JKKI: Jurnal Kedokteran dan Kesehatan Indonesia
Indonesian Journal of Medicine and Health
Journal homepage: https://journal.uii.ac.id/JKKI
P-ISSN 2085-4145 | E-ISSN 2527-2950

Anemia in young pregnant women: A cross-sectional study in Indonesia

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Original Article

ARTICLE INFO

Keywords:
anemia,
determinants,
Indonesia,
pregnancy,
young pregnant women

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DOI: 10.20885/JKKI.Vol15.Iss2.art3

History:
Received: February 21, 2024
Accepted: August 23, 2024
Online: August 27, 2024

ABSTRACT

Background: The prevalence of anemia among pregnant women in Indonesian remains high at 48.9%, with the highest rates observed among young mothers aged 15-24 years. Anemia is associated with adverse outcomes for both mothers and their children. Understanding the determinants of anemia in young mothers is crucial for taking preventive measures. However, there are currently no national studies in Indonesia on the prevalence and risk factors of anemia in pregnant women aged 15 to 24 years.

Objective: To measure the prevalence and factors associated with anemia in young pregnant women in Indonesia.

Methods: This cross-sectional study utilized on secondary data from the 2018 Basic Health Research (*Riset Kesehatan Dasar= Riskesdas*). The subject of this research were pregnant women aged 15 to 24 years who participated in *Riskesdas* 2018 and had independent variables data including hemoglobin measurement data, age, education, residence, occupation, travel time to health facilities, age at first pregnancy, ownership of the maternal and child health (MCH) handbook, history of previous abortion, gestational age, number of iron supplement tablets, supplementary feeding, and chronic energy deficiency. Univariate analysis was conducted to analyse the subject characteristics and hemoglobin data, while chi-square and logistic regression were used to determine factors associated with anemia in young pregnant women

Results: The study found that 36.2% of young pregnant women had anemia. The incidence of anemia was associated with gestational age but not with other factors. Pregnancy in the first trimester poses the highest risk compared to other trimesters (cOR=3.89; 95%CI:1.47-10.30; p=0.006), as confirmed by multivariate analysis (aOR=4.44; 95%CI: 1.41-13.95; p=0.01).

Conclusion: Anemia affects 36.2% of pregnant women aged 15 to 24 years in Indonesia. The risk of anemia in young pregnant women is significantly associated with gestational age with the first trimester being the most critical period.

INTRODUCTION

The prevalence of ealry marriage in poor and developing countries, including Indonesia, remains relatively high. Approximately 21 million adolescents were pregnant in 2019, with half of these pregnancies being unwanted.[1] Several factors are associated with early marriage, including education and gender inequality. Unintended pregnancies also increase the likelihood of early marriage. Emotionally immature adolescents often have limited knowledge of reproductive health and contraception, and some may become sexually active without understanding the associated risks.[2,3]

Marriage and pregnancy in young women, especially in a patriarchal culture and gender disparity, can make women vulnerable. This vulnerability increases morbidity and mortality rates amon mothers and their children, including a heightened risk of anemia during pregnancy.[4] Anemia is among the most common forms of malnutrition in pregnant women,characterized by low hemoglobin levels (hemoglobin of < 11 g/dl). Anemia in women of reproductive age (15-49 years) is a major health issue and serves as an indicator of progress toward the Sustainable Development Goals (SDGs). An analysis of data from 197 nations reveals that approximately 36% of pregnant women are anemic.[5] Based on the prevalence of anemia, Indonesia is at a moderate level, with 22.3% of women of reproductive age affected.[4,6] Meanwhile, the 2018 *Riskesdas* results showed that 48.9% of Indonesian pregnant women experienced anemia.[7,8]

Teenage pregnant women are more sensitive to a various pregnancy-related issues, including anemia. The highest incidence of anemia in pregnancy in Indonesia is among pregnant women aged 15-24 years.[7,8] These young women require nourishment not only to sustain their growth and development as teenagers but also to support the growth and development of their fetuses. Several studies have shown that anemia in pregnancy is closely associated with an increased risk of poor outcomes for both mothers and children, such as uterine atony, bleeding, fetal growth failure, prematurity, stillbirth, low birth weight, and prolonged stage II of labor. These risks are higher in young pregnant women.[9] Young pregnant women are also likely to face psychological issues due to their unpreparedness for parenthood, as well as financial issues. Pregnancy at a young age has a wide-ranging impact on their lives, particularly their education, health, career, and financial prospects. They are at risk of being unable to complete their education, which decreases their opportunities to attain better positions with higher earnings, affecting their capacity and access to health services and purchasing power to satisfy their nutritional needs.[10] This impact on access to health services further worsen pregnancy outcomes.

Given that young pregnant women are still in the process of growing and developing, treating anemia during pregnancy has been shown to have a positive impact not only on the fetus's health and development but also on the mother's health and cognitive function.[11,12] Despite several efforts, anemia in pregnancy in Indonesia has yet to be addressed satisfactorily. Information on the factors related to the incidence of anemia in young pregnant women needs to be analyzed to determine appropriate interventions.

Previous research has linked anemia in adolescents to various factors, including mid-upper arm circumference (MUAC) size, menstrual durations,[13,14] meal frequency,[15] inadequate and limited dietary intake, gastrointestinal illnesses, living in rural areas, and body mass index (BMI).[14] Other studies have demonstrated that chronic energy deficiency, parity, iron pill consumption, employment, family income,[16] food intake, frequency of antenatal care (ANC) visits,[17] low levels of education and health knowledge are risk factors for anemia in pregnant women.[8] However, some research shows that anemia in pregnant women is associated with knowledge and gestational age but not with age or socioeconomic status.[18] The frequency and drivers of anemia among young pregnant women in Indonesia remain understudied and are still limited to a small scope. There is currently no published research based on national survey data.

This study aimed to describe the prevalence and factors contributing to anemia in young pregnant women in Indonesia using *Riskesdas* 2018 data. The findings of this study are intended to inform successful approaches to addressing the problem of anemia in young pregnant women.

