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A STUDY OF IMPACT OF BIOSOCIAL CHARACTERISTICS OF THE MOTHER ON BIRTH WEIGHT OF THE NEWBORN.

Dr. Jaya Suryawanshi*[1] and Dr. Kaveri[2]

[*1]Department of Community Medicine, Maharashtra Institute of Medical Sciences and Research, Latur, 413 531, Maharashtra, India.

[2]Department of Obstetrics and Gynecology, Veer Surender Sai Medical College, Sambalpur, Odhisa.

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***Correspondence for Author**
Dr. Jaya Suryawanshi
Department of Community Medicine, Maharashtra Institute of Medical Sciences and Research, Latur, 413 531, Maharashtra, India.

ABSTRACT

Aim and objectives: To find out risk factors associated with low birth weight. To study strength of association between hypothesized risk factors and low birth weight. Setting: a hospital based case control study. Study place: The study was done in postnatal care ward of obstetrics and gynaecology department. Study population: The study population was postnatal mothers along with singleton live born baby, delivered during the study period**. Results:** In present case control study, the incidence of low birth weight found was 27.73 %. Univariate analysis showed following factors to be significantly associated with low birth weight- maternal age, gestational age at the time of birth or, low socioeconomic status, occupation of mother, low education of mother, primiparity, parity of 4 and 5,maternal height <145 cm, maternal weight < 45 kg, less than 4 anc visits, inadequate intake of ifa tablets, complications during pregnancy, bad obstetric history, severe and moderate anaemia, addiction of mother, household heavy physical activity of mother. **Conclusion:** Following factors to be significantly associated with low birth weight- maternal age, gestational age at the time of birth, low socioeconomic status, occupation of mother, low education of mother, primiparity, parity of 4 and 5, maternal height <145 cm, maternal weight < 45 kg, less than 4 anc visits, inadequate intake of ifa tablets, complications during pregnancy, bad obstetric history, severe and moderate anaemia, addiction of mother, household heavy physical activity of mother.

KEYWORDS: low birth weight, biosocial factors, maternal factors.

INTRODUCTION

Birth weight has been defined by the World Health Organization as weighing less than 2,500 grams are approximately 20 times more likely to die than heavier babies.2 More common in developing than developed countries, a birth weight below 2,500 grams contributes to a range of poor health outcomes. The goal of reducing low birth weight 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.[1] The reduction of low birth weight also forms an important contribution to the Millennium Development Goal (MDG) for reducing child mortality. Low birth weight is therefore an important indicator for monitoring progress towards these internationally agreed-upon goals. 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.[1]

MATERIALS AND METHODS

Present study was done in postnatal care ward of Obstetrics and Gynaecology department. The study population was postnatal mothers along with singleton live born baby, delivered during the study period of 24 months (August 2011 to July 2013).A total of 130 cases and 260 controls were selected. Two controls were selected per case thus making a proportion of 1:2. This is calculated by taking power of 80%, odds ratio of 2, two sided significant level as 0.05 and proportion of controls with exposure as 0.3. The data collection consisted of two types of procedures- personal interview and anthropometric measurements. Mothers of babies with birth weight > 2,499 g who were born consecutively after each case, constituted the control group. A written informed consent of mother of the newborn baby was taken before starting the interview.

The participants were interviewed using a pre-tested standard structured questionnaire. Anthropometric measurements of mother included postpartum weight and height. Other variables were Maternal age, gestational age at the time of birth, sex of the newborn, maternal educational and occupational status, socioeconomic status, type of family, type of residence, parity, birth spacing, bad obstetric history, obstetric complications during pregnancy ,total ANC visits, time of ANC registration, consumption of IFA and calcium tablets, rest received

in daytime, physical activity, addiction, haemoglobin percentage and maternal height and weight.All the data was entered into the Epi Info software version 7. Association of the risk factors under study was assessed by applying chi – square test taking a level of significance of $P < 0.05$. To assess the strength of association the odds ratio and 95% confidence interval of odds ratio was calculated.

RESULTS

Table 1: **Distribution of cases and controls according to sex of the newborn**

Sr. No.	Sex of the newborn	Cases	Controls	Total
1	Female	69(53.08%)	127(48.85%)	196(50.26%)
2	Male	61(46.92%)	133(51.15%)	194(49.74%)
3	Total	130 (100%)	260 (100%)	390(100%)

X^2=0.62, df = 1, P=0.43, OR=1.18 (0.77-1.80) (Not significant)

Table 1 shows that overall more number of female babies were born as compared to male babies (50.26%,49.74% respectively).There were more number of female babies (53.08%) in case group than control group (48.85%). However, this difference was statistically not significant.

