



Original Research Paper

## CORRELATION BETWEEN BLOOD GLUCOSE LEVEL AND BODY MASS INDEX AMONG PREGNANT WOMEN WITH EXCESS BODY WEIGHT

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### ABSTRACT

Amount of 207 million (83.6%) women who give birth simultaneously are diagnosed with GDM in 2019. Prevalence of GDM reaches 1.9-3.6% in Indonesia. Amount of 40-60% of GDM will suffer from postpartum Non-Dependent Insulin Diabetes Mellitus. Hence, this study was aimed to look for the distribution of blood sugar levels among pregnant women who are overweight. This research was performed among pregnant women in the Obstetrics and Gynecology polyclinic of Royal Prima Medan Hospital against 41 people as the sample with a cross-sectional model (Longitudinal study). The aspects evaluated in this study were age, gestational age, BMI, occupation, income, recent education, history of gestational DM, Macrosomia, and obstetrics. All research data was analyzed with SPSS 25 by spearman correlation. The trend of random et blood sugar levels of pregnant women as respondents was 100 mg/dL, while the BMI tendency was 31.72 kg/m<sup>2</sup>. Based on these parameters, they had a correlation with each other among overweight pregnant women (Value P = 0.007) that was moderate (R = 0.417). Blood sugar levels were moderate correlated with BMI among pregnant women with excess body weight.

### ABSTRAK

Pada tahun 2019 terdapat 207 juta (83,6%) wanita yang melahirkan bersamaan didiagnosa DMG. Prevalensi di Indonesia, kejadian DMG mencapai 1,9-3,6%. Sebanyak 40-60% dari DMG akan mengalami Diabetes Mellitus Tipe 2 pasca melahirkan. Sehingga, penelitian ini bertujuan untuk mengetahui gambaran kadar gula darah ibu hamil yang memiliki berat badan berlebih. Penelitian ini dilakukan pada ibu hamil di poliklinik Obstetri dan Ginekologi Rumah Sakit Umum Royal Prima Medan terhadap 41 orang sebagai sampel penelitian dengan model Cross sectional (Potong Lintang). Aspek-aspek yang dinilai dalam penelitian ini adalah umur, usia kehamilan, IMT, pekerjaan, pendapatan, pendidikan terakhir, riwayat DM gestasional, macrosomia, dan obstetric. Seluruh data penelitian dianalisa dengan SPSS 25 dan dianalisa dengan menggunakan korelasi spearman. Kecenderungan kadar gula darah et random dari ibu hamil sebagai responden adalah 100 mg/Dl, sedangkan kecenderungan IMT adalah 31.72 kg/m<sup>2</sup>. Dari kedua parameter tersebut, terdapat korelasi antara IMT dan kadar gula darah pada ibu hamil dengan berat badan berlebih (Nilai P = 0.007), korelasi antar kedua variabel bersifat cukup kuat (R = 0.417). Kadar gula darah cukup kuat berkorelasi dengan IMT pada kelompok ibu hamil dengan berat badan berlebih.

## INTRODUCTION

Several studies have been performed to evaluate the effect of blood glucose level against the body weight. Gou et al. (2019) reported that fasting blood glucose after 1 to 2 hour consume 75-gram glucose showed a significant difference at various degrees of excess body weight pregnant women (P-Value

< 0.05). Furthermore, Bloomgarden (2010) also reported that not only blood glucose but also the level of HbA1C significantly increase among pregnant women with an excess of increasing body weight (P-Value < 0.05)<sup>1,2</sup>.

It becomes clear whether blood glucose level might affect the body weight among pregnant women. The increase of blood

glucose level and body weight among pregnant women is a risk factor for Gestational Diabetes Mellitus. Gestational Diabetes Mellitus (GDM) is classified as the type of diabetes Mellitus. GDM is an intolerance glucose condition that is found at the pregnant period (the most of case within 24 weeks of gestation age).<sup>3 4</sup>.

GDM is a severe problem not only in Indonesia but also over the world. International Diabetes Federation (2019) reported that the case of diabetes would increase significantly every year until 2045. It estimates 463 million people at 20-79 years old over the world will suffer from diabetes, and around 79.4% of them were lived at the low to middle-income countries. Meanwhile, the number of pregnant women that suffer from GDM in 2019 was around 207 million (83.6%) women that birth alive<sup>3</sup>. Furthermore, the rate of GDM in Indonesia was 1.9 to 3.6%, and the amount of 40-60% of them suffered from Non-Insulin Dependent Diabetes Mellitus after giving birth<sup>5,6</sup>.

