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RESEARCH ARTICLE

Estimation of Hematological Parameters Among Neonate of Sudanese Women with pre Eclampsia/Eclampsia

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Abstract

Preeclampsia is a serious disease, is one of a potentially fatal com-plication of pregnancy, it can lead to eclampsia and may result in maternal and neonatal mortality and morbidity.This is a case control study conducted at hematology lab in Omdurman maternity hospital and central lab in Ibrahim malik teaching Hospital, Khartoum Sudan. The study aimed to estimate the hematological parameters among neonate of Sudanese women with pre eclampsia/eclampsia . Fifty neonate of women with pre eclampsia/eclampsia utilized as a cases and fifty neonate of apparently health women were used as a control. Three ml of cord blood samples were collected from each subject in EDTA for analysis.When compared the results between case and control groups reveled that; there was a significant decrease in WBCs (p.value 0.000), significant increase in relative lymphocytes (p.value 0.000), significant decrease in absolute lymphocytes count (p.value0.002), significant decrease in relative neutrophils count (p.value 0.000) and insignifi-cant decrease in absolute neutrophils count (p.value0.111).significant decrease in RBCs and HGB (p.value0.002), in significant decrease HCT% (p.value 0.1750, significant increase in MCV and RDW-SD (p.value 0.029), in addition to that there was insignificant decrease in RDW-CV(p.value 0.444), significant decrease in MCH (p.value0.110) but there was significant decrease in MCHC (p.value0.017).there was a significant decrease in platelets count(p.value 0.000) , also there was a significant increase in platelets distribution width PDW (p.value 0.001). There was clearly variation between neonate of preeclampsic mothers and neonate of eclampsic mothers , the result showed; sig-nificant decrease in WBCs /RBCs/HGB/ and HCT% of neonate of preeclampsic mothers compared with neonate of eclampsic mothers with (p.value 0.000) for WBCs, (p.value 0.010) for RBCs, (p.value 0.003) for HGB and (p.value 0.0150 for HCT%), while there was in significant decrease in platelets count of neonate of preeclampsic mothers when compared with neonate of eclampsic mothers (p.value 0.104) , also there was significant increase in MCV/MPV and RDW-SD (p.value 0.00100, (p.value 0.000), (p.value 0.00) respectively. There was significant direct correlation (positive correlation) between age and relative lymphocytes/ absolute lymphocytes with (p.value 0.030) (p.value 0.010), and there was significant inverse correlation (negative correlation) between age and MXD / relative neutrophils with (p.value 0.000, p.value 0.030), also there was there was significant inverse correlation (negative correlation) between age and MCV / MCH / RDW-SD and MPV with (p.value 0.002, p.value 0.001, p.value 0.005 and p.value0.000) respectively.

Keyword: Preeclampsic, eclampsic, neonate,WBCs,RBCs,HCT,MCV,MCH and platelets.

1 | INTRODUCTION

Preeclampsia (PE) is a certainly fatal complication of pregnancy identified by an increase in blood pressure (>140/90 mmHg) and proteinuria (>300 mg/24 hrs), usually accompanied by edema. Symptoms of PE begin after 20 weeks of gestation, If remains untreated , it can lead to eclampsia , it is affect 2-10% of pregnancies worldwide, and claims the lives of over 75,000 mothers and 500,000 newborns yearly . No therapeutic agents have been progressed to prevent or cure PE, because of the absence of a complete understanding of the pathogenesis of this disease. PE has long been considered as a "disease of theories", and the path physiology of PE continues to be the subject of argument. (1)

The cytotoxic environment present in PE affects the development of fetal cell lineages neutropenia is observed in 50% of neonates and is correlated with mortality, this disruption alters the immune system response into a pro inflammatory profile and can be correlated to neonatal necrotizing enterocolitis. An antiangiogenic environment is also part of the preeclampsia presentation and can be responsible for the enhancement of bronchopulmonary dysplasia (2) . Infants exposed to preeclampsia had remarkably higher systolic (SBP), diastolic (DBP) , and mean blood pressure (mbp) on the subsequent days up to the fourth postnatal week (3) Background events in pregnancy play an essential role in predisposing the newborn to the risk of developing congenital heart disease CHD (4)

Preeclampsia/eclampsia has remained a significant public health problem inSudan. The effect of preeclampsia on neonate/infant hematological parameters is still controversial, also there is no publisheddata inSudan regarding this topic. This study is designed to determine the effect of maternalpreeclampsia/ eclampsia in the hematological parameters of theirfetus.

2 | MATERIALS AND METHODS

This is a case-control descriptive studyin neonate of Sudanese women,withpre eclampsia/eclampsiaconducted at Omdurman maternity hospital, Khartoum,Sudan, during the period February 2021 to may2021.neonate of preSudanesewomen withpre eclampsia/eclampsia were used as a cases(17-45 years) and apparently healthy neonate from health womenNeonate of 17-45 years Sudanesewere used as a control.

women that suffering from other complication like diabetes , or have other confounding factors like smoker women were excluded from the control , as well as the women withpre eclampsia /eclampsiaand t other medical complication like diabetes were excluded from the cases.

The samples were collected from the vein cord blood after delivery by nursing staff or registrar or other medical person on operation staffin EDTA anticoagulant container for hematological parameters analysis .Data collectedby used; secondary data collection from mothers file used data sheet, results of vein cord blood analysis byautomated cell analyzer counter sysmex KX-21as laboratory result. SPSS13.0 statistical software (SPSS Inc., USA) was used for statistical analysis. The study approved by the ethical committee of the National University , also approved by ministry of health and then the study finally approved by research department of Omdurman maternity hospital.

3 | RESULTS

In the present study 50neonate of mothers with pre eclampsia/eclampsia were included as case group. In addition, 50 neonates of apparently healthy women were selected as control group, for both the women age between (17-45years) (Table 1).This result revealed that is in significant association between age of mother and neonate of case and control neither positive (direct) nor negative (inverse) (mean 27.4

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TABLE 1: Frequency of age group in case and control

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Case	50	18	39	27.4 ± 6.1	27.4
Control	50	19	39	29.5 ± 5.3	29.5

$\pm$ 6.1 ,9.5$\pm$5.3 respectively) (p.value0.062) (table 2)

3.1 | White blood cell result

When compared the WBCs between case and control groups; there was a significant decrease in WBCs (mean9.1$\pm$3.7, 14$\pm$5.6respectively) (p.value 0.000).

For the differential result when compared between case and control our result showed that; there was significant increase in relative lymphocytes (mean 52.9$\pm$8.5 % , 43.3$\pm$5.6 %) (p.value 0.000), significant decrease in absolute lymphocytes count(mean 4.8$\pm$2.1, 6.3$\pm$2.7) (p.value0.002), significant decrease in relative neutrophils count (mean 38.9 $\pm$8.9 %, 47.1$\pm$7.8 %) (p.value 0.000) and insignificant decrease in absolute neutrophils count (mean 4.5$\pm$0., 6.1$\pm$1.5) (p.value0.111) (tables 3,4,and 5)(fig 1)

3.2 | Red blood cell and indices

The result revealed significant decrease in RBCs and HGB When compared between case and control (3.7$\pm$0.8, 4.2$\pm$0.4) (p.value0.002) and (13.0$\pm$2.7, 13.9$\pm$1.3) 9p.value 0.044) respectively. Also showed in significant decrease HCT% (40.2$\pm$8.0, 41.9$\pm$4.5) (p.value 0.1750, significant increase in MCV and RDW-SD (110.9$\pm$4.6 / 99.1$\pm$4.6 (p.value 0.000) (67.9$\pm$6.8, 63.8$\pm$11.5) (p.value 0.029) respectively. in addition to that there was insignificant decrease in RDW-CV (16.9$\pm$2.0, 17.5$\pm$5.2) (p.value 0.444).There was in significant decrease in MCH (34.7$\pm$2.3, 34.0$\pm$1.8) (p.value0.110) but there was significant decrease in MCHC (32.0$\pm$1.5, 32.7$\pm$1.3) (p.value0.017).(table 6) (fig 2, 3, and 4)

3.3 | Platelet

there was a significant decrease in platelets countwhen compered between the case group and control group (84.0$\pm$61.9, 276.9$\pm$74.3) (p.value 0.000) , also there was a significant increase in platelets distribution width PDW (19.2$\pm$11.9/ 12.9$\pm$3.8) (p.value 0.001).(table 7) (fig 5,6)

Additionally our result showed clearly variation between neonates of mothers with pre eclampsia and neonates of mothers with eclampsia , the result showed there was significant decrease in WBCs /RBCs/HGB/ and HCT% of neonate of mothers with pre eclampsia compared with neonate of mothers with eclampsia (p.value 0.000) for WBCs, (p.value 0.010) for RBCs, (p.value 0.003) for HGB and (p.value 0.0150 for HCT%), while there was in significant decrease in platelets count of neonate of pree mothers with pre eclampsiawhen compared with neonate of mothers with eclampsia (p.value 0.104) , also there was significant increase in MCV/MPV and RDW-SD (p.value 0.00100, (p.value 0.000), (p.value 0.00) respectively. (tables 8,9,10,11 and 12)