METHOD

Study design

This was a cross-sectional study using secondary data from the 2018 Indonesian Riskesdas, which was integrated with the March 2018 National Health Survey (*Survei Sosial Ekonomi Nasional=Susenas*) conducted by the Central Bureau of Statistics (*Biro Pusat Statistik=BPS*).

Population and sample

The 2018 Basic Health Research involved participants from 34 provinces in Indonesia. The *Riskesdas*' population consists of all Indonesian households, with a target sample of 300,000 families selected from 30,000 *Susenas* blocks.

The BPS selected samples using the probability proportional to size (PPS) approach with linear systematic sampling and two stages of sampling. Stage 1 entailed the implicit stratification of all census blocks (CB) from the 2010 population census (PC) according to welfare strata. PPS selected 180,000 CB (25%) from the master frame of 720,000 CB from the 2010 PC to serve as the CB selection sampling frame. A census block sample list was produced by selecting a total of n CB using the PPS technique in each urban/rural stratum per district/municipality. The total number of CB picked was 30,000. The second stage involves selecting 10 households in each CB from the results of the systematic sampling update with implicit stratification of the highest education completed by the head of household, to maintain the representativeness of the value of the diversity of household characteristics.

The researcher obtained access to data for this study from the Health Development Policy Agency which can be accessed with certain requirements and procedures through www.badankebijakan.kemkes.go.id. The participants selected for this study were pregnant Indonesian women aged 10 to 24 years who had hemoglobin test results. Unfortunately, not all pregnant women were tested for hemoglobin. Participants under 15 years of age were eliminated from the study due to a lack of hemoglobin level data. Of 2,389 young pregnant women, only 152 (6.36%) had hemoglobin level data. All 152 participants were subsequently selected for this study. The flowchart of the selection of the study subjects is presented in Figure 1.

Data collection

The 2018 *Riskesdas* statistic were gathered

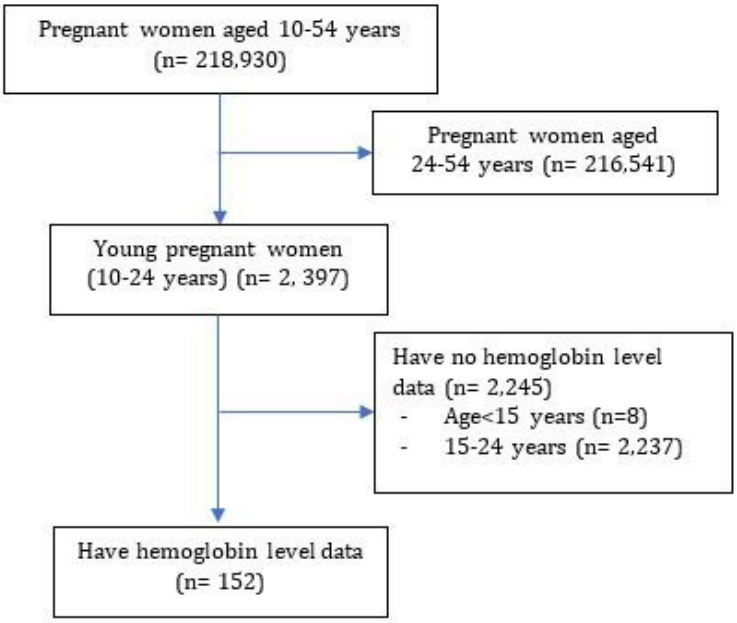

Figure 1: Flowchart of the selection of the subjects

through interviews and measurements. Measurements and inspections at the research settings included hemoglobin levels. Hemoglobin data, the standard for anemia status, was determined by photometric measurement using Hemocue® (California, United States). This measuring method is considered quite valid, with good validity and sensitivity[19], and is commonly used in the field for hemoglobin testing, particularly for anemia screening, due to its simplicity.[20] The device is portable, battery-powered, rechargeable, and does not require a direct connection to a power supply.[21] Before the *Riskesdas* installation, data collectors received graded training on how to use the device and approach. The researchers also calibrated the devices before using them for measurement, partly to reduce bias. The data management process, which includes the collection, submission, analysis, and discussion of the 2018 *Riskesdas* data analysis output, is carried out in stages, ensuring that quality and valid data are produced.[8]

Data analysis

We assessed the data through IBM SPSS Statistic 21 software. The univariate analysis results are presented in the form of frequency distribution tables of subject characteristics, hemoglobin examination results, and anemia incidence. We applied chi-square analysis and binary logistic regression to investigate the association between the independent and dependent variables. The level of significance is indicated as p-value < 0.05.

Anemia became the dependent variable with a hemoglobin level lower than 11 g/dl. The independent variables analyzed included age, education level, place of residence, occupation, travel time to health facilities, ownership of MCH handbook, previous abortion history, gestational age, number of iron supplement tablets, supplementary feeding, and chronic energy deficiency. Age was categorized into under 20 years and 20 years or more. Education level was categorized into low (junior high school graduate or lower) and high (senior high school and above). Based on the place of residence, subjects were categorized into rural and urban area, as used in the 2018 *Riskesdas* questionnaire. The BPS classifies places of residence into rural and urban areas based on population density, economic activity or livelihood, and infrastructure facilities. Maternal occupation was grouped into working and not working. Access to services was assessed by the time to reach the nearest health facility, categorized into more than 30 minutes and 30 minutes or less. Maternal age at first pregnancy was categorized into less than 20 years (15-19 years old) and 20 years or more. The raw Riskesdas data stated gestational age in months, subsequently divided it into three stages: first trimester (first three months), second trimester (second three months), and third trimester (final three months of pregnancy). Iron supplement consumption was categorized into two groups: 60 tablets or less and more than 60 tablets during the whole pregnancy. According to the upper arm circumference, the nutritional status of the mothers was divided into two categories: chronic energy deficiency if the MUAC < 23.5 cm and non-chronic energy deficiency (MUAC > 23.5 cm).

Ethics

We did not apply for the ethical approval independently. However, we obtained permission to use the 2018 Riskesdas data from the Agency for Health Policies Development (AHPD). Riskesdas has received ethical approval from the Health Research and Development Agency of the Ministry of Health of the Republic of Indonesia with the letter LB 02.01/2/KE.267/2017. All participants provided written consent before data collection was carried out.

