Research Report

On

THE STUDY OF MEDICAL AND NON-MEDICAL RISK FACTORS ASSOCIATED WITH LOW BIRTH-WEIGHT IN NEPAL.

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Chapter 1.0: INTRODUCTION

1.1 Context

Low birth-weight is a weight at birth less than 2,500 gram (up to and including 2,499 gram) irrespective of gestational age[1]. More than 20 million infants worldwide, representing 15.5 percent of all births are born with low birth-weight (LBW), 95.6 percent of them in developing countries. Half of all low birth-weight babies are born in South-central Asia, where more than a quarter (27 per cent) of all infants weighs less than 2,500 gram at birth[2]. In Nepal, 21 and 14 percentage of low birth-weight babies was reported in DHS 2001 and 2006 respectively[3]. This is based on epidemiological observations that infants weighing less than 2,500 gram are approximately 20 times more likely to die than heavier (normal babies).A child's birth weight is an important indicator of a child's vulnerability to the risk of childhood illness and the chances of survival.

LBW has been associated with higher probabilities of infection, malnutrition and handicapped conditions during childhood, mental deficiencies and problems related to behavior and learning during childhood[4, 5]. Children who survive LBW have a higher incidence of diseases, retardation in cognitive development and undernourishment.
There is also evidence that LBW or its determinant factors are associated with a predisposition to higher rates of diabetes, cardiac diseases and other future chronic health problems [6, 7].

Low birth-weight due to restricted foetal growth affects the person throughout life and is associated with poor growth in childhood and a higher incidence of adult diseases, such as type 2 diabetes, hypertension and cardiovascular disease. An additional risk for girls is having smaller babies when they become mothers[8].

The biological processes that affect the fetus in utero are related to the mother's physiology, including her nutrition (mother's weight before pregnancy and history of having newborns with LBW), exercise, infections and consumption of tobacco, alcohol and other drugs[9, 10]. During the fetal phase, growth depends on the nutritional condition of the mother, indicating that pregnant women should not only increase their weight but also consume essential nutrients. For many women in the developing world however, economic, social and cultural factors make it difficult for them to obtain the necessary food and health care, which are closely interrelated. Some researchers consider that health, therefore, may be an important determinant of opportunities in life and this process termed 'selection by health', and suggest that health 'selects' people in different social strata[11, 12]. The socio-economic factors are income, education, occupation, household leadership and gender differences related to roles within the family[13, 14].

Low birth-weight has long been used as an important public health indicator. Low birth-weight is not a proxy for any one dimension of either maternal or perinatal health outcomes. Globally, the indicator is a good summary measure of a multifaceted public health problem that includes long-term maternal malnutrition, ill health, hard work and poor pregnancy health care[2].

The independent effect of each of the factors for LBW is still debatable. The present study high lightened selected independent factors of LBW through multiple regression analysis and thus would have contributed in reducing the incidence of low birth weight by giving more attention to them.

The objective of the research was to study medical and non-medical risk factors associated with low birth-weight in Janakpurdham.

1.2 Importance and Justification of the Study

The registration of a vital event such as birth is incomplete in many developing countries, with only about 60 per cent of births registered worldwide [15].

An adjustment procedure originally proposed in 1996 by Boerma et al. used the mother's subjective assessment of the infant's size at birth (i.e., very large, larger than average, average, smaller than average, very small) in addition to the birth-weight data 16. Also in Nepal, DHS (2006) used mother's subjective assessment of the infant's size at birth in addition to the birth weight data. Children whose birth-weight is less than 2,500 gram or children reported to be very small or smaller than average are considered to LBW. In the absence of birth weight, a mother's subjective assessment of the size of the baby at birth may be a useful proxy. This study was conducted on hospital births newborns and weight was calculated to define low birth weight.

Survey data are limited since the majority of infants in developing countries are not weighed at birth.

The reduction of low birth-weight also forms an important contribution to the Millennium Development Goal (MDG) for reducing child mortality. This study helps to give overall situation of LBW in that place.

Globally, LBW indicator is good summary measure of a multifaceted public health problem that includes long term maternal malnutrition, ill health, hard work and poor pregnancy health care. This study helps to measure such health outcomes in with local context of Nepalese people.

This study helps to explore medical and non medical maternal risk factors associated with low birth-weight such as age, birth order, smoking status, residence, ecological zone, education, socio-economic status, antenatal care, hypertension, diabetes, toxemia in pregnancy, nephritic syndrome etc.

