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Correlation Between Fasting Blood Glucose and Hemoglobin Level in Women of Childbearing Age: A Base-case Analysis

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ABSTRACT
The childbearing age for women is the period when their reproductive organs are still active, so that is when women can give birth to children. Many factors can affect women's health conditions during this fertile age, including blood sugar and hemoglobin levels. These two factors are very important to know to reduce maternal and child mortality during childbirth. This study aimed to determine the basic description of fasting blood sugar (FBG) and hemoglobin (HB) levels of women of childbearing age and next to determine the relationship between blood sugar and hemoglobin levels in women of childbearing age. **Method**: A retrospective study was conducted by observing the patient's medical record data at a private health facility in Padang from June to July 2021. From the medical record search, 32 participants met the inclusion criteria: women of childbearing age and no history of diabetes. The data obtained were analyzed descriptively using *Statistical Package for the Social Sciences* SPSS® 23. **Results**: The FBG rate of the participants was 83.53 (66.0 – 118.0) mmHg. Of the 32 participants, there was no relationship between FBG and HB of women of childbearing age (p = 0.331). In addition, it was also found that age did not affect FBG (p= 0.288) and hemoglobin (p= 0.376) women of childbearing age. **Conclusion**: although FBG and hemoglobin have an important influence on the health condition of pregnant women, it turns out that in women of childbearing age, these two things are not correlated with each other.

Keywords: *FBG, Hemoglobin, Childbearing, Women*

1. INTRODUCTION

The availability of new food selections has increased vividly in recent times, while increasingly sedentary lifestyles have reduced calorie intake requirements. As a result, energy intake in young people has increased, combined with an increasingly sedentary lifestyle, which may have directed to an upsurge in obesity and associated metabolic diseases. As a result, large increases in the prevalence of metabolic syndrome, diabetes, hypertriglyceridemia, and gout have been observed [1].

Women of childbearing age are women who come in the age of 15-49 years regardless of their matrimonial status. Women of childbearing age have generative body part that are still functioning properly between 20-45 years (SDG) [2].

Women of childbearing or reproductive age, especially in Indonesia, are currently facing multiple complex nutritional problems. Obesity is one of the most popular dietary problems experienced by the obese. Anemia is one side of the numerous nutritional issues that are often encountered in developing countries. Obesity, which is then associated with increased blood sugar, is related to anemia in women of reproductive age [3], [4].

Enhancement in the diagnosis and management of pregnant women with blood glucose impairment primes to a marked improvement in the newborn outcome with a decrease in the rate of macrosomia, glucose deficiency, Neonatal Intensive Care Unit (NICU) charge, and hereditary malformations [5]. However, there is still a higher prevalence of these comorbidities in infants with Diabetes Mellitus (DM), and Gestational Diabetes Mellitus (GDM) equated to women's glucose standard.

In addition, obesity and overweight in women during the motherhood period appear to contribute to elevated rates of blood glucose impairment during gestation [6]. The measurements to reduce obesity during the pregnancy period and accurate glucose control during prenatal period are mandatory to prevent any indisposition and worsening condition of women with DM and GDM.

Divalent metal transporter 1 (DMT1) plays a major role in regulating the iron absorptive capacity of villus enterocytes. Recent studies characterizing -cell-specific DMT1 plays a role in reactive oxygen species (ROS) production in the pancreas in response to cytokines. This feature contributes to metabolic syndrome and insulin resistance. Some studies reported insulin resistance as a primary consequence of iron overload. However, result from such research has been inconsistent. Dietary loading with carbonyl iron also results in iron accumulation in the pancreas and reduced serum insulin [7]

The association between iron deficiency anemia, which also known as iron-deficiency anemia (IDA) and the level of HbA1c in blood has established incomplete attention. However, some studies recommend that IDA may increase concentrations of fasting blood glucose [8]. In addition, previous studies also showed that blood glucose level and glycated albumin in gastrectomized subjects with Iron Deficiency Anemia (IDA) were significantly higher than normal subjects [9]. Therefore, this study was conducted to define how this significant difference affects women of childbearing age.

2. METHODS

This research was conducted by collecting patient medical records from June to July 2021 at a private clinic in Padang city. The inclusion benchmarks in this study were: women of childbearing age, had no family history of diabetes, and had never been diagnosed with diabetes. Women with hormonal disorders were the exclusion criteria in this study. The subjects in this study were not limited to married, nulliparous, or multiparous women. As long as they are in the fertile age range, this woman's medical record can be used as research materials.

All sociodemographic-related data were collected, and also data related to fasting blood sugar and hemoglobin levels. This data was then analyzed descriptively using *Statistical Package for the Social Sciences* SPSS®23. The relationship between numeric and categorical data will be analyzed using a one-way *analysis of variance* (ANOVA). Meanwhile, the relationship between FBG and hemoglobin will be analyzed using Pearson correlation.

The analysis results will be presented in tabular form using a p-value <0.05 as the confidence level.

3. RESULTS

As many as 32 medical records meet the inclusion criteria. The patient's sociodemographic data can be seen in Table 1. The data in table 1 is basic data without any treatment. The age range obtained is around 20 years and evenly distributed to all groups. The average education level of the subject is high school, although some subjects have completed the postgraduate program. The subject's body mass index is classified as “good” to minimize the research bias. Therefore, it can be concluded that the average physiological condition of the subjects in this study was normal.

