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Breastfeeding background and hemoglobin behavior in children from Puno

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ABSTRACT

Objective: To determine the breastfeeding background related to hemoglobin level in children aged 6 to 36 months attended in a Health Center in Puno, Peru. **Materials and methods:** The hypothetical-deductive method was used, with a correlational level, non-experimental cross-sectional design, and quantitative approach. The population consisted of 155 children aged 6 to 36 months. The sample consisted of 111 children with their mothers, in whom the variables were studied, applying the validated data collection form and questionnaire instruments. Descriptive statistics and the chi-square association test were analyzed using SPSS software. **Results:** There is no relationship between the background of breastfeeding initiation and hemoglobin level (p = 0,078); there is a relationship between the background of breastfeeding type and hemoglobin level (p =0,018); and there is a relationship between the background of breastfeeding time and hemoglobin level (p = 0,003). **Conclusions:** The breastfeeding background that is related to hemoglobin behavior in children is breastfeeding type and breastfeeding time.

Keywords: breastfeeding; hemoglobin; iron deficiency anemia; infant nutrition.

INTRODUCTION

Hemoglobin is an iron-rich protein found in red blood cells, whose essential function is to transport oxygen (O_2) to the body's tissues. At the same time, hemoglobin levels are measured through a blood test and expressed in grams per deciliter (g/dL) (1).

Child anemia and malnutrition are serious public health concerns worldwide, especially among the most vulnerable populations. These issues are influenced by several determining factors, including early pregnancy, inadequate intake of food and nutrients during pregnancy, breastfeeding history, hemoglobin level patterns, and iron deficiency (2).

In the Americas, according to the Pan American Health Organization (3), at the beginning of 2022, the countries with the lowest prevalence of exclusive breastfeeding (EBF) were the Dominican Republic (4.6%), Venezuela (7.1%) and

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Suriname (8.9%), while the countries with the highest prevalence were Bolivia (55.7%), Uruguay (57.7%) and Peru (65.3%).

However, in Peru, according to INEI-ENDES, in 2020, 40.1% of children aged 6 to 35 months suffered from anemia. This means that nearly 700,000 children under three years old were anemic, with the highest prevalence in those living in the cities of Puno (69.9%), Cuzco (57.4%), Huancavelica (54.2%), and Ucayali (53.7%) (4).

On the other hand, breastfeeding is one of the survival mechanisms of human being and requires social support, due to the multiple benefits and advantages—not only for the newborn, but also for the mother-child relationship, society, and the economy of the country (5).

The World Health Organization and UNICEF suggest that breast milk be the exclusive source of nutrition for newborns up to six months of age and that up to 2 years of age it should be complemented with other types of food; however, in fact, 2 out of 3 children under 1 year old did not receive EBF during the first 6 months, a rate that has not improved in 20 years (6).

Breast milk provides approximately 30% of iron that a newborn needs, while the remaining percentage should come from iron reserves accumulated during pregnancy. These reserves are important to balance the low intake of iron from breast milk, allowing the infant to remain independent of exogenous iron during the first six months of life (7).

After six months of age, as growth and development progress, the body's iron stores become depleted, and nutritional requirements increase. Consequently, infants may be prone to iron deficiency, low hemoglobin, anemia and malnutrition if complementary feeding and breastfeeding practices are not properly implemented (8).

In this context, several studies have demonstrated a relationship between breastfeeding and anemia in children. A study conducted in Havana, Cuba, determined a statistically significant association between iron deficiency anemia (61.0%) and inadequate EBF during the first 6 months of life (87.5%). This means that iron deficiency anemia is twice as likely to occur in children who received EBF for less than 6 months compared to those who were exclusively breastfed for the full 6 months (9).

Another study conducted in Montevideo, Uruguay, found that 67.7% of children received EBF during the first six months of life. Within this group, 82.1% had mild anemia, 17.9% had moderate anemia, and no cases of severe anemia were reported. Based on these findings, the study concluded that EBF during the first 6 months of life serves a protective factor against anemia (10).

In Peru, a study conducted in Trujillo with 6-month-old infants found that 52.0% had anemia. The prevalence of anemia was 55.8% among infants who received exclusive breastfeeding (EBF), 47.7% among those with mixed feeding, and 50.0% among those fed with formula. These findings suggest a relationship between the type of feeding and the occurrence of anemia (11).

