

Association of Maternal Pre-Eclampsia with Birth Weight of Newborn: A Comparative Study

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ABSTRACT

Background: Pre-eclampsia is a multiorgan, heterogeneous pregnancy illness linked to notable morbidity and death in mothers and newborns because of uteroplacental insufficiency, which compromises the fetus's blood supply. Anthropometry, which measures the physical characteristics of the human body at various ages, is a useful and widely used method for evaluating children for nutrition and health issues. Preterm delivery, fetal growth restriction frequently resulting in asymmetric fetal body proportion, a 5% drop in birthweight, and 3.6 times the likelihood of delivering small for gestational age babies compared to mothers with normal blood pressure are all connected with pre-eclampsia. The goal of the current study is to determine whether a newborn's birth weight and the mother's pre-eclampsia are related.

Methods: A study on 60 neonates delivered at Sri Siddhartha Medical College and Research Centre by women who were pre-eclamptic and 60 newborns by mothers, who were normotensive was carried out in the departments of anatomy and obstetrics and gynecology. Newborns' birthweights were determined using electronic weighing equipment within 24 hours of delivery.

Results: Compared to moms with normotension, pre-eclamptic mothers had a higher incidence of low birth weight in their babies.

Conclusion: Newborns of pre-eclamptic mothers had more incidence of low birth weight and it increased with the increasing grades of hypertension.

Key-words: Pre-eclampsia, Low Birth Weight, Very Low Birth Weight, Normotension, Growth charts

INTRODUCTION

A significant contributor to maternal and perinatal morbidity and death is pregnancy-induced hypertension, particularly in the form of pre-eclampsia ^[1]. According to estimates, this illness complicates 5 to 8% of pregnancies globally, contributing significantly to the overall disease burden ^[2].

Preeclampsia is a multisystem condition with an unclear aetiology that manifests as hypertension reaching 140/90 mmHg or more in conjunction with pregnancy-

induced proteinuria after the 20th week in a patient, who was previously normotensive and non-proteinuric ^[3].

Pre-eclampsia is categorized as severe pre-eclampsia with persistent severe epigastric pain, elevated liver enzymes, visual disturbances, oliguria, protein excretion >5g/day, platelet count <1 lakh/mm³, elevated liver enzymes, and retinal degeneration, and mild pre-eclampsia with blood pressure >140/90 mmHg but less than 160mmHg systolic or 110diastolic without significant proteinuria. bleeding, pulmonary oedema, IUGR, and papilloedema. Because it is very simple to measure and has a strong association with gestation, birth weight has been widely utilized as an indicator of intrauterine growth ^[4,5].

The newborn's weight at delivery is a reliable predictor of its chances of survival, growth, long-term health, and psychological development, as well as the health and nutritional state of the mother ^[6,7]. Particularly, birth

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weight has a substantial correlation with illness in infants and children as well as with fetal, neonatal, and postnatal mortality [8]. Birth weights may prove to be a helpful metric for tracking advances in the calibre of prenatal treatment.

The newborn should have anthropometric measures taken within 24 hours of birth. The primary benefits of the newborn measures are their portability, affordability, non-invasiveness, simplicity, and high suitability for usage in paediatric clinics, wards, or other settings. It offers a straightforward and impartial way to evaluate fetal development at the moment of delivery [9].

To plan their upcoming child growth charts and, consequently, diagnose sickness by recognizing overt deviation from typical patterns, it is required to determine the neonatal growth characteristics in each population from various locations [2]. It has been hypothesized that PIH increases the chance of low birth weight considerably by decreasing fetal development and increasing premature delivery. The difficulty for doctors is to recognize IUGR fetuses whose health is at risk in the womb due to a hostile intrauterine environment and to monitor and intervene as necessary [10].

MATERIALS AND METHODS

At Sri Siddhartha Medical College and Research Centre, 60 babies of normotensive mothers and 60 newborns of pre-eclamptic mothers were delivered as part of the current study, which was carried out at the Departments of Anatomy and Obstetrics and Gynaecology. The research covered live births that were observed within 24 hours after delivery and finished 32 weeks of gestation.