RESULT

Descriptive analysis revealed that the study respondents were mainly 20-24 years old (77.6%), had completed high school as their highest level of education (45.4%), lived in rural areas (50.7%), and were not employed. Most participants traveled 30 minutes or less to the nearest health institution. The distribution of variables describing maternal health conditions during pregnancy showed that most had no history of abortion (90.8%), consumed <60 tablets of iron supplements (61.8%), did not receive supplementary food (73.0%), did not experience chronic energy deficiency (72.4%), and had an MCH handbook (79.0%) (Table 1). Data indicated that 55 out of 152 young pregnant women with hemoglobin test data (36.2%) were anemic. The hemoglobin level ranged from 7.0 to 16.8 g/dL; with a mean level was 11.4 g/dL and a standard deviation of 1.6 g/dL.

The bivariate analysis showed that the variables of being 15-19 years old, living in rural areas, being unemployed, traveling more than 30 minutes to health facilities, being younger than 20 years at the time of first pregnanc, taking fewer than 60 iron supplement tablets, receiving supplementary feeding, and experiencing chronic energy deficiency (CED) were associated with the incidence of anemia in young pregnant women but not statistically significant. The variable significantly correlated with anemia in young pregnant women was gestational age. The younger the gestational age, the higher the risk of anemia. Young women in their first-trimester pregnancies were 3.89 times more likely to endure anemia than those in their third-trimester (Table 2).

The multivariate analysis showed that having a junior high school or lower education level, living in rural areas, being unemployed, traveling more than 30 minutes to health facilities, not having an MCH handbook, and having a MUAC of less than 23.5 cm slightly increased the risk of anemia in young pregnancy women. However, these factors

were not statistically significant. The incidence of anemia during pregnancy was strongly associated with gestational age. The younger the gestational age, the higher the risk of anemia in young mothers. Pregnancy in the first trimester was 4.44 times (95% CI: 1.41-13.95) more at risk, while pregnancy in the second trimester was 1.19 times (95% CI: 0.51-2.76) more at risk than in the third trimester (Table 3).

DISCUSSION

This study covered 152 participants because the 2018 *Riskesdas*' data did not include hemoglobin data for all pregnant women aged 15 to 24 years old. About 22.37% of the participants were teenagers. This result is consistent with research indicating that young marriages and pregnancies are frequent in Indonesia. According to *Susenas*' results, 48% of women aged 20-24 years were married or lived together in 2022.[22]

Table 1. Characteristics of the subjects (n=152)

Variable	n	Percent (%)
Age		
15-19 years old	34	22.4
20-24 years old	118	77.6
Level of education		
No education	1	0.7
Not graduated from primary school	3	2.0
Primary school	17	11.2
Junior high school	57	37.5
Senior high school	69	45.4
Diploma	2	1.3
Undergraduate/graduate/postgraduate	3	2.0
Residence		
Rural	77	50.7
Urban	75	49.3
Number of family members		
≤ 4	89	58.6
> 4	63	41.4
Occupation		
Not working	113	74.3
Student	2	1.3
Civil servant/police officer/military personnel/employee of state-owned enterprise	1	0.7
Private sector employee	10	6.6
Self-employed	7	4.6
Farmer	6	3.9
Laborer/driver/domestic helper	4	2.6
Others	9	5.9
Travel time to health facilities		
More than 30 minutes	11	7.2
≤ 30 minutes	141	92.8
Abortion history		
Yes	14	9.2
No	138	90.8

Table 1. Characteristics of the subjects (continued)

Variable	n	Percent (%)
Gestational age		
1st trimester	41	27.0
2nd trimester	57	37.5
3rd trimester	54	35.5
Number of iron tablets taken during pregnancy		
≤ 60 tablets	94	61.8
> 60 tablets	58	38.2
Receiving supplementary food during pregnancy		
Yes	41	27.0
No	111	73.0
Chronic energy deficiency		
Yes	42	27.6
No	110	72.4
MCH handbook ownership		
No	32	21.0
Yes	120	79.0

MCH= Maternal Child Health

Based on National Population and Family Planning Board data, risk factors for births to teenage mothers include being unemployed, residing in rural areas, having a low-income socioeconomic position, and having a history of youthful intercourse.[23] According to Australian research, teenage pregnancy is also linked to childhood sexual and physical assault, as well as domestic violence.[24]

In this study, the total prevalence of anemia among young pregnant women was 36.2%, which was higher than the 22.3% prevalence among women of reproductive age (15-49 years) in 2019.[6] The 15-19 years old age group had a higher prevalence (41.18%) than the 20-24 years age group (34.75%). School-age teenagers had a limited understanding of anemia and poor food consumption behaviors. This is influenced by parents' knowledge and attitudes, as well as their cultural background, particularly in terms of local diets.[25]

This study observed a significant relationship between gestational age and anemia in young Indonesian pregnant mothers. Compared to the second or third trimesters, the first trimester of pregnancy carries the highest risk. This finding differs from the Ghanaian study, which found that the second trimester is more prone to anemia than the first and third trimesters.[26] However, both studies found that the incidence of anemia was lower in the third trimester than in the prior two trimesters. This is likely because, at older gestational ages, pregnant women have received iron supplementation, folic acid, additional food, and pregnancy management compared to women with earlier gestational ages. Other studies have found that iron absorption by the placenta rises with gestational age due to increasing bioavailability in the blood.[27] Hemoglobin levels in the first trimester and 26-30 weeks of gestation are associated with pregnancy outcomes, including low birth weight (LBW), stillbirth, and small gestational age (SGA). The lower the hemoglobin level, the worse the pregnancy outcome.[28]