Locally, observations in a healthcare center in Puno indicate that child healthcare often includes a diagnostic phase during growth and development check-ups (GDC). These check-ups involve hemoglobin screening to detect anemia and provide either preventive supplementation or therapeutic treatment as needed.

In this regard, and considering the aforementioned aspects, a study was conducted to determine the relationship between breastfeeding history and hemoglobin levels in children aged 6 to 36 months who have had been treated in a healthcare center in Puno.

MATERIALS AND METHODS

The study followed a quantitative approach and was classified as basic research with a correlational level. It employed a non-experimental, cross-sectional design, as data collection was gathered at a single point in time.

A total of 155 children aged 6 to 36 months who were treated at a healthcare center in Puno, Peru, were considered. The sample determined using the formula for finite population sample size calculation, with a 5% margin of error and a 95% confidence level, resulting in 111 children selected through non-probabilistic accidental sampling. Children attended in April 2023 whose first hemoglobin screening was conducted at 6 months of age were included in the study.

Observation and interview techniques were applied to measure the research variables. As an instrument, a data collection sheet was used to record hemoglobin levels from the child's records in the GDC control. The indicator was the hemoglobin level, with parameters and ranges stipulated in the Technical Health Standard No. 134-MINSA/2017:

normal (≥11.0 g/dL), mild anemia (10,0-10,9 g/dL), moderate anemia (7.0-9.9 g/dL) and severe anemia (<7,0 g/dL). Additionally, general data such as age, sex, weight, height, and date of birth were registered. A questionnaire was also administered to the mother of the children to gather information on the variable of breastfeeding history, which comprised three dimensions: initiation of breastfeeding, type of breastfeeding, and duration time of breastfeeding.

Both instruments were created by the author of this study and were evaluated by a panel of five experts, who gave their favorable opinion, thus confirming their validity. To determine reliability, a pilot test was conducted with 30 subjects who were not part of the study sample, for which the Cronbach's alpha test was applied, yielding a value of 0.662 for the observation sheet, and 0.607 for the interview guide, confirming that both instruments are reliable.

The information was collected after authorization from the head of the healthcare facility, the director of the Puno Network, and the Training Area, as well as the coordination with the head nurse and the person in charge of child growth and development at the healthcare facility. At the end, the instruments were administered to individuals who voluntarily agreed to participate in the study by signing the informed consent form.

The collected data was processed, analyzed and evaluated through a coding process for each study subject based on variables, dimensions, and grouped indicators. This tabulation was prepared in a database using a Microsoft Excel template. Additionally, the SPSS Statistics v.25 software (Statistical Package for the Social Sciences) was used for data processing and statistical analysis. At the end, the analysis was conducted using descriptive statistical calculations and, for hypothesis testing, the chi-square test was applied, considering a 95% confidence level to determine significance.

RESULTS

The study included 111 children aged 6 to 36 months who were treated at a healthcare center in Puno. The mean age of the sample was 15 months, with 56.8% being male. The minimum height recorded was 58.0 cm, the maximum height was 91.5 cm, and the mean height was 75.6 cm. Additionally, the minimum weight observed was 4.640 kg, the maximum weight was 16.500 kg, and the average weight was 10.012 kg.

With regard to the history of breastfeeding, Table 1 shows that 48.6% (n = 54) initiated breastfeeding the day after birth, 55.9% (n = 62) received EBF, and 84.7% (n = 94) continued breastfeeding even after 6 months.

Table 1. History of breastfeeding by dimensions.

Dimensions	n	%
Initiation of breastfeeding		
Within the first hour after birth	47	42.3
The day after birth	54	48.6
One week after birth	8	7.2
One month after birth	2	1.8
Never received breastfeeding	0	0.0
Type of breastfeeding		
Exclusive breastfeeding	62	55.9
Mixed feeding	38	34.2
Formula feeding	11	9.9
Duration of Breastfeeding		
Until before 6 months	17	15.3
Even after 6 months	94	84.7
Total	111	100.0

Regarding hemoglobin levels by age, Table 2 shows that 36.9% (n = 41) of children aged 6 to 11 months have hemoglobin levels of ≥11.0 g/dL (normal value). Additionally, 15.3% (n = 17) of children aged 12 to 17 months also have hemoglobin levels of ≥11.0 g/dL. Furthermore, 8.1% (n = 9) of children aged 18 to 23 months present hemoglobin levels between 10.0 and 10.9 g/dL (mild anemia), while 2.7% (n = 3) of children in the same age group have hemoglobin levels between 7.0 and 9.9 g/dL (moderate anemia).

