ORIGINAL ARTICLE

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Risk factors associated with anemia in pregnant women in a Peruvian health center

Factores de riesgo asociados a anemia en gestantes de un centro de salud peruano

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ABSTRACT

Introduction: Anemia is a significant public health problem, especially in women of reproductive age. In pregnant women, it can cause serious complications, such as premature birth. Iron deficiency is a common cause of anemia, so early detection and treatment is crucial. Objective: To identify risk factors associated with anemia in pregnant women attended at the Ex Fundo Naranjal Health Center in 2022. Materials and Methods: Cross-sectional observational study of 387 pregnant women attended between July and December 2022. A total of 173 women in the third trimester of gestation were selected by non-probabilistic convenience sampling. Data were obtained from prenatal records and analyzed with SPSS 25. Descriptive, bivariate and multivariate analyses were performed to identify significant associations between factors and anemia. Results: The majority of pregnant women were under 35 years of age (84.4%), with basic education (74%) and came from marginal urban areas (79.8%); 36.4% were overweight and 25.4% obese. Multivariate analysis showed that maternal age under 35 years (adjusted OR 1.18), low education level (aOR 1.14), and not receiving nutritional counseling (aOR 1.03) were significantly associated with anemia. Conclusions: Maternal age less than 35 years, low education level and lack of nutritional counselling were significant risk factors for anemia in pregnant women. Improved nutrition education and counselling and ensuring adequate iron supplementation are recommended.

Key words: Pregnancy, Anemia, Maternal health

RESUMEN

Introducción. La anemia es un problema de salud pública significativo, especialmente en mujeres en edad reproductiva. En embarazadas, puede causar complicaciones graves, como partos prematuros. La deficiencia de hierro es una causa común de anemia, por lo que es crucial detectarla y tratarla a tiempo. Objetivo. Identificar los factores de riesgo asociados a la anemia en gestantes atendidas en el Centro de Salud Ex Fundo Naranjal en 2022. Materiales y Métodos. Estudio observacional transversal con 387 mujeres grávidas atendidas entre julio y diciembre de 2022. Se seleccionaron 173 mujeres en el tercer trimestre de gestación mediante muestreo no probabilístico por conveniencia. Los datos se obtuvieron de registros prenatales y se analizaron con SPSS 25. Se realizaron análisis descriptivos, bivariados y multivariados para identificar asociaciones significativas entre los factores y la anemia. Resultados. La mayoría de las gestantes eran menores de 35 años (84,4%), con educación básica (74%) y procedían de zonas urbanas marginales (79.8%). El 36,4% estaban en sobrepeso y el 25,4% eran obesas. El análisis multivariado mostró que la edad materna menor de 35 años (OR ajustado 1,18), el bajo nivel educativo (ORa 1,14) y no recibir consejería nutricional (ORa 1,03) fueron factores significativamente asociados con la anemia. Conclusiones. La edad materna menor de 35 años, un nivel educativo bajo y la falta de consejería nutricional fueron factores de riesgo significativos para la anemia en gestantes. Se recomienda mejorar la educación y la consejería nutricional, y asegurar una adecuada suplementación con hierro.

Palabras clave. Embarazo, Anemia, Salud materna

Introduction

Anemia is a significant global public health challenge, particularly affecting women in the reproductive stage[1]. In pregnant women, undetected and untreated anemia can cause severe problems, such as premature births, miscarriages, low height and weight of the newborn, infant anemia and poor school performance. It also predisposes postpartum women to emotional instability, stress and postpartum depression[2,3]. Both nutritional and non-nutritional factors contribute to its develop-

ment, with iron deficiency being one of the most common causes[4]. Therefore, it is crucial to detect and treat anemia early to prevent complications in both the fetus and the mothers.

A systematic review with meta-analysis found that the overall prevalence of anemia in pregnant women is 36.8%, being more common in its mild form (70.8%) and in the third trimester of pregnancy (48.8%)[5]. The sub-Saharan region has the highest rate of anemia during pregnancy, with 17.2 million women affected. In East Africa, prevalence varies significantly between countries, being 20% in Rwanda and 32.5% in Uganda[6]. In Brazil, the pooled prevalence of anemia in pregnant women is 23% (95% CI: 20, 27), with the highest rate in the Northeast Region, reaching 26% (95% CI: 23, 29)[7]. In Peru, according to the Demographic and Family Health Survey (ENDES, for its acronym in Spanish) 2019, 28.3% of pregnant women suffer from anemia, with the Peruvian jungle being the region with the highest prevalence (34.3%), followed by the Peruvian coast (32.0%) and Metropolitan Lima (26.3%)[8]. Therefore, anemia in pregnant women is a significant global problem with variations according to the region, highlighting the high incidence in sub-Saharan Africa and Peru. The mild form of anemia and its increase in the third trimester of pregnancy underscore the need for specific interventions.