Exclusion criteria- The intrauterine deaths, stillborn babies, babies with gross congenital anomalies, babies born to mothers with conditions likely to influence fetal growth i.e. anaemia, gestational diabetes mellitus, chronic infections and illness and babies seen after 24hrs of birth were excluded. Pregnant women with diabetes, chronic hypertension, chronic renal problem, thyrotoxicosis, TORCH-positive mothers or body weight <40 kg and with history of smoking were excluded from the study as they are confounding variables known to be associated with PIH and IUGR.

Inclusion criteria- In the normotensive group only those with normal blood pressure without oedema or proteinuria were included. The selected pregnant women were between the gestational age of 32-40 weeks and selection was done based on the diagnosis made by a registered physician or from a hospital record.

The mother and the neonate identified for this study were given code numbers and detailed information related to the mother and fetus was recorded as follows-

Mother-(a) Name, age, IP number, clinical diagnosis, presenting complaints, obstetrics history, menstrual history, family history. (b) General physical examination, laboratory investigation reports: Blood-% of haemoglobin, group and typing, urea, sugar, serum creatinine. Urine: protein, sugar and microscopy.

Fetus- (a) Mode of delivery, (b) Gestational age, (c) Data and time of delivery, (d) Weight

The Birth weight was measured using an Electronic Weighing Machine which was checked periodically by known standard weights for measuring weight.

The newborns were allocated as:

Group-1 Newborns of Normotensive mothers

Group-2 Newborns of mild pre-eclamptic mothers

Group-3 Newborns of severe pre-eclamptic mothers.

Based on WHO classification of low birth weight newborns [11]:

Birth weight (LBW)= Birth weight less than 2500 gm.

Very low birth weight (VLBW)= Birth weight less than 1500 gm

Extremely low birth weight (ELBW)= Birth weight less than 1000 gm

On average, ideal birth weight is said to be around 3.25kg [12].

The newborns were classified as Normal birth weight, Low Birth Weight and Very Low Birth Weight.

Statistical Analysis- All the data was analyzed by using SPSS Version 15.0. Student t-test and Analysis Of Variance (ANOVA) were used for statistical significance. Microsoft Word and Excel have been used to generate graphs and tables.

+ Suggestive significance (p-value: $0.05 < p < 0.10$)
* Moderately significant (p-value: $0.01 < p \leq 0.05$)
** Strongly significant (p-value: $p \leq 0.01$)

Ethical Approval- Approval for this study was obtained from the relevant ethical committee, ensuring that all research procedures adhered to ethical standards and guidelines for protecting participants' rights and confidentiality.

RESULTS

The distribution of newborn cases among various maternal blood pressure groups was examined in this study. Out of the total of 120 cases, 50% were born to normotensive mothers, 32.5% were born to mild pregnancy-induced hypertension (PIH) mothers, and 17.5% were delivered to severe PIH mothers (Table 1).

Table 1: Distribution of cases

Group	No. of cases	Percentage (%)
Newborns of normotensive mothers	60	50
Newborns of Mild PIH mothers	39	32.5
Newborns of Severe PIH mothers	21	17.5
Total	120	100

The age distribution among the women revealed a greater prevalence of preeclampsia in the younger age range of 18-25 years, with 48.3% normotensive mothers falling in this category when compared to 58.3% pre-eclamptic mothers. Mothers between 26-35 years of age had a reduced occurrence rate, with 41.7% experiencing pre-eclampsia and 51.7% with normotensive (Table 2).

Table 2: Age Distribution of Mothers

Age in	Normotensive		Pre-eclamptic	
	No	%	No	%
18-25 yrs	29	48.3	35	58.3
26-35 yrs	31	51.7	25	41.7
Total	60	100.0	60	100.0

The parity analysis showed that a greater proportion of mothers with pre-eclampsia were primipara (61.7%) compared to normotensive mothers (51.7%). In contrast,

38.3% of mothers were multipara, who are pre-eclamptic, and 48.3% of mothers, who were multipara are normotensive (Table 3).