Uncontrolled of GDM among pregnant women may lead to various morbidity and mortality. These conditions include maternal or fetal complication for the short or long term that leads to potential maternal and fetal death<sup>5,6 7,8</sup>.

Based on the information above, it becomes important to early prevention of the GDM. This study was performed to explore the relationship between the blood glucose level and body mass index among pregnant women with excess body weight.

## METHOD

This study was an observational study with cross-sectional design in the Obstetrics and Gynecology Polyclinic of Royal Prima Hospital in Medan at June-October 2020.

This study has been approved by the director of the hospital with letter no.

1062/EXT/PP/RSURP/VI/2020 and the Health Research Ethics Committee from Universitas Prima Indonesia with registration no. 028/KEPK/UNPRI/V/2020.

The population of this study was all pregnant women in first to the third trimester in the Obstetrics and Gynecology Polyclinic of Royal Prima Hospital in Medan.

The number of sample in this study was determined by the following formulation<sup>9</sup>:

$$N = \left[ 2 \frac{z_{\alpha} \times P (1-P)}{W} \right]^2$$
$$N = \left[ 2 \frac{1.96 \times 0.09 (1-0.09)}{0.05} \right]^2$$
$$N = \left[ 2 \frac{1.96 \times 0.09 (0.91)}{0.05} \right]^2$$
$$N = \left[ 2 \frac{1.96 \times 0.08}{0.05} \right]^2$$
$$N = \left[ 2 \frac{0.16}{0.05} \right]^2 = [2 (3.2)]^2 = [6.4]^2$$
$$N = 40.96 \sim 41 \text{ women}$$

$Z_{\alpha}$ ,  $P$ , and  $W$  were Z-Score for  $\alpha = 0.05$ , Proportion of high blood glucose among pregnant women in the previous study (0.09), and allowable error (5%), respectively.

Forty-one women as the sample were selected by the disproportional stratified random sampling. It was selected sample from a population by stratifying them not proportionally from each strata. The strata were the number of the month along the time of this study (3 months). Hence, the sample was selected for 14 women every month.

All data in this study was collected by a questionnaire about body weight and height before pregnancy, gestational age, the highest level of education, history of diabetes mellitus in family, history of Macrosomia and GDM, average earnings of the household, and personal identity. The body weight and height of pregnant women before pregnancy was collected from the medical record.

On the other hand, this study was also used an observational sheet included blood glucose level, body weight, height, Body Mass

Index (BMI), and height of fundus. BMI was determined by divided the body weight (kg) to the square of height (m). A glucometer measured the blood glucose level (Autocheck®). Meanwhile, the height of fundus was measured by body measuring tape.

Initially, all pregnant women, as the sample were told about the purpose, protocol, and confidentiality of this study. After pregnant woman agreed to join to this study, the capillary blood was collected by pen lancet, and it was determined the level of blood glucose by glucometer. After that, their body weight and height were measured. At last, the pregnant woman was interviewed by the questionnaire.

All data in this study were analyzed by IBM SPSS 25. All data were firstly analyzed descriptively. After that, it was continued to correlation analyses based on the normality of data. If the data distributed normally, it was analyzed by Pearson correlation, instead of spearman correlation.

**RESULT**

This study was performed against 41 pregnant women with excess body weight that have agreed to join this study, and the following table showed the characteristic of the sample.

**Table 1. Characteristics of Pregnant Women as Sample**

Parameters	Frequency	Percentage
Age (Mean ± SD)	27.02 ± 3.57	
Gestation age (Median) (Range)	29.00 (14.00)	
<b>Body Massa Index (kg/m<sup>2</sup>)</b>		
Overweight	20	48.9
Obesity class I	10	24.4
Obesity class II	8	19.5
Obesity class III	3	7.3
<b>Blood Glucose Level (mg/dL)</b>		

≤ Median (99.50 mg/dL)	20	48.8
> Median (99.50 mg/dL)	21	51.2
<b>Occupation</b>		
Housewife	22	53.7
Government employee	11	26.8
Self-employed	8	19.5
<b>Earning of the household (IDR/Bulan)</b>		
None	22	53.7
≤ Mean (3.247.368 IDR/Bulan)	13	31.7
> Mean (3.247.368 IDR/Bulan)	6	14.6
<b>The Highest Level of Education</b>		
Primary school	7	17.1
Junior High School	5	12.2
Senior High School	13	31.7
College/University	16	39.0
<b>History of Diabetes Mellitus (DM) in Family</b>		
No	22	53.7
Yes	19	46.3
<b>History of Macrosomia</b>		
No	27	65.9
Yes	14	34.1
<b>History of Obstetrics</b>		
<b>Gravidarum (G)</b>		
Primigravida	11	26.8
Multigravida	30	73.2
<b>Parity (P)</b>		
Primipara	18	43.9
Multipara	12	29.3
<b>Abortion (A)</b>		
None	37	90.2
Yes	4	9.8

