

HISTO-MORPHOLOGICAL STUDY OF FULL- TERM PLACENTA IN SELECTED NORMOTENSIVE AND PRE-ECLAMPTIC WOMEN IN BANGLADESH

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Abstract

Pre-Eclampsia is a disorder in 2nd half of pregnancy, characterized by a combination of hypertension, proteinuria, and edema, secondary to decreased placental perfusion. Clinical studies suggest histo-morphological changes in the placenta of pre-eclamptic women compared to normotensive pregnant women. This study aimed to compare the histo- morphological changes of the placenta in selected pre-eclamptic and normotensive pregnant women.

Methods: *Two hundred twenty pregnant women were selected with inclusion and exclusion criteria from 3 different medical colleges and divided into two groups. A study group comprised 110 pre-eclamptic women, and a control group comprised 110 normotensive pregnant women. After delivery, tissue samples were collected from the placenta and prepared for histopathological studies by hematoxylin and eosin stain. The mean number of areas of syncytial knot formation, the mean number of areas of cytotrophoblast cell proliferation, the mean number of areas of fibrinoid necrosis, and the mean number of areas of hyalinized villi of pre-eclamptic and normal pregnant women were evaluated. We evaluated the morphology by weight, diameters, number of cotyledons, and placental infarcts.*

Results: *The mean number of areas of syncytial knot formation, cytotrophoblastic cell proliferation, fibrinoid necrosis, and hyalinised villi were significantly higher in the study group compared to the control group. The mean weights, diameters, and the number of cotyledons were considerably lower in the study group compared to the control group. Moreover, the number of infarcted areas was significantly higher in the placentas of pre-eclamptic women.*

Conclusion: *There are histomorphologic changes in the placenta of pre-eclamptic women.*

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Introduction

The placenta is a temporary structure unique to pregnancy function to sustain and protect the fetus until birth.¹ It obtains its metabolic, immunological requirements, and secretory functions to support fetal development.^{2,3} The placenta is attached to the uterus, and the fetus is connected to the placenta via the umbilical cord.⁴ The human placenta is hemomochorial, meaning that only one chorionic cell layer exists between maternal and fetal blood,⁵

allowing nutrient uptake, waste elimination, and gas exchange via the mother's blood supply.⁶ The placenta clips to the wall of the uterus, usually at the top, side, front, or back of the uterus. However, in rare cases, the placenta might be found in the lower region of the uterus.⁷ A term placenta measures about 2.0 to 2.6 cm thick and 23 cm in diameter: a term placenta usually weighs approximately 470g to 508g with 500 ml of an average volume.⁸

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Measurements of the placenta differ broadly and substantially in distinct regions.⁹ Studies exhibited that fetal or maternal illnesses such as acute anemia, hypertension, and fetal hydrops affect fetal and placental weight.^{10,11} Race and socioeconomic position affect the placental weight.¹²

In Asia report of placental weight is 588g, and 470g in Ukraine.^{12,13}

The shape of the placenta is highly variable, probably due to placental location. It is influenced by implanted position in the uterus, its interaction with the endometrium, and uterine shape¹⁴ It usually shows an oval shape with a 16-20 cm diameter and a 2-3 cm thickness. It grows exponentially during gestation, from an average of 6 gm at three weeks to 470 gm at term.¹⁵ The placenta implants anywhere in the uterus, but most commonly, it is in an anterior or posterior location, much less often on the fundus.¹⁶

One of the prominent innovations in early mammalian embryogenesis is the formation of the placenta. By 21 days after fertilization, the trophoblasts have begun to sort themselves into the tree-like structures that make up the placenta.¹⁷

The trophoblast cells are a major component in the placenta¹⁸ and are fetal epithelial cells that form an interface between mother and offspring.¹⁹ In humans, the trophoblast cells are tumor-like in their aspect of invasion. However, their invasiveness is precisely controlled so that spatially the cells stop penetration at the inner third of the myometrium, and temporarily, the invasion occurs only at the early stage of pregnancy.²⁰ The human trophoblast differentiates along two pathways^{21,22} the Villous trophoblast pathway and the extravillous trophoblast pathway.