However, this study showed no correlation between the age groups of pregnant women and the incidence of anemia, although those aged 15-19 years were more at risk of anemia.Thisis similar to the results of another study on adherence to taking iron-folic acid supplements (IFAs) among pregnant women visiting the health facilities in South-east Ethiopia, which showed no difference in the probability of IFAs adherence among the age groups of 15-24 years, 25-34 years, and 35-44 years.[29] However, other studies have found that pregnant women under the age of 20 are at a higher risk than those aged 20 to 35 years.[30] Their immaturity corresponds to their lack of information about prenatal nutrition. Teenagers are not ready to marry or have children and still want to to engage in various activities, such as

Table 2. Bivariate analysis results

Variable	Anemia		p-value	cOR (95%CI)
	Anemia (n=55)	No anemia (n=97)		
Ages				
15-19 years old	14	20	0.492	1.3 (0.60-2.87)
20-24 years old	41	77		1
Level of education				
Junior high school graduate or lower	28	50	0.940	0.98 (0.50-1.89)
High school or higher	27	47		1
Residence				
Rural	30	47	0.470	1.28 (0.66-2.48)
Urban	25	50		1
Occupation				
Not working	41	72	0.966	1.02 (0.48-2.17)
Working	14	25		1
Travel time to health facilities				
More than 30 minutes	4	7	0.990	1.01 (0.28-3.61)
30 minutes or more	51	90		1
Maternal age at first pregnancy				
< 20 years old	27	41	0.416	1.32 (0.68-2.56)
≥ 20 years old	28	56		1
MCH handbook ownership				
No	10	22	0.513	0.76 (0.33-1.74)
Yes	45	75		1
Abortion history				
Yes	3	11	0.228	0.45 (0.12-1.69)
No	52	86		1
Gestational age				
1st trimester	7	34	0.006*	3.89 (1.47-10.30)
2nd trimester	24	33	0.804	1.1 (0.52-2.33)
3rd trimester	24	30		1
Number of iron tablets taken during pregnancy				
≤60 tablets	36	58	0.49	1.27 (0.64-2.54)
>60 tablets	19	39		1
Receiving supplementary food during pregnancy				
Yes	16	25	0.658	1.18 (0.56-2.47)
No	39	72		1
Chronic energy deficiency				
Yes	18	24	0.290	1.48 (0.72-3.06)
No	37	73		1

cOR= Crude Odds ratio; CI= Confidence interval; MCH= Maternal Child Health, *p< 0.05

Table 3: Multivariate analysis of factors associated with anemia in young pregnant women

Variable	Anemia		
	p-value	aOR	95%CI
Ages			
15-19 years old	0.837	0.89	0.31-2.60
20-24 years old			1
Level of education			
Junior high school graduate or lower	0.569	1.27	0.56-2.83
High school or higher			1
Residence			
Rural	0.831	1.09	0.51-1.34
Urban			1
Occupation			
Not working	0.653	1.21	0.52-2.83
Working			1
Travel time to health facilities			
More than 30 minutes	0.608	1.44	0.36-2.02
30 minutes or more			1
Maternal age at first pregnancy			
< 20 years old	0.579	0.77	0.28-2.02
≥ 20 years old			1
MCH handbook ownership			
No	0.829	1.12	0.40-3.19
Yes			1
Abortion history			
Yes	0.355	0.51	0.12-2.13
No			1
Gestational age			
1st trimester	0.010*	4.44	1.41-13.95
2nd trimester	0.685	1.19	0.51-2.76
3rd trimester			1
Number of iron tablets taken during pregnancy			
≤60 tablets	0.644	0.84	0.40-1.77
>60 tablets			1
Receiving supplementary food during pregnancy			
Yes	0.831	0.91	0.51-2.76
No			1
Chronic energy deficiency			
Yes	0.274	1.57	0.70-3.49
No			1

OR= Odds ratio; CI= Confidence interval; MCH= Maternal Child Health; aOR= adjusted Odds Ratio, *p < 0.05

socializing with peers. They also lack the skills to manage family finances and remain dependent on their parents.[31] As a result, pregnant women's health and nutrition are not given priority. Another study of the Indonesian population found that the older the woman, the more likely she was to have four or more antenatal visits.[32] This number is still substantially lower than the World Health Organization (WHO) recommendation of at least eight check-ups during pregnancy.[33] This indicates that many young pregnant women are still unaware of their pregnancy.

According to the data, young pregnant women with lower education levels had a higher risk of anemia than those with higher education. This aligns with the results of research conducted in Nepal.[34] Higher education levels enable mothers to be informed and maintain a healthy lifestyle, including better nutritional intake. They have a better understanding of the numerous sources of nutritious food and how to appropriately prepare them.35 A higher level of education also increases awareness and ability to access health services and antenatal care (ANC) during pregnancy. Mothers with a high education level have an earlier first examination and more complete and regular ANC visits.[36] Furthermore, they are more likely to understand and implement the advice given by health workers during ANC visit. Pregnant women who have their first ANC visit after the first trimester and have incomplete ANC (less than four visits during pregnancy) have a higher risk of anemia.[37] This follows what Fite et al. revealed, in which the level of knowledge about anemia, IFAs, IFAs counseling, and fourth antenatal visit positively correlates with adherence to IFAs.[38] Pregnant women in Sub-Saharan Africa who have knowledge and receive IFAs counselling in pregnancy program have better adherence to IFAs consumption than those who do not have knowledge or do not receive counselling.

Pregnant women in rural areas were slightly more likely to develop anemia than those in urban areas. A study conducted in Brazil found that the frequency of anemia among teenagers was higher in rural regions than in cities, likely due to access to health care.[39] Other studies conducted in Indonesia and the Philippines have identified disparities in ANC utilization between pregnant women in urban and rural areas. Those whose travel time to a health facility was more than 30 minutes were also at a higher risk than those with 30 minutes of travel time or less. Pregnant women in Indonesia who live in cities tend to have more frequent (four or more) ANC visits than those residing in rural areas, likely related to the distance from home to health facilities and the limited transportation facilities available in rural areas. Additionally, women in rural areas have lower incomes than those in urban areas.[32] This low utilization of ANC in rural areas may hinder delivering information and education to the community and in making essential interventions to improve the knowledge and practice of healthy behaviors.

