



# COMPARISON OF LOW DENSITY LIPOPROTEIN AND HIGH DENSITY LIPOPROTEIN RATIO IN PREECLAMPSIA AND NORMAL PREGNANCY

Rizka Amelia Sari<sup>1</sup>, Letta S. Lintang<sup>1</sup>, Binarwan Halim<sup>1</sup>, Johny Marpaung<sup>1</sup>, Henry Salim Siregar<sup>1</sup>,  
Deri Edianto<sup>1</sup>

<sup>1</sup>Department of Obstetric and Gynaecology, Medical Faculty, University of North Sumatra, H. Adam Malik  
Hospital Medan

**Abstract:** Maternal mortality rate were higher in developing countries, includes Indonesia with preeclampsia was second most common causes. This study was aimed to assess low density lipoprotein, high density lipoprotein, ratio of low density lipoprotein and high density lipoprotein, triglycerides, and total cholesterol in preeclampsia compared with normal pregnancy. This is case control study on pregnant women in third trimester pregnancy which divided into preeclampsia group and normal pregnancy group. Total sample was 30 sample for each group which selected by consecutive sampling. Total cholesterol levels ( $226.33 \pm 40.22$  mg/dl) were higher in normal pregnancy. HDL in preeclampsia woman ( $50.87 \pm 14.06$  mg/dl), LDL levels ( $148.4 \pm 49.4$  mg/dl) was lower than in normal pregnancy. Higher triglyceride levels and LDL/HDL ratio were found in preeclampsia woman ( $290.57 \pm 132$  mg/dl and  $3.07 \pm 1.1$  mg/dl). A significant difference between two groups was only found in HDL levels ( $p = 0.004$ ).

**Keywords:** preeclampsia, normal pregnancy, LDL/HDL ratio

## I. INTRODUCTION

According to World Health Organization (WHO), 295,000 women died during pregnancy, childbirth and after pregnancy in 2017. In Indonesia, according to 2015 Intercensus Population Survey, maternal mortality rate (MMR) is 305 per 100,000 live births. Direct causes of maternal mortality rate include bleeding 42%, eclampsia/preeclampsia 13%, abortion 11%, infection 10%, prolonged or obstructed labor 9%, and other causes 15%. According to 2017 district/city health profile, MMR in North Sumatra is 85/100,000 live births. The prevalence of preeclampsia in developed countries is 1.3-6%, while in developing countries is 1.8-18%.<sup>1</sup>

Women with preeclampsia show arterial lesions at uteroplacental implantation site. This morphological lesion is usually observed in cases of acute atherosclerosis, and is characterized by fibrinoid necrosis areas surrounded by macrophages with high lipid content.<sup>2</sup> A dyslipidemic pattern of elevated total cholesterol, triglycerides, and low-density lipoprotein cholesterol (LDL-C), combined with decreased concentrations of high-density lipoprotein cholesterol (HDL-C) may be associated with increased risk of preeclampsia.<sup>3</sup> Dyslipidemia in early pregnancy is associated with increased preeclampsia risk. Women who later developed preeclampsia had higher concentrations of LDL-C, triglycerides, and LDL/HDL, respectively ( $p < 0.05$ ). HDL-C concentrations were 7.0% lower in women with preeclampsia than in control subjects ( $p < 0.05$ ).<sup>4</sup> Failure to raise HDL cholesterol levels may have some association with preeclampsia-eclampsia.<sup>5</sup>

## II. RESEARCH METHODOLOGY

Case control study with consecutive sampling method to assess low density lipoprotein, high density lipoprotein, ratio of low density lipoprotein and high density lipoprotein, triglycerides, and total cholesterol in preeclampsia compared with normal pregnancy. The research sample was 30 people for each group. Population study were all pregnant women at Haji Adam Malik Hospital Medan, USU Hospital, and Sundari Hospital in February 2021 until number of samples was met.

Subject inclusion criteria were pregnant women in third trimester pregnancy (control group); preeclampsia pregnant women in third trimester pregnancy (case group); pregnancy with one live fetus based on ultrasonography examination; willing to sign informed consent and participate in research process. The exclusion criteria were patients with history of hypertension before pregnancy; history of diabetic mellitus; and patients with history of coronary heart disease.