Table 2. Hemoglobin levels by age.

Age in months	Moderate anemia (7.0-9.9 g/dL)*		Mild anemia (10.0-10.9 g/dL)*		Normal (≥11.0 g/dL)*	
	n	%	n	%	n	%
6-11	3	2.7	5	4.5	41	36.9
12-17	2	1.8	1	0.9	17	15.3
18-23	3	2.7	9	8.1	13	11.7
24-29	1	0.9	1	0.9	8	7.2
30-36	1	0.9	4	3.6	2	1.8
Total	10	9.0	20	18.0	81	73.0

* Values taken from the Technical Health Standard No. 134-MINSA/2017.

Table 3 shows that 36.0% (n = 40) of children have normal hemoglobin levels and initiated breastfeeding within the first hour after birth. Apart from that, 32.4% (n = 36) have normal hemoglobin levels and initiated breastfeeding the day after birth. Meanwhile, 9.9% (n = 11) have mild anemia and initiated breastfeeding the day after birth. Therefore, statistically, there is no significant association between breastfeeding initiation and hemoglobin levels.

Table 3. History of breastfeeding initiation and hemoglobin behavior.

Breastfeeding initiation	Moderate anemia (7.0-9.9 g/dL)*		Mild anemia (10.0-10.9 g/dL)*		Normal (≥11.0 g/dL)*		Chi (sig.)
	n	%	n	%	n	%	
Within the first hour after birth	1	0.9	6	5.4	40	36.0	0.078
The day after birth	7	6.3	11	9.9	36	32.4	
One week after birth	2	1.8	3	2.7	3	2.7	
One month after birth	0	0.0	0	0.0	2	1.8	
Never received breastfeeding	0	0.0	0	0.0	0	0.0	
Total	10	9.0	20	18.0	81	73.0	

* Values taken from the Technical Health Standard No. 134-MINSA/2017.

Table 4 shows that 46.8% (n = 52) have normal hemoglobin levels and receive EBF. 19.8% (n = 22) have normal hemoglobin behavior levels and receive mixed feeding. And 9.9% (n = 11) have mild anemia and receive mixed feeding. Therefore, statistically, there is an association between the type of breastfeeding and hemoglobin levels.

Table 4. History of type of breastfeeding and hemoglobin levels.

Type of breastfeeding	Moderate anemia (7.0-9.9 g/dL)*		Mild anemia (10.0-10.9 g/dL)*		Normal (≥11.0 g/dL)*		Chi (sig.)
	n	%	n	%	n	%	
Exclusive breastfeeding	2	1.8	8	7.2	52	46.8	0.018
Mixed feeding	5	4.5	11	9.9	22	19.8	
Formula feeding	3	2.7	1	0.9	7	6.3	
Total	10	9.0	20	18.0	81	73.0	

* Values taken from the Technical Health Standard No. 134-MINSA/2017.

Table 5 shows that 66.7% (n = 74) have a hemoglobin level of ≥11.0 g/dL (normal value) and are breastfed even after 6 months. 12.6% (n = 14) have a hemoglobin level between 10.0 to 10.9 g/dL (mild anemia) and are breastfed even after 6 months. 6.3% (n = 7) have a hemoglobin level of ≥11.0 g/dL and are breastfed up to the age of 6 months. Therefore, statistically, there is an association between breastfeeding time and hemoglobin levels.

Table 5. History of breastfeeding time and hemoglobin levels.

Breastfeeding time	Moderate anemia (7.0-9.9 g/dL)*		Mild anemia (10.0-10.9 g/dL)*		Normal (≥11.0 g/dL)*		Chi (sig.)
	n	%	n	%	n	%	
Until before 6 months	4	3.6	6	5.4	7	6.3	0.003
Even after 6 months	6	5.4	14	12.6	74	66.7	
Total	10	9.0	20	18.0	81	73.0	

* Values taken from the Technical Health Standard No. 134-MINSA/2017.

