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Prevalence And Modeling For Low Birth Weight Neonates With Maternal Risk Determinants

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ABSTRACT

Objective: The current survey based study is conducted to get the maternal determinants towards low birth weight (LBW) in neonates.

Methods and Materials: This cross sectional study was conducted and analyzed on 600 neonates. Data collected from different hospitals of Pakistan were used to determine the influence of possible factors on LBW. Various statistical tools were used to analyze the collected data; i.e., Chi square test, t-test, odds ratio and logistic regression analysis.

Results and Conclusion: It has been observed that total fifteen out of twenty seven factors, i.e., the number of physician visits, smoking status, number of children, physical work, level of hemoglobin, blood pressure, gender of baby, household helper, psycho-social stress, nutrition, domestic violence, periodontal disease, hormonal abnormalities, susceptibility to various infections and nature of birth are the major risk factors of LBW in neonates.

Conclusion: Major risk factors that engender the LBW need to address properly through suitable healthcare programs to curtail the loss as well as contribute in building a healthy nation.

Keywords: Newborn, Socioeconomic Status, Epidemiology, Health correlates, Morbidity

INTRODUCTION

Low birth Weight (LBW) is considered as weight less than 2,500 g (5.5 pounds) at the time of delivery (WHO, 1992; UNICEF, 2004). LBW is a vital sign of reproductive health and universal health condition of residents which depends on a number of reproductive, nutritional, demographic, and socioeconomic features, all potentially playing a significant role. It has been reported that every year, around 21 million LBW babies are born. A number of causes of LBW included economic condition, parent's education, maternal hemoglobin (Hb) level, maternal age, maternal nutrition antenatal care, tobacco use and parity (Kadam et al., 2013; WHO, 2014; Dongming et al., 2016). It is well evident that, family planning has good effects on mother and child health. By increasing birth intervals, health status of mother and children can be improved. In addition, gestational age is very necessary for birth weight because birth weight increases with gestational age. (Gibbs et al., 2012).

Maternal dynamic smoking amid pregnancy actuates birth weight decline and essentially builds the danger of LBW (Lieberman et al., 1994; Ko et al., 2014). There is no important relationship with maternal age and society with birth weight. Moreover, a superior occurrence of LBW babies born to uneducated mothers is observed. Mothers belonging to poor socioeconomic class have greater ability of delivering LBW babies. Likewise, parity has an important association with birth weight and higher birth weight has been observed among women with higher parity. There is no significant association of LBW with gender of the neonate. It has been found that motherly food crisis and anemia have a major connection with LBW (Prudhivi and Bhosgi, 2015). LBW is intimately linked with neonatal and fetal morbidity and mortality, cognitive growth and inhibited development, and chronic diseases afterward in life (Barker, 1995; Alexander et al., 2014; Deng et al., 2016). LBW can damage the growth of new born and is related to the elevated death rate, augmented morbidity, impaired mental development and chronic adult disease. Maternal short body mass index (BMI), prim parity and number or short delivery gap are linked hazards for delivery of LBW babies (Bhatti et al., 2010).

LBW is a universal health problem but prominent in the developing countries. According to an estimate of WHO, about 25 million LBW offspring born per year at world level (Pawar and Kumar, 2017). From 18 Asian countries, almost 13% of births (generally 1 out of 7) are LBW. There is an important local split among countries in Eastern Asia (China, Korea and Mongolia) and Southern Asia (Pakistan, Bangladesh, India, Nepal, and Sri Lanka). The rate of LBW varies from an average of 6% in Eastern Asia to 24% in Southern Asia. Overall, 19 million infants every year in the rising world, weight less than 2500 g and more than half are born in Southern Asia. In Pakistan, every 32 of 100 children has LBW (SOS, 2013; UNICEF, 2013). Birth weight is the indicator of maternal health and socioeconomic status as well as the future health of the newborns. In Europe, the occurrence of LBW is 1 in every 17 infants (i.e. almost 6%) thus a few provinces of Asia the occurrence is of 1 in every 2 infants. LBW is an ordinary contributor to child and baby death and has a recognized relationship with babyhood morbidity and elongated developmental squeal (Anjum et al., 2011). Survived LBW children have faced a greater incidence of diseases, retardation in cognitive growth and malnutrition (Badshah et al., 2008). Pregnancy heed is an essential element of primary health concern (Sheoran et al.,

2011). This happens still more vital in countries with awfully high infant mortality like Pakistan. Plan for antenatal care program desires to be evaluated in order to give valuable pregnancy care.

