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Overview of Hemoglobin Levels in Pregnant Women at Dr. H. Chasan Boesoirie Hospital

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ABSTRACT

Anemia remains a significant public health concern among pregnant women, particularly in developing countries, because of its association with increased risks of maternal and fetal complications. Hemoglobin (Hb) concentration is a key indicator used to assess anemia during pregnancy. This study aimed to describe the distribution of hemoglobin levels among pregnant women at Dr. H. Chasan Boesoirie Hospital according to maternal age, gestational age, gravidity, and employment status. A descriptive cross-sectional study was conducted using secondary data obtained from the medical records of pregnant women at Dr. H. Chasan Boesoirie Hospital in 2024. A total of 461 records met the inclusion criteria and were included using a total sampling technique. Data were analyzed descriptively using IBM SPSS Statistics version 29. The results showed that most pregnant women (71.8%) had Hb concentrations ≥11 g/dL. Among the study participants, Hb concentrations ≥11 g/dL were most frequently observed in women aged 20–35 years (56.0%), those in the third trimester of pregnancy (69.4%), multigravida women (46.4%), and unemployed women (59.9%). Severe anemia, defined as an Hb concentration below 7 g/dL, was identified in 0.9% of the participants, predominantly among multigravida women. In conclusion, most pregnant women at Dr. H. Chasan Boesoirie Hospital had Hb concentrations of at least 11 g/dL, with the largest proportions observed among women aged 20–35 years, those in the third trimester, multigravida women, and unemployed women. Regular maternal health education and comprehensive medical record documentation are recommended to support anemia prevention, facilitate early detection, and improve maternal and fetal health outcomes.

INTRODUCTION

Hemoglobin (Hb) is an iron-containing protein found in red blood cells that plays a crucial role in transporting oxygen (O_2) to body tissues (Sil & Chakraborti, 2025). Hemoglobin consists of heme and globin components, with heme containing iron within a protoporphyrin IX ring and globin comprising polypeptide chains. These components facilitate oxygen transport and contribute to carbon dioxide (CO_2) transport between tissues and the lungs. Oxygenated hemoglobin appears bright red, whereas deoxygenated hemoglobin appears dark red. Normal hemoglobin concentrations generally range from 13.0 to 18.0 g/dL in adult men and from 12.0 to 16.0 g/dL in nonpregnant adult women, although reference ranges may vary among laboratories (Sherwood, 2014).

According to the World Health Organization (WHO), anemia during pregnancy has traditionally been defined as a hemoglobin concentration below 11 g/dL. The Centers for Disease Control and Prevention (CDC) applies trimester-specific thresholds, defining anemia as an Hb concentration below 11 g/dL during the first and third trimesters and below 10.5 g/dL during the second trimester. These thresholds account for physiological changes in maternal blood volume throughout pregnancy (Wibowo et al., 2021).

Anemia during pregnancy is associated with an increased risk of maternal and fetal complications, including cardiovascular strain, postpartum hemorrhage, susceptibility to infections, impaired fetal growth, preterm birth, and low birth weight (Berat Badan Lahir Rendah, BBLR). Severe maternal anemia may also increase the risks of perinatal mortality and maternal morbidity and mortality (Amiruddin et al., 2022). Anemia remains a substantial global public health concern, particularly in low- and middle-income countries, where nutritional deficiencies, infectious diseases, and limited access to maternal health services contribute to its prevalence. Previous studies have reported a considerable burden of anemia among pregnant women and its association with adverse maternal health outcomes (Endang et al., 2023).

According to the 2018 Indonesian Basic Health Research (Riset Kesehatan Dasar, Riskesdas), the prevalence of anemia was approximately 27.2% among women, based on a sample of 23,616 respondents, and 20.3% among men, based on 23,849 respondents. Among pregnant women, the prevalence reached 48.9%, based on a sample of 538 respondents, with the highest prevalence observed among those aged 15–24 years (84.6%, based on 161 respondents) (Endang et al., 2023). These findings indicated that anemia during pregnancy represented a severe public health concern in Indonesia, as its prevalence exceeded the 40% threshold traditionally used to classify anemia as a severe public health problem. In North Maluku Province, the highest reported proportion of pregnant women with anemia occurred among those aged 30–34 years (20.93%), followed by those aged 25–29 years (10.77%) (Health Research and Development Agency, 2019).

Hemoglobin is the primary oxygen-carrying protein in erythrocytes and also contributes to CO_2 transport, hydrogen ion (H^+) buffering, and the regulation of nitric oxide (NO) bioavailability. It binds a portion of the CO_2 produced by tissue metabolism and helps maintain acid–base balance by buffering hydrogen ions. Hemoglobin also interacts with nitric oxide, influencing vascular signaling and local blood flow regulation. Additionally, hemoglobin binds carbon monoxide (CO) with a substantially higher affinity than oxygen, potentially impairing oxygen transport when exposure occurs (Sherwood, 2014). Structurally, adult hemoglobin consists of four globin chains, each associated with a heme group containing a central iron atom. The principal hemoglobin fractions in healthy adults include hemoglobin A (HbA), hemoglobin A_2 (HbA_2), and small amounts of fetal hemoglobin (HbF). Hemoglobin synthesis involves coordinated heme production and globin chain synthesis. Heme biosynthesis begins in the mitochondria with the condensation of glycine and succinyl-coenzyme A, catalyzed by 5-aminolevulinate synthase (ALAS), followed by additional enzymatic reactions. The resulting heme molecules subsequently combine with globin chains synthesized by ribosomes to form functional hemoglobin (Aliviameita & Puspitasari, 2019).

