

AIM OF THE WORK

The aim of this study is to identify the relation between the placental morphological and circulatory changes and the neonatal short term outcome in cases of preclampsia.

PATIENTS

This study is case-control study, was conducted upon 150 pregnant women attended El-Shatby University Maternity hospital from January 2013- July 2013. They were subdivided into 2 major groups:

1. Group (A):50 normo-tensive pregnant women, with appropriate fetal growth (Control group).
2. Group (B):100 pregnant pre-eclamptic women further divided into:
 - Group (B1): 91cases complicated with mild preeclampsia.
 - Group (B2): 9 cases complicated with severe preeclampsia.

Inclusion criteria:

1. The age range from 20- 40ys.
2. Gestational age was 37wk (\pm 2wks.) of singleton full term pregnancy.
3. Normo-tensive before pregnancy and started to develop hypertension after 20 weeks of gestation. Pre-eclamptic women diagnosed on basis of persistent high blood pressure measured on two separate occasion at least four hour apart equal to or more than 140/90mm Hg (for mild pre-eclampsia) or sustained systolic BP \geq 160 mmHg or diastolic BP \geq 110 mmHg (for Severe pre-eclampsia) and one or more of the following signs:⁽³⁵⁾
 - Proteinuria.
 - Thrombocytopenia.
 - Impaired liver functions.
 - Impaired renal functions.
 - Pulmonary edema.
 - New-onset headache.
 - Visual disturbances.

According to the American College of Obstetricians and Gynecologists (2013) Proteinuria, or elevated protein in the urine, is no longer be considered the signature criterion besides new-onset hypertension in diagnosing preeclampsia.⁽³⁵⁾

Exclusion criteria:

Any woman with history of chronic hypertension, renal disease, diabetes mellitus, congenital malformation or abnormal placentation, vascular disease, multiple pregnancies was excluded from the study. All these exclusion criteria are likely to affect the placental function and morphology, smokers and not on aspirin treatment.

METHODS

- The procedures (ultrasound examination, Doppler study and placental examination) had been explained to all cases and their agreement and informed consent had been taken.
- Full history taking including:
 - Complete personal, menstrual, obstetric, family and past history to ascertain inclusion and exclusion criteria.
 - Symptoms as headache, visual disturbance, epigastric pain, oliguria and edema to differentiate mild or severe pre-eclampsia.
- General examination including:
 - Vital signs: temperature, respiratory rate, pulse and blood pressure was measured using:⁽³⁶⁾
 - ✓ Mercury sphygmomanometers.
 - ✓ Appropriate size cuff.
 - ✓ Patient in semi-setting positions with the manometer at the level of her heart.
 - ✓ Korotkoff sounds: 1st (systolic) and 5th (diastolic) which is the disappearance of the sound.
 - Head & neck, cardiac, chest and extremities examination.
 - Weight measurement.
- Lab. Investigations:
 - Complete blood count.
 - Urine dipstick test for proteinuria.
 - Liver function tests (SGOT, SGPT and prothrombin activity).
 - Renal function test (urea and creatinine).
 - Fasting and post prandial blood glucose level.
 - Serum uric acid.
 - Total proteins.
- Obstetric ultrasound examination: done trans-abdominally using “Medison-SonoAce x6” to certify:
 - Fetal biometry (BPD, HC, AC, FL and TCD) for confirmation of gestational age.
 - Amniotic fluid index (using the four quadrant technique).⁽³⁷⁾
 - Estimated fetal weight (EFW) according to Hadlock tables.
 - Placentation (site, grade⁽³⁸⁾, maximum thickness and any abnormalities).
- Doppler study of the following vessels:
 - Uterine arteries (Ut A): The mean of both uterine arteries.

Methods

- Umbilical artery (UA).
- Retro placental vascular space.

Doppler indices were measured including:

- Pulsatility index (PI).
- Systolic/diastolic ratio (S/D).
- Resistance index (RI).

Measurement to confirm gestational age:⁽³⁹⁻⁴¹⁾

The biparietal diameter (BPD) and the head circumference (HC) are both obtained from the transthalamic view and all measuring data calculating the gestational age according to Hadlock tables.

The transcerebellar diameter (TCD) was calculated using the transcerebellar view, measuring the maximum transverse diameter of the dumbbell shaped structure in posterior cranial fossa (cerebellum).

The abdominal circumference (AC) and the femur length (FL) were measured, the measuring data calculating the gestational age according to Hadlock table).





Doppler studies:

Of the following arteries: Uterine arteries (Ut A) umbilical artery (UA) and retro placental vascular space (for any abnormalities like hematomas or adherent placenta) were sampled by Color Doppler ultrasound and pulsed wave Doppler.

Doppler indices were calculated by the built-in software programs in the machine.

- Systolic/diastolic ratio (S/D) the systolic/diastolic ratio is the simplest of all indices and is expressed by S/D, where S is the peak systolic frequency and D is the end diastolic frequency.
- Resistance index (RI): This index, also known as Pourcelot’s ratio examines the differences between the peak systolic and end diastolic velocity and is expressed by:

$$RI = (S-D)/S$$

- Pulsatility index (PI): This index, also known as the mean pulsatility index to distinguish it from the peak to peak pulsatility index, is expressed by:

$$PI = (S-D)/\text{velocity}_{\text{mean}}$$

S: is the peak systolic velocity, D: is the minimum or end diastolic velocity.

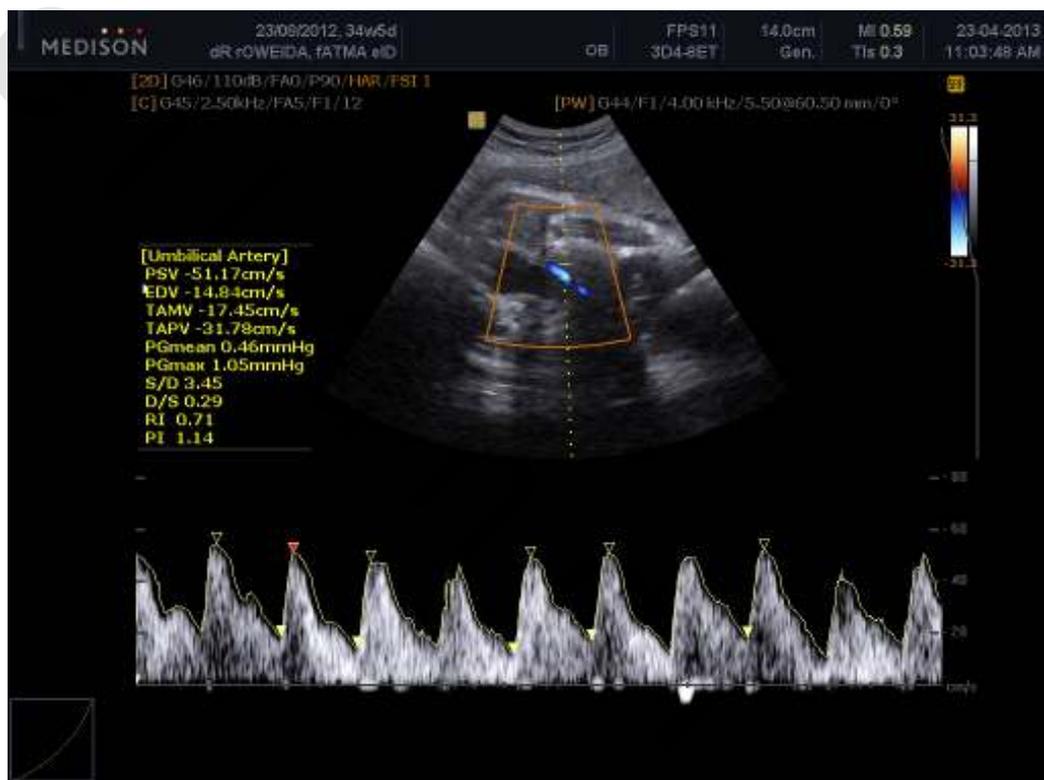
Uterine artery (UTA) Doppler technique:

The technique of (UTA) Doppler interrogation is fairly simple, was performed with the women lying in a semi-recumbent position, taking care of the absence of fetal movements and a fetal heart rate between 120 and 160 bpm. The transducer was placed on the left and right lower quadrant of the maternal abdominal wall, visualizing the external iliac artery and identifying the uterine artery medial to it.⁽⁴²⁾ Once waveforms are obtained with a clear envelope, at least three waveforms can be averaged and impedance indices calculated. The presence of a diastolic notch in the follow-profiles of the uterine arteries was noted qualitatively as a clearly definable upturn of the flow velocity, and the resistance index was calculated from three to five waveforms of satisfactory quality. A RI>0.58 was defined as abnormal and a RI>0.7 was defined as very abnormal.⁽¹⁶⁾