Low birth-weight is an important predicator of health; efforts must therefore go into measuring it as accurately as possible at birth or within 24 hrs for find out prevalence of LBW and to recommend for planning infant care accordingly.

1.3 Objective of the study

General Objective:

- To study the medical and non-medical risk factors associated with low birth-weight in Nepal.

Specific Objectives:

- To calculate the prevalence of low birth-weight.
- To find out the effect of various medical and non-medical risk factors on the birth weight of institutionally delivered newborns.
- To analyze maternal risk factors associated with low birth-weight.
- To recommend policy makers as well as managers to plan implement effective safe motherhood programme.

Chapter 2.0: REVIEW OF LITERATURE

Low birthweight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams (5.5 pounds). This is based on epidemiological observations that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies. More common in developing than developed countries, a birthweight below 2,500 g contributes to a range of poor health outcomes. The goal of reducing low birthweight incidence by at least one third between 2000 and 2010 is one of the major goals in 'A World Fit for Children', the Declaration and Plan of Action adopted by the United Nations General Assembly Special Session on Children in 2002. The reduction of low birthweight also forms an important contribution to the Millennium Development Goal (MDG) for reducing child mortality. Activities towards the achievement of the MDGs will need to ensure a healthy start in life for children by making certain that women commence pregnancy healthy and well nourished, and go through pregnancy and childbirth safely. Low birthweight is therefore an important indicator for monitoring progress towards these internationally agreed-upon goals.

A baby's low weight at birth is either the result of preterm birth (before 37 weeks of gestation) or due to restricted foetal (intrauterine) growth. Low birthweight is closely associated with foetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life. Many factors affect the duration of gestation and foetal growth, and thus, the birthweight.

They relate to the infant, the mother, or the physical environment and play an important role in determining the birthweight and the future health of the infant. Birthweight is affected to a great extent by the mother's own foetal growth and her diet from birth to pregnancy, and thus, her body composition at conception. Mothers in deprived socio-economic conditions frequently have low birthweight infants. In those settings, the infant's low birthweight stems primarily from the mother's poor nutrition and health over

a long period of time, including during pregnancy, the high prevalence of specific and non-specific infections, or from pregnancy complications, underpinned by poverty.

Physically demanding work during pregnancy also contributes to poor foetal growth. More than 20 million infants worldwide, representing 15.5 per cent of all births, are born with low birthweight, 95.6 per cent of them in developing countries. The level of low birthweight in developing countries (16.5 per cent) is more than double the level in developed regions (7 per cent).

Half of all low birthweight babies are born in South-central Asia, where more than a quarter (27 per cent) of all infants weigh less than 2,500 g at birth. Low birthweight levels in sub-Saharan Africa are around 15 per cent. Central and South

America have, on average, much lower rates (10 per cent), while in the Caribbean the level (14 per cent) is almost as high as in sub-Saharan Africa. About 10 per cent of births in Oceania are low birthweight births. One of the major challenges in measuring the

incidence of low birthweight is the fact that more than half of infants in the developing world are not weighed. In the past, most estimates of low birthweight for developing countries were based on data compiled from health facilities.

However, these estimates are biased for most developing countries because the majority of newborns are not delivered in facilities, and those who are represent only a selected sample of all births.

In recent years, household survey data have become much more widely available, and procedures have been applied to these data that adjust for the underreporting and misreporting of birthweights. The analysis presented in this report includes these data for the first time and thus represents a major improvement over past assessments. The rates, nonetheless, are still likely to underestimate the true magnitude of the problem.

Rizvi SA et al. 18 (Maternal risk factors associated with low birth weight in Karachi: a case-control study. The Eastern Mediterranean Health Journal, Volume 13 No. 6 November December, 2007.) The study found that maternal risk factors associated with low birth weight (LBW) among women aged 15-35 years, They carried out a hospital-based, case-control study on 262 cases (mothers of neonates weighing < or = 2.5 kg) and 262 controls (mothers of neonates weighing > 2.5 kg). Odds of delivering a low-birth-weight baby decreased with increase in maternal haemoglobin [odds ratio (OR): 0.701; 95% confidence interval (CI): 0.62-0.79]. Odds were greater among mothers not using iron supplements during pregnancy (OR: 2.88; 95% CI: 1.83-4.54). Mothers of LBW babies had lower haemoglobin levels before delivery.