The risk of anemia was slightly higher in the pregnant women without an MCH handbook than in those who did. The MCH handbook is an essential tool for pregnantcontaining various information, including health records or health problems experienced by mothers during pregnancy, childbirth, and postpartum and until the child is five years old. This handbook contains child growth and development records, immunization, nutrition, and family planning. Pregnant women can obtain this handbook from the nearest health worker or health facility. During pregnancy, the MCH handbook is helpful for pregnant women or health workers to monitor the health of the mother and her fetus. The 2016 *Riskesdas* results showed the relationship between MCH handbook ownership and maternal and child health services utilization. Mothers with an MCH handbook utilize health services more frequently than those without it. The MCH handbook is a means of education and a two-way communication tool.[40] Research shows that the MCH handbook can increase knowledge and improve the behaviour of pregnant women's and their families. This handbook also increases the frequency of ANC visits and counselling of pregnant women by midwives.[41]

Furthermore, this study showed that pregnant women who did not work had a slightly higher risk of anemia than working mothers. Working mothers have a self-managed income and the flexibility to obtain information and access health services, affecting their decisions and behaviors, including the choice of food or supplements they consume. Another study discovered that working mothers are more likely to take iron-folic acid supplements than housewives.[29] They have more opportunities to interact with others and are also more likely to seek counseling from health professionals, which

usually requires financing.

In this study, the pregnant women who consumed less than or equal to 60 iron tablets had a slightly lower risk of anemia than those who took more than 60 tablets. A similar study showed that iron tablet administration is not associated with maternal anemia.[8] Another study in Bogor showed that supplementation of biscuits, vermicelli, and milk improves pregnant women's hemoglobin levels, not babies'.[42] Delays at the initial antenatal check-up will delay basic laboratory testing, including hemoglobin, causing delays in both diagnosis and treatment of anemia, including iron supplementation.[43]

Efforts to identify the causes of anemia are significant for appropriate anemia management. The management of anemia caused by infection differs from anemia due to insufficient intake. Physiologically, the need for iron in pregnant women usually increases. The WHO recommends providing iron supplement tablets once daily for three months to pregnant women who are not anemic (Hb > 11 g/dl). For pregnant women with hemoglobin of less than 11 g/dl, iron supplement tablets are given in double doses, which is twice a day for three months.[44] Additionally, counseling pregnant women on food diversification, increasing compliance with iron and folic acid consumption, providing education, and improving women's empowerment is essential to enhance their nutritional status.[45]

Adolescents are a vulnerable group for anemia. They need adequate nutrition for growth and development but also face the risk of blood loss due to menstruation or infectious diseases, such as helminthiasis. The provision of iron tablets for school-age children for early prevention of anemia in Indonesia has been implemented since 2016. For one year, school-age girls are expected to receive at least one tablet of iron-folic acid supplements every week. Unfortunately, the implementation of this initiative in Indonesia has not been successful.[46] The percentage of school children taking iron tablets still needs to be higher, reaching 31% in East Java and only 10% in East Nusa Tenggara.[25,47] Different approaches to distributing and monitoring the iron tablet program for schools in each region resulted in varying degrees of compliance.[46] The need for more understanding of the benefits induces this condition. Parents, especially mothers, are instrumental in encouraging their daughters to take iron supplement tablets. Therefore, education and counseling should target school children and their parents. Additionally, adolescents who are anemic and nutritionally deficient have a high risk of becoming anemic during pregnancy.

On the other hand, based on the nutritional status, pregnant women with MUAC of less than 23.5 cm had a higher risk of anemia than those with MUAC of 23.5 cm or more. Chronic energy deficiency indicates a long-term deficiency in the food intake consumed by mothers. This deficiency is related to macronutrients, which produce calories and are utilized by the mother and fetus, as well as micronutrients. Therefore, a lack of maternal intake can lead to energy deficiency and micronutrient deficiencies, including iron and folic acid. The risk of maternal anemia, low birth weight, and stunting in children increases in pregnant women with chronic energy deficiency [8,48]. Anemia risk can increase in women of childbearing age who are chronically undernourished, including non-pregnant women as well.[49]

This study also revealed that the risk of anemia was slightly lesser in pregnant women who received supplementary feeding (*Pemberian makanan tambahan = PMT*) during pregnancy than those who did not. Inadequate food intake and micronutrient deficiencies are intermediate determinants of anemia in pregnancy. Nutritional causes of anemia in pregnancy include iron deficiency and other micronutrients such as vitamins A, B12, C, D, and E, riboflavin, folic acid, and minerals. It is related to low food intake, impaired absorption, increased needs during pregnancy, and the possibility of increased losses.[4]

These findings support the need for ANC check-ups for pregnant women starting early in pregnancy to determine the health development of the mother and fetus. Health workers should recommend that mothers have a hemoglobin check at the first visit and then be monitored at subsequent visits. It is essential for early detection of anemia in pregnancy and considering appropriate interventions. Meeting the nutritional needs of the mother is essential. Young pregnant women need the necessary social support, especially from the surrounding environment and family, because some do not have independence in

seeking health services. Malnutrition in pregnant women that is not appropriately addressed can increase morbidity in children, including low birth weight babies and impaired child development. The children of mothers with malnutrition have a high risk of cognitive impairment and stunting. When this happens to female children, they also risk becoming energy-deficient pregnant women and giving birth to children with even worse conditions. It eventually becomes a vicious cycle of malnutrition.[50]

The results of this study are intended to be used to develop interventions to address the problem of anemia among young pregnant women in Indonesia. Solving the anemia problem is insufficient with nutritional programs because its etiology is very complex. Furthermore, the public must be educated and counseled on food issues in general. It is related to both the quantity and the quality of food. Mothers must be educated about various types of food, their nutritional composition, processing methods, and serving methods to satisfy their families' nutritional demands adequately. Local food is recommended since it is also less expensive, nutritious, tasty, and provides a broader range of options. It is crucial to the program's future sustainability.[51] Interventions to improve mothers' nutritional condition should begin before pregnancy starting during childhood or youth.

