Research Article

Correlation between Body Mass Index and Lipid Profile in Second Trimester with the Incidence of Hypertension in Third Trimester

Hubungan Indeks Massa Tubuh dan Profil Lipid Trimester Kedua dengan Kejadian Hipertensi pada Trimester Ketiga

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Abstract

Objective : To determine the relationship of BMI (Body Mass Index) and lipid profile (total cholesterol, triglycerides, HDL, LDL, VLDL) in the second trimester of pregnancy with the incidence of hypertension in the third trimester of pregnancy.

Methods : This was a prospective study. Subjects were the second-trimester pregnant women group which examined by BMI and lipid profile, then assessed the incidence of hypertension in the third trimester. The study was conducted in the Department of Obstetrics and Gynecology and Prof. DR.RD Kandou General Hospital, and affiliated hospital from January 2017 until May 2017. Data analysed with SPSS version 2.0

Results : Of 49 subjects, based on age, most subject with age 20-34 years with 42 subjects (85.8%). Based on the parity obtained 27 subjects (55.2%) with multigravida. By education level, most are high school with 19 subjects (38.7%). From the occupation, most are housewives with 30 subjects (61.3%). Based on BMI, most were subjects with normal BMI with 21 subjects (42.9%). Pearson test showed a significant association between BMI with total cholesterol (r = 0.500 and p = 0.000), whereas Spearman test showed significant relation between BMI with LDL cholesterol (r = 0.416 and p = 0.003) and significant relation between second-trimester LDL cholesterol with third trimester diastolic blood pressure(r = 0.303 and p = 0.034).

Conclusions : There was a significant correlation between BMI with total cholesterol & LDL in the second trimester, and there was a significant correlation between LDL in the second trimester and third-trimester diastolic blood pressure.

Keywords : BMI, HDL, hypertension, LDL, TG, VLDL, total cholesterol

Abstrak

Tujuan : *Untuk mengetahui hubungan IMT (Indeks Massa Tubuh) dan profil lipid (kolesterol total, trigliserida, HDL, LDL, VLDV) pada trimester kedua kehamilan dengan kejadian hipertensi pada trimester ketiga kehamilan.*

Metode : *Penelitian ini merupakan kohort prospektif. Subjek penelitian adalah kelompok ibu hamil trimester kedua yang diperiksa IMT dan profil lipidnya, kemudian dinilai kejadian hipertensi pada trimester ketiga. Penelitian dilakukan di Departemen Obstetri dan Ginekologi Rumah Sakit Umum Pusat (RSUP) Prof.DR.R.D Kandou, dan RS jejaring mulai Januari 2017 sampai Mei 2017. Data dianalisa dengan SPSS versi 2.0*

Hasil : *Dari 49 subjek penelitian, berdasarkan usia paling banyak usia 20 – 34 tahun dengan 42 subjek (85,8%). Berdasarkan paritas didapatkan 27 subjek (55,2%) dengan multigravida. Berdasarkan pendidikan, paling banyak adalah SMA dengan 19 subjek (38,7%). Dari jenis pekerjaan, paling banyak adalah ibu rumah tangga dengan 30 subjek (61,3%). Berdasarkan IMT, paling banyak adalah subjek dengan IMT normal dengan 21 subjek (42,9%). Uji Pearson menunjukkan hubungan bermakna antara IMT dengan kolesterol total (r = 0,500 dan p = 0,000), sedangkan Uji Spearman menunjukkan hubungan bermakna antara IMT dengan kolesterol LDL (r = 0,416 dan p = 0,003) dan hubungan bermakna antara kolesterol LDL trimester kedua dengan tekanan darah diastol trimester ketiga (r = 0,303 dan p = 0,034).*

Kesimpulan : *Terdapat hubungan bermakna antara IMT dengan kolesterol total, LDL trimester kedua dan terdapat hubungan bermakna antara LDL trimester kedua dengan tekanan darah diastol trimester ketiga.*

Kata kunci : *HDL, hipertensi, IMT, kolesterol total, LDL,VLDL, TG*

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INTRODUCTION

Maternal nutritional status is essential for the achievement of maternal and fetal. The most common method used to know the nutritional status of a person is by calculating the Body Mass Index (BMI). Body Mass Index (BMI) is body weight divided by squared height is influenced by ethnicity and genetics and can also be used for measurement of adiposity and energy balance.[1]

