation in children and sociodemographic factors. Among the factors analyzed, the prevalence of iron supplementation

recommendations among children differed significantly only with respect to age. Children aged 13–23 months had a higher prevalence of iron supplementation recommendations than those aged 6–12 months. Sex, skin color, the caregiver's age and educational level, and family income were not associated with this outcome.

Table 4 presents the association between prenatal, birth, and childcare factors and the recommendation for iron supplementation. Among the factors analyzed, only receiving guidance on the indication for ferrous

Table 2. Characteristics of prenatal care, birth, and infant care. Santa Cruz do Sul (Rio Grande do Sul, Brazil), 2023.

	n	%
Parity		
1	14	31.11
2	14	31.11
≥3	17	37.78
Prenatal visits		
≤6 visits	11	25.58
7–10 visits	21	48.84
≥11 visits	11	25.58
Use of ferrous sulfate during pregnancy		
>24 weeks	19	42.22
≤12 weeks	19	42.22
Did not use	7	15.56
Prenatal pathology		
No	34	75.56
Prematurity	7	15.56
Other	4	8.89
Gestational age		
Preterm (<37 weeks)	8	17.78
Full-term (37–42 weeks)	37	82.22
Birth weight		
<3,000 g	15	33.33
≥3000 g	30	66.67
Head circumference		
>33 cm	16	35.56
≤33 cm	29	64.44
Exclusive breastfeeding		
Yes	32	71.11
No	13	28.89
Childcare visits during the first year		
≤5 visits	22	48.89
>5 visits	23	51.11
Guidelines on the supplementation of ferrous sulfate		
Yes	33	73.33
No	12	26.67
Guidelines on the use of ferrous sulfate		
Yes	35	77.78
No	10	22.22

Categorical variables expressed as n (%).

Table 3. Association of sociodemographic factors with the recommendation of iron supplementation in children. Santa Cruz do Sul (Rio Grande do Sul, Brazil), 2023.

	Recommendation for iron supplementation		
	Yes n (%)	No n (%)	p
Age			0.014[a]
6–12 months	13 (59.09)	9 (40.91)	
13–23 months	21 (91.30)	2 (8.70)	
Sex			0.257[b]
Female	12 (66.67)	6 (33.33)	
Male	22 (81.48)	5 (18.52)	
Skin color			0.237[b]
White	25 (80.65)	6 (19.35)	
Brown/Black	9 (64.29)	5 (35.71)	
Age of the guardian			
16–29 years	19 (79.17)	5 (20.83)	0.874[a]
30–39 years	12 (70.59)	5 (29.41)	
≥40 years	3 (75.00)	1 (25.00)	
Guardian's educational level			0.550[a]
Incomplete elementary school	8 (88.89)	1 (11.11)	
Completed elementary school / Incomplete high school	11 (64.71)	6 (35.29)	
Completed high school / Incomplete higher education	12 (75.00)	4 (25.00)	
Completed higher education / Graduate studies	3 (100)	0 (0)	
Family income			0.533[a]
Up to 2 minimum wages	20 (74.07)	7 (25.93)	
≥3 minimum wages	14 (77.78)	4 (22.22)	

Categorical variables expressed as n (%). [a]Fisher's exact test; [b]Chi-square test.

sulfate and guidance regarding its use were associated with higher prevalences of iron supplementation in children.

DISCUSSION

The present study indicates that 64.5% of the sample did not take iron in accordance with current guidelines. This finding raises concern, since the PNSF stipulates that all children in this age group should take iron prophylactically. Lower-than-expected results were also observed in a cohort study conducted in Pelotas, where the prevalence of prophylactic iron use at 3 months was 8% and at 6 months, 17.0%. It was found that 79.4% of those assessed were not taking iron at either of these time points.[7] Another study in Minas Gerais reported a prevalence of 22.6% for prophylactic iron use.[8] Corroborating this concern, the results of the 2021 report on progress and challenges in the assessment of actions, prepared by the MS, indicate that ferrous sulfate supplementation in the recommended age group reached only 27.4% of the target.[3]

Among the associations evaluated, it was believed that the stronger the bond between caregivers and the FHS, the greater the adherence to prophylactic iron use would be. However, this association was not

Table 4. Association of prenatal, birth, and childcare factors with the indication for iron supplementation in children. Santa Cruz do Sul (Rio Grande do Sul, Brazil), 2023.

	Recommendation for iron supplementation		
	Yes n (%)	No n (%)	p[a]
Parity			0.829
1	11 (78.57)	3 (21.43)	
2	11 (78.57)	3 (21.43)	
≥3	12 (70.59)	5 (29.41)	
Prenatal visits			0.356
≤6 visits	10 (90.91)	1 (9.09)	
7–10 visits	15 (71.43)	6 (28.57)	
≥11 visits	7 (63.64)	4 (36.36)	
Use of ferrous sulfate during pregnancy			0.337
>24 weeks	16 (84.21)	3 (15.79)	
≤12 weeks	12 (63.16)	8 (36.84)	
Did not use	6 (85.71)	1 (14.29)	
Prenatal Pathology			0.176
No	25 (73.53)	9 (26.47)	
Prematurity	7 (100)	0 (0)	
Other	2 (50.00)	2 (50.00)	
Gestational age			0.084
Preterm	8 (100)	0 (0)	
Full-term	26 (70.27)	11 (29.73)	
Birth weight			0.540
<3,000 g	11 (73.33)	4 (26.67)	
≥3,000 g	23 (76.67)	7 (23.33)	
Head circumference			0.610
>33 cm	12 (75.00)	4 (25.00)	
≤33 cm	22 (75.86)	7 (24.14)	
Exclusive breastfeeding			0.607
Yes	24 (75.00)	8 (25.00)	
No	10 (76.92)	3 (23.08)	
Childcare visits during the first year			0.666
≤5 visits	16 (72.73)	6 (27.27)	
>5 visits	18 (78.26)	5 (21.74)	
Guidelines on the supplementation of ferrous sulfate			<0.001
Yes	31 (93.94)	2 (6.06)	
No	3 (25.00)	9 (75.00)	
Guidelines on the use of ferrous sulfate			<0.001
Yes	33 (94.29)	2 (5.71)	
No	1 (10.00)	9 (90.00)	