Associations between socio-economic status, nutritional predictors, physical jobs, laborers, preterm LBW babies, oral health conditions of a pregnant woman with other risk factors such as blood pressure and blood sugar has already been studied (Yilgwan et al., 2012; Mumbare et al., 2012; Kader and Perera, 2014). The objectives of this study were to collect the data regarding LBW with several potential risk factors and to assess the association of different qualitative factors. Furthermore, Chi-square test was used to find out whether there was a few statistically major variations between definite groups of maternal uniqueness among many others isolated the risk factors for LBW (Limwattananon et al., 2011; Jeong et al., 2014; Jacob and Nath, 2014).

MATERIALS AND METHODS

Study Design

This non-interventional, multi-center, cross sectional study was conducted at two hospitals; Civil Hospital, Sahiwal and Fatima Memorial Hospital, Multan in Punjab, Pakistan. A total of 600 subjects or neonates were examined to investigate the risk factors of LBW. The subjects were selected using convenience sampling method and visiting the hospitals for the period of one year.

Assessment Questionnaire

For data collection, the validated questionnaire signifying different demographic variables and risk factors associated with LBW were used. The questions were asked from the mothers of neonates and responses were noted down on the questionnaire. The study was conducted in accordance with the principles stated in the Declaration of Helsinki (1961) and its subsequent revisions, Good Clinical Practice guidelines, as well as the national laws. Prior approval of the study was obtained from the concerned Research and Ethics Committees of the hospitals.

Data Analysis

For data analysis, the techniques used were Chi-square, t-test, odds ratio and logistic regression analysis (Richard et al., 2003). Multivariable logistic regression is the arithmetical method used to approximate the chance of a dichotomous result such as the existence or nonappearance of a disease or death. Chi-square analysis was used to evaluate the observed data to get precise assumption. Odds ratio is the calculation of relationship among an exposure and a result (Szumilas, 2010). Chi-square test was used to verify the connection between quantitative variables. The t-test and logistic regression were used to test the mean of qualitative variables and model the LBW withb different factors, respectively. Concordant pairs, discordant pairs, Somers'D, Goodman-Kruskal Gamma were used to assess the association of different qualitative factors. All the statistical analyses were performed through Minitab and SPSS software programs.

RESULTS

In the current survey based study, the data is set to determine the association of LBW and various factors. The analyzed data showed the percentage of LBW and normal birth weight neonates were 14.5% and 85.5%, respectively. The percentage of male and female neonates was 54.67% and 45.33%, respectively and smoker and non-smoker was 2.33% and 97.67%. Similarly, the percentage of women performing physical hard work and nonphysical hard work during pregnancy was 78.17% and 21.83%, respectively. The percentage of household women and non-household women was 60.67% and 39.33%, respectively. In the same way, the percentage of the women possessing psycho-social stressor was 21.83% whereas, 78.17% was observed without any psycho-social stressor. The percentage of women taking good and poor nutrition was 77.17% and 22.83%, respectively. The current study also showed the percentage of abortion for the first three consecutive times were 75.67%, 24.0% and 0.33%, respectively while the percentage of domestic and non- domestic violence was 20.67% and 79.33%, respectively. It was also observed from the current study the percentage of periodontal disease and non-periodontal disease was 14.67% and 85.33% while the percentage of hormonal abnormalities and non-hormonal abnormalities in the women were 12.67% and 87.33%, respectively. In the similar way the percentage of susceptibility to various infections and otherwise is 12.17% and 87.83%, respectively. The current study also showed that the percentage of normal birth and cesarean was 66.83% and 33.17%, respectively. The association between LBW and physical hard work, gender of the baby, household worker, psycho-social stressor, nutrition, domestic violence, periodontal disease, hormonal abnormalities, and nature of birth, smoking status and susceptibility of various infections were expressed through Chi-square test (Table 1).

Table 1: Association between birth weight and quantitative variables

Variables	Chi-square value	P-value	Remarks
Birth weight vs smoking status	2.289	0.130	Non-significant
Birth weight vs physical hard work	13.302	0.000	Significant
Birth weight vs gender of baby	7.249	0.007	Significant
Birth weight vs presence of household helper	6.547	0.011	Significant
Birth weight vs psycho-social stressor	15.450	0.000	Significant
Birth weight vs nutrition	30.933	0.000	Significant
Birth weight vs domestic violence	11.847	0.001	Significant
Birth weight vs periodontal disease	13.571	0.000	Significant
Birth weight vs hormonal abnormalities	4.346	0.037	Significant
Birth weight vs susceptibility of various infections	1.467	0.226	Non-significant
Birth weight vs recurring infections	1.186	0.276	Non-significant
Birth weight vs nature of birth	4.756	0.029	Significant

Subsequently, the results observed in Table 2 using t-test indicated that the average age of mother in our data set was equal to 26 years, the average short inter pregnancy interval was 16.2 months (Gibbs et al., 2012), the average income was PKR 48,500 per month, the average level of Hb of mother was 10.1 g/dL, the average systolic and diastolic blood pressure of mother was 125.2 and 69.3, respectively, the average mother height and weight was 5.2 feet and 61.5 kg, respectively, the average mother postpartum weight was 56.2 kg and the average mother BMI was 25.4 (Deshpande et al., 2011).

