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Association between Breastfeeding, Complementary Feeding and Iron Supplementation and Anemia in Children Under Three Years of Age

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Abstract: ***Introduction: Anemia is a global public health problem, affecting approximately 40% of children under five years of age worldwide. Methods: A cross-sectional observational study was conducted. The sample consisted of 324 children under three years of age selected from the records of health facilities in the Pachacutec Micro-network. Data were obtained through a review of medical records and the use of an instrument validated by expert judgment and with adequate reliability (Cronbach's α = 0.7). Statistical analyzes were performed using RStudio version 2025. Absolute and relative frequencies were used, as well as chi-square tests to evaluate associations, considering a significance level of p < 0.05. Results: Of the total participants, 31% presented with anemia and 69% did not. Bivariate analysis showed statistically significant associations between anemia and diet, nutritional habits, and iron supplementation (p < 0.001 in all cases). Conclusions: Breastfeeding, complementary feeding, and iron supplementation were significantly associated with the presence of anemia in children under three years of age.***

Keywords: Anemia, Iron, Dietary Supplements, Breastfeeding (Source: MeSH)

1. Introduction

Anemia is a major public health problem and particularly affects young children. This condition occurs when the concentration of hemoglobin is insufficient to ensure adequate oxygen transport to the organs and tissues [(1)] . In its most severe forms, it can cause impairments in children's cognitive and motor development. Worldwide, it is estimated that approximately 40% of children under five years of age have anemia [(1)] .

Low- and middle-income countries, especially those in Africa, Asia, Latin America, and the Caribbean, have the highest burden of anemia in children under 36 months, with estimated prevalence rates between 60% and 78%. Within this group, the highest rates are observed in sub-Saharan African countries such as Angola and Gambia, while in Latin America, Bolivia, Peru, and Venezuela stand out [(2)] .

According to data reported by the ENDES (National Demographic and Health Survey) in 2023, the prevalence of anemia in children aged 6 to 35 months in Peru was 43.1% [(3)] .

Similarly, researchers from the Regional Government of Callao estimated in 2024 a prevalence of 34.9% of childhood anemia in children under 3 years of age [(4)] , which is why the need to work early arises. In this context, the present study aims to identify the association of breastfeeding, complementary feeding and supplementation and anemia in children under three years of age in the Pachacútec Micro-network - Ventanilla Network - Callao.

2. Materials and Methods

Design
This study employed a cross-sectional, non-experimental design.

Population and sample
The population consisted of all children with iron deficiency anemia under 3 years of age during the months of January to December 2020, according to the records of the Office of Informatics and Telecommunications (OITE) of the DIRESA Callao, totaling 695 children.

Mothers of children under three years of age diagnosed with iron deficiency anemia who attended growth and development check-ups or the nutrition clinic within the jurisdiction and who agreed to participate through informed consent were included. Mothers with language difficulties, as well as those whose children had congenital or genetic diseases or other types of anemia, and mothers with children over three years of age without anemia were excluded.

The sample consisted of 324 children who strictly met the inclusion and exclusion criteria.

Since the Pachacútec Micro-network comprises five health centers, the sample was distributed proportionally according to the number of cases reported at each facility. Eligible medical records were identified from the patient care records of each health center and organized using a sequential numbering system for review.

The procedure was as follows:
Each health center was asked to provide a list of children under three years of age diagnosed with iron deficiency anemia during the study period. Subsequently, a sequential number was assigned to each medical record within each stratum to facilitate identification and selection. Finally, all the collected information was recorded and organized in a Microsoft Excel spreadsheet for subsequent processing and statistical analysis.

Techniques and instruments for collecting information.
A structured instrument of 16 questions was used, distributed in three dimensions, two of which corresponded to determinants of health and one to the degree of iron deficiency anemia in children under 36 months, classified as mild, moderate and severe according to established criteria.

The validity of the instrument was determined through expert judgment, with evaluations from ten specialists, while reliability was assessed through a pilot test administered to 25 mothers from the Angamos Micro-network. The analysis showed a Cronbach's alpha coefficient of 0.7, demonstrating adequate internal consistency of the instrument.