Categorical variables expressed as n (%). [a]Fisher's exact test.

demonstrated. This may be due to the small sample size and the lack of significant disparity in the number of visits within the sample. The average number of pediatric care visits in the first year was 5.71, which is lower than the MS recommendation of seven visits during this period.[9] One study evaluated the impact of training health professionals on infant feeding regarding the outcome of anemia, demonstrating that the use of ferrous sulfate for periods longer than 180 days was positively associated with a higher number of visits. Children who had at least seven visits during their first year were 1.25 times more likely to receive ferrous sulfate.[10] Therefore, measures to encourage caregivers to engage with the service need to be discussed.

Regarding indications for iron use, 33 of the 45 interviewees received guidance on iron supplementation, and the average age at which iron supplementation began was 4.62 months. In light of this data, current recommendations and the differences among the Brazilian Society of Pediatrics (SBP), the WHO, and the MS are discussed. Currently, the MS, within the framework of the PNSF, recommends — in accordance with WHO guidelines — prophylactic iron supplementation for all children aged 6 to 24 months, administered at a daily dose of 10.0 to 12.5 mg of elemental iron for three consecutive months, followed by a three-month break. Afterward, a new three-month cycle begins. Special conditions apply to children who are not exclusively breastfed and who receive cow's milk; they may begin the supplementation regimen at four months of age with the introduction of complementary foods, in accordance with the Dietary Guidelines for Brazilian Children Under Two Years of Age. It also notes that preterm infants (<37 weeks) or those born with low birth weight (<2,500 g) should follow the recommendations of the SBP.[1]

The SBP recommends the initiation and dosage of elemental iron supplementation based on specific guidelines according to gestational age and birth weight. Full-term infants with adequate birth weight should receive 1 mg/kg/day from three months of age; full-term weighing <2,500 g, 2 mg/kg/day from 30 days of age for one year, and 1 mg/kg/day for another year; preterm infants weighing 1,500–2,500 g, 2 mg/kg/day from 30 days of age for one year, followed by 1 mg/kg/day for another year; preterm weighing 1,000–1,500 g, 3 mg/kg/day from 30 days of age for one year, followed by 1 mg/kg/day for another year; and preterm weighing <1,000 g, 4 mg/kg/day from 30 days of age for one year, followed by 1 mg/kg/day for another year.[2]

In 2019, the SBP opposed the recommendations of the Dietary Guidelines for Brazilian children under two years of age, arguing that the introduction of solid foods should only begin at six months, even in cases where exclusive breastfeeding is not practiced, and that infant formula should be prescribed in such cases.[2] It is assumed that the current difficulty in reaching a consensus among these organizations may ultimately be reflected in the practices carried out in primary care, since these are not individualized recommendations but rather recommendations with a widespread impact on public health.

Furthermore, adherence to drug therapy is influenced by demographic and regional factors, as well as interventions by health professionals, encompassing medication costs, availability, dosage, and adverse effects. However, nonadherence to treatment is a significant factor in public health.[11] In the present study, of the 12 cases that reported difficulty adhering to treatment, the reasons cited were side effects, inadequate guidance or lack of professional follow-up, forgetfulness, and refusal by family members.

In a study conducted in the municipality of Viçosa, the reasons for discontinuing iron supplementation were: adverse effects, inadequate guidance from healthcare professionals, forgetfulness, and lack of follow-up or guidance regarding supplementation. Socioeconomic conditions were direct determinants of low adherence.[12] In the present study, this association was not demonstrated, likely due to the homogeneity of the sample. Similarly, the Pelotas cohort study also found no association between family income, maternal age, skin color, educational level, number of prenatal visits, and exclusive breastfeeding with iron use.[7]

It is worth noting that this study, despite having met the minimum sample size recommended by the sample calculation, has limitations regarding its size. Another limitation relates to homogeneity, since users belonging to the area covered by the FHS have very similar sociodemographic characteristics that are difficult to stratify.

It is concluded that the prevalence of prophylactic iron use in children aged 6 to 24 months, in accordance with current guidelines, was 35.5%, lower than expected. Regarding associated factors, problems with adherence, side effects, inadequate guidance, and a lack of follow-up by both the health service and caregivers were identified; among caregivers, forgetfulness and refusal to administer the medication were noted.

Thus, given the importance of interventions aimed at improving adherence, it is necessary to address this issue during medical consultations, occasional visits to health centers, and home visits. It is suggested that investing in continuing health education for the entire FHS team would be beneficial. Furthermore, the need for additional studies on this topic is emphasized, as the existing literature tends to focus on evaluating the efficacy and outcomes of anemia treatment, with a lack of studies on prevalence and associated factors — given that this issue has significant implications for public health and public spending.

CONFLICT OF INTERESTS

Nothing to declare.

AUTHORS' CONTRIBUTIONS

JLR: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing. TCF: Conceptualization, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. IBM: Conceptualization, Methodology, Project administration, Supervision, Validation, Writing – review & editing. LT: Formal Analysis, Methodology, Validation, Writing – review & editing. GM: Formal Analysis, Methodology, Validation, Writing – review & editing. JRW: Formal Analysis, Methodology, Validation, Writing – review & editing.

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