Table 2: Mean testing of qualitative variables

Variable	Hypothesis	t-value	P-value	Remarks
Age of mother	H_0:μ=26 vs H_1:μ≠26	0.99	0.324	Non-significant
No of physician visits	H_0:μ=5.2 vs H_1:μ≠5.2	-1.79	0.073	Non-significant
Short inter pregnancy interval	H_0:μ=16.2 vs H_1:μ≠16.2	1.13	0.260	Non-significant
No of children	H_0: μ=2.5 vs H_1: μ≠2.5	1.64	0.101	Non-significant
Income	H_0:μ=48500 vs H_1:μ≠48500	0.98	0.330	Non-significant
Level of hemoglobin	H_0:μ=10.1 vs H_1:μ≠10.1	0.43	0.671	Non-significant
Diastolic	H_0:μ=69.3 vs H_1: μ≠69.3	1.13	0.258	Non-significant
Systolic	H_0:μ=125.2 vs H_1:μ≠125.2	1.47	0.143	Non-significant
Mother height	H_0:μ=5.2 vs H_1:μ≠5.2	-2.28	0.023	Significant
Mother weight	H_0:μ=61.5 vs H_1:μ≠61.5	1.54	0.123	Non-significant
Mother postpartum weight	H_0: μ=56.2 vs H_1:μ≠56.2	1.92	0.055	Non-significant
Mother body mass index	H_0:μ=25.4 vs H_1:μ≠25.4	1.03	0.304	Non-significant

The results or logistic regression analysis are expressed in Table 3. The logistic regression results showed that -0.0407 was the average rate of change in log of odds due to unit change in age of mother. Similarly, -0.253 was determined for the no. of physician visits, 0.063 for smoking status, 0.032 for short inter pregnancy interval, 0.235 for the no of children, -0.152 for education level, 0.0000081 for the income, -1.731 for physical hard work, 1.571 for level of hemoglobin, 0.0466 for diastolic blood pressure, -0.012 for systolic blood pressure, 0.004 for gender of baby, 0.154 for category of the presence of household helper, 0.176 for mother body mass index, 1.857 for mother height, -0.045 for mother weight, -0.064 for mother

postpartum weight, 0.034 for psycho-social stress, 1.389 for category of nutrition, -0.140 for previous reproductive loss, -0.503 for domestic violence, -0.293 for periodontal disease, 0.045 for hormonal abnormalities, -0.333 for susceptibility of various infections, 0.219 for recurring infections and -0.483 for nature of birth.[22,29] (Kader and Perera, 2014; Pinzon-Rondon et al., 2015). The model is good fit as the results of the goodness of fit test are expressed in Table 4.

Table 3: Logistic Regression Analysis

Predictor	Coefficient	P-value	Odds ratio
Constant	-20.6386	0.106	----
Age of mother	-0.0407850	0.254	0.96
No of physician visits	-0.253134	0.046	0.78
Smoking status	0.0638560	0.938	1.07
Short inter pregnancy interval	0.0326289	0.236	1.03
No of children	0.235177	0.048	1.27
Education level	-0.152016	0.132	0.86
Income	0.0000081	0.464	1.00
Physical hard work	-1.73165	0.001	0.18
Level of hemoglobin	1.57180	0.000	4.82
Diastolic	0.0466437	0.008	1.05
Systolic	-0.0120226	0.344	0.99
Gender of baby	0.0040693	0.982	1.00
Presence of household helper	0.154680	0.590	1.17
Mother body mass index	0.176693	0.404	1.19
Mother height	1.85710	0.431	6.41
Mother weight	-0.0455511	0.701	0.96
Mother postpartum weight	-0.0644686	0.438	0.94
Psycho-social stress	0.0342945	0.931	1.03
Nutrition	1.38983	0.000	4.01
Previous reproductive loss	-0.140915	0.687	0.87
Domestic violence	-0.503337	0.196	0.60
Periodontal disease	-0.293663	0.457	0.75
Hormonal abnormalities	0.0457362	0.919	1.05
Any infection with high fever	-0.333780	0.467	0.72
Recurring infections	0.219758	0.589	1.25
Nature of birth	-0.483159	0.144	0.62

Table 4: Goodness of fit tests

Method	Chi-square	df	P-value
Pearson	562.199	574	0.630
Deviance	358.478	574	1.000
Hosmer-Lemeshow	16.539	8	0.035

