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Hemoglobin Levels in the First and Third Trimesters of Pregnancy: A Comparison between Indigenous Papuan and Non-Indigenous Papuan Women

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ABSTRACT

Hemoglobin (Hb) is a component of red blood cells that functions to transport oxygen throughout the body. Decreased hemoglobin levels cause anemia. The World Health Organization (WHO) recommends that ideal Hb levels are ≥11 gr/dL. Various factors such as ethnicity, environmental conditions, age, culture, parity, nutritional value, and socioeconomic status can affect the occurrence of anemia during pregnancy. The purpose of this study was to determine the comparison of Hb levels in pregnant women in the first and third trimesters, both in indigenous Papuans (OAP) and non-OAP. This type of research is quantitative analytic with a comparative research design. The population in this study were 290 pregnant women who came and underwent examinations at the Malawili Health Center. The number of pregnant women in this study was 36 people. The sampling technique used was purposive sampling. The results showed no significant difference ($p > 0.05$) in hemoglobin levels in pregnant women in the first and third trimesters in the OAP and Non-OAP categories. The average hemoglobin level of pregnant women in the first trimester who were anemic and not anemic was 11,076 and in the third trimester it was 10,850. The results of the study showed that the incidence of anemia was more common in pregnant women in the third trimester who did not receive iron and folic acid supplementation (non-OAP) due to lack of knowledge about the preparations needed during pregnancy. It is recommended to increase the role of health workers in providing information to pregnant women in order to reduce the incidence of anemia in pregnant women.

Key Message:
This study investigated whether there were significant differences in hemoglobin levels among groups of pregnant women based on trimester of pregnancy and ethnic group (OAP vs. Non-OAP). Hemoglobin levels are important indicators of maternal health, and comparing them can help understand whether ethnicity and trimester of pregnancy affect maternal hemoglobin status and improve health services at Malawili Public Health Centers.

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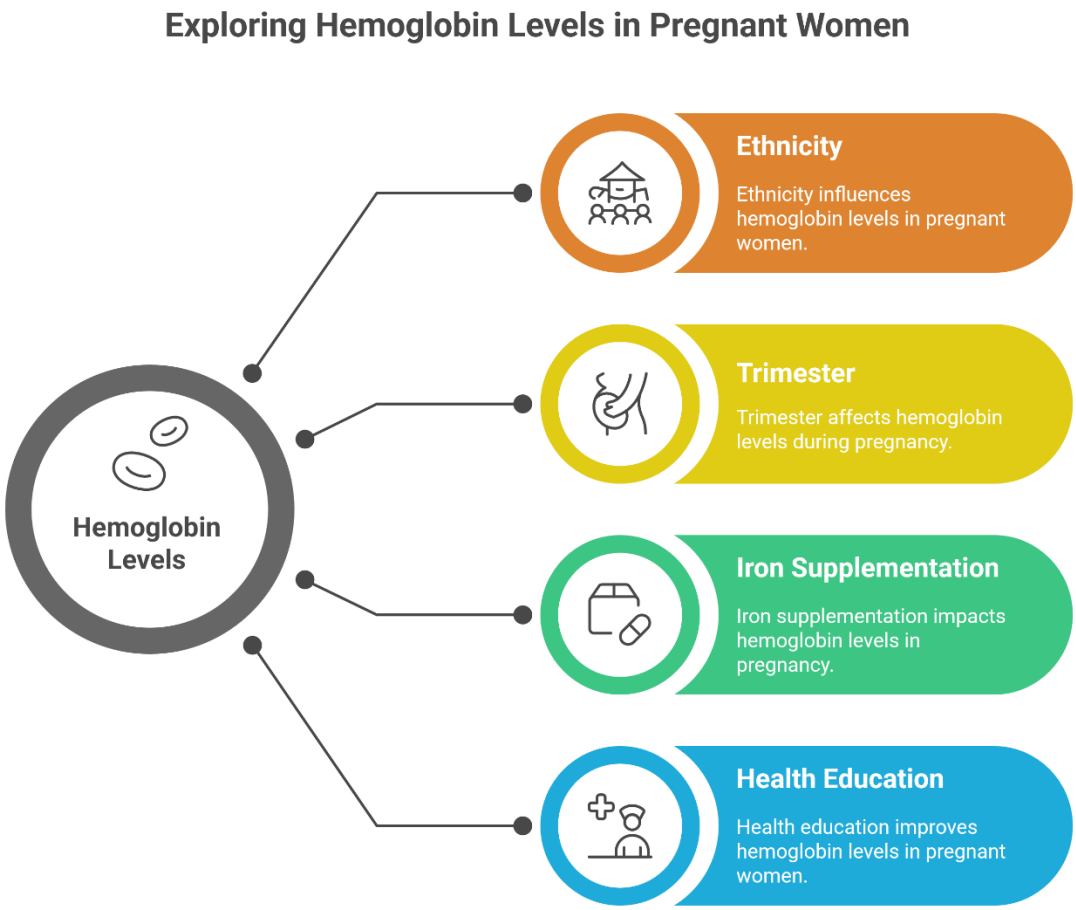
GRAPHICAL ABSTRACT



