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COAGULATION CHANGES IN DIFFERENT TRIMESTERS OF PREGNANCY

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ABSTRACT : As a result of the typical physiological needs of pregnancy and childbirth, the hemostatic system develops a physiological hypercoagulable condition and the levels of coagulation factors I, VII, IX, X and XII rise during pregnancy. The aim of this study was to compare pregnant women to non-pregnant women in terms of coagulation changes during all three trimesters of pregnancy. The research was conducted during the period from July 2020 to March 2021 on 40 pregnant women, aged range between 17-40 year, who attended Al Shames Medical laboratory in Diayla-Iraq, Cross-sectional study, followed up done for all 40 pregnant women during (first, second and third trimesters) by assigning PT, PTT & platelets count and compared with other forty non-pregnant women which serve as controls. PT, PPT & platelets showed decrease in third trimesters in pregnant women and PT also decrease in second trimester, while PTT decrease in all three trimesters in pregnant women when compared with non-pregnant women. These parameters also decrease in third trimester when compared with first trimester. In conclusion, a condition of physiological low-grade intravascular coagulation characterizes normal pregnancy. In our research, in each trimester, there were alterations in the levels of coagulation parameters. In addition, the ranges for coagulation measures were supplied, which may help clinicians track coagulation in pregnant women more effectively.

Key words : Coagulation factors, three trimesters, pregnant women, non-pregnant women.

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INTRODUCTION

Hemostasis is a complicated network of negative and positive feedback loops that combines blood arteries, coagulation factors, platelets, coagulation inhibitors and fibrinolysis to keep the vasculature intact (Kumari *et al*, 2021). Pregnancy is a unique physiological phenomenon that happens in women and has the potential to alter the coagulation and fibrinolytic systems of pregnant women. Changes in hormone levels *in vivo* are noticed throughout pregnancy, particularly in the third trimester when estrogen and progesterone are at their highest levels, resulting in a hypercoagulable state in pregnant women (Holmes *et al*, 2005). Normal pregnancy is associated with significant changes in hemostasis, which have been linked to a complex physiological adaptation that allows the maternal and fetal circulations to expand at the uteroplacental interface while ensuring rapid and efficient regulation of placental bleeding at the time of placental separation. (Lockwood, 2006; O'Riordan and Higgi, 2003; Stirling *et al*, 1984). Most of these improvements in blood coagulation and fibrinolysis, however, result in hypercoagulability (Prisco *et al*, 2005), which protects pregnant women from hemorrhage during childbirth but puts them at risk for thromboembolism (Reger *et al*, 2013). Within 4-6 weeks after delivery, these changes in the hemostatic system that occur during pregnancy return to normal or non-pregnant status (Prisco *et al*, 2005). The levels of coagulation factors I, VII, IX, X and XII rise during pregnancy. Hypercoagulability is caused by most changes in blood coagulation and fibrinolysis (Prisco *et al*, 2005). The number of platelets in pregnant women is significantly decrease than in non-pregnant women (Akinbami *et al*, 2013). There are some variations between the three trimesters of pregnancy. As a result, trimester-specific reference intervals are needed for accurate hemostatic status diagnosis during pregnancy (Cui *et al*, 2017). The current research aimed to assess certain coagulation change in pregnant women during the all three trimesters of pregnancy and compare them to non-pregnant women.

MATERIAL AND SUBJECTS

The research was conducted during the period from July 2020 to March 2021 on 40 pregnant women, aged

range between 17-40 year, who attended Al Shames Medical laboratory in Diayla, Iraq. Cross-sectional study, followed up done for all 40 pregnant women during (first, second and third trimesters) by assigning PT, PTT & platelets count and compared with other forty non-pregnant women which serve as controls. All women pregnant and non-pregnant were non-smokers. The study removed participants who had coagulopathy or were taking drugs that could impair their coagulation profile, women with a body mass index of 40 or higher, no kidney liver disease, or other disorders that could impair coagulation parameters. At each visit, each subject gave a 5.0 ml of venous blood sample, of which 1.8 mL was combined with 0.2 mL of 32.0 g/L trisodium citrate solution used for PT & PTT estimation and the remaining was placed into an EDTA container with a final concentration of 1.5 mg/ml used for platelets estimation the plasma was isolated from the blood samples in the citrated containers after centrifugation at 2500g for 15 minutes. Platelets estimation by using an auto-analyze device (ABX – HORIBA) from the French company, PT and PTT estimation by using an auto-analyzer device for blood coagulation tests of Star Max model, supplied from Staggo Company.

