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To Evaluate the Haematological Changes at Different Trimesters during Pregnancy in Tertiary Care Centre

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ABSTRACT

Background: Pregnancy is the term used to describe the period in which a fetus develops inside a women's womb or uterus. Pregnancy usually lasts about 40 weeks, or just over 9 months, as measured from the last menstrual period to delivery. During pregnancy, the pregnant mother undergoes significant anatomical and physiological changes including alterations in hematologic parameters in order to nurture and accommodate the developing foetus.

Aim: To assess the haematological changes at different trimesters during pregnancy.

Material & Method: Blood sample reports were taken from 150 pregnant women after taking informed consent that came for regular check-up. We have collected the CBC report from the patient and taken the haematological profile such as RBC, PCV, Hb and HCT parameters at different trimesters and includes socio-demographic parameters such as height, weight were measured and age, occupation, physical activity were noted.

Result: RBC'S mean value was 4.0979 ±0.54428, PCV mean value was 33.650 ±4.2068,Hb mean value was 11.189 ±1.5316, HCT mean value was 33.7390 ±3.94516. While comparing the haematological profile of different trimesters, We observed that haematological change occurred in all three trimesters ,RBC count decreased in 2nd trimester, PCV progressively decreased from 1st to 3rd trimester, Hb showed slightly changes in 2nd and 3rd trimester and HCT slightly decreased in 2nd trimester

Conclusion: This study concluded that pregnancy in women alters haematological indices such as packed cell volume, haemoglobin concentration, red blood cell count shows statistical decrease in 2nd trimester because of expansion of plasma volume,increased secretion of aldosterone production by renin-angiotensin system stimulation & nutritional deficiency of iron supply. RBC count decreased in 2nd trimester and the p value of RBC (0.000) shows statistically significant while packed cell volume decreased from 1st trimester till 3rd trimester and the p value of PCV and HB is not less than 0.05 which is not considered as statistical significant.

Keywords: *Packed cell volume (PCV), Haemoglobin (Hb), Red blood cell (RBC), White blood cell (WBC), Haematocrit (HCT)*

1. INTRODUCTION

Pregnancy is the term used to describe the period in which a fetus develops inside a woman's womb or uterus. Pregnancy usually lasts about 40 weeks, or just over 9 months, as measured from the last menstrual period to delivery[1]. Health care providers refer to three segments of pregnancy, called trimesters. First trimester (week 1 to week12), second trimester (week 13 to week 28),third trimester (week 29 to week 40). Maternal health refers to the health of women during pregnancy,

childbirth and the postnatal period. Each stage should be a positive experience, ensuring women and their babies reach their full potential for health and well –being[1, 2].

During pregnancy, the pregnant mother undergoes significant anatomical and physiological changes including alterations in hematologic parameters in order to nurture and accommodates the developing foetus[5]. In pregnancy, changes occur and can be observed in haematological indices such as red blood cell (RBC) count, haemoglobin concentration, platelet count and white blood cell (WBC) count[6, 7].

In this study we assessed the changes PCV, RBC, Hemoglobin among pregnant women at different trimesters. Comparison of changes observed in haematological indices at three different trimester helps to analyse irregularities of particular haematological indices and trimester to prevent life threatening complication with timely management by a skilled health professional working in a supportive environment.

METHODS

This observational study was performed at the department of Obstetrics and Gynaecology (OB-GYN), ACS Medical College and Hospital, DR MGR Educational and Research institute, Chennai after getting informed consent from institutional Scientific and Ethics Committee. Blood sample reports were taken from 150 pregnant women after getting proper informed consent who came for regular check-up. We have collected the CBC report from the patient and taken the haematological profile such ad red blood cell, packed cell volume, haemoglobin and haematocrit parameters at different trimesters. The profoma includes socio-demographic parameters such as Height, Weight were measured and age, occupation, physical activity were noted. Inclusion criteria includes Pregnant women of different trimesters (1^{st} trimester-50, 2^{nd} trimester-50, 3^{rd} trimester-50) and age ranges from 20 to 40.

Exclusion criteria includes patient with Anaemia before pregnancy and

Patient with diseased abnormalities (cardiovascular, renal, respiratory)

2. RESULT

This observational study on 150 pregnant women shows RBC'S mean value was 4.0979 ±0.54428,PCV mean value was 33.650 ±4.2068,Hb mean value was 11.189 ±1.5316,HCT mean value was 33.7390 ±3.94516.While comparing the haematological profile of different trimesters. We observed that haematological change occurred in all three trimesters, RBC COUNT decreased in 2^{nd} trimester, PCV progressively decreased from 1^{st} to 3^{rd} trimester, Hb showed slightly changes in 2^{nd} and 3^{rd} trimester and HCT slightly decreased in 2^{nd} trimester .