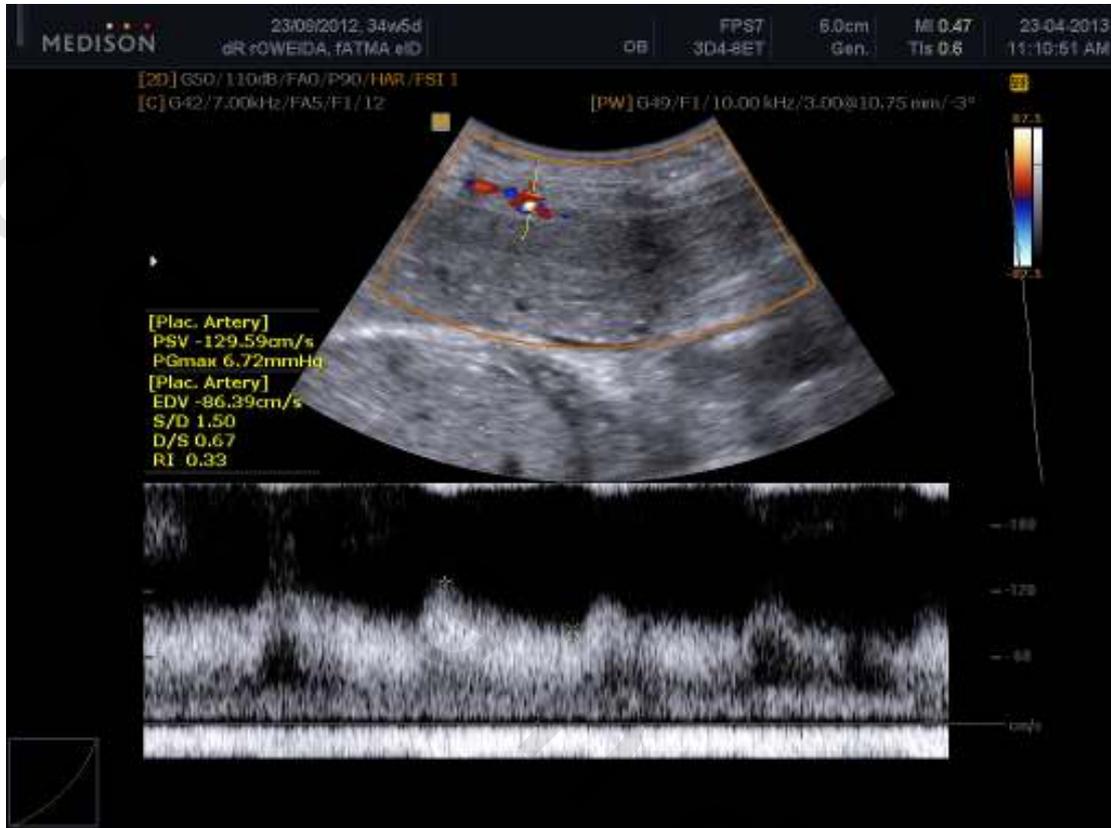
Umbilical artery (UA) Doppler technique:

The transducer is placed on the mother's abdomen overlying the fetus and is systematically manipulated to obtain the characteristic waveforms from the umbilical artery and vein. With a pulsed wave Doppler system, an ultrasound scan is first carried out, a free-floating portion of the cord is identified and the Doppler sample volume is applied over an artery and the vein, parallel to blood flow, using color-flow mapping, umbilical artery Doppler studies should be avoided during fetal breathing.⁽¹⁵⁾ Once waveforms are obtained with a clear envelope, at least three waveforms can be averaged and impedance indices calculated $PI > 1$, $RI > 0.6$ or $S/D \text{ ratio} > 3$ or absent or reversed diastolic blood flow wave forms were considered as abnormal.⁽⁴³⁾



Retroplacental vascular space

The identification of the Retroplacental myometrial vessels blood flow was made using Color Doppler looking for any abnormalities like hematomas or adherent placenta.⁽¹⁹⁾



Examination of placenta after delivery

Placenta after delivery was examined (after cutting of the cord about 5 cm away from its insertion) for circumference, central thickness, surface, weight, number of cotyledons, number of lobes, site of umbilical cord insertion, numbers of umbilical cord vessels and areas of hemorrhage or infarction.

Neonatal assessments include:

- 1. Fetal birth weight:** then calculation of feto/placental weight ratio and placental index.⁽⁴⁴⁾
- 2. 5-minute Apgar score:** (five easily identifiable characteristics: heart rate, respiratory effort, muscle tone, reflex irritability, and color were assessed and assigned a value of 0 to 2, by the neonatologist attending labor. The total score, based on the sum of the five components, was determined 5 minutes after delivery).⁽²⁶⁾
- 3. Admission to NICU** (Neonatal intensive care unit), days of admission, complications were reported.

RESULTS

The study was carried upon 150 patients divided into 2 groups:

1. Group (A): 50 normo-tensive pregnant women, with appropriate fetal growth (Control group).
2. Group (B): 100 pregnant pre-eclamptic women further divided into:
 - Group (B1): 91 cases complicated with mild preeclampsia.
 - Group (B2): 9 cases complicated with severe preeclampsia.

The age range from 20- 40 years. Gestational age is 37wk (\pm 2wks.) of singleton full term pregnancy. Normo-tensive before pregnancy and developed hypertension after 20 weeks of gestation. Pre-eclamptic women diagnosed on basis of blood pressure equal to or more than 140/90mm Hg (measured in two or more separate occasion) (for mild cases) and blood pressure equal to or more than 160/110mm Hg (for severe cases).

All the following parameters were assessed:

- Patients' demographic data and obstetric history.
- Patients' clinical data.
- Patients' laboratory data.
- Ultrasound parameters including:
 - Fetal biometry, Mean gestational age by ultrasound (MGA by U/S), estimated fetal weight by ultrasound (EFW by U/S) and amniotic fluid index (AFI).
- Doppler ultrasound study including Doppler indices (S/D ratio, RI and PI) of the following arteries:
 - Uterine arteries (Ut A).
 - Umbilical artery (UA).
 - Retro-placental vascular space.
- Placenta after delivery was examined for:
 - Circumference, central thickness, weight, number of cotyledons, site of umbilical cord insertion and areas of hemorrhage or infarction.
- Neonatal outcomes parameters including:
 - Birth weight, Apgar score 5 minute after delivery and admission to NICU.
- Feto/placental weight ratios (F/P ratio) calculated in each case.
- Placental index: The ratio between the placental weight and neonatal weight also calculated in each case.⁽⁴⁴⁾

Results

1- Demographic data and obstetric history:

Table (1) comparison between the three studied groups regarding the demographic data (maternal age, maternal weight) and obstetric history (gravidity, parity, abortions and gestational age by last menstrual period in weeks). There was no statistical significant difference between the three studied groups regarding the demographic data and obstetric history ($P > 0.05$).

Table (1): Comparison between the three studied groups regarding demographic data and obstetric history.

		N	Min.	Max.	Mean	S.D.	F-test	p
Maternal Age(in years)	Control	50	18	39	29.08	6.33	2.204	0.114
	Mild	91	18	41	27.00	5.84		
	Severe	9	23	37	28.68	4.77		
Maternal weight	Control	50	60	120	89.66	3.16	0.745	0.433
	Mild	91	66	122	89.8	3.29		
	Severe	9	65	130	97.12	3.29		
Gravidity	Control	50	1.0	5.0	2.36	1.06	0.536	0.586
	Mild	91	1.0	6.0	2.33	1.41		
	Severe	9	1.0	3.0	1.89	0.93		
Parity	Control	50	0.0	3.0	0.90	0.91	0.085	0.918
	Mild	91	0.0	3.0	0.84	0.92		
	Severe	9	0.0	2.0	0.89	0.93		
Abortions	Control	50	0.0	1.0	0.40	0.49	2.832	0.062
	Mild	91	0.0	3.0	0.53	0.77		
	Severe	9	0.0	0.0	0.00	0.00		
Gestational age by LMP (in weeks)	Control	50	36.0	41.0	38.62	1.37	1.02	0.32
	Mild	91	36.0	40.0	38.24	1.05		
	Severe	9	35.0	39.0	37.00	0.71		

2- Clinical data:

Table (2) Comparison between the three studied groups regarding the clinical data revealed no significant statistical difference between three studied groups regarding temperature, respiratory rate and the pulse ($P > 0.05$). While the mean arterial blood pressure (MABP) revealed significant statistical difference between the three studied groups ($P = 0.001$).

Table (2): Comparison between the three studied groups regarding to clinical data.

		N	Minimum	Maximum	Mean	Std. Deviation	F-test	P
Temperature	Control	50	37.0	38.0	37.50	0.33	2.65	.128
	Mild	91	37.2	38.0	37.61	0.31		
	Severe	9	37.0	38.0	37.58	0.29		
Respiratory Rate	Control	50	14.0	16.0	15.02	0.82	.025	.782
	Mild	91	14.0	17.0	15.32	0.69		
	Severe	9	14.0	16.0	15.03	0.82		
Pulse	Control	50	75.0	85.0	80.56	5.22	.125	.754
	Mild	91	66.0	82.0	74.6	5.01		
	Severe	9	65.0	80.0	72.43	4.77		
MABP	Control	50	70.0	103.0	82.66	8.91	14.6	0.001* P1:0.004* P2:0.001* P3:0.001*
	Mild	91	106.0	118.0	110.31	4.16		
	Severe	9	123.0	143.0	132.00	7.23		

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

Results

Table (3): Comparison between the three studied groups regarding to laboratory data. There was no significant statistical difference between the three groups except for serum uric acid and dip stick test for proteinuria there was significant statistical difference with ($P<0.05$).

Table (3): Comparison between the three studied groups regarding to laboratory data.

		N	Minimum	Maximum	Mean	Std. Deviation	F-test	P
SGOT	Control	50	8.0	25.0	16.74	5.11	0.365	0.852
	Mild	91	10.0	22.5	16.5	4.01		
	Severe	9	8.0	25.0	17.38	5.42		
SGPT	Control	50	11.0	38.0	24.90	8.46	.120	.789
	Mild	91	12.0	35.6	23.9	7.89		
	Severe	9	11.0	38.0	24.92	8.05		
Prothrombin activity	Control	50	65.0	100.0	82.34	11.22	.211	.784
	Mild	91	66.0	100.0	83.65	10.21		
	Severe	9	65.0	99.0	82.28	10.25		
Blood Urea nitrogen	Control	50	1.0	4.6	3.02	0.94	1.32	0.442
	Mild	91	1.5	5.2	2.71	0.98		
	Severe	9	1.0	4.6	2.60	1.02		
Serum Creatinine	Control	50	0.5	1.7	1.12	0.39	0.21	0.68
	Mild	91	0.42	1.33	0.98	0.28		
	Severe	9	0.5	1.7	1.09	0.39		
Fasting blood glucose	Control	50	61.0	99.0	69.20	16.52	.274	.425
	Mild	91	72.0	98.0	72.6	15.6		
	Severe	9	70.0	97.0	70.68	17.96		
Post Prandial blood glucose	Control	50	89.2	118.8	83.04	11.83	0.754	0.365
	Mild	91	90.0	122.0	92.2	9.98		
	Severe	9	88.0	120.8	84.82	12.56		
Serum Uric Acid	Control	50	1.0	4.6	2.84	1.09	3.12	.037*
	Mild	91	1.0	4.8	2.94	1.10		
	Severe	9	2.9	6.22	3.98	1.21		
Dip stick test	Control	50	1	2	1.05	0.11	2.98	0.013*
	Mild	91	1	2	1.06	0.13		
	Severe	9	2	3	2.52	0.11		

3- Biometric measures:

Table (4) comparison between the three studied groups regarding mean gestational age by ultrasound in weeks (MGA by U/S). There was a significant statistical difference between severe and both mild and control groups ($P < 0.05$), while there was no significant difference between mild and control groups ($P > 0.05$).