In early pregnancy there is an increase in fat buildup associated with increased feeding and increased fat.[2] Fat concentration in blood, lipoprotein and apolipoprotein in plasma increased significantly during pregnancy.[3] Fat accumulation occurred during midterm pregnancy.[4-8] Lipid accumulation can cause endothelial dysfunction, causing preeclampsia, lipid profiles are total cholesterol, triglycerides, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and Very low-density lipoprotein (VLDL). It is suspected that there is an association between preeclampsia with elevated total cholesterol, triglycerides, LDL and VLDL.[9] It has been suggested that elevated plasma triglycerides and LDL during pregnancy can be used to identify women who will experience atherogenic changes in later life.[10]

Hypertension in pregnancy is a complication found in 5-10% of all pregnancies and has an increased risk of poor pregnancy outcomes.[11] The risk of poor outcome of pregnancy in hypertension in pregnancy is commonly found related to the diagnosis of preeclampsia.[11-16] Hypertension in pregnancy divided to preeclampsia or non-preeclampsia which the basis of consideration of possible disease course, appropriate management and possible outcomes.[11-13]

METHODS

This was prospective study identifying the relationship of BMI and lipid profile (total cholesterol, triglycerides, HDL, LDL, VLDL) in the second trimester of pregnancy with the incidence of hypertension in the third trimester of pregnancy. This research was conducted from January 2017 until May 2017 in RSUP Prof. dr.R.D.Kandou Manado, and affiliated hospitals in Manado. We included 49 subjects. All subjects of this study have entered the inclusion criteria and exclusion criteria and have signed a willingness form to participate in the study.

Sampling was conducted at RSUP Prof. dr.R.D.Kandou Manado and an affiliated hospital in Manado which fulfill the inclusion criteria. Samples' body weight, height, vital signs were measured, and venous blood was taken for the examination of lipid profiles in the second trimester of pregnancy and then the samples vital signs were measured and urinalysis laboratory was taken for hypertension examination in the third trimester of pregnancy which pregnant women had been explained and had signed approval statements letter to following the research that has been provided. Analysis and data processing carried out by the researcher and statistic supervisor. The data collection will be carried out by the researcher. This is done manually and computerized by using the software program Statistical Product and Service Solution (SPSS) for Windows version 22.0.

RESULTS

This research was conducted and evaluated from January until May 2017 in the Department of Obstetrics and Gynecology Faculty of Medicine Universitas Sam Ratulangi / RSUP Prof. Dr. R. Kandou Manado and affiliated hospitals in Manado. The subjects consisted of 49 samples of pregnant women.

Table 1. Characteristics of Research Subjects

Characteristics	n	%
Maternal age		
< 20	3	6,1
20 - 34	42	85.8
≥ 35	4	8.1
Parity		
Primigravida	22	44.8
Multigravida	27	55.2
Education		
Bachelor	13	26.6
D3	9	18.4
Senior High School	19	38.7
Junior High School	6	12.2
Primary School	2	4.1
Occupation		
Private Employee	2	4.1
Midwife	8	16.3
Civil Servant	9	18.3
Housewife	30	61.3
Body Mass Index		
Underweight (<18.5 kg/m2)	1	2
Normoweight (18.5 to 24.9 kg/m2)	21	42.9
Overweight (25 to 29.9 kg/m2)	17	34.7
Obese (≥ 30 kg/m2)	10	20.4

Table 2. Statistical Analysis of Second Trimester BMI and Lipid Profile with Incidence of Hypertension in Third Trimester

		Trimester III Blood Pressure			
Trimester II	**Mean (n= 49)**	**Systole**		**Diastole**	
		r	***P-value***	***r***	***P-value***
BMI (kg/m2)	25.95	0.000	0.999	0.073	0.620
Lipid Profile Serum					
Total cholesterol (mg/dl)	211.63	0.200	0.167	0.273	0.058
VLDL (mg/dl)	41.004	– 0.109	0.456	– 0.055	0.705
Triglycerides (mg/dl)	205.02	– 0.109	0.456	– 0.055	0.705
HDL (mg/dl)	60.33	0.026	0.860	0.091	0.534
LDL (mg/dl)	121.22	0.246	0.088	0.303	0.034

Table 3. Statistical Analysis of Blood Pressure

Trimester III	**Mean (n=49)**
Blood pressure	
BP-sistole (mm Hg)	130.82
BP-diastole (mm Hg)	83.88

