ASSOCIATION OF TEENAGE PREGNANCY WITH LOW BIRTH WEIGHT OF NEONATES: TERTIARY CARE HOSPITALS BASED CASE CONTROL STUDY IN PESHAWAR

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ABSTRACT

OBJECTIVES: To determine the association between teenage pregnancy and low birth weight (LBW) of neonates in hospital setting at Peshawar, Pakistan.

METHODS: This case control study was conducted between July and December 2014 at Neonatal Care units of Khyber Teaching Hospital and Hayatabad Medical Complex, Peshawar. Birth weight (BW) of the newborn was measured. Cases (neonates with BW<2.5 kg) and controls (neonates with BW>2.5kg) were matched for socio-economic status. Data was collected by interviewing, using semi-structured questionnaire. Logistic regression analysis was applied to determine the association between teenage pregnancy and LBW after adjustment for potential confounding factors.

RESULTS: Out of 330 newborns (110 cases and 220 controls) analyzed, 219 (66.4%) were males. Mean BW of newborn was 2.64±0.67 kg and gestational age was 37.29±3.7 weeks. Out of 110 LBW newborn, 84 (76%) were premature and 26 (23.6) were full term with LBW (Intrauterine growth restriction- IUGR). In controls, 216 (98.2) were full term with normal BW. Overall 26/330 (7.9%) newborns were with LBW/ IUGR. Teenage pregnancy was found in mothers of 38 (34.5%) cases and 56 (25.5%) controls. Antenatal care was received by 88% of mothers and 63% were uneducated. Prematurity and IUGR were associated with LBW (p=< 0.001) but this was not significant after adjustment for potential confounders. Overall, there was no significant association between teenage pregnancy and LBW (Adjusted O.R: 9.03, p-value = 0.164).

CONCLUSION: LBW was mainly due to prematurity. However, our study could not establish association of LBW with young maternal age.

KEY WORDS: Low Birth Weight (MeSH), Premature Infants (MeSH), Fetal Growth Retardation (MeSH), Pregnancy in adolescence (MeSH).

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INTRODUCTION

Neonatal mortality accounts for 44% of all fewer than five deaths, worldwide. Low Birth Weight (LBW) and prematurity, infections and birth asphyxia are main causes of neonatal mortality.[1] LBW accounts for 60-80% of all neonatal deaths.[2] World Health Organization (WHO) defined LBW as "weight at birth of less than 2,500 grams".[3] LBW mainly results from prematurity (gestational age <37 completed weeks), or intrauterine growth restriction (birth weight <2.5 kg and gestational age >37 weeks) or both.[3,4]

Globally, more than 20 million LBW neonates are born every year; 95.6% of these in developing countries.[3] Pakistan is one of the developing countries with the LBW rate of 32%[5] and has the fourth highest number of preterm births (748,100) in the world.[6] However, available data on LBW are not representative of the general population and are often underestimates[7]; because 65% of deliveries in Pakistan occur at home, without a skilled attendant and babies are usually not weighed at birth[8]. According to Pakistan Demographic Health Survey (PDHS) 2012-13, only 12% of children born were weighed at birth and one-fourth of these were < 2.5 kg[9].

Birth weight is recognized as a major determinant of infant survival, mortality and health outcomes later in life.[10] LBW infants are at higher risk of infectious disease, inhibited physical growth and cognitive development and chronic diseases later in life[3]. LBW children, when grown up, are less productive, thus adding to unemployment and poverty in the society.[11] In Pakistan, prematurity accounts for 16% of neonatal deaths.[8] Pakistan has Neonatal Mortality Rate of 55 per 1,000 live births which has remained unchanged for the last 20 years.[9]

It is generally assumed that prevention of LBW may result in a corresponding reduction in perinatal and infant mortality.[12] Any long term strategy for reducing infant mortality will require identification and improvement in factors that affect birth weight.[13]

