

Factors associated with low birthweight among newborns delivered at term in a tertiary care hospital in Lahore

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ABSTRACT

Background: Low birth weight (LBW) is an important risk factor that contributes to mortality of 15-20% of newborn globally. This case-control study was conducted to determine factors associated with low birth weight among newborn delivered at term in obstetrical and gynecological wards of the hospital.

Patients and methods: Mothers of 150 low birth weight babies born at term were taken as cases and 150 normal weight babies born at same day, were taken as controls. Mothers were interviewed on using a semi-structured and pretested questionnaire. The data was analyzed on SPSS Version 22.0. A p-value ≤ 0.05 was considered statistically significant.

Results: Illiterate mothers had 2.332 odds of having low birth weight babies (0.03, 95% CI = 1.3317 to 4.152). Mothers from low socio-economic status had 3.54 odds of delivering LBW (p-value = 0.000, 95% CI = 2.184 to 5.94). The odds of having low birth weight babies was 4.004 times high in the mothers exposed to passive smoking (p-value = 0.000, 95% CI = 2.477 to 6.474). Hemoglobin value less than 10 gm/dl was found to be significantly associated with odd of having LBW 3.003 in anemic mothers versus non anemic mothers (p-value = 0.0027, 95% CI = 1.279 to 3.227). Mother with parity < 3 had 0.0933 odds of having low birth weight babies. Mothers having adequate antenatal care had 0.394 odds of having low birth weight babies.

Conclusion: Illiteracy, low socio-economic status, employment, anemia, tobacco smoke exposure and inadequate antenatal care were significantly associated with LBW.

Keywords:

Low birth weight, Socio-demography, Pregnancy, Factors, Term newborns

INTRODUCTION

Low Birth Weight (LBW) is defined as a newborn weighing less than 2500 g at birth, irrespective of gestational age.¹ A baby is labelled as small for gestational age (SGA) when the gender specific birth weight is $< 10^{\text{th}}$ percentile for that gestational age.² It has documented that more than two-third of LBW newborns are small because of environmental, pathological, and constitutive factors resulting in intra uterine growth restriction. It is a significant public health problem, leaving nations like Pakistan fighting for high mortality and morbidity of the newborn. More than 20 million newborns are LBW annually, the incidence being 15 to 20% worldwide, 95.6% of which occur in low- and middle-income countries and 28% in South Asia.^{1,2}

Pakistan is one of the countries with high burden of LBW ranging from 19% to 32%. These high values

are reflective in high neonatal mortality and high under five stunting, which are 58 per 1000 live births and 44% respectively.¹ LBW is multi-factorial. It is a complex cascade of maternal, fetal, placental and obstetrical factors in the backdrop of poor socio-economic background. A number of studies show that LBW correlates with infant's maternal nutritional status, maternal age, bad obstetric history, maternal anemia, antenatal care, prematurity and birth interval. Besides these, poor environmental conditions including tobacco smoke, have gained much importance as a leading cause of LBW over the past few decades.^{2,3} LBW directly relates to renal and cardiac pathologies, maternal blood pressure, smoking and alcohol intake during pregnancy, low socio-economic status, educational background and poor nutritional status reflected as anemia.¹⁻³ Short stature, previous preterm delivery, obesity, pre-delivery weight, poor weight gain in pregnancy and physical hard work all increase the risk of LBW.⁴

Keeping in the socio-cultural set up of this country, this case-control study was conducted from in Sir Ganga Ram Hospital, Lahore to determine factors associated with low birth weight among new-born

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delivered at term in Obstetrical and Gynecological wards of the hospital.

PATIENTS AND METHODS

Prospective matched case control study was conducted in the Department of Obstetrics and Gynecology of Sir Ganga Ram Hospital from November 2017 till April 2018. After taking ethical approval from Institutional Ethical Board, informed consent was obtained from the mothers of cases (LBW term newborn) and controls (normal birthweight newborn). The data was collected on a pre-tested structured questionnaire covering all the variables by the researcher herself. The sample size calculated by using power of study 95%, 99% Confidence level, with anticipated proportion in cases and control being 0.68 and 0.42 respectively for anemia. 132 cases and controls were rounded off to 150 in each group keeping 1:1 for cases and controls.¹

