ORIGINAL

Gac Med Bilbao. 2023;120(4):169-174

The Prevalence of Anemia Patients in Pregnant Women based on Erythrocyte Index Value

Mursalim[a], Yaumil Fachni Tandjungbulu[a], Syahida Djasang[a], Muhammad Nasir[a]

a) Department of Medical Laboratory Technology. Makassar Health Polytechnic. Makassar, Indonesia

Recibido el 14 de noviembre de 2023; aceptado el 15 de marzo de 2023

Abstract:
Anemia is a global public health problem characterized by decreased hemoglobin levels in erythrocyte cells, leading to the absence of a person's physiological needs. The physiological needs of each person vary according to age, gender, and even during pregnancy. The value of the erythrocyte index in anemia largely determines the severity and duration of anemia in pregnant women. The study aimed to determine anemia's prevalence and hematological characteristics in pregnant women.

Materials and Methods:
This study was a descriptive laboratory observation with a total of 128 samples. The samples were used based on the cluster sampling method and by multiplying the calculation results. The prevalence of anemia in pregnant women was 77.3% (n = 99) based on hemoglobin level examination.

Results:
The results showed that the most common level of anemia was mild (64.6%; n = 64), followed by moderate (35.4%; n = 35), and, based on the erythrocyte index value, 41.4% (n = 41) of the pregnant women patients had normochromic normocytic anemia with decreased hemoglobin levels.

Conclusion:
Therefore, it is recommended that pregnant women frequently take blood-boosting vitamins and eat nutritious foods to prevent anemia.

KEYWORDS

Anemia.
Erythrocyte Index Value.
Pregnant Women.

Autor para correspondencia: mursalim@poltekkes-mks.ac.id. (Mursalim).

PALABRAS CLAVE

Anemia.
Valor del índice de eritrocitos.
Mujeres embarazadas.

La prevalencia de pacientes con anemia en mujeres embarazadas según el valor del índice de eritrocitos

La anemia es un problema de salud pública mundial que se caracteriza por la disminución de los niveles de hemoglobina en las células de los eritrocitos, lo que lleva a la ausencia de las necesidades fisiológicas de una persona. Las necesidades fisiológicas de cada persona varían según la edad, el sexo e incluso durante el embarazo. El valor del índice de eritrocitos en la anemia determina en gran medida la gravedad y duración de la anemia en mujeres embarazadas. El estudio tuvo como objetivo determinar la prevalencia de la anemia y las características hematológicas en mujeres embarazadas.

Materiales y métodos:
Este estudio fue una observación descriptiva de laboratorio con un total de 128 muestras. Las muestras se utilizaron con base en el método de muestreo por conglomerados y multiplicando los resultados del cálculo. La prevalencia de anemia en mujeres embarazadas fue del 77,3 % (n = 99) según el examen del nivel de hemoglobina.

Resultados:
Los resultados mostraron que el nivel de anemia más común fue leve (64,6%; n = 64), seguido de moderado (35,4%; n = 35), y con base en el valor del índice eritrocitario, 41,4% (n = 41) de las pacientes gestantes presentaron anemia normocítica normocrómica con disminución de los niveles de hemoglobina.

Conclusión:
Por lo tanto, se recomienda que las mujeres embarazadas tomen con frecuencia vitaminas para aumentar la sangre y consuman alimentos nutritivos para prevenir la anemia.

GILTZA-HITZAK

Anemia.
Eritrozitoen indizearen balioa.
Haurdun dauden emakumeak.

Haurdun dauden emakumeen anemia duten pazienteen prebalentzia, eritrozito-indizearen balioaren arabera

Anemia munduko osasun publikoko arazo bat da, eta eritrozitoetako zeluletan hemoglobina-mailak jaitsi egiten dira, eta horrek pertsona baten behar fisiologikorik eza eragiten du. Pertsona bakoitzaren behar fisiologikoak adinaren, sexuaren eta haurdunaldiaren araberakoak dira. Anemiako eritrozito-indizearen balioak erabakitzen du, neurri handi batean, haurdun dauden emakumeen anemiaren larritasuna eta iraupena. Ikerketaren helburua haurdun dauden emakumeen anemiaren prebalentzia eta ezaugarri hematologikoak zehaztea izan zen.

Materialak eta metodoak:
Azterketa hau laborategiko behaketa deskriptibo bat izan zen, guztira 128 laginekin. Laginak laginketa-metodoan oinarrituta erabili ziren, konglomeratuen bidez, eta kalkuluaren emaitzak biderkatuta. Haurdun dauden emakumeen anemiaren prebalentzia % 77,3koa izan zen (k = 99) hemoglobina-mailaren azterketaren arabera.