Table 3: Parity Wise Distribution of Mothers

Parity	Normotensive		Pre-eclamptic	
	No	%	No	%
Primi	31	51.7	37	61.7
Multi	29	48.3	23	38.3
Total	60	100.0	60	100.0

The distribution of birth weights revealed notable disparities between infants born to normotensive mothers and those born to mothers with pre-eclampsia. Out of the 60 infants born to mothers with pre-eclampsia, 13.3% had a very low birth weight between 1500 and 2000 grams, while 38.3% had a low birth weight between 2001 and 2500 grams. Conversely, only 15% of infants born to normotensive mothers were classified as having low birth weight. Approximately 55% of children born to normotensive women had a weight ranging from 2500 to 3000 grams, but 38.3% of newborns born to pre-eclamptic mothers fell within this weight range. In addition, 30% of children born to mothers without hypertension had birth weights ranging from 3000 to 3500 grams, but only 10% of newborns born to mothers with pre-eclampsia fell within this weight range. The disparities in birth weight distributions were statistically significant, as indicated by a p-value of less than 0.001 (Table 4).

Table 4: Birth Weight Distribution in Newborns of Normotensive Mothers and Pre-Eclamptic Mothers

Weight (grams)	A	B	p-value
1500-2000	0	8(13.3)	<0.001**
2001-2500	9(15)	23(38.3)	
2500-3000	33(55)	23(38.3)	
3000-3500	18(30.0)	6(10.0)	
Total	60(100)	60(100)	

A=Newborns of normotensive mothers (%)

B= Newborns of pre-eclamptic mothers (%)

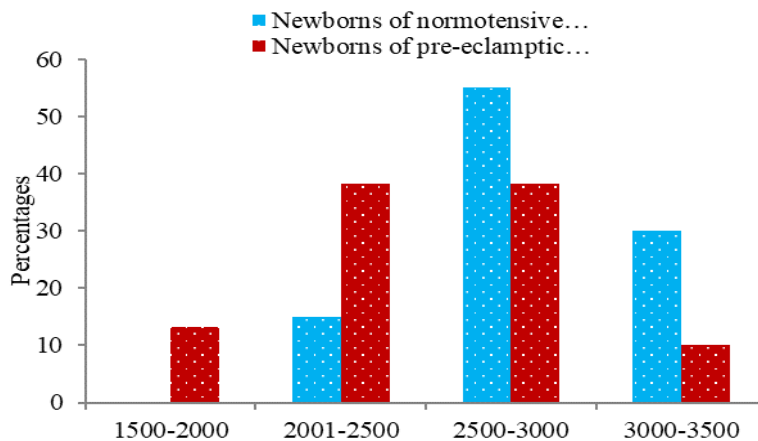


Fig. 1: Birth Weight distribution in Newborns of normotensive mothers and Newborns of pre-eclamptic mothers.

The incidence of Low birth weight was more newborns of severe pre-eclamptic mothers (38.3%) compared to the newborns of mild pre-eclamptic mothers (15%) (Table 5).

Table 5: Distribution of Weight in Grams in Three Groups

Weight (grams)	Newborns of normotensive mothers	Newborns of Mild pre-eclamptic mothers (%)	Newborns of Severe pre-eclamptic mothers (%)	p-value
1500-2000	0	4(10.3)	4(19.1)	<0.001**
2001-2500	9(15)	12(30.8)	11(52.4)	
2500-3000	33(55)	18(46.2)	5(23.8)	
3000-3500	18(30)	5(7.7)	1(4.8)	
Total	60(100)	39(100)	21(100)	