Singleton, alive baby born to mothers fulfilling the criteria through vaginal delivery at term (born after 37 completed weeks) and weighing less than 2500 gram, without any gross congenital malformation, selected as case. Newborn with weight of at least 2500 gram, born after 37 weeks of gestation on same day as that of cases, to mothers fulfilling the criteria, through vaginal delivery without any gross congenital malformation, were taken as control. Smoker mothers having age less than 20 years or more than 35 years, short stature, height less than 145 cm, having chronic ailments like hypertension and diabetes, history of bleeding during this pregnancy, bad obstetrical history during past pregnancies and unwilling to participate were excluded. Data was collected from mothers on socio-demographic profile and obstetrical history by interview within a day of delivery. Mothers were interviewed in same tone and time to reduce intra-rater bias and same portable scale was used for all. Average of three reading of weight in kilograms were entered. Cases and controls weighed within 24 hours of delivery on scale pan with minimum clothing. Antenatal care was considered adequate when the pregnant women who had at least four antenatal check-ups during the pregnancy, was vaccinated against tetanus toxoid, had taken at least 100 folic acid tablets during the pregnancy, along with minimum 2 hours sleep during daytime and 8 hours sleep during night and had not been involved in any heavy labour work. Post-pregnancy weight was obtained as a proxy for body mass index (BMI). Exposure to environmental tobacco smoke (ETS) during pregnancy was considered significant if at least one hour of exposure to ETS per week during last trimester was recalled.^{1,5,6} Mothers

having hemoglobin levels below 10gm/dl were labeled as anaemic.²

The data was entered and analyzed in the SPSS version 22. Mean and standard deviations were calculated for quantitative variables while frequencies and percentages in case of qualitative variable. Odds ratio was calculated to seek the significance between different factors and low birth weight babies and more than 2 was considered significant. It was stratified for age, occupation, education, low socio-economic status, parity, and weight of the respondent at time of delivery, previous history of low birth weight babies delivered, antenatal care received, Environmental tobacco smoke exposure during pregnancy and anemia (hemoglobin less than 10gram/dl). Post stratification odd ratio was calculated. Statistical significance considered at p-value ≤ 0.05 .

RESULTS

Out of 150 responding mothers of cases, 82 (54.7%) were aged up less than 25 years, 36 (24%) aged 25-30 years and 32 (21.5%) aged from 31-35 years. Among 150 controls 80(53.3%) aged up to 25 years, 39 (26%) aged from 25-30 years and remaining 31 (14%) age ranged from 31-35years. 52 (34.7%) mothers of cases were employed and 98 out 150 (65.3%) were house wives. **Among controls' mothers**, 34 (22.7%) were employed and remaining 116 (77.3%) were housewives. Whereas, 43 (28.7%) of cases' mothers were illiterate and 22 (14.7%) of control respondents didn't know how to read and write. **Among the remaining cases' mothers**, 81 (54%) had less than or equal to 10 years of formal schooling while 26 (17.3%) had more than 10 years of formal schooling. **57 (38%) of the controls' mothers** education was less than or equal to 10 years of formal schooling while 71 (47.3%) had more than 10 years of formal schooling. Majority of the respondents for cases, 77.3% (116) had low socio-economic status while 48.7% (73) of respondents for controls had low socio-economic status (Table1).

Association of low birth weight with socio-demographic profile and obstetrical history

For age, it was found that mothers <25 years had 1.055 odds of having low birth weight babies (p-value = 0.817, 95% CI = 0.688 to 1.662). Employed mothers had 1.81 odds of having low birth weight (p-value = 0.02, 95% CI = 1.087 to 3.012). Illiterate mothers had 2.332 odds of having low birth weight babies (p-value = 0.03, 95% CI = 1.3317 to 4.152). Mothers of low socio-economic status had 3.54 odds of giving birth to low socio-

economic birth weight babies (p-value = 0.000, 95% CI = 2.184 to 5.94) (Table 2).

Mother with parity <3 had 0.0933 odds of having low birth weight babies (p-value = 0.000, 95% CI = 0.050 to 0.172). Mothers weighing <55kg had 1.104 odds of having low birth weight babies (p-value = 0.753, 95% CI = 0.5923 to 2.064). Those mothers having history of previous low birth weight babies had 0.617 odds of having low birth weight babies (p-value = 0.245, 95% CI = 0.482 to 1.206). Mothers receiving antenatal care had 0.76 odds of having low birth weight babies (p-value = 0.245, 95% CI = 0.482 to 1.206). Mothers having adequate antenatal care had 0.394 odds of having low birth weight babies (p-value = 0.394, 95% CI = 0.618 to 0.8792). The odds of having low birth weight babies was 4.004 times high in the mothers exposed to passive smoking than unexposed (p-value = 0.000, 95% CI = 2.47 to 6.474). Hemoglobin value less than 10 gm/dl was found to be significantly associated with odds of having LBW 3.003 in anemic mothers vs. non anemic mothers (p-value = 0.0027, 95% CI = 1.279-3.227) (Table 3).