INTRODUCTION

Pregnancy is a physiological condition that occurs when fertilization between sperm and ovum takes place, leading to the development of an embryo. Pregnancy is divided into three trimesters, each lasting approximately three months. During this period, women are generally vulnerable to various nutritional deficiencies, one of the most common being anemia(1,2). Anemia during pregnancy is primarily caused by insufficient intake of iron (Fe), a vital nutrient needed for hemoglobin synthesis. In the first trimester, symptoms such as nausea, vomiting, and loss of appetite often hinder pregnant women from fulfilling their nutritional needs, including the regular intake of iron supplements (3,4).

Hemoglobin (Hb), a component of red blood cells, is synthesized from iron and protein and plays a critical role in transporting oxygen throughout the body. A deficiency in iron during pregnancy reduces hemoglobin levels, thereby increasing the risk of maternal and fetal complications (5). A study on the behavior of pregnant, laboring, and postpartum women in maternal healthcare practices revealed that cultural factors significantly influence dietary and health-seeking behaviors (6). In many communities, food consumption patterns during pregnancy are not markedly different from daily diets, which mainly consist of cassava, sago, and vegetables (7). The use of modern medicine remains limited due to mistrust toward healthcare services, while traditional remedies are also rarely used. Additionally, pregnant women continue performing heavy physical activities such as farming and hunting, even until the time of delivery. Cultural beliefs, including dietary taboos and restrictions on certain activities (e.g., pregnant women going to the sea), persist and are believed to affect pregnancy outcomes (8).

These culturally influenced practices may contribute to poor maternal nutrition and reduced hemoglobin levels during pregnancy. However, it remains unclear whether these effects differ between older adult pregnant women (OAP) and younger or non-OAP groups, especially in communities where such cultural norms are strongly upheld. Given this context, a comparative analysis between OAP and Non-OAP

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groups is essential to understand whether age interacts with cultural practices to influence hemoglobin levels and anemia prevalence.

The objective of this study is twofold: first, to contrast the hemoglobin levels of OAP and Non-OAP pregnant women, and second, to assess the impact of cultural traditions on their nutritional status and risk for anemia.

METHOD

The type of research used is quantitative analysis with a comparative research design. This research was conducted in the laboratory of the Malawili Aimas Health Center, Sorong Regency from June 20 to July 2, 2024. The population in this study were 290 pregnant women who underwent examination at the Malawili Health Center. The sample size of this study was obtained using the *Slovin formula* , so that the number of samples was 36 pregnant women. The sampling technique was carried out by purposive sampling, namely the selection of samples based on certain considerations.

Data collection from respondents was carried out directly to patients and through the health center. Data collection was conducted through direct interviews with respondents, and the information was recorded on an observation sheet. The collected variables included initials, age, address, highest level of education, occupation, gestational age, and hemoglobin (Hb) levels. Age was recorded in completed years and later categorized into three groups: under 21 years, 21 to 35 years, and over 35 years, based on reproductive health risk classifications. Educational attainment was categorized according to the highest level of formal education completed: Junior High School (completion of grade 9), Senior High School (completion of grade 12), and College/University (completion of a diploma or undergraduate program). Occupation was classified as “working” if the respondent was engaged in any form of paid employment, whether formal or informal, and “not working” if the respondent was a housewife, student, or unemployed. Gestational age was determined based on self-reported last menstrual period (LMP) and categorized into first trimester (0–13 weeks), second trimester (14–27 weeks), and third trimester (28 weeks or more). Hemoglobin levels were measured by collecting capillary blood from the fingertip, which was then tested using a point-of-care testing (POCT) device (HemoCue Hb 201+, Cat. Number AKD 20207420165, SAM MEDICAL, Bandung, Indonesia). The Hb value was read directly from the device, and anemia was defined as an Hb level of less than 11 g/dL, following WHO criteria.