The finger-like chorionic villi are the central functional units of the placenta¹⁷, mediating nutrient absorption, waste elimination, and generating the bulk of the hormones produced by the placenta during pregnancy.³

Materials and method

A comparative cross-sectional study was done for three years, from June 2015 to May 2018.

Study groups were selected from three major tertiary hospitals in Dhaka City: Dhaka Medical College and Hospital, Sir Salimullah Medical College and Mitford Hospital, and Holy Family Red Crescent Medical College and Hospital. We followed the standard procedure to calculate the prevalence and proportion of pre-eclampsia. A total of 10,800 pregnant patients were admitted to the Gynae and Obs Department of hospitals above from June 2015 to May 2018. Amongst them, a total of 1800 were complicated with pre-eclampsia. So, the Sample size was calculated as $n=217$. Selection of cases was based on strict inclusion and exclusion criteria: In the case of pre-eclamptic women, age groups: 18 to 40 years, Pregnancy status: third trimester of pregnancy, Blood Pressure: Diastolic Blood Pressure above 90 mm of Hg. Clinically edema of legs present; Proteinuria: Confirmed by biochemical tests. Exclusion Criteria: Less than 18, greater than 40; No edema; No proteinuria; Normal Blood Pressure (diastolic < 90 mm of Hg). A questionnaire was developed to obtain relevant information regarding socioeconomic Status, age, obstetric history, monthly income, living area, family size, education, type of jobs, and habit of food before hospital admission. Ethical permission has been obtained from the Ethical review committee of the Bangladesh Medical and Research Council (B.M.R.C.). Written consent was taken from both pre-eclamptic and normal pregnant women. Tissue samples were collected from the placenta after delivery to evaluate the histopathology of the placenta, and they were prepared for histopathological studies by hematoxylin and eosin stain. The mean number of areas of syncytial knot formation, cytotrophoblastic cell proliferation, fibrinoid necrosis, and hyalinised villi of pre-eclamptic and normal pregnant women were evaluated. The decidual part of the placentas was removed to measure the weight of the placentas. The umbilical cords were then cut, nearest to the placenta, to drain the blood from the placental vessels, and the weight was recorded up to the nearest gram with a weighing machine. The diameters of the placentas were measured by taking the average of two maximum diameters of the placentas with measuring tape (cm). The cotyledons were

counted from the maternal side after the removal of deciduas basalis. The number of placental infarcts was counted from the fetal side. We did the Hematological and Biochemical Assays, including C.B.C., HB%, E.S.R, Fasting Blood Sugar, serum Vit C, serum Vit E, and Urine for Albumin. Nutritional Status was measured by Mid Upper Arm Circumference (M.U.A.C.) using a measuring tape (in cm). Dietary Information: Dietary information was measured by seven daily food frequency questionnaires. A bathroom scale measured body weight to the nearest 0.5 kg. We used A wooden height scale to record height with bared heels, standing upright. Height was measured to the nearest 0.1 cm. The blood pressure was measured by a sphygmomanometer machine and stethoscope. Birth weights of newborn babies: Birth weights of newborn babies were recorded to the nearest 20 grams after delivery without clothes on a beam balance (Dedecto medic, Delecto scale inc., U.S.A.)

