Research Article

Lipid Profile, Blood Glucose Level and Body Mass Index (BMI) in Second Trimester of Pregnancy: Screening with Gestational Diabetes

Profil Lipid, Gula Darah dan Indeks Massa Tubuh (IMT) pada Kehamilan Trimester II: Skrining Kejadian Kehamilan dengan Diabetes Melitus

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Abstract

Objective: To find out lipid profile data, blood sugar and Body Mass Index in trimester II pregnancy to the incidence of pregnancy with diabetes mellitus.

Methods: This study is a cross sectional study. The number of samples obtained was 42 samples where all were taken in the second trimester. Samples taken from RSUP Prof. Dr. R. D. Kandou Manado and networking hospitals around Manado that meet the inclusion and exclusion criteria. All patient patients were explained about the research procedure and the signing of consent information. Blood samples were taken for examination of blood sugar (fasting blood sugar and 2 hours post-prandial blood sugar) and lipid profiles (total cholesterol, HDL, LDL, triglycerides). After the data is collected, it is included in the SPSS version 22.0 program for data analysis.

Results: Found 2 subjects (4.76%) who had abnormal fasting blood sugar and found 4 subjects (9.53%) who had abnormal 2-prandial 2-hour blood sugar. For lipid profiles, it was found 16 subjects (38.1%) who had abnormal total cholesterol levels, for LDL there were 13 subjects (30.96%) who had abnormal levels, for HDL there were 4 subjects (11.9%) who had abnormal levels and for triglycerides there were 23 subjects (54.76%) who had abnormal levels. There was a significant negative correlation between LDL cholesterol and fasting blood sugar (p = 0.002; r = - 0.455), and so did total cholesterol with fasting blood sugar (p = 0.047; r = - 0.302). There was a significant correlation between BMI and total cholesterol (p = 0.013; r = 0.371). There was 1 subject (2.38%) diagnosed with gestational diabetes melt and fasting blood sugar at 190 mg / dL, for prandial 2 hours post blood sugar at 309 mg / dL and for triglycerides at 617 mg / dL.

Conclusions: Based on this study found the incidence of gestational diabetes mellitus 2.38% of all trimester II pregnancies. There is a positive but not significant correlation between blood sugar and triglycerides, whereas there is no significant relationship between blood sugar and other lipid profiles. There is a positive but not significant correlation of BMI in trimester pregnancy with total cholesterol.

Keywords: Blood sugar, Body Mass Index (BMI), lipid profile

Abstrak

Tujuan: *Untuk mengetahui data profil lipid, gula darah dan Indeks Massa Tubuh pada kehamilan trimester II terhadap kejadian kehamilan dengan diabetes melitus.*

Metode: *Studi ini merupakan studi potong lintang. Jumlah sampel yang didapatkan sebesar 42 sampel di mana seluruhnya diambil pada trimester II. Sampel diambil dari RSUP Prof. Dr. R. D. Kandou Manado dan rumah sakit jejaring sekitar Manado yang memenuhi kriteria inklusi dan eksklusi. Semua pasien-pasien dijelaskan mengenai prosedur penelitian dan penandatanganan inform consent baru dilakukan pengambilan sampel darah untuk pemeriksaan gula darah (gula darah puasa dan gula darah 2 jam postprandial) dan profil lipid (Kolesterol total, HDL, LDL, Trigliserida). Setelah data dikumpulkan, maka dimasukkan ke dalam program SPSS versi 22.0 untuk data analisis.*

Hasil: *Ditemukan 2 subjek (4,76%) yang memiliki gula darah puasa abnormal dan ditemukan 4 subjek (9.,53%) yang memiliki gula darah 2 jam postprandial yang abnormal. Untuk profil lipid, ditemukan 16 subjek (38,1%) yang memiliki kadar kolesterol total abnormal, untuk LDL ditemukan sebanyak 13 subjek (30,96%) yang memiliki kadar abnormal, untuk HDL ditemukan 4 subjek (11,9%) yang memiliki kadar abnormal dan untuk trigliserida ditemukan 23 subjek (54,76%) yang memiliki kadar abnormal. Terdapat korelasi negatif signifikan antara kolesterol LDL dengan gula darah puasa (p = 0,002 ; r = – 0,455), dan begitu juga dengan kolestrol total terhadap gula darah puasa (p = 0,047 ; r = – 0,302). Terdapat korelasi signifikan antara IMT dengan kolesterol total (p = 0,013 ;r = 0,371). Terdapat 1 subjek (2,38%) yang terdiagnosis diabetes melitus gestasional di mana gula darah puasa sebesar 190 mg/dL, untuk gula darah 2 jam postprandial sebesar 309 mg/dL dan untuk trigliserida sebesar 617 mg/dL.*