.**Joshi HS et al**. 19 (Risk Factors Associated with Low Birth Weight in Newborns: Indian Journal of Community Medicine Vol. 30, No. 4, October-December, 2005.) The study revealed that Overall mean birth weight was found to be 2.64 + 0.444 kg (95% CI 2.59 - 2.69). Out of total 34.37% newborns were weighing less than 2.50 kg (95% CI 28.58-40.22). Among these LBW babies majority (27.73%) were in the weight group of 2.00-2.50 kg. Proportion of LBW was 32.59% in males and 36.37% in females, however this difference was not found to be statistically significant. Maternal education ($c2 = 9.42$, $p < 0.05$), occupation ($c2 = 8.14$, $p<0.02$) and per capita income of the family per month ($c2 = 22.02$, $p<0.001$) were found to be significantly associated with birth weight of the newborn. 45.45% of the babies born to illiterate mothers and 43.94% of babies born to mothers who were labourers by occupation were of LBW.

Proportion of LBW babies was maximum (52.56%) in mothers of low income group (percapita income less than Rs. 150 per month). Association between religion and birth weight was found to be insignificant ($c2 = 4.12$, $p> 0.05$).The utilization of antenatal care was adequate (> 3 antenatal visits) in 58.20% mothers. Proportion of LBW was maximum (61.76%) in mothers who did not receive any antenatal care, followed by those who received inadequate care, in whom LBW proportion was 46.57%. There was significant association between birth weight and utilization of antenatal care by mothers ($c2 = 26.01$, $p < 0.001$).

Out of 177 births, birth interval in relation to previous birth was found to be less than 3 years in 74.01% mothers. In these mothers 42.75% of newborns were LBW as compared to 19.57% in those with birth interval more than or equal to 3 years. Here the birth weight was found to be significantly associated with birth interval in relation to previous birth.

Proportion of babies born with LBW was 53.45% in mothers who were less than 20 years of age. In newborns of birth order fourth and above, 51.28% were LBW. In mothers with

BMI less than or equal 20 (kg/m2) 47.25% newborns were LBW. Maternal age ($c2 = 10.19$, $p < 0.01$), Parity ($c2 = 13.4$, $p<0.01$) and BMI ($c2 = 17.57$, $p<0.001$) were found to be significantly associated with LBW. Out of 256, 123 (48.05%) mothers had significant illness during their pregnancy. Of these mothers 51.22% delivered LBW babies.

Out of 76 newborns delivered by anaemic mothers 61.84% were LBW. There is significant association between maternal illness and LBW ($Z=5.75$, $p<0.001$). Strength of association was maximum with severe anaemia ($c2 = 39.68$, $p< 0.001$). Out of the total, 71 (27.73%) mothers had some complication during the present pregnancy and 39 (54.93%) newborn delivered by them were LBW. 75% of newborns delivered by mothers suffering from pre-eclampsia and eclampsia during present pregnancy were LBW, followed by the Ante Partum Haemorrhage (53.85%) and Malpresentation (46.75%). The association between maternal complication during present pregnancy and LBW was found to be statistically significant ($Z=4.22$, $p<0.001$).

Hirse ss et al. (Determinants of low birth weight: a community based prospective cohort study. 1994 Oct; 31(10):1221-5 K.E.M. Hospital Research Centre, Rasta Peth, Pune.) The study aimed at identifying and quantifying determinants of low birth weight (LBW) by following a community based prospective cohort of pregnant women in 45 villages in Pune district. In the 1922 live births born to mothers without a chronic illness, in whom birth weight was available within 24 hours, the cumulative incidence of LBW (< 2500 g) was 29%.

The unadjusted relative risks for LBW were significantly higher for lower socio-economic status (RR = 1.71), maternal age less than 20 years (RR = 1.27), primiparity (RR = 1.32), last pregnancy interval less than 6 months (RR = 1.48), non-pregnant weight less than 40 kg (RR = 1.3), height below 145 cm (RR = 1.51), hemoglobin less than 9 g/dl (RR = 1.53) and third trimester bleeding (RR = 1.87). Multivariate logistic regression analysis showed that the adjusted odds ratio for LBW decreased with increasing gestational duration, non-pregnant weight, parity and rising education level of the mother. Socio-economic status, non-pregnant weight, maternal height, and severe anemia in pregnancy had substantial attributable risk per cent for LBW (41.4%, 22.9%, 29.5% and 34.5%, respectively).

PMID: 7875782 [PubMed - indexed for MEDLINE]21: The study found that In India, medical social workers followed a cohort of 1922 pregnant women in 45 contiguous villages in Pune District at monthly intervals so researchers could identify and quantify risk factors of low birth weight (LBW: 2500 g). 29% of the infants were LBW infants.

