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ORIGINAL ARTICLE

Maternal predictors of Low Birth Weight among women attending private hospitals of Lahore, Pakistan

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Summary. *Background:* Low Birth Weight (LBW) is a global public health concern. In Pakistan, little progress has been made towards achieving the Millennium Development Goals. The study objective was to identify maternal predictors of LBW infants among women attending private hospitals in Lahore, Pakistan. *Method & Materials:* A descriptive cross-sectional study was conducted at three randomly selected tertiary care private hospitals in Lahore, Pakistan. A total of 225 participants were consecutively approached to participate in the study, 75 from each hospital. 164 gave written informed consent; the response rate was 73%. Data on demography was collected with the help of a piloted, structured questionnaire. Previous maternal anthropometric measurements, birth weight, mode of delivery, gestational age, sex and intra uterine growth retardation was obtained from patient's file. Descriptive statistics, correlations, Anova and Chi-square was applied. A p-value of 0.05 was taken as statistically significant. *Results:* Inferential statistics revealed that maternal age of less than 24 years ($F=4.531$, $p<\alpha$; $X^2=12.170$, $p<\alpha$); height less than 150cm ($F=2.884$, $p<\alpha$; $X^2=8.187$, $p<\alpha$); booking weight less than 61 kg ($F=4.080$, $p<\alpha$; $X^2=11.138$, $p<\alpha$); weight 27-32 weeks less than 63 kg ($F=3.646$, $p<\alpha$; $X^2=10.086$, $p<\alpha$) was significantly associated with low birth weight in newborns. No association was found between BMI 1, BMI 2, education, parity and income. *Conclusion:* We concluded that birth weight of a newborn reflects maternal health and nutritional status; and maternal age, height and weight are predictors of low birth weight among women attending private hospitals. Mothers should be counseled regarding importance of adequate pre-pregnancy weight and weight gain during pregnancy.

Key words: maternal, factors, height, weight, weight gain, BMI, Low Birth Weight

Background

Low Birth Weight (LBW) is one of the most serious public health concerns especially in under developed and developing countries. World Health Organization defines LBW as birth weight of less than 2.5 kg (1). Inspite of constant efforts to alleviate the maternal and child health status; globally 15.5% of all live births i.e. more than 20 million infants are born low birth weight. In developed countries prevalence of LBW is 7% whereas in developing countries its 16.5% (2). In South Asia, the situation is more severe with up to 50% of all neonates being low birth weight (3). In Pakistan, little progress has been made towards achieving the Millennium Development Goals and still around 25% of neonates are LBW (4).

LBW is either due to preterm birth (less than 37 weeks of gestation) or intrauterine growth restriction (IUGR) resulting in small for gestational age babies. Common cause of LBW in developed countries is due to preterm birth while IUGR is the reason behind LBW's in developing countries (5). Out of total projected IUGR babies, Asia accounts for 75% (6). Birth weight is not only the predictors of mother's health

status but also a newborn's probability for survival, development and long-term health. LBW is one of the major determinants of infant morbidity and mortality. There is an increased 40% chance of infant death within one month among LBW infants than normal birth weight infants (7).

Major determinants of LBW in developing countries are short maternal stature, poor maternal nutritional status before pregnancy, low weight gain during pregnancy; due to inadequate dietary intake, low SES, inadequate prenatal care, multiple births, and medical complications during pregnancy. Malnutrition, anemia, folate deficiency, poverty, illiteracy, gender inequality, under-utilization of maternal health care services are some of the social factors responsible for low birth weight. Cultural Factors like prejudices and food taboos also contribute to malnutrition. Low per capita income is a major determinant of neonatal weight.

LBW affects individuals, but families and community at large. It is a major rectifiable and preventable public health issue. Numerous maternal and fetal factors contribute to LBW; and are interrelated. In Pakistan, national nutrition surveys have estimated the prevalence of LBW at 12%–25% (4). However, limited research is available on maternal predictors of LBW in Pakistan and that too have been conducted at individual selected government hospitals, catering only to low socio economic status. In order to prevent incidence of LBW, its contributory factors need to be identified in all the segments of population. Middle class is the biggest segment of population of Pakistan accounting to 55% that is why postnatal women from private hospitals were selected in this study. The objective of the study was to identify maternal predictors of Low Birth Weight infants of women attending private hospitals in Lahore.