Kesimpulan: *Berdasarkan penelitian ini ditemukan kejadian diabetes melitus gestasional 2,38% dari seluruh kehamilan trimester II. Terdapat korelasi positif tetapi tidak bermakna antara gula darah dengan trigliserida, sedangkan tidak terdapat hubungan bermakna antara gula darah dengan profil lipid lainnya. Terdapat korelasi positif tetapi tidak bermakna IMT pada kehamilan trimester dengan kolestrol total.*

Kata kunci: *gula darah, Indeks Massa Tubuh (IMT), profil lipid*

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INTRODUCTION

Pregnancy is a major change that occurs in the life of a woman. These changes include the anatomical and physiological changes of the female organs. Physiologically, a woman does not experience severe disorders or abnormalities in the process of adapting to her pregnancy. However, it occurs in a number of women with various pathological conditions that are affected by their pregnancy, and surely this can be dangerous or at high risk for the survival of the intrauterine fetus and in the future course.[1-5]

Epidemiologically, it is estimated that in 2030, the prevalence of Diabetes Mellitus (DM) in Indonesia reaches 21.3 million people (Diabetes Care, 2004). While the results of the Basic Health Research (Riskesdas) in 2007 was that the proportion of causes of death from DM in the 45-54 years old group in urban areas was ranked second with 14.7% and in rural areas, DM ranks 6th, which is 5.8%.

Diabetes mellitus, in general, is an abnormality that results in the absence of energy use, especially from glucose. Insulin hormones produced by the pancreas, which are needed in this metabolic process, are inadequately produced. In Indonesia, the incidence of GMD ranges from 1.9 to 3.6%. If this pancreatic hormone in children or young adults is produced too little or none at all, it is called Diabetes in young, also called type 1 diabetes. (Insulin-dependent / IDDM). Type 2 is called Adult onset.[3,4]

Women with GMD have enough insulin for their needs, sometimes having more levels than non-pregnant women. But the effect of insulin is partly blocked by various hormones produced by the placenta (insulin resistance).[5]

Obesity in BMI has received serious attention because of the increasing number of sufferers, including women of reproductive age and the number of obese people in pregnant women also increased by around 18.5% to 38.3%. Obese pregnant women are now known to be very risky to suffer from diseases in pregnancy. Besides that obesity also affects a woman's fertility, obese pregnant women are also more at risk of miscarriage than normal pregnant women.[6]

The World Health Organization (WHO) reported an emergency in connection with the above phenomenon, with overweight adults reaching 1.6 billion and obesity around 400 million in 2005. WHO and the National Institutes of Health (NIH) define overweight as a condition when the Body Mass Index (BMI) is around 25-29.9 kg/m2 and obese ≥ 30 kg/m2. And it is estimated that in 2015, adults who are overweight reach 2.3 billion while those who are obese reaches 700 million people.[7]

Many factors play a role in the occurrence of obesity, including environmental factors, lifestyle, genetics, and socioeconomics. Obesity is a state of disordered balance between caloric intake and its use.[8] Therefore many complications caused by obesity both for the mother and the fetus or the baby either in the early trimester or later gestation, at antepartum, intrapartum or postpartum, it even affects the life of the baby in adulthood later with all the consequences of metabolic diseases. It is based on several hypotheses which stated that this condition had been programmed since the conception process. Based on these matters, the management of obesity in connection with pregnancy is essential to do both in preconceptions and during pregnancy.[9]

Weight gain during pregnancy can affect maternal and perinatal, but sometimes it does not show a significant effect. So it is interesting to know whether BMI and weight gain during pregnancy, which is BMI during the second trimester can affect the maternal and perinatal output. It is also added with people's lifestyles that have changed especially related to food consumption, and dietary habits.[1]