LBW infants were significantly more likely to be born to mothers of very low socioeconomic status (unadjusted relative risk [RR] = 1.71), aged less than 20 (RR = 1.27), pregnant for the first time (RR = 1.32), whose last pregnancy interval was shorter than 6 months (RR = 1.48), whose nonpregnant weight was less than 40 kg (RR = 1.3), whose height was less than 145 cm (RR = 1.51), whose hemoglobin was less than 9 g/dl (RR = 1.53), who bled during the third trimester (RR = 1.87), and who delivered the infant prematurely (i.e., 32 weeks) (RR = 3.84). Mothers with 8-10 years of formal schooling were less likely to have an LBW infant than illiterate mothers (RR = 0.78).

Boys were less likely to be LBW infants than girls (RR = 0.78). The multivariate logistic regression analysis revealed that the adjusted odds ratio for LBW fell as gestational age (0.207), nonpregnant weight (0.711), parity (0.835), and maternal educational status (0.869) increased. The attributable risk percentages for risk factors were 73.9% for premature birth, 46.6% for third trimester bleeding, 41.4% for very low socioeconomic status, 34.5% for hemoglobin less than 9 g/dl, 32.5% for last pregnancy interval shorter than 6 months, 29.5% for height less than 145 cm, 24.4% for primiparity, 22.9% for

nonpregnant weight less than 40 kg, 21.3% for adolescent mother, and 21.5% (preventive fraction) for high maternal educational status. These findings suggest that health professionals should target limited resources to improving maternal education and nutrition status (i.e., reducing anemia), to providing wider availability of contraception to delay age at first pregnancy and to increase intervals between births, and to making sure that mothers at greatest risk of delivering a LBW infant receive appropriate care.

Deshmukh JS et al. 22 (Low birth weight and associated maternal factors in urban area: From the Department of Preventive and Social Medicine, Government Medical College, Nagpur 440 003. September 4, 1997.) The study found that the LBW prevalence in the study was 30.3%. Table I depicts the results of univariate analysis of maternal factors associated with LBW.

TABLE I– *Maternal Factors Associated with LBW Univariate Analysis*

Risk Factors	LBW (n=61)	Non LBW (n=140)
Age (yrs) (mean, sd)	22.4 (3.3)	22.9 (2.3)
Primipara* (%)	31.0 (50.8)	50.0 (35.7)
Birth interval[1] (mo) (mean, sd)	26.2 (14.3)	29.5 (9.5)
Hemoglobin (G/dl)* (mean, sd)	9.9 (0.8)	11.2 (8.0)
Weight gain in[2], ** pregnancy (kg) (mean, sd)	5.2 (1.4)	6.8 (1.7)
Height (cm)* (mean, sd)	143.9 (5.1)	148.8 (20.1)
Tobacco exposure (%)*	33 (54.1)	45 (32.1)
Low SE status (%)**	45 (73.7)	35 (25)

1 = LBW (n=31), Non LBW (n=89)

2 = LBW (n=34), Non LBW (n=70)

* $p < 0.05$; ** $p < 0.001$

TABLE II–*Unweighted Multiple Logistic Regression Analysis of Maternal Factors Associated with LBW*

Maternal factors	Odds ratio	95% confidence interval	Regression coefficient
Anemia	4.81	1.68-12.43	1.48
Socioeconomic status	3.96	2.10-6.46	1.22
Birth interval	3.84	2.12-8.42	1.51
Tobacco exposure (tobacco chewing, passive smoking)	3.14	2.08-4.88	1.15
Height	2.76	1.92-3.92	1.01
Maternal age	2.68	1.70-3.81	1.02
Body mass index	2.02	1.26-3.14	0.79
Primipara	1.58	1.20-2.10	0.51

The factors observed to be significantly associated with LBW included socioeconomic status, parity, maternal height, pregnancy weight gain, tobacco exposure and anemia. Confounder control by multiple logistic regression analysis revealed that significant factors (in descending order of odds ratio) were anemia, low socio-economic status, short birth interval, tobacco exposure, maternal height, maternal age, BMI and primiparity.