The results of the study will be presented in the form of a table and processed first in the master table before being analyzed using statistical software. For analysis SPSS Version 26.0 (IBM Corporation, New York, United States) Statistical analysis was conducted using a combination of tests based on the type of data. A two-way ANOVA test with a significance level of $\alpha = 0.05$ was used to examine the interaction effects between trimester of pregnancy and ethnicity on mean hemoglobin (Hb) levels. For comparisons involving categorical variables, such as the proportion of anemia cases across trimesters and between ethnic groups, chi-square tests were applied. Independent t-tests were used when comparing mean Hb levels between two groups. All analyses were performed to ensure alignment with the research objective of comparing anemia status and hemoglobin levels across different trimesters and ethnicities. The interpretation of the results of the examination of hemoglobin levels in pregnant women is as follows: normal levels are 11 gr / dL, while Hb levels < 11 gr / dL indicate that the pregnant woman is anemic.

CODE OF HEALTH ETHICS

Research involving pregnant women as research subjects has been approved by the Health Research Ethics Committee of Haluoleo University, Kendari with registration number 288/KEPK.IAKMI/V/2024.

RESULTS

Based on demographic data obtained from respondents, the majority of pregnant women are in the age range of 21-35 years (77.8%) which reflects the productive age group for pregnancy. Regarding ethnicity, respondents are evenly divided between OAP and Non-OAP, with each reaching 50%. This shows that both ethnicities are equally involved in it. Regarding pregnancy rates, the data shows an even distribution of pregnant women in the First Trimester and Third Trimester, each at 50%. This ensures that

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both stages of pregnancy are well represented. The majority of respondents' highest education level is high school (88.9%), with only a few graduating from junior high school (2.8%) or college (8.3%). This shows that the majority of pregnant women in this study have a secondary education background. Regarding employment, almost all respondents are housewives, covering 91.7% of the total respondents. Only 8.3% work as civil servants (PNS). This reflects the dominant role of housewives among respondents.

Table 1. Frequency Distribution of Respondents

Variables	n	%
Age (Years)		
<21	2	5.60
21- 35	28	77.80
>35	6	16.70
Ethnicity		
OAP	18	50
Non OAP	18	50
Age Pregnancy		
Trimester I	18	50
Trimester III	18	50
Education		
Junior High School	1	2.80
Senior High School	32	88.90
College	3	8.30
Work		
Housewife	33	91.70
Civil servant	3	8.30
Total	**36**	**100**

Table 2. Results Level Hemoglobin in Mother Pregnant Trimester I & III Category OAP and Non-OAP.

	Normal		Anemia		Total		p
	n	%	n	%	N	%	
Trimester I							
OAP	6	66.7	3	33.3	9	50	0.424
Non OAP	8	88.9	1	11.1	9	50	
Total	14	66.7	4	33.3	18	100	
Trimester III							
OAP	6	66.7	4	33.3	10	55.55	0.021
Non OAP	3	44.4	5	55.6	8	44.45	
Total	9	50	9	50	18	100	

In table 2. Based on the analysis of the relationship between ethnicity (OAP and Non-OAP) with hemoglobin levels (normal or anemia) in pregnant women in the first trimester, it was found that the OAP group had 66.7% of respondents with normal hemoglobin levels, while 33.3% had anemia. In the Non-OAP group, 88.9% had normal hemoglobin levels, while only 11.1% had anemia. However, the results of the statistical test showed a significance value ($p = 0.424$) which was greater than the significance level ($p > 0.05$). Therefore, it can be concluded that there is no significant difference between ethnicity and hemoglobin levels in pregnant women in the first trimester. Although there is a difference in percentage between AOP and Non-AOP, it is not statistically strong enough to show the influence of ethnicity on hemoglobin levels. Based on the analysis of the relationship between ethnicity and hemoglobin levels in pregnant women in the third trimester, there was a significant difference between the OAP and Non-OAP groups. In general, in the elderly group, 66.7% had normal hemoglobin levels, while 33.3% had anemia. On the other hand, in the Non-OAP group, 44.4% had normal hemoglobin levels, but more had anemia, namely 55.6%. The results of the statistical test showed a significance value ($p = 0.021$) which was smaller than the significance level ($p < 0.05$), so it can be concluded that ethnicity has a significant effect on hemoglobin levels in pregnant women in the third trimester. Non-elderly adults tend to have a higher risk of experiencing anemia compared to elderly adults.