DISCUSSION

LBW is this reflective of the maternal nutritional health before conception and during pregnancy. Intra uterine growth restriction is a result of complex interaction of maternal, fetal, placental and environmental factors.² In order to determine the association between low birth weight and maternal sociodemographic and obstetrical factors, the following case control study was conducted in Sir Ganga Ram Hospital Lahore, Pakistan with sample size of 300 newborns (150 controls and 150 cases) born during study period after fulfilling strict inclusion and exclusion criteria.

In this study, the association between age (<25 and above 25 years) and low birth weight baby was evaluated, and it was found that it was quite insignificant as we got the p-value = value 0.0817, Odds ratio 1.055 and 95% CI with range 0.668 to 1.662. Khan and coworkers argued that risk of LBW increases proportionally with maternal age.² The study published in 2020 constituting of data collected about children born during 1995-2000 from Finish population supports results of this study that poorer birth outcomes are not at all associated with maternal of age, however, descriptive analysis of study from Finland involving children born from 1987-2000 shows that there is a U-shaped association between low birth weight and preterm delivery with maternal age.⁶ Mumbaree and colleagues however, showed that maternal age was not

significantly associated with LBW providing strength to our study.⁵ It must be bore in mind that mothers of extremes of age i.e. <20 years and > 35 years were not enrolled in the study as the focus of the study was purely on LBW at term.^{2,5,7}

When the association between occupation (employed or housewife) and low birth weight was studied, p-value = value was found to be significant with value 0.02 (<0.05), however; Odds ratio was found to be insignificant with value 1.81 (>2), whereas 95% CI falling in the range of 1.087, 3.012 is also found to be slightly significant. A study from Tehran in 2012 on a sample of 512 mother to assess relationship between mother employment status and low birth weight incidence through a research-based questionnaire. It was found that low birth weight incidence was 5 times higher in employed women.⁹ A study conducted at rural Ghana including data from databases of 6777 mothers (a large sample size) depicted that civil servant mothers were having 77% more incidence of normal birth weight as compared to those unemployed ones with the argument that the employment status reflected the better financial condition of mother.¹⁰ The results were similar to our study which also showed that women contributing monetary to the finances of the household are at lower risk of having LBW vs. housewives (p-value = 0.02, Odds ratio 1.81, 95% CI = 1.087 to 3.012)

A significant association was found between illiteracy and LBW (p-value = 0.03, Odds ratio 2.332 and 95% CI = 1.317 to 4.152). The study at Tehran also supported our results showing LBW is three times higher in uneducated woman.⁹ Current study finding are also supported by a large cohort study involving mothers from 2010 to 2013 conducted a secondary analysis of the nulliparous pregnancy outcomes and narrated that illiterate mothers had chances of having 1.4 times more small for gestational age babies, higher incidences of preterm births and increased chances of low birth weight.¹¹ Another strong significant association was found between low birth weight and low socioeconomic status with p-value = 0.000, Odds ratio 3.54 and 95% CI range 2.184 to 5.94. In other study, a mixed pattern of this association was reported from countries like United States, Canada, and Australia we find a clearer and significant income gradient.¹² However, in Canada this relationship was not statistically significant in multivariate context might be due to the smaller sample from there.¹² The Ghana study findings explained a strong association between birth weight and socioeconomic status with results relevant to our study that higher socioeconomic status

Table 1: Frequency distribution of socio-demographic characteristics of respondents

Characteristics	Cases (n=150)		Controls (n=150)		Total (n=300)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Age In years						
Up to 25	82	54.7%	80	53.3%	162	54%
Above 25-30	36	24.0%	39	26%	75	25%
31-35	32	21.3%	31	14%	63	21%
Occupation						
Employed	52	34.7%	34	22.7%	86	28.7%
House wife	98	65.3%	116	77.3%	214	71.3%
Education						
Illiterate	43	28.7%	22	14.7%	65	21.7%
<10yrs of formal schooling	81	54%	57	38%	138	46.0%
>10 years of formal schooling	26	17.3%	71	47.3%	97	32.3%
Low socioeconomic status						
Yes	116	77.3%	73	48.7%	189	63%
No	34	22.7%	77	51.3%	111	37%