Based on the table above, most of the pregnant women that joined this study had an average age of 27.02 years old with an average

of 29 weeks of gestational age. All sample had excess body weight before pregnancy; most of them had overweight (48.9%) when the period of the study was performing. Social demography characteristic of the sample showed that all sample had worked as a housewife (53.7%) with none annual earning of household (53.7%). Most of the sample also had the highest level of education as a college/university (39%).

Furthermore, other characteristics that were also evaluated viz. a history of DM in family, Macrosomia, and obstetric as the characteristics of the sample. The most of sample in this study did not have a history of Macrosomia (65.9%) or DM (53.7%) in the family. Meanwhile, the history of obstetric of the sample showed that most of the sample was Multigravida (73.2%), multipara (73.2%), and none abortion history (90.2%).

After evaluating the characteristic of the sample, the analysis was continued to Spearman correlation due to the blood glucose level, and BMI was not distributed normally. The following table showed the result of the analysis.

**Table 2. Spearman Correlation Analysis of Blood Glucose Level and BMI**

Parameter	Median	Range	P-Value	r
Blood Glucose Level	100.00	125.00 (78-203.00)	0.007	0.417
BMI	30.18	14.67 (25.96-40.63)		

Based on the table above, there was a significant correlation between the blood glucose level and BMI. It due to the P-Value < 0.05 (P-Value = 0.007). Moreover, the r as correlation coefficient implies the direction and power of the correlation. This study showed that the correlation coefficient

between Blood glucose level and BMI was 0.417; it means that the correlation was a moderate positive correlation.

**DISCUSSION**

The result of this study has achieved the purpose of this study to look for the relationship between the blood glucose level and BMI among pregnant women with excess body weight. The blood glucose level significantly affects the BMI among pregnant women with excess body weight. The correlation between blood glucose and BMI was moderate; when the blood glucose level increases, it will increase the BMI among pregnant women with excess body weight. It means that the increase or decrease in blood glucose level will cause an increase or decrease in BMI, respectively.

The physiology change and insulin resistance during pregnancy may be responsible for the correlation between blood glucose and BMI in this study. These changes are caused by high concentrations of steroid hormones: progesterone, estrogen, prolactin, cortisone, and human placental lactogen. All of these hormones can cause a decrease in the sensitivity of insulin receptors to target organs. It shows as the increase of blood glucose level to Gestational diabetes mellitus in varying severity that occurs in pregnancy<sup>10</sup>.

There was a limited number of study that explore the effect of blood glucose level and BMI; most of study looked for the relationship between GDM and IMT. Id et al. (2019) reported a similar result to this study. Id et al. (2019) reported that the BMI significantly affect to develop of Non-Dependent Insulin Diabetes Mellitus (P-Value= 0.001). Other factors also affected to develop of Non-Dependent Insulin Diabetes Mellitus like hip and waist circumference, blood glucose level (Fasting or oral glucose tolerance test), and oral hypoglycemic medication<sup>11</sup>.

The most of studies looked for GDM and

BMI, Yong et al. (2020) reported that maternal age and BMI at the first prenatal care had a significant independent association with risk of GDM. Overweight / obese women (OR = 1.44, 95% CI = 1.04–1.81) had a significantly higher risk of GDM than women with underweight / normal weight. No significant independent effect was observed between pregnancy weight gain in trimesters 1 and 2 and the risk of GDM<sup>12</sup>.

The latest study that was performed by Winardo et al. (2020) reported whether other factors affect the BMI among pregnant women. These were lipid profile. There was a significant correlation between BMI and total cholesterol ( $p = 0.013$ ;  $r = 0.371$ ). Moreover, the LDL and total cholesterol were also significantly correlated to fasting blood glucose. Hence, it was obvious that BMI, blood glucose and lipid profile were correlated with each other. In additional, Winardo et al. (2020) also reported that the incidence of gestational diabetes mellitus was 2.38% of all second-trimester pregnancies<sup>10</sup>

## CONCLUSION

Overall, the blood glucose level was correlated positively against the BMI among pregnant women with excess body weight before getting pregnant. Further investigation was required to looking for the correlation among all pregnant women with various body weight.

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