Emaitzak:
Emaitzek erakutsi zuten anemia-maila ohikoena arina izan zela (% 64,6; n = 64), eta, ondoren, moderatua (% 35,4; n = 35), eta indize eritrozitarioaren balioan oinarrituta, paziente haurdunen % 41,4k (n = 41) hemoglobina-mailak murriztuta zituen normokritika normokromikoa izan zuten.

Ondorioa:
Beraz, haurdun dauden emakumeek maiz bitaminak hartzea gomendatzen da odola handitzeko eta elikagai nutritiboak kontsumitzea anemia prebenitzeko.

Introduction

Anemia is defined as decreased number of hemoglobin in erythrocyte cells. This inadequate hemoglobin level does not suffice the needs of the body. These physiological needs differ for each person based on age, sex, height of residence from above the sea, and pregnancy[1]. Anemia is currently a global public health problem[2] with its prevalence reaches more than 30% or about 2 billion people worldwide[3]. In 2013, there was a 21.7% increase of anemia cases in Indonesia[2]. The need for oxygen is increased during pregnancy, triggering an increase in erythropoietin production. Therefore, plasma volume and erythrocytes increase to fulfill the body's needs. However, the increase in plasma volume happens in a huge number compared to the increase of erythrocytes, which causes a reduction in hemoglobin concentration due to hemodilution. The plasma volume expansion causes pregnancy-related physiological anemia, which is frequently found in medical issues[4].

In 2018, the prevalence of anemia in pregnant women increased by 48.9%[5]. Currently, the government is focused on reducing the maternal mortality rate (MMR) caused by anemia. In Asia, 12.8% of maternal deaths during pregnancy and childbirth are due to anemia. MMR measures the health status of mothers in an area. The MMR is 359 per 100,000 live births; however, based on the Indonesian Demographic and Health Survey (2012), the target, as per the Millennium Development Goals, should be 102 per 100,000 live births. The highest percentage of maternal death is 28%. Anemia and chronic energy deficiency are significant causes of bleeding in pregnant women. Early diagnosis is needed to manage patients with anemia and monitor mortality and morbidity. Establishing an anemia diagnosis requires laboratory tests to confirm the diagnosis[6].

Anemia can be diagnosed using anamnesis, physical examination, and laboratory testing. The laboratory testing parameters used to identify anemia patients include routine blood tests to determine hemoglobin concentration, packed cell volume (PCV), leukocytes, and thrombocytes. Also, an erythrocyte index examination using the mean cell volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC)[7]. Other supporting laboratory measurements include reticulocyte, red cell distribution width (RDW), edge-blood morphology saturation, and an iron status check (iron serum, total iron binding capacity, transferrin saturation, free erythrocyte protoporphyrin (FEP), and serum ferritin).

The erythrocyte index is a hematological metric that identifies the type of anemia. Hemoglobin levels measure erythrocyte index values, the number of erythrocytes, and hematocrit. Patients with hypochromic microcytic anemia have decreased MCV, MCH, and MCHC values. The erythrocyte index increases in a patient with macrocytic anemia. For prolonged or severe anemia, the new MCHC value decreases. On the other hand, if someone has macrocytic anemia, their erythrocyte index value will rise. The new MCHC value will decrease if the anemia has been ongoing or severe. The change in the erythrocyte index level is related to the severity and duration of anemia[8]. Therefore, confirming the erythrocyte index in pregnant women is necessary. This study aims to determine the prevalence of anemia in pregnant women using the erythrocyte index value.

Methodology

This study was a descriptive laboratory observation conducted from June to October 2019, with the population of pregnant women who were examined in Rumah Sakit Bersalin Ibu dan Anak Pertiwi dan Fatimah and Mamajang Health Center. The patients have agreed with the informed consent. The Ethical Review Committee of Politeknik Kesehatan Kementerian Kesehatan, Makassar approved this study protocol (No. 380/KEPK-PTKMKS/III/2021).

The sample was taken using the cluster sampling technique with a sample size of 128 patients. This study starts with screening, which entails collecting personal information from research participants who are willing to participate by completing and signing written informed consent agreements—then by interviewing the participant by utilizing questionnaires. The erythrocyte index consists of hemoglobin levels and MCV, MCH, and MCHC values of pregnant women. This study used Ethylenediaminetetraacetic acid (EDTA) tubes, tourniquet, 70% alcohol, holders, BD Flashback, cotton dry, OK-Plash, personal protective equipment, and Sysmex XS 500i Hematology Analyzer.