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DISCUSSION

Based on the study results, there was no significant difference in hemoglobin levels between pregnant women in the first and third trimesters, both among OAP (Indigenous Papuans) and Non-OAP groups. This finding aligns with previous research (9), which reported anemia prevalence of 20% in the first trimester, increasing sharply to 70% in the second trimester and remaining high in the third trimester. This trend is explained by the increased iron requirements in pregnancy: blood volume expands by approximately 35% in the second and third trimesters, requiring an additional 450 mg of iron to produce red blood cells that transport oxygen to the fetus. During delivery, an additional 300–350 mg of iron is lost due to blood loss. Overall, pregnant women need around 40 mg of iron daily, which is twice the amount required by non-pregnant women (10). Pregnant women should regularly consume calcium supplements and iron tablets to meet their iron and calcium needs, which can help prevent anemia (11).

Our findings also support a previous study Surya AF (2020) (12) involving 60 respondents, which found no significant difference in hemoglobin levels across trimesters. Furthermore, ethnic differences did not significantly affect hemoglobin levels during pregnancy in this study. This may be due to social and cultural assimilation that reduces dietary pattern diversity across ethnic groups. Additionally, education and income levels influence health behaviors such as adherence to antenatal care (ANC) visits and iron supplementation (13,14) (15). These findings are consistent with research by Masruroh N (2020) (16), which found no significant hemoglobin differences among different religions and ethnicities.

However, a notable observation emerged in the third trimester: Non-OAP pregnant women exhibited a higher prevalence of anemia compared to their OAP counterparts. Although no difference was detected in the first trimester, the disparity became evident by the third trimester. This suggests that factors influencing anemia risk become more pronounced as pregnancy progresses. One possible explanation is differences in adherence to antenatal care recommendations, access to supplementation programs, or specific dietary habits among Non-OAP women in the Malawili Health Center's catchment area. Ethnic disparities in hemoglobin concentration decreases among pregnant women, highlighting the influence of socio-cultural factors on anemia risk (17,18).

Our data also indicate that many anemic Non-OAP pregnant women fall outside the ideal reproductive age range of 21 to 35 years. Women within this age range tend to have optimal reproductive, emotional, and social maturity(19). Pregnancies before age 20 may carry higher risk due to ongoing maternal growth, which compromises nutrient availability for fetal development (20). Conversely, pregnancies after age 35 are associated with diminished immune function and increased risk of health complications (21).

This study has several limitations. First, the relatively small sample size (n=36) limits the generalizability of the findings. Second, purposive sampling introduces potential selection bias due to the non-randomized sample selection. Third, hemoglobin measurements were conducted using a point-of-care testing (POCT) device without laboratory confirmation, which may affect measurement accuracy. Finally, the cross-sectional design means that different women were sampled at each trimester rather than following the same cohort longitudinally, limiting the ability to observe individual changes in hemoglobin levels over time.

CONCLUSION

The conclusion of this study is that there is no significant difference in hemoglobin levels between pregnant women in the first trimester, but a significant difference is observed in the third trimester between OAP and Non-OAP groups in the Malawili Health Center work area. Anemia prevalence is higher among pregnant women in the third trimester within the Non-OAP category. This finding may be influenced by factors such as varying levels of knowledge about pregnancy programs, differences in health behaviors, and potentially the age of the mother at pregnancy, although further investigation is needed to confirm these associations. Some pregnant women were also noted to become pregnant again shortly after a miscarriage without prior consultation with health professionals, which could contribute to health risks.

Based on these findings, it is recommended that pregnant women be encouraged to regularly monitor

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their hemoglobin levels and receive targeted education on the importance of antenatal care and nutrition. Education should also consider cultural practices during pregnancy to effectively address anemia risk and promote maternal and fetal health, particularly focusing on the specific needs of the Non-OAP group in the later stages of pregnancy.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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