Finally our result reveled that; there was significant direct correlation (positive correlation) between age and relative lymphocytes/ absolute lymphocytes with (p.value 0.030) (p.value 0.010) respectively, and there was significant inverse correlation (negative correlation) between age and MXD / relative neutrophils with (p.value 0.000, p.value 0.030), also there was There was significant inverse correlation (negative correlation) between age and MCV / MCH / RDW-SD and MPV with (p.value 0.002, p.value 0.001, p.value 0.005 and p.value0.000) respectively. (tables 13,14 and 15) (fig7,8,9,10,11,12,13 and 14)

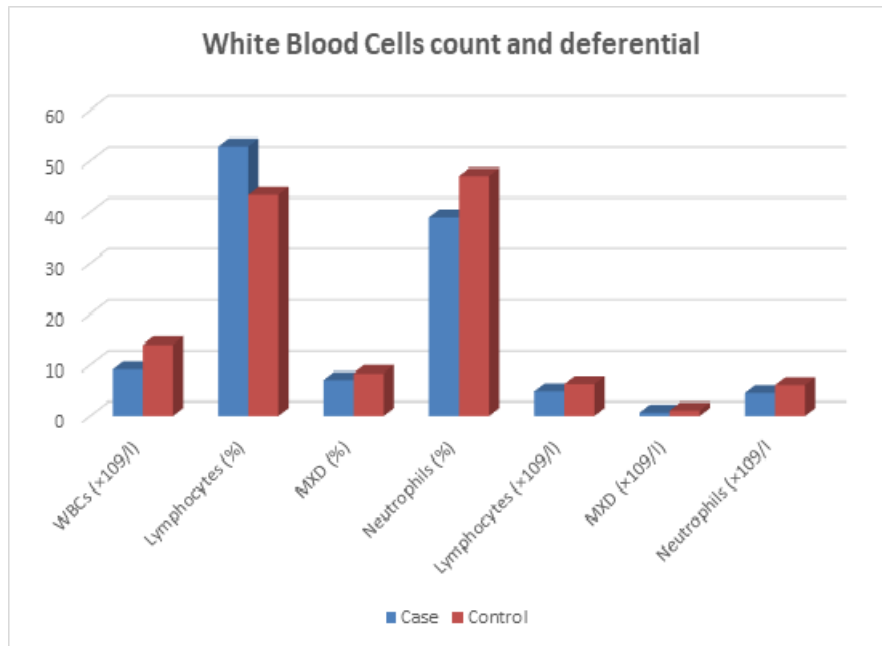**Tabl (14): Correlations between age, Red Blood Cells count and indices**

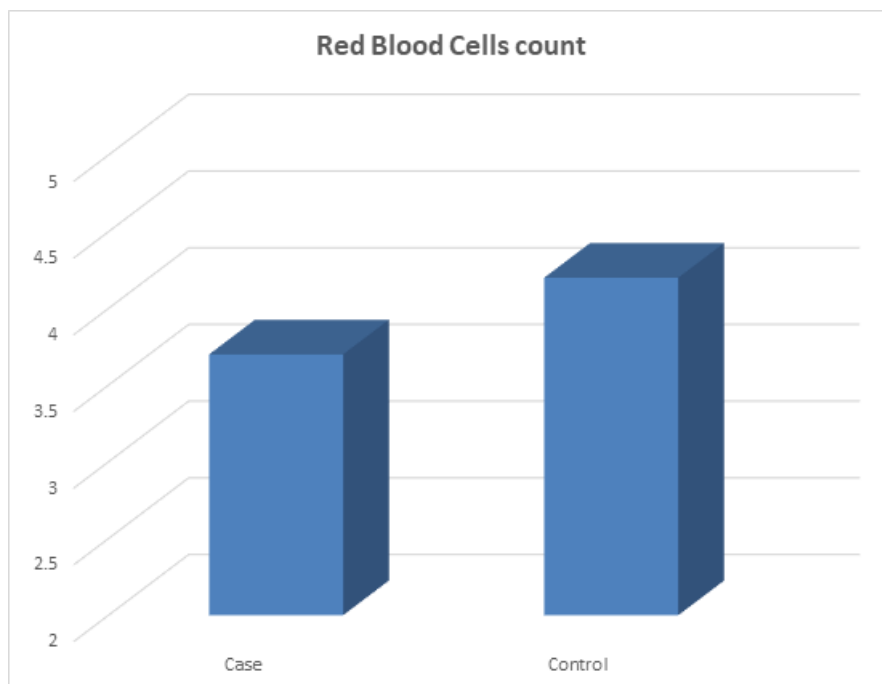Chart 1: **white blood cell count and differential**

Chart 2: **Red cell count in case and control**

TABLE 2: Table (2) Comparison of mothers' age between case and control

Variables	Study population		Mean ± SD	P. value
	Case (n= 50)	Control (n=50)		
Age (years)	27.4 ± 6.1	29.5 ± 5.3		0.062

TABLE 3: Descriptive Statisticsof variables in case group

	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	50	18	39	27.4	6.1
White Blood Cells					
WBCs ($\times 10^9$/l)	50	3.3	16.3	9.1	3.7
Lymphocytes (%)	50	33.0	70.0	52.9	8.5
MXD (%)	50	0.4	10.3	7.1	1.8
Neutrophils (%)	50	8.1	57.8	38.9	8.9
Lymphocytes ($\times 10^9$/l)	50	2.3	8.2	4.8	2.1
MXD ($\times 10^9$/l)	50	0.2	1.1	0.7	0.2
Neutrophils ($\times 10^9$/l	50	0.8	48.4	4.5	0.9
Red Blood Cells					
RBCs ($\times 10^{12}$/l)	50	1.6	5.0	3.7	0.8
HGB (g/dl)	50	6.0	18.2	13.0	2.7
Hct (%)	50	18.5	53.3	40.2	8.0
MCV (fl)	50	102.0	120.0	110.9	4.6
MCH (pg)	50	30.0	38.0	34.7	2.3
MCHC (%)	50	29.0	34.6	32.0	1.5
RDW-SD	50	59.3	82.1	67.9	6.8
RDW-CV	50	13.0	21.1	16.9	2.0
Platelets					
Platelets ($\times 10^9$/l)	50	16.0	260.0	84.0	61.9
PDW (%)	50	10.5	81.1	19.2	11.9
MPV (fl)	50	6.9	12.0	9.142	1.2

4 | DISCUSSION:

This study was carried out to estimate the hematological parameters among neonate of Sudanese women with pre eclampsia/eclampsia in Khartoum statedur- ing the period of February to may 2021.One hundred (100) EDTA vein cord blood sample collected from the cases (mothers with pre eclampsia/eclampsia) and from the control (Healthy mothers) ; so fifty (50) were neonate of Sudanese women with pre eclampsia and eclampsia whereas fifty (50) were neonate of apparently health women .

Our results contribute a clearer understanding of effect of preeclampsia/eclampsia on hematological parameters of neonate.

There was new insightrevealed by this study clearly showed in insignificant association between age of mother and neonate of case and control neither positive (direct) nor negative (inverse).When compared the WBCs between cases and controls groups; there was a highly significant decrease in WBCs of cases our results supports Mosayebi Z et al study which was done in Iran reported that ; Leucopenia was found in 28.5% of the babies in the study, which was more common in babies of gestational age of 32-37weeks (5) . Harms K et al study in Germany demonstrated leucopenia in 21% of the affected infants (6)

Our study indicated that there was a highly significant increase in relative lymphocytes count of cases (neonate ofmothers with pre eclampsia/eclampsia) ,

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TABLE 4: Descriptive Statistics of variables in control group

	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	50	19	39	29.5	5.3
White Blood Cells					
WBCs ($\times10^9$/l)	50	7.1	27.7	14.0	5.6
Lymphocytes (%)	50	31.5	54.8	43.3	5.6
MXD (%)	50	1.1	18.2	8.4	4.6
Neutrophils (%)	50	5.7	57.2	47.1	7.8
Lymphocytes ($\times10^9$/l)	50	3.2	11.7	6.3	2.7
MXD ($\times10^9$/l)	50	0.2	2.6	1.1	0.6
Neutrophils ($\times10^9$/l)	50	4.7	10.4	6.1	1.5
Red Blood Cells					
RBCs ($\times10^{12}$/l)	50	3.3	4.9	4.2	0.4
HGB (g/dl)	50	12.2	16.1	13.9	1.3
Hct (%)	50	35.7	48.7	41.9	4.5
MCV (fl)	50	92.0	109.0	99.1	4.6
MCH (pg)	50	29.9	36.2	34.0	1.8
MCHC (%)	50	30.7	35.5	32.7	1.3
RDW-SD	50	47.4	88.4	63.8	11.5
RDW-CV	50	11.7	49.1	17.5	5.2
Platelets					
Platelets ($\times10^9$/l)	50	100.0	370.0	276.9	74.3
PDW (%)	50	9.4	20.1	12.9	3.8
MPV (fl)	50	8.1	11.0	9.2	0.6

TABLE 5: Comparison of White Blood Cells count and deferential between case and control