History taking, physical examination and blood pressure measurements were carried out. If hypertension is found, then proceed with laboratory tests (urinalysis and blood tests which is platelets, creatinine, SGOT/SGPT, LDL, HDL) according to clinical pathology laboratory protocol using 2 mL blood sample taken from median cubital vein and examined for LDL, HDL and LDL/HDL ratios, total cholesterol, triglycerides value.

Data collected were analyzed descriptively, then normality test was performed with Saphiro Wilks test. If data is normally distributed, independent T test will be used, while when data is not normally distributed, Mann-Whitney test will be used.

### III. RESULTS AND DISCUSSION

This study was followed by 60 research subjects who met inclusion criteria taken by consecutive sampling which were divided into 30 patients in each group.

Table 1. Characteristics of research subjects

Characteristics	Group		p
	Preeclampsia (n, %)	Normal pregnancy (n, %)	
Age (years old)			
20-35	24 (80%)	26 (86,7%)	0,731*
>35	6 (20%)	4 (13,3%)	
Parity (n, %)			
Primiparous	14 (46,7%)	10 (33,3%)	0,518*
Secundiparous	10 (33,3%)	11 (36,7%)	
Multiparous	6 (20%)	9 (30%)	
Total	30 (100%)	30 (100%)	

\*T-independen, \*\* Mann-Whitney

Based on Table 1., majority of subjects were aged 20-35 years old with greater proportion in normal pregnancies (86.7%) than preeclampsia (80%). Based on parity, primiparous were more common in preeclampsia woman (46.7%) than normal pregnancy (33.3%), while proportion of secundiparous and multiparous was greater in normal pregnancies (36.7% and 30%) than in preeclampsia woman (33.3% and 20%).

Table 2. Comparison of total cholesterol, HDL, LDL, triglycerides and LDL/HDL ratio between preeclampsia and normal pregnancy groups.

Variable	Group		p
	Preeclampsia (Mean ± SD)	Normal pregnancy (Mean ± SD)	
Total cholesterol (mg/dl)	224,33 ± 50,17	226,33 ± 40,22	0,865*
HDL (mg/dl)	50,87 ± 14,06	61 ± 12,21	0,004*
LDL (mg/dl)	148,4 ± 49,4	164,83 ± 42,87	0,174*
Triglycerides (mg/dl)	290,57 ± 132	246,33 ± 70,09	0,243**
LDL/HDL Ratio (mg/dl)	3,07 ± 1,1	2,79 ± 0,85	0,276*

\*T-independen, \*\* Mann-Whitney

Based on Table 2. Total cholesterol levels were higher in normal pregnancy ( $226.33 \pm 40.22$  mg/dl) than in preeclampsia woman ( $224.33 \pm 50.17$  mg/dl). Similar findings were also found, HDL in preeclampsia woman ( $50.87 \pm 14.06$  mg/dl) which was lower than in normal pregnancy ( $61 \pm 12.21$  mg/dl). Lower LDL levels were also found in preeclampsia woman ( $148.4 \pm 49.4$  mg/dl) than normal pregnancy ( $164.83 \pm 42.87$ ). A significant difference between two groups was only found in HDL levels ( $p = 0.004$ ), while total cholesterol and LDL levels were not found to be significant differences between two groups ( $p = 0.865$  and  $0.174$ ). Higher triglyceride levels and LDL/HDL ratio were found in preeclampsia woman ( $290.57 \pm 132$  mg/dl and  $3.07 \pm 1.1$  mg/dl) than normal pregnancy ( $246.33 \pm 70.09$  mg/dl and  $2.79 \pm 0.85$  mg/dl). Triglyceride levels and LDL/HDL ratio were not significantly differences between two groups ( $p = 0.243$  and  $0.276$ ).

Pregnant women aged over 35 years old have an odds ratio of 3 times higher for preeclampsia compared to women aged 20-25 years old, due to aging process of uterine blood vessels and increased arterial stiffness leading to gradual loss of heart blood vessel compliance, as well as triggering endothelial disorders (characteristics of preeclampsia). Primiparous women also have 2 times higher risk of developing preeclampsia than multiparous women. This finding is associated with first-time exposure to chorionic villi

(of fetal origin) and maternal immune incompetence which is more common in first pregnancy and increases preeclampsia risk.<sup>6</sup>