Results

Table-I

Distribution of respondents according to Hospital

Hospitals	Pre-eclamptic Women (Study Group A) N=110		Normal Pregnancy (Control Group - B) N = 110	
	DMCH	70	63.64%	70
Mitford	30	27.27%	30	27.27%
HFRCH	10	9.09%	10	9.09%
Total	110	100%	110	100%

Table I shows 63% respondents were from DMCH, 27% from Mitford, and 9% from HFRCH

Table II

Anthropometric and clinical indices

N=220	Pre - Eclamptic (Group - A) n= 110 (Mean ± STD.)	Normal Pregnant Women (Control - B) n = 110 (Mean ± STD.)	P. value
Weight (Kg.) of the Patient	66.65±5.34	66.9±2.05	0.65
Height (cm.) of the Patient	154.06±3.58	156.003±3.36	0.62
MUAC (CM)	23.5±2.64	25.1.1±2.24	0.001
Systolic Blood Pressure (mm/Hg)	125.14±28.34	117.27±4.47	0.001
Diastolic Blood Pressure (mm/Hg)	98±5.55	79±3.51	0.001
Wt. of Babies (Kg.)	2.09 ± 0.13	2.80 ± 0.12	0.001

Table II, shows mean MUAC, systolic and diastolic BP, weight of new born Babies of Study and Control Group were different, it was statistically, significant.

Morphological study of placenta

Table-III

Placental Weight (gm) of pre-eclamptic and normal pregnant women

	Pre-eclamptic Women (Group-A) N=110 (Mean±SD)	Normal Pregnant Women Control Group - B N=110 (Mean±SD)	P. value
Wt. of Placenta (gm.)	404.80±4.04	486.96±1.62	0.001

Table III shows that mean placental weight of pre-eclamptic women (404.80 ± 4.04) was significantly lower than the mean placental weight of normal pregnancy women (486.96 ± 1.62).

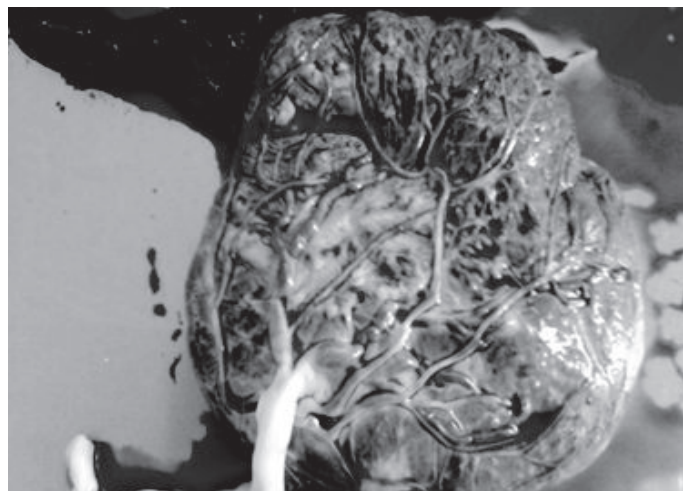


Fig. 1: Normal placenta

Table-IV

Diameter (cm) of Placenta of pre-eclamptic and normal pregnant women

	Pre eclamptic Women (Group-A N=110 (Mean ±SD)	Normal Pregnant Women Control Group – B N=110 (Mean ±SD)	P. Value
Placenta Diameter (cm.)	15.88 ± 0.13	18.22 ± 0.79	0.001

Table IV shows that mean placenta diameter of pre-eclamptic women (15.88 ± 0.13) was significantly (p-value .001) lower than the mean placental diameter of normal pregnancy women (18.22 ± 0.79).

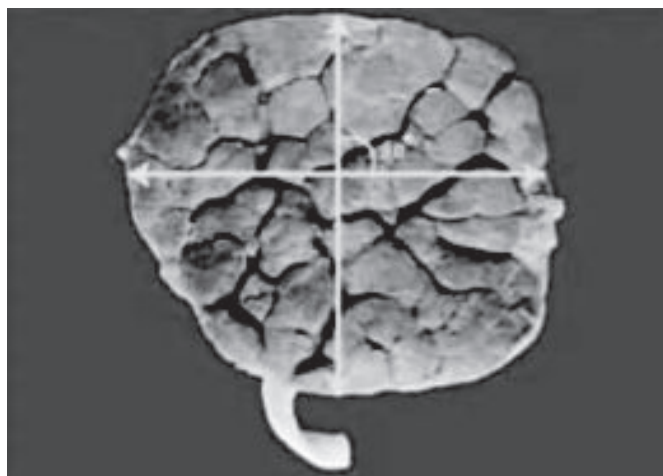


Fig. 2: Measurement of the placenta (Diagrammatic)