Data Analysis and Processing

Data analysis .
Statistical analyses were performed using RStudio version 2025 software, with the R programming language. Absolute and relative frequencies were calculated for categorical variables, and associations between variables were assessed using Pearson's chi-squared test or Fisher's exact test, as appropriate. A p-value < 0.05 was considered statistically significant.

Operationalization of variables
The variable anemia was defined according to the criteria established by the World Health Organization (WHO). In children aged 6 months to 5 years, anemia was considered present when the hemoglobin concentration was less than 11.0 g/dL, while values equal to or greater than 11.0 g/dL were classified as normal [(5)] .

The definition of anemia and the recommendations for iron supplementation were established in accordance with the Technical Health Standard No. 213-MINSA/DGIESP-2024 for the prevention and control of iron deficiency anemia [(6)] .

Ethical aspects
This research stems from the thesis entitled "Determinants of Health and Anemia in Children Under 3 Years of Age During the COVID-19 Pandemic in the Pachacútec Micro-Network - Ventanilla Network - Callao, 2020-2021," developed by the study's lead author. This project was evaluated and approved by the Research Ethics Committee of the Callao Regional Health Directorate (DIRESA), ensuring compliance with the ethical principles applicable to research. Informed consent was also obtained from the parents or legal guardians of the participating children, who were informed about the study's objectives and the confidentiality of the collected information.

3. Results

Features	N = 324
Prevalence of anemia	
No anemia	225 (69%)
Anemia	99 (31%)

A total of 324 children were included in the study. The group with anemia consisted of 94 girls and 5 boys. Of the total participants, 99 (31%) had anemia, while 225 (69%) did not.

Feature	No anemia	Anemia	p-value [2]
	N = 225 [1]	N = 99 [1]	
Type of feed			<0.001
Exclusive breastfeeding	205 (91%)	7 (7.1%)	
Mixed feeding before 6 months	20 (8.9%)	63 (64%)	
Complementary Feeding	0 (0%)	29 (29%)	
Nutritional habits			<0.001
Consume iron-rich foods 3 times a week	188 (84%)	0 (0%)	
Consume iron-rich foods once or twice a week.	37 (16%)	48 (48%)	
He does not consume iron-rich foods	0 (0%)	51 (52%)	
Iron supplement consumption			<0.001
3 times a week	173 (77%)	0 (0%)	
Daily	52 (23%)	65 (66%)	
It does not consume	0 (0%)	34 (34%)	

[1]n (%)
[2]Pearson's Chi-squared test; Fisher's exact test

Bivariate analysis showed statistically significant associations between anemia and diet type, nutritional habits and iron supplement consumption, with differences between the groups compared in all variables evaluated (p < 0.001).

4. Discussion

The results obtained are consistent with the findings of a study conducted in Peruvian children under five years of age treated in Ica, where exclusive breastfeeding was identified as a factor associated with a lower frequency of anemia. These results showed that non-exclusive breastfeeding significantly

increased the probability of anemia (OR = 2.00; 95% CI: 1.50–2.60; p = 0.038), supporting the protective effect of exclusive breastfeeding on infant hematological status [7].

Similarly, a study conducted in children under five years of age found a higher prevalence of anemia among those with inadequate complementary feeding and supplementation, as well as a statistically significant association (p = 0.000) . Consistently, in our research, bivariate analysis showed statistically significant associations between anemia and the type of feeding, nutritional habits, and consumption of iron supplements ($p < 0.001$ in all cases). Children without anemia more frequently presented exclusive breastfeeding, regular consumption of iron-rich foods, and iron supplementation, while children with anemia showed higher proportions of mixed feeding or early complementary feeding, lower consumption of iron-rich foods, and absence or lower frequency of supplementation [8].

The evidence obtained highlights the fundamental role of proper nutrition and iron supplementation in the prevention of anemia, especially during the first years of life, a critical stage for the child's growth and development.

5. Conclusion

Breastfeeding, complementary feeding and iron supplementation are associated with anemia in children under three years of age in the Pachacútec Micronetwork - Ventanilla Network - Callao.

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