In pregnant women are known to experience changes in the body. Not only does the body's metabolic increase for baby's growth and structure-related development, but it also causes hormonal changes in the body which trigger changes in lipid profiles that are different in each semester of pregnancy.[10] During pregnancy, women experience large amounts of psychological and hormonal changes such as estrogen, progesterone and corticosteroid production during pregnancy that affect various physiological metabolic and endocrine systems. Significant variations in maternal lipid metabolism

accompany pregnancy.[11] Many research explained that in the serum of pregnant women, there is a higher fat content than all fat fractions and is called hyperlipidemia.[12] Early in pregnancy, there is an increase in fat accumulation associated with eating and increasing fat formation, at the end of pregnancy there is a sudden decrease in fat reserves which plays an important role in the development of the baby.[13] The concentration of fat in the blood, lipoprotein, and apolipoprotein in plasma increases significantly during pregnancy.[14]Fat accumulation occurs during midterm pregnancy.[15-19] It is assumed that there is a relationship between gestational diabetes mellitus and an increase in total cholesterol, triglycerides, LDL and VLDL.[20] It was suggested that an increase in plasma triglycerides and LDL patterns during pregnancy can be used to identify women who will experience atherogenic changes in the future[10]

For the success of maternal health efforts, among them can be seen from the indicator of Maternal Mortality Rate (MMR).[21] Decreasing maternal mortality (MMR) occurred in Indonesia from 1991 to 2007, which was from 390 to 228. However, the 2012 IDHS showed a significant increase in MMR, which was 359 maternal deaths per 100,000 live births.22 MMR again showed a decrease to 305 maternal deaths per 100,000 live births based on the results of the 2015 Intercensal Population Survey *(Survei Penduduk antar Sensus - SUPAS)*.[22]

Obesity is one of the trigger factors for the occurrence of GMD. It was proven that the occurrence of an increase in Lipid profiles resulted in insulin resistance which can trigger gestational diabetes mellitus.

Gestational diabetes mellitus uniquely manifests in pregnancy and is related to the pathophysiological phenotype of placental diseases, macrosomia and the development of severe but reversible hypertension during pregnancy[23-25.]

So far a study of the relationship between blood sugar levels & lipid profile in 2nd trimester pregnancy with the incidence of gestational diabetes mellitus in the third trimester has not been done in the Obstetrics, and Gynecology Universitas Sam Ratulangi / Prof. DR. R.D Kandou Manado Hospital has never done, therefore, the researchers would like to do this study.

METHODS

This study is a cross-sectional study. The number of samples obtained was 42 samples, where all were taken in the second trimester. Samples taken from RSUP Prof. Dr. R. D. Kandou Manado and networking hospitals around Manado that meet the inclusion and exclusion criteria. All patient patients were explained about the research procedure and the signing of consent information. Blood samples were taken for examination of blood sugar (fasting blood sugar and 2 hours post-prandial blood sugar) and lipid profiles (total cholesterol, HDL, LDL, triglycerides). After the data is collected, it is included in the SPSS version 22.0 program for data analysis

RESULTS

Table1. Characteristics of Research Subjects

	Characteristics	n	%
Age (y.o)	≤ 20	5	11.90
	21 – 30	22	52.38
	31 – 40	13	30.95
	≥ 40	2	4.77
Parity	1	14	33.33
	2-3	22	52.38
	≥ 4	6	14.29
Age of Gestation (weeks)	≤ 20	9	21.42
	20 – 24	5	11.90
	24 – 28	28	66.68

Latest Education	ES	4	9.52
	JHS	4	9.52
	HS	24	57.14
	Undergraduate	10	23.82
Occupation	Housewive	28	66,67
	Private employment	5	11.90
	Student	1	2.38
	Others	8	19.05
Body Mass Index	Normal (< 24,9 kg/m^2)	21	50.00
	Overweight (25 – 30 kg/m^2)	12	28.57
	Obese (>30 kg/m^2)	9	21.42

Table 2. Relationship between Blood Sugar Level & Lipid Profile in Second Trimester Pregnancy

Lipid Profile Serum	Mean (n=42)	Blood Sugar			
		Fasting Blood Sugar		Two-hour postprandial blood sugar	
		r	*P-value*	r	*P-value*
Total cholesterol	140.14	-0.302	0.047	-0.048	0.755
LDL	57.02	-0.455	0.002	-0.192	0.213
HDL	217.02	-0.024	0.876	-0.017	0.912
Triglycerides	204.0	-0.068	0.662	-0.064	0.680