Table (4): Comparison between the three studied groups regarding MGA by U/S (in weeks)

		N	Min.	Max.	Mean	S.D.
MGA by U/S (in weeks)	Control	50	36.5	40.4	38.29	1.14
	Mild	91	35.3	40.0	38.49	1.81
	Severe	9	33.11	36.3	34.10	1.07
F		2.77				
P		0.045*				
P1		0.354				
P2		0.041*				
P3		0.039*				

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

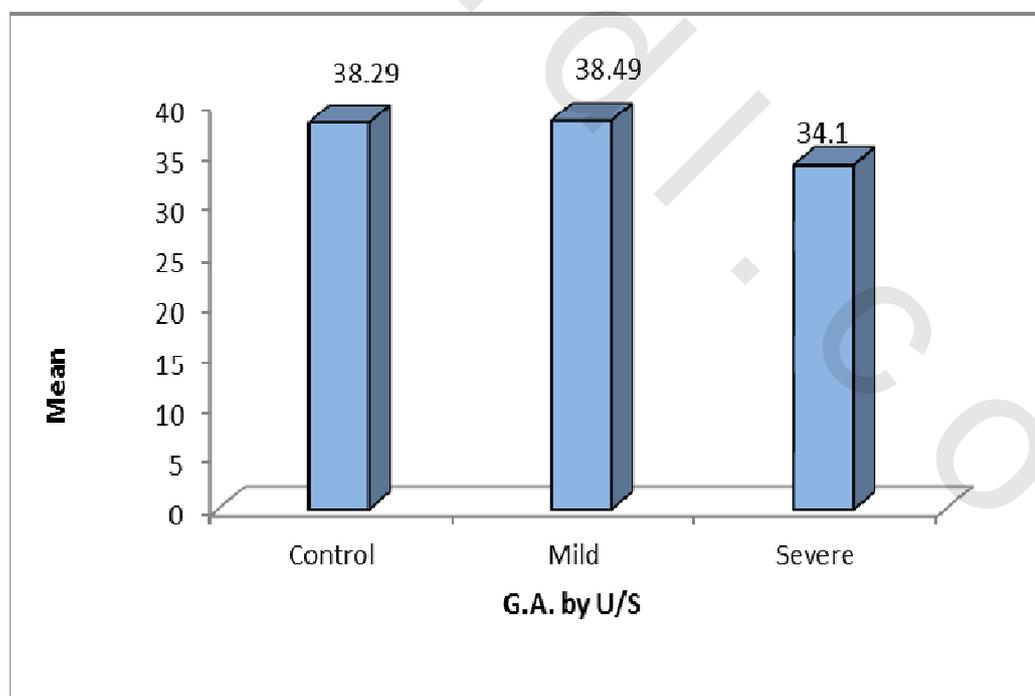


Figure (19): Comparison between the three studied groups regarding MGA by U/S (in weeks)

Results

Table (5) comparison between the three studied groups regarding estimated fetal weight by ultrasound in grams (EFW by U/S in grams). There was a significant statistical difference between severe and both mild and control groups regarding EFW by U/S ($P < 0.01$), while there was no significant difference between mild and control groups.

Table (5): Comparison between the three studied groups regarding EFW by U/S (in grams).

		N	Min	Max	Mean	S.D.
EFW by US (in grams).	Control	50	3100.0	4100.0	3596.64	315.59
	Mild	91	2399.0	4000.0	3322.26	348.03
	Severe	9	1650.0	2900.0	2311.11	458.79
F					15.89	
P					0.001*	
P1					0.098	
P2					0.001*	
P3					0.001*	

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

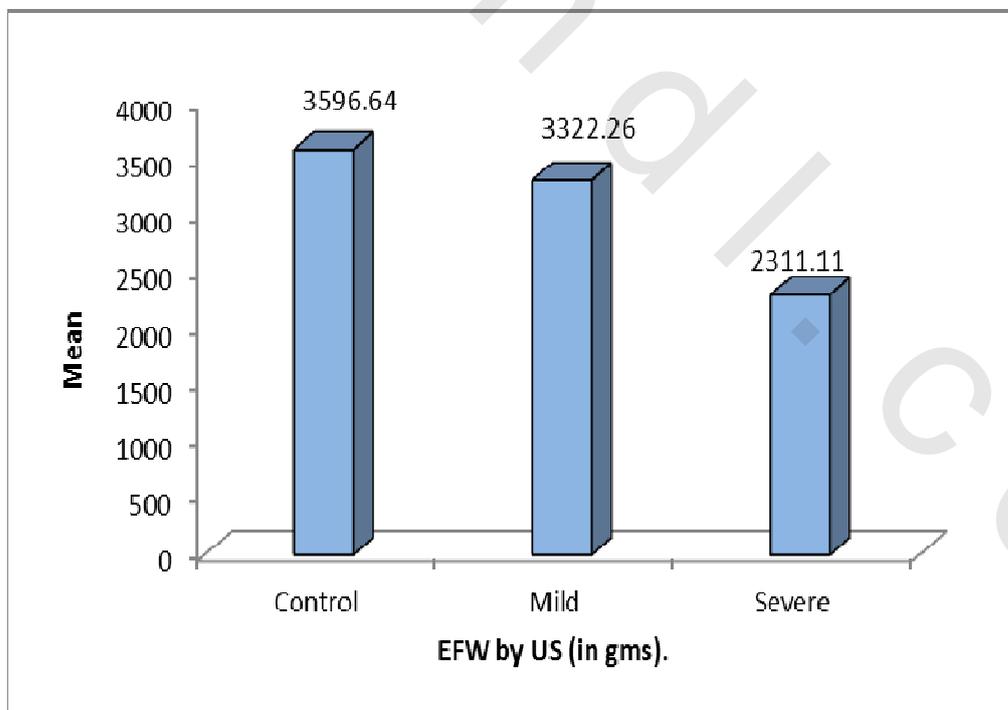


Figure (20): Comparison between the three studied groups regarding EFW by U/S (in grams).

Table (6) shows comparison between the three studied groups regarding amniotic fluid index (AFI). There was significant statistical difference between sever pre-eclamptic group and both mild and control groups regarding AFI ($P < 0.001$), while there was no significant difference between mild and control groups.

Table (6): Comparison between the three studied groups regarding AFI

		N	Min.	Max.	Mean	S.D.
AFI	Control	50	7.0	17.0	11.24	2.71
	Mild	91	7.0	14.0	10.03	1.76
	Severe	9	5.0	9.0	6.11	1.36
F				23.224		
P				0.0001*		
P1				0.068		
P2				0.001*		
P3				0.001*		

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

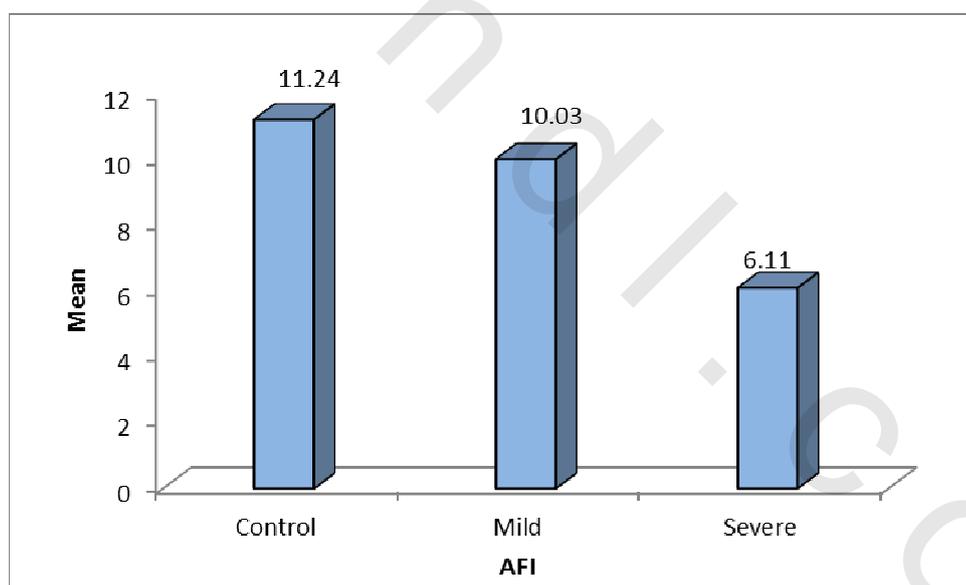


Figure (21): Comparison between the three studied groups regarding AFI

Doppler studies:

Table (7) comparison between the three studied groups regarding uterine artery (Ut.A) Doppler indices (S/D, RI and PI). There was statistical significant difference between the three studied groups regarding UTA Doppler indices ($P = 0.001$). The highest indices were among severe pre-eclamptic group with mean values of (4.5 ± 0.06 , 0.7 ± 0.03 and 1.2 ± 0.1) respectively compared to mild pre-eclamptic and control groups mean values (2 ± 0.04 , 0.5 ± 0.09 and 0.8 ± 0.1) (1.6 ± 0.3 , 0.3 ± 0.1 and 0.5 ± 0.1) respectively.

Table (7): Comparison between the three studied groups regarding Ut.A Doppler indices.