A 3 ml blood sample was obtained through a vein vessel and placed into an EDTA tube. Blood sample evaluation was conducted to measure the hemoglobin levels and MCV, MCH, and MCHC values using the Sysmex XS 500i Hematology Analyzer in the Clinical Pathology Laboratory, Politeknik Kesehatan Kementerian Kesehatan, Makassar.

Based on the hemoglobin levels in pregnant women, anemia is categorized as mild when the level is between 10 and 11.9 g/dL, moderate when it is between 7 and 9.9 g/dL, and severe when it is below 7 g/dL. The categorization of anemic patients with low erythrocyte index values in pregnant women has the average MCV values of 80–100 fL, MCH values of 26–34 pg, and MCHC values of 32–36%. Microcytic anemia is diagnosed when the hemoglobin level, MCV value, and MCH value are all low, while normocytic anemia has low hemoglobin levels and increased MCV, MCH, and MCHC values within normal limits 1. Descriptive data were presented in frequency and percentage distributions, while numerical data were presented as averages. Data analysis was performed using SPSS version[22].

Tabla I
Anemia Distribution in Pregnant Women Based on Hemoglobin Levels.

Category	Frequency	(%)
Without anemia	29	22.7%
With anemia	99	77.3%
Total	128	1
Anemia Category Based on Hemoglobin Levels		
Mild anemia	64	64.6%
Moderate anemia	35	35.4%
Severe anemia	0	0
Total	99	1

*Source: Primary data, 2019

Tabla II
Anemia Classification in Pregnant Women Based on Erythrocyte Index Value.

Category	Frequency	%
Without anemia	29	22.7%
With anemia	99	77.3%
Total	128	1
Anemia Classification Based on Erythrocyte Index Value		
Normochromic normocytic anemia	41	41.4%
Hypochromic normocytic anemia	4	0,04
Normochromic microcytic anemia	20	20.2%
Hypochromic microcytic anemia	34	34.4%
Total	99	1

*Source: Primary data, 2019

Results
As shown in Table I, based on their hemoglobin levels, 29 (22.7%) pregnant women do not have anemia, and 99 (77.3%) have anemia. These expectant mothers are then categorized into three anemia levels according to their hemoglobin levels. The findings revealed that no women had severe anemia, while the majority included mild anemia with 64.6%. While table II below shows the anemia level determined by the erythrocyte index value. As shown in Table II, it is found that 29 (22.7%) pregnant women do not have anemia, and 99 (77.3%) have anemia. Normochromic normocytic anemia dominated the anemia classification based on the erythrocyte index value with 41 pregnant women.

Discussion
Hemoglobin level of below 11 g/dL causes anemia in pregnant women, and this can occur in every pregnant woman. Pregnancy-related anemia is brought by an excessive growth in plasma volume and red blood cells, which results in hemodilution, also known as physiological anemia. Physiological anemia may lower erythrocyte, hematocrit, and hemoglobin levels[9]. Low hemoglobin and erythrocyte index (MCV, MCH, and MCHC values) might develop in pregnant women with iron deficiency anemia. Iron deficiency is a typical physiological state that occurs in pregnant women, characterized by a drop in iron concentration in the body, both in storage and circulation, as well as in the form of heme bonds, which can cause a decrease in erythrocyte concentration[10]. Every pregnant woman may experience anemia. It has the potential to affect the continuity of the pregnancy (immature or premature labor), the delivery process

(inertia, atony, extended work, atonic hemorrhage), disorders during the puerperium (sub involution of the uterus), and disorders of the fetus (occurrence of newborns with low birth weight (LBW), miscarriage (abortion), and perinatal mortality. Pregnant women need to recognize symptoms of anemia such as fatigue, frequent dizziness, dizzy eyes, malaise, tongue sores, decreased appetite or anorexia, concentration loss, breath shortness (in severe anemia), nausea disturbance, and vomiting[11,12].

This study found that from 99 pregnant mother with anemia, 64 mothers have mild anemia, and the rest of 35 mothers have moderate anemia, whereas none of the mother is included in severe anemia. This was supported by Gebre & Mulugeta[13]; Melku et al.[14]; and Valentri et al.[15] who also found that most of the pregnant women is having mild anemia. Different anemia rates can be attributed to socioeconomic status, educational attainment, and geographic conditions in each area and nation. Different hemoglobin measurement techniques and different cut off points might also contribute to these differences[16]. Moreover, the highest percentage of mild anemia also seen in Mirong and Anggaraeningsih[17] for 93.3% than the moderate anemia (6.7%).