Pregnancy is a physiological process that begins with fertilization and progresses through embryonic and fetal development until childbirth (Prawirohardjo, 2016). Gestational age is conventionally calculated from the first day of the last menstrual period, with a full-term pregnancy commonly estimated at approximately 40 weeks or 280 days. Pregnancy is divided into three trimesters: the first trimester extends from conception-related early gestation through 13 weeks and 6 days, the second trimester spans 14 weeks through 27 weeks and 6 days, and the third trimester begins at 28 weeks and continues until delivery. These stages are associated with distinct physiological changes that influence maternal hematological parameters, including hemoglobin concentration (Yulizawati et al., 2021).

Pregnancy induces substantial cardiovascular and hematological adaptations, including an increase in maternal plasma volume of approximately 40%–50%. Because plasma volume expands proportionally more than red blood cell mass, hemoglobin concentration and hematocrit decrease through a physiological process known as hemodilution. Increased estrogen and progesterone concentrations contribute to peripheral vasodilation, while cardiac output begins to rise during early pregnancy and continues to increase as gestation progresses. These hemodynamic changes become particularly pronounced during the second and third trimesters. Although red blood cell mass also increases, its expansion is generally smaller than that of plasma volume, resulting in physiological anemia of pregnancy. Concurrent adaptations in renal function, respiratory physiology, and endocrine regulation further influence maternal hematological status (Yulizawati et al., 2021).

Anemia is characterized by a hemoglobin concentration below the established reference threshold for an individual's physiological condition. Its assessment must consider factors such as sex, age, pregnancy status, gestational age, and other relevant clinical characteristics. Hemoglobin concentration, hematocrit, and erythrocyte indices are commonly used to assess hematological status and identify potential causes of anemia (Wibowo et al., 2021). Maternal anemia is associated with adverse pregnancy outcomes, including increased maternal morbidity and complications affecting newborn health (Putri, 2014). Iron deficiency is a major contributor to anemia during pregnancy because maternal iron requirements increase to support expanded red blood cell production, placental development, and fetal growth. Iron deficiency anemia (Anemia Defisiensi Besi, ADB) is among the most common forms of nutritional anemia during pregnancy, although folate deficiency, vitamin B12 deficiency, and other micronutrient deficiencies may also contribute (Mentari & Nugraha, 2023).

The determinants of anemia during pregnancy can be categorized into direct, indirect, and underlying factors. Direct factors include inadequate dietary iron intake, insufficient absorption of essential nutrients, and infectious diseases such as helminthiasis and malaria. Indirect factors include increased physical demands associated with occupational and household responsibilities, unequal intrahousehold food distribution, and inadequate family support during pregnancy. Underlying determinants include limited educational attainment, low socioeconomic status, gender inequality, restricted access to health care, and geographical barriers, particularly in remote or malaria-endemic areas (Dewi et al., 2019). Iron deficiency impairs hemoglobin synthesis,

leading to reduced hemoglobin concentrations and potentially resulting in iron deficiency anemia (Sikoway et al., 2020). The total additional iron requirement throughout pregnancy is estimated to be approximately 1,000 mg, supporting maternal erythrocyte expansion, fetal and placental development, and physiological iron losses. Hemodilution becomes particularly prominent during the late second and early third trimesters, while blood loss during childbirth further increases maternal iron requirements and the risk of postpartum iron deficiency (Sjahriani & Faridah, 2019).

Pregnant women with anemia may experience fatigue, weakness, lethargy, dizziness, drowsiness, difficulty concentrating, and reduced exercise tolerance. Clinical examination may reveal pallor of the conjunctivae, lips, nail beds, and palms, particularly in moderate or severe cases (Ministry of Health of the Republic of Indonesia, 2018b). Based on the underlying pathophysiological mechanism, anemia can be classified as hypoproliferative or regenerative, depending on the bone marrow response. Morphologically, anemia is classified according to mean corpuscular volume (MCV) as microcytic, normocytic, or macrocytic, while mean corpuscular hemoglobin concentration (MCHC) helps distinguish hypochromic from normochromic erythrocytes. Anemia may also be categorized clinically as acute or chronic, depending on its onset and duration (Chulilla et al., 2009; Maulana et al., 2022). The Indonesian Ministry of Health recommends a minimum of six antenatal care (ANC) visits during an uncomplicated pregnancy, comprising one visit in the first trimester, two visits in the second trimester, and three visits in the third trimester (Ministry of Health of the Republic of Indonesia, 2021). Common etiological categories of anemia during pregnancy include blood loss-related anemia, hypoproliferative anemia associated with iron, folate, or vitamin B12 deficiency, anemia of inflammation, and anemia associated with chronic kidney disease (Wibowo et al., 2021).

The severity of anemia in pregnant women has traditionally been classified into three categories: mild anemia, with hemoglobin concentrations of 10.0–10.9 g/dL; moderate anemia, with concentrations of 7.0–9.9 g/dL; and severe anemia, with concentrations below 7.0 g/dL (Ministry of Health of the Republic of Indonesia, 2018a). These classifications provide a framework for assessing anemia severity and identifying pregnant women who may require further clinical evaluation and management. The diagnostic pathway for anemia during pregnancy is presented in Figure 1 (Wibowo et al., 2021).