Statistical analysis

SPSS 20. Software (SPSS, Inc., Chicago, IL, USA) was used to analyze continuous variables, the mean and standard error was calculated and is given as the standard error of the mean. Student's t-test and one-way analysis of variance (ANOVA) tests were used in the statistical analysis. A statistically significant difference was defined as one with a P value of less than 0.05.

RESULTS

Hemostatic changes through pregnancy as shown in table1 between non-pregnant and pregnant women in 1st, 2nd and 3rd trimesters. The means of platelet in non-pregnant women were (280 ± 10.14 × 10^3/ml) and in pregnant women in the 1st (272.55 ± 11.56 × 10^3/ml), 2nd (254. 35 ± 14.01 × 10^3/ml), and 3rd (237.50 ± 12.29 × 10^3/ml) trimesters. The mean platelet decreases significantly in 3rd trimester only when compared with non-pregnant women p-value (0.014). The means of PT in non-pregnant women were (13.65 ± 0.10 second), and in pregnant women in the 1st (13.37 ± 0.23 second), 2nd (13.20 ± 0.12 second) and 3rd (12.93 ± 0.04 second), trimesters. There was a statistically significant difference between the PT of pregnant women in the 2nd and 3rd trimesters compared with non-pregnant p-value 0.032 and 0.001, respectively. The means of PTT in non-pregnant women were (34.20 ± 0.49 second) and in pregnant women in the 1st (31.68 ± 0.58 second), 2nd (30.94 ± 0.36 second) and 3rd (30.43 ± 0.19 second) trimesters. There were significant differences between the means of PTT non-pregnant women and pregnant women in all of the 3 trimesters p-value (<0.00).

Table 2 shows comparison of means of coagulation parameters among 3ed trimesters, the means of platelet, PT, and PTT in in pregnant women were in the 1st (272.55 ± 11.56 × 10^3/ml, 13.37 ± 0.23 second) and 31.68 ± 0.58 second) respectively, 2nd (254. 35 ± 14.01 × 10^3/ml, 13.20 ± 0.12 second, and 12.93 ± 0.04 second) respectively and 3rd trimesters (237.50 ± 12.29 × 10^3/ml, 12.93 ± 0.04 second and 30.43 ± 0.19 second), respectively. There were no significant differences for all coagulation

Table 1 : Coagulation parameters in NPW and pregnant women (1st, 2nd, and 3rd trimesters).

Mean ± Standard error					t-test P-value		
Parameters	**NPW**	**1st trimester**	**2nd trimester**	**3rd trimester**	**NPW & 1st trimester**	**NPW & 2nd trimester**	**NPW & 3rd trimester**
PLT (10^3/ml)	280 ±10.14	272.55±11.56	254.35±14.01	237.50±12.29	0.637	0.128	0.014
PT (second)	13.65±0.10	13.37±0.23	13.20±0.12	12.93±0.04	0.179	0.032	0.001
PTT (second)	34.20±0.49	31.68±0.58	30.94±0.36	30.43±0.19	< 0.000	< 0.000	< 0.000

PLT: Platelet count, PT: Prothrombin time, PTT: partial thromboplastin time, NPW: Non-pregnant women, *Significant at P<0.05.

Table 2 : Reveals Changes in coagulation parameters among pregnant women (1st, 2nd and 3rd trimesters).

Mean ± Standard error				ANOVA P-value		
Parameters	**1st trimester**	**2nd trimester**	**3rd trimester**	**1st & 2nd trimester**	**1st & 3rd trimester**	**2nd & 3rd trimester**
PLT (10^3/ml)	272.55 ± 11.56	254. 35 ± 14.01	237.50 ± 12.29	0.290	0.044	0.327
PT (second)	13.37 ± 0.23	13.20 ± 0.12	12.93 ± 0.04	0.412	0.035	0.300
PTT (second)	31.68 ± 0.58	30.94 ± 0.36	30.43 ± 0.19	0.241	0.047	0.407

PLT: Platelet count, PT: Prothrombin time, PTT: partial thromboplastin time, *Significant at P < 0.05.