The need for iron increases considerably during pregnancy, especially in the second trimester, and its deficiency can increase maternal morbidity and mortality and susceptibility to infections, as well as the risk of bleeding and obstetric complications[9]. Although the prevalence of anemia in pregnant women has been widely documented globally, there is a significant gap in knowledge about the specific factors that contribute to its development in different local contexts. This study is necessary to identify and understand the factors associated with anemia in pregnant women in different regions, which will allow the design of more effective interventions adapted to the particular needs of each population, thus contributing to improve maternal and fetal health.

Therefore, the objective of this study was to identify the factors associated with anemia in pregnant women attended at the Ex Fundo Naranjal Health Center, 2022.

Materials and methods

The design of the present study was observational and cross-sectional. The population consisted of 387 pregnant women who received care at the Ex Fundo Naranjal Health Center, Lima, Peru, during the period from July to December 2022. The website https://www.openepi.com/SampleSize/SSPropor.htm was used to calculate the sample size, considering an anticipated frequency of 28.3%[4], a confidence level of 95% and a design effect of 1.0. The resulting sample size was 173 women. The sample was non-probabilistic by convenience, the medical records were evaluated by inclusion and exclusion criteria, selecting patients in the third trimester of pregnancy with complete medical, obstetric and nutritional medical history, pregnant with hemoglobin tests of the last trimester or sample taken before delivery, belonging to the jurisdiction of the health facility and registered in the 'WAWARED', attended between July and December 2022. Exclusion criteria were pregnant women requesting referral to a higher-level facility, not residing in the jurisdiction, or with diagnoses of pre-pregnancy diseases affecting red blood cell production.

The data were obtained mainly from the prenatal control records and the participants' medical histories. A data collection form was used, which consisted of five sociodemographic items, six obstetric items and three nutritional items. The instrument had an average rating of 83.5 for expert opinion, with an opinion of good applicability[10]. For the purposes of this study, three modifications were made to achieve the objectives. In relation to anemia, the participants were classified into two categories: those without anemia and those with anemia. In the case of anemia, a subclassification was made according to severity into mild, moderate or severe levels. The information collected was stored in Excel 2020 and analyzed statistically with SPSS 25.

A descriptive analysis was applied to characterize the population studied and a bivariate analysis was applied to identify significant associations between factors and anemia, using the p-value < 0.05 to determine statistical significance. In addition, a multivariate analysis was performed by logistic regression to adjust the factors associated with anemia, calculating the crude and adjusted odds ratio (OR) together with their respective 95% confidence intervals.

Regarding ethical considerations, the present study was reviewed and approved by the ethics committee of the Universidad Privada San Juan Bautista, Lima, Peru, receiving registration code No. 0574-2023-CIEI-UPSJB. This research consisted of an analysis of clinical histories, avoiding invasive methods and direct contact with the participants. Strict confidentiality measures were implemented, storing the information under alphanumeric codes accessible only to thesis students and their supervisors. No face captures were taken and no visual evidence was kept that could identify the participants. In addition, no names or sensitive information of those involved was publicly disclosed.

Results

Table 1 shows that most of the women (84.4%) were under 35 years of age, and 76.9% had an intimate partner. In terms of education, 74% had basic education and 78.0% were not working. Most of the women came from marginal urban areas (79.8%) and were multiparous (76.9%). Half of the pregnant women received less than six prenatal care visits and 75.7% had an inter-gestational period of more than two years. In terms of body mass index (BMI) before pregnancy, 37.6% were normal weight, while 36.4% were overweight and 25.4% were obese. Some 71.7% received nutritional counseling, but only 28.9% had adequate supplementation with ferrous sulfate. The mean hemoglobin value was 11.6 ± 1.1 g/dL.

Table 2 indicates that maternal age less than 35 years, low educational attainment, and origin from urban slum areas were significantly associated with anemia, with $p = 0.02$ for each respectively. In addition, lack of nutritional counseling and inadequate ferrous sulfate supplementation also showed a significant association with anemia ($p = 0.00$ and $p = 0.03$, respectively).