Table 1. Sociodemographic data

	N (%)	mean	SD	min - max
Age (year)		31.59	4.53	23.90 – 39.82
- 20-29	13 (40.6)			
- 30-39	19 (59.4)			
Education				
- High school	15 (46.9)			
- Undergraduate	13 (40.6)			
- Graduated	4 (12.5)			
Weight (Kg)		55.81	7.20	45.00 – 70.00
Height (Cm)		157.09	6.16	148 – 167
BMI		22.69	3.22	16.93 – 29.47
- Underweight (<18.5)	4 (12.5)			
- Normal (18.5 – 24.9)	21 (65.6)			
- Overweight (25.0 – 29.9)	7 (21.9)			
Fasting Blood Glucose (ml/dl)		83.53	13.64	66.0 – 118.0
Hemoglobin (Hb)		9.78	1.66	7.0 – 12.0

The relationship between FBG and Hb can be obtained based on age and education level using one-way ANOVA. These results can be seen in tables 2 and 3.

Table 2. Relationship between FBG, HB, and BMI based on age

Parameters	*p*-value
Fasting Blood Glucose	0.28
Hemoglobine (Hb)	0.37
Body Mass Index (BMI)	0.01

Table 3. Relationship between FBG, Hb, and BMI based on level of education

Parameters	*p*-value
Fasting Blood Glucose	0.65
Hemoglobine (Hb)	0.27
Body Mass Index (BMI)	0.06

Then, by using the Pearson Correlation *p*-value = 0.18, so it can be interpreted that there was no significant relationship between fasting blood sugar levels and hemoglobin levels of women of childbearing age in this study.

4. DISCUSSION

This research is an initial study which is a base-case analysis of the subject taken from medical record data. In this study, it was hoped that there are no precipitating factors for complications in pregnancy. Among the complications in pregnancy are gestational diabetes mellitus and anemia. This gestational diabetes can also develop into progressing type 2 diabetes mellitus in the future. Theoretically, diabetes mellitus (DM) patients, especially type 2 DM, had higher iron deposits, total body iron, and heme oxygenase activity than patients with metabolic syndrome (MS) disorders [10]. This oxygen activity is also known as a high oxidative stress condition.

In this study, although a good average value was obtained in each group, not all of the standard deviation (SD) values were also good. This specific value of SD can be seen in the value of FBG. The difference between the maximum and minimum FBG values is quite large, so the SD value also becomes large. These results need to have attention because the highest FBG value has crossed the normal FBG limit. Therefore, it is feared that it will develop into GDM when this childbearing age woman experiences pregnancy.

Although many forms of anemia are related with lowering fasting blood glucose (FBG), iron-deficiency anemia (IDA) tends to increase FBG related to blood glucose level fluctuation [11].

Deficiencies in micronutrients are common in developing countries and associated with maternal anemia and adverse birth outcomes. Especially if this deficiency has started to occur before pregnancy and at childbearing age. Deficiencies already present in these countries' populations may be exacerbated during pregnancy because of increased requirements for the growing fetus, placenta, and maternal tissues [12].

Indonesia is included in 70 out of 117 countries in the global hunger index that currently have three nutritional problems (child stunting, child wasting, and undernutrition) [2], [13]. Unfortunately, national data on maternal nutrition do not yet exist. Still, low birth weight and anemia can be considered representative of underlying nutritional status, as low birth weight is a direct result of the health and nutritional status of the mother before and during pregnancy [12], [14].

Advance in the diagnosis and administration of women of reproductive period that leads to investigating pregnant women with dysglycemia primes to a marked development in newborn outcome with a decrease in the rate of macrosomia, glucose deficiency, Neonatal Intensive Care Unit (NICU) charge, and hereditary malformations [15]. However, there is still a higher prevalence of these comorbidities in DM and GDM infants than in normal women. In addition, obesity and overweight in women during the childbearing period appear to contribute to high rates of dysglycemia during pregnancy. Therefore, measurements to reduce overweightness during the motherhood period and blood glucose control are required to prevent any morbidity of women with DM and GDM.

Health care systems might contemplate greater investigation and targeted interventions throughout the peri- and post-natal and also reproductive periods in the following decades. These strategies include lifestyle behaviors (consistent-persistent diet, continuance of a healthy weight, tobacco stopping, and physical activity) but also urgencies for women's postpartum health, including depression treatment, lactation assistance (in-hospital and post-discharge), better sleep quality, and social policies that sustenance overall maternal health (prolonged paid maternity leave) [16], [17]. This effort will require coordinated systems to identify, trail, asess, educate, and handle these women before, during, and after prenatal period. Real interventions for risk saving will also need increased consciousness and engagement of primary- and secondary- care, field doctors and practical research studies inside integrated health care structures to appraise and accomplish supreme health for women for years after gestational diabetes mellitus diagnosis.

The strength of this study is to use data with clear inclusion criteria. Besides, this research is the beginning of research that will involve intervention on the subject. However, the overall inadequacy of this study is the insignificant sample proportions. Therefore, this association must be investigated in bigger patient groups. In addition, the level of metabolic control can be further stratified, and the correlation of FBG with iron status can be resoluted.

5. CONCLUSION

In conclusion, our study affords valuable understanding into the correlation of FBG numbers with iron deficiency anemia (IDA). Although there was no significant relationship between FBG and Hb, it also suggests that people with anemia who are close to the diagnostic threshold may need to retest their blood glucose levels, or use another diagnostic method.

AUTHORS' CONTRIBUTIONS

NF is the principal investigator in this study. NF design ideas and techniques in doing research. FMD and YOS collect and rewrite medical record data on worksheets. Furthermore, NF also performs data analysis and writes the manuscript.

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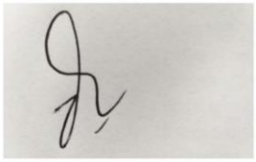

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