This study also showed that the classification of anemia based on the erythrocyte index is dominated by normochromic normocytic anemia for 41.4%, while the lowest erythrocyte index value is in hypochromic normocytic anemia for 4%. The results supported by Sari et al.[11] that most pregnant mothers experienced normochromic normocytic anemia. Normochromic normocytic anemia is the reduction of the total of erythrocytes without transforming the hemoglobin concentration, form, and erythrocyte size. The color and size of erythrocyte cells are in average condition with decreased hemoglobin concentration. This condition can be caused by the initial phase of iron deficiency, anemia, kidney failure, and suppression of bone marrow due to chemotherapy. On the other hand, microcytic anemia is a condition in which the erythrocyte cell size is smaller than usual (microcytic) and the hemoglobin concentrations are fewer than usual. Microcytic anemia is often caused by the iron deficiency and chronic anemia disease, thalasemia, lead poisoning, and sideroblastic anemia[18].

The most common type of anemia in pregnant women causes iron deficiency[21]. During pregnancy, the total iron demand is much higher than in non-pregnant women[22].

This is due to a rise in plasma volume in pregnant women, which seeks to fulfill the demands of the mother and the baby, however this increased plasma volume will result in an increase in the pregnant woman's need for iron. This study found that 61.5% of pregnant women have low levels of iron levels in the Public Health Center, Manado, Indonesia. This finding is similar to research in Malaysia, where 81.3% of pregnant women have anemia. Pregnant women need high iron nutrition (1000 mg iron) for the daily need of mothers and babies. The need for iron during pregnancy is 1000-1200mg[23,24.] However, the iron content of diet is insufficient to meet the demands of a pregnant woman with anemia[25]. Iron supplements are crucial for pregnant women[26]. If the pregnant woman's body does not have enough iron levels, she will show clinical symptoms of iron deficiency anemia. Moreover, iron loss during and after childbirth is a serious risk for pregnant women[1]. However, taking iron supplements as a preventative strategy for pregnant women with normal iron levels will not give any postive effects on health[26]. They can consume adequate iron through food instead. Therefore, pregnant women have a high risk of anemia if they do not fulfill their iron needs.

The study limitations are as follows: (1) pregnant anemia patients were not categorized based on the trimester of pregnancy, and (2) anemia caused by chronic disease, thalassemia, sideroblastic anemia, kidney disease, aplastic anemia, nutritional conditions, and chemotherapy were included in this study.

Conclusion

Based on hemoglobin level evaluation, mild anemia is the most common type of anemia in pregnant women, followed by moderate anemia, and mostly, pregnant women had normochromic normocytic anemia. To minimize the cases of anemia, counseling for pregnant women should be conducted by the Department of Health and Public Health Services to increase nutrition consumption awareness during pregnancy.

References

1. Wirahartari LM, Herawati S, Wande IN. Gambaran Indeks Eritrosit Anemia pada Ibu Hamil Di RSUP Sanglah Denpasar Tahun 2016. E-Jurnal Med Udayana. 2019;8(5).
2. Sriningrat GAA, Yuliyatni PCD, Ani LS. Prevalensi Anemia pada Remaja Putri Di Kota Denpasar. E-Jurnal Med Udayana. 2019;8(2).
3. Chairunnisa O, Nuryanto N, Probosari E. Perbedaan Kadar Hemoglobin pada Santriwati dengan Puasa Daud, Ngrowot, dan Tidak Berpuasa Di Pondok Pesantren Temanggung Jawa Tengah. J Nutr Coll. 2019;8(2):58-64.
4. Sikoway S, Mewo Y, Assa Y. Gambaran Kadar Hemoglobin pada Ibu Hamil Trimester III di Rumah Sakit Robert Wolter Mongisidi Manado. Med Scope J. 2020;1(2). doi:10.35790/msj.1.2.2020.28004
5. Riskesdas. Laporan Hasil Riset Kesehatan Dasar. Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI.
6. Anggraini DD, Purnomo W, Trijanto B. Interaksi Ibu Hamil dengan Tenaga Kesehatan dan Pengaruhnya Terhadap Kepatuhan Ibu Hamil Mengon-