		Min.	Max.	Mean	S.D.	F-test	P	P1	P2	P3
S/D Ratio	Control	1.2	2.5	1.68	0.34	18.98	0.001*	0.013*	0.001*	0.001*
	Mild	1.3	3.2	2.07	0.42					
	Severe	3.9	5.4	4.51	0.61					
RI	Control	0.1	0.6	0.38	0.12	18.55	0.001*	0.025*	0.001*	0.001*
	Mild	0.3	0.7	0.51	0.09					
	Severe	0.7	0.8	0.77	0.03					
PI	Control	0.2	0.9	0.53	0.18	16.98	0.001*	0.021*	0.0013*	0.001*
	Mild	0.5	1.2	0.80	0.14					
	Severe	1.1	1.4	1.25	0.11					

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

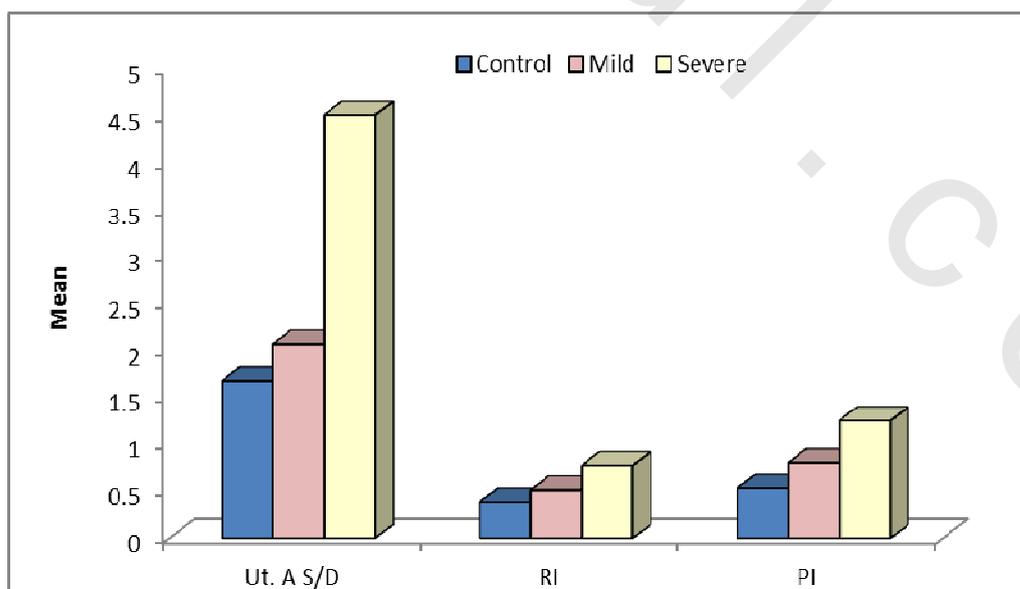


Figure (22): Comparison between the three studied groups regarding Ut.A Doppler indices.

Table (8) comparison between the three studied groups regarding umbilical artery (UA) Doppler indices (S/D, RI and PI). There was significant statistical difference regarding UA Doppler indices between severe pre-eclamptic group and both mild and control groups ($P < 0.001$), while there was no significant difference between mild and control.

Table (8): Comparison between the three studied groups regarding UA Doppler indices.

		Min.	Max.	Mean	S.D.	F-test	P	P1	P2	P3
S/D Ratio	Control	1.2	3.0	2.22	0.46	20.90	.0001*	0.21	0.001*	0.001*
	Mild	1.8	3.9	2.49	0.50					
	Severe	0.0	4.6	3.56	1.39					
RI	Control	0.2	0.7	0.51	0.11	22.25	.0001*	0.365	0.001*	0.001*
	Mild	0.4	0.8	0.55	0.08					
	Severe	0.7	0.8	0.74	0.04					
PI	Control	0.3	1.0	0.71	0.17	34.97	.0001*	0.098	0.001*	0.001*
	Mild	0.6	1.3	0.81	0.15					
	Severe	1.1	1.3	1.20	0.10					

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

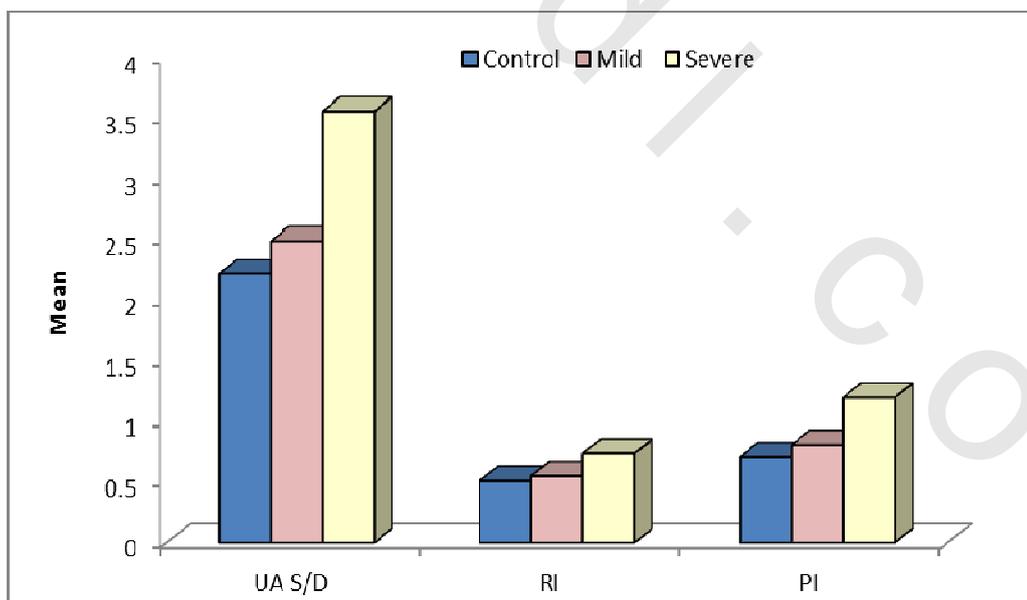


Figure (23): Comparison between the three studied groups regarding UA Doppler indices

Results

Table (9): Comparison between the three studied groups regarding retro-placental vascular space Doppler study revealed insignificant statistical variation between the groups.

Table (9): Comparison between the three studied groups regarding retro placental vascular space.

			Groups			Total
			Control	Mild	Severe	
Retro-placental vascular space	Normal	No.	50	88	8	146
		%	100.0	96.7	88.9	97.3
	Abnormal	No.	0	3	1	4
		%	0.0	3.3	11.1	2.7
Total		No.	50	91	9	150
		%	100.0%	100.0%	100.0%	100.0%
X ²			1.03			
P			0.201			

4- Antenatal placental morphological features (by Ultrasound examination):

Table (10) Comparison between the three studied groups regarding placental site. There was no statistical significant difference regarding placental site in relation to groups ($P > 0.05$).

Table (10): Comparison between the three studied groups regarding placental site.

		Groups				Total	
		Control	Mild	Severe			
placental site	Fundal	No.	18	25	3	46	
		%	36.0	27.5	33.3	30.7	
	Lateral	No.	8	19	1	28	
		%	16.0	20.9	11.1	18.7	
	Anterior	No.	14	27	3	44	
		%	28.0	29.7	33.3	29.3	
	Posterior	No.	10	20	2	32	
		%	20.0	22.0	22.2	21.3	
	Total		No.	No.	9	50	150
			%	%	100.0%	100.0%	100.0%
X ²		2.72					
P		0.548					

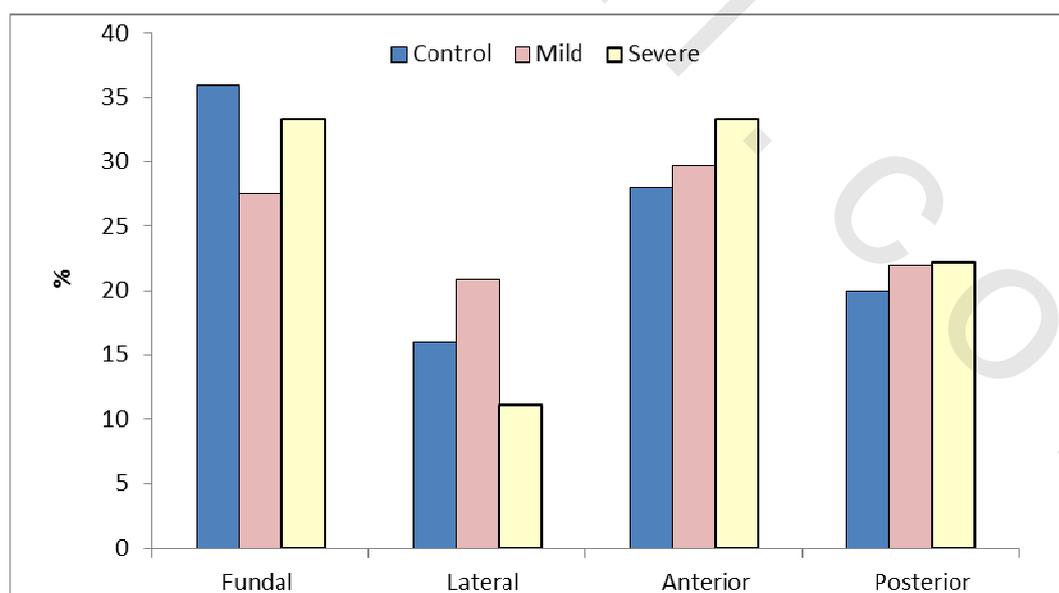


Figure (24): Comparison between the three studied groups regarding placental site.

Results

Table (11) Comparison between the three studied groups regarding the placental grade. There was no statistical significant difference regarding placental grade in relation to groups ($P > 0.05$).