From Table 5, the positive values of measure of association showed the strong positive tendency between the birth weight and predicted probabilities. The estimated odds ratio of LBW and smoking status was 1.07; LBW and physical hard work during pregnancy was 0.18, LBW and gender of baby was 1, LBW and presence of household helper during pregnancy was 1.17; LBW and psycho-social stress during pregnancy was 1.03; LBW and nutrition was 4.01, LBW and domestic violence during pregnancy was 0.60; LBW and periodontal disease was 0.75; LBW and hormonal abnormalities was 1.05; LBW and susceptibility of various infections was 0.72; LBW and recurring infections was 1.25, and LBW and nature of birth was 0.62
The contribution of socioeconomic status in offspring health during pregnancy has also been observed retrospectively. It has been noted that the lower the socioeconomic status the higher the incidence of complications of pregnancy and resultantly greater the number of LBW babies were born.
As indicated in the Table 5, the concordant pairs are greater than the discordant pairs and resultantly their percentages, the strong positive association observed. Moreover, the values of Somer's D and Goodman-Kruskal Gamma (both are at 0.69, which is positive and greater than 0.5) reach at the same conclusion.

Table 5: Measures of Association

Pairs	Number	Percent	Summary measures	
Concordant	37654	84.4	Somers' D	0.69
Discordant	6804	15.2	Goodman-Kruskal Gamma	0.69

Discussion

Current study was designed to determine the relation between the LBW and various factors. Based on the Chi-square test (Table 1), it was observed that there was a strong association between LBW and physical hard work, gender of baby, presence of household helper, psycho-social stressor, nutrition, domestic violence, periodontal disease, hormonal abnormalities and nature of birth (Coutinho et al., 2011). A significant difference was observed between the incidence of LBW neonates and above mentioned factors. However, the chances of LBW were non-significant in case of smoking status, susceptibility of various infections and recurrence of infections.

Subsequently, the results mentioned in Table 2 using t-test indicated that the average age of mother, the no. of physician visits, the duration of short inter pregnancy interval, no. of children, the average income, the level of Hb in the mother, the average systolic and diastolic blood pressure, the height and weight of mother, the mother postpartum weight and the body mass index of the mother impart a non-significant impact on the LBW of the neonates (Deshpande et al., 2011).

It was observed on the basis of logistic regression analysis (Table 3), that the no. of physician visits, no. of children, physical hard work, level of Hb, diastolic blood pressure and nutrition were the major risk factors of LBW (Mahumud et al., 2017). The logistic regression results, i.e., coefficient, p-value and odds ratio indicated that a positive association was present between the birth weight and predicted probabilities (Kader and Perera, 2014; Pinzon-Rondon et al.,

2015). Association between different factors can also be calculated by the odds ratio. Two events are independent if the odds ratio equals to '1', means that the odds of one event are the same in the existence or non-existence of the second event. If it is greater than '1', then two events are positively associated in such a way that that odds of first are greater than the other one and vice versa for the less than '1' values of the odds ratio. The odds ratios of smoking, household worker, psycho-social stress during pregnancy, hormonal abnormalities, nutrition and recurring infections are greater than '1', show positive association of these factors towards LBW. However; physical hard work, domestic violence during pregnancy, periodontal diseases, susceptibility of various infections and nature of birth having odds ratios less than '1', show negative association of these factors towards LBW (Talie et al., 2019; Rajashree et al., 2015). From Table 4 the results of goodness of fit test shows that the model is good fit as indicated through the p-values.

The contribution of socioeconomic status in offspring health during pregnancy of mother has also been observed retrospectively and vice versa. It has been noted that the lower the socioeconomic status, the higher the incidence of complications of pregnancy and resultantly greater the number of low birth weight babies are born. Also the health status and survival of both mother and child become low. Moreover, many community characteristics related to socioeconomic status are negatively associated with LBW.

CONCLUSION

In the current study, the maternal determinants of LBW were determined by applying variable factors influencing on it. Number of physician visits, smoking status, number of children, physical hard work, level of hemoglobin, diastolic blood pressure, gender of baby, presence of household helper, psycho-social stress, nutrition, domestic violence, periodontal disease, hormonal abnormalities, and susceptibility of various infections and nature of birth are the major maternal determinants or risk factors which highly influence on LBW. The problem of LBW in Pakistan needs to focus special attention and research required on innovative strategies to attempt and identify protective measures to address this nature of issue, i.e. LBW aggressively. Health awareness programs to be delivered by health workers and experts in the villages, remote area and at educational institutions and through media campaign should be carried out. Moreover, there should be a proper rest and nutrition to be provided the mothers during pregnancy in order to minimize the LBW rate in neonates. Recommendations for events to make the most of force concern falling LBW are proposed both for the public and for the biomedical, public health and research communities.

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