Many factors, relating to infant, mother and the environment, determine the infant's birth weight and future health. LBW in developing countries primarily results from poor maternal health[3]. Teenage pregnancy defined as "a teenage girl, usually within the ages of 13-19, becoming pregnant"[14] is suggested to be one of the maternal risk factor for LBW. However, studies investigating association of teenage pregnancy with LBW have reported contradictory results; some studies found the association between teenage pregnancy and LBW, while other studies have attributed poor birth outcomes of teenage pregnancy to low socioeconomic status, illiteracy, lack of antenatal care and contraception rather than to young maternal age.[15-18] The controversy around the association between adolescent pregnancy and LBW might be due to limited sample size and lack of information on confounders.[18]

Pakistan is among the top ten countries in the world with largest number of adolescent child bearing.[19] The Adolescent birth rate is 44 per 1,000 girls aged 15-19 with Khyber Pakhtunkhwa (KP) having the highest percentage (10%) of teenage child bearing.[9] However, there is paucity of research in the area of adolescent sexual and reproductive health in Pakistan[16] and limited published data has been found regarding the outcome of teenage pregnancy. Thus in view of all these a case control study was designed to determine whether teenage pregnancy is associated with increased risk of LBW and with increased rates of intrauterine growth restriction (IUGR) and prematurity and whether the association is independent of the effects of confounding factors. In our study cases and controls were matched for socio-economic status. The study aimed to understand the relationship between young maternal age and LBW, especially in the context of developing countries like Pakistan.

METHODS

The case control study was conducted at the Neonatal Care Units (NCU) of Hayatabad Medical Complex (HMC) and Khyber Teaching Hospital (KTH), Peshawar from July to December 2014. Single, alive newborns >28 weeks of gestation, admitted in neonatal care units of HMC and KTH within 24 hours of birth, were included in the study. Newborn with recognizable congenital anomalies, with maternal history of gestational diabetes mellitus, pregnancy induced hypertension, antepartum hemorrhage, chronic infections or other co-morbidities during present pregnancy, newborn of mothers above 30 years of age or newborns whose maternal age was not known were not included in the study. Sample size was calculated using WHO sample size calculator for case control study with anticipated probability of LBW in teenage mothers: 32% (0.32) and in adult mothers: 8% (0.08) and anticipated Odds Ratio: 5 at 95% confidence level.[20]

Ethical approval was obtained from the Ethical Board of Khyber Medical University, Peshawar and permission was seeked from heads of paediatric department and administration of HMC and KTH, Peshawar. Data was collected by data collectors trained for the purpose. The data was collected through interview technique using pretested structured questionnaire, anthropometry of newborn and abstraction of medical records, when required. Questionnaire was pretested and necessary changes were made as required.

A sample of 330 newborns, fulfilling the inclusion and exclusion criteria, was obtained using consecutive sampling technique. Cases and controls were selected in 1: 2 ratio. 110 newborns with birth weight < 2.5kg were selected as cases. For each case, two consecutive newborns with birth weight > 2.5kg were selected as control (220). Cases and controls were matched for socio-economic status. After enrollment in the study, weight of the newborn was measured with minimum clothing on an infant weighing scale in kilograms, by the trained staff of neonatal care unit and verified by the researcher. Weighing scale was checked and zeroed before weighing. Machine was standardized from time to time. Birth weight of newborn was categorized as Normal birth weight (> 2.5 kg) and Low birth weight (≤ 2.5 kg), following WHO criteria.[3,4] Gestational age of newborn (recorded as completed intrauterine weeks) was determined from Last Menstrual period (LMP) and ultrasound scan in the first trimester (if available).[21] Newborns were categorized into full term (> 37 wks of gestation), premature (< 37 wks of gestation) and IUGR (Birth weight < 2.5 kg and gestational age > 37 Weeks).[3,4] Sex of newborn was also recorded.