Previous studies reported that preeclampsia lipid/fat profile will be disturbed by fatty acid metabolism. Women with history of preeclampsia have significant differences in lipid parameters and an increased susceptibility to lipoprotein oxidation, which causes hypertension and proteinuria. Dyslipidemia is a lipid fraction disorder, most important of which is an increase in total cholesterol, LDL cholesterol, triglyceride levels with decrease in HDL levels. High concentrations of plasma lipoproteins in preeclampsia women can induce cholesterol deposition in injured blood vessels, causes plaque formation in placental vessels which exacerbates placental ischemia. Uteroplacental insufficiency results in inadequate blood circulation to placenta. Oxidative stress is thought to play an important role in endothelial changes which lead to atherosclerosis.<sup>7</sup>

Dyslipidemia can cause endothelial damage by increasing oxidized LDL which is phagocytosed by macrophages that form foam cells and increase monocyte accumulation, will stimulate cytokine production and cause endothelial damage.<sup>8</sup> Several reports indicate that preeclampsia risk is increased in women who have higher LDL and TG levels than normal pregnant women. Oxidized LDL inhibits synthesis of endothelial prostacyclin, endothelium-derived relaxing factor (EDRF), and stimulates releases endothelial hormones that have effect of smooth muscle contraction, thereby inhibiting vascular vasodilation. In addition, lipid fraction, plasma lipid peroxidation and free radicals were also increased in preeclampsia patients.<sup>9,10</sup>

#### IV. CONCLUSION

The study results showed that majority of study subjects in preeclampsia group were aged 20-35 years old (80%) and normal pregnancy aged 20-35 years old (86.7%), primiparous were more commonly found in preeclampsia woman (46.7%) than in normal pregnancy (33.3%). A higher LDL/HDL ratio was found in preeclampsia woman ( $3.07 \pm 1.1$  mg/dl), as well as triglycerides ( $290.57 \pm 132$  mg/dl mg/dl). LDL ( $148.4 \pm 49.4$  mg/dl) and total cholesterol ( $224.33 \pm 50.17$  mg/dl) were found to be lower but these differences were not statistically specific except for HDL levels ( $50.87 \pm 14.06$ ) mg/dl which was found to be significantly lower in preeclamptic women.

#### V. ACKNOWLEDGEMENT

The researcher thanks supervisor of Obstetric and Gynaecology Department and all parties involved in this research. However, the researcher admits that there are weaknesses in this study, so further research with larger number of samples is needed to confirm results of this study.

#### REFERENCES

1. Badan Pusat Statistik, 2015. Profil Penduduk Indonesia Hasil SUPAS 2015.
2. Jose de Lima, V, Roberta de Andrade, C, Ruschi, G E, Sass, N. Serum lipid levels in pregnancies complicated by preeclampsia. Sao Paulo Med J. 2011;129(2):73-6.
3. Spracklen et al. Maternal Hyperlipidemia and the Risk of Preeclampsia: A Meta- Analysis. American Journal of Epidemiology. 2014.
4. Kaaja, R. Lipid abnormalities in pre-eclampsia: implications for vascular health. Taylor and Francis Group LLC. 2011.
5. Rajyalakshmi, K, Rao, B S. A Study of Serum Lipoproteins and Serum Triglycerides in Normal Pregnancy and Pregnancy Induced Hypertension and Eclampsia. International Journal of Contemporary Medical Research. 2016.
6. Das S, Das R, Bajracharya R, Baral G, Jabegu B, Odland JO, et al. Incidence and risk factors of pre-eclampsia in the Parokar Maternity and Women's Hospital, Nepal: A retrospective study. International Journal of Environmental Research and Public Health. 2019; 16: 3571.
7. Ujan YM. Kadar Low Density Lipoprotein sebagai Faktor Risiko terjadinya Preeklampsia. FK Univ.Udayana. 2012.
8. Tesfa E, Nibret E, Munshea A. Maternal lipid profile and risk of pre-eclampsia in African pregnant women: a systematic review and meta-analysis. PLoS One. 2020; 15(2): e0243538.
9. Spracklen CN. Dyslipidemia and the Risk of Preeclampsia: Genetic Causes and Related Modifiers. Iowa Research Online. 2014: 25-27.
10. Islam NAF, Chowdhury MAR, Kibria GM, Akhter S. Study of serum lipid profile in pre-eclampsia and eclampsia. Faridpur Med Coll J. 2010; 5(2): 56-59.