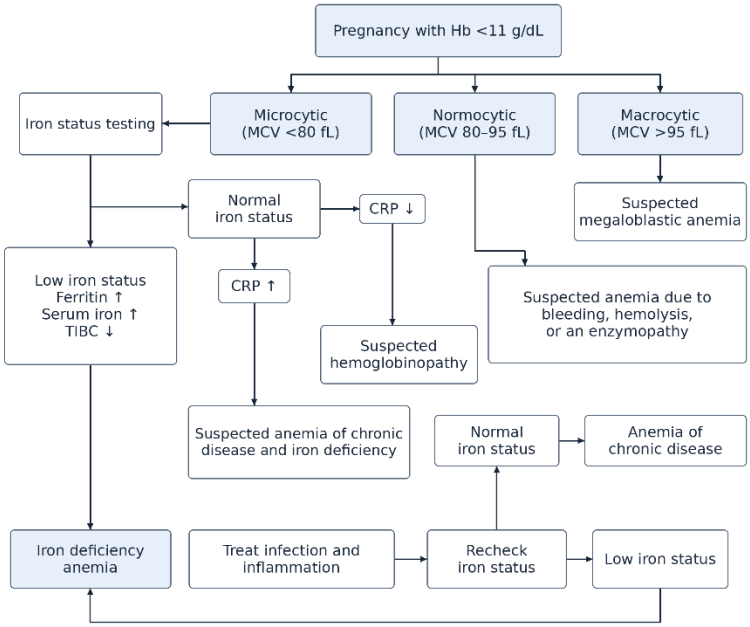

Figure 1. Diagnosis of Anemia in Pregnancy
Source: Wibowo *et al*. (2021)

Several risk factors contribute to anemia during pregnancy, including inadequate nutritional intake, gestational diabetes mellitus, multiple gestation, adolescent pregnancy, and infectious or inflammatory conditions such as helminth infections, tuberculosis (TB), human immunodeficiency virus (HIV) infection, and malaria (Wibowo et al., 2021). Maternal age and parity are also important factors associated with anemia during pregnancy. Adolescent pregnancy may increase the risk of anemia because maternal nutritional requirements coincide with the nutritional demands of ongoing physical growth, while inadequate nutritional knowledge and limited access to prenatal care may further increase vulnerability. Conversely, advanced maternal age may be associated with a higher prevalence of underlying medical conditions and pregnancy-related complications that can contribute to anemia (Sari et al., 2022).

Higher parity has been associated with an increased risk of maternal anemia, primarily because repeated pregnancies and deliveries may deplete maternal iron stores, particularly when interpregnancy intervals are short or nutritional intake is inadequate. Findings from the 1985–1986 Household Health Survey (Survei Kesehatan Rumah Tangga, SKRT) indicated that women with a parity of three or more had a higher prevalence of anemia than nulliparous women. Childbirth may also contribute to maternal iron depletion through blood loss, with iron losses varying according to the volume of bleeding (Fraga & Tri, 2021). Women with high parity, particularly those who have experienced four or more deliveries, may face an increased risk of anemia and other maternal complications. However, this association is influenced by nutritional status, pregnancy spacing, maternal health conditions, and access to appropriate antenatal care (Sari et al., 2022).

Maternal anemia has been associated with several adverse fetal and neonatal outcomes, including fetal growth restriction (FGR), previously referred to as intrauterine growth restriction (IUGR), preterm birth, low birth weight (Berat Badan Lahir Rendah, BBLR), and increased perinatal mortality. Severe maternal anemia may also cause fatigue, dyspnea, palpitations, reduced physical capacity, and cardiovascular complications. Furthermore, anemia has been associated with an increased risk of adverse obstetric outcomes, including postpartum hemorrhage and maternal morbidity, although these relationships may vary according to anemia severity and underlying causes (Asmin et al., 2021). The consequences of anemia may differ across pregnancy stages. During the first trimester, severe anemia may be associated with an increased risk of miscarriage and impaired embryonic development. During the second and third trimesters, maternal anemia may contribute to fetal growth restriction, preterm delivery, low birth weight, and reduced maternal tolerance to blood loss during childbirth. In the intrapartum and postpartum periods, severe anemia may increase vulnerability to complications associated with hemorrhage, infection, and cardiovascular decompensation, particularly in women with underlying medical conditions (Defrin & Ermawati, 2015). Untreated anemia during pregnancy may further increase the risk of preterm delivery, prolonged labor, postpartum hemorrhage, and hypovolemic shock in cases complicated by substantial blood loss (Tenribali et al., 2022). Preventive strategies include maintaining a balanced diet rich in iron, folate, and other essential nutrients; consuming vitamin C-rich foods to enhance non-heme iron absorption; and ensuring adequate intake of iron and folic acid supplements in accordance with antenatal care recommendations. Vitamin B12 supplementation may also be indicated in women with confirmed deficiency or increased risk of inadequate intake (Wibowo et al., 2021). The theoretical framework of this study is presented in Figure 2.