Table 01: Age distribution

VARIABLE	FREQUENCY	PERCENTAGE
20-30 YEARS	115	76.7%
30-40 YEARS	35	23.3%
TOTAL	150	100%

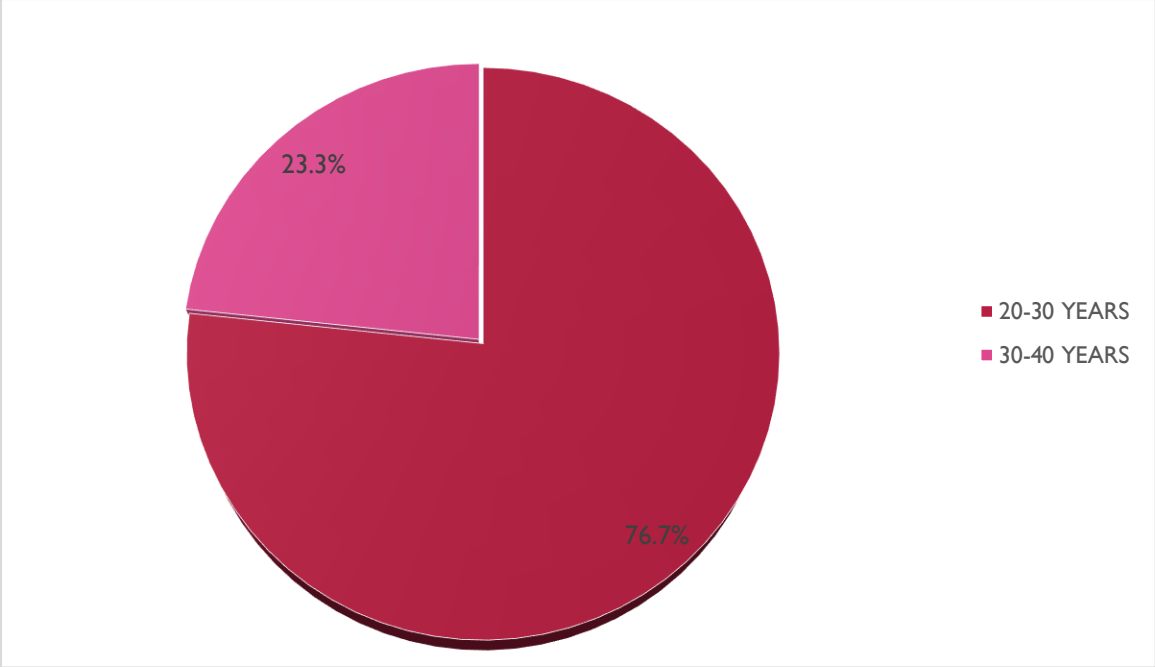

Figure 01: Age Distribution

Table 2: Haematological changes during pregnancy

VARIABLES	FREQUENCY	MEAN±STANDARD DEVIATION
RBC	150	4.0979±0.54428
PCV	150	33.650±4.2068
HB	150	11.189±1.5316
HCT	150	33.7390±3.94516