Table 2-a: Distribution of cases and controls according to maternal age

Sr. No.	Maternal age(yrs.)	Cases	Controls
1	≤ 19	19(14.62%)	21 (8.07%)
2	20-24	58(44.61%)	132(50.77%)
3	25-29	36(27.69%)	87(33.47%)
4	≥ 30	17(13.08%)	20 (7.69%)
5	Total	130 (100%)	260 (100%)

Table 2-b: Distribution of cases and controls according to maternal age

Sr. No.	Maternal age	Cases	Controls
1	≤ 19 years	19(16.82%)	21 (8.75%)
2	20-29 years	94(83.18%)	219(91.25%)
3	Total	113 (100%)	240 (100%)

χ^2 =4.97, df = 1, P= 0.02, OR=2.10 (1.08-4.10) (Significant)

Table 2-b shows that mothers with age group ≤ 19 years were comparatively more in case group (16.81%) than controls (8.75%). This difference was found statistically significant. Maternal age ≤ 19 years showed a risk of having low birth weight baby 2.10 times that of mate.

Table 2-c: Distribution of cases and controls according to maternal age

Sr. No.	Maternal age	Cases	Controls
1	≥ 30 years	17(15.32%)	20 (8.37%)
2	20-29 years	94(84.68%)	219(91.63%)
3	Total	111 (100%)	239 (100%)

X^2 =3.86, df = 1, P= 0.04, OR=1.98 (0.99-3.94) (Significant)

Table 2-c shows that mothers with age group ≥ 30 years were comparatively more in case group (15.32%) than controls (8.37%). This difference was found statistically significant. However, a higher risk is not seen.

Table 3-a: Distribution of cases and controls according to gestational age at the time of birth:

Sr. No.	Gestational age at the time of birth	Cases	Controls
1	≤ 34 wks	35(26.92%)	11(4.23%)
2	35 wks	25 (19.23%)	23(8.85%)
3	36 wks	19 (14.62%)	34(13.08%)
4	37 wks	16(12.31%)	45(17.30%)
5	38 wks	12(9.23%)	52 (20.00%)
6	39 wks	12(9.23%)	57(21.92%)
7	40 wks	7(5.38%)	24 (9.23%)
8	41 wks	3(2.31%)	9(3.47%)
9	42 wks	1(0.77%)	5 (1.92%)
10	Total	130 (100%)	260 (100%)

Table 3-a shows that most of the cases delivered at 34 wks of gestation (26.92%) followed by 35 wks of gestation (19.23%) and most of the controls delivered at 39 wks of gestation (21.92%) followed by 38 wks of gestation(20.00%) .

Table 3-b: Distribution of cases and controls according to gestational age at the time of birth

Sr. No.	Gestational age at the time of birth	Cases	Controls
1	< 37 wks	79(60.77%)	68(26.15%)
2	≥37 wks	51 (39.23%)	192(73.85%)
3	Total	130 (100%)	260 (100%)

χ^2=44.21, df = 1, P=0.000, OR=4.37 (2.79-6.84) (Significant)

Table 3-b shows that more number of cases delivered at a gestation of less than 37 wks (60.77%) as compared to controls (26.15%).This difference was statistically significant. Preterm delivery showed a risk of having low birth weight baby 4.37 times that of term delivery.

Table 4: Distribution of cases and controls according to type of residence

Sr. No.	Residence	Cases	Controls	Total
1	Rural	102(78.46%)	180(69.23%)	282(72.31%)
2	Urban	28 (21.54%)	80 (30.77%)	108(27.69%)
3	Total	130 (100%)	260 (100%)	390(100%)

χ^2=3.68, df = 1, P=0.054, OR=1.61(0.98-2.65) (Not significant)

Table 4 shows that overall most of the participants in both groups were from rural area (72.31%). More number of cases lived in a rural area (78.46 %) as compared to controls (69.23%).

Table 5: Distribution of cases and controls according to religion

Sr. No.	Religion	Cases	Controls
1	Hindu	97 (74.62%)	210 (80.77%)
2	Muslim	12 (09.23%)	23 (08.85%)
3	Buddhist	19 (14.62%)	26 (10.00%)
4	Others	02 (01.53%)	01 (0.38%)
5	Total	130 (100%)	260 (100%)

Table 4 shows that higher number of mothers in both case and control group were Hindus (74.62%, 80.77% respectively) followed by Buddhists (14.62%, 10.00% respectively)

Table 6: Distribution of cases and controls according to type of family

Sr. No.	Type of family	Cases	Controls
1	Nuclear	33 (25.38%)	47(18.08%)
2	Joint	97 (74.62%)	213 (81.92%)
3	Total	130 (100%)	260 (100%)

χ^2=2.83, df =1, P =0.09, OR =1.54 (0.92 – 2.55) (Not significant)

Table 6 shows that overall majority of mothers belonged to joint families in both groups (74.62%, 81.92% respectively). More number of cases belonged to nuclear family than the controls (25.38%, 18.08% respectively).However, this difference was statistically not significant.