Before enrollment in study, the purpose of the study was explained to participants and Informed consent (verbal/written) was obtained. Information was obtained from mothers of the newborn. In cases where newborns were not accompanied by their mothers, information was obtained from accompanying relative. The response rate was 99%. Data was collected for maternal age, socioeconomic status, maternal educational status, parity, obstetric history, antenatal visits and inter pregnancy interval (duration between conception for index pregnancy and the preceding delivery, abortion or stillbirth). Maternal age was recorded as continuous variable as completed years at the time of admission. Information about maternal age was obtained from the mother through interview, verified from her national identity card (if available) as well as from the hospital records and women close relatives accompanying her (father/mother/husband) or from age of menarche.

In case of disparity, the national identity card was used (where available). Mothers of the newborn less than 20 years of age were termed teenage mothers and mothers between 20 and 30 years of age were termed as adult mothers.[17] Antenatal visits during present pregnancy was categorized as > 4 visits and < 4 visits, based on the WHO and UNICEF criteria that women should have minimum of four ANC visits with a skilled health care provider.[22] Socioeconomic status was assessed on basis of monthly household income in Pakistani Rupee (PKR), father occupation and education status, and was categorized into upper, middle and low socio-economic status using Modified Kuppuswamy's Socioeconomic Status Scale.[23] Parents education status was recorded as categorical variable according to level of education achieved. Father occupation was also recorded as categorical variable according to type of occupation.

Statistics

Data was analyzed using statistical package (SPSS 16.0 version). Descriptive analysis including Mean and standard deviation for continuous variables and frequencies, proportions and percentages for categorical variables were done. Chi-square test was used to analyze independent variables across the categories of outcome (LBW and NBW). Method of Logistic Regression was used to determining the risk of LBW in association with neonatal and maternal factors. Univariate analysis was done using Unadjusted Odds Ratio (OR) and 95% Confidence Interval (CI). Multiple logistic regression analysis was applied to determine the association between teenage pregnancy and LBW after adjustment for potential confounding factors and identifying the individual effects of the independent variables. Multivariate analysis was done for the variables that were found to be significant on univariate analysis ($p \leq 0.25$). Adjusted OR and 95% CI were calculated for these. A cut off of $p < 0.05$ was taken as significant in this study.

TABLE 1: DESCRIPTIVE ANALYSIS OF NEONATAL AND MATERNAL CHARACTERISTICS ASSOCIATED WITH LOW BIRTH WEIGHT

Characteristics	Cases (LBW)		Controls (NBW		Total		P-value
	N	%	N	%	N	%	
	110	(33.3)	220	(66.7)			
Neonatal Characteristics:							
Sex:							
Male	71 (64.5)		148 (67.3)		219 (66.4)		0.623
Female	39 (35.5)		72 (32.7)		111 (33.6)		
Gestational Age (Wks):							
Premature	84 (76.4)		4 (1.8)		88 (26.7)		<0.001*
Full Term with NBW	0		216 (98.2)		216 (65.4)		
Full Term with LBW (IUGR)	26 (23.6)		0		26 (7.9)		
Maternal Characteristics:							
Maternal Age:							
< 20 yrs.	38 (34.5)		56 (25.5)		94 (28.5)		0.085
20 -30 yrs	72 (65.5)		164 (74.5)		236 (71.5)		
Age at Marriage:							
< 20 yrs.	78 (70.9)		164 (74.5)		242 (73.3)		0.481
20 -30 yrs	32 (29.1)		56 (25.5)		88 (26.7)		
Age at First Pregnancy:							
< 20 yrs.	68 (61.8)		153 (69.5)		221 (66.97)		0.159
20 -30 yrs	42 (38.2)		67 (30.5)		109 (33.03)		
Parity:							
Primi Para	51(46.36)		94 (42.7)		145 (44.0)		0.152
Multi Para	55 (50)		124 (56.3)		179 (54.2)		
Grand Multi Para	4 (3.64)		2 (1)		6 (1.8)		
Inter Pregnancy Interval:							
< 2 yrs.	60 (85.7)		103 (75.73)		163 (79.1)		0.095
>2 yrs.	10 (14.3)		33 (24.27)		43 (20.9)		
Antenatal Care Received:							
Yes	100 (90.9)		191 (86.8)		291(88.2)		0.278
No	10 (9.1)		29 (13.2)		39 (11.8)		
Antenatal Visits:							
No visits	10 (9.1)		29 (13.2)		39 (11.8)		0.554
< 4 visits	37 (33.6)		70 (31.8)		107 (32.4)		
> 4 visits	63 (57.3)		121 (55)		184 (55.8)		

