Hematology Profile Analysis and Birth Weight in Preeclampsia

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Abstract. Preeclampsia is a specific syndrome in pregnancy that occur after 20 weeks gestation in women who were previously normotensive. Hypertension in pregnancy caused complications in cardiovascular, hematology, endocrine, metabolic and regional blood flow accompanied by disorders of various organs, resulting in an increase of hemoconcentration in haemoglobin. The purpose of this study was to analyze the hematology profile and birth weight in preeclampsia. the design of this study was cross sectional with a sample of 40 respondents, consisting of 20 preeclampsia women and 20 women normal pregnancy. The hematology profile assessed was haemoglobin levels, hematocrit levels, platelet levels and blood sedimentation rates. The results showed haemoglobin levels, hematocrit levels, platelet level and blood sedimentation rates in both groups were not significantly difference with p value in each category was 0,110; 0,163; 0,686 and 0,983 (p value >0,05). Thus this study concludes that the hematological profile and birth weight in preeclampsia and normal pregnancies are the same.

Keywords. hematological profile; preeclampsia; birth weight.

1 Introduction

Preeclampsia in pregnancy is characterized by hypertension after 20 weeks gestation, followed by one of the criteria namely: proteinuria, organ dysfunction and uteroplacental dysfunction [1]. In the world there are estimated 349.000 women dying during pregnancy or childbirth and preeclampsia is the second cause of maternal death [2].

The clinical finding of preeclampsia can manifest either as a maternal syndrome (hypertension, proteinuria with or without edema and other multisystem abnormalities) or as a foetal syndrome (foetal growth restriction, reduced amniotic fluid and abnormal placentation) [3].

The sole source of nutrients for the growing foetus is the maternal blood [4]. The pathogenesis of preeclampsia is accumulation of the fibrinoid material and foam cells in spiral arteries caused by trophoblastic invasion which lead to reduced blood flow and

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favour the interaction between the surrounding cells. Longer exposure of red blood cells to oxygen metabolites and proteases produced by inflammatory cells causes red blood cells damage which may compromise maternal foetal exchange of oxygen and hence alters placental homeostatis and foetus development [5].

Clinical research showed that preeclampsia significantly caused low birth weight [5]. Low birth weight in babies born with preeclampsia occurred because babies are born premature or mature but have growth restriction caused by retroplacental circulation disorder whereas arteriolar spasm causes asphyxia and longer spasm can interfere foetal growth. Arteriolar spasm causes blood flow constriction to retroplacenta which interfere with exchanges of CO₂, O₂ and nutrients in foetus, thus impact foetal growth restriction [7,8].

It is caused by various changes in pregnancy, one of its is hematology changes of pregnant women.⁹ So as to detect preeclampsia, in addition to blood pressure and proteinuria, hematology profile is one thing that worth for researching [5]. According to recent reports, the levels of haemoglobin can help to predict preeclampsia [10-13]. In addition, other researchers, showed that high levels of haemoglobin may be associated with the increased risk of diabetes, hypertension in pregnancy, preterm delivery and low birth weight [12].

In addition to haemoglobin levels, hematocrit levels in preeclampsia are also higher than in normal pregnancy [13]. High hematocrit levels or low blood plasma volume during pregnancy, especially in second trimester can be associated with the risk of foetal growth restriction, foetal death, preterm labor and preeclampsia [13].

Another research also revealed a decrease in platelet levels and an increase in the rate of blood sedimentation in preeclampsia occurs due to arteries vasospasm that causes thrombocytopenia [14,15].

Based on previous researchers hematology profile in preeclampsia is needed to be assessed to know whether or not in every preeclampsia occurs hematological changes or can we use hematology profile in pregnancy as an indicator to detect preeclampsia and also its effect in baby birth weight. The different of this research with previous researchers was 4 categories of profile hematology (haemoglobin levels, hematocrit levels, platelet levels and blood sedimentation rates) that being assessed, also place and time occurrence of preeclampsia. This research aims to determine whether the hematology profile (haemoglobin levels, hematocrit levels, platelet levels, and blood sedimentation rates) can be used as an indicator to predict preeclampsia and to compare birth weight of preeclampsia and normal pregnancy.

2 Research Method

This research is a cross sectional study conducted in August until September 2019 in 9 public health centers of Semarang city, namely Bulu Lor, Halmahera, Kedungmundu, Genuk, Bangetayu, Tlogosari Wetan, Tlogosari Kulon, Ngesrep and Sekaran whose implementation is assisted by 2 enumerators with a midwifery undergraduate degree background.

The population in this research were all third trimester pregnant women in 9 public health centers of Semarang city and the data were obtained through antenatal care history record. With convenient sampling (non probability sampling), a total of 40 respondents were obtained.