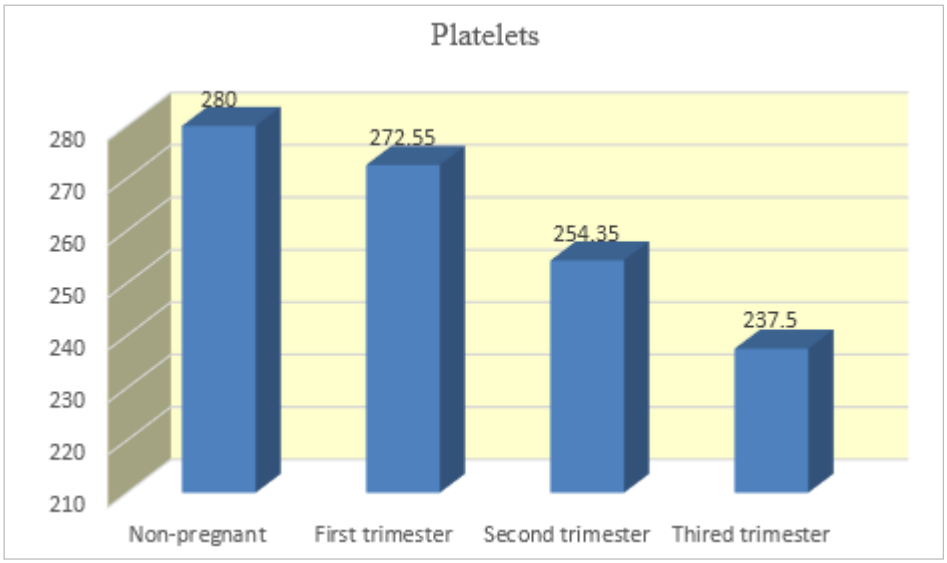

Fig. 1 : Reveals changes in platelets among pregnant women (1st, 2nd and 3rd trimesters).

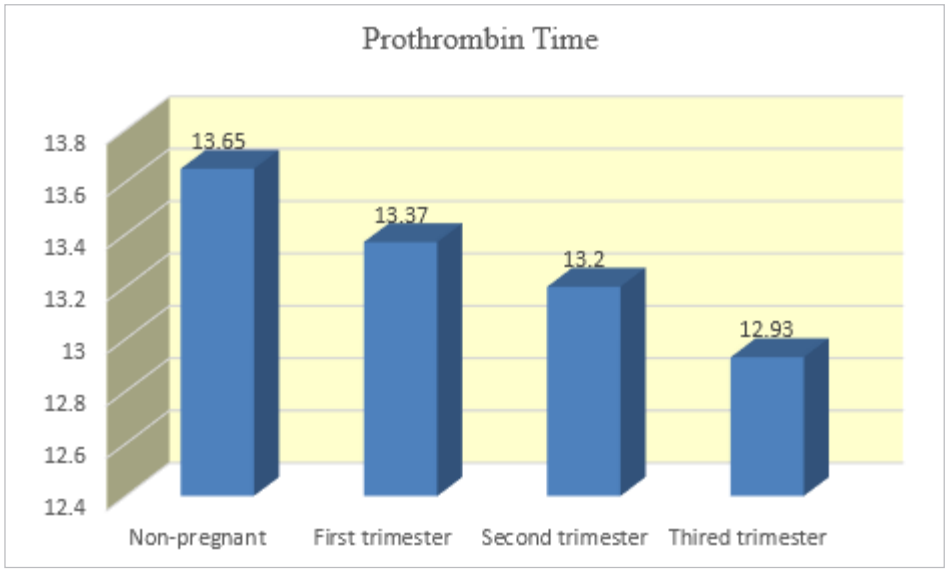

Fig. 2 : Reveals changes in prothrombin among pregnant women (1st, 2nd and 3rd trimesters).