Methods and Materials

Study settings

Lahore is the capital city of the Pakistani province of Punjab, the second largest metropolitan area in the country and 14th most populous city in the world. It is an important historical center in South Asia. Lahore has 36 tertiary care private hospitals, which cater to middle and elite class of Lahore. The study was carried out April-September 2014.

Study design and population

A descriptive cross-sectional study was conducted at three randomly selected tertiary care private hospitals in Lahore, Pakistan. The study participants were post-natal women, aged 18-39years.

Sample size and sampling procedure

Sample size was calculated on the basis of 95% confidence interval, 80% power, 5% assumed outcome in non exposed and 20% outcome among exposed group. The sample was calculated to be 176. Assuming a 20% non response rate an initial sample comprised of 225 participants. They were consecutively approached to participate in the study, 75 from each hospital. 164 gave oral informed consent; the response rate was 73%.

Variables

Maternal height, weight, BMI, parity, age, household income and education were independent variables and birth weight of newborn was dependent variable.

Data collection

A structured questionnaire was developed by researcher to collect data on demographic (income, age, education, parity, occupation status) and anthropometric measurements. The instrument was administered face to face by the researcher. Record of maternal weight was obtained through the patient's file. Booking weight 10-20 weeks of gestation (W1) and (W2) was recorded at 27-32 weeks of gestation. Maternal weight was recorded on an electronic weighing machine and rounded off to nearest 0.1 kilogram. Height was taken with a standard stadiometre and recorded to nearest 0.1cm. BMI was calculated as weight in kg/ height $m^{2.}$ New born's weight was evaluated by neonatal nurse on an electronic weighing scale and rounded off to nearest kilogram. Data on mode of delivery, gestational age, gender and Intra uterine Growth Retardation was obtained from patient's file. Gestational age was calculated on the basis of LMP and neonates born before 37 weeks of gestation were classified as preterm. IUGR was determined by Ultrasound report evaluated by gynecologist.

Data quality assurance

To assure quality of data, a pretest of questionnaire was performed and these participants were not included in final sample. Vague questions were reviewed and adjusted accordingly. Data collector was a trained interviewer. The collected data were reviewed and checked for completeness on the day of each data collection.

Ethical considerations

Ethical approval for the study was obtained from the Institutional Review Board of the respective hospitals. The research was conducted in compliance with the ethical principles for medical research involving human subjects of the Helsinki Declaration. Written informed consent was obtained from all subjects. The right to privacy, anonymity, voluntary participation and confidentiality were observed.

Statistical analysis

Descriptive statistics were calculated for all continuous variables. Correlation coefficient was calculated to observe the relationship between maternal anthropometric and socio demographic factors and new born's birth weight. Maternal predictors were divided in quartiles and Anova was applied to observe differences between the groups. Chi-square was applied to observe significant association between maternal predictors and birth weight of newborns. A p-value of 0.05 was taken as statistically significant. Data was analyzed using SPSS v.17.

Results

The study population was 164 mothers and their newborn selected from three randomly tertiary care private hospitals. Table 1 shows that 60% had a normal vaginal delivery and rest 40% were delivered through C-section. Among the newborns 44% were male while 56% were female. Out of 164 newborns, 87% of babies were born after 37 weeks of gestation whereas 13% were preterm. Intra-uterine growth retardation among total birth was observed to be 4%. The frequency of newborns with birth weight less than 2.5 kg was 34 (21%).

The socio-demographic and anthropometric variables of mother and newborns are shown in Table 2. The mean maternal booking weight (W1) was 66.80±10.41 kg whereas weight of mother at 27-32 weeks (W2) was 70.35±12.12 kg. Height of mother had a mean value of 157.06±4.95 cm while the mean BMI (1) and BMI (2) were 27.03±3.59 and 28.45±4.09 respectively. The mean age of mother was 26.87±3.09 years and the mean maternal education was 12.38±3.09 years and mean income was 37207.32±13029.63PKR ($372±130). The mean maternal parity was 2.35±1.38. Birth weight of newborn had a mean value of 2.85±0.71 kg. Correlation analysis revealed that LBW had a moderate correlation with maternal height (r=0.441, p=0.000) and weight 27-32 weeks (r=0.408, p=0.000). LBW had a weak to moderate correlation with booking weight 10-20 weeks (r=0.397, p=0.000), BMI 1(r=0.254, p=0.024), BMI 2(r=0.284, p=0.012), and age (r=0.200, p=0.011). No correlation was found with education, parity and household income (p= 0.988, 0.598, 0.939 respectively).