Table 4. Statistical Analysis of Second Trimester BMI with Lipid Profile in Second Trimester

Trimester II	**Mean (n= 49)**	**Trimester II Lipid Profile Serum**								**Trimester III Blood Pressure**					
	TC	**TC**		**VLDL**		**TG**		**HDL**		**LDL**		**Systole**		**Diastole**	
		r	***P-value***	***r***	***P-value***	***r***	***P-value***	***r***	***P-value***	***r***	***P-value***	***r***	***P-value***	***r***	***P-value***
BMI (kg/m2)	25.95	0.500	0.000	0.177	0.223	0.177	0.223	0.189	0.194	0.416	0.003	0.000	0.999	0.073	0.620

DISCUSSION

In Table 1.shown the characteristic of the study were 42 subjects (85.8%) aged 20-34 years. Based on parity 27 subjects (55.2%) was found with multipara, for education obtained high school with 19 subjects (38.7%). For occupation obtained housewives with 30 subjects (61.3%), for body mass obtained normal body mass index with 21 subjects (42.9%). In Table2. Statistical analysis finds that the average value of body mass index at the second-trimester increase in the condition of pregnancy, for the average value of the lipid profile (total cholesterol, VLDL, triglycerides, HDL, LDL) increases in pregnancy. Similarly for the average results of blood pressure measurement also increased.

The correlation between Body Mass Index (BMI) with the second-trimester lipid profile using Pearson correlation test found a significant correlation between BMI with total cholesterol (r = 0.500 and p = 0.000). Increased of BMI on the second trimester is followed by an increase in total cholesterol. There is no correlation between BMI with HDL cholesterol (r = 0.189 and p = 0.194). With the Spearman correlation test, there was no significant correlation between BMI with VLDL (r = 0.177 and p = 0.223), no significant correlation between BMI with triglycerides (r = 0.177 and p = 0.223) but there is a significant correlation between BMI with LDL cholesterol (r = 0.416 and p = 0.003). Conclusion: BMI was increased in the second trimester, followed by an increase in LDL cholesterol on the second trimester.

Vahratianet al[17] studied the BMI and lipid levels (total cholesterol, triglycerides, LDL, and HDL cholesterol) were increased during gestation. Body Mass Index obtained through the interaction of gestational age was found statistically significant for total cholesterol (p= 0,01) and LDL (p <0.001). It has shown that total cholesterol and LDL were significantly lower for overweight or obese compared with normoweight in the latter half of pregnancy. Vahratian et al found that this difference may be related to metabolic dysregulation associated with maternal overweight and obesity can affect the course of pregnancy and its effects on the fetus. Increased body mass index values found in some other studies, [17-20]

For the relationship of BMI on second trimester with blood pressure measure on third trimester, we found there is no significant between BMI on the second trimester with systolic blood pressure on the third trimester (r = 0.000 and p = 0.999), and there was no significant correlation between BMI on the second trimester with diastolic blood pressure on third trimester (r = 0.073 and p = 0.620).

Savitri Ary I et al [21] suggested BMI in pregnancy determine the maternal weight levels, but not the changes in blood pressure during pregnancy and it associated with the possibility of pregnancy hypertension and preeclampsia, regardless of gestational weight gain. Based on Hogan et al [22] and Macdonald-Wallis et al [23] suggested that weight gain during pregnancy was associated with an increased risk of gestational hypertension and preeclampsia. However, this study showed different results due to IMT measurements were taken in the second trimester.

For second trimester total cholesterol with third-trimester blood pressure, total cholesterol was increased in pregnancy with value of 211.63. With Pearson correlation test there was no significant correlation between second-trimester total cholesterol and third-trimester systolic blood pressure(r = 0.200 and p = 0.167), and there was no significant correlation between second-trimester total cholesterol and third-trimester diastole blood pressure (r = 0.273 and p = 0.058).

In this study found that the mean value of VLDL increased in pregnancy condition with a value of 41.004 compared with the normal reference values (2-30 mg/dl). The Spearman correlation test found no significant correlation between second-trimester VLDL with third trimester systolic blood pressure (r = - 0.109 and p = 0.456) and no significant correlation between second-trimester VLDL and third trimester diastolic blood pressure (r = - 0.055 and p = 0.705).

