

## Determinants of low birth weight

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### ABSTRACT

**Background:** WHO defines low birth weight as “birth weight of an infant of 2499 grams or less, regardless of gestational age”. The prevalence of LBW is considerably high in developing countries, with the highest prevalence in South Asia estimated to be 27%. In Pakistan it accounts for nearly 20% of all live births.

**Aim:** To find the strength of association of various factors affecting low birth weight amongst infants

**Setting:** Inpatient Gynaecology and Obstetrics Department, Ghurki Trust Teaching Hospital, Lahore

**Methodology:** Cross-sectional study carried out from January to April 2019 with a sample size of 121 mothers who had delivered a single live neonate in the previous 24 hours. Mothers with multiple gestations or missing anthropometric data were excluded from the study. Study tool used was structured pre-tested questionnaire consisting of socio-demographic and obstetric variables.

**Results:** Amongst the socio-demographic factors monthly family income ( $p=0.002$ ) and maternal education ( $0.002$ ) had significantly positive impact on birth weight of infant. Length of gestation had the most significant effect on birth weight ( $P=0.000$ ). Equally significant was number of antenatal visits undertaken by the mother ( $P=0.016$ ). Other antenatal factors, used to assess adequacy of antenatal care, also proved to be significantly associated ( $P<0.05$ ) with birth weight.

**Conclusion:** Our study showed that more educated mothers were less likely to have LBW infants while mothers who received adequate antenatal care were also less likely to have LBW infants. This confirms the absolute necessity of having widespread antenatal service provision for pregnant mothers.

**Key words:** Low birth weight, determinants, Antenatal care.

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### INTRODUCTION

Low birth weight (LBW) is defined by World Health Organization as “birth weight of an infant of 2499g or less, regardless of gestational age”<sup>1</sup>. LBW is an important public health problem globally due to its very strong association with long and short term adverse consequences. Globally almost 20 million infants are born with LBW annually, which forms almost 15.5% of all the live births. The prevalence of LBW is considerably high in developing countries with the highest prevalence in South Asia estimated to be 27%. In Pakistan, it accounts for 19% of all the live births, ranging from 5-23% in different parts of the country<sup>2,3</sup>.

LBW babies have almost twenty times increased risk of mortality during the neonatal period when compared to the neonates weighing more than 2500g at birth. Moreover higher mortality is not just confined to neonatal period but also there is an increased risk of mortality during childhood, adolescence and later during adulthood<sup>4,5,6</sup> primarily due to conditions associated with nervous system (20%) and respiratory system (16%).

LBW is an important public health indicator of maternal health, nutrition, health care delivery system of the community and poverty. There are various factors known to affect the birth weight of a newborn. Some of these are length of gestation, parity, multiple pregnancies, prenatal care, education level of mother and father, socioeconomic status, maternal malnutrition, maternal smoking, adequacy of antenatal care, short stature of mother and father, placental, uterine and cervical

abnormalities, maternal and fetal medical conditions such as diabetes, hypertension and anemia, short inter-pregnancy birth spacing, as well as certain infections<sup>7,8,9</sup>.

The aim of the study is to find the strength of association of various factors affecting low birth weight in infants. The results of the study will provide suggestions and recommendations for the clinicians especially to the obstetricians, pediatricians and fetal medicine specialists, other stake holders, and family planning, population welfare, maternal and child health departments regarding the provision of adequate prenatal and antenatal counseling and timely intervention facilities to the gravid females so that the high burden of hospitalization, resuscitative and treatment cost of babies with low birth weight can be significantly reduced<sup>10</sup>.

### MATERIALS AND METHOD

A hospital based cross sectional study was conducted in the inpatient department of Gynecology and Obstetrics Unit in Ghurki Trust Teaching Hospital from 1<sup>st</sup> January 2019 to 1<sup>st</sup> April 2019 after getting an approval from ethical review board. Data was collected using a structured, pre-tested questionnaire which consisted of two portions. 1<sup>st</sup> portion was about the socio-demographic profile of the participants and 2<sup>nd</sup> being the obstetric and neonatal history of the mothers and neonate. Data was collected using simple random sampling from those fulfilling the inclusion and exclusion criteria after getting an informed verbal consent. A total of 121 participants were included in the sample. All post partum women who successfully delivered single, alive neonate in last 24 hours admitted in inpatient Gynecology and Obstetrics department at GTTH were

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included in the study; while twins, still born neonates or mothers who did not give consent were excluded from the study.