Khatun S et al. 23 studied that among which 108 were LBW and 357 were normal birth weight (NBW). When Chi-square test was done for individual factors, age, education, occupation, per head yearly income, gravid status of mother, gestational age at Ist visit, pre-delivery BMI, quality of antenatal care received and number of antenatal visits attended were found to be significant. LBW (N=108) babies mostly come from the mother of <19 and >30 age group [88 (81.5%)], without education [66 (66.1%)], belongs to the family of below average per capita yearly income [9 (85.2%)], 1st and 4th or more gravid those started their antenatal care in the last trimester 23, and who attended < 4 antenatal visit [96 (88.11)].

In contrast, NBW (n==357) babies come from 20- 29 years old mother [287 (80.4%)] who were medium and highly educated [239 (66.9%)], had above average per capita yearly income [222 (62.2%)], started their antenatal care mostly in the 2nd trimester [244 (68.3%)], had average quality care [255 (71.4%)] and took more than 4 visits [326 (91.3%)].

The following variables were found insignificant: mother's religion, family size, family type, birth to conception interval, history of stillbirth, neonatal death, abortion in the last pregnancy, hyperemesis in the present pregnancy and intake of iron and vitamin throughout the pregnancy. BMI (BMI at the time of 1st check up) of the mother and sex of the baby was also found to be insignificant. Multivariate analysis (stepwise logistic) was done by taking LBW as 0, NBW as 1 and the significant individual factors as covariates (mother's age, education, occupation, yearly income, gravid status, gestational age at first visit, number of antenatal care visit attended, quality of antenatal care received and pre-delivery BMI). Only 4 variables created the best model, the rest had no individual effects. Nagelkerke R square increasedfrom 64% to 78% from step 1-4. In Hosmer and Lemeshow test, the mode was a very good fit in each step especially at 4; chi-sq test value was 0.848. The overall classification was also increased from step 1 to step 4 from 90.8% to 92.5%. Odds ratios were shown.

Chapter 3.0: MATERIALS AND METHODS

The research methodology adopted to explore the information reflects the procedural steps followed in the light of objectives of the study. The various aspects of research methodology are discussed under the following headings.

3.1 Study Design:

A hospital based cross sectional study.

3.2 Study Area:

Janakpur city was selected purposively as study area.

Janakpur Zonal Hospital, Janakpurdham: On an average 700-750 babies are born here in a month.

3.3 Reasons for selection of study area are:

1. In DHS 2006, reported that the percentage of children with low birth-weight varies from 13 per cent in hills and 16 (high) per cent in the terai.
2. Convenience and feasible within time period.
3. Researcher is familiar with the local area and the socio-cultural aspects of the respondents.

3.4 Study Population:

This study was conducted in the gynaecology and obstetrics ward in Janakpur zonal hospital, Janakpurdham. Study population was comprised of mothers along with newborns delivered.

3.5 Unit of Study:

Mothers along with newborns delivered.

3.6 Sample Size:

Derived numbers of respondents was selected by using formula as followings.

$$n = \frac{Z^2pq}{d^2}$$

Where, z = Magnitude of the population variance (confidence Interval, 1.96 for 95% CI)

p = Anticipated population proportion (probability of getting case)

q = 1-p

d = Absolute precision required on either side of the proportion (permissible error, 0.05 For 95% CI)

n = Sample Size

According to DHS 2001, table 9.8. A total 21% of low birth-weight infants in Nepal, Computing the sample size by the above-mentioned formula taking Confidence Interval of 95% and permissible error of 0.05 and p as 0.21 the number of sample size was **255**.

But study by Khatun S et al. (2008) conducted socio-economic determinants of low birth weight in Bangladesh and revealed that 28 percentage of babies were low birth weight [23].

Hence 306 respondents were taken from Janakpur zonal hospital, Janakpurdham and respondents were mothers who have delivered newborns in hospital were taken as sample number. A total of 306 required sample size was calculated for this study.

3.7 Sampling Technique:

- Janakpur Zonal Hospital was selected purposively.
- Samples were selected purposively following the inclusion and exclusion criteria.

Inclusion criteria: Mothers along with newborns (live-birth singleton) delivered in hospital.

Exclusion criteria: Mothers who had given multiple births or still birth baby.

- Mothers will be refused to parcipate (will not give consent) in this study.

3.8 Tools and Technique of data collection:

- A pretested schedule was used to record the information.
- Record review format was used for reviewing antenatal care cards.
- A spring type weighing machine scale was used to measure birth weight of the babies.
- Each questionnaire was completed and birth weight was taken within 24 hrs of birth.
- Maternal nutritional status was assessed by post partum weight and hemoglobin level was recorded before delivery.
- Information about maternal hemoglobin, gestational age and morbidity during pregnancy and other required data was taken from the any medical records of indivual's.

