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TO DETERMINE ASSOCIATION BETWEEN LBW / IUGR / PRE-MATURITY IN NEONATES AND MATERNAL HEALTH IN A TERTIARY CARE HOSPITAL, KARACHI

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Abstract

Background: Low birth weight (LBW), intrauterine growth restriction (IUGR), and prematurity are major contributors to neonatal morbidity and mortality and are strongly influenced by maternal health.

Objective: To determine the association between maternal health indicators and adverse neonatal outcomes (LBW, IUGR/SGA, prematurity) in a tertiary hospital in Karachi.

Methods: Prospective observational study of consecutive mother–infant dyads using a standardized proforma. Maternal variables included hemoglobin, BMI, antenatal care (ANC) visits, booking status, and complications (PIH, DM/GDM). Neonatal outcomes included gestational age (GA), birth weight, and growth status (AGA/SGA/IUGR). Data were summarized as mean±SD or n (%). Exploratory associations were evaluated with crude odds ratios (OR) and 95% confidence intervals (CI) from 2×2 tables.

Results: N = 26 dyads. Mean GA 32.84 ± 1.73 weeks; mean birth weight 1792.2 ± 500.3 g. Preterm (<37 weeks) 22/26 (84.6%); LBW (<2500 g) 21/24 (87.5%); IUGR/SGA 15/26 (57.7%). Maternal anemia (<10 g/dL) 7/24 (29.2%); ANC ≥ 4 visits 11/16 (68.8%); booked 17, unbooked 5. Exploratory associations (imprecise due to small denominators): unbooked status showed higher odds of LBW (OR 2.33; 95% CI 0.10–52.65); anemia appeared inversely related to LBW (OR 0.20; 0.02–1.88) given near-universal LBW; PIH vs IUGR OR 0.45 (0.07–2.82).

Conclusion: In this tertiary NICU, LBW and prematurity were highly prevalent. Maternal factors—ANC use, booking status, and complications—clustered with adverse neonatal outcomes.

Strengthening ANC coverage and maternal anemia/PIH/DM screening and management may mitigate risk. Larger, fully captured datasets are needed for adjusted analyses.

Keywords: Maternal anemia; Antenatal care; LBW; IUGR; Prematurity; Pakistan; NICU.

Introduction

Adverse neonatal outcomes—particularly low birth weight (LBW, <2500 g), intrauterine growth restriction (IUGR) or small for gestational age (SGA), and prematurity—remain among the leading contributors to neonatal morbidity and mortality worldwide. These conditions are closely linked with increased risks of hypothermia, sepsis, respiratory complications, prolonged neonatal intensive care unit (NICU) admissions, and early mortality (Lawn et al., 2012; Katz et al., 2013). Global estimates suggest that in 2015, nearly 20 million infants were born with LBW, representing over 14% of all live births, with the highest burden concentrated in South Asia and sub-Saharan Africa (Blencowe et al., 2019). Similarly, preterm birth—affecting an estimated 15 million infants annually—accounts for more than one million neonatal deaths each year (March of Dimes et al., 2012). These figures underscore the persistent challenge of achieving Sustainable Development Goal (SDG) targets for neonatal survival in low- and middle-income countries (LMICs), including Pakistan. Maternal health factors exert profound influence on fetal growth and gestational duration. Anemia during pregnancy, a condition affecting over 40% of pregnant women in LMICs, has consistently been associated with increased risks of LBW and preterm birth (Rahman et al., 2016; Haider et al., 2013). Similarly, maternal nutritional status, particularly body mass index (BMI), is a key determinant of perinatal outcomes: low BMI is linked with IUGR and LBW, while maternal overweight and obesity increase risks of preterm birth and obstetric complications (Black et al., 2013; Vieira et al., 2019; Aune et al., 2016). Antenatal care (ANC) is another critical determinant, serving as the platform for early detection and management of complications, provision of nutritional supplementation, and counseling. The World Health Organization (WHO) now recommends a minimum of eight ANC contacts to optimize maternal–fetal health, yet many LMICs, including Pakistan, still report suboptimal ANC coverage and quality (WHO, 2016).

Obstetric complications, particularly pregnancy-induced hypertension (PIH), preeclampsia, and gestational diabetes mellitus (GDM), further compound risks. PIH and preeclampsia are strongly associated with placental insufficiency, growth restriction, and preterm delivery, and remain major contributors to maternal and neonatal morbidity (NICE, 2019; Lees et al., 2020). Similarly, maternal hyperglycemia—even at subclinical levels—has been linked with increased risks of macrosomia, preterm birth, and neonatal hypoglycemia (Goldenberg et al., 2008). Other maternal factors such as short interpregnancy intervals (Conde-Agudelo et al., 2006), infections (Goldenberg et al., 2000), and inadequate nutritional supplementation (WHO, 2012) are also implicated in adverse outcomes. In Pakistan, the burden of adverse perinatal outcomes remains disproportionately high. The most recent Demographic and Health Survey highlights persistently elevated rates of maternal anemia, undernutrition, and inadequate ANC utilization, with significant rural–urban disparities (Pakistan DHS, latest edition). Neonatal mortality, estimated at 42 per 1000 live births, is among the highest globally, with LBW and prematurity identified as major drivers (Lee et al., 2013; Katz et al., 2013). Tertiary care hospitals in urban centers such as Karachi receive a high proportion of high-risk referrals, reflecting both the limited reach of preventive maternal health interventions and delays in timely obstetric care.