Table (11): Comparison between the three studied groups regarding the placental grade

			Groups			Total
			Control	Mild	Severe	
placental grade	I	Count	4	5	0	9
		% within Group	8.0%	5.5%	.0%	6.0%
	II	Count	36	72	7	115
		% within Group	72.0%	79.1%	77.8%	76.7%
	III	Count	10	14	2	26
		% within Group	20.0%	15.4%	22.2%	17.3%
Total		Count	91	9	50	150
		% within Group	100.0%	100.0%	100.0%	100.0%
X^2			1.65			
P			0.799			

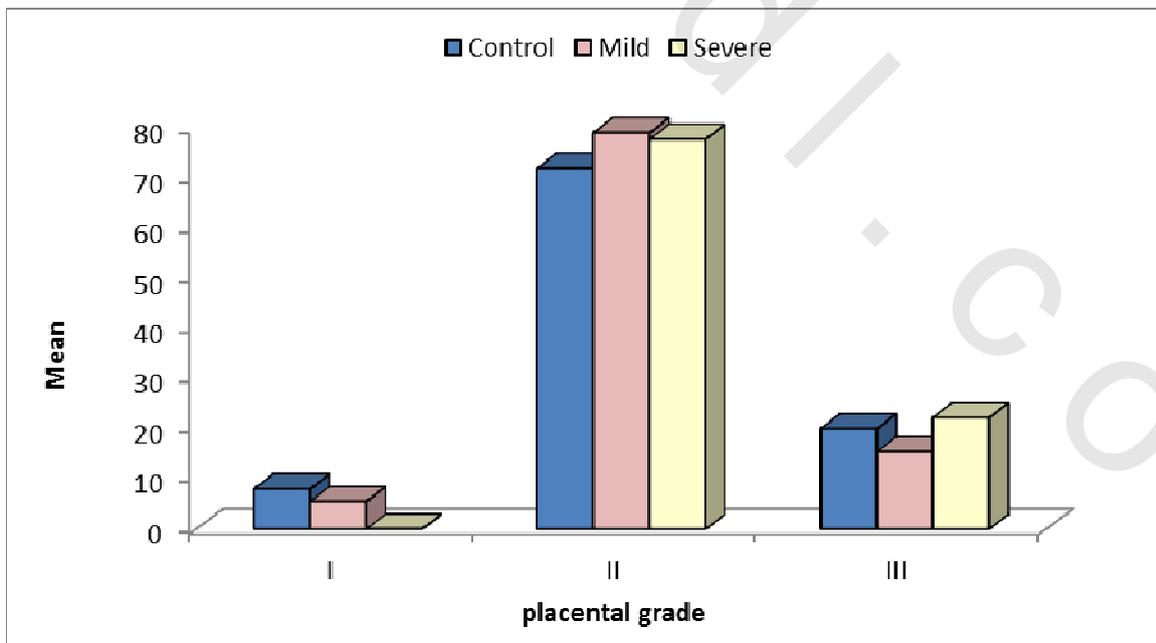


Figure (25): Comparison between the three studied groups regarding placental grade.

Table (12) comparison between the three studied groups regarding placental maximum thickness by ultrasound (in cm). There was statistical significant difference between severe pre-eclamptic group and both mild and control groups (P= 0.001), while there was no significant difference between mild pre-eclamptic and control groups.

Table (12): Comparison between the three studied groups regarding placental maximum thickness by U/S (in cm)

		N	Min.	Max.	Mean	S.D.
placental maximum thickness by u/s	Control	50	3.0	5.0	3.83	0.77
	Mild	91	2.0	5.5	3.34	0.79
	Severe	9	1.5	3.0	2.11	0.55
F-test		20.5				
P		0.0001*				
P1		0.21				
P2		0.001*				
P3		0.001*				

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

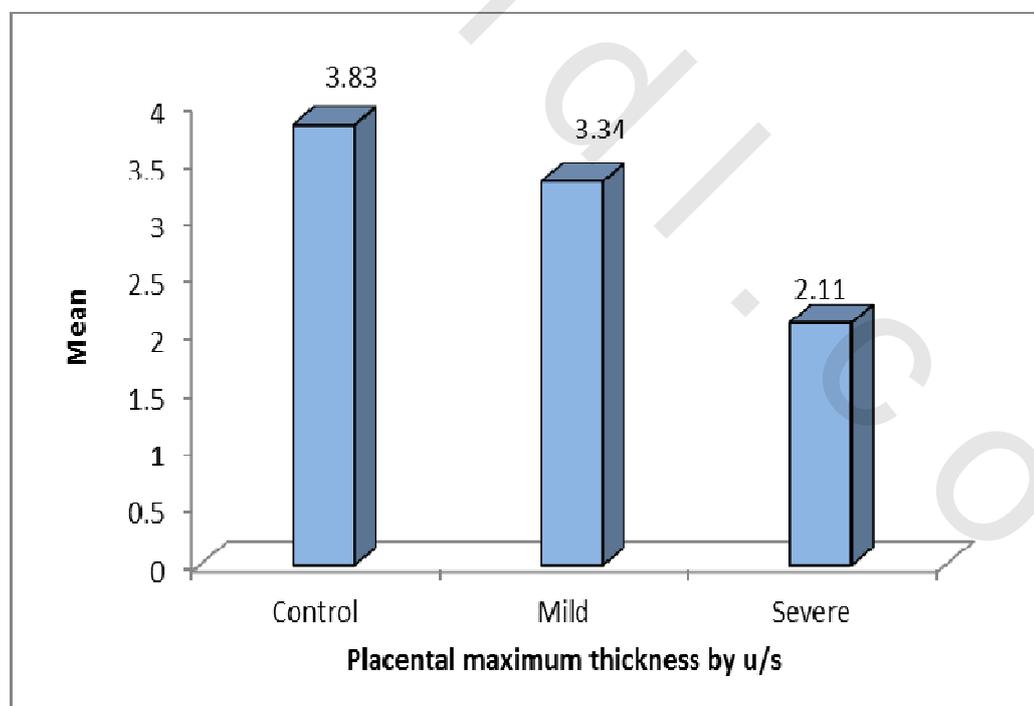


Figure (26): Comparison between the three studied groups regarding placental maximum thickness by U/S (in cms)

5- Post-natal placental morphological features:

Table (13) comparison between the three studied groups regarding placental circumference (in cm). There was statistical significant difference between severe pre-eclamptic group and both mild and control groups ($P < 0.001$), while there was no significant difference between mild and control groups ($P > 0.05$).

Table (13): Comparison between the three studied groups regarding placental circumference (in cm).

		N	Min.	Max.	Mean	S.D.
Placental Circumference	Control	50	56.0	85.0	74.48	8.26
	Mild	91	54.0	86.0	74.38	7.43
	Severe	9	37.0	65.0	55.67	9.14
F		24.295				
P		.0001				
P1		0.321				
P2		0.001*				
P3		0.001*				

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

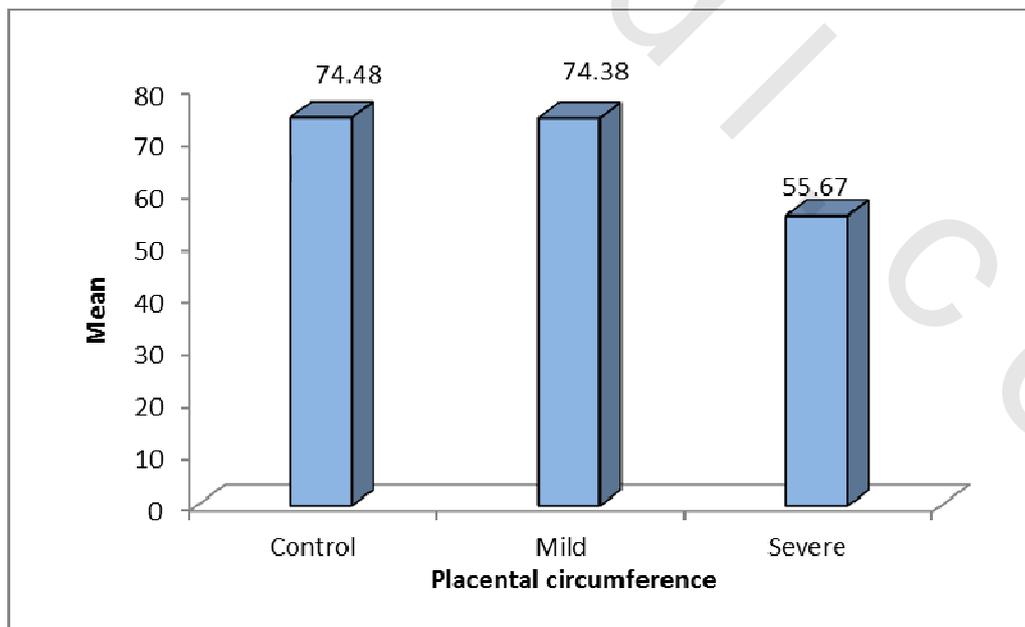


Figure (27): Comparison between the three studied groups regarding placental circumference (in cm).

Table (14) Comparison between the three studied groups regarding placental central thickness (in cm). There was statistical significant difference between severe pre-eclamptic group and both mild and control groups ($P= 0.001$), while there was no significant difference between mild and control groups ($P>0.05$).

Table (14): Comparison between the three studied groups regarding placental central thickness (in cms).

		N	Min.	Max.	Mean	S.D.
Placental central thickness	Control	50	2.0	5.0	3.12	0.73
	Mild	91	1.5	5.0	2.73	0.69
	Severe	9	1.0	2.5	1.78	0.57
F			22.65			
P			0.001*			
P1			0.062			
P2			0.001*			
P3			0.013*			

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

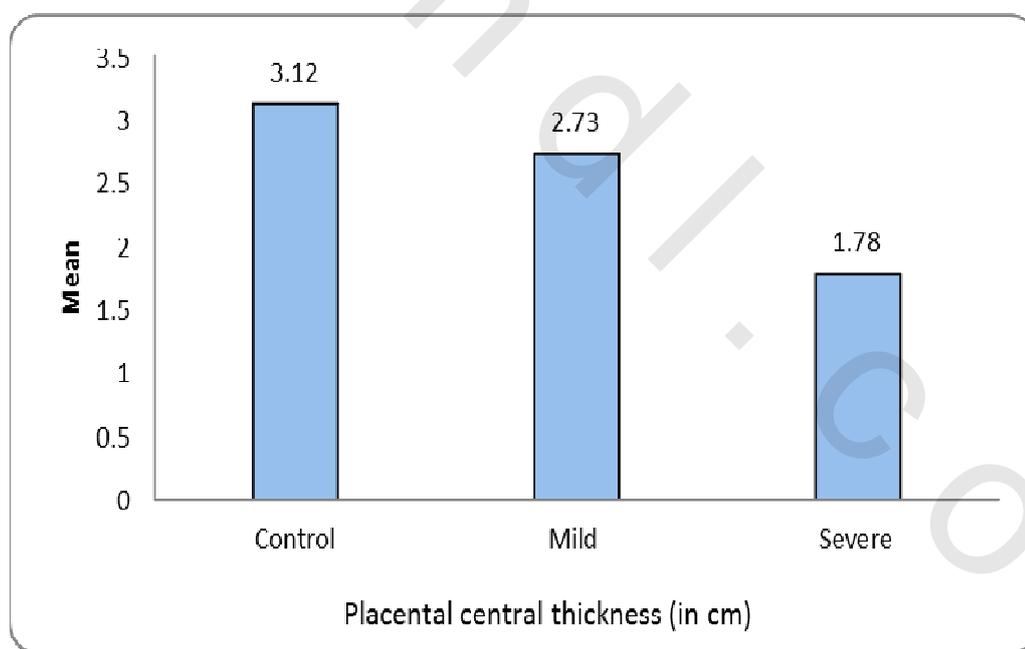


Figure (28): Comparison between the three studied groups regarding placental central thickness (in cm)

Results

Table (15) Comparison between the three studied groups regarding placental weight (in grams). There was a significant statistical difference between severe pre-eclamptic group and both mild and control groups ($P=0.001$), while there was no significant statistical difference between mild pre-eclamptic group and control group ($P>0.05$).