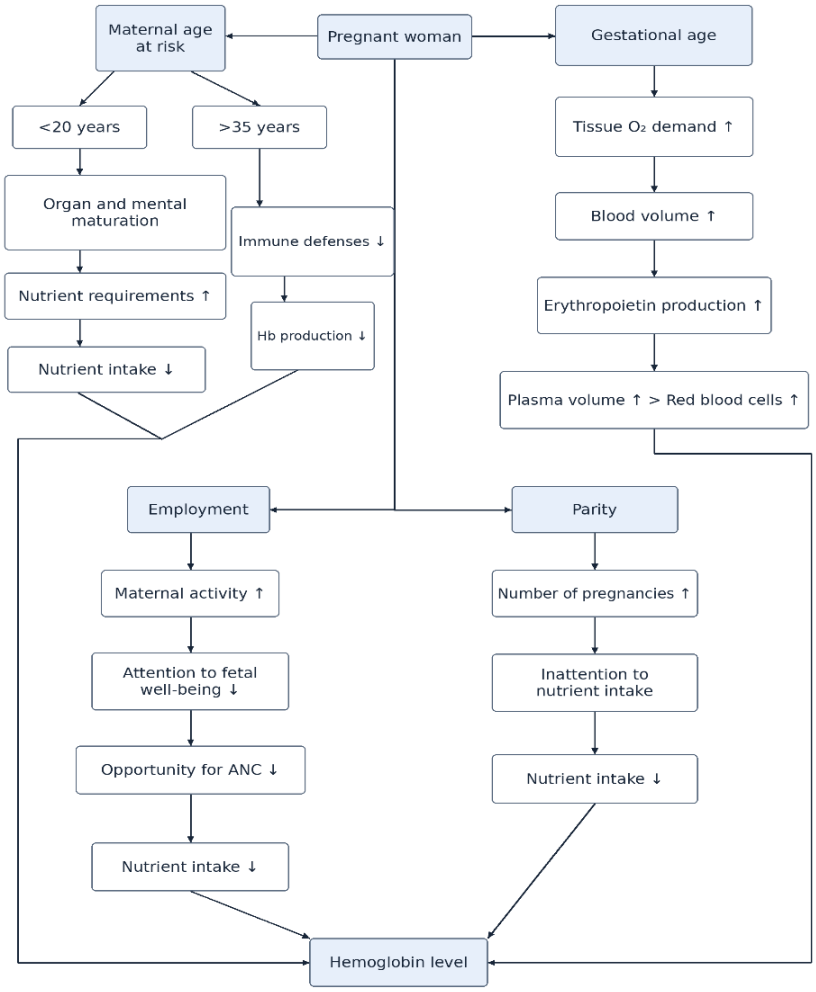

Figure 2. Theoretical Framework

A study conducted at the Bahu Manado Health Center in 2016 found that 27 of 40 pregnant women had hemoglobin (Hb) concentrations above 11 g/dL, while 13 had concentrations below 11 g/dL (Lantu et al., 2016). Similarly, a study conducted by the Faculty of Medicine at Tarumanagara University in 2018 reported that 27 of 96 pregnant women had Hb concentrations below 11 g/dL (Pratiwi & Ludong, 2018). These findings highlight the importance of monitoring maternal hemoglobin concentrations to identify anemia during pregnancy. Accordingly, this study aimed to describe the distribution of hemoglobin concentrations among pregnant women at Dr. H. Chasan Boesoirie Hospital according to maternal age, gestational age, parity, and employment status.

METHOD

This study employed a descriptive cross-sectional design to assess hemoglobin levels among pregnant women at Dr. H. Chasan Boesoirie Hospital in Ternate City, Indonesia. The study was conducted in December 2024 using medical records from January to December 2024. The study

population comprised pregnant women who received care at the hospital during 2024. The inclusion criteria required complete medical records containing information on maternal age, gestational age, parity, employment status, and hemoglobin levels. Records with incomplete data were excluded. A total sampling technique was employed, resulting in 461 eligible medical records being included in the study.

The study variables included maternal age, gestational age, parity, and employment status as demographic and obstetric characteristics, with hemoglobin concentration as the primary outcome variable. Data were obtained from the hospital's medical records, and the conceptual framework is presented in Table 1.

Table 1. Research Concept Framework

Independent Variables	Dependent Variable
1. Age of Pregnant Women 2. Gestational Age 3. Parity 4. Employment Status	Hemoglobin levels in pregnant women

The research flow is presented in Table 2. The data collection process is carried out by looking at medical record data according to the needs of the research.

Table 2. Research Flow

Stages	Activities
1	Proposal
2	Licensing of Dr. H. Chasan Boesoirie Hospital
3	Collection of medical record data on the population of pregnant women at Dr. H. Chasan Boesoirie Hospital
4	Data processing and analysis
5	Results and conclusions

Data processing begins with data retrieval, then collected in the form of a table using Microsoft Excel. The data that has been compiled is analyzed using univariate analysis to find the frequency distribution of each variable through the *Statistical Product and Service Solutions* (SPSS) application version 29. The operational definition of the research variables is presented in Table 3.

Table 3. Operational Definition

Variable	Operational Definition	Scale of Measurement	Measurement Results
Hb Rate	Description of the total Hb level of the subject listed in the medical record	Ordinal	1 = <7 g/dL 2 = 7–9.9 g/dL 3 = 10–10.9 g/dL 4 = ≥11 g/dL (Ministry of Health of the Republic of Indonesia, 2018a)
Age of Pregnant Women	Description of the subject's age recorded in the medical record or by calculating the subject's date of birth	Ordinal	1 = <20 years 2 = 20–35 years 3 = >35 years (Yulizawati *et al*., 2021)
Gestational Age	Description of the subject's gestational age in the trimester or week listed in the medical record	Ordinal	1 = First Trimester (1st to 12th week) 2 = Second Trimester (13th to 27th week) 3 = Trimester III (28th to 40th week) (Anggraheny *et al*., 2015)
Parity	Description of the parity of the subject listed in the medical record	Nominal	1 = Primigravida 2 = Multigravity
Employment Status	Subject's employment status listed in the medical record	Nominal	1 = Work 2 = Not working

This research has been approved by the ethics committee of the Faculty of Medicine and Health Sciences, Khairun University, with ethics number 046/UN44/C.9/KEP/2024 on December 31, 2024 in accordance with the principles of research ethics.