*Fisher exact test was used to determine the association of gestational age with LBW

RESULTS

Total of 330 newborns were included in the study with 110 cases and 220 controls. Mean (Standard deviation) of birth weight of newborn was 2.64±0.67 kg and gestational age was 37.29±3.7 weeks. Mean age of the mothers was 22.26±3.7 years. There were 219 (66.4%) male newborns. Twenty seven

TABLE II: UNIVARIATE AND MULTIVARIATE ANALYSIS OF NEONATAL AND MATERNAL SOCIO-DEMOGRAPHIC CHARACTERISTICS ASSOCIATED WITH LOW BIRTH WEIGHT

Characteristics Tested	Univariate		Multivariate	
	Unadjusted OR 95% CI	P-value	Adjusted OR 95% CI	P-value
Neonatal Characteristics:				
Sex:				
Male	ref			
Female	1.129 (0.698 – 1.83)	0.621		
Gestational Age (wks):				
Full Term with NBW	ref			
Premature	1.74 (0.59 - 5.14)	<0.001	2.18 (0.526 – 9.10)	0.104
IUGR	5.375 (0.326 – 8.861)	<0.001	0.231 (0.90 – 16.62)	0.105
Maternal Socio-demographic Characteristics				
Maternal Age:				
20 -30 yrs	ref			
< 20 yrs.	1.54 (0.94 – 2.54)	0.086	9.033 (0.407 – 0.200)	0.164
Age at Marriage:				
20 -30 yrs	ref			
< 20 yrs.	1.33 (0.26- 0.81)	0.260	0.56 (0.012 – 25.84)	0.770
Maternal Education Level:				
Uneducated	ref			
< Secondary School	1.34 (0.76 – 2.38)	0.314		
Secondary School	0.76 (0.32 – 1.82)	0.548		
> Secondary School	0.67 (0.27 – 1.66)	0.387		

TABLE III: UNIVARIATE AND MULTIVARIATE ANALYSIS OF MATERNAL OBSTETRIC CHARACTERISTICS ASSOCIATED WITH LOW BIRTH WEIGHT

Characteristics Tested	Univariate		Multivariate	
	Unadjusted OR 95% CI	P-value	Adjusted OR 95% CI	P-value
Age at First Pregnancy:				
20 -30 yrs	ref			
< 20 yrs	1.49 (0.101 - 0.93)	0.101	4.92 ((0.798 – 303.5)	0.448
Parity:				
Primi Para	ref			
Multi/ Grand Multi Para	0.86 (0.54 – 1.37)	0.53		
Inter pregnancy Interval:				
First pregnancy	ref			
≤ 2 yrs.	1.16 (0.71 – 1.89)	0.554	0.291(0.002 – 54.48)	0.644
> 2 yrs.	0.64 (0.29 – 1.43)	0.278	0.398 (0.003 – 153.88)	0.543
Antenatal Care Received:				
No	ref			
Yes	1.52 (0.71 -3.24)	0.280	0.82 (3.23 -2.07)	0.994
Antenatal Visits:				
No visits	ref			
< 4 visits	1.53 (0.67 - 3.48)	0.308		
> 4 visits	1.51 (0.69 – 3.29)	0.301		