The government must carry out non-nutritional activities as well as nutritional ones, such as environmental, social, economic, and cultural interventions. These interventions involve many stakeholders, such as health workers, community members and leaders, religious leaders, government officials, and the private sector.4 The community, especially brides-to-be, young couples, and their parents, must be educated about the importance of prenatal check-ups from the beginning of pregnancy. All pregnant women should have their hemoglobin levels checked at the initial visit to detect anemia early and receive prompt management. The support of health personnel and families is critical in ensuring that young pregnant women receive appropriate nourishment for both the mother and the fetus. Pregnant women's consumption of iron-folic acid supplements should also be monitored, given Indonesia's high incidence of anemia. The WHO recommends that pregnant women with anemia take a double dose of IFAs, counseling, and re-monitoring at their next ANC visit.[43] Since anemia has a very complex etiology, it is equally important to fulfill nutritional needs, detect, and manage the etiology of anemia in girls from an earlier age.

The limitation of this study is that, despite the broad coverage of 34 provinces, the number of participants who fit the criteria needs to be increased. Few pregnant women in the 2018 *Riskesdas* study had their hemoglobin measured. Exploring other causes and factors of anemia in young pregnant women using larger samples presents both an opportunity and a challenge for further research.

CONCLUSION

The prevalence of anemia among young pregnant women (15-24 years old) in Indonesia was 36.2%. The incidence of anemia is significantly related to gestational agewith the highest risk occuring during the first trimester, followed by the second and third trimesters. Factors such as low education level, living in rural areas, residing far from health facilities, not working, not having an MCH handbook, not receiving supplementary food during pregnancy, and chronic energy deficiency tend to slightly increase the risk of experiencing anemia during pregnancy. These findings emphasize the necessity of early and comprehensive anemia prevention activities, including education, nutritional support, equal access to health care, and socioeconomic improvements. Hemoglobin measurements for anemia screening in young pregnant women should be performed at the initial phase of the pregnancy. ANC visits should be optimized to evaluate the symptoms and indicators of anemia. The support of closet family members is critical, as young pregnant women are highly dependent on those around them.

CONFLICT OF INTEREST

The authors declared that no significant competing financial, professional, or personal interest might have influenced the performance or presentation of the work described in this article.

ACKNOWLEDGEMENTS

The authors would like to thank the Agency for Health Policies Development for offering permission to access and publish the results of

the 2018 *Riskesdas* data analysis, as well as the Faculty of Medicine at the Islamic University of Indonesia for funding manuscript improvements and this article processing charge.

AUTHOR CONTRIBUTIONS

TK arranged access to the data from the Health Development Policy Agency of the Ministry of Health of the Republic of Indonesia; TK analyzed the data; TK and SS wrote the manuscript. All of the authors read and approved the final manuscript.

LIST OF ABBREVIATIONS

AHPD: the Agency for Health Policies Development; ANC: Antenatal care; aOR: adjusted Odds Ratio; BPS: Biro Pusat Statistik; CB: Census Blocks; CED: chronic energy deficiency; CI: confidence interval; cOR: crude Odds Ratio; IFAs: iron-folic acid supplements; LBW: Low Birth Weight; MCH: maternal child health; MUAC: Mid Upper Arm Circumference; PC: Population Census; PMT: Pemberian Makanan Tambahan; PPS: probability proportional to size; *Riskesdas: Riset Kesehatan Dasar*; SDGs: Sustainable Development Goals; SGA: Small gestational age; *Susenas: Survei Sosial Ekonomi Nasional*; WHO: World Health Organization.

REFERENCES

1. World Health Organization. Adolescent pregnancy [Internet]. 2023 [cited 2023 Jun 20]. Available from: https://www.who.int/en/news-room/fact-sheets/detail/adolescent-pregnancy
2. Guspaneza E, Martha E. Determinant of unwanted pregnancy in Indonesia 2017 (A secondary data analysis of 2017 IDHS). In: Proceedings of International Conference on Applied Science and Health. Yayasan Aliansi Cendekiawan Indonesia Thailand; 2019. p. 1135–44. Available from: https://publications.inschool.id/index.php/icash/article/view/741
3. World Health Organization. Early marriages, adolescent and young pregnancies [Internet]. Sixty-fifty World Health Assembly Provisional Agenda Item 13.4. 2012 [cited 2023 Jun 19]. p. 16–9. Available from: https://apps.who.int/gb/ebwha/pdf_files/WHA65/A65_13-en.pdf
4. World Health Organization. Global anaemia reduction efforts among women of reproductive age: Impact, achievement of targets and the way forward for optimizing efforts. Geneva: World Health Organization; 2020. Available from: https://www.who.int/publications/i/item/9789240012202
5. Stevens GA, Paciorek CJ, Flores-urrutia MC, Borghi E, Namaste S, Wirth JP, et al. National, regional , and global estimates of anaemia by severity in women and children for 2000-19: A pooled analysis of population-representative data. Lancet Glob Health. 2022;10:e627–39. doi: 10.1016/S2214-109X(22)00084-5
6. Sari P, Judistiani RTD, Hilmanto D, Herawati DMD, Dhamayanti M. Iron deficiency anemia and associated factors among adolescent girls and women in a rural area of Jatinangor, Indonesia. Int J Women Health. 2022;14:1137–47. doi: 10.2147/IJWH.S376023
7. Kementerian Kesehatan RI. Laporan nasional RISKESDAS 2018. Jakarta: Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan; 2019.
8. Lipoeto NI, Masrul, Nindrea RD. Nutritional contributors to maternal anemia in Indonesia: Chronic energy deficiency and micronutrients. Asia Pac J Clin Nutr. 2020;29(suppl 1):s9–17. doi: 10.6133/apjcn.202012_29(S1).02
9. Smith C, Teng F, Branch E, Chu S, Joseph KS. Maternal and perinatal morbidity and mortality associated with anemia in pregnancy. Obstet Gynecol. 2019;134(6):1234–44. doi: 10.1097/AOG.0000000000003557
10. Lambonmung A, Acheampong CA, Langkulsen U. The effects of pregnancy: A systematic review of adolescent pregnancy in Ghana, Liberia, and Nigeria. Int J Environ Res Public Health. 2022;20(1):605. doi: 10.3390/ijerph20010605
11. Marshall NE, Abrams B, Barbour LA, Christian P, Friedman JE, Jr WWH, et al. The importance of nutrition in pregnancy and lactation: Lifelong consequences. Am J Obstet Gynecol. 2022;226(5):607–32. doi: 10.1016/j.ajog.2021.12.035.
12. Juffrie M, Helmyati S, Hakimi M. Nutritional anemia in Indonesia children and adolescents: Diagnostic reliability for appropriate management. Asia Pac J Clin Nutr. 2020;29((Suppl 1)):S18–31. doi: 10.6133/apjcn.202012_29(S1).03.
13. Sari P, Herawati DMD, Dhamayanti M, Hilmanto D. Anemia among adolescent girls in West Java, Indonesia: Related factors and consequences on the quality of life. Nu-