Despite extensive global evidence, there remains a paucity of context-specific data quantifying associations between maternal health indicators and neonatal outcomes in Pakistan. Local evidence is essential to guide priority interventions such as strengthening ANC coverage, early detection and management of maternal anemia, PIH, and GDM, and optimizing referral pathways.

Objective: This study aimed to determine the association between maternal health indicators—including hemoglobin concentration, BMI, ANC adequacy, booking status, and obstetric

complications (PIH, DM/GDM)—and neonatal outcomes (LBW, IUGR/SGA, prematurity) among mother–infant dyads admitted to a tertiary care hospital in Karachi.

Methodology

This prospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) and the Department of Obstetrics and Gynecology of a tertiary care hospital in Karachi. Data were prospectively captured at the time of delivery or neonatal admission using a structured proforma specifically designed to record maternal and neonatal characteristics. Consecutive mother–infant dyads were eligible for inclusion, provided both maternal and neonatal records were available. Dyads were excluded if neonates presented with major congenital anomalies or if essential maternal or neonatal variables were incomplete. The primary neonatal outcomes assessed were low birth weight (LBW), prematurity, and intrauterine growth restriction (IUGR)/small for gestational age (SGA). LBW was defined as a birth weight below 2500 g. Prematurity was defined as gestational age (GA) at delivery less than 37 completed weeks, estimated using last menstrual period (LMP), early ultrasound when available, or clinical assessment. In cases where GA was categorized (e.g., very preterm, moderate preterm, late preterm) rather than recorded in exact weeks, midpoint values were assigned for summary analyses. IUGR/SGA status was recorded as per clinical documentation and growth assessments noted in the proforma. Key maternal exposures included hemoglobin level, with anemia defined as hemoglobin <10 g/dL; body mass index (BMI), calculated in kilograms per square meter; antenatal care (ANC) adequacy, classified as adequate with ≥4 visits; booking status, recorded as booked or unbooked; and the presence of maternal complications such as pregnancy-induced hypertension (PIH), diabetes mellitus/gestational diabetes mellitus (DM/GDM), or other significant comorbidities.

Ethical approval for the study was obtained from the Institutional Review Board, and written informed consent was secured from parents or guardians in accordance with unit protocol.

Results

A total of 26 mother–infant dyads were included in the analysis. The mean gestational age at delivery was 32.84 ± 1.73 weeks, and the mean birth weight was 1792.2 ± 500.3 g. Preterm birth was highly prevalent, affecting 22 of 26 neonates (84.6%), while 21 of 24 infants with documented birth weights (87.5%) met criteria for low birth weight (LBW). More than half of the neonates (57.7%) were classified as intrauterine growth restriction (IUGR) or small for gestational age (SGA). Among mothers with available records, the mean hemoglobin was 11.1 ± 1.7 g/dL, and anemia (hemoglobin <10 g/dL) was observed in 7 of 24 cases (29.2%). Antenatal care utilization was suboptimal: only 11 of 16 women (68.8%) had attended at least four visits, while five mothers were unbooked at the time of delivery compared with 17 who were booked. Documented maternal complications included pregnancy-induced hypertension (n=3) and diabetes mellitus/gestational diabetes mellitus (n=3). Neonatal outcomes at discharge were available for a subset of cases, with six infants successfully discharged and two recorded deaths during the admission period.

Table 1. Maternal characteristics (n = 26)

Characteristic	Value
Hemoglobin (g/dL), mean ± SD	11.1 ± 1.7 (n=24)
Anemia (<10 g/dL), n/N (%)	7/24 (29.2%)
BMI (kg/m²), mean ± SD	24.2 ± 2.2 (n=5)
ANC ≥4 visits, n/N (%)	11/16 (68.8%)
Booking status, n	Booked 17; Unbooked 5
PIH/preeclampsia noted, n	3
DM/GDM noted, n	3
Maternal age (years), mean ± SD	27.4 ± 4.6 (n=16)