Table 3 presents the multivariate analysis adjusting the odds ratios (OR) for various risk factors. The results show that maternal age younger than 35 years (ORa 1.2; 95% CI: 1.2, 3.4), low educational level (ORa 1.1; 95% CI: 1.0, 2.7) and not receiving nutritional counseling (ORa 1.0; 95% CI: 1.0, 2.3), remain significantly associated with anemia even after adjusting for other factors.

Table 1. Descriptive analysis of the general characteristics of the pregnant.

General characteristics	N (=173)	%
Maternal age		
< 35 years	146	84.4%
≥ 35 years	27	15.6%
Marital status		
With intimate partner	133	76.9%
Without an intimate partner	40	23.1%
Level of education		
No education	3	1.7%
Basic education	128	74.0%
Higher education	42	24.3%
Occupation		
Working	38	22.0%
No occupation	135	78.0%
Origin		
Marginal urban	138	79.8%
Rural	35	20.2%
Parity		
Primiparous	40	23.1%
Multiparous	133	76.9%
Prenatal care		
< 6 visits	93	53.8%
≥ 6 visits	80	46.2%
Intergestational period		
≤ 2 years	42	24.3%
> 2 years	131	75.7%
BMI before pregnancy		
Underweight	1	0.6%
Normal weight	65	37.6%
Overweight	63	36.4%
Obesity	44	25.4%
Nutritional counseling		
Yes	124	71.7%
No	49	28.3%
Ferrous sulfate supplementation		
Adequate	50	28.9%
Inadequate	123	71.1%
Hemoglobin values (mean ± SD)		11.6 ± 1.1 g/dL

BMI: body mass index; SD: standard deviation

Discussion

In the present study conducted at the Ex Fundo Naranjal Health Center, 2022, it was observed that most of the pregnant women were under 35 years of age, with a high prevalence of basic education, unemployment, and coming from marginal urban areas. In terms of nutritional status, a significant proportion were over-

Table 2. Bivariate analysis of factors associated with anemia in pregnant women.

Demographic factors	Anemia status				*p* value
	Yes		No		
	N (=36)	%	N (=137)	%	
Maternal age					
< 35 years	31	86.1%	115	83.9%	0.02*
≥ 35 years	5	13.9%	22	16.1%	
Marital status					
With intimate partner	27	75.0%	106	77.4%	0.21
No romantic partner	9	25.0%	31	22.6%	
Level of education					
No education	1	2.8%	2	1.5%	
Basic education	30	83.3%	98	71.5%	0.02*
Higher education	5	13.9%	37	27.0%	
Occupation					
Working	8	22.2%	30	21.9%	0.56
No occupation	28	77.8%	107	78.1%	
Origin					
Marginal urban	27	75.0%	111	81.0%	0.02*
Rural	9	25.0%	26	19.0%	
Parity					
Primiparous	7	19.4%	33	24.1%	0.34
Multiparous	29	80.6%	104	75.9%	
Prenatal care					
< 6 visits	20	55.6%	73	53.3%	0.06
≥ 6 visits	16	44.4%	64	46.7%	
Intergestational period					
≤ 2 years	12	33.3%	30	21.9%	0.15
> 2 years	24	66.7%	107	78.1%	
BMI before pregnancy					
Underweight	1	2.8%	0	0.0%	0.09
Normal weight	18	50.0%	47	34.3%	
Overweight	10	27.8%	53	38.7%	
Obesity	7	19.4%	37	27.0%	
Nutritional counseling					
Yes	26	72.2%	98	71.5%	0.00*
No	10	27.8%	39	28.5%	
Ferrous sulfate supplementation					
Adequate	7	19.4%	43	31.4%	
Inadequate	29	80.6%	94	68.6%	0.03*

BMI: Body mass index
** Statistical significance established with p-value less than 0.05*

weight or obese. Although most received nutritional counseling, only a minority had adequate supplementation with ferrous sulfate. Bivariate and multivariate analysis revealed significant associations between sociodemographic factors and anemia. Maternal age under 35 years, low educational level and lack of nutritional counseling remained significant in multivariate analysis, underscoring the need for interventions to improve education, nutritional counseling and adequate supplementation in this vulnerable population.