Table (15): Comparison between the three studied groups regarding placental weight (in grams)

		N	Min.	Max.	Mean	S.D.
Placental Weight (in grams)	Control	50	380.0	800.0	604.80	128.94
	Mild	91	350.0	750.0	539.23	117.55
	Severe	9	300.0	400.0	344.44	39.09
F					15.65	
P					0.001*	
P1					0.123	
P2					0.001*	
P3					0.001*	

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

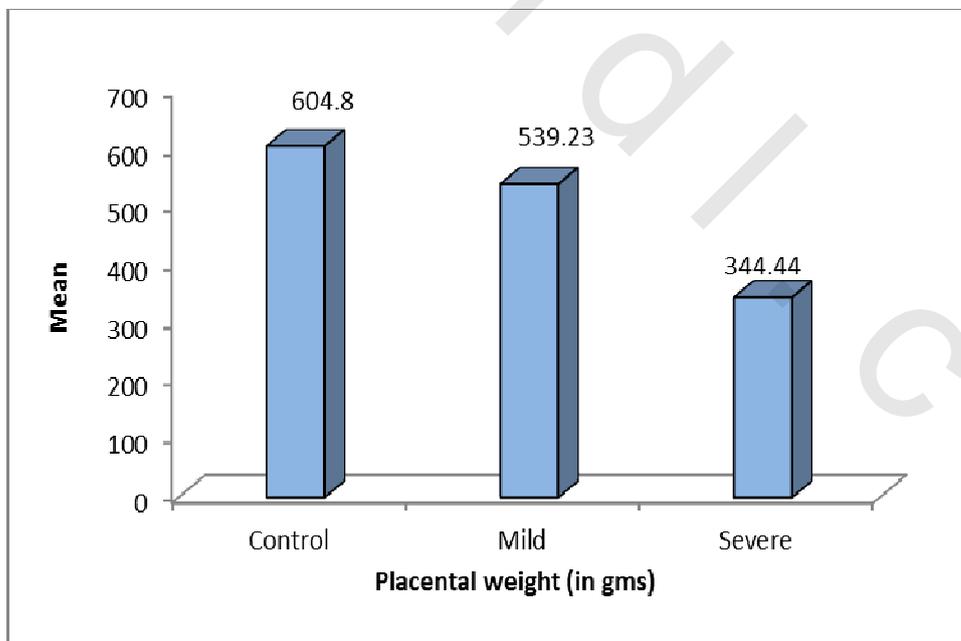


Figure (29): Comparison between the three studied groups regarding placental weight (in grams)

Table (16) Comparison between the three studied groups regarding number of cotyledons. There was significant statistical difference between severe pre-eclamptic group and both mild and control groups ($P=0.001$), while there was no significant statistical difference between mild and control groups ($P>0.05$).

Table (16): Comparison between the three studied groups regarding number of cotyledons

		N	Min.	Max.	Mean	S.D.
Number of Cotyledons	Control	50	10.0	19.0	13.26	2.66
	Mild	91	10.0	17.0	12.45	2.00
	Severe	9	7.0	10.0	8.33	1.22
F		16.98				
P		0.001*				
P1		0.215				
P2		0.001*				
P3		0.001*				

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

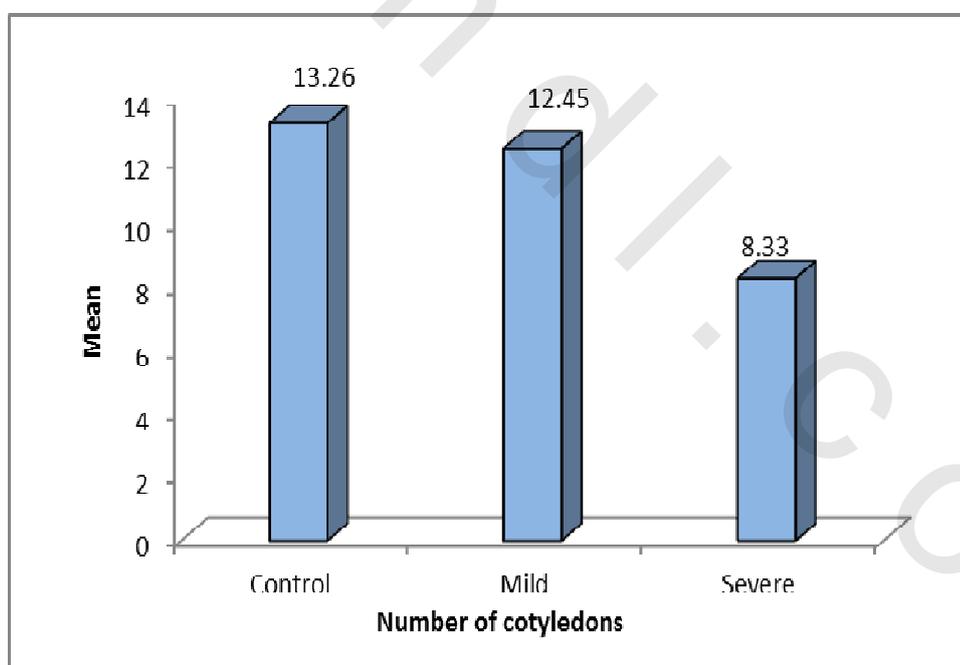


Figure (30): Comparison between the three studied groups regarding number of cotyledons.

Results

Table (17) Comparison between the three studied groups regarding areas of hemorrhage and infarctions. There was significant statistical difference between severe pre-eclamptic group and both mild and control groups ($P < 0.05$), while there was no statistical difference between mild and control groups ($P > 0.05$).

Table (17): Comparison between the three studied groups regarding areas of hemorrhage and infarction.

			Groups			Total
			Control	Mild	Severe	
Areas of hemorrhage and infarction	Absent	No.	44	62	5	111
		%	88.0%	79.5%	55.6%	81.0%
	Present	No.	6	16	4	26
		%	12.0%	20.5%	44.4%	19.0%
Total		No.	50	78	9	137
		%	100.0%	100.0%	100.0%	100.0%
X^2			5.4			
P			0.044			

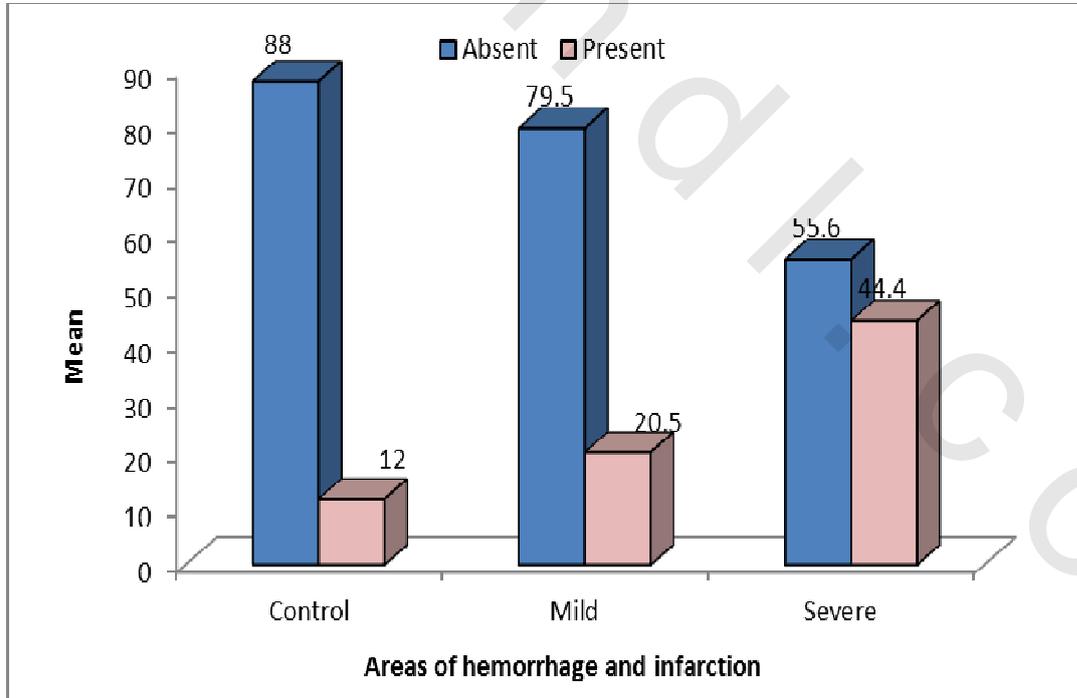


Figure (31): Comparison between the three studied groups regarding areas of hemorrhage and infarction.

Table (18) Comparison between the three studied groups regarding site of cord insertion. There was no statistical significant difference regarding site of cord insertion in relation to groups ($P>0.05$).

Table (18): Comparison between the three studied groups regarding site of cord insertion.