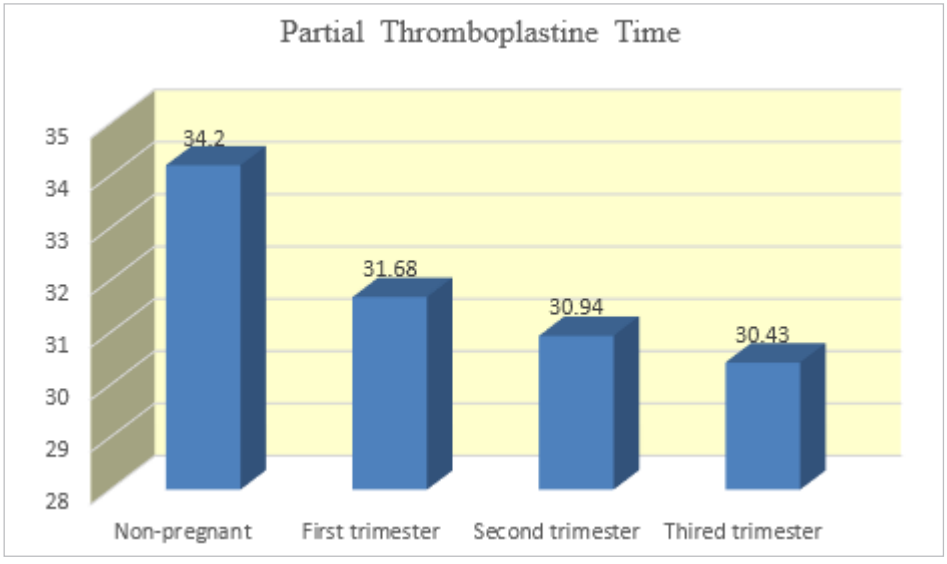

Fig. 3 : Reveals changes in partial Prothrombin time among pregnant women (1st, 2nd and 3rd trimesters).

parameters between 1st trimester when compared 2nd and also between 2nd and 3rd trimesters, but the theses parameters decrease significantly in 3rd trimester when compared with 1st trimester p-value 0.004, 0.035 and 0.047, respectively.

DISCUSSION

Hypercoagulability, which has developed to protect women from the bruising and bleeding associated with miscarriage and childbirth is the main reason for the increased risk of thromboembolism during pregnancy. When compared to non-pregnant women, PLT, PT and PPT decreased in all three trimesters in pregnant women, with PT also decreasing in the second trimester. PTT decreased in all three trimesters in pregnant women. These parameters also decrease in third trimester when compared with first trimester. The PLT is decrease in pregnant than in non-pregnant women. When compared to a pre-pregnancy stage, most studies show a 10% lower PLT level at term (Cui *et al*, 2017 and Boehlen *et al*, 2000). The study has further shown increasing in Thrombocytopenia that occurs during pregnancy. It's the second most common form of hematological abnormality in pregnancy and it's normally harmless (Jensen *et al*, 2011). The decrease PLT in pregnant women caused by the dilution effects and rapid destruction of PLTs passing over the frequently scarred and weakened trophoblast surface of the placenta are thought to be the mechanisms (Fay *et al*, 1983). PT evaluates the extrinsic coagulation pathway and is responsive to Fibrinogen and factors II, V, VII and these findings are in agreement with X. Liu *et al* (2012) showed that PT a shorter pattern as the gestational weeks increased (Levy and Murphy, 2002). Coagulation factors fail to synthesize on time during pregnancy due to physiological changes, which can result in a decrease in PT (Liu *et al*, 2012 and Abbassi *et al*, 2009). This research further revealed that PT values decreased during pregnancy, which agrees with the findings of some authors (Hui *et al*, 2012 and Szecsi *et al*, 2010), but differs from those of other authors who found fluctuated PT results during pregnancy (Jeremiah *et al*, 2012). The sensitivities of the reagents and techniques used can be linked to different PT values recorded by different authors. The PTT measures the intrinsic coagulation pathway and is susceptible to factors I, II, VIII, IX, X, XI and XII deficiency (Thornton *et al*, 2010). In previous study, PT and APTT were observed to be substantially shorter, while FIB and DD plasma concentrations were significantly greater, particularly in the third trimester (Hammerova *et al*, 2014). In our study, decreased PTT was ascribed to the quick activation of coagulation factors active in the intrinsic route (Thornton *et al*, 2010).

CONCLUSION

A condition of physiological low-grade intravascular coagulation characterizes normal pregnancy. In our research, in each trimester, there were alterations in the levels of coagulation parameters. In addition, the ranges for coagulation measures were supplied, which may help clinicians track coagulation in pregnant women more effectively.

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