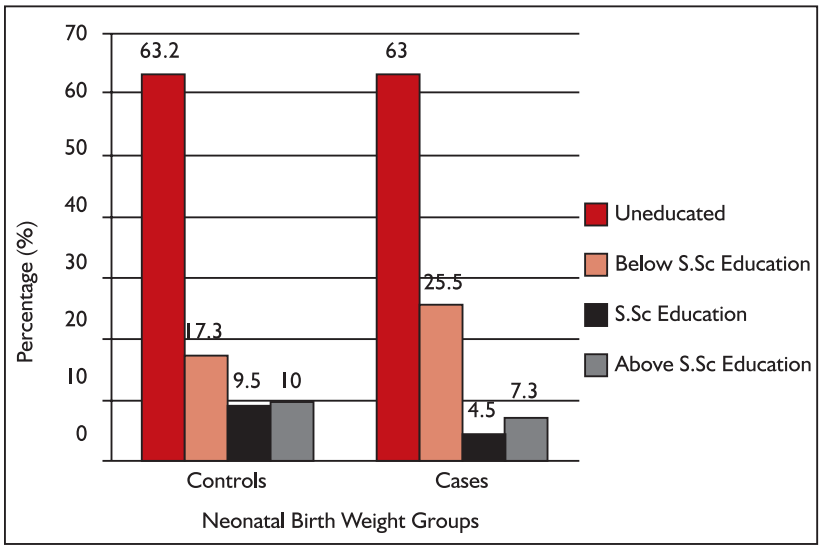

Figure 1: Distribution of maternal education level among cases and controls

percent newborn were premature and 8% were IUGR. Twenty eight percent mothers had < 20 years of age. Teenage marriages (73%) and child bearing (67%) and multiparity (54%) were commonly found in the study. Inter pregnancy interval of < 2 years was found in 79% of study participants. Antenatal care was received by 88% of mothers and > 4 antenatal visits were made by 55.8% mothers in present pregnancy. Sixty three percent of mothers were uneducated.

Descriptive analysis of neonatal characteristics showed no significant difference in the gender distribution of the neonates (p = 0.623) between the cases and controls. Low birth weight was mainly due to prematurity (76.4%). Both prematurity and IUGR were significantly associated with LBW (p < 0.001) (Table 1). Maternal socio-demographic and obstetric characteristics were analyzed in cases and controls and no significant association was found between the LBW and maternal characteristics (Table 1). Maternal age analysis showed that 34.5% of mothers of cases were < 20 years of age as compare to 25.5% mothers of controls, but the association was not significant ((p = 0.086). Age at marriage (p = 0.481) and age at first pregnancy (p = 0.159) also had no significant association with LBW. Interval of <2 years between indexed and previous pregnancy was seen in 85% mothers of cases, however the association was statistically insignificant (p = 0.095). Antenatal care received and >4 antenatal visits made by mothers of cases could not improve birth outcome in term of birth weight. Mothers of both cases and controls were uneducated in equal proportion (63% each). Among educated mothers, education was low for all levels, among mothers of LBW neonates (Figure 1); however, the association was insignificant (p = 0.254).

Logistic Regression analysis was made to determine risk of LBW in association with neonatal and maternal risk factors (Table II and III). On Univariate analysis, the neonatal factors found to be associated with LBW was gestational age. Risk of prematurity and IUGR was significantly higher in LBW newborns. Univariate analysis of maternal factors showed insignificant association of young maternal age with LBW (Unadjusted OR: 1.45, p = 0.086). Similarly increasing maternal education level had protective effect against LBW. However, no maternal factor was found to be associated with LBW. Multi parity and interval between indexed and previous pregnancy of >2 years had protective effect against LBW, however, the associations were statistically insignificant (Unadjusted OR: 0.86, p= 0.531) and (Unadjusted OR: 0.64, p = 0.543), respectively.

Multivariate analysis was made to determine risk of LBW in association with young maternal age after adjusting for potential confounders. Multivariate analysis was done for the variables that were found to be significant on univariate analysis (p≤ 0.25). Risk of LBW was found to be 9 times higher in teenage mothers but association was statistically insignificant (p = 0.164). After adjusting for confounding factors no neonatal and maternal factor was found to be associated with LBW.