3.9 Validity and Reliability of research tools and data:

- Necessary suggestions were obtained from the advisors for time to time.
- Ideas of many health researchers were incorporated.

3.10 Data processing and analysis:

- Quality of data was cross-checked at various stages of study.
- First the questionnaire completed and then thoroughly checked by the research assistant in the field.

- These questionnaires were brought to PU for further checking, coding, processing, data entry and analysis.
- Data were coded and compiled in SPSS software and analyzed.
- Appropriate statistical test was applied wherever required. The result was interpreted in the light of the objectives.

3.11 Ethical Considerations:

- Approval was taken from Pokhara University and Janakpur zonal hospital.
- Participants were fully informed and written consent was taken from mothers before the study procedure.

Chapter 4.0: RESULTS

According to WHO classification, ≤ 2499 grams weight at birth are low birth weight newborns and >2500 grams weight at birth are normal birth weight newborns. A total of 1426 birth occurred during the study period (December 2009 to January 2010), of which 306 met the study criteria. Among which 66 were low birth weight (LBW) and 240 were normal birth weight (NBW). Hence the prevalence of low birth weight newborns in the present study was found 21.56 %. Overall mean birth weight was found to be 2.75 ± 0.639 kg. Out of total 21.56 % newborns were weighing less than 2.50 kg and mean birth weight was 1.96 ± 0.409 kg (Table 1).

Table 1: Mean median, standard deviation and range by study subject

	Newborn Babies (n= 306)	LBW babies (n = 66)	NBW babies (n = 240)
Mean	2.7594	1.9612	2.9831
Median	2.7000	2.0550	3.0000
Sd.	0.63908	0.40976	0.48368
Min-Max (Range)	1000-5000 grams	1000-2499 grams	2500-5000 grams

Table 2: Newborns by their birth weight

Birth Weight (in grams)	No. of Newborns	Percentage
1000	3	1
1001-2499	63	20.6
≥ 2500	240	78.4

Table 3: Effects of maternal socio-economic factors on birth weight of newborn.

Variables	LBW babies (n = 66)	NBW babies (n = 240)	Newborn Babies (n= 306)	P value
Age				
20-29 Years	37(17.45)	175(82.55)	212	$\chi 2$= 6.911
< 19 and ≥ 30	29(30.85)	65(69.15)	94	p=0.009
Religion				
Hindu	62(22.32)	216(77.68)	278	NS
Muslim	4(14.29)	24(85.71)	28	
Residence				
Urban	10(20.83)	38(79.17)	48	NS
Rural	56(21.71)	202(78.29)	258	
Education				
No	48(25.53)	140(74.47)	188	$\chi 2$= 4.527
Primary, secondary & above	18(15.25)	100(84.75)	118	p=0.033
Occupation				
Housewife	62(21.53)	226(78.47)	288	NS
Working	4(22.22)	14(77.78)	18	
Family Members				
≤ 5	50(19.16)	211(80.84)	261	$\chi 2$= 6.101
>5	16(35.56)	29(64.44)	45	p= 0.014
Family Type				
Nuclear	22(25.29)	65(74.71)	87	NS
Joint	44(20.09)	175(79.91)	219	
Family Yearly Income				
Up to 25000	32(18.71)	139(81.29)	171	
25001-50000	24(26.67)	66(73.33)	90	
50001-75000	9(28.12)	23(71.88)	32	NS
Above 75000	1(7.70)	12(92.30)	13	

Table 4: Maternal Reproductive factors affecting birth weight

Variables	LBW babies (n = 66)	NBW babies (n = 240)	Newborn Babies (n= 306)	P value
Gravida				
1st & ≥ 4	51(25.76)	147(74.24)	198	$\chi 2$= 5.189
2 - 3	15(13.89)	93(86.11)	108	p= 0.016
Birth to conceptional interval				
≥ 24 months	10(17.54)	47(82.46)	57	NS
≤ 23 months	18(17.65)	84(82.35)	102	
Still birth				
No	63(22.67)	215(77.33)	278	NS
Yes	3(10.71)	25(89.29)	28	
Abortion				
No	64(21.92)	228(78.08)	292	NS
Yes	2(14.29)	12(85.71)	14	
Death of previous children				
No	64(22.38)	222(77.62)	286	NS
Yes	2(10)	18(90)	20	
ANC in this pregnancy				
No	14(42.42)	19(57.58)	33	$\chi 2$= 9.511
Yes	52(19.04)	221(80.96)	273	p= 0.002
Total Antenatal visit				
< 4	27(17.31)	129(82.69)	156	NS
≥ 4	25(21.37)	92(78.63)	117	
Gestational age at 1st visit				
1st trimester	40(18.43)	177(81.57)	217	NS
2nd trimester	10(24.39)	31(75.61)	41	
3rd trimester	2(14.29)	12(85.71)	14	