Data was analyzed in SPSS using descriptive statistics. The outcome variable under observation was birth weight of indexed neonate. The variables were all analyzed against birth weight of indexed infant. Nutritional status of mother cannot be properly assessed due to recall bias therefore instead BMI of mother just prior to delivery was used as an indicator of maternal nutrition.

## RESULTS

A total of 121 mothers were included in this study with a mean age of  $27.54 \pm 4.89$  years. Mean birth weight calculated was  $2.99 \pm 0.65$  kg. Incidence of low birth weight babies in our study was 20.7% (25 infants).

Out of the 121 mothers 24(19.8%) were primigravidas and remaining 97 women had been previously pregnant. Amongst these 97 women, 21 (17.4%) mothers had a previous abortion followed by dilatation and curettage. Birth spacing was calculated in months between the end of previous gestation and end of present gestation. Average birth spacing was  $30.76 \pm 23.05$  months. Birth spacing had no significant effect on new born birth weight. Average antenatal visits of all mothers were  $7.93 \pm 3.86$ . Socio-demographic profiles of the mothers are depicted in Table 1 while Table 2 shows all the determinants along with their effect on birth weight of the new born.

There was history of tobacco use during pregnancy in 3(2.5%) mothers and alcohol consumption in 1(0.8%) mother. These two factors again showed no significant effect on birth weight of new born.

Mothers were also asked regarding family planning counseling done antenatally and use of contraceptives. Only 59(48.8%) mothers had received counseling regarding family planning antenatally and of these 51 (42.1%) times the counseling was done by a doctor. The remaining times it had been done by a family member or a lady health visitor, while 62(51.2%) mothers had not received any family planning counseling. Use of contraceptives was alarmingly low in the mothers interviewed, with only 24(19.8%) having said to have used any contraception at all.

Table1: Socio-demographic background of mothers (n=121)

Background	n
<b>Age group (years)</b>	
<25	30(24.8%)
26-29	53(43.8%)
≥30	38(31.4%)
<b>Education level of mothers</b>	
Primary and below	49(40.5%)
Matriculate and above	72(59.5%)
<b>Monthly family income (rupees)</b>	
<30,000/-	63(52.1%)
≥30,000	58(47.9%)
<b>BMI of mothers</b>	
Normal	29(24%)
Overweight	36(29.7%)
Obese	56(46.3%)
<b>Mode of delivery in present pregnancy</b>	
Vaginal delivery	39(32.2%)
C-section	82(67.8%)

Table 2: Determinants and birth weight of new born

Determinants (n)	Birth Weight of Child				p value
	<2.5 kg		≥ 2.5 kg		
	n	%	n	%	
<b>Age group (years)</b>					
<25 (30)	7	23.3	23	76.7	0.677
25 – 29 (53)	9	17.0	44	80.8	
≥30 (38)	9	23.7	29	76.3	
<b>Literacy status of mothers</b>					
Illiterate or Primary (49)	17	34.7	32	65.3	0.002
Matriculation and above (72)	8	11.1	64	88.9	
<b>Monthly family income (rupees)</b>					
<30,000 (63)	20	31.7	43	68.3	0.002
≥30,000 (58)	5	8.6	53	91.4	
<b>BMI of mothers</b>					
Normal(29)	4	13.8	25	86.2	0.371
Overweight (36)	10	27.8	26	72.2	
Obese(56)	11	19.6	45	80.4	
<b>Parity</b>					
Para 1 (35)	7	20.0	28	80.0	0.131
Para 2 (37)	4	10.8	33	89.2	
Para 3 and above (49)	14	28.6	35	71.4	
<b>Antenatal visits</b>					
Less than three (25)	6	46.2	7	53.8	0.016
At least three or more (96)	19	17.6	89	82.4	
<b>Consumed 100 folic acid &amp; iron tablets</b>					
Yes (83)	13	15.7	70	84.3	0.045
No (38)	12	31.6	26	68.4	
<b>Received adequate rest &amp; sleep</b>					
Yes (100)	17	17.0	83	83.0	0.030
No (21)	8	38.1	13	61.9	