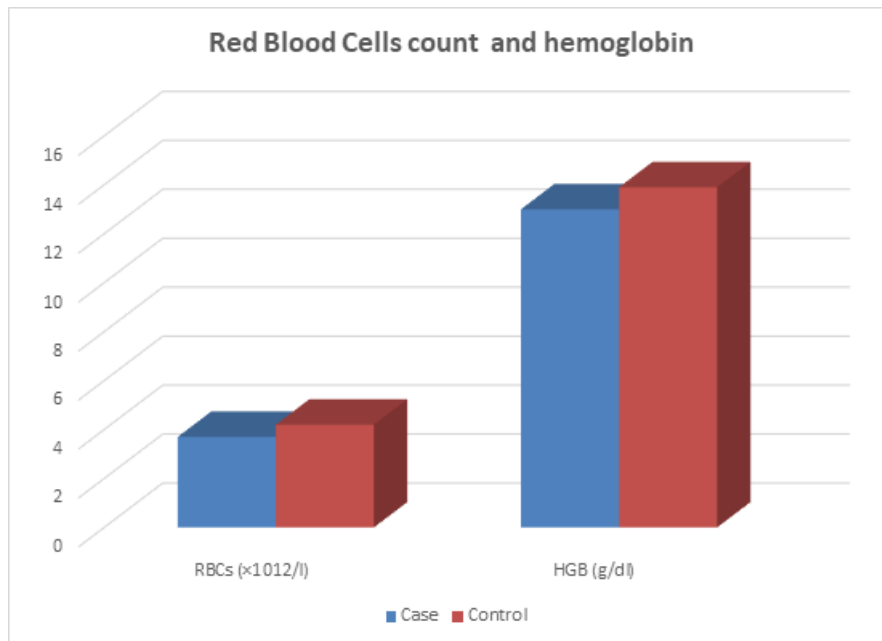| Variables	Study population Mean SD		P. Value
	Case (n= 50)	Control(n=50)	
WBCs ($\times10^9$/l)	9.1 ± 3.7	14.0 ± 5.6	0.000
Lymphocytes (%)	52.9 ± 8.5	43.3 ± 5.6	0.000
MXD (%)	7.1 ± 1.8	8.4 ± 4.6	0.076
Neutrophils (%)	38.9 ± 8.9	47.1 ± 7.8	0.000
Lymphocytes($\times10^9$/l)	4.8 ± 2.1	6.3 ± 2.7	0.002
MXD ($\times10^9$/l)	0.7 ± 0.2	1.1 ± 0.6	0.000
Neutrophils ($\times10^9$/l	4.6 ± 0.9	6.1 ± 1.5	0.111

in contrast there was significant decrease in absolute lymphocytes count with , This finding agree with KalavakuruMouna et al which was done in India reported ; Lymphocyte count was reduced with 43.03% and p<0.001 (7) .

In this study there was significant decrease in relative neutrophils count and insignificant decrease in absolute neutrophils count in cases (Neonate of mothers withpre eclampsia/eclampsia) , Our result disagree with the result of Sivakumar et al which done in Belgium reported ; insignificant change in neutrophil count , while KalavakuruMouna et al which done in India said ; neutropenia caused decrease in absolute neutrophil count and was statistically significant (7).Bolat A et al. reportedin the study done in turkeythat; the total count of lymphocyte, eosinophil, monocyte, andneutrophil was significantly lower in babies of women withpreeclampsia in comparison to babies born to healthy normotensivewomen (8)

TABLE 6: Comparison of Red Blood Cells count and indices between case and control

Variables	Study population Mean SD ±		P. value
	Case (n= 50)	Control (n=50)	
RBCs ($\times 10^{12}$/l)	3.7 ± 0.8	4.2 ± 0.4	0.002
HGB (g/dl)	13.0 ± 2.7	13.9 ± 1.3	0.044
Hct (%)	40.2 ± 8.0	41.9 ± 4.5	0.175
MCV (fl)	110.9 ± 4.6	99.1 ± 4.6	0.000
MCH (pg)	34.7 ± 2.3	34.0 ± 1.8	0.110
MCHC (%)	32.0 ± 1.5	32.7 ± 1.3	0.017
RDW-SD	67.9 ± 6.8	63.8 ± 11.5	0.029
RDW-CV	16.9 ± 2.0	17.5 ± 5.2	0.444

Chart 3: **red cell count and hemoglobin**

TABLE 7: Comparison of Plateletscount and indices between case and control

Variables	Study population Mean ± SD		P. Value
	Case (n= 50)	Control (n=50)	
Platelets ($\times 10^9$/l)	84.0 ± 61.9	276.9 ± 74.3	0.000
PDW (%)	19.2 ± 11.9	12.9 ± 3.8	0.001
MPV (fl)	9.1 ± 1.2	9.2 ± 0.6	0.701

As mentioned in study that was done in Iran by Mosayebi Z, Nariman S Preeclampsia is a common known risk factor for neonatal neutropenia with the incidence of 50% and is the cause for neonatal sepsis mainly in premature newborns (5) . It is a transient hematologic alteration which lasts for days and weeks. Koenig TN and Christensen RD study which done in USA stated that neutropenia and leucopenia was caused by decrease in Granulocyte Colony Stimulating Factor (G-CSF) which is an important haematopoietic growth factor for granulocyte differentiation and proliferation. Neutropenia associated with maternal preeclampsia is also associated with uteroplacental insufficiency which inhibits foetal

TABLE 8: Comparison of White Blood Cells count and deferential between Pre-eclampsia and Eclampsia

Variables	Case group Mean $\pm$ SD		P. value
	Pre-eclampsia (n=28)	Eclampsia (n=22)	
WBCs ($\times 10^9$/l)	7.3 $\pm$ 2.1	11.4 $\pm$ 3.9	0.000
Lymphocytes (%)	52.2 $\pm$ 9.8	53.8 $\pm$ 6.6	0.521
MXD (%)	7.8 $\pm$ 1.7	6.4 $\pm$ 1.5	0.004
Neutrophils (%)	39.8 $\pm$ 9.3	37.9 $\pm$ 8.7	0.485
Lymphocytes ($\times 10^9$/l)	3.7 $\pm$ 1.1	6.2 $\pm$ 2.1	0.000
MXD ($\times 10^9$/l)	0.6 $\pm$ 0.2	0.7 $\pm$ 0.2	0.153
Neutrophils ($\times 10^9$/l	3.1 $\pm$ 1.2	6.5 $\pm$ 9.5	0.067

TABLE 9: Comparison of Red Blood Cells count and indices between Pre-eclampsia and Eclampsia

Variables	Case group Mean $\pm$ SD		P. value
	Pre-eclampsia (n=28)	Eclampsia (n=22)	
RBCs ($\times 10^{12}$/l)	3.5 $\pm$ 0.9	4.1 $\pm$ 0.6	0.010
HGB (g/dl)	12.1 $\pm$ 2.9	14.2 $\pm$ 1.8	0.003
Hct (%)	37.8 $\pm$ 9.2	43.2 $\pm$ 5.1	0.015
MCV (fl)	112.6 $\pm$ 3.9	108.6 $\pm$ 4.5	0.001
MCH (pg)	35.4 $\pm$ 2.2	33.8 $\pm$ 2.1	0.018
MCHC (%)	32.1 $\pm$ 1.5	31.9 $\pm$ 1.6	0.727
RDW-SD	71.7 $\pm$ 6.3	63.2 $\pm$ 3.8	0.000
RDW-CV	17.3 $\pm$ 2.4	16.5 $\pm$ 1.3	0.163

TABLE 10: Comparison of Plateletscount and indices between Pre-eclampsia and Eclampsia

Variables	Case group Mean $\pm$ SD		P. value
	Pre-eclampsia (n=28)	Eclampsia (n=22)	
Platelets ($\times 10^9$/l)	96.7 $\pm$ 71.4	67.9 $\pm$ 43.8	0.104
PDW (%)	21.3 $\pm$ 15.5	16.6 $\pm$ 2.8	0.162
MPV (fl)	9.7 $\pm$ 0.9	8.4 $\pm$ 1.0	0.000

TABLE 11: Comparisonsof White Blood Cells count and deferential among study group

Variable	Group (I)	Group (II)	Mean (I)	Mean (II)	P. value
WBCs ($\times 10^9$/l)	Control	Pre-eclampsia	14.0 $\pm$ 5.6	7.3 $\pm$ 2.1	0.000
		Eclampsia	11.4 $\pm$ 3.9	0.025	
Lymphocytes (%)	Control	Pre-eclampsia	43.3 $\pm$ 5.6	52.2 $\pm$ 9.8	0.000
		Eclampsia	53.8 $\pm$ 6.6	0.000	
MXD (%)	Control	Pre-eclampsia	8.4 $\pm$ 4.6	7.8 $\pm$ 1.7	0.440
		Eclampsia	6.4 $\pm$ 1.5	0.024	
Neutrophils (%)	Control	Pre-eclampsia	47.1 $\pm$ 7.8	39.8 $\pm$ 9.3	0.000
		Eclampsia	37.9 $\pm$ 8.7	0.000	
Lymphocytes ($\times 10^9$/l)	Control	Pre-eclampsia	6.3 $\pm$ 2.7	3.7 $\pm$ 1.1	0.000
		Eclampsia	6.2 $\pm$ 2.1	0.835	
MXD ($\times 10^9$/l)	Control	Pre-eclampsia	1.1 $\pm$ 0.6	0.6 $\pm$ 0.2	0.000
		Eclampsia	0.7 $\pm$ 0.2	0.001	
Neutrophils ($\times 10^9$/l)	Control	Pre-eclampsia	6.1 $\pm$ 1.5	3.1 $\pm$ 1.2	0.007
		Eclampsia	6.5 $\pm$ 9.5	0.748	