In this research the sample was divided into 2 groups, namely 20 respondents with preeclampsia (third trimester pregnant women with blood pressure $\geq 140/90$ mmHg and proteinuria + 1) and 20 respondents with normal pregnancy (third trimester pregnant women with blood pressure normotensive and proteinuria negative) that meets the

research’s inclusion and exclusion criteria. Each respondent was asked to fill out an informed consent sheet and a blood sample was taken one times for each respondents in third trimester pregnancy.

Blood taken was as much as 2,5 cc and put into EDTA tubes for blood hematology examination namely haemoglobin levels, hematocrit levels, platelet levels and blood sedimentation rates which were analyzed by IBL Laboratory in Semarang. Data of birth weight are obtained through birth records.

After normality test, the blood hematology profile (hematocrit levels, platelet levels and blood sedimentation rates) and birth weight were analyzed using an independent t-test while haemoglobin levels were analyzed using Mann Whitney test.

This research was approved by the ethics commission of Sultan Agung Islamic University in Semarang with number 336/VIII/2019/KomisiBioetik.

3 Analysis Results

Table 1 shows that the mean ages in preeclampsia was 30,7 years and 29,7 years in non preeclampsia. Mean haemoglobin levels was 11.61 gr/dl in preeclampsia and 11.05 gr/dl in non preeclampsia. Mean hematocrit levels was 34.85% in preeclampsia and 33.10% in non preeclampsia. Mean platelet levels was 281.9 x 10³/μL in preeclampsia and 292.5 x 10³/μL in non preeclampsia. Mean blood sedimentation rates was 37 mm/hours in preeclampsia and 36.9 in non preeclampsia. Mean birth weight was 3250 gr in preeclampsia and 3225 gr in non preeclampsia.

. **Table 1.** frequency distribution of ages, haemoglobin levels, hematocrit levels, platelet levels, blood sedimentation rates and birth weight in preeclampsia.

Variables	Mean	Median	Min	Max	SD
Ages					
Preeclampsia	30.7	30.5	24	40	4.231
Non Preeclampsia	29.7	28.5	22	39	5.833
Haemoglobin levels					
Preeclampsia	11.61	11.65	9	14	1.315
Non Preeclampsia	11.05	10.65	10	14	1.278
Hematocrit levels					
Preeclampsia	34.85	35	27	41	3.964
Non Preeclampsia	33.10	32	28	43	3.810
Platelet levels					
Preeclampsia	281.9	268	150	437	87.7
Non Preeclampsia	292.5	288	175	450	76.6
Blood sedimentation rates					
Preeclampsia	37	39.5	6	65	18.48
Non Preeclampsia	36.9	30	5	78	24.17
Birth weight					
Preeclampsia	3083.50	3250	2100	3800	491.97
Non Preeclampsia	3190.50	3225	2570	3800	306.05
Total	7073.31	7278.8	5126	8821	21435.97

Table 2 shows that all variable (ages, haemoglobin levels, hematocrit levels, platelet levels, blood sedimentation rates and birth weight) was normally distributed in preeclampsia group (p value <0,05), while in non preeclampsia group haemoglobin levels

was not normally distributed (p value >0,05).

Table 2. Normality data

Variables	<i>p-value</i>	
	Preeclampsia	Non preeclampsia
Ages	0.305	0.105
Hemoglobin levels	0.221	0.046
Hematocrit levels	0.106	0.059
Platelet levels	0.351	0.583
Blood sedimentation rates	0.230	0.068
Birth weight	0.139	0.935

Table 3 shows that there is no significant difference ages in both groups with p value > 0,05 (0,519). Haemoglobin levels in both groups are not significantly difference (p value = 0,519), hematocrit levels in both groups are not significantly difference (p value = 0,163), platelet levels in both groups are not significantly difference (p value = 0,686), blood sedimentation rates in both groups are not significantly difference (p value = 0,983), birth weight in both groups are not significantly difference (p value = 0.414).