<b>Sex of the child</b>					
Male (63)	9	14.3	54	85.7	<i>0.071</i>
Female (58)	16	27.6	42	72.4	
<b>Gestational age at birth</b>					<b>0.000</b>
Pre term (15)	11	73.3	4	26.7	
Full term (104)	14	13.5	90	86.5	
Post term (2)	0	0.0	2	100.0	
<b>Antenatally registered at GTTH</b>					<b>0.002</b>
Yes (67)	7	10.4	60	89.6	
No (54)	18	33.3	36	66.7	
<b>Pregnancy Induced Hypertension</b>					<i>0.443</i>
Yes (27)	7	25.9	20	74.1	
No (94)	18	19.1	76	80.9	
<b>Gestational Diabetes Mellitus</b>					<i>0.696</i>
Yes (12)	3	25.0	9	75.0	
No (109)	22	20.2	87	79.8	
<b>Presence of Any Chronic Disease</b>					<i>0.093</i>
Yes (13)	5	38.5	8	61.5	
No (108)	20	18.5	88	81.5	

## DISCUSSION

The ever-rising burden of low birth weight babies in a critically low resource country like Pakistan is a tremendous constrain on the already crippling health care system, contributing to high neonatal mortality and morbidity as well as ailments linked to childhood and adolescence. The multi-factorial causation of low birth weight has made it even more difficult to control the rampage, where a lot of factors starting from socio-demographic determinants of the family, to preconception care, to significantly being affected by antenatal care of the mother during her gestation. These determinants are crucial for the allocation of magnitude of intra-natal and postnatal care, services and expenses hence direly required to be addressed, so that preventive strategies could timely be employed. Our study tried to encompass more or less all the factors associated with low birth weight.

Our study found an incidence of 20.7% of LBW infants which corresponded with previous local studies<sup>2, 3</sup>. As evident from previous literature maternal age has a wavering effect on the birth weight. Recent studies provide an unclear opinion about the effect of maternal age on birth weight of newborn. In our study no association was found between maternal age and low birth weight, consistent with another previous study.<sup>11</sup> Maternal nutrition is a direct factor influencing infant's weight.<sup>12</sup> In our study caloric count of the mother during gestation could not be done, however BMI, weight at the end of pregnancy and monthly family income were taken as the indicators for maternal malnutrition. Yet we failed to find any association between BMI which was in contrast to the previous data available.<sup>6, 13, 14</sup> We did however find, as stated in previous studies as well<sup>13</sup>, a positive association between family income and birth weight of new born. Family income is a rather obvious determinant of low birth weight since with improved family income, the mother is bound to have improved nutrition and antenatal care, thus leading to better outcomes for the new born.

In our study, we also saw that mothers with little or no education led to increased chances of having a low birth weight infant which was evident from previous studies done as well.<sup>7, 13</sup> A more educated pregnant mother is therefore much more aware of her health and well-being, and she

would consciously make more effort to improve her health for the well-being of her unborn child.

Short duration of gestation leading to preterm babies is a significant risk factor for low birth weight as evident from previous literature<sup>2, 15</sup>. Similarly in our study preterm birth had strong effect on low birth weight.

Fetal gender is also known to affect the birth weight of the baby. According to a previous literature male gender is at increased risk of being LBW<sup>16</sup> whilst another study suggested that female gender is at increased risk<sup>11</sup>. Our study however failed to find any such association.

We also saw, there is no association of previous abortion with low birth weight. However similar studies conducted in Peshawar and Calcutta reported abortion as one of the main causes of adverse pregnancy outcomes<sup>17, 18</sup> as abortion affects maternal health causing anemia and hemorrhage thus the pregnancy outcomes of LBW and preterm births.