DISCUSSION

Hospital based case control study was conducted to determine association between teenage pregnancy and low birth weight. The birth weight was less in male neonates. LBW of newborns was mainly due to prematurity. Majority of mothers were uneducated. Among educated mothers, maternal education at all levels was low for cases. Teenage marriages and pregnancies and multi parity were commonly seen in study participants. Inter pregnancy interval of < 2 years was more in mothers of cases. Antenatal care received and > four antenatal visits made by mothers of cases could not improve birth outcome in term of birth weight. Multiparity and inter pregnancy interval of > 2 years and increasing maternal education level had protective effect against LBW.

Gender analysis of neonates showed that 67% of neonates in our study were male. A study by Taj et al also had more male (66%) neonates in the study and more male neonates with LBW (65.5%).[21] Similar findings were also given by our study. Conversely a study by Afshan Bhatti and colleagues showed female predominance in LBW group (62%).[24] There were 26% premature neonates in our study as compare to 59% preterm births reported by Fariha

Anjum.[10] and 41.6% given by Badshah and colleagues[20] in their hospital based studies in Lahore and Peshawar, respectively.

Significant association was found between LBW and gestational age of newborn in our study. Researchers and clinicians appreciated significant correlation between LBW and gestation of the newborn and that both are useful in assessing newborn prognosis.[25] In our study prematurity was found to be mainly related to LBW. According to WHO report, Pakistan has fourth highest number of preterm births (748,100) in the world.[6]

The significance of preterm birth is attributed to the complications associated with it and the impacts of these complications on the infant's survival and subsequent development.[26] Prematurity accounts for almost half of all newborn deaths and is now the second leading cause of death in children under 5, after pneumonia, worldwide.[6] Preterm neonates are vulnerable to respiratory distress syndrome, chronic lung disease, intestinal injuries, compromised immune system, cardiovascular disorders, hearing and vision problems, and delayed psychomotor development. The complications of preterm birth arise from immaturity of organ systems that are not yet prepared to support life in the extra-uterine environment.[26] The mortality rises continuously with decreasing weight and gestational age.[3] In a study by Imtiaz et al gestational age < 37 weeks (RR, 5.8; 95% CI: 3.4–9.7) and birth weight < 2000 g were found to be significantly associated with neonatal deaths.[27]

Public health significance of IUGR is associated with poor growth in childhood and higher incidence of chronic diseases in adult life.[3] These infants are also at risk of mental retardation, low I.Q, learning disabilities, poor school performance, childhood psychiatric disorders as well as visual and hearing impairments.[27] LBW due to IUGR can be related to maternal under-nutrition before pregnancy, aggravated by under-nutrition during pregnancy.[28] High level of malnutrition contributes toward poor maternal and child health in Pakistan. According to Pakistan National Nutrition Survey (NNS) 2010-11, 50% of children and women are malnourished; more pregnant than non-pregnant women are malnourished.[11]

Our study could not established association of LBW with teenage pregnancy and other maternal risk factors (including maternal education level, early marriage and child bearing, high parity and repeated pregnancies with short inter pregnancy interval) as suggested by literature. Teenage pregnancy is suggested to be one of the maternal risk factor associated with LBW. However, studies on outcomes of teenage pregnancy have provided conflicting results, and opinions of different authors vary in this regard. The relation between teenage pregnancy and has been reported by some studies.[15,16] A study by Tufail and Hashmi at Karachi shows that neonates born to teenage mothers have higher risk of IUGR (5.3% vs.0%, p= 0.043), LBW (32% vs. 12%, p = 0.003).[29] Iacobelli and colleagues found higher proportion of preterm (14 vs. 12%; p = 0.0008) and LBW (17 vs. 14%; p = 0.002) in adolescent pregnancies.[30] However, Satin et al found that the obstetric risk increased only in teenage <16 years of age.[18] The association between young maternal age and adverse pregnancy outcome has been attributed to gynecological immaturity and the growth and nutritional status of the mother. The reduction in fetal growth described in some studies has been proposed to result from competition for nutrients between the still growing adolescent mother and her fetus.[15]