Table 03: Haematological changes at different trimesters

VARIABLES	TRIMESTER 1 MEAN	TRIMESTER 2 MEAN	TRIMESTER 3 MEAN
RBC	4.3228	3.6500	4.3210

PCV	34.672	33.940	32.338
HB	11.314	11.158	11.094
HCT	33.8650	33.4740	33.8780

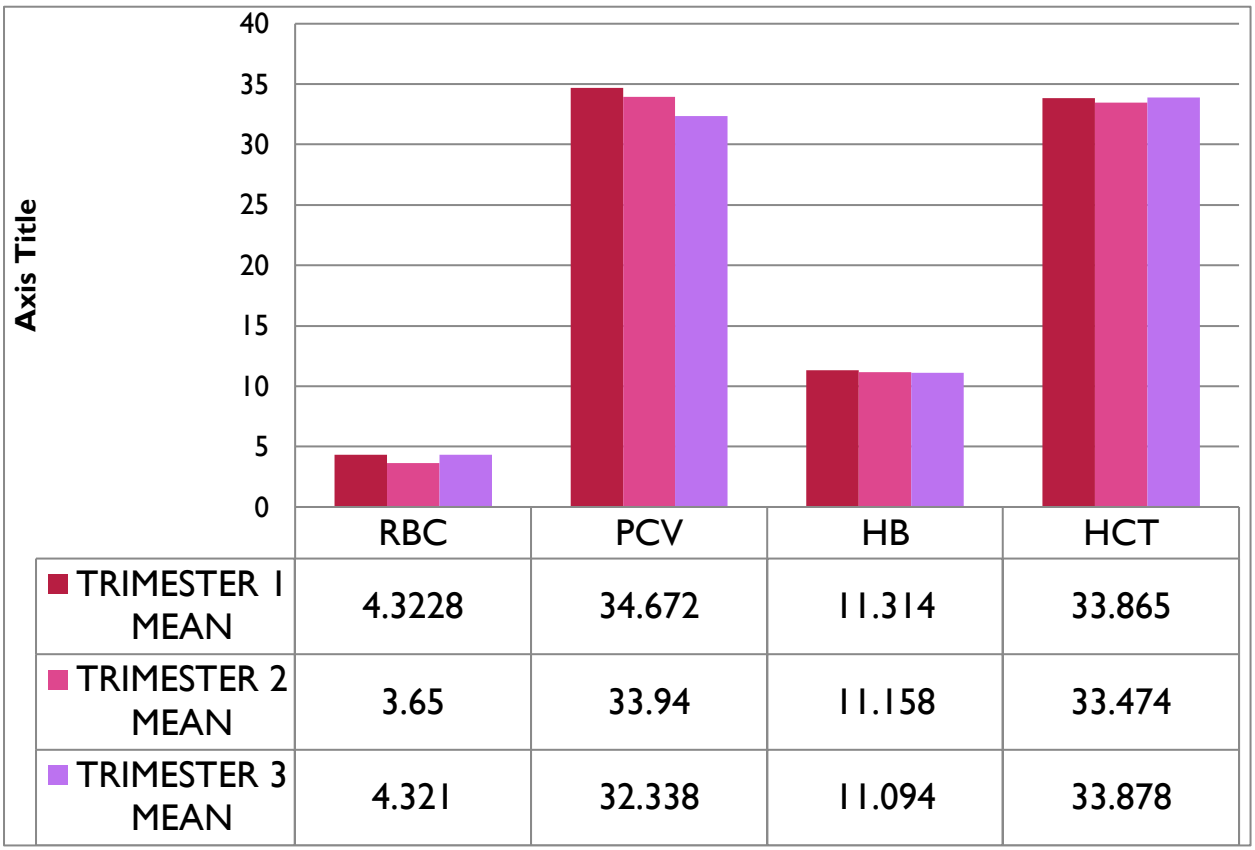

Figure 02: Haematological changes at different trimesters

3. COMPARISON BETWEEN TRIMESTERS

Table 04 : Comparison between trimester 1 vs trimester 2

VARIABLE	TRIMESTER 1	TRIMESTER 2	P VALUE
RBC	4.3228	3.6500	0.000
PCV	34.672	33.940	0.648
HB	11.314	11.158	0.868
HCT	33.8650	33.4740	0.875