Table 3. Relationship between BMI & Lipid Profile in 2nd Trimester pregnancy

BMI(kg/m^2)	Mean (n=42)	Lipid Profile							
		Total cholesterol		LDL		HDL		Triglycerides	
		r	*P-value*	r	*P-value*	r	*P-value*	r	*P-value*
	26.37	0.371	0.013	0.126	0.126	0.321	0.034	0.287	0.059

DISCUSSION

This research was conducted at Prof. Dr. R.D Kandou hospital and Network Hospitals in Manado from April 2018 to October 2018. In this study, 42 women in second-trimester pregnancy were eligible as the subjects. All subjects of this study met the inclusion criteria and exclusion criteria and had signed a form of consent to be involved in this study. This research was conducted in stages; they are filling out questionnaires, physical examinations, and laboratory examinations.

In this study, sample characteristics were assessed from age, parity, education, occupation, and Body Mass Index. In table 1 can be seen the age characteristics of the study subjects consisted of 22 subjects (52.38%) aged 21-30 years old. At parity there were 22 subjects (52.38%) with multiparas, the 24-28 weeks gestation had 28 subjects (66.68%), for education, there were 24 subjects (57.14%) from high school, for the type of occupation, most of them were housewives with 28 subjects (66.67%), on Body Mass Index, most of them were normoweight with 21 subjects (50%).

The incidence of diabetes mellitus in the world from year to year continues to increase. Based on the latest WHO data showed that in 2000 as many as 150 million of the world's population suffered from DM, and this number will double by 2025. The rate of sufferers will occur in developing countries due to population growth, ageing, unhealthy diets, obesity and lack of physical activity. In Indonesia, according to the 2013 Basic Health Research data, the proportion of diabetes mellitus was 6.9% in people aged > 15 years.[26]

This Research also describes fasting blood sugar levels and 2-hour postprandial blood sugar levels. Where the limit of <100 mg/dL was taken for fasting blood sugar and <140 mg/dL for 2-hour postprandial blood sugar. Based on WHO criteria, patients can be diagnosed with gestational diabetes mellitus if they fulfil the following conditions.[27]When blood glucose

level is > 200 mg/dL (accompanied by classic symptoms of hyperglycemia); or fasting blood glucose level > 126 mg/dL; or glucose levels 2 hours after TTGO> 200 mg/dL, HbA1c level > 6.5%

In this study, a lower limit was used which found two subjects who had glucose intolerance. Of the 42 subjects, there were two subjects (4.76%) who had glucose intolerance, but there was one subject that met the criteria of WHO, where one subject (2.38%) had fasting blood sugar level of 190 mg/dL and 2-hour postprandial blood sugar of 309 mg/dL. This is in accordance with the A. E. Omu study, in which the study stated that the incidence of gestational diabetes mellitus was around 2-4% of all pregnancies.[28] In addition, in the study It was stated that the incidence of gestational diabetes mellitus in Northern Europe was 0, 6-3.6%, increasing in Italy (6.3%). In the United States, there are around 7% of pregnancies with diabetes mellitus from all existing pregnancies.[29]

In pregnancy, there are changes in physiology and insulin resistance that are not permanent. This condition is caused due to the high concentration 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. Gestational Mellitus diabetes causes carbohydrate intolerance in various degrees of severity that arise in pregnancy.[30]

Several factors increase the risk of coronary heart disease in patients with type 2 diabetes mellitus. These factors are divided into two groups. The first group is called demographic risk factors and clinical data, which includes age, families with cardiovascular disease, obesity, metabolic syndrome, etc.[31]

The second group is called the risk factor of laboratory data. These risk factors include: high HbA1c levels, high cholesterol levels, low HDL levels, high non-HDL cholesterol levels, high triglyceride levels, high triglyceride/HDL ratio, etc.[31]

This research shows different variations between increases in total cholesterol, LDL, HDL, and triglycerides. Where from 42 research subjects there were 16 subjects (38.10%) who had high total cholesterol levels, there were 13 subjects (30.96%) who had high LDL levels; there were five subjects (11.90%) who had levels Low HDL and 23 subjects (54.76%) who had high triglyceride levels.