DISCUSSION

This study shows that the history of breastfeeding and the level of hemoglobin are risk factors for the development of childhood anemia, a condition that constitutes one of the major public health problems worldwide.

Regarding the relationship between both variables, it was found that if the child initiates breastfeeding within the first 24 hours and continues breastfeeding even after 6 months of age, the anemia will be mild. In terms of EBF, these findings are supported by a study conducted in Cuba, where it was demonstrated that being breastfed for less than 6 months constitutes a risk factor for the development of iron-deficiency anemia (OR 1.5; CI: 1.3-2.4) (9). Similarly, another study conducted on a pediatric population at a hospital in the Dominican Republic found that only 9.0% were breastfed for 6 months. It reported that the two patients who showed a decrease in hematocrit and hemoglobin had never been breastfed (12).

In our nation, there is a study conducted with children under 36 months who are patients at a healthcare center in Huancayo. That study found that those children who were breastfed until the age of two did not develop severe anemia, and that only 12 and 5 children presented moderate and mild anemia, respectively, out of a total of 29 children (13). We also found a national study with results differing from ours, which was performed in Tumbes, with infants aged 6 to 8 months. This research found that 24 children who were breastfed did not develop iron-deficiency anemia, while 3 children who were also breastfed presented mild anemia. At the end, they concluded that there is no relationship between breastfeeding practices and iron-deficiency anemia (14).

In fact, considering that breastfeeding has proven to be a protective factor against various diseases, it also ensures proper growth and development in children (15). Therefore, the early initiation of this feeding practice is crucial for establishing exclusive breastfeeding (EBF), ideally within the so-called "golden hour" (16). In addition, its exclusive consumption promotes an affective bond between the mother, the father and the child, supports the child's physical and emotional development, and contributes to the well-being of mothers. At the same time, EBF is ideal until the age of 6 months; beyond this period, it becomes complementary and is recommended until the age of 2, together with the child's diet (17). Consequently, based on the findings, it was possible to determine and support the importance of timely and continuous EBF, as it is a crucial factor for the overall well-being of children.

The study demonstrates that the breastfeeding-related factors associates with hemoglobin levels are the type of breastfeeding and the duration of breastfeeding ($p < 0.05$), while the initiation of breastfeeding is not associated ($p > 0.05$). In this regard, a previous study conducted in Cuba found a statistically significant association between iron-deficiency anemia and the lack of exclusive breastfeeding (EBF) during the first 6 months of life (87.5%); Moreover, the highest *odds ratio* (OR) for adverse health outcomes was associated with EBF for less than 6 months (OR = 2.1; CI: 1.9-2.5), meaning that iron-deficiency anemia is twice as likely to occur in infants who were breastfed for less than 6 months compared to those who were breastfed for the full 6 months (9).

Similarly, a national study conducted in Huancayo determined, using Fisher's exact test with a significance level of = 0.00 (<0.05), that the correlation between hemoglobin diagnosis and the duration time of breastfeeding was significant. In the same way, with a significance level below 5% (0.00 < 0.05), it indicated that the relationship between the frequency of breastfeeding and hemoglobin diagnosis is also significant (13). On the other hand, a national study concluded that there is no relationship between breastfeeding practices and iron-deficiency anemia in children aged 6 to 8 months who attended a healthcare center (14).

Breastfeeding history encompasses all postnatal events or circumstances that serve as a reference for a child's growth, development, and well-being (18). In addition, hemoglobin levels refer to the analysis of hemoglobin values that indicate health status, disease, or conditions such as iron-deficiency anemia (19). Consequently, there is a history of breastfeeding factors related to hemoglobin levels in children aged 6 to 36 months treated in a health center in Puno, such as the type of breastfeeding and the duration of breastfeeding ($p < 0.05$).

CONCLUSIONS

It was determined that the breastfeeding-related factors associated with hemoglobin levels are the type of breastfeeding and the duration of breastfeeding ($p < 0.05$), whereas initiation of breastfeeding is not associated ($p > 0.05$).

A high percentage of children were found to initiate breastfeeding within the first 24 hours after birth, along with a significant number of infants who were breastfed. Regarding the duration dimension, most children continued breastfeeding beyond 6 months of age.

It is recommended to further analyze the history of breastfeeding to contribute to research on this topic, considering additional dimensions and indicators.

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