We also saw a significant association between number of antenatal visits and birth weight of new born. Similarly, a study carried out in Mexico, showed that women with an inadequate number of antenatal visits had an OR of 2.11 (95% CI 1.38 - 3.23) of having a LBW infant, either due to intrauterine growth retardation (IUGR) or premature delivery (PD), both of which could have been screened out if there was an adequate number of prenatal visits.<sup>19</sup> Other studies too have consistently shown that more prenatal visits results in lower maternal, fetal, and neonatal morbidity and mortality<sup>20, 21</sup>. A different study in Nepal also proved that not attending antenatal care increased the odds of having a LBW infant by more than two times<sup>22</sup>. On the other hand, Guillermo et al believed the content of the antenatal visits matters more than the frequency of antenatal visits. They showed in their study that a goal-oriented, fewer antenatal visits model could be introduced into clinical practice<sup>21</sup>. This, however, was a limitation of this study since data was collected at the time of birth; the antenatal care quality was not assessed.

Our study also showed that mothers who had been registered prenatally at GTTH during their first trimester had significantly lower rates of LBW infants as compared to the prenatally unregistered mothers. This finding was in agreement of K. S. Negi et al and Anand et al, two different

studies from India which also proved that prenatal maternal registration had a positive effect on birth weight<sup>23,24</sup>.

We also saw in our study that there is no impact of pre-existing chronic diseases, such as sero-positive HCV, hypertension and chronic anemia on the birth weight of the infant in contrast to another similar study carried out in Karachi that demonstrated positive association between LBW infants and chronic ill health in mothers.<sup>25</sup> Moreover, in contrast to other studies, we saw no relationship between PIH or GDM with birth weight. This in turn may be due to well managed PIH and GDM of the affected mothers.

We also saw no relationship between tobacco or alcohol consumption on birth weight of infant. This was in contrast to other studies which depicted a strong association between tobacco and alcohol exposure intra-natally.<sup>13, 26, 27</sup> This disparity is probably due to the extremely diminutive number of mothers with tobacco (n=3) and alcohol (n=1) exposure in our study.

We also assessed consumption of iron and folic supplements for a minimum of three months or consumption of 100 tablets in our study which proved to have a positive effect on infant birth weight. This finding was also supported by a systemic review done in 2014 which assessed data from ten RCTs proving that folate supplementation did in fact increase birth weight (P=0.03).<sup>28</sup> Similarly, the benefits of iron supplementation on infant birth weight have been documented by many articles. One such study from Nepal, showed that mothers not taking iron supplement had a higher likelihood of having a LBW infant (OR=1.84, 95% CI 1.28-2.36)<sup>22</sup>.

Furthermore, our study also saw a significant association between adequate sleep and rest during pregnancy with birth weight of infant. This, however, was in contrast to another study from Karachi which showed no significant association between these two variables.<sup>25</sup> Nevertheless, a study from 2011 carried out in India showed a very significant association between adequate antenatal care and birth weight. They used adequate sleep and rest (minimum 2 hours sleep during day and 8 hours sleep at night) as a major determinant of antenatal care quality<sup>13</sup>.

Additionally, we also assessed prenatal contraceptive counseling done for future pregnancies. Enough evidence is already present to promote use of contraceptives and family planning services to increase birth spacing, in order to avoid adverse outcomes. Though previous studies showed that increased birth spacing was directly associated with increased new born birth weight<sup>13, 29</sup> we were not able to prove this association in our study. However, our study corresponded with previously calculated contraceptive rates in Pakistan.<sup>30</sup> In comparison, contraceptive rates in the developed world like USA were recorded at 62%.<sup>31</sup> These findings showed a dire need for more vigorous contraceptive counseling sessions to be done.

Though this study did find strong associations between some of the variables and birth weight of infants, the study faced a few limitations such as small sample size. For this purpose we recommend repetition of this study at a large scale, with a multi-centered approach. Another limitation of this study was lack of history or records of any

intra-uterine infection or detection of any cervical/ uterine/ placental abnormality during gestational period.

## CONCLUSION

Our study showed that mothers who were more educated, belonging to better socio-economic strata and those who received adequate antenatal care were much less likely to have LBW infants. This confirms the absolute necessity of having widespread antenatal service provision and health education for pregnant mothers as well women of child bearing age.

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