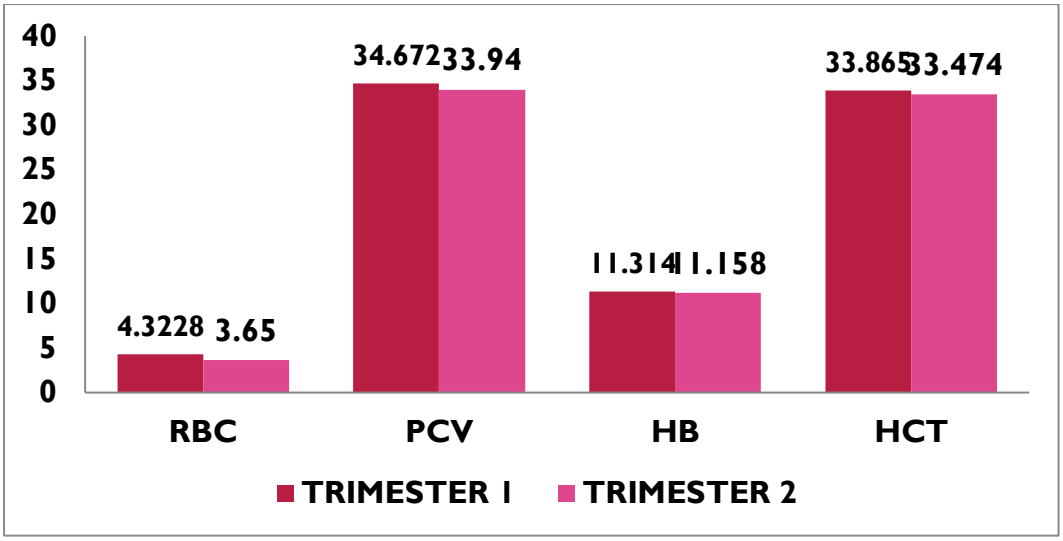

Figure 03: Trimester 1 vs Trimester 2

Table 05: Comparison between trimester 2 vs trimester 3

VARIABLE	TRIMESTER 2	TRIMESTER 3	P VALUE
RBC	3.6500	4.3210	0.000
PCV	33.940	32.338	0.130
HB	11.158	11.094	0.976
HCT	33.4740	33.8780	0.867

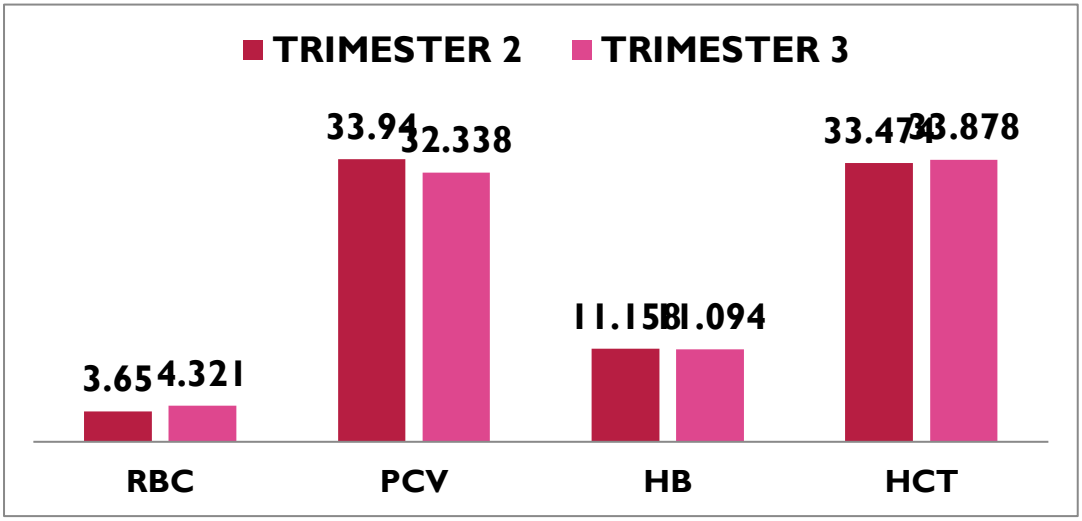

Figure 04:Trimester 2 vs Trimester 3

Table 06: comparison between trimester 1 vs trimester 3

VARIABLE	TRIMESTER 1	TRIMESTER 3	P VALUE
RBC	4.3228	4.3210	1.000
PCV	34.672	32.338	0.014
HB	11.314	11.094	0.755
HCT	33.8650	33.8780	1.000