Table 3. The differences of ages, hemoglobin levels, hematocrit levels, platelet levels, blood sedimentation rates and birth weight in preeclampsia

Variables	Preeclampsia	Non preeclampsia	<i>P</i>
ages (years)			
Mean	30.7 (4.231)	29.7 (5.833)	0.519
Median	30.5	28.5	
Minimum	24	22	
Maximum	40	39	
Haemoglobin levels (g/dl)			
Mean	11.61(1.315)	11.05 (1.278)	0.110
Median	11.65	10.65	
Minimum	9	10	
Maximum	14	14	
Hematocrit levels (%)			
Mean	34.85 (3.964)	33.10 (3.810)	0.163
Median	35	32	
Minimum	27	28	
Maximum	41	43	
Platelet levels (x 10 ³ /μL)			
Mean	281.9 (87.7)	292.5 (76.6)	0.686
Median	268	288	
Minimum	150	175	
Maximum	437	450	
Blood sedimentation rates (mm/hours)			

Mean	37 (18.48)	36.9 (24.17)	0.983
Median	39.5	30	
Minimum	6	5	
Maximum	65	78	
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Birth weight (gr)			
Mean	30383.50 (35,05)	3190.50	0.414
Median	3250	3225	
Minimum	2100	2570	
Maximum	3800	3800	

Hematology profile in preeclampsia

Based on research that has been done, haemoglobin levels in preeclampsia was higher than non preeclampsia, but not significantly difference (p value = 0,519), means that haemoglobin levels in both groups are the same. This results was different with the research of phaloprakan et.al and Chang et. al which concluded that haemoglobin levels was higher in first and third trimester can be associated with preeclampsia (p >0,01) or the research of Nasiri M, et al which showed that in preeclampsia, haemoglobin levels was higher compared with normotensive whereas mean haemoglobin levels in first trimester was higher than second trimester and lower than third trimester with p value < 0,001 thus haemoglobin levels can be used as one of indicator of preeclampsia [17].

But with this research we concluded that haemoglobin levels cannot be use as a define indicator of preeclampsia but as a early sign of preeklampsia, whereas blood pressure, proteinurine, or other blood profile still need to be assessed.

This research showed that in preeclampsia hematocrit levels was 34.85%, higher than non preeclampsia 33,10%, but not significantly difference (p value = 0,163). This result was difference with the research of Basak et al, and also the research of Heilman which concluded there is an increase of hematocrit levels in preeclampsia compare to normotensive [13,18].

Other research also showed that there is a significant correlation between hematocrit and gestation [19]. But in this research hematocrit levels in both group was founded to be not significantly difference, so we can concluded that hematocrit levels in preeclampsia was higher than non preeclampsia but this is not always happen in every pregnancy women and hematocrit levels cannot be used as a define indicator of preeclampsia.

In this research, platelet levels in preeclampsia was lower than non preeclampsia but not significantly difference (p value>0,05). This is different with the research of Jaremo et al that founded in preeclampsia there is a significant decreased of platelet levels.²¹ however this result was in line with the research of Ceyhan et al which assess hematology profile of 56 preeclampsia and 43 normal pregnancy women which founded there is significant difference in platelet levels of both groups [21]. So we can concluded that platelet levels cannot be use as a define indicator of preeclampsia.

Blood sedimentation rates in this research was 37 mm/hours in preeclampsia and higher than non preeclampsia but not significantly difference (p value>0,05). The research of Van NR et al showed that blood sedimentation rate was affected by gestation and hemoglobin levels with p value <0,0001. Also in third trimester founded that normal blood sedimentation rates was 15-116 mm/hours so the result of this research was still in category normal therefore an increase of blood sedimentation rates cannot be used as an define indicator of preeclampsia [22].

Effect of Preeclampsia in Birth Weight

This research showed that there is no significant difference in birth weight between both

groups (p value $> 0,05$). This result was different with other researchs which concluded that in preeclampsia mean birth weight was lower than non preeclampsia in every gestation [23].

This is happen because in this research we are not assess other factor that affect baby birth weight and based on research of Seyom E et al social economic status, gestation, and blood pressure during pregnancy affect baby birth weight [23, 24].

Levels of severity and occurrence time of preeclampsia was also affect baby birth weight. The research of Odeagrd RA et al founded that preeclampsia in early pregnancy have a significant effect in fetal growth restriction. This research also said that low birth weight risk also have higher occurrence [6].

Based on our research we can concluded that there is no significant diffence in hematology profile (hemoglobin levels, hematocrit levels, platelet levels and blood sedimentation rates) in preeclampsia and non preeclampsia so we can assumed that plasenta dysfunction not occurs therefore there is no foetal growth restriction which affect baby birth weight. This is in line with the research of Obed SA that concluded preeclampsia is a heterogenic disorder which causes 2 phases, baby born with normal weight (normal placenta) and low birth weight baby (placenta dysfunction) [25].

Further research about level severity of preeclampsia, occurance time of preeclampsia (in first, second or third trimester) and its effect on baby birth weight is needs to be researched.

4 Conclusion

In preeclampsia hematology changes may not be occurs, thus hematology profile cannot be used as a define indicator of preeclampsia. Whereas baby birth weight in preeclampsia and non preeclampsia also not significantly difference.

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