Table-V

Number of Cotyledons of of pre-eclamptic and normal pregnant women

	Pre eclamptic Women (Group-A N=110 (Mean ±SD)	Normal Pregnant Women Control Group – B N=110 (Mean ±SD)	P. Value
No of Cotyledon (Nos.)	16 ± 0.78	17.10 ± 0.89	0.002

Table V shows that mean number of cotyledon (Nos.) of pre-eclamptic women (16 ± 0.78) was significantly lower than the mean number of cotyledon (Nos.) of normal pregnant women (17.10 ± 0.89).

Table VI

Number of Infarcted Areas of pre-eclamptic and normal pregnant women

	Pre eclamptic Women (Group-A N=110) (Mean ±SD)	Normal Pregnant Women Control Group – B N=110 (Mean ±SD)	P. Value
No. of Infarcted Area in Placenta	16.02 ± 0.80	4.02 ± 0.80	0.001

Table VI shows that mean number of infarcted area in placenta of pre-eclamptic women (16.02 ± 0.80) was significantly (p-value .001) higher than the mean number of infarcted area in placenta of normal pregnancy women (4.02 ±0.80).



Fig. 3: Measurement of the placenta

Histological Study of Placenta

Table VII

Mean number of Areas of Syncytial Knot Formation in pre-eclamptic and normal pregnant women

Mean number Areas of Syncytial Knot Formation	Pre-eclamptic Women (Group-A) N=110 (Mean ±SD)	Normal Pregnant Women Control Group – B N=110 (Mean ±SD)	P. Value
	26.76 ± 3.86	9.60 ± 1.46	0.001

Table VII shows that mean number of areas of syncytial knot formation of pre-eclamptic women (26.76 ± 3.86) was significantly (p-value .001) higher than the mean number of areas of syncytial knot formation of normal pregnant women (9.60 ± 1.46).

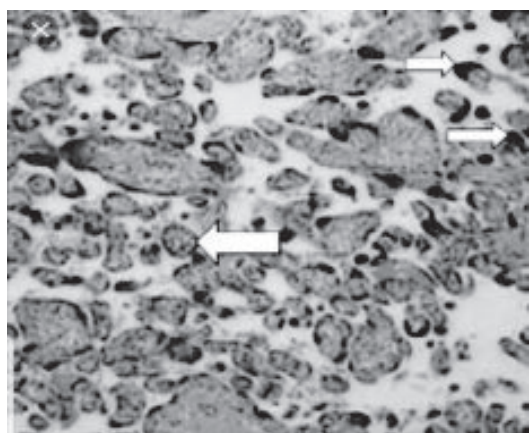


Fig. 4: Syncytial knot

higher than the mean no. of areas of cytotrophoblastic cell proliferation of normal pregnancy women (7.16 ±.2.06).