Table 3 and 4 depicts the results of univariate analysis of maternal factors associated with LBW. The factors associate with LBW included age, education, family members, gravida and antenatal care. The following variables were found insignificant: religion, residence, occupation, family type, birth to conceptional interval, still birth, abortion, death of previous children, total Antenatal visit and gestational age at 1st visit.

Table 5: Multiple logistic regression analysis of maternal factors associated with LBW

Variables	Odd ratios	95% confidence interval	Regression coefficient
Age of the mothers 0 = 20-29 Years, 1 = < 19 and ≥ 30	0.474	0.270-0.832	1.169
Mother's education 0 = otherwise, 1 = no education	1.905	1.046-3.469	0.766
Antenatal Care 0 = No, 1 = Yes	0.319	0.15-0.678	1.609

Multivariate analysis (multiple logistic regression) revealed that significant factors were age and education of mother and antenatal care and taking LBW as 0, NBW as 1.

Table 3 and 4 depicts the results LBW babies mostly come from the mother of <19 and ≥ 30 years age group and 31% that age group women delivered low birth weight babies while minimum (17%) LBW babies delivered from mother of 20 – 29 years age group.

26% of babies born to illiterate mothers and 22% of babies born to mothers who were housewife by occupation were of LBW. Proportion of LBW babies was minimum (8%) in mothers of high income group (per capita income of family more than NRs. 75000 per year). Association between family members and birth weight was found to be significant.

The utilization of antenatal care was in 89% mothers. Proportion of LBW was maximum (42%) in mothers who didn't receive any antenatal care, followed by those who received antenatal care, in whom LBW proportion was19%. There was significant association between birth weight and utilization of antenatal care by mothers.

Out of 159 births, birth interval in relation to previous birth was found to be ≤23 months in 65% mothers. In these mothers 18% of newborns were LBW and similar findings was found in mothers who had birth interval ≥ 24 months.

Table 6: Antepartum Haemorrahe during pregnanancy and birth weight

Antepartum Haemorrage	LBW	NLBW	Total	P Value
Yes	7(46.67)	8(53.33)	15	
No	59(20.27)	232(79.73)	291	NS
Total	66	240	306	

Table 7: Swelling leg or body part during pregnancy and birth weight

Swelling leg or body part	LBW	NLBW	Total	P Value
Yes	11(26.19)	31(73.81)	42	
No	55(20.83)	209(79.17)	264	$\chi 2$= 6.072 p= 0.04
Total	66	240	306	

Table 8: Maternal haemoglobin before delivery and birth weight

Maternal Haemoglobin (g/dl)	LBW	NLBW	Total	P Value
8-9	31(34.44)	59(65.56)	90	
9.5-10.8	23(16.67)	115(83.33)	138	$\chi 2$= 12.54 p= 0.002
11-14	12(15.38)	66(84.62)	78	
Total	66	240	306	

Out of 306, 121 (40%) mothers had significant illness during their pregnancy. Of these mothers 53%delivered LBW babies. Out of 54 newborns delivered by anemic mothers and 31% were LBW. There is significant association between anemia and LBW ($\chi 2$=12.5; df= 2; p=0.002). (Table 8)

Out of total, 69(23%) mothers had some complication during the pregnancy and 22(32%) newborns delivered by them were LBW. 50% of LBW newborns delivered mothers suffering from swelling legs or body, followed by antepartum haemorrage (47%). The association between antepartum haemorrage in present pregnancy and LBW was found to be statistically significant ($\chi 2$=6.072; df=2; p=0.04). (Table 6 & 7)

Out of 306, 51 (17%) mothers were not consuming extra meal during pregnancy. Of these mothers 55% delivered LBW babies. There is statistical significant between extra meal taken during pregnancy and LBW ($\chi 2$= 9.314; df=2; p=0.009).

Out of 306, 16 (5%) mothers had no mid day rest during their pregnancy and 5%, out of them 44% LBW babies were delivered by these mothers. There is statistical significant between mid day rest during pregnancy and LBW ($\chi 2$= 13.754; df =2; p=0.003).