However, other studies have shown no increases in the risks of LBW in association with teenage pregnancy. A study by some by S.A. Rizvi at Karachi showed insignificant association of teenage pregnancy with low birth weight (P = 0.135).[31] In a study by Pun KD in Khatmandu also found no association of LBW with adolescent maternal age (R.R: 1.1, CI: 0.75-1.68).[32] Many researchers have failed to find any evidence of poor birth outcome among teenage mothers with provision of high-quality maternal care with complete coverage.[17] and some studies have actually shown a good outcome of teenage pregnancies in developed countries where high quality maternity care is available.[15] According to Mahfouz et al pregnant teenagers were not a high-risk group if good prenatal care was provided.[18] It is argued that age by itself is not a risk factor but poor outcomes of teenage pregnancy may be attributed to low socioeconomic status, illiteracy, lack of antenatal care, social support and contraception rather than to maternal age.[15,16,17,18] In our study, after controlling for socio-economic status and other confounders, we could not found association between teenage pregnancy and LBW.

Early marriage and child bearing are common traditional practices in Pakistan and there is a social expectation to have a child soon after marriage.[33] Median age at first marriage among women age 25-49 is 19.5 years.[9] Pakistan is also among the top ten countries in the world with largest number of adolescent child bearing,[19] with Khyber Pakhtunkhwa (KP) having the highest percentage (10%) of teenage child bearing. Thirty seven percent of births occur within 24 months after a previous birth.[9] Similar findings were seen in our study where majority of mothers had their marriages and pregnancies in teenage, while half of women had inter-pregnancy interval of < 2 years. Findings similar to our study were given by Kleiijar in his study.[34] However, a study by Afshan Bhatti found that no birth interval or interval < 5 months were significantly associated with LBW (P= 0.009).[24] Nusrat Khan found short interval as an independent risk factor for LBW.[35] Inter-pregnancy interval of > 2 years was found to have protective

effect against LBW in our study, though association was insignificant. World-wide birth interval has been taken defined differently and this aspect needs further research where standard definition and criterion should be made to evaluate it fully in muti-gravda women as risk factor for LBW.[24]

Gravidity and parity are important factors associated with LBW. There were more LBW births to multigravida and multipara mothers in our study. Due to repeated pregnancies and short pregnancy intervals, the risk of having an LBW births increases in multiparous women.[31] However, studies by Afshan Bhatti[24] in Larkana and Taj et al[21] in Peshawar found significant association of primi-parity with LBW. Duration of exposure to the risk of pregnancy depends primarily on the age at which women first marry. Women who marry early, on average, are more likely to have their first child at a young age and give birth to more children overall, contributing to higher fertility.[11] Early child bearing repeated pregnancies and short inter-pregnancy interval are key factors associated with high fertility rate and explosive population growth in Pakistan. Social norms, poverty, illiteracy, lack of awareness about reproductive sexual health, lack of access to family planning services, incorrect use of contraception can explain these practices.[9,14]