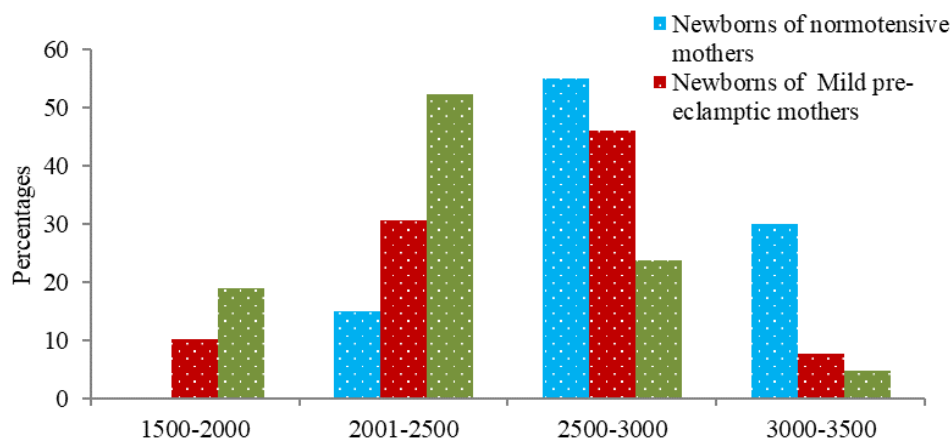


Fig. 2: Distribution of Weight in grams in three groups

DISCUSSION

Pregnancy-induced hypertension, especially pre-eclampsia, is a major cause of maternal and perinatal morbidity and mortality. It affects about 6-8% of all pregnancies [6]. The incidence of PIH in India ranges from 5-15% [3]. In the present study 48.3% of normal and 58.3% of preeclamptic mothers were in the age group of 18-25 yrs, which is by Anand *et al.* [10], Ma *et al.* [11], Afaya

et al. [12], Ganesh *et al.* [13] and Gowswami *et al.* [14]. In the present study, the incidence of PIH was high (61%) in primigravida as compared to multigravida. Anand *et al.* [10] observed that 47% PIH mothers were primigravida. The study was done by Ganesh *et al.* [13], Gowswami *et al.* [14] and Kishwara *et al.* [15]. Observed that PIH incidence was higher in primigravida [16]. The mean birthweight in

the present study was 2.86 kg in Newborns of normotensive mothers, 2.54 kg in Newborns of mild pre-eclamptic mothers and 2.34 kg in Newborns of severe preeclamptic mothers which is by Udainia *et al.* ^[16], Mohan *et al.* ^[17] and Das *et al.* ^[18]. The study done by Cibils *et al.* ^[19] also found that the mean birth weight was 3.32 kg, 2.77 kg and 2.35kg in the newborns of normotensive, mild pre-eclamptic and severe pre-eclamptic mothers.

Pregnancy-induced hypertension, particularly pre-eclampsia, is a significant contributor to maternal and neonatal morbidity and mortality. It impacts around 6-8% of pregnancies ^[6]. The prevalence of pregnancy-induced hypertension (PIH) in India varies from 5% to 15% ^[3]. In the current study, 48.3% of normal mothers and 58.3% of mothers with preeclampsia were between 18-25 years of age. This finding aligns with previous studies conducted by Anand *et al.* ^[10], Ganesh *et al.* ^[13] and Pushpa Kishwara *et al.* ^[15]. In this study, the occurrence of PIH was significantly higher (61%) among primigravida compared to multigravida. Shwetha Anand *et al.* ^[10] observed that 47% PIH mothers experienced primigravida. The research conducted by Ganesh *et al.* ^[13] Gowswami *et al.* ^[14] and Kishwara *et al.* ^[15] found that the occurrence of PIH was higher in primigravida. The average birthweight in this study was 2.86 kg for newborns of normotensive women, 2.54 kg for newborns of mothers with mild pre-eclampsia, and 2.34 kg for newborns of mothers with severe pre-eclampsia, which aligns with Udainia's findings. Mohan *et al.* ^[17], Das *et al.* ^[18] and Cibils *et al.* ^[19]. In the study conducted by Wen *et al.* ^[20] it was shown that the average birth weight of babies from women with normal blood pressure was 3.32 kg, while newborns from mothers with mild pre-eclampsia had an average birth weight of 2.77 kg, and newborns from mothers with severe pre-eclampsia had an average birth weight of 2.35 kg.