TABLE 12: Comparison of Red Blood Cells count and indices among study group

Variable	Group (I)	Group (II)	Mean (I)	Mean (II)	P. value
RBCs (×10¹²/l)	Control	Pre-eclampsia	4.2 ± 0.4	3.5 ± 0.9	0.000
	Eclampsia		4.1 ± 0.6		0.625
HGB (g/dl)	Control	Pre-eclampsia	13.9 ± 1.3	12.1 ± 2.9	0.000
	Eclampsia		14.2 ± 1.8		0.447
Hct (%)	Control	Pre-eclampsia	41.9 ± 4.5	37.8 ± 9.2	0.006
	Eclampsia		43.2 ± 5.1		0.425
MCV (fl)	Control	Pre-eclampsia	99.1 ± 4.6	112.6 ± 3.9	0.000
	Eclampsia		108.6 ± 4.5		0.000
MCH (pg)	Control	Pre-eclampsia	34.0 ± 1.8	35.4 ± 2.2	0.006
	Eclampsia		33.8 ± 2.1		0.718
MCHC (%)	Control	Pre-eclampsia	32.7 ± 1.3	32.1 ± 1.5	0.069
	Eclampsia		31.9 ± 1.6		0.036
RDW-SD	Control	Pre-eclampsia	63.8 ± 11.4	71.7 ± 6.3	0.000
	Eclampsia		63.2 ± 3.8		0.793
RDW-CV	Control	Pre-eclampsia	17.5 ± 5.2	17.3 ± 2.4	0.787
	Eclampsia		16.5 ± 1.3		0.299

TABLE 13: Comparison of Plateletscount and indicesamong study group

Variable	Group (I)	Group (II)	Mean (I)	Mean (II)	P. value
Platelets (×10⁹/l)	Control	Pre-eclampsia	276.9 ± 74.3	96.7 ± 71.4	0.000
	Eclampsia		67.9 ± 43.8		0.000
PDW (%)	Control	Pre-eclampsia	12.9 ± 3.8	21.3 ± 15.5	0.000
	Eclampsia		16.6 ± 2.8		0.103
MPV (fl)	Control	Pre-eclampsia	9.2 ± 0.6	9.7 ± 0.9	0.011
	Eclampsia		8.4 ± 1.0		0.000

TABLE 14: Correlations between age, White Blood Cells count and deferential

		WBCs	Lympho-cytes (%)	MXD (%)	Neu-trophils (%)	Lymphocytes (×10⁹/l)	MXD (×10⁹/l)	Neutrophils (×10⁹/l)
Age	Pearson Correlation	.215	.307*	-.478*	-.308*	.361*	-.049	.090
	P. value	.135	.030	.000	.030	.010	.734	.536
	N	50	50	50	50	50	50	50

TABLE 15:

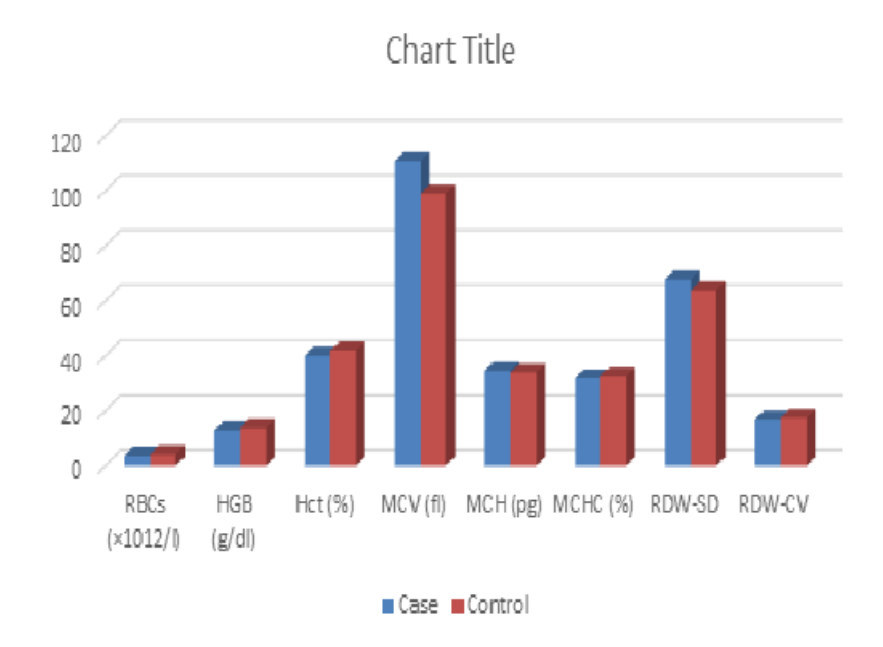|		RBCs	HGB	Hct	MCV	MCH	MCHC	RDW-SD	RDW-CV
Age (years)	Pearson Correlation	.259	.189	.195	-.425*	-.452*	-.188	-.388*	.072
	P. value	.069	.189	.174	.002	.001	.192	.005	.617
	N	50	50	50	50	50	50	50	50

Chart 4: **red blood cell indices in case and control**
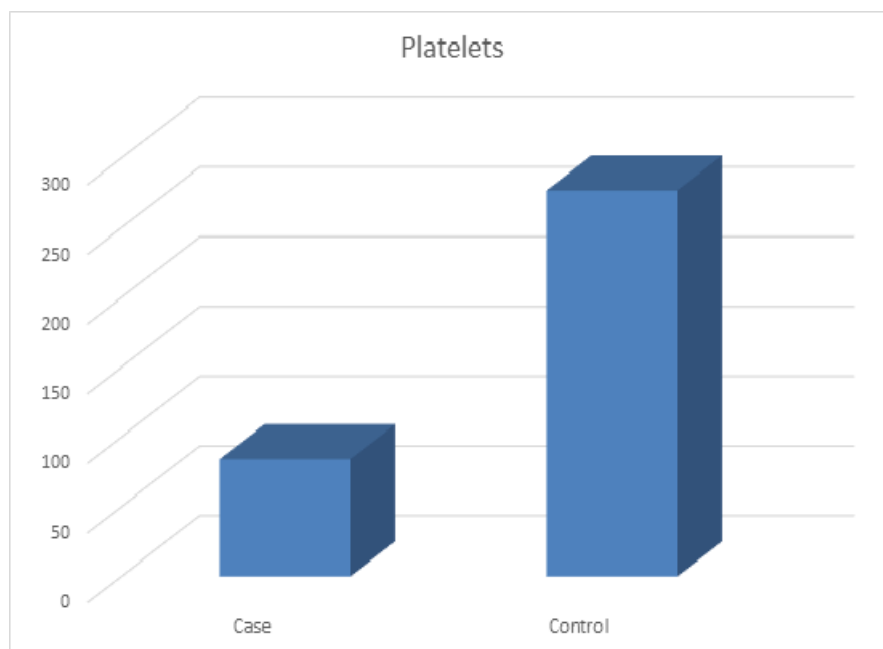

Chart 5: **platelet count in case and control**

TABLE 16: Correlations between age, Plateletscount and indices

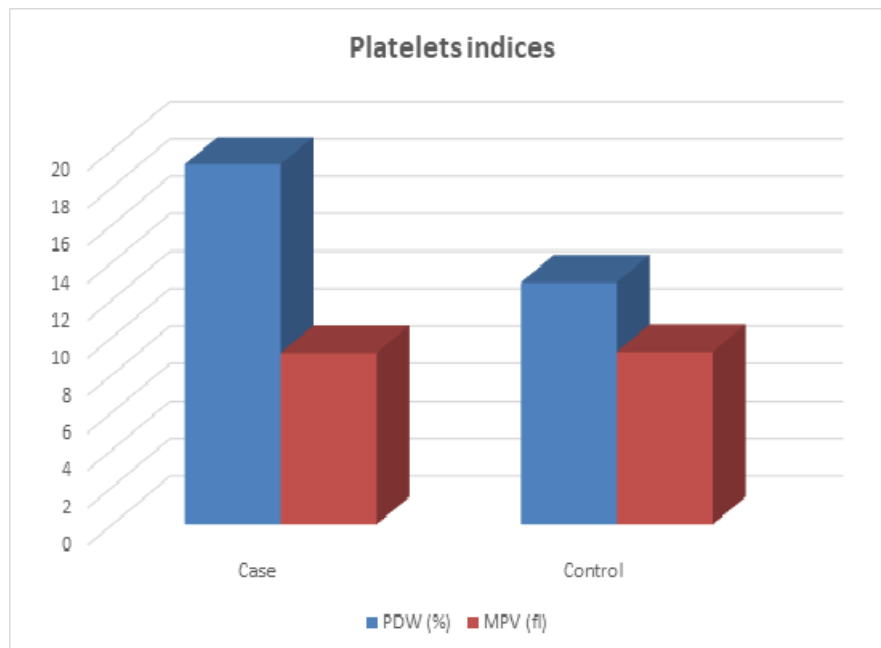|		Platelets	PDW	MPV
Age (years)	Pearson Correlation	.133	-.139	-.554*
	P. value	.358	.334	.000
	N	50	50	50

Chart 6: **platelet indices in case and control**

bone marrow production of the myeloid lineage (8, 9)

.