trients. 2022;14(18):3777. doi: 10.3390/nu14183777.
14. Berhe K, Gebrearegay F, Gebreegziabher H, Weldegerima L, Kahsay A, Hadush H, et al. Magnitude and associated factors of anemia among adolescent girls in Ethiopia: A systematic review and meta-analysis. Arch Public Health. 2022;80(1):189. doi: 10.1186/s13690-022-00942-y
15. Agustina R, Nadiya K, El Andini A, Setianingsih AA, Sadariskar AA, Prafiantini E, et al. Associations of meal patterning, dietary quality and diversity with anemia and overweight-obesity among Indonesian schoolgoing adolescent girls in West Java. PLoS One. 2020;15(4): e0231519. doi: 10.1371/journal.pone.0231519
16. Bansal R, Bedi M, Kaur J, Kaur K, Shergill HK, Khaira HK, et al. Prevalence and factors associated with anemia among pregnant women attending antenatal clinic. Adesh Univ J Med Sci Res. 2020;2(1):42–8. doi: 10.25259/AUJMSR_8_2020
17. Yadav UK, Ghimire P, Amatya A, Lamichhane A. Factors associated with anemia among pregnant women of underprivileged ethnic groups attending antenatal care at Provincial Level Hospital of Province 2, Nepal. Anemia. 2021;2021: 8847472. doi: 10.1155/2021/8847472
18. Wemakor A. Prevalence and determinants of anaemia in pregnant women receiving antenatal care at a tertiary referral hospital in Northern Ghana. BMC Pregnancy Childbirth. 2019;19:495. doi: 10.1186/s12884-019-2644-5
19. Rana A, Khaliqur KS, Jaseem R, Mohd H. HemoCue photometer: A better alternative of hemoglobin estimation in blood donors ? Indian J Hematol Blood Transfuus. 2008;24(4):170–2. doi: 10.1007/s12288-008-0041-8
20. Whitehead RD, Mei Z, Mapango C, Jefferds MED. Methods and analyzers for hemoglobin measurement in clinical laboratories and field settings. Ann N Y Acad Sci. 2019;1450(1):147–71. doi: 10.1111/nyas.14124.
21. Faatih M, Dany F, Rinendyaputri R, Sariadji K, Susanti I, Nikmah UA. Metode estimasi hemoglobin pada situasi sumberdaya terbatas: Kajian pustaka. Jurnal Penelitian dan Pengembangan Pelayanan Kesehatan. 2020;4(2):23–31. DOI:10.22435/jpppk.v4i2.2961
22. Badan Pusat Statistik. Proporsi perempuan umur 20-24 tahun yang berstatus kawin atau berstatus hidup bersama sebelum umur 15 tahun (persen) [Internet]. 2022 [cited 2023 Jun 9]. Available from: https://www.bps.go.id/indikator/indikator/view_data/0000/data/1358/sdgs_5/1
23. Devi YP, Ekoriano M, SAri DP, Muthmainnah M. Factors associated with adolescent birth in indonesia: A national survey. Rural Remote Health. 2022;22(2):7219. doi: 10.22605/RRH7219
24. Mann L, Bateson D, Black KI. Teenage Pregnancy. Aust J Gen Pract. 2020;49(6):310–6. doi: 10.31128/AJGP-02-20-5224.
25. Seminar AU, Briawan D, Khomsan A, Dewi M, Ekayanti I, Mardewi, et al. Awareness about anaemia and weekly iron-folic acid supplementation (WIFAS) among school-going adolescent girls and parents in East Java and East Nusa Tenggara, Indonesia. J Nutr Sci Vitamol. 2020;66(Supplement):S111–7. doi: 10.3177/jnsv.66.S111.
26. Ayensu J, Annan R, Lutterodt H, Edusei A, Peng LS. Prevalence of anaemia and low intake of dietary nutrients in pregnant women living in rural and urban areas in the Ashanti region of Ghana. PLoS ONE. 2020;15(1):1. e0226026. doi: 10.1371/journal.pone.0226026
27. Grzeszczak K, Kwiatkowski S, Kosik-Bogacka D. The role of Fe, Zn, and Cu in pregnancy. Biomolecules. 2020;10(8):1176. doi: 10.3390/biom10081176.
28. Jessani S, Saleem S, Hoffman MK, Goudar SS, Derman J, Moore JL, et al. Association of hemoglobin levels in the first trimester and at 26 to 30 weeks with fetal and neonatal outcomes: A secondary analyses of the Global Network for Women's and Children's Health's ASPIRIN Trial. BJOG. 2021;128(9):1487–96. doi: 10.1111/1471-0528.16676
29. Berarti AE, Gebrie M, Beyene B. Adherence to iron folic acid supplementation and associated factors among antenatal CARE attending women in Sire district primary health care units, South-East Ethiopia: A facility based cross-sectional study. Int J Afr Nurs Sci. 2023;18:100526. https://doi.org/10.1016/j.ijans.2023.100526
30. Attaqy FC, Kalsum U, Syukri M. Determinan anemia pada wanita usia subur (15-49