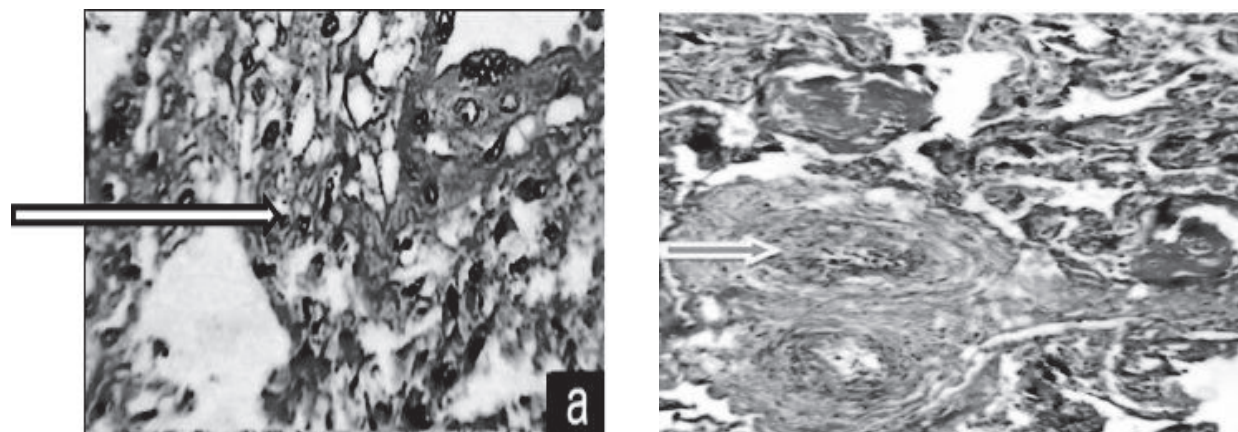
Syncytial knot formation

Table VIII

Mean No. Areas of Cytotrophoblastic Cell Proliferation in pre-eclamptic and normal pregnant women

Mean no. of areas of Cytotrophoblastic Cell Proliferation	Pre-eclamptic Women (Group-A) N=110 (Mean ±SD)	Normal Pregnant Women Control Group – B N=110 (Mean ±SD)	P. Value
	21.52 ± 5.03	7.16 ±.2.06	0.001

Table 8 shows that mean number of areas of cytotrophoblastic cell proliferation of pre-eclamptic women (21.52 ± 5.03) was significantly (p-value .001)



Cytotrophoblastic cell proliferation

Fibrinoid Necrosis

Fig.-5: Cytotrophoblastic cell proliferation and Cytotrophoblastic cell proliferation

Table IX

Mean number of Area of Fibrinoid Necrosis in pre-eclamptic and normal pregnant women

Mean No. of Area of Fibrinoid Necrosis	Pre-eclamptic Women (Group A) N=110 (Mean ±SD)	Normal Pregnant Women Control Group – B N=110 (Mean ±SD)	P. value
	10.68 ± 3.33	2.24 ± 0.69	0.001

Table IX shows that mean number of areas of fibrinoid necrosis of pre-eclamptic women (10.68 ± 3.33) is significantly (p-value .001) higher than the mean no. of areas of fibrinoid necrosis of normal pregnancy women (2.24 ± 0.69).

Fibrinoid Necrosis

Table X

Mean number of Areas of Hyalinised Villi. of Pre-eclamptic and normal pregnant women

Mean No. of Area of Hyalinised Villi	Pre-eclamptic Women (Group-A) N=110 (Mean ±SD)	Normal Pregnant Women Control Group – B N=110 (Mean ±SD)	P. Value
	9.46 ± 4.10	2.32 ± 0.59	0.001

Table X shows that mean number of areas of hyalinised villi of pre-eclamptic women (9.46 ± 4.10) was significantly (p-value .001) higher than the mean no. of areas of hyalinised villi of normal pregnancy women (2.32 ± 0.59).

Discussion

The present study was conducted amongst 220 pregnant women to see the effect of pre-eclampsia on the histomorphology of the placenta. So far, studies like this have yet to be conducted in Bangladesh.