On the other hand our study revealed significant decrease in RBCs and HGB of neonate ,here our results contradict the claims of Other study done in India that was showed ; RBC , reticulocyte count , reticulocyte production Index (RPI) were found to be higher in neonatal cord blood from preeclamptic females than those from normal pregnancies , hemoglobin and hematocrit were found to be lower in neonatal cord blood from preeclamptic pregnancies (10) , and also our result disagree with the study done in Argentina by Kurlat I et al., the risk of polycythemia in babies born to hypertensive mothers compared to general population was 12.6 fold and was proven that maternal hypertension constitutes a significant risk for polycythemia independent of foetal growth (11)

There is a hypothesis which has been proposed for increased number of nucleated RBC's in preeclampsia. It states that the cytotrophoblasts are unable to differentiate correctly and this leads to failure of invasion of cytotrophoblasts and its arterioles into the uterus. This relatively leads to hypoxic environment in the placenta which results in increased production of erythropoietin which in turn leads to stimulation of erythropoiesis and thereby increased number of nucleated RBC. Therefore, increased count of nRBC

is considered as a marker of hypoxia (12) .

On the other part of variables in this study there was insignificant decrease HCT %, significant increase in MCV and RDW-SD , insignificant decrease in RDW-CV, insignificant decrease in MCH and significant decrease in MCHC of neonate respectively. One of the studies done in India reveled that; hemoglobin and hematocrit were found to be lower in neonatal cord blood from preeclamptic pregnancies (10)

Study that was done in finland by Saarinen UM and Siimes MA reported; As hemoglobin increases hematocrit also increases. Also said there was increased in MCV and this increase may be due to increase in the size of RBCs in preterm babies (13) . There was insignificant difference found in MCH and MCHC which was comparable to Sivakumar S et al., Bolat A et al., and Prakash PL et al., (7, 8) .

This analysis supports the theory of HELLP syndrome by showing there was highly significant decrease in platelets countofneonate , which is agree with Mohammad etal reported that ; there was a positive association between preeclampsia and neonatal thrombocytopenia in the Qatari population. Also our result showed significant increase in platelets distribution width PDW ofneonate respectively.

P. value (0.030)
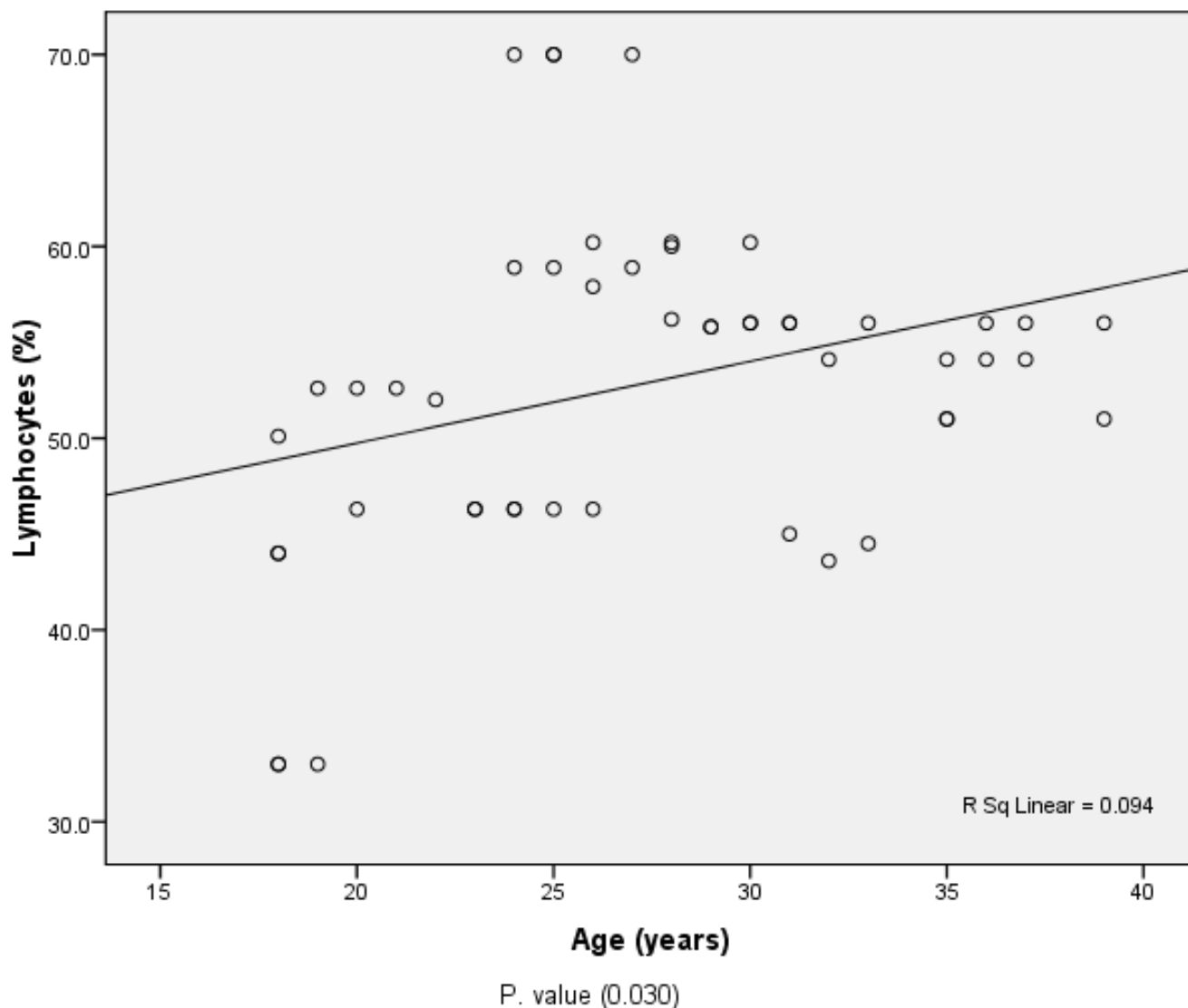
FIGURE 1: Correlations between age and relative lymphocytes

KalavakuruMouna et al study which done in India said ; the most significant feature found in our study was the presence of thrombocytopenia in the babies born to preeclamptic mothers and it was 94,250/mm3 when compared to babies of normotensive mothers having mean platelet count of 2 lakh/mm3 with p<0.001(18). In newborns born to preeclamptic mothers, the incidence of thrombocytopenia was found to be higher compared to the newborns of normotensive mothers. The underlying pathophysiologic mechanism for thrombocytopenia is not clear but there are studies which states that pathology arises at the placental level, in which thrombocytes

gets attached to endothelial cells which are damaged due to segmental vasoconstriction and dilatation of the blood vessels in the placenta of preeclamptic mothers leading to thrombocytopenia (14) .