Table 2: Association of socio-demographic characteristics of mothers with low birth weight babies

Characteristics	Cases n=150		Controls (n=150)		Total Frequency	p-value*	Odds ratio (95% confidence Interval)**
	Frequency	Percentage	Frequency	Percentage			
Age In years							
<25	82	54.7%	80	53.3%	162	0.817	1.055 (0.668 to 1.662)
Above 25	68	45.3%	70	46.7%	138		
Occupation							
Employed	52	34.7%	34	22.7%	86	0.02	1.81 (1.087 to 3.012)
House wife	98	65.3%	116	77.3%	214		
Education							
Illiterate	43	28.7%	22	14.7%	65	0.03	2.332 (1.317 to 4.152)
Literate	107	71.3%	128	85.3%	235		
Socioeconomic status							
Lower class	116	77.3%	73	48.7%	189	0.000	3.54 (2.184 to 5.94)

*p-value ≤ 0.05 was taken as significant**Odds ratio > 2 is taken as significant

Table 3: Association of low birth weight with obstetrical history of the mothers of cases and controls

Obstetrical history	Cases (n = 150)		Controls (n = 150)		Total Frequency	p-value*	Odds ratio (95%confidence Interval)**
	Frequency	Percentage	Frequency	Percentage			
Parity							
<3	16	10.7%	84	56%	100	0.000	0.0933 (0.050 to 0.172)
>4	134	89.3%	66	44%	200		
Weight of the respondent at time of delivery							
<55kg	127	84.7%	125	83.3%	252	0.753	
>55kg	23	15.3%	25	16.1%	48	1.104	
Previous history low birth weight babies delivered							
Yes	29	19.3%	42	28%	71	0.077	0.617 (0.359 to 1.059)
No	121	80.7%	108	72%	229		
Antenatal care received							
Yes	79	52.7%	89	59.3%	168	0.245	
No	71	47.3%	61	40.7%	132	0.76	
Adequate Antenatal care received (n=79)			n=89				
Yes	10	12.7%	24	27%	34	0.021	0.394 (0.168 to 0.8792)
No	69	87.3%	65	73%	134		
Environmental Tobacco smoke exposure during pregnancy							
Yes	98	73.3%	48	32.0%	146	0.000	4.004 (2.477 to 6.474)
No	52	26.9%	102	68%	154		
Anaemia							
Yes	96	64.0%	70	46.7%	134	0.0027	3.003 (1.279 to 3.227)
No	54	36.0%	80	53.3%	166		

*p-value ≤ 0.05 was taken as significant**Odds ratio > 2 is taken as significant

has likely the chances of reducing the risk of LBW.¹⁰ The study had the edge due to large sample size with considerable limitation of not including the **confounding factors like mother's weight gain during various trimesters, gestational age and any other related maternal comorbidity.**

In the obstetrical factors, the odds ratio for parity < 3 was 0.093 with 95% CI = 0.050 to 0.172, showing that parity > 4 was associated with LBW with effect of parity < 3 having protected effect on the delivery of low birth weight. Similarly, antenatal care has protective effect with odds ratio of 0.76 with 95% CI = 0.483 to 1.206, showing statically significant protective effect of antenatal care. Not only antennal care but adequate antenatal care has significant protective effect to 0.394 with 95% CI = 0.168 to 0.879 with risk of LBW in mothers not having adequate antenatal care being 60.6%.

One previous showed antenatal care is considered adequate when the pregnant women has at least four antenatal check-ups during the recent pregnancy, is registered during anytime in this pregnancy at a hospital, has been vaccinated against tetanus toxoid has taken at least 100 folic acid tablets during the pregnancy, taken adequate rest during pregnancy (minimum 2 hours sleep during daytime and 8 hours sleep during night).⁵

This further emphasizes the role of good primary care services in prevention of LBW of the newborn. Similar risk was shown in a matched pair case-control study conducted in by Mumbare and group from India where 62.4% mothers of LBW had inadequate antenatal care with odds of inadequate ANC being 4.98.⁵ similarly in another study conducted by Khattar et al in India showed odds ratio of utilization antenatal care being 0.34.⁸