RESULTS AND DISCUSSION

This study was conducted at Dr. H. Chasan Boesoirie Hospital in December 2024 using secondary data from the medical records of pregnant women patients in 2024 with data collected in the form of pregnant women's age, gestational age, parity, and employment status. The number of pregnant women samples collected was 473 samples and 461 samples met the inclusion criteria because 12 samples were incomplete. The results of the study are presented in the following tables.

Characteristics of Research Samples

Table 4. Characteristics of Research Samples

Variable	Frequency (n)	Percentage (%)
Age of Pregnant Women		
<20 years old	36	7,8
20–35 years old	353	76,6
>35 years old	72	15,6
Gestational Age		
Trimester I	5	1,1
Trimester II	11	2,4
Trimester III	445	96,5
Parity		
Primigravida	168	36,4
Multigravity	293	63,6
Hemoglobin Levels		
<7 g/dL	4	0,9
7–9.9 g/dL	69	15,0
10–10.9 g/dL	57	12,4
≥11 g/dL	331	71,8
Employment Status		
Work	69	15,0
Not Working	392	85,0
Total	**461**	**100,0**

Based on Table 4, the results of the univariate analysis of the frequency distribution of the research variables show that based on the age of pregnant women there are three categories, namely the age of <20 years as many as 36 samples (7.8%), the age of >35 years as many as 72 samples (15.6%), and most of them are dominated by the age category of 20–35 years old as many as 353 samples (76.6%). Based on gestational age, the first trimester is 5 samples (1.1%), the second trimester is 11 samples (2.4%), and most of it is dominated by the third trimester as many as 445 samples (96.5%). Based on Hb levels, Hb levels <7 g/dl were 4 samples (0.9%), Hb levels were 7–9.9 g/dl in 69 samples (15.0%), Hb levels were 10–10.9 g/dl in 57 samples (12.4%), and most of them were dominated by Hb levels ≥11 g/dl in 331 samples (71.8%). Based on parity, primigravida was 168 samples (36.4%) and multigravida was dominated by 293 samples (63.6%). Based on employment status, the dominant category was non-working as many as 392 samples (85.0%) followed by working as many as 69 samples (15.0%).

Overview of Hemoglobin Levels by Age of Pregnant Women

Table 5. Overview of Hemoglobin Levels by Age of Pregnant Women

Variable	<7 g/dL		7–9.9 g/dL		10–10.9 g/dL		≥11 g/dL		Total	
	n	%	n	%	n	%	n	%	N	%
Age of Pregnant Women										
<20 years old	0	0,0	10	2,2	6	1,3	20	4,3	**36**	**7,8**
20–35 years old	2	0,4	50	10,8	43	9,3	258	56,0	**353**	**76,6**
>35 years old	2	0,4	9	2,0	8	1,7	53	11,5	**72**	**15,6**
Total	**4**	**0,9**	**69**	**15,0**	**57**	**12,4**	**331**	**71,8**	**461**	**100,0**

Based on Table 5, pregnant women aged <20 years who had Hb levels <7 g/dl in 0 samples (0.0%), Hb levels 7–9.9 g/dl in 10 samples (2.2%), Hb levels 10–10.9 g/dl in 6 samples (1.3%), and Hb levels ≥11 g/dl in 20 samples (4.3%) from a total of 36 samples (7.8%). Pregnant women aged 20–35 years who had Hb levels <7 g/dl in 2 samples (0.4%), Hb levels 7–9.9 g/dl in 50 samples (10.8%), Hb levels 10–10.9 g/dl in 43 samples (9.3%), and Hb levels ≥11 g/dl in 258 samples (56.0%) from a total of 353 samples (76.6%). Pregnant women aged >35 years who had Hb levels <7 g/dl in 2 samples (0.4%), Hb levels 7–9.9 g/dl in 9 samples (2.0%), Hb levels of 10–10.9 g/dl in 8 samples (1.7%), and Hb levels ≥11 g/dl in 53 samples (11.5%) out of a total of 72 samples (15.6%). The highest number of samples were pregnant women aged 20–35 years who had Hb levels ≥11 g/dl as many as 258 samples (56.0%) out of a total of 461 samples (100.0%).