Because it was not cohort study It is beyond the scope of this study to follow up the effect of medication that use to manage or to avoid eclampsia on hematological parameters of the neonate but for Addition to above results our results contradict the claims of other study that was done in turkey showed there was no statistically significant difference between neonate of preeclamptic/severe preeclamptic
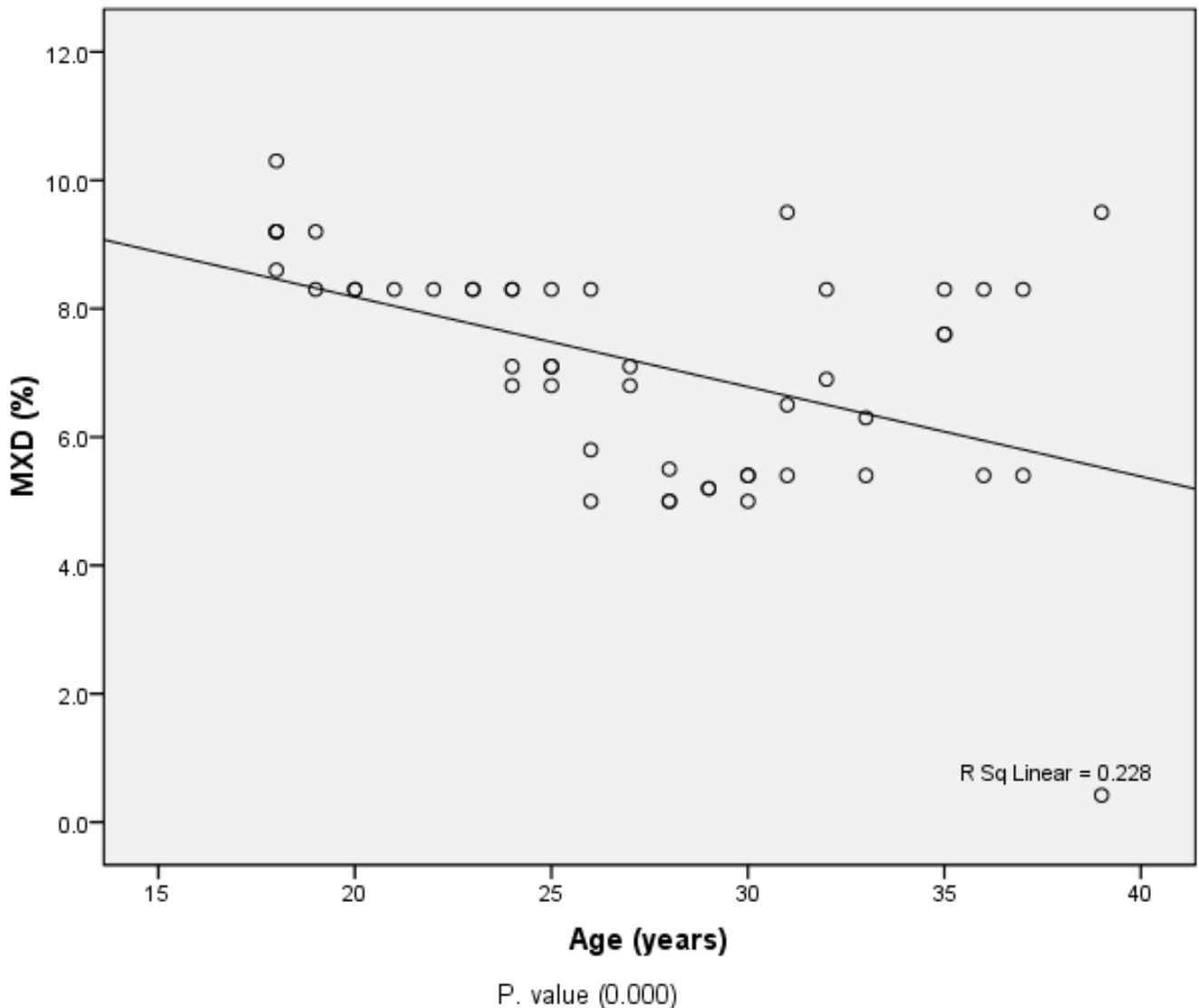
FIGURE 2: Correlations between age and relative MXD

/eclamptic (15)

Our study demonstrates clearly variation between neonate of mothers with pre eclampsiaand neonate of mothers with eclampsia , the result showed there was significant decrease in WBCs /RBCs/HGB/ and HCT% of neonate of mothers with pre eclampsiacompared with neonate of mothers with eclampsia, Furthermore there was insignificant decrease in platelets count of neonate of mothers with pre eclampsiacompared with neonate of mothers with eclampsia, also result showed additional variation between neonate of mothers with pre eclampsiaand neonate of e mothers with eclampsia in MCV/MPV and RDW-SD , the result showed there was sig-

nificant increase in MCV/MPV and RDW-SD of neonate of mothers with pre eclampsiacompared with neonate of mothers with eclampsia.

Finally we found that as you can observe in correlation found as X and Y axis in chapter three there was significant direct correlation (positive correlation) between age of mother and relative lymphocytes/ absolute lymphocytes , and there was significant inverse correlation (negative correlation) between age of mother and MXD / relative neutrophils. Also there was significant inverse correlation (negative correlation) between age of mother and MCV / MCH / RDW-SD and MPV .

P. value (0.030)
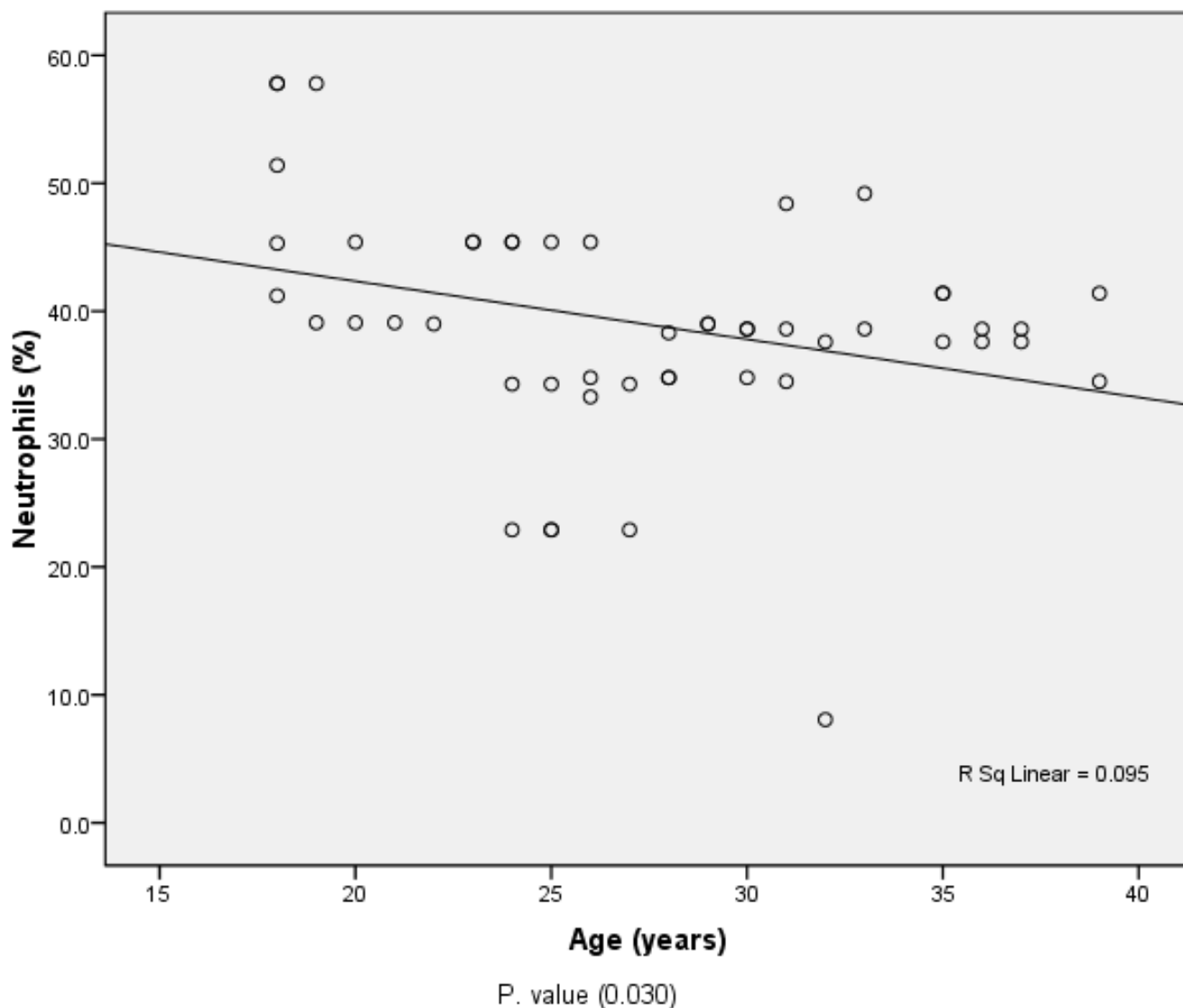
FIGURE 3: Correlations between age and relative neutrophils

5 | CONCLUSION:

For the complete blood cell count in the neonate of Sudanese mothers with pre eclampsia/eclampsia there was a significant decrease in WBCS , significant increase in relative lymphocytes , significant decrease in absolute lymphocytes count , significant decrease in relative neutrophils count , insignificant decrease in absolute neutrophils count , significant decrease in RBCs and HGB , insignificant decrease in hct% , significant increase in MCV and RDW-SD , insignificant decrease in RDW-CV, insignificant decrease in MCH , significant decrease in platelets count and significant increase in platelets distribution width PDW ofneonate of Sudanese mothers with preeclampsia/eclampsia.

Also there was clearly variation in the hematological parameters between neonate of mothers with pre eclampsia and neonate of mothers with eclampsia.