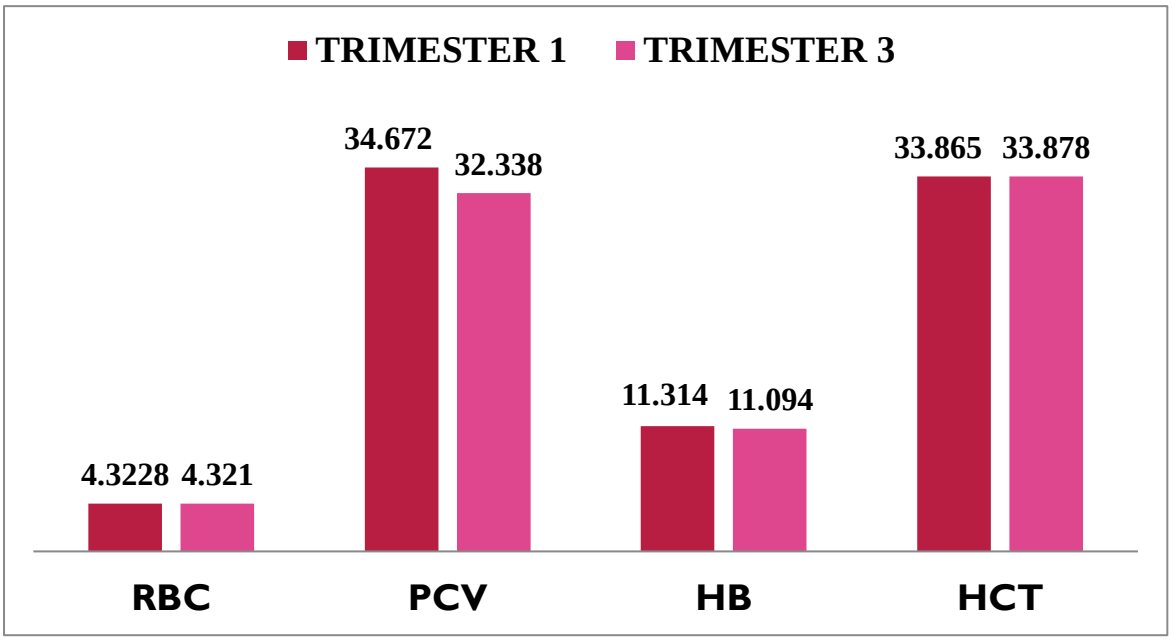

Figure 05:Trimester 1 vs Trimester 3

4. DISCUSSION

Pregnancy is a physiological state that is characterized by different haematological changes. In this study we assessed the changes PCV, RBC, HEMOGLOBIN among pregnant women at different trimesters. The main effect of decrease in PCV, RBC, Hb concentration and increase of plasma volume during pregnancy that lead to haemodilution. These results might be due to the massive and rapid increase in plasma volume during pregnancy to compensate the high demand.

This study population comprised of 150 pregnant women at different trimesters, 50 pregnant women in 1st trimester (0-12 weeks), 50 pregnant women in 2nd trimester (13-26 weeks), and 50 pregnant women in 3rd trimester (27-41 weeks). There has been an increased maternal and infant mortality in Elele population (Madonna University) and that study evaluates the haematological effects of pregnant women at different trimester and to compare PCV and Hb concentration of pregnant women in Elle population and healthy non pregnant women in Enugu city[12], data showed a marked decrease in Packed cell volume and Haemoglobin especially in 2nd trimester. In our study population, by comparing Packed cell volume(PCV), Red blood cell(RBC), Haemoglobin(Hb) and Haematocrit (HCT) of pregnant women at different trimesters, this showed a

progressive decrease in packed cell volume from 1st trimester to 3rd trimester. Red blood cell count decrease in 2nd trimester and regains to normal range in 3rd trimester. Haemoglobin shows slight fall in 2nd and 3rd trimester and Hemotocrit slightly decrease in 2nd trimester. In comparison, this study found that both packed cell volume and Haemoglobin were progressively decreased in 2nd and 3rd trimester.

A greater expansion of plasma volume relative to the increase in haemoglobin mass and erythrocyte volume is responsible for the modest fall in haemoglobin levels (ie, physiological or dilutional anaemia of pregnancy) observed in healthy pregnant women[12]

A progressive increase of red blood cell occurs from 8–10 weeks of gestation till the end of pregnancy but the average red blood cell life span is slightly reduced. Erythropoietin levels are 50% higher due to the higher metabolic oxygen requirement and this account the moderate bone marrow erythroid hyperplasia and elevated reticulocyte count. There is also an increased transportation of oxygen across the placenta due to the combination of a reduced maternal RBCs oxygen affinity from an elevated 2,3Diphosphoglycerate and a low maternal Pco2on-pregnant state. This population, data showed a marked decrease in packed cell volume, Red blood cell and haemoglobin especially in second trimester. It has been confirmed the morbid genic nature of low haemoglobin and haematocrit levels during pregnancy and the optimal haemoglobin appears to be in the vicinity of 11 -12 g/dl and optimal haematocrit of 31 – 35 % (Garn et al.,1981).

In a healthy pregnancy, there is pronounced activation of the RAAS, where the concentrations of Plasma Renin Activity and aldosterone are increased compared with non-pregnant states. The regulation of renin activity and aldosterone secretion play key roles in physiologic adaptations to a healthy pregnancy, such as promoting sufficient reabsorption of water and sodium to support the demand for a 40-50% increase in blood volume.