In our study, the mean value of triglycerides in pregnancy was increased to 205.02 compared with the normal reference values (<150 mg/dl). There is a significant correlation between VLDL in the second trimester compared with systolic blood pressure in the third trimester using the Spearman correlation test (r = - 0.109 and p = 0.456) and there was no significant correlation between VLDL in the second trimester with blood pressure diastolic in third trimester (r = - 0.055 and p = 0.705).

In this study, the mean value of HDL in pregnancy was 60.33. Using Spearman correlation test, there is no significant correlation between HDL in the second and third trimester with systolic blood pressure (r = 0.036 and p = 0.805), and there was no significant correlation between HDL in the second and third trimester with diastolic blood pressure (r = 0.092 and p = 0.531).

The mean value of LDL in pregnancy was increased with a value of 121.22 compared with the normal reference values (<100 mg/dl). Spearman correlation showed no significant correlation between LDL cholesterol in the second trimester with systolic blood pressure on the third trimester (r = 0.246 and p = 0.088), but there is a significant correlation between LDL cholesterol on the second trimester with diastolic blood pressure third trimester (r = 0.303 and p = 0.034). These findings were similar with previous studies before, which showed an increase in total cholesterol, VLDL, triglycerides, HDL and LDL in the second trimester compared with the third trimester. Based on Pusukuru et al[24] and Jayanta De et al[25] hypertriglyceridemia are risk factors for preeclampsia, gestational diabetes and premature. Lipid profile measure is highly recommended during pregnancy to implement appropriate management strategies to prevent adverse effects of hyperlipidemia associated with pregnancy.

Takahashi et al [26], stated that total cholesterol, VLDL, triglycerides, HDL and LDL are increased from the first trimester to the second trimester. Lokhande al[27] found that association between increased of lipid profile, endothelial cells and oxidative stress are involved in the pathophysiology of hypertension in pregnancy. Increased plasma lipids cause the activation of endothelial cells. Study from Lokhande et al showed that total cholesterol levels did not affect hypertension in pregnancy (preeclampsia). However, there is a change in the lipid profile in hypertension in pregnancy (preeclampsia) that is hypertriglyceridemia.

A study from Lokhande show increase in triglycerides was statistically significant (p<0.0001) in pregnancy with hypertension when compared with women with normal pregnancies. Hypertriglyceridemia can be modulated by hyperinsulinism in pregnancy. Triglycerides, LDL and increasing free fatty acid levels in normal pregnancy which correlates with insulin resistance. In hypertension in pregnancy (preeclampsia) show excessive amounts of insulin resistance resulting in increased levels of triglycerides. In pregnancy this triglyceride endothelial dysfunction which can affect endothelial cells.

Based on Research from Kiran et al[28], which examined the lipid profile in the second trimester as a predictor of hypertension in pregnancy is getting results where pregnant women with preeclampsia had higher levels of total cholesterol, triglycerides, VLDL and LDL compared with normotensive pregnant women. This can be explained by several mechanisms: increased plasma lipid and lipoprotein (LDL) may induce endothelial dysfunction caused by oxidative stress. When oxidative stress is to a certain extent, cell damage can occur, including damage to the structure of the cell membrane of mitochondria and nucleus DNA. Dyslipidemia can also attack the trophoblasts that contribute to the occurrence of preeclampsia.

Based on Sattar N et al[29], preeclampsia can be characterised by dyslipidemia, with its predominant hypertriglyceridemia. In women with preeclampsia found increased concentrations of triglycerides in early pregnancy, and it is associated with a high concentration of free fatty acids. High levels of triglycerides associated with increased LDL. Increased levels of free fatty acids cause the accumulation of fat in the liver and kidneys that contributes to some of the complications of preeclampsia.

CONCLUSION

There is a significant correlation between BMI with total cholesterol (r = 0.500 and p = 0.000), there is a significant correlation between BMI with LDL cholesterol (r = 0.416 and p = 0.003) and there is a significant correlation between LDL cholesterol trimester II with blood pressure diastolic trimester III (r = 0.303 and p = 0.034).

SUGGESTION

It is expected that further research conducted to assess changes in lipid profile (total cholesterol, VLDL, triglycerides, HDL and LDL) in the third-trimester pregnant women. This research can be continued with a larger sample to be able to assess complication that occurs in the third trimester with the change in lipid profile.

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