Conflict of interest

There was no conflict of interest

Author's contribution

All authors equally contributed to this manuscript, included wrote, corrected and

Approved this manuscript.
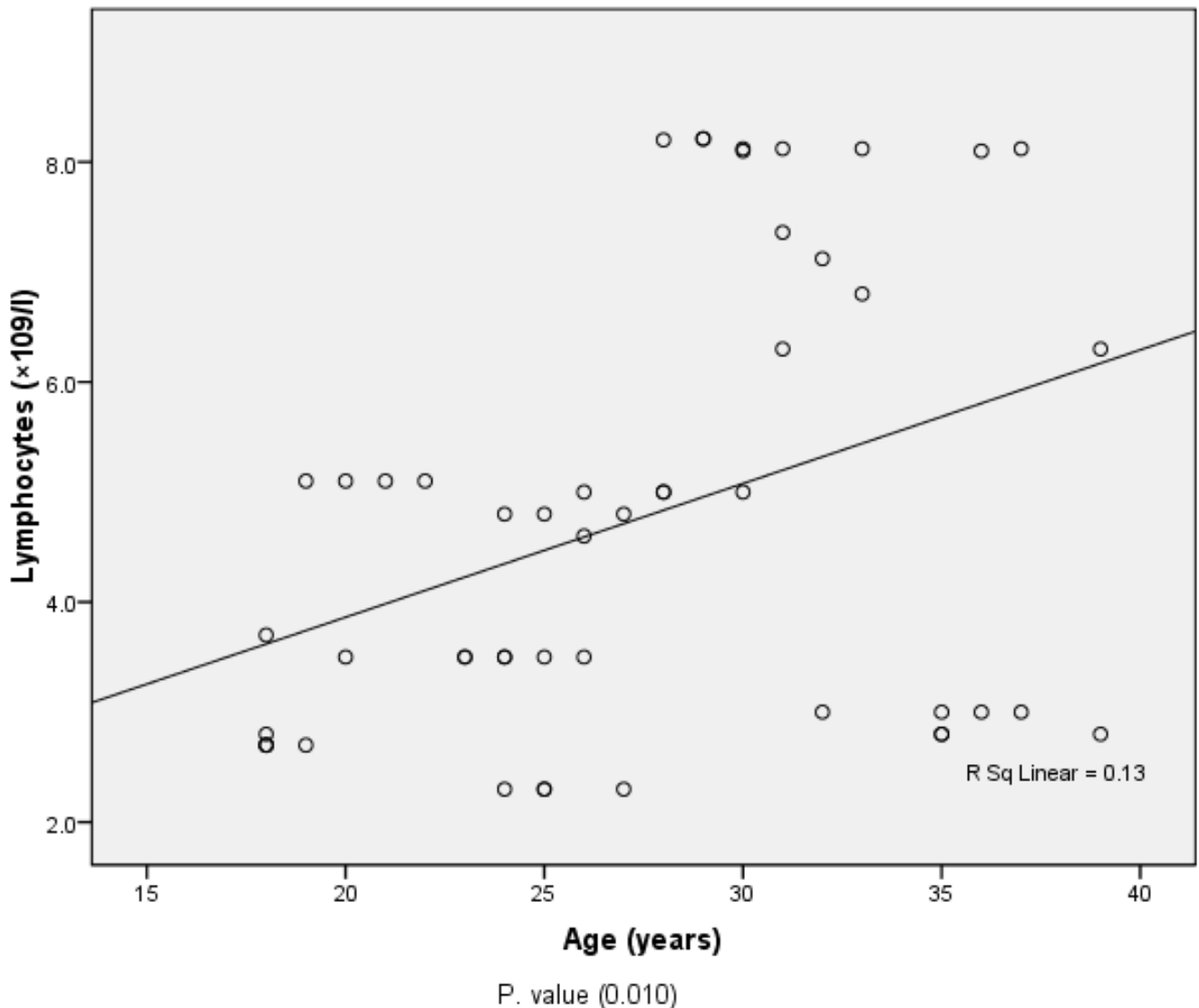
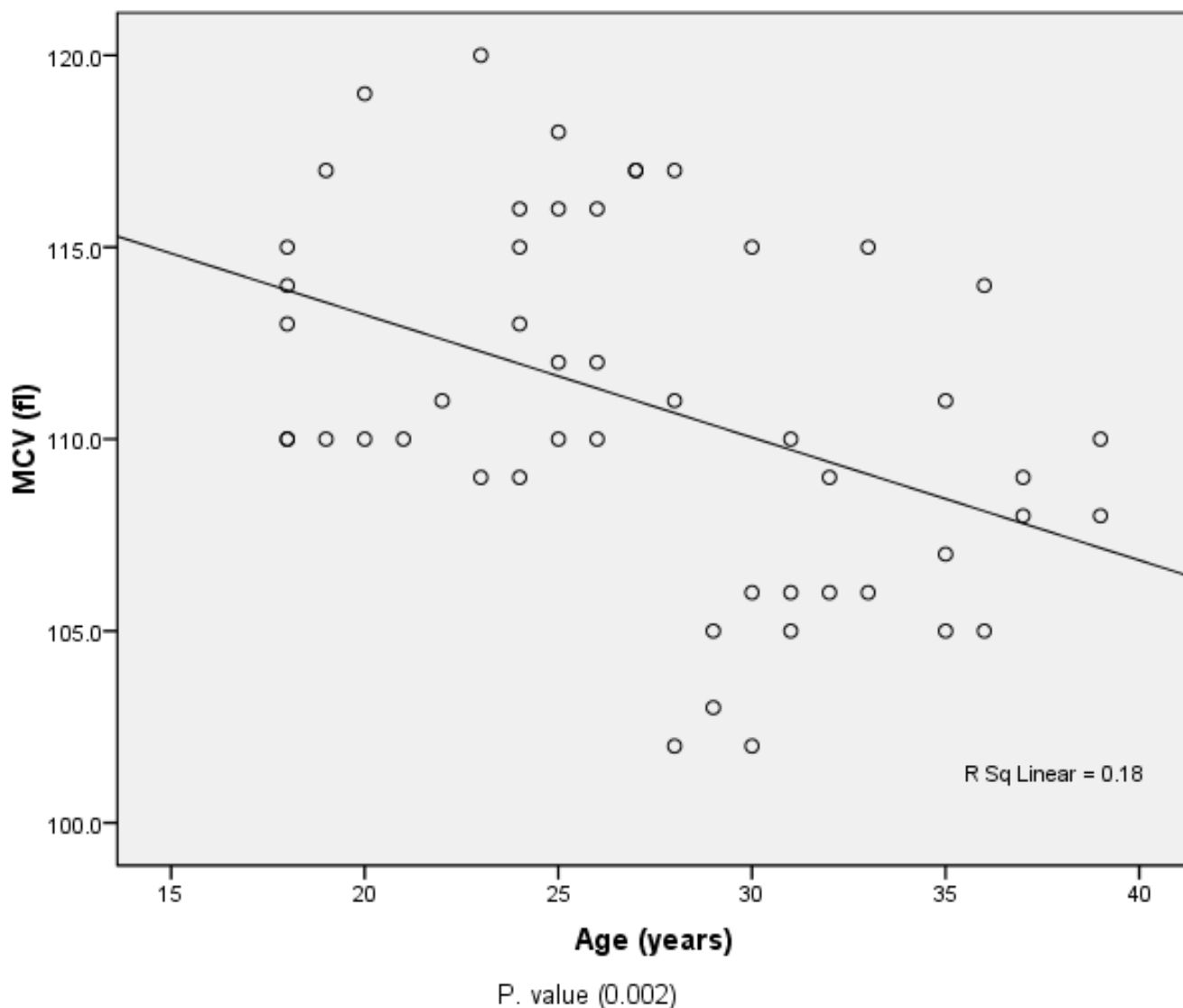**FIGURE 4: Correlations between age and absolute lymphocytes**

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P. value (0.002)