Hyperlipidemia is a frequent comorbid in patients with diabetes mellitus.[32]Some studies suggested that there is a relationship between cholesterol input and the incidence of gestational diabetes mellitus. In the placenta, the expression of protein increases in lipid synthesis, which causes maternal metabolic changes (hypocholesterolemia) and can cause developmental changes in the fetus and cause asymmetric macrosomia. In this case, damage to placental function causes an increase of LDL, Apo-B-100, and triglycerides in maternal serum where there is an increase in Fatty Acid Synthase (FAS) and SREBP-2 expression and inflammatory cytokines (IL-1β and TNF-α) in the placenta.[27]

Maternal Triacylglycerol (TAGs) and non-esterified fatty acids (NEFAs) have a positive correlation with changes in fetal weight and fat mass in patients with gestational diabetes mellitus.[33]

In the second trimester, there is an increase of adipose tissue which causes changes in the maternal body shape. This occurs because of hyperphagia and the increase in fat synthesis.[33] In the third trimester, there is a halt in accumulation of maternal fat deposits where there are 3 changes a decrease of fatty acid synthesis in adipose tissue, a decrease in LPL (lipoprotein lipase) activity which causes the retrieval from TADs and the increased occurrence of Hipertrigliseridemia and an increase in lipolytic adipose tissue.[33]

In this study, it can be seen that more than 50% of subjects had an increase in triglycerides with a mean of 281.56 mg/dL. Hyperlipidemia can increase the risk of oxidative stress and increase lipid peroxidase; in several studies it can be found in pregnancy with diabetes and an increase in various markers of oxidative stress.[34]

Catabolic state is found in maternal adipose tissue in the second and third trimesters where hyperlipidemia occurs which causes an increase in triglycerides.[33] VLDL and triglycerides production

is increased in the liver and a decrease in disposal from circulation which is the impact of a decrease in LPL activity. Triglycerides are also increased in other lipoprotein fractions which are abnormally transported like LDL and HDL.[35]

Physiologically the increase in insulin resistance in each pregnancy will increase at 24-28 weeks gestation and increase continuously until third trimester.[36]In gestational diabetes mellitus, there are physiological changes in insulin and fat increase and it causes metabolic dysfunction of sugar and fat.[36]

Fat circulation in patients with gestational diabetes mellitus is different from normal pregnancy, where triglyceride levels increase in patients with gestational diabetes mellitus.[36] This is in accordance with subjects found with gestational diabetes mellitus, which there was an increase in triglycerides after an increase in fasting blood sugar and 2-hour postprandial blood sugar. After being examined it was found that triglyceride levels reached 617 mg/dL.

In this study, there were 28 subjects (66.68%) who were in 24-28 weeks of gestation. Of the 28 subjects, it was found that there were two subjects (7.18%) who had an increase in fasting blood sugar, two subjects (7.18%) who had an increase in 2-hour postprandial blood sugar. For lipid profiles, from 28 subjects, 11 subjects (39.28%) were found to have increased total cholesterol, found 8 subjects (28.57%) who experienced an increase in LDL, there were 2 subjects (7.18%) who experienced low HDL and there were 19 subjects (67.85%) who had elevated triglycerides. This is in accordance with previous studies that there was an increase in lipid metabolism at 24-28 weeks of gestation.[36]

We found that the mean values of serum lipid profiles (total cholesterol, LDL, HDL, triglycerides) were found to correlate with several factors on fasting blood sugar and 2-hour postprandial blood sugar.

In this study, it was found that there was a negative correlation between total cholesterol and fasting blood sugar (r = - 0.302 and p = 0.047). Result: increased total cholesterol in the blood causes a decrease in fasting blood sugar. There was no correlation between total cholesterol and 2 hour postprandial blood sugar (r = - 0.048 and p = 0.755). There was no negative correlation between LDL cholesterol and fasting blood sugar (r = - 0.455 and p = 0.002). Results: increased concentration of LDL in the blood causes fasting blood sugar decreases. There was no correlation between LDL and 2 hour postprandial blood sugar (r = -0,192 and p = 0,213). There was no correlation between HDL cholesterol and fasting blood sugar (r = -0.024 and p = 0.876) and 2 hour postprandial blood sugar (r = -0.017 and p = 0.912). It was similar with triglycerides, where in this study there was no correlation between triglyceride and fasting blood sugar (r = -0.068 and p = 0.662) and 2-hour postprandial blood sugar (r = -0.064 and p = 0.680).