Overview of Hemoglobin Levels by Gestational Age

Table 6. Overview of Hemoglobin Levels by Gestational Age

Variable	<7 g/dL		7–9.9 g/dL		10–10.9 g/dL		≥11 g/dL		Total	
	n	%	n	%	n	%	n	%	N	%
Gestational Age										
Trimester I	0	0,0	2	0,4	0	0,0	3	0,7	**5**	**1,1**
Trimester II	0	0,0	1	0,2	2	0,4	8	1,7	**11**	**2,4**
Trimester III	4	0,9	66	14,3	55	11,9	320	69,4	**445**	**96,5**
Total	**4**	**0,9**	**69**	**15,0**	**57**	**12,4**	**331**	**71,8**	**461**	**100,0**

Based on Table 6, pregnant women with the first trimester of pregnancy who had Hb levels <7 g/dl as many as 0 samples (0.0%), Hb levels 7–9.9 g/dl as many as 2 samples (0.4%), Hb levels 10–10.9 g/dl as many as 0 samples (0.0%), and Hb levels ≥11 g/dl as many as 3 samples (0.7%) from a total of 5 samples (1.1%). Pregnant women in the second trimester who had Hb levels <7 g/dl as many as 0 samples (0.0%), Hb levels 7–9.9 g/dl as many as 1 sample (0.2%), Hb levels 10–10.9 g/dl as many as 2 samples (0.4%), and Hb levels ≥11 g/dl as many as 8 samples (1.7%) from a total of 11 samples (2.4%). Pregnant women in the third trimester who had Hb levels <7 g/dl in 4 samples (0.9%), Hb levels 7–9.9 g/dl in 66 samples (14.3%), Hb levels 10–10.9 g/dl in 55 samples (11.9%), and Hb levels ≥11 g/dl in 320 samples (69.4%) out of a total of 445 samples (96.5%). The highest number of samples were pregnant women in the third trimester who had Hb levels ≥11 g/dl as many as 320 samples (69.4%) out of a total of 461 samples (100.0%).

Overview of Hemoglobin Levels based on Parity

Table 7. Overview of Hemoglobin Levels by Parity

Variable	<7 g/dL		7–9.9 g/dL		10–10.9 g/dL		≥11 g/dL		Total	
	n	%	n	%	n	%	n	%	N	%
Parity										
Primigravida	0	0,0	24	5,2	27	5,9	117	25,4	**168**	**36,4**
Multigravity	4	0,9	45	9,8	30	6,5	214	46,4	**293**	**63,6**
Total	**4**	**0,9**	**69**	**15,0**	**57**	**12,4**	**331**	**71,8**	**461**	**100,0**

Based on Table 7, pregnant women in the primigravida group who had Hb levels <7 g/dl in 0 samples (0.0%), Hb levels 7–9.9 g/dl in 24 samples (5.2%), Hb levels of 10–10.9 g/dl in 27 samples (5.9%), and Hb levels ≥11 g/dl in 117 samples (25.4%) from a total of 168 samples (36.4%). Pregnant women in the multigravida group with Hb levels of Hb <7 g/dl in 4 samples (0.9%), Hb levels of 7–9.9 g/dl in 45 samples (9.8%), Hb levels of 10–10.9 g/dl in 30 samples (6.5%), and Hb levels ≥11 g/dl in 214 samples (46.4%) from a total of 293 samples (63.6%). The highest number of samples were multigravida pregnant women who had Hb levels ≥11 g/dl as many as 214 samples (46.4%) out of a total of 461 samples (100.0%).

Overview of Hemoglobin Levels by Employment Status

Table 8. Overview of Hemoglobin Levels by Employment Status

Variable	<7 g/dL		7–9.9 g/dL		10–10.9 g/dL		≥11 g/dL		Total	
	n	%	n	%	n	%	n	%	N	%
Employment Status										
Work	0	0,0	3	0,7	11	2,4	55	11,9	**69**	**15,0**
Not Working	4	0,9	66	14,3	46	10,0	276	59,9	**392**	**85,0**
Total	**4**	**0,9**	**69**	**15,0**	**57**	**12,4**	**331**	**71,8**	**461**	**100,0**

Based on Table 8, pregnant women with working status who had Hb levels <7 g/dl in 0 samples (0.0%), Hb levels 7–9.9 g/dl in 3 samples (0.7%), Hb levels of 10–10.9 g/dl in 11 samples (2.4%), and Hb levels ≥11 g/dl in 55 samples (11.9%) out of a total of 69 samples (15.0%). Pregnant women with non-working status who had Hb levels <7 g/dl in 4 samples (0.9%), Hb levels 7–9.9 g/dl in 66 samples (14.3%), Hb levels 10–10.9 g/dl in 46 samples (10.0%), and Hb levels ≥11 g/dl in 276 samples (59.9%) from a total of 392 samples (85.0%). The highest number of samples were non-working pregnant women who had Hb levels ≥11 g/dl) as many as 276 samples (59.9%) out of a total of 461 samples (100.0%).

Overview of Hemoglobin Levels by Age of Pregnant Women and Parity

Table 9. Overview of Hemoglobin Levels by Age of Pregnant Women and Parity

Variable	<7 g/dL		7–9.9 g/dL		10–10.9 g/dL		≥11 g/dL		Total	
	n	%	n	%	n	%	n	%	N	%
Primigravida Parities										
Age <20 years old	0	0,0	10	6,0	6	3,6	16	9,5	**32**	**19,0**
Age 20–35 years old	0	0,0	14	8,3	21	12,5	101	60,1	**136**	**81,0**
Age >35 years old	0	0,0	0	0,0	0	0,0	0	0,0	**0**	**0,0**
Total	**0**	**0,0**	**24**	**14,3**	**27**	**16,1**	**117**	**69,6**	**168**	**100,0**
Multigravity Parity										
Age <20 years old	0	0,0	0	0,0	0	0,0	4	1,4	**4**	**1,4**
Age 20–35 years old	2	0,7	36	12,3	22	7,5	157	53,6	**217**	**74,1**
Age >35 years old	2	0,7	9	3,1	8	2,7	53	18,1	**72**	**24,6**
Total	**4**	**1,4**	**45**	**15,4**	**30**	**10,2**	**214**	**73,0**	**293**	**100,0**