FIGURE 5: Correlations between age and MCV

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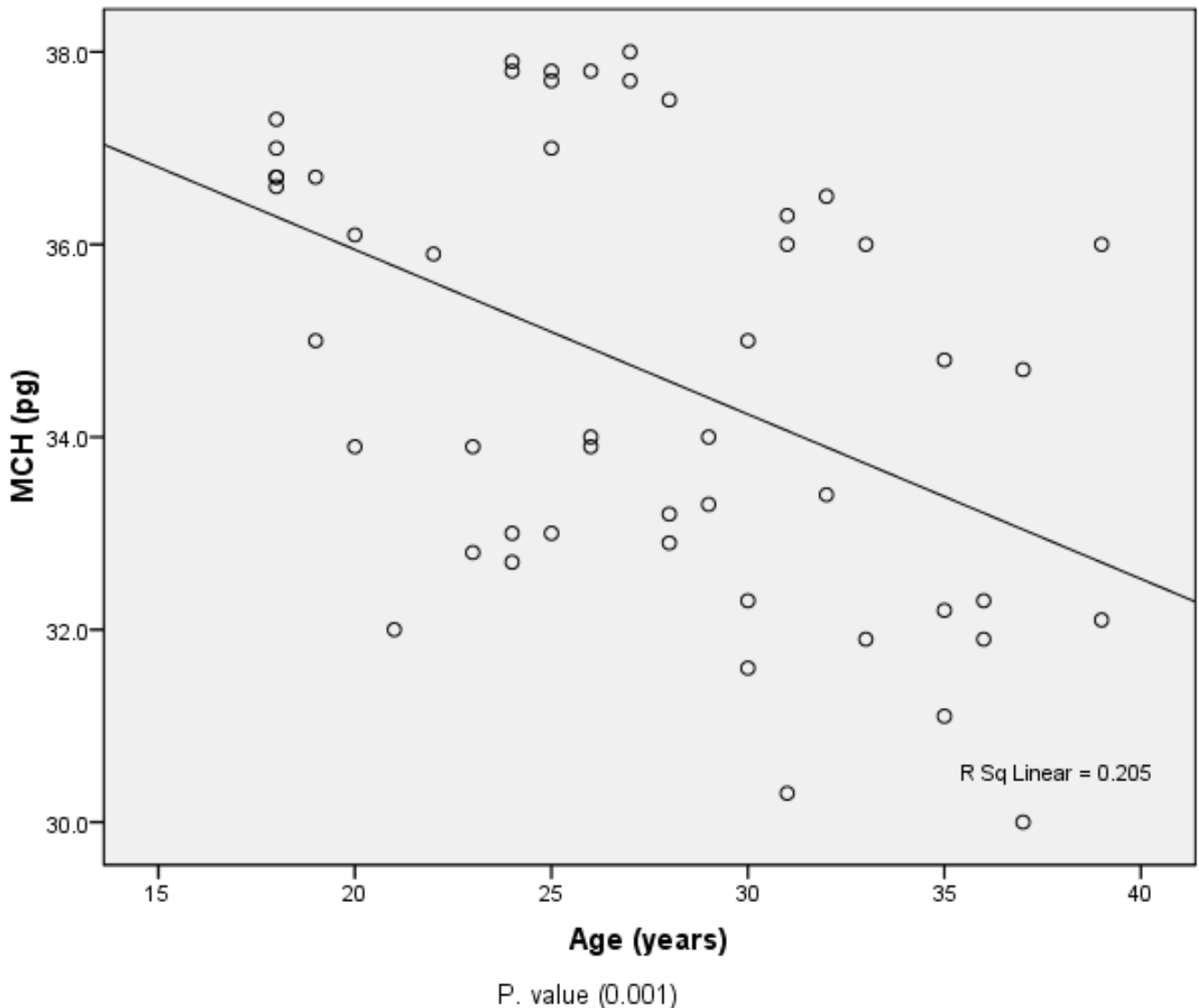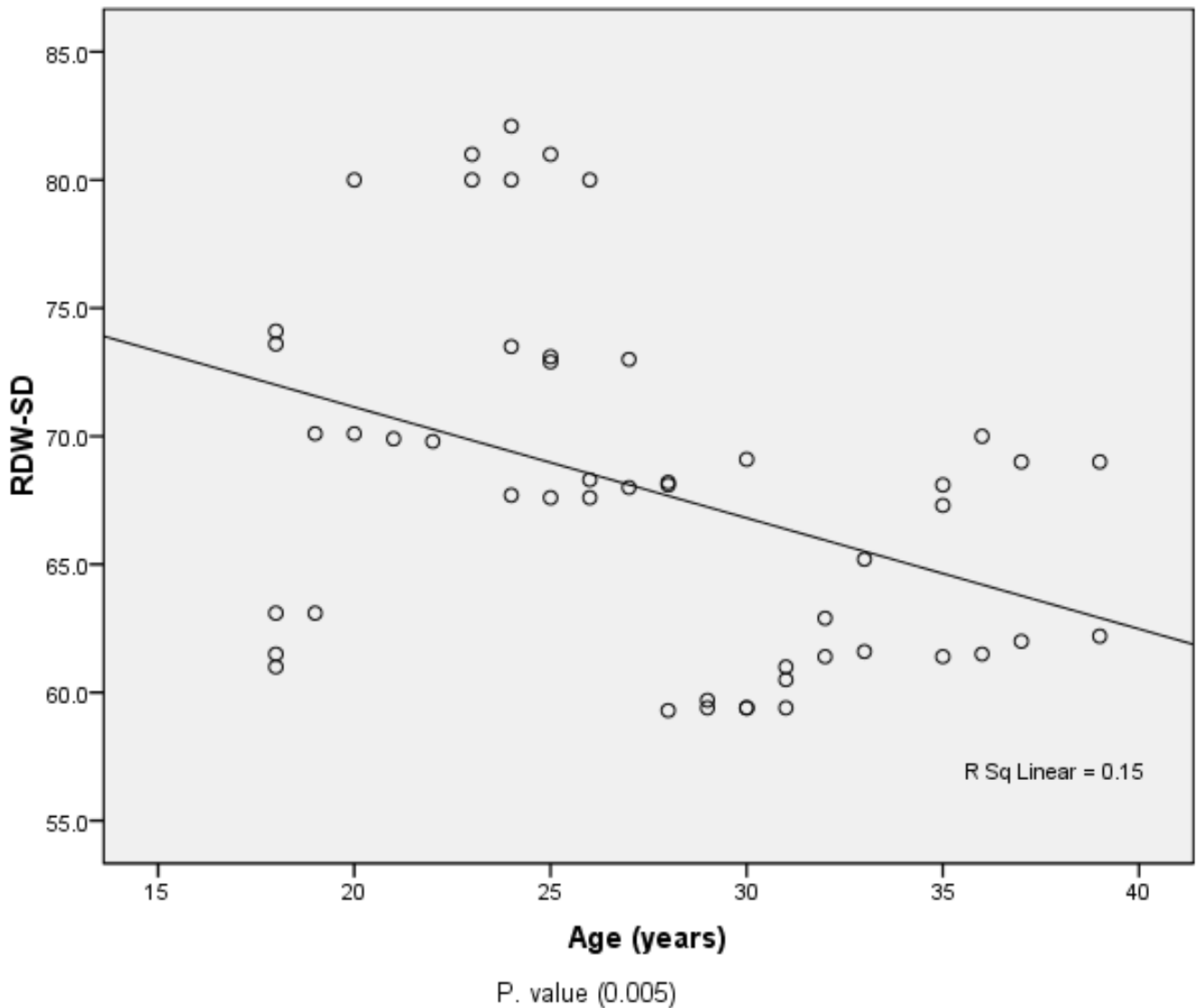
FIGURE 6: Correlations between age and MCH

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P. value (0.005)

FIGURE 7: Correlations between age and RDW-SD
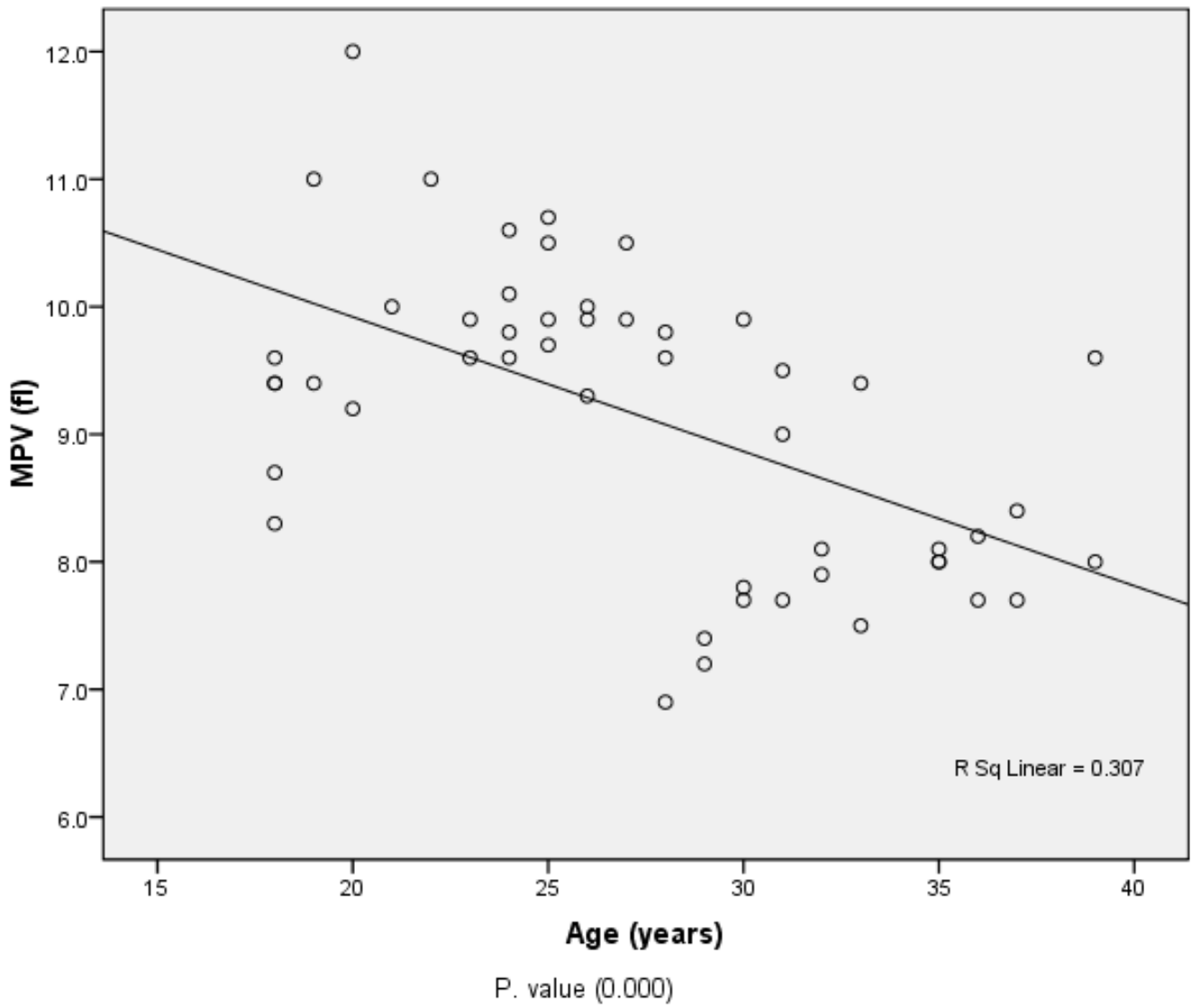
National center for biotechnology information .2006 ; 85(5).;.

FIGURE 8: Correlations between age and MPV