tahun) pernah hamil di Indonesia: Analisis data Riskesdas 2018. Jurnal Ilmu Kesehatan. 2022;6(1):48–56. doi : 10.33757/jik.v6i1.486.g212
31. Erfina E, Widyawati W, McKenna L, Reisenhofer S, Ismail D. Becoming an adolescent mother: The experiences of young Indonesian new mothers living with their extended families. Midwifery. 2022;104:103170. doi: 10.1016/j.midw.2021.103170
32. Wulandari RD, Laksono AD, Rohmah N. Urban-rural disparities of antenatal care in South East Asia: A case study in the Philippines and Indonesia. BMC Public Health. 2021;21(1): 1221. doi: 10.1186/s12889-021-11318-2
33. Istifa MN, Efendi F, Wahyuni ED, Ramadhan K, Adnani QES, Wang JY. Analysis of antenatal care, intranatal care and postnatal care utilization: Findings from the 2017 Indonesian Demographic and Health Survey. PLoS One. 2021;16(10): e0258340. doi: 10.1371/journal.pone.0258340
34. Sunuwar DR, Singh DR, Adhikari B, Shrestha S, Pradhan PMS. Factors affecting anaemia among women of reproductive age in Nepal: A multilevel and spatial analysis. BMJ Open. 2021;11(3). https://doi.org/10.1136/bmjopen-2020-041982
35. Paramashanti BA, Dibley MJ, Alam A, Huda TM. Wealth- and education-related inequalities in minimum dietary diversity among Indonesian infants and young children: A decomposition analysis. Glob Health Action. 2022;15(1). 2040152. doi: 10.1080/16549716.2022.2040152
36. Nababan HY, Hasan M, Marthias T, Dhital R, Rahman A, Anwar I. Trends and inequities in use of maternal health care services in Indonesia, 1986–2012. Int J Women' Health. 2018;10:11–24. doi: 10.2147/IJWH.S144828.
37. Hani SP, Kuntari T. Association among timing of first visit, antenatal care frequency, and anaemia gravidarum during the peak period of the COVID-19 pandemic. Jurnal Profesi Medika : Jurnal Kedokteran dan Kesehatan. 2023;17(1):85–95. DOI:https://doi.org/10.33533/jpm.v17i1.5663
38. Fite MB, Roba KT, Oljira L, Tura AK, Yadeta TA. Compliance with iron and folic acid supplementation (IFAS) and associated factors among pregnant women in Sub-Saharan Africa: A systematic review and metaanalysis. PLoS One. 2021;16(4):e0249789. doi: 10.1371/journal.pone.0249789.
39. de Andrade Cairo RC, Silva LR, Bustani NC, Marques CDF. Iron deficiency anemia in adolescents; A literature review. Nutr Hosp. 2014;29(6):1240–9. doi: 10.3305/nh.2014.29.6.7245
40. Wignarajah S, Bhuiyan SU, Gugathasan A. The maternal and child health (MCH) handbook and its influence on health behaviors: A literature review. Eur J Environ Public Health. 2021;6(1):em0092. https://doi.org/10.21601/ejeph/11357
41. Dharmawan Y, Mawarni A, Handayani N, Pradana AR. Knowledge and attitudes towards family use of maternal child health handbook. Jurnal Kesehatan Masyarakat. 2021;16(3):322–30. DOI: https://doi.org/10.15294/kemas.v16i3.23768
42. Dewi NU, Mahmudiono T. Effectiveness of food fortification in improving nutritional status of mothers and children in Indonesia. Int J Environ Res Public Health. 2021;18(4):2133. doi: 10.3390/ijerph18042133
43. Kuntari T, Supadmi S, Purwoko S. Optimalisasi antenatal care pada ibu hamil di usia muda. In: Nugraha G, Mentari D, editors. Mengenal anemia: Patofisiologi, klasifikasi, dan diagnosis. Jakarta: Penerbit BRIN; 2023. p. 203–28.
44. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. Geneva: WHO Press; 2016.
45. Alemu T, Yakob T, Solomon T. Dietary diversity and haemoglobin level associated with under nutrition among pregnant women at Sidama Hawassa, Ethiopia: Facility based cross-sectional study. Nutr Metab Insights. 2023;16:1–9. 11786388231165136. doi: 10.1177/11786388231165136
46. Helmyati S, Syarifa CA, Rizana NA, Sitorus NL, Pratiwi D. Acceptance of iron supplementation program among adolescent girls in Indonesia: A literature review. Amerta Nutrition. 2023;7(3):50–61. https://doi.org/10.20473/amnt.v7i3SP.2023.50-61
47. Alfiah E, Briawan D, Khomsan A, Dewi M, Ekayanti I, Mardewi, et al. Coverage and adherence of weekly iron folic acid supplementation among school going adolescent girls in Indonesia. J Nutr Sci Vitamol. 2020;66(Supplement):S118–21. doi: 10.3177/jnsv.66.

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48. Pusporini AD, Salmah AU, Wahyu A, Seweng A, Indarty A, Suriah, et al. Risk factors of anemia among pregnant women in community health center (Puskesmas) Singgani and Puskesmas Tipo Palu. Gac Sanit. 2021;35(S2):S123–6. S123-S126. doi: 10.1016/j.gaceta.2021.10.010
49. Nainggolan O, Hapsari D, Titaley CR, Indrawati L. The relationship of body mass index and mid- upper arm circumference with anemia in non- pregnant women aged 19 – 49 years in Indonesia : Analysis of 2018 Basic Health Research data. 2022;17(3): e0264685. doi: 10.1371/journal.pone.0264685.
50. Agbozo F, Abubakari A, Der J, Jahn A. Maternal dietary intakes, red blood cell indices and risk for anemia in the first, second and third trimesters of pregnancy and at predelivery. Nutrients. 2020;12(3): 777. doi: 10.3390/nu12030777
51. Katenga-Kaunda LZ, Iversen PO, Kamudoni PR, Holmboe-Ottesen G, Fjeld HE. Food-based nutrition counselling and education intervention for improved diets of pregnant women in rural Malawi: A qualitative study of factors influencing dietary behaviour change. Public Health Nutr. 2022;25(9):2436–47. 2436-2447. doi: 10.1017/S1368980022000593