			Groups			Total
			Control	Mild	Severe	
Site of cord Insertion	Central	No.	22	29	0	51
		%	44.0%	31.9%	.0%	34.0%
	Eccentric	No.	28	62	9	99
		%	56.0%	68.1%	100.0%	66.0%
	Marginal	No.	0	0	0	0
		%	0.0	0.0	0.0	0.0
Total		No.	50	91	9	150
		%	100.0%	100.0%	100.0%	100.0%
X ²			8.84			
P			0.065			

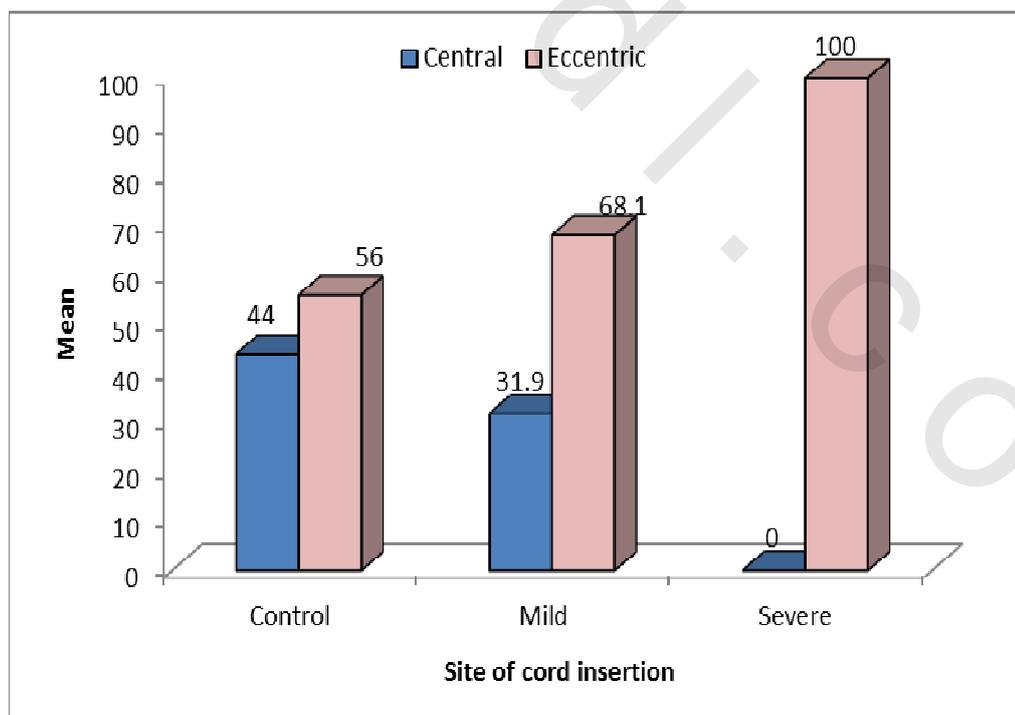


Figure (32): Comparison between the three studied groups regarding site of cord insertion

6- Neonatal outcome:

Table (19) Comparison between the three studied groups regarding neonatal weight (in grams). There was significant statistical difference between the severe pre-eclamptic group and both mild and control (P=0.001), while there was no significant statistical difference between mild pre-eclamptic and control groups (P>0.05).

Table (19): Comparison between the three studied groups regarding neonatal weight (in grams)

		N	Min.	Max.	Mean	S.D.
Neonatal weight (in grams)	Control	50	2500.0	4150.0	3399.00	414.22
	Mild	91	2150.0	3900.0	3323.08	332.69
	Severe	9	2000.0	2750.0	2355.56	272.08
F			11.23			
P			0.001*			
P1			0.102			
P2			0.001*			
P3			0.001*			

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

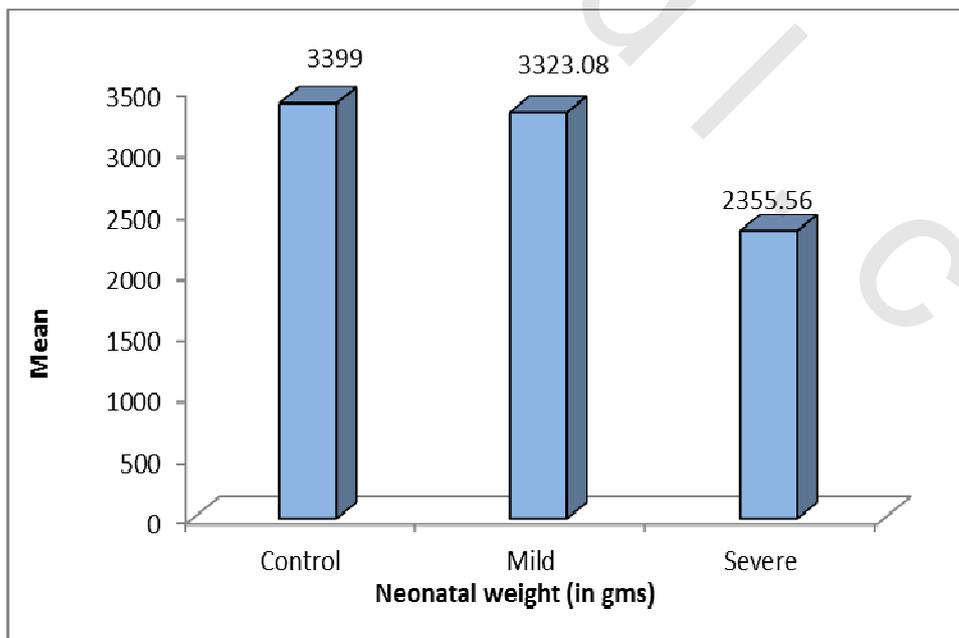


Figure (33): Comparison between the three studied groups regarding neonatal weight (in gms)

Table (20) Comparison between the three studied groups regarding Apgar score. There was significant statistical difference between severe pre-eclamptic group and both mild and control groups ($P= 0.001$), while there was no significant difference between mild pre-eclamptic and control groups ($P>0.05$).

Table (20): Comparison between the three studied groups regarding Apgar score

		N	Min.	Max.	Mean	S.D.
Apgar score	Control	50	7.0	9.0	8.54	0.61
	Mild	91	7.0	9.0	8.70	0.51
	Severe	9	6.0	8.0	6.89	0.78
F			9.58			
P			0.001*			
P1			0.122			
P2			0.001*			
P3			0.001*			

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

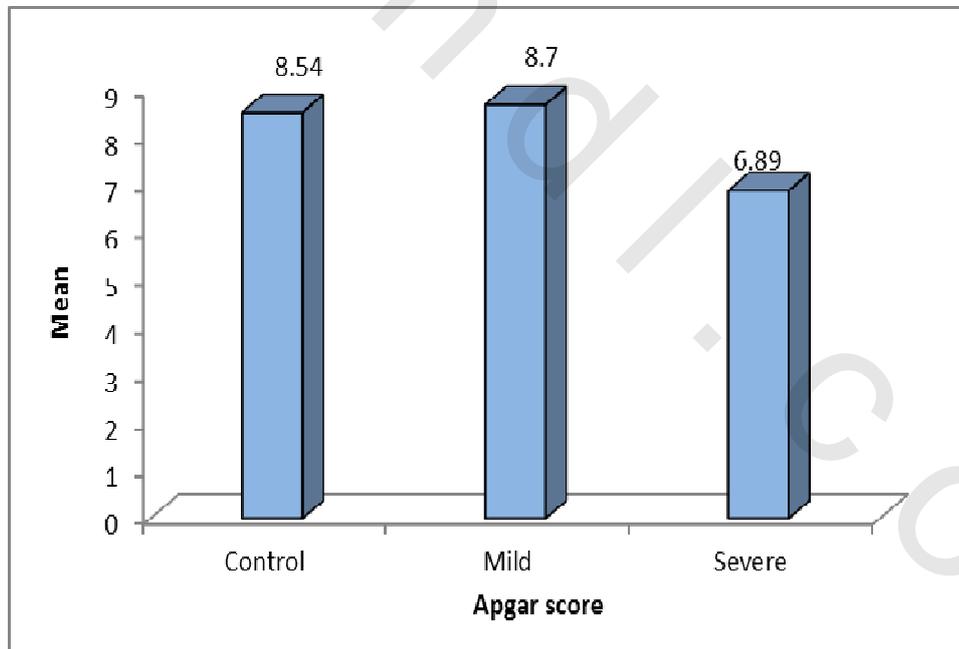


Figure (34): Comparison between the three studied groups regarding Apgar score

Results

Table (21) Comparison between the three studied groups regarding NICU admission. There was a significant difference between severe pre-eclamptic group and both other groups ($P < 0.001$), while there was no significant difference between mild pre-eclamptic and control groups.

Table (21): Comparison between the three studied groups regarding NICU admission.

			Groups			Total
			Control	Mild	Severe	
NICU admission	No admission	No.	48	88	2	138
		%	96.0	96.7	22.2	92.0
	Admission	No.	2	3	7	12
		%	4.0%	3.2%	77.8%	8.0%
Total		No.	50	91	9	150
		%	100.0%	100.0%	100.0%	100.0%
X ²		32.5				
P		0.0001*				
P1		0.23				
P2		0.001				
P3		0.001				

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

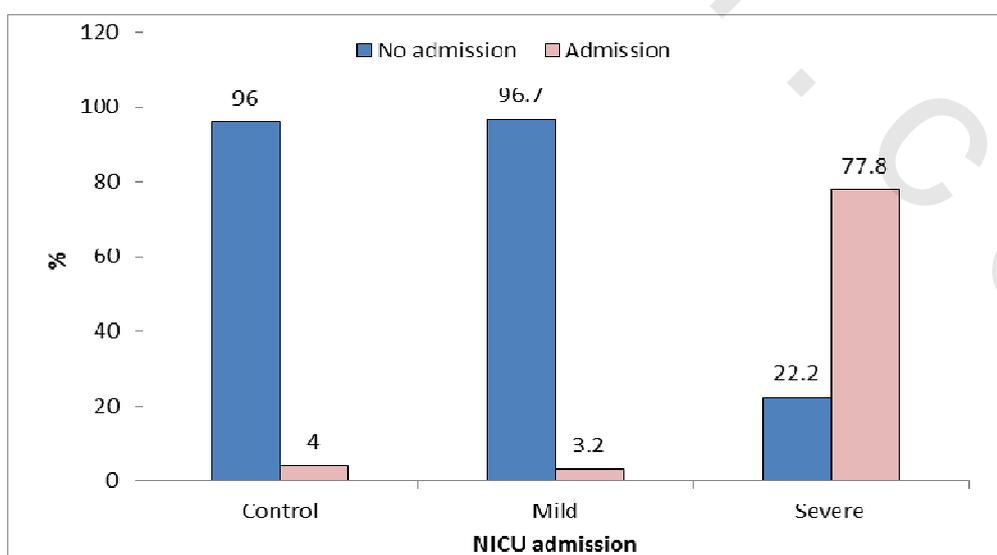


Figure (35): Comparison between the three studied groups regarding NICU admission.