The study found that maternal age younger than 35 years was statistically significant in both bivariate and multivariate analysis. These findings are consistent with a study conducted at the Hospital Nacional San José del Callao, Peru, and published in February 2020, which revealed that maternal age was a risk factor with an OR of 2.2 (95% CI: 1.17, 4.48)[8]. Another study on anemia conducted in Peruvian Andean puerperal women in 2023 found significant differences in age (p = 0.011)[11]. Likewise, a secondary analysis based on the 2019 Peruvian ENDES found that being aged between 15 and 19 years is a factor that increases the association with anemia (OR 2.35; 95% CI: 1.33, 4.14)[4]. Similarly, in Colombia, Rincón-Pabón et al. found that pregnant women under 30 years of age had an odds ratio of 1.8 (95% CI: 1.0, 3.2), which was statistically significant[12]. These results are also congruent with a study in Argentina, where maternal age showed a significant association with anemia (p < 0.05)[13]. Furthermore, in Bangladesh[14], anemia was significantly associated with maternal age at 20-25 years (OR = 1.9) and 26-30 years (OR = 2.37). This consistency across different settings and studies suggests a biological and socioeconomic vulnerability affecting young pregnant women, possibly related to factors such as less experience in prenatal health management.

Table 3. Multivariate analysis of the factors associated with anemia in pregnant.

Associated factors	*p*-value	Crude OR (95% CI)	Adjusted OR (95% CI)
Maternal age less than 35 years	0.02*	1.1 (1.1, 2.7)	1.2 (1.2, 3.4)
Low education level	0.02*	1.1 (1.1, 2.2)	1.1 (1.0, 2.7)
Origin from marginal urban areas	0.02*	0.8 (0.4, 1.5)	0.7 (0.3, 1.5)
Did not receive nutritional counseling	0.00*	1.0 (0.5, 2.0)	1.0 (1.0, 2.3)
Inadequate nutritional supplementation	0.03*	0.6 (0.3, 1.3)	0.5 (0.2, 1.3)

OR: odds ratio; CI: confidence interval
** Statistical significance established with p-value less than 0.05*

In our study, low educational level was statistically significant in bivariate and multivariate analysis. This is consistent with a secondary analysis based on the 2019 Peruvian ENDES, whose results indicated that having an educational level of primary school is a factor that increases the association with anemia, with an OR of 1.96 (95% CI: 1.18, 3.28)[4]. A systematic review of pregnant women in Malaysia[15] identified that low maternal educational level was significantly associated with anemia during pregnancy. However, these results differ from the study by Anuradha[16], which did not detect any significant association between the severity of anemia and the educational level of pregnant women. Similarly, in a Peruvian study in Puno, Peru and another based on the ENDES 2017 found no significant association between educational level and anemia[17,18]. Likewise, in the study by Rincón-Pabón et al. no significant association was found between lack of schooling and anemia in pregnant women in the multivariate analysis, both in the crude and adjusted models[12]. The discrepancy between the studies may be due to differences in the socioeconomic and cultural contexts, as well as in the methods of analysis and definitions of educational level.

In our study, lack of nutritional counseling was significantly associated with anemia in pregnant women, a result that is consistent with the study of Garbey Pierre et al. who found that inadequate nutritional habits showed a causal association with anemia, with an OR of 3.5[19]. These findings highlight the importance of nutritional counseling as a key intervention to prevent anemia during pregnancy. Appropriate nutritional counseling can significantly improve the eating habits of pregnant women, ensuring that they receive the essential nutrients needed to maintain optimal health during pregnancy.

The strength of this research is the use of adjusted multivariate analysis, as it allows controlling for multiple variables simultaneously, thus reducing the possibility of bias and providing more robust and reliable results. Data collection was rigorously carried out from clinical histories and prenatal control records, which ensures the accuracy and reliability of the information collected. Finally, the sample size, calculated using an appropriate methodology, ensures that the results are statistically significant and representative of the population studied.

Despite its strengths, this research has some limitations and possible biases. Data collection based on clinical registries could be influenced by the accuracy and completeness of these registries, which could introduce information bias. Another aspect is the possible presence of unmeasured confounding factors that could have influenced the results, such as undetailed socioeconomic aspects or health factors not documented in the clinical records. Finally, the reliance on self-reporting for some data, such as adherence to ferrous sulfate supplementation, could introduce recall bias or desire for ingratiation.

CONCLUSION

This study has managed to identify several factors associated with anemia in pregnant women attended at the Ex Fundo Naranjal Health Center during the year 2022. It concludes that maternal age under 35 years, low educational level and lack of nutritional counseling are factors significantly associated with an increased risk of anemia in this population. These findings underscore the importance of implementing intervention strategies focused on improving education and nutritional counseling for pregnant women, as well as ensuring adequate iron supplementation.

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