Figure: 1

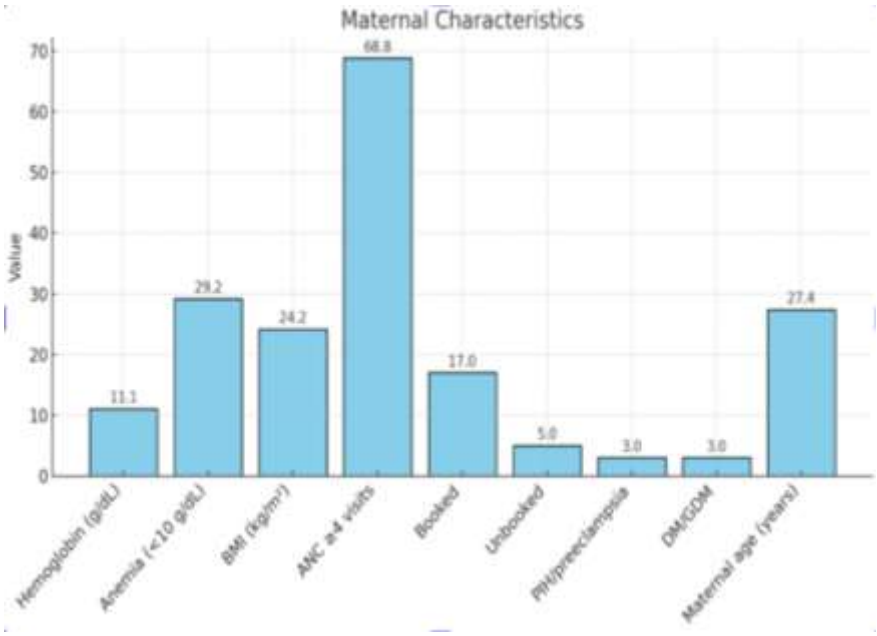

Table 2. Neonatal profile and outcomes (n = 26)

Variable	Value
Gestational age (weeks), mean ± SD	32.84 ± 1.73
Preterm (<37 wks), n/N (%)	22/26 (84.6%)
Birth weight (g), mean ± SD	1792.2 ± 500.3 (n=24)
LBW (<2500 g), n/N (%)	21/24 (87.5%)
IUGR/SGA, n/N (%)	15/26 (57.7%)
Discharged alive, n	6
Expired, n	2

Table 3. Exploratory associations (crude OR, 95% CI)

Exposure → Outcome	2×2 counts (a,b,c,d)†	N (complete)	OR	95% CI
Anemia → LBW	(5, 2, 16, 1)	24	0.20	0.02–1.88
Unbooked → LBW	(5, 0, 16, 3)	24	2.33	0.10–52.65
ANC ≥4 → Prematurity	(10, 1, 4, 1)	16	2.33	0.19–28.95
PIH → IUGR/SGA	(2, 3, 13, 8)	26	0.45	0.07–2.82

Discussion

This single-center analysis shows a **very high burden of prematurity (84.6%) and LBW (87.5%)** among NICU admissions, with over half documented as **IUGR/SGA (57.7%)**. Maternal anemia affected nearly a third of mothers with recorded hemoglobin, and roughly two-thirds of those with recorded ANC data had ≥4 visits. Booking status and complications (PIH/DM) were variably present.

Associations: Given near-universal LBW, crude ORs were unstable and imprecise. Unbooked status trended toward higher odds of LBW, consistent with fewer preventive/early-detection opportunities. The anemia-LBW OR <1 reflects data structure (very high LBW prevalence) rather than a protective effect. PIH did not show a clear association with IUGR in this small series, although biologically and in larger literature PIH is a key driver of placental insufficiency and growth restriction.

Implications:
Despite the limitations of incomplete records, the observed clustering of adverse neonatal outcomes among mothers with suboptimal antenatal care (ANC) utilization and unbooked status underscores the urgent need for system-level interventions. Strengthening ANC coverage and improving quality—ensuring a minimum of four, and ideally eight, structured contacts—remains a cornerstone for reducing preventable risks. Early screening and treatment of maternal anemia should be prioritized, given its well-documented association with preterm birth and low birth weight. Similarly, timely identification and management of pregnancy-induced hypertension (PIH) and diabetes mellitus/gestational diabetes mellitus (DM/GDM) are critical to mitigating complications related to fetal growth restriction and prematurity. Finally, enhanced risk-based referral pathways and delivery planning are essential to ensure that high-risk pregnancies receive appropriate monitoring and care within adequately equipped facilities, thereby improving neonatal survival and long-term health outcomes.

Conclusion
In this Karachi tertiary hospital cohort (N=26), prematurity and LBW were highly prevalent**,** and adverse neonatal outcomes clustered with maternal factors related to ANC use, booking status, and pregnancy complications**.** Strengthening ANC engagement and maternal screening/management (anemia, PIH, DM/GDM) is likely to reduce the burden of LBW/IUGR and preterm birth. Larger, fully captured datasets are needed for multivariable analyses and causal inference.

Ethical Approval
Approved by the Institutional Review Board; parental/guardian consent obtained per unit policy.

Funding
No external funding.

Conflict of Interest
None declared.

Data Availability
De-identified dataset and proforma-level extractions are available on reasonable request with institutional permissions.

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