sumsi Tablet Besi (Fe) dan Anemia Di Puskesmas Kota Wilayah Selatan Kota Kediri. Bul Penelit Sist Kesehat. 2018;21(2):82-89. doi:10.22435/hsr.v21i2.346.82-89
7. Amalia A, Tjiptaningrum A. Diagnosis dan Tatalaksana Anemia Defisiensi Besi. Major J. 2016;5(5):166-169.
8. Ikawati K, Rokhana R. Pengaruh Buah Bit (Beta Vulgaris) terhadap Indek Eritrosit pada Remaja Putri dengan Anemia. J Nurs Public Heal. 2018;6(2):60-66. doi:10.37676/jnph.v6i2.659
9. Vricella LK. Emerging understanding and measurement of plasma volume expansion in pregnancy. Am J Clin Nutr. 2017;106(Supplement 6):1620S-1625S. doi:10.3945/ajcn.117.155903
10. Istiqomah N, Umarghanies SS, Fatmawati A, et al. Polimorfisme gen ferroportin (FPN)-1355 G/C sebagai faktor risiko anemia defisiensi besi pada ibu hamil. J Gizi Klin Indones. 2013;9(4):162-169.
11. Sari BK, Sasongkowati R, Anggraini AD. Insidensi Anemia pada Ibu Hamil Di Puskesmas Bangilan Kabupaten Tuban. E-Journal Anal Kesehat Sains. 2019;8(1):683-690.
12. Camaschella C. Iron-Deficiency Anemia. Longo DL, ed. N Engl J Med. 2015;372(19):1832-1843. doi:10.1056/NEJMra1401038
13. Gebre A, Mulugeta A. Prevalence of Anemia and Associated Factors among Pregnant Women in North Western Zone of Tigray, Northern Ethiopia: A Cross-Sectional Study. J Nutr Metab. 2015;2015:1-7. doi:10.1155/2015/165430
14. Melku M, Addis Z, Alem M, Enawgaw B. Prevalence and Predictors of Maternal Anemia during Pregnancy in Gondar, Northwest Ethiopia: An Institutional Based Cross-Sectional Study. Anemia. 2014;2014(2):1-9. doi:10.1155/2014/108593
15. Valentri R, Hertati D, Angelina NK. Karakteristik ibu hamil dengan anemia di puskesmas Panarung Kota Palangkaraya. Akad Kebidanan Betang Asi Raya. 2015;1:1-10.
16. Noronha JA, Khasawneh E Al, Seshan V, Ramasubramaniam S, Raman S. Anemia in Pregnancy—Consequences and Challenges: A Review of Literature. J South Asian Fed Obstet Gynaecol. 2012;4(1):64-70. doi:10.5005/jp-journals-10006-1177
17. Mirong ID, Anggaraeningsih NLMDP. Hubungan Anemia Pada Ibu Hamil Aterm Dengan Berat Lahir Plasenta Dan Berat Lahir Bayi Di Rsu Kota Kupang Tahun 2014. Midwifery Med J. 2014;1(1):8-14.
18. Muncie JR HL, Campbell JS. Alpha and Beta Thalassemia. Am Fam Physician. 2009;80(4):339-344.
19. Bain BJ. Buku Hematologi Kurikulum Inti. Penerbit Buku Kedokteran EGC; 2014.
20. Saputra L. Buku Saku Harrison Hematologi Dan Onkologi. Karisma Publishing Group; 2013.
21. Garzon S, Cacciato PM, Certelli C, Salvaggio C, Magliarditi M, Rizzo G. Iron Deficiency Anemia in Pregnancy: Novel Approaches for an Old Problem. Oman Med J. 2020;35(5):e166. doi:10.5001/omj.2020.108
22. Parisi F, Berti C, Mandò C, Martinelli A, Mazzali C, Cetin I. Effects of different regimens of iron prophylaxis on maternal iron status and pregnancy outcome: a randomized control trial. J Matern Neonatal Med. 2017;30(15):1787-1792. doi:10.1080/14767058.2016.1224841
23. Fisher AL, Nemeth E. Iron homeostasis during pregnancy. Am J Clin Nutr. 2017;106(Supplement 6):1567S-1574S. doi:10.3945/ajcn.117.155812
24. Milman N, Taylor CL, Merkel J, Brannon PM. Iron status in pregnant women and women of reproductive age in Europe. Am J Clin Nutr. 2017;106(Supplement 6):1655S-1662S. doi:10.3945/ajcn.117.156000
25. Hidayatunnikmah N. Level of education, knowledge of pregnant women regarding iron tablets to compliance with their consumption. J Kesehat LLDikti Wil 1. 2021;1(1):15–21.
26. Peña-Rosas JP, De-Regil LM, Garcia-Casal MN, Dowswell T. Daily oral iron supplementation during pregnancy. Cochrane Database Syst Rev. 2015;2015(7). doi:10.1002/14651858.CD004736.pub5.