Chapter 5.0: DISCUSSION

LBW is a public health problem linked to a wide range of possible predictors, sometimes those are difficult to handle. Despite efforts to decrease the proportion of newborns with LBW, success has been quite limited and the problem persists in both developing and developed countries[23].

There are a number of studies around the world done on this subject by using different methodologies. Either they evaluate the effects of the factors in isolation through cross tabulations or, utilizing statistical techniques to see the individual factors in presence of others. The later is more likely to give a better indication of the contribution to low birth weight of each of the various risk factors. Both ways were followed in this study. Some of the information of this study was collected from the mother by interviewing her and some by reviewing the records. If it was possible to cross check the mother's answer with that of records would have been better. It was one of the other limitations of the study. Moreover the study was done in an urban hospital and there was in total 258 (84%) mothers who come from rural area. So, they represented of the rural areas.

Most of the mother of LBW babies in this study belongs to the <19 and ≥30 years whereas, it was 20-29 years for the mother with normal birth weight babies. Thus, the maternal age of 20-29 years was found to be the most suitable age group for giving birth to normal weight babies. The finding of the study agrees with many similar studies in developing countries[24, 25]. There was insignificant association between residence and birth weight. Both groups are equally facilitated to enjoy the MCH services.

It was observed that 61% mothers were illiterate and 26% of them delivered LBW babies. It was conformity with earlier reports by Kiran A et al [26] and Mavalankar DV et al [27]. This may be explained by increased awareness of educated women regarding health services. While literate mothers delivered minimum (15%) LBW babies.

Household head educational status also influences the birth weight of baby. In this study household head education had significant association with birth weight ($\chi 2$=5.819; df=1; p=0.01). While parental education had insignificant with birth weight.

The present study shows that there was no significant association between birth weight and religion. Similar findings observed by Joshi Hs et al [18]. The proportion of LBW babies decreased wit increase in the per capita income of the family. These findings are in accordance with other studies [27, 28].

Birth to conception interval has insignificant association with birth weight. Similar study done by Khatun S et al [22]. It may be happen because it is not only the interval, some more, specially nutritional factor responsible for birth weight of baby. If a woman could regain her nutritional status before the conception of baby and could keep it for the period next, it may be possible to get a normal weight baby. The insignificant association between previous pregnancy abortion, stillbirth and neonatal death in present pregnancy and birth weight in the present study might follow the logic of the above.

Primiparous women in this study also had more number (27%) of LBW babies as found in other studies done by Kiran A et al [26] and Mavalankar DV et al [27]. An increase in LBW was found after forth parity (50%). Joshi Hs et al [29] documented 51.28% LBW after 4th parity. There is statistical significant between parity of mother and LBW ($\chi 2$=19.725; df=3; p=.0001).

In the present study 40% mothers had significant illness. Of them, 23% had some complication during their pregnancy. Among all maternal illness proportion of LBW was maximum 53% and also proportion of LBW 23% in mothers with anemia similar study by Idris et al [28], and Deswel et al [29].

Chapter 6.0: CONCLUSIONS AND RECOMMENDATIONS

This study suggests that there are several factors interplaying which lead to LBW babies. Socio-demographic factors (maternal age, educational level and economic status) and antenatal care (in terms of contains and number) are more important.

It is concluded that it is advisable to undertake a similar type of study on community level. To confirm the findings of the above study and to strengthen MCH services, by giving more emphasis on the factors identified in the present study in order to reduce the overall incidence of low birth weight in the community.

The present study suggests that improvements in maternal nutrition during pregnancy, avoiding close birth spacing, delayed child bearing in young females (<20 years), universal coverage of adequate antenatal care, early recognition of maternal illness and complications are essential for reducing the LBW in newborns. This can be achieved by including health education component for adolescents (both males and females) and pregnant mothers in MCH program, especially in rural areas where literacy rate is very low by utilizing grass route level health workers already existing in community.

Chapter 7.0: STRENGTHS AND LIMITATIONS OF THE STUDY

7.1 Strengths of the Study:

- The research findings assist health professionals to control the low birth weight.
- This study was based on primary and secondary data.
- It provides required information for further study.

7.2 Limitations of the Study:

- The research conducted in an urban hospital in Janakpur. So, it cannot be a true representation of the country.
- The researcher was limited to the study of medical and non medical maternal risk factors associated with low birth weight only and excluded the other areas of study.

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