There is a relationship between insulin resistance to inflammatory factors that can affect the increase in blood sugar and lipid profile. Where in various studies revealed that there was an increase in leptin concentration in pregnancy with diabetes. Where hyperlipidemia can be used as a predictor for an increased risk of gestational diabetes mellitus. The placenta produces cytokines such as TNF-α, resistin, and leptin which are also produced by adipose tissue. This becomes very important in the regulation of insulin.[37]

In early pregnancy, glucose tolerance occurs from normal to slightly increased and peripheral (muscle) insulin sensitivity and glucose production in the liver tend to be normal. Increased insulin resistance begins after 24-28 weeks this occurs because of an increase in the hormone cortisol, estrogen, and progestin which causes lipogenesis and increased fat storage.[38]

In gestational diabetes, there is Hypertriglyceridemia found in the first, second and third trimesters when compared to normal pregnancies, but there are several studies that said there is no change in triglycerides in gestational diabetes and normal pregnancy. For plasma cholesterol, when compared with pregnancy without diabetes in the first trimester, there is no difference in cholesterol levels. Some studies said that there is a decrease in LDL cholesterol levels in the second and third trimesters in gestational diabetes.[34] This is in accordance with the theory, wherein this study it was found that there were an increase in triglyceride levels of 54.76% and

a decrease in LDL levels which were found 29 subjects (69.04%) found to be normal and tend to be low.

Based on the existing theory, it was found an increase in pro-inflammatory factors and cytokines, which caused an increase in insulin resistance which could lead to gestational diabetes mellitus. In a different path where there is an increase in fatty acids which causes a decrease in transport between insulin and glucose which can cause gestational diabetes. Significantly based on existing theories, an increase in blood sugar is not related to an increase in lipid profile. However, both of these can cause gestational diabetes mellitus. This is consistent in this study that, based on the Spearman correlation test, no correlation was found between blood sugar and lipid profile.[27]

Suggested their study that measured BMI and fat levels (total cholesterol, triglycerides, LDL, and HDL cholesterol) which increased during gestation.[39] BMI has a statistically significant interaction of gestational age for total cholesterol (P = 01) and LDL (P <0.001). Where this difference results in significantly lower total cholesterol and LDL cholesterol for overweight or obese compared to normoweight in the latter half of pregnancy. Argued that this difference may be related to metabolic dysregulation associated with overweight & obese mothers who can affect the course of pregnancy and its effect on the fetus. Increased body mass index values were found in several other studies.[39-42]

Statistical analysis as listed in table 3.5 found that the average value of 2nd trimester BMI increased during pregnancy with a value of 26.37 kg/m^2, total cholesterol increased in the second trimester of pregnancy with a value of 229.07 mg/dL, HDL mean value of 56.36 mg/dL in the range of normal value, LDL mean value in the normal range in second trimester pregnancy with a value of 141 mg/dL, and an increase in triglycerides in the second trimester of pregnancy with an mean of 216.07 mg/dL.

For the relationship between BMI and serum lipid profile, there was a significant correlation between BMI and total cholesterol (r = 0.371 and p = 0.013). Conclusion: increased concentration of total cholesterol in the blood causes BMI increases. There was no correlation between BMI and LDL (r = 0.126 and p = 0.126). For the relationship between HDL and BMI, there was a significant correlation (r = 0.321 and p = 0.034). Conclusion increased concentration of HDL cholesterol in the blood causes BMI increases. There was no correlation between BMI and triglycerides (r = 0.287 and p = 0.059). This is consistent with RaghuramPusukuru et al. that there was an increase in total cholesterol, VLDL, triglycerides, HDL and LDL in the second trimester.[43]

Hypertriglyceridaemia is a risk factor for preeclampsia, Gestational DM and premature, estimates of lipid profiles are highly recommended during pregnancy so that they can implement appropriate management strategies to prevent adverse effects of hyperlipidemia associated with pregnancy.[43,44]

Gestational diabetes mellitus can be characterized by dyslipidemia, predominantly hypertriglyceridemia. In women with gestational diabetes mellitus, there was an increase in triglyceride concentrations in early pregnancy, and this was associated with high concentrations of free fatty acids. High triglyceride levels are associated with increased LDL. Increased levels of free fatty acids causes accumulation of fat in the liver and kidneys which contributes to the occurrence of gestational diabetes mellitus.