Table (22) shows comparison between the three studied groups regarding fetoplacental weight ratio (F/P weight ratio). There was significant statistical difference between severe preeclamptic group and the other two groups ($P < 0.05$). While the mean F/P weight ratio of mild preeclamptic group (4.7 ± 2.1) was more than that of control group (4 ± 1.9) but it was statistically insignificant ($P > 0.05$).

Table (22): Comparison between the three studied groups regarding F/P weight ratio.

	N	Min.	Max.	Mean	S.D.
Control	50	1.85	7.56	4.012	1.93
Mild	91	1.85	8.95	4.782	2.191
Severe	9	2.20	8.97	5.98	1.12
F		2.92			
P		0.0431*			
P1		0.251			
P2		0.041*			
P3		0.039*			

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

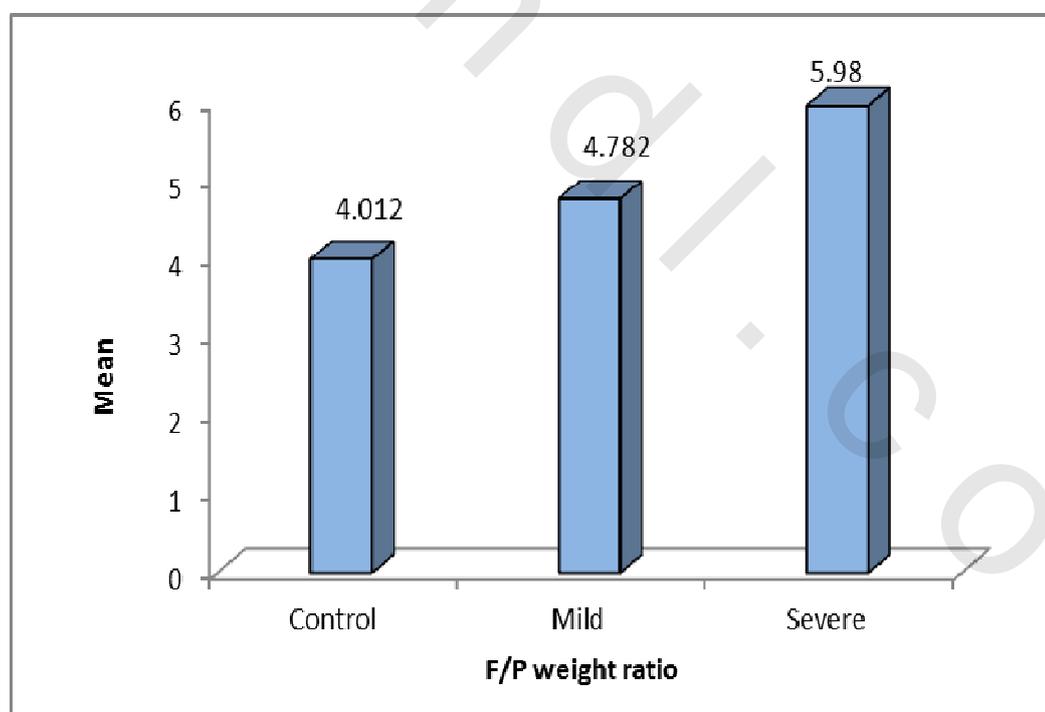


Figure (36): Comparison between the three studied groups regarding F/P weight ratio

Results

Table (23) Comparison between the three studied groups regarding placental index. There was significant statistical difference between severe preeclamptic group and the other two groups ($P < 0.05$). While the mean placental index of mild preeclamptic group (0.17 ± 0.03) was less than that of control group (0.18 ± 0.03) but it was statistically insignificant ($P > 0.05$).

Table (23): Comparison between the three studied groups regarding placental index

		N	Min.	Max.	Mean	S.D.
Placental index	Control	50	0.1520	0.1928	0.1879	0.0353
	Mild	91	0.1628	0.1923	0.1723	0.0310
	Severe	9	0.1500	0.1620	0.1413	0.0140
F			1.87			
P			0.0465			
P1			0.254			
P2			0.042*			
P3			0.046*			

P1 comparison between control and mild, P2 comparison between control and severe and P3 comparison between mild and severe

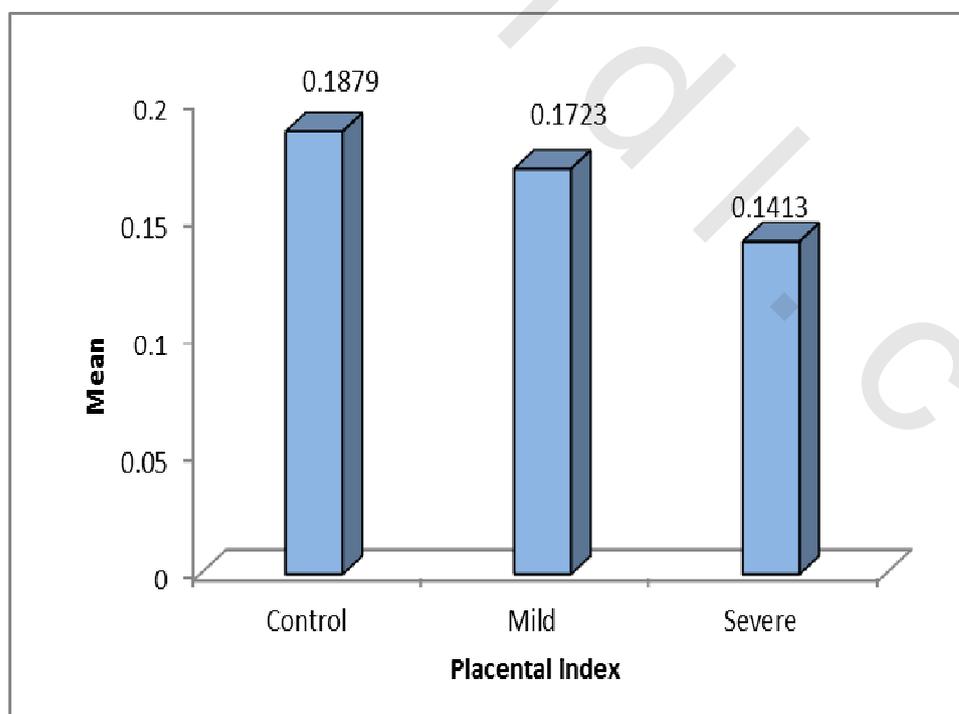


Figure (37): Comparison between the three studied groups regarding placental index.

Table (24) Correlation between the placental morphometric measures (placental circumference, thickness and weight), F/P ratio and placental index with uterine artery (Ut.A) Doppler indices in pre-eclamptic group, there was statistically significant negative correlation with P value (<0.001).

Table (24): Correlation between placental measurements, F/P ratio and placental index with Ut.A Doppler indices in severe pre-eclamptic group.

		placental circumference	placental central thickness	placental weight	F/P ratio	Placental index
S/D ratio	r	-.236**	-.352**	-.502**	-.365**	-.415**
	p	0.00	0.00	0.00	0.00	0.00
RI	r	-.296**	-.469**	-.559**	-.490**	-.480**
	p	.000	.000	.000	.000	.000
PI	r	-.262**	-.495**	-.586**	-.549**	-.441**
	p	.001	.000	.000	.000	.000

(25) Correlation of the placental morphometric measurements, F/P ratio and placental index with umbilical artery (UA) Doppler indices in pre-eclamptic group, there was high statistically significant negative correlation with (P<0.001).

Table (25): Correlation between placental morphometric measurements, F/P ratio and placental index with UA Doppler indices in severe pre-eclamptic group.

		Placental circumference.	placental central thickness	placental weight	F/P ratio	Placental Index
S/D ratio	r	-.293**	-.399**	-.364**	-.412**	-.388**
	p	.000	.000	.000	.000	.000
RI	r	-.393**	-.315**	-.258**	-.322**	-.415**
	p	.000	.000	.002	.000	.000
PI	r	-.341**	-.395**	-.416**	-.359**	-.401**
	p	.000	.000	.000	.000	.000

Results

Table (26) correlation between the placental morphometric measurements, F/P ratio and placental index with neonatal outcome parameters in pre-eclamptic group, there was statistically significant positive correlation regarding neonatal weight and Apgar score with ($p < 0.001$) and statistically significant negative correlation regarding NICU admission with ($P < 0.001$).

Table (26): Correlation between placental morphometric measurements, F/P ratio and placental index with neonatal outcome parameters.

		placental circumference	placental central thickness	placental weight	F/P ratio	Placental index
Neonatal weight	r	.551**	.316**	.439**	.328**	.473**
	p	.000	.000	.000	.000	.000
Apgar score	r	.387**	.322**	.268**	.350**	.274**
	p	.000	.000	.001	.000	.001
NICU admission	r	-.380**	-.358**	-.362**	-.431**	-.435**
	p	.000	.000	.000	.000	.000

Table (27) Correlation between the uterine artery (PI) and neonatal outcome parameters revealed statistically significant negative correlation regarding neonatal weight and Apgar score with ($P < 0.0001$) and significant positive correlation regarding NICU admission with ($P < 0.0001$).

Table (27): Correlation between uterine artery (PI) and neonatal outcome parameters.

		Ut.A (PI)
Neonatal weight	r	-.360**
	p	.000
Apgar score	r	-.374**
	p	.000
NICU admission	r	.441**
	p	.000