This study indicates that the mean placental weight in pre-eclamptic women was less (404.80 gm) compared to normal pregnant women (486.96 gm). A study conducted by Shah et al. 23., 1985; and others (Cibil LA 24, Teasdale 25, Barua 26 R., and Begum27) also observed

reduced placental weight (390.82 gm) in pre-eclamptic women in compared to average pregnant women (496.56 gm). A study was conducted by Sengupta Kishwara, Abu Sadat, Shamim Ara²⁸, and others, Department of Anatomy, Dhaka Medical College, 2010. They observed lower placental weight in pre-eclampsia compared to normal pregnancy. Many foreign studies have shown the effect of Hypertensive disorders of pregnancy on the placental weight and the overall status of the mother and the baby; they reported a moderate to severe reduction of placental weight in pre-eclampsia and eclampsia^{29,30,25,31}. Cibils²⁴ studied pregnancy outcomes. He commented that the placenta from hypertensive patients was significantly smaller than the normal, suggesting that the pathologic process interferes with normal placental growth. Shah et al.²³ found that mean weight decreases with increasing severity of toxemia. Fox²⁹ attributed abnormal maternal uteroplacental vasculature to weight reduction. Soma et al.³⁰ also stated that it must be assumed that morphological and histological findings in the hypertensive placenta are due to occlusion or narrowing of the uteroplacental vasculature and placental ischemia. Later, Fox and Jones³¹ and Teasdale²⁵ suggested that ischemia was the dominating factor for the morphological alteration of the placenta.

In a study, Mallik, Mirchandani, and Chitra³², Udainia and Jain³³, Majumdar *et al.*³⁴, and Artico *et al.*³⁵ found reduced placental weight in pre-eclampsia. In pre-eclampsia, the birth weights of newborn babies were significantly lower than the normal birth weight of normotensive mothers observed by Damania³⁶, Fox³⁷, Kalousek and Langlois³⁸ and Majumdar *et al.*³⁴. Mirchandani, Malik, and Chitra³⁹, Masodkar, Kalamkar, and Patke⁴⁰, and Avasthi *et al.*⁴¹ also observed increased stillbirth associated with pre-eclampsia.

The placental infraction was more in the case of pre-eclamptic women compared to normal normotensive pregnant women⁴². It was also observed by Mirchandani *et al.*⁴³ and Masodkar *et al.*⁴⁴

In this study, it was observed that the mean diameter of the placenta (15.88 cm), the number

of cotyledons¹⁶ was less, and the number of infarcted areas was increased (16.02) in the case of pre-eclamptic women compared to normal pregnant women were (18.22 cm),¹⁷ and (4.02) respectively. Sengupta Aishwarya et al., (2010); and several others (Abu Sadat Mohammad Nurunnabi, Mahamudra Begum, Abu Rayhan, Shamim Ara)²⁸ observed that the mean diameter of placenta, (16.08 + 2.08 cm), mean number of cotyledons were (14.30 + 2.47) was less in the study group, compared to the control group (18.80 + 2.32cm) and (15.77 + 2.80) respectively. They also observed an increased number of infarcted areas¹⁸, in the placenta of the study group, compared to the control group, which were only 4.

This study also reveals that the mean number of areas of syncytial knot formation (26.76), cytotrophoblastic cell proliferation (21.52), area of fibrinoid necrosis(10.68), and hyalinised villi. (9.46) were increased in the case of pre-eclamptic women, compared to normal pregnancy, which was (9.60), (7.16), (2.24), and (2.32), respectively. M. Akhlag, 2012; and others (AH Nage, AW Yousuf) also observed increased syncytial knot formation (25.23+1.23) in pre-eclamptic women compared to normal pregnant women. Other studies have also found similar results, with increased syncytial knots formation (26.31+2.72); cytotrophoblastic cell proliferation (22.53+1.74), fibrinoid necrosis (9+2.96), and hyalinized villi (8.96+2.42), in the pre-eclamptic patient.

Conclusion

This was a comparative study to evaluate the histo-morphological changes of the placenta in pre-eclamptic women. Our study revealed that the mean number of areas of syncytial knot formation, cytotrophoblastic cell proliferation, fibrinoid necrosis, and hyalinised villi were significantly higher in the study group compared to the control group. Moreover, the mean weights, diameters, and the number of cotyledons were significantly lower in the study group compared to the control group. The number of infarcted areas was considerably higher in the placentas of pre-eclamptic women.

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