The ratio between triglycerides and high HDL has been confirmed as the ratio of insulin resistance. Obesity is an independent risk factor for gestational diabetes mellitus and an increased risk of increasing BMI before pregnancy.[43]

Several studies revealed that there is a relationship between dyslipidemia and glucose intolerance. Where some studies said that Plasma triglyceride level > 137 mg/dL have a 3.5 times greater risk of causing gestational diabetes mellitus. It is said that the higher the BMI before pregnancy, the risk of developing gestational diabetes mellitus increases.[43]

Various risk factors also play a role in helping diagnose gestational diabetes mellitus. Where these risk factors include: obesity, previous history of gestational diabetes mellitus, glucosuria, family history of diabetes, recurrent abortion, history of birth with congenital defects or infants ≥ 4,000

grams, history of preeclampsia.

This study suggests that in the history of previous pregnancies for each subject studied, the changes in blood sugar and lipid profiles mostly found in subjects who gave birth to babies died without cause. Whereas for subjects with a history of giving birth to babies with BW ≥ 4,000 grams, no changes in blood sugar were found, both fasting blood sugar and 2-hour postprandial blood sugar. Only 1 subject (2.38%) was found to have a history of diabetes mellitus in a previous pregnancy, but the subject had fasting blood sugar and 2-hour postprandial blood sugar within normal limits.

There was no significant change in lipid profile in the pregnancy history, all in total cholesterol, LDL, HDL, and triglycerides. However, 3 subjects with hypertriglyceridemia were found to have a history of giving birth to baby with BW ≥ 4,000 grams.

In the history of diabetes mellitus in the family, from the subjects who had biological mothers with a history of diabetes mellitus, 1 subject had an increase in 2-hour postprandial blood sugar, and there was a change in lipid profile in total cholesterol, LDL, HDL, and triglycerides. For siblings, biological father, siblings of father and mother, biological parents of father and mother, no significant changes were found.

In this study, 1 subject (2.38%) was diagnosed with gestational diabetes mellitus which was based on WHO criteria for the assessment of fasting blood sugar and 2-hour postprandial blood sugar.[27] In line with previous findings, fasting blood sugar in this subject was to 190 mg/dL, and 2-hour postprandial blood sugar was 309 mg/dL. There was also a study that suggested that in high fasting blood sugar and 2-hour postprandial blood sugar; hypertriglyceridemia was found.[44] Where in this patient found triglyceride levels of 617 mg/dL. In this subject, there were no abnormalities in the history of previous pregnancies, but a history of diabetes mellitus was found in the biological mother of the subject.

The subject had already been informed of the blood sugar and triglyceride levels and had been consulted to the internal medicine department to get further treatment. Apart from internal medicine, fetal well-being is also assessed to reduce complications that can occur.

Complications that can occur include maternal complications and fetal complications. Maternal complications include increased risk of preeclampsia, cesarean section, and type 2 diabetes mellitus. For complications in the fetus: increase the risk of perinatal mortality, macrosomia, labour trauma, hyperbilirubinemia, and neonatal hypoglycemia.[44]

CONCLUSION

Based on research conducted at Prof. Dr. R.D Kandou Hospital and network hospitals in Manado from April 2018 to October 2018, it can be concluded that: The incidence of gestational diabetes mellitus is 2.38% of all 2nd-trimester pregnancies. The incidence of abnormal fasting blood sugar level and 2-hour postprandial blood sugar level in the second trimester of pregnancy is 4.76% and 9.53%, respectively. Abnormal total cholesterol level in the second trimester of pregnancy is 38.10% and abnormal LDL level in the second trimester of pregnancy is 30.96%. Abnormal HDL level in the second trimester of pregnancy is 11.90%. Abnormal triglyceride level, the second trimester of pregnancy is 54.76%. There is a positive but not significant correlation between blood sugar and triglycerides, and there is no significant relationship between blood sugar and other lipid profile. There is a positive but not significant correlation of BMI with total cholesterol in the second trimester of pregnancy.

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