Preeclampsia is a frequent factor in premature birth and negative health outcomes for newborns, although its connection to neonatal respiratory distress syndrome (RDS) is still a subject of debate. An investigation was carried out to assess the correlation between maternal preeclampsia and neonatal RDS. The researchers determined that maternal preeclampsia has a small impact on the likelihood of severe RDS in very low birth weight (VLBW) newborns ^[21].

A study was done to investigate the correlation between birth weight and mother pre-eclampsia throughout pregnancy in a low-resource obstetric environment. Pre-eclampsia is the primary factor that determines the birth weight in settings with limited resources, and therefore, it is highly likely to have a significant impact on the survival of newborns. The influence of pre-eclampsia on birth-weight diminishes as the pregnancy progresses, a distinction that cannot be entirely accounted for by considering the degree of pre-eclampsia ^[22].

An investigation was carried out to analyze the impact of gestational hypertension and preeclampsia on the development of the fetus. Preeclampsia and gestational hypertension are strongly linked to the occurrence of large-for-gestational-age infants, as well as low-birth-weight and small-for-gestational-age infants ^[22]. Pregnancy-induced hypertension, especially pre-eclampsia, is a major cause of maternal and perinatal morbidity and mortality. It affects about 6-8% of all pregnancies ^[6]. The incidence of PIH in India ranges from 5-15% ^[3]. In the present study 48.3% of normal and 58.3% of preeclamptic mothers were in the age group of 18-25 yrs which is by Anand *et al.* ^[10], Ma *et al.* ^[11], Afaya *et al.* ^[12], Ganesh *et al.* ^[13] and Gowswami *et al.* ^[14]. In the present study, the incidence of PIH was high (61%) in primigravida as compared to multigravida. Anand *et al.* ^[10] observed that 47% PIH mothers were primigravida. The study was done by Ganesh *et al.* ^[13], Gowswami *et al.* ^[14] and Kishwara *et al.* ^[15]. Observed that PIH incidence was higher in primigravida ^[16]. The mean birthweight in the present study was 2.86 kg in Newborns of normotensive mothers, 2.54 kg in Newborns of mild pre-eclamptic mothers and 2.34 kg in Newborns of severe preeclamptic mothers which is by Udainia *et al.* ^[16], Mohan *et al.* ^[17] and Das *et al.* ^[18]. The study done by Cibils *et al.* ^[19] also found that the mean birth weight was 3.32 kg, 2.77 kg and 2.35kg in the newborns of normotensive, mild pre-eclamptic and severe pre-eclamptic mothers.

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CONCLUSIONS

Pre-eclampsia is a heterogenous disease that affects multiple organs during pregnancy and is associated with considerable mortality of both maternal and neonatal. Early identification of individuals at high risk by highly skilled workers and prompt treatment of pre-eclampsia can result in enhanced perinatal outcomes. The main medical intervention in a pregnancy affected by intrauterine growth restriction (IUGR) is to ensure that the baby is delivered at the most appropriate time, balancing the fetal compromise risks against prematurity from uteroplacental dysfunction. The overwhelming majority of cases of pre-eclampsia occurred in the age group of 18-25 years (58.3%).

The prevalence of pre-eclampsia was higher in primigravida (61.7%) compared to multigravida (38.3%). The birth weight of newborn babies was markedly reduced in cases of pregnancy-induced hypertension, and this reduction was correlated with the severity of the hypertension. This study's findings could inform the development of targeted interventions to improve fetal outcomes in pre-eclamptic pregnancies and contribute to creating updated growth charts for high-risk neonates.

CONTRIBUTION OF AUTHORS

Research concept- Shilpakala LB

Research design- Shilpakala LB

Supervision- Shilpakala LB

Materials- Shilpakala LB

Data collection- Shilpakala LB

Data analysis and Interpretation- Shivaleela C

Literature search- Shilpakala LB

Writing article- Shilpakala LB

Critical review- Shivaleela C

Article editing- Shilpakala LB

Final approval- Shivaleela C

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