Findings of our study, regarding antenatal care, are supported by PDHS 2012-13 statistics, showing that seventy five percent of mothers received antenatal care and more than thirty seven percent of pregnant women make four or more antenatal care visits during their pregnancy.[9] However, antenatal care received by most of the mothers during present pregnancy and frequent antenatal visits made by mothers in our study could not be associated with better neonatal outcome in terms of birth weight. Similarly studies by Taj et al[21] and Afshan Bhatti[24] showed no significant association between LBW and antenatal care as observed in our study. However, the importance of antenatal care into better obstetric outcome cannot be overlooked. According to, Fariha Anjum antenatal booking (OR – 3.38, $p < 0.001$) and less than three antenatal visits ($p < 0.001$), were significant risk factors associated with LBW.[10] Thus, antenatal care form skilled health care provider has an impact on general health of the mother and child as well as reduce the risk of maternal and neonatal complication and mortality during pregnancy and delivery.[9,36] The WHO recommends a minimum of four antenatal visits. However, it is the quality of the visits rather than the number of visits that is of primary concern.[22] The components of an antenatal care visit are an essential indicator of the quality of health services provided to pregnant women. Ensuring that every pregnant woman receives basic information about pre existing health conditions (e.g; anemia, hypertension), potential complications, and birth preparedness should be a routine part of antenatal care.[9]

Our study could not found association of maternal education level with LBW. Similarly, illiteracy was found to be insignificantly associated with LBW in study by Taj et al[21] Low education level of all mothers in general and those of LBW neonates in particular was found in our study. Low level of literacy for women is also given in PDHS 2012-13, showing that 57% of ever-married women age 15-49 have never attended school and 9% have reached education higher than secondary school level. In Khyber Pakhtunkhwa, 72% of the women have never attended the school. Education level is closely related to socio-economic status[9] and lower education level of our study participants can be explained by their low socio-economic status.

However, the significance of maternal education level cannot be overlooked. A study by Elshibly and Schmalisch in Sudan showed that the number of years of education was positively correlated with birth weight ($p = 0.01$). The LBW rate decreased from 9.2% for ≤ 8 years of education to 6.0% for >12 years of education.[37] Similarly Matin A. and colleagues in Bangladesh found highly significant association of maternal education with LBW (p-value < 0.0001).[38] Higher maternal education level was found to have protective effect against LBW in our study; however, the association was insignificant.

Premature births, in our study, were mainly found to be related to LBW. High rate of premature births in our study need further investigations. Prematurity is the second leading cause of neonatal mortality and poor child health indicators of Pakistan demand to pay attention to the issue. Low birth weight due to IUGR in our study may indicate poor maternal nutritional status, highly prevalent in Pakistan. Low education level of mothers, found in our study, is an area of concern. Similarly early marriage and child bearing, repeated pregnancies with short inter pregnancy intervals among study participants are important issues to be addressed. Our study could not established association of LBW with teenage pregnancy and other maternal risk factors (including maternal education level, early marriage and child bearing, high parity and repeated pregnancies with short inter pregnancy interval) as suggested by literature. Population based studies with a large sample size are required to determine the risk factors associated with LBW.

Strength and Limitations

Most of studies argued that association between young maternal age and LBW is due to confounding effect of socio-economic factors. In order to control this effect we matched cases and controls for socio-economic status. The weighing scales used in study were standardized and calliberated to remove systematic error in data collection. To reduce recall and reporting biases, and to ensure the validity of data, the data was cross checked with hospital records, obtained information from close relatives

and checked available record with the participants.

Limitations of study include; firstly it was an observational study design (case control) and evidence generated to measure association between teenage pregnancy and LBW may not be strong. Secondly, the data collected was based on information provided by the study participants, which are subject to recall and reporting biases. Thirdly, information about maternal age was obtained from the mother/her close relatives (father/mother/husband) or from age of menarche, verified from her national identity card (if available) as well as from the hospital records. In case of disparity, the national identity card was used (where available). There was no other available tool for validating this information. The errors in assessment of maternal age for both cases and controls were obtained in a similar manner distributed equally between two groups. Finally, it was a hospital based study, care should be observed while generalizing study results to general population.

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CONFLICT OF INTEREST

Authors declared no conflict of interest

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AUTHOR'S CONTRIBUTION

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AI: Conception, acquisition & analysis of data, drafting the manuscript, final approval of the version.

ZUH: Analysis of data, drafting the manuscript.

MB: Acquisition of data, drafting the manuscript.

SF: Study design, drafting the manuscript, critical review, supervision, final approval of the version.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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