Based on Table 9, primigravida pregnant women aged <20 years who had Hb levels <7 g/dl in 0 samples (0.0%), Hb levels 7–9.9 g/dl in 10 samples (6.0%), Hb levels 10–10.9 g/dl in 6 samples (3.6%), and Hb levels ≥11 g/dl in 16 samples (9.5%) out of a total of 168 samples (100.0%). Primigravida pregnant women aged 20–35 years who had Hb levels <7 g/dl in 0 samples (0.0%), Hb levels 7–9.9 g/dl in 14 samples (8.3%), Hb levels of 10–10.9 g/dl in 21 samples (12.5%), and Hb levels ≥11 g/dl in 101 samples (60.1%) out of a total of 168 samples (100.0%), while primigravida pregnant women aged >35 years were 0 samples (0.0%). Multigravid pregnant women aged <20 years who had Hb levels <7 g/dl, 7–9.9 g/dl, and 10–10.9 g/dl were 0 samples each (0.0%), while Hb levels ≥11 g/dl were 4 samples (1.4%) from a total of 293 samples (100.0%). Multigravida pregnant women aged 20–35 years who had Hb levels <7 g/dl as many as 2 samples (0.7%), Hb levels 7–9.9 g/dl as many as 36 samples (12.3%), Hb levels of 10–10.9 g/dl as many as 22 samples (7.5%), and Hb levels ≥11 g/dl as many as 157 samples (53.6%) from a total of 293 samples (100.0%). Multigravida pregnant women aged >35 years who had Hb levels <7 g/dl in 2 samples (0.7%), Hb levels 7–9.9 g/dl in 9 samples (3.1%), Hb levels of 10–10.9 g/dl in 8 samples (2.7%), and Hb levels ≥11 g/dl in 53 samples (18.1%) out of a total of 293 samples (100.0%).

Overview of Hemoglobin Levels by Age of Pregnant Women

Based on Table 5, the results of the study on Hb levels based on the age of pregnant women showed the highest percentage of pregnant women aged 20–35 years who had Hb levels ≥11 g/dl as many as 258 samples (56.0%) out of a total of 461 samples (100.0%). These results are in line with the research of Sun et al. (2023) in China which used the retrospective study method and prospective cohort analysis with a total of 143,307 samples, which obtained 125,568 samples (87.6%) in the age group of 20–34 years (Sun *et al*., 2023). These results are also in line with research at the Bahu Manado Health Center on 40 pregnant women who showed that pregnant women aged 21–34 years had Hb levels >11 g/dl) in 21 samples (52.2%) (Lantu *et al*., 2016), as

well as research at the Lubuk Basung Health Center on 69 pregnant women who found pregnant women aged 21–35 years totaling 62 samples (89.9%) and pregnant women with normal Hb levels (11–15 g/dl) as many as 52 samples (75.4%) (Fitri *et al*., 2024).

Age is one of the risk factors for the incidence of anemia in pregnant women. Pregnant women aged 20–30 years are categorized into the age not at risk of developing anemia in pregnancy because this age is the optimal age mentally and physically to face any physiological changes in pregnancy. Anemia conditions are often associated with several adverse effects on maternal and fetal health as well as increased morbidity and fetal mortality (Abu-Ouf & Jan, 2015). Pregnant at the age of <20 years is not biologically optimal, emotions tend to be volatile, and immature mentality results in pregnant women being prone to shocks that cause a lack of attention to nutritional consumption during pregnancy, and pregnancies under the age of 20 have a possible risk of reproductive health complications due to immature physical conditions (Fegita *et al*., 2022; Sari *et al*., 2022). This is supported by research by Ayu et al. (2019) using the *cross sectional method* on 214 pregnant women in Banten Province which showed that adolescent pregnant women have a 10.31 times greater chance of experiencing prenatal distress than adult pregnant women (Ayu *et al*., 2019).

Pregnancy at the age of >35 years is related to a decrease in the body's immune system and the function of the reproductive organs which can cause several diseases. As a result, this can cause complications during childbirth, such as birth difficulties, baby location disorders, and growth disorders due to insufficient nutrition to meet the needs of the mother and the baby's growth, causing BBLR and premature birth (Sari *et al*., 2022).

Overview of Hemoglobin Levels by Gestational Age

Based on Table 6, the results of the research on Hb levels based on gestational age showed the highest percentage in the third trimester gestational age with Hb levels ≥11 g/dl as many as 320 samples (69.4%) out of a total of 461 samples (100.0%). This is in line with research at the UPTD Puskesmas III of the North Denpasar District Health Office in 2022 which found that 5 out of 12 pregnant women in the third trimester had normal Hb levels (≥11 g/dl) (Suari *et al*., 2022), as well as research in the work area of the Danurejan II Health Center which showed that pregnant women in the third trimester had normal Hb levels in 18 out of 30 respondents (Andriyani, 2017). In contrast to the study at Robert Wolter Mongisidi Hospital in Manado, which actually showed that 25 out of 39 pregnant women in the third trimester had low Hb levels (<11.7 g/dl) (Sikoway *et al*., 2020). Contrary to the results of this study, Sun et al. (2023) in China with 143,307 samples found that hemoglobin tends to decrease with the increase in the trimester, from 12.57 g/dl in the first trimester to 11.87 g/dl, and the third trimester is the highest prevalence of anemia at 12,295 out of 56,042 samples (21.9%) (Sun *et al*., 2023).