Inferential statistics revealed that maternal age of less than 24 years ($F=4.531$, $p<\alpha$; $X^2=12.170$, $p<\alpha$); height less than 150cm ($F=2.884$, $p<\alpha$; $X^2=8.187$, $p<\alpha$); booking weight less than 61 kg ($F=4.080$, $p<\alpha$; $X^2=11.138$, $p<\alpha$); weight 27-32 weeks less than 63 kg ($F=3.646$, $p<\alpha$; $X^2=10.086$, $p<\alpha$) was significantly associated with low birth weight in newborns. No association was found between BMI 1 ($F=0.128$, $p>\alpha$; $X^2=1.401$, $p>\alpha$), BMI 2 ($F=0.419$, $p>\alpha$; $X^2=1.301$, $p>\alpha$), education ($F=2.042$, $p>\alpha$; $X^2=7.864$, $p>\alpha$), parity

Table 1. Descriptive variables of the newborn n=164

Variables		Frequency	Percentage
Mode of delivery	Normal	98	60
	C-Section	66	40
Sex of the baby	Male	72	44
	Female	92	56
Gestational age	< 37 weeks	22	13
	> 37 weeks	142	87
IUGR	Presence	6	4
	Absence	158	96
Birth weight	< 2.5kg	34	21
	>2.5kg	130	79

Table 2. Description of maternal socio-demographic and anthropometric variables and relationship with weight of newborn=164

Variables	Mean	S.D	Range	R	P value*	95% CI**	
Age	26.87	4.40	21	0.200	0.110	0.042	0.177
Height (cm)	157.06	4.95	22.50	0.441	0.000*	0.000	0.036
Booking weight kg (W1)	66.80	10.41	62	0.397	0.000*	0.000	0.036
Weight kg (W2)	70.35	12.12	69	0.408	0.000*	0.000	0.036
BMI (1)	27.03	3.59	18.57	0.254	0.024*	0.000	0.058
BMI (2)	28.45	4.22	20.99	0.284	0.012*	0.000	0.036
Education (years)	12.38	3.09	16	0.002	0.988	0.964	1.000
Monthly Income (PKR)	37207.32	13029.63	39000				
	($372)	($130)	($390)	0.010	0.939	0.490	0.704
Parity	2.35	1.38	5	0.077	0.598	0.887	0.991
Weight of new born (kg)	2.85	0.71	4.60	-	-	-	-

**P value < α*
***Monte Carlo Significance*

(F=0.279, p> α; X^2=0.870, p>α) and income (F=1.950, p> α; X^2=5.720, p>α) (Table 3).

Discussion

The reduction of LBW also forms an important contribution to the Millennium Development Goal for reducing child mortality. Low birth weight is a risk factor for poor health outcomes in later age (8). Maternal nutritional status both before and during pregnancy is a well-recognized determinant of birth outcomes. We found that significant predictors for the LBW are low maternal height and low gestational weight. Literature has shown that short statured women have a higher risk of preterm birth and LBW (9-10), similar results were found and a significant association was observed with birth weight. The weight of an infant at birth is an important indicator of maternal health and nutrition prior to and during pregnancy (11). Low maternal weight gain during pregnancy has been suggested as a cause of intrauterine growth retardation (12) and LBW (9-10). In the current study a significant association was observed with booking weight (10-20 weeks) and weight at 27-32 weeks of gestation. Majority of the women in current sample were overweight. BMI is a simple and useful tool for assessing pre conception nutritional status. Although pre conception BMI has a genetic as well as dietary aspect, a low pre conception BMI is considered a pointer for minimal tissue nutrient reserves (13). A weak to moderate correlation was observed between birth weight and BMI1 and 2, which is concurrent with previous findings but it was not significant.