Although Red blood cell (RBC)mass increases during pregnancy, so plasma volume increases more resulting in Hemodilution leads to gestational anaemia. This results in a physiologically lowered haemoglobin (Hb) level, RBC count and other indices including packed cell volume(PCV). Reduced PCV value in pregnant women probably due to hemodilution and dietary deficiency of iron.

Decrease in PCV may be due to increase in plasma volume during pregnancy causing hemo-dilution, infection (e.g. malaria), hormonal changes that increase fluid retention and iron deficiency (James et al., 2008; Waheed et al., 2008;Sembulingam and Sembulingam 2010). As we observed in our present study, a low level of PCV was recorded in first , second and third trimesters. Low PCV in early pregnancy was associated with a higher rate of preterm birth.

In our study, we observed that majority of pregnant women under the age of 20-30 years (76.7%) and the remaining population under 30-40 years (23.3%) . Acccording to 150 samples of pregnant women, the mean standard deviation of RBC – 4.0979± 0.54428 , PCV – 33.650±4.2068 , HB – 11.189±1.5316 , HCT – 33.7390±3.94516.

According to WHO, during pregnancy the Hemoglobin level less than 11.0 g/dl is considered to be an anemia and the levels of severity: mild anemia (Hb level 9 to 10.9 g/dL), moderate anemia (Hb level 7 to 8.9 g/dL).While evaluating the haematological changes during trimesters we observed that the presence of mild and moderate anemia (gestational anemia)in pregnant women.In late 1st trimester(3rd month)- 30% of pregnant women had mild anemia,In 2nd trimesters - 42% of women under mild anemia and 2% under moderate anemia in 3rd trimester we found 30% of women under mild and 8% under moderate anemia. In our study while comparing mild anemia in all the trimesters we found maximum of 42% pregnant women are in 2nd trimester meanwhile comparing the moderate anemia in all the trimesters maximum of 8% pregnant women in 3rd trimester.

In this study we made comparison between trimesters, while comparing the haematological profile of pregnant women in 1st trimester and 2nd trimester, we found that Red blood cell count is decreased in 2nd trimester(p-0.000), Packed cell volume is decreased in 2nd trimester (p-0.658), Hemoglobin showed slight change (p-0.868)and Hematocrit

While comparing the haematological profile of 2nd trimester and 3rd trimester, we found that Red blood cell count is decreased in 2nd trimester and increased count in 3rd trimester (p-0.000),there is progressive fall in Packed cell volume from 2nd to 3rd trimester (p-0.130), Hemoglobin showed slight fall in 3rd trimester when compared to 2nd trimester (p-0.976) and Hematocrit slightly increased in 3rd trimester when compared to 2nd trimester (p-0.867)

While comparing the haematological profile of 1st trimester and 3rd trimester, we found that progressive rise in Red blood cell count in 3rd trimester from 2nd trimester and the Red blood cell volume found equal to 1st trimester (p-1.000), there is progressive fall in packed cell volume from 1st to 3rd trimester (p-0.014), Hemoglobin showed fall in 3rd trimester while compared to 1st trimester (p-0.755) and Hematocrit slightly increased in 3rd trimester when compared to 1st trimester (p-1.000)

The risk of low birth weight, preterm birth and small for gestational age was increasedsteadily with a decrease of first trimester hemoglobin (Ren et al.,2007). This risk of preterm birth was increased in women with low hemoglobin level in the first and second trimester (Scanion et al.,2000) revealing that second trimesters at increased risk of preterm birth.

Based on observational study of haematological changes during pregnancy at different trimesters, the p value of 0.00

indicates statistically significant varies in haematological profile of different trimesters. Hence, we observe that haematological change occurred in all three trimesters, RED BLOOD CELL COUNT decreased in 2nd trimester, PACKED CELL VOLUME progressively decreased from 1st to 3rd trimester, HEMOGLOBIN showed slight changes in 2nd and 3rd trimester and HEMATOCRIT slightly decreased in 2nd trimester.

5. CONCLUSION

This study concluded that pregnancy in women alters haematological indices such as packed cell volume, Haemoglobin concentration and red blood cell. In 2nd trimester Red blood cell count got decreased whereas Packed cell volume decreased from 1st to 3rd trimester.

Therefore, the pregnant women should be monitored for haematological changes during their routine checkup to avoid pregnancy complication earlier

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