The total volume of plasma during pregnancy ranges from 4,700–5,200 ml or 50% more than before pregnancy. During pregnancy, the volume of erythrocytes also increases, but not as much as the increase in plasma volume, resulting in erythrocyte dilution. An increase in erythrocyte volume that is not proportional to an increase in plasma volume causes a decrease in Hb and Hct concentrations that cause physiological anemia during pregnancy, and when approaching

pregnancy, the Hb concentration increases again with a steady plasma concentration (Wibowo *et al*., 2021). Some factors related to the prevalence of anemia in the third trimester include maternal age, pregnancy distance, parity, nutritional status, adherence to taking iron tablets, and knowledge (Arfan *et al*., 2024).

Overview of Hemoglobin Levels based on Parity

Based on Table 7, the results of the study on Hb levels based on parity showed the highest number of samples in multigravid pregnant women who had Hb levels ≥11 g/dl as many as 214 samples (46.4%) out of a total of 461 samples (100.0%). The data is in line with the research of Al-Farsi et al. (2011) in Oman which used a retrospective cohort study with 479 samples and found 289 samples suffering from anemia, 248 samples (85.5%) of which were multigravid patients with an average hemoglobin of 11.4 g/dl (Al-Farsi *et al*., 2011). This is also in line with Imai's (2020) research in Shizuoka City, Japan, with a retrospective method on 1,084 samples, of which 603 samples (55.6%) were multigravids with a hemoglobin level of 12.4 g/dl (Imai, 2020). These results are not in line with research at the Anggut Atas Health Center, Bengkulu City, which showed that out of 135 samples, most pregnant women with parity were at risk of multigravida and grandemultipara experiencing anemia (60.0%), while most pregnant women with parity were not at risk of non-anemia primigravida (66.7%) (Permatasari, 2021).

Frequent pregnancies and childbirth can increase the risk of anemia in women. The more pregnancies and childbirths, the more iron is lost, increasing the severity of anemia. Repeated pregnancies in a short period of time can also deplete the mother's iron reserves, especially if the birth distance is short and the function of the reproductive organs has not fully recovered (Sari, 2020). The greater risk of anemia at higher parity can be explained by the susceptibility of multiple pregnancies to bleeding, which may be influenced by increased venous drainage to the lower part of the uterus, hylinization of blood vessels, and decreased elasticity of the uterine wall (Al-Farsi *et al*., 2011).

Overview of Hemoglobin Levels by Employment Status

Based on Table 8, the results of the study on Hb levels based on employment status showed that the highest percentage of non-working pregnant women who had Hb levels ≥11 g/dl as many as 276 samples (59.9%) out of a total of 461 samples (100.0%). This is in line with research at the Bahu Manado Health Center which found 28 out of 49 (57.1%) pregnant women with the status of Housewives (IRT) or not working, and pregnant women who did not work had Hb levels >11 g/dl as many as 17 samples (Rai *et al*., 2016). In contrast to a study at the Jagir Health Center in Surabaya on 30 pregnant women which showed that almost half (47.3%) of the respondents who worked had Hb levels >11 g/dl (Masruroh & Nugraha, 2020).

Pregnant women with non-working status tend to have lower socioeconomic status, so energy needs are difficult to meet and antenatal care becomes inadequate. Pregnant women who do not work and only act as IRTs are risk factors for anemia because most of their income depends on the husband's income to meet his needs (Rai *et al*., 2016). This study has limitations, namely there are some incomplete medical record data and some data that are not clearly readable in

writing so that the number of samples obtained is reduced and the data collection process slows down.

CONCLUSION

Based on the findings of this study on hemoglobin levels among pregnant women at Dr. H. Chasan Boesoirie Hospital, it was concluded that the majority of participants (331 of 461; 71.8%) had hemoglobin (Hb) concentrations ≥11 g/dL. According to maternal age, Hb concentrations ≥11 g/dL were most frequently observed among women aged 20–35 years (258 participants; 56.0%), whereas severe anemia (Hb <7 g/dL) was identified in two participants (0.4%) aged 20–35 years and two participants (0.4%) aged over 35 years. Regarding gestational age, Hb concentrations ≥11 g/dL were most frequently observed during the third trimester (320 participants; 69.4%), while moderate anemia (Hb 7.0–9.9 g/dL) was identified in one participant (0.2%) during the second trimester. Based on gravidity, Hb concentrations ≥11 g/dL were most frequently observed among multigravida women (214 participants; 46.4%), while severe anemia (Hb <7 g/dL) was identified in four multigravida women (0.9%). Regarding employment status, Hb concentrations ≥11 g/dL were most frequently observed among unemployed women (276 participants; 59.9%), whereas moderate anemia (Hb 7.0–9.9 g/dL) was identified in three employed women (0.7%). These percentages were calculated using the total study population of 461 participants as the denominator. Based on these findings, the Provincial Health Office should strengthen regular maternal health counseling and nutritional education programs to improve awareness of anemia prevention during pregnancy. Hospitals should also ensure the completeness and accuracy of medical records to support clinical monitoring and future research. Further studies are recommended to investigate potential associations between maternal characteristics and hemoglobin concentrations among pregnant women in North Maluku Province, incorporating additional clinical, nutritional, and socioeconomic variables to provide a more comprehensive understanding of anemia-related factors.

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