A large retrospective cohort and population based study have concluded that teenage pregnancy increases the risk of adverse birth outcomes that is independent of important known confounders; that are Low SES, inadequate prenatal care and inadequate weight gain during pregnancy (14, 15). A weak positive relationship was found between age and birth weight of neonates as maternal age ranged from 18 to 39 years in our sample. But when data was categorized, maternal age less than 24 years was significantly associated with low birth weight in infants.

Various studies reveal that maternal education (16-18), household income and socio-economic status (16, 17) and parity (18) is associated to infants birth weight. Population based researches have demonstrated that women with lower education levels and those living in poorer neighbourhoods are more vulnerable to adverse birth outcomes. From individual indicators

Table 3. Maternal predictors versus birth weight N=164

Variables	Quartiles	LBW N	NBW N	F	P-value	Chi-square	P-value
Age, years	<24	18	32	4.531	0.006*	12.170	0.007*
	25-27	4	44				
	28-30	12	22				
	>31	0	32				
Height, cm	<150	10	10	2.884	0.041*	8.187	0.042*
	151-155	16	52				
	156-160	6	36				
	>161	2	32				
Weight (W1), kg	<61	18	24	4.087	0.009*	11.138	0.011*
	62-65	2	40				
	66-71	4	36				
	>72	10	30				
Weight (W2), kg	<63	18	26	3.646	0.016*	10.086	0.018*
	64-68	2	38				
	69-75	4	36				
	>76	10	30				
BMI (1)	<24.99	12	42	0.128	0.942	0.401	0.940
	25.00-26.99	8	30				
	27.00-28.99	6	32				
	>29.00	8	26				
BMI (2)	<25.99	14	42	0.419	0.740	1.301	0.729
	26.00-27.99	6	26				
	28.00-29.99	4	30				
	>30.00	10	32				
Education, years	>10	14	30	2.042	0.168	5.108	0.164
	11-dic	12	28				
	13-14	4	4				
	>15	4	26				
Parity	1	14	54	0.279	0.840	0.870	0.833
	2	4	18				
	3	10	26				
	>4	6	32				
Monthly Income, PKR	<25,000	12	32	1.950	0.128	5.720	0.126
	26,000-38,500	10	28				
	39,000-50,000	2	46				
	>51,000	10	24				

of SES, education is regarded the most influential predictor of neonatal birth weight (16, 17). The mechanisms associated with LBW among the less educated may include poor diet as a result of low income, low dietary literacy and limited access to prenatal care. But in the current study, the researchers did not find an association between education, house hold income and incidence of low birth weight. The reason could be that the study group was literate (only four mothers reported to be illiterate) and they belonged to middle class families (as they were attending private hospitals).

The incidence of Low Birth Weight infants has been reported to be higher among nulliparous and grand multiparrous women (18). The researchers did not find an association between parity and birth weight. As the education level and socio economic level was good therefore mean parity in this group was also lower in than general population in Pakistan.

This study had a few limitations. Firstly, data was collected on selected risk factors; there are other factors that may be associated with LBW. Furthermore majority of the data (e.g. education, parity) was self-reported. But a major strength of our study is that it highlighted the factors contributing to low birth weight among middle class women attending private hospitals in Pakistan. Thus current study addressed a neglected segment of the opulation.

Conclusion

In this study, relationships of some maternal risk factors with birth weight in reference to our population were highlighted. The findings suggest that birth weight of a newborn reflects maternal health and nutritional status. Interestingly; education, parity and household income do not have a relationship with birth weight of newborns of women attending private hospitals. So it can be concluded that among educated middle class that accounts for 55% of the population of Pakistan only age at conception, height and weight affects weight of the newborn. Height is an un-modifiable characteristic but mothers should be counseled regarding importance of adequate pre-pregnancy weight and weight gain during pregnancy through healthy eating habits. Health education programs should also target towards creating awareness about proper age for marriage and conceiving. Further studies are suggested as birth weight data is crucial for monitoring and evaluation of interventions targeted towards alleviating neonatal morbidity and mortality.

Author's contribution

AS was responsible for conception and design of the study; and data collection and drafting of the manuscript. AMS was responsible for data analysis, interpretation and critical revision of manuscript. All authors have given final approval of published version and agree to accountability.

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