It was also concluded by Khattar and coworkers that preterm pregnancy (<37weeks gestation), low socioeconomic status, previous LBW neonate, severe anemia were significantly associated with LBW neonate odds ratio being 11.58, 1.71 (95%CI = 0.99 to 2.93), 4.72 (95%CI = 1.19 to 18.69), 1.82 (95%CI = 1.04 to 3.18) respectively.⁸ No association of post-delivery weight was found with LBW (p-value = 0.753, odds ratio 1.104 and 95% CI = 0.592 to 2.064). Previous studies found to be having similar results thus showing significant association among the above said parameters.¹⁰⁻¹³ The study conducted in Thailand was contrary with our study with opposing results.¹⁴ Another study with respect to analyze restrictive dietary

intake during pregnancy leads to low birth weight is also not supportive with our results.¹⁵

A hospital-based study conducted in Karachi showed limitation towards the results of association between antenatal care and low birth weight as mostly high-risk pregnant women are expected to deliver in the health facility or have an antenatal card.¹⁶ However, the study was in favor of antenatal care for effective monitoring of anemias and maternal health status. The association of low-birth-weight babies with Previous history of low-birth-weight babies was found to be greatly insignificant with p-value = 0.077, Odds ratio 0.0617, 95% CI = range of 0.359 to 1.059 making such women more vigilant in the current pregnancy. Similarly, a very extensive study conducted in 42 countries of western China stated that newborns with mothers without receiving proposed five ANC visits had a higher risk of LBW than those whose mothers had received it (AOR = 1.32, 95% CI = 1.01 to 1.73). A study performed at Ghana showed that women having adequate antenatal care with continuous monitoring of maternal health and counselling on family planning, showed that the outcome were 6 times better than those not having.¹⁵

The association between anaemia and low birth weight is found to be strongly significant with p-value = 0.0027, Odds ratio 3.003 and 95% CI range 1.279 to 3.227. A study conducted in rural area of Sindh Province also depicts that like our study results illiteracy, anemia and antenatal care were significantly associated with the low-birthweight.¹ A case control study was carried out in 2017 to assess factors associated with low-birth-weight babies in which structured interview was conducted to collect data from public health facilities in Nekemte town. Maternal anemia and lack of nutritional counselling which can be addressed through antenatal care were also found to be the two major culprits for low birth weight.¹⁶

The association between parity <3 and >4 and low birth weight is protective with p-value = 0.000 (<0.05), Odds ratio being insignificant 0.0933 (>2) and 95% CI being significant by falling in the range of 0.050, 0.172. The results were different from Habib et al who showed that risk of LBW was more in nulliparous mothers.¹

The environmental tobacco smoke association in relation with low birth weight is found to significant with p-value = 0.000, Odds ratio 4.004 and 95% CI range 2.477 to 6.474. Study shows that plasma cotinine level of ≥ 3.03 ng/mL, irrespective of passive and active smoking can cause small for gestational age. SGA.¹⁷ Abu

Saleh and core searcher showed that odds of LBW was 3.4 among mothers exposed to environmental tobacco smoke as compared to non-exposed mothers.⁶

Previous studies shows that illiteracy, low socio-economic status, being housewife were significantly associated with LBW.¹⁻¹⁵ Adequate antenatal care, previous history of low birth weight, low parity had protected role. Anemia and exposure to environmental tobacco smoke is also identified as significant factors. The most pivotal role can be played by the Health care professionals by counselling sessions about avoidable risk factors for low-birth-weight indices. It can be improved by using the approach of primordial prevention through conducting media shows, educational programs to so that awareness and understanding of pregnant women and their husbands can be enhanced with realization of community responsibility.

CONCLUSIONS

Illiteracy, low socio-economic status, unemployment of mother, anemia, tobacco smoke exposure and inadequate antenatal care were significantly associated with LBW. Importance of antenatal care cannot be overemphasized, as it is the foremost tool to recognize and minimize the effect of factor such as anemia and environmental tobacco smoke exposure. As LBW is a leading cause of neonatal morbidity and mortality worldwide, so addressing these problems will also help in reducing these incidences.

The pregnant women had at least three antenatal check-ups during the recent pregnancy, should be vaccinated against tetanus toxoid, should take at least 100 folic acid tablets during the pregnancy, take adequate rest during pregnancy (minimum 2 hours sleep during day time and 8 hours sleep during night) and should not involve in any heavy labour.⁵ Further environmental tobacco smoke exposure must be avoided including cigarette, bedi, huuka smoke. Blood haemoglobin level should not be less than 10gm/dl².

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