Table7-a: Distribution of cases and controls according to socioeconomic status

Sr. No.	Socioeconomic status	Cases	Controls
1	I	09(6.92%)	19 (7.30%)
2	II	24(18.46%)	78 (30.00%)
3	III	30(23.08%)	104(40.00%)
4	IV	48 (36.92%)	51 (19.62%)
5	V	19 (14.62%)	08(3.08%)
6	Total	130 (100%)	260 (100%)

Table 7 shows that majority of cases (36.92%) belonged to class IV, followed by class III (23.08%) and majority of controls belonged to class III (40.00%) followed by class II (30.00%).

Table 7-b: Distribution of cases and controls according to socioeconomic status

Sr. No.	Socioeconomic status	Cases	Controls
1	Class IV, V	67 (51.54%)	59(22.69%)
2	Class I,II,III	63 (48.46%)	201(77.31%)
3	Total	130 (100%)	260 (100%)

χ^2= 32.97, df =1, P = 0.000, OR =3.62 (2.31-5.68) (Significant)

Table 7-b shows that more number of cases belonged to class IV and V as compared to controls (51.54%, 22.69% respectively).The difference was statistically significant .Mothers of socioeconomic class IV and V showed a risk of having low birth weight baby 3.62 times that of mothers of socioeconomic class.

Table 9-a: Distribution of cases and controls according to education of mother

Sr. No.	Education	Cases	Controls
1	Illiterate	3(2.31%)	1(0.38%)
2	Primary	33(25.38%)	27 (10.38%)
3	Middle	57(43.85%)	131 (50.39%)
4	High school	31(23.85%)	88 (33.85%)
5	Higher secondary and above	6 (4.61%)	13(5.00%)
6	Total	130(100%)	260(100%)

Table 9-a shows that the maximum number of cases and controls had studied up to middle school (43.85%, 50.39% respectively). Very few mothers in both groups had studied up to higher secondary and above (4.61%, 5.00% respectively).

Table 9-b: Distribution of cases and controls according to education of mother

Sr. No.	Education	Cases	Controls
1	Less than high school	93(71.54%)	159 (61.15%)
2	High school and above	37 (28.46%)	101(38.85%)
3	Total	130(100)	260(100%)

χ^2=4.08, df =1, P = 0.04, OR= 1.59(1.01-2.51) (Significant)

Table 9-b shows that more number of cases had education less than high school as compared to controls (71.54%, 61.15% respectively).This difference was statistically significant. Mothers with education less than high school showed a risk of having low birth weight baby 1.59 times that of mothers with education upto and above high school.

Table 10-a: Distribution of cases and controls according to parity of mother

Sr. No.	Parity	Cases	Controls
1	1	78(60.00%)	125(48.08%)
2	2	26(20.00%)	99(38.08%)
3	3	13 (10.00%)	29 (11.15%)
4	4	7(5.38%)	5(1.92%)
5	5	6(4.62%)	2(0.77%)
6	Total	130 (100%)	260 (100%)

Table 10-a shows that there were more number of primiparous mothers among both groups (60%, 48.08% respectively), followed by parity 2 (20%, 38.08% respectively).

Table 10-b: Distribution of cases and controls according to parity of mother

Sr. No.	Parity	Cases	Controls
1	Para 1	78 (66.67%)	125(49.41%)
2	Para 2 ,3	39(33.33%)	128(50.59%)
3	Total	117 (100%)	253 (100%)

χ^2= 9.62, df =1, P = 0.001, OR= 2.04 (1.29 -3.23) (Significant)

Table 10-b shows that there were more number of primiparous mothers among cases as compared to controls (66.67%, 49.41% respectively). This difference was statistically significant. Primipara mothers showed a risk of having low birth weight baby 2.04 times that of mothers of parity 2 and 3.

Table 10-c: Distribution of cases and controls according to parity of mother

Sr. No.	Parity	Cases	Controls
1	Para 4 , 5	13 (25.00%)	7 (5.19%)
2	Para 2 , 3	39(75.00%)	128(94.81%)
3	Total	52 (100%)	135 (100%)

χ^2= 15.43, df =1, P = 0.000, OR= 6.09 (2.27-16.34) (Significant)

Table 10 - c shows that there were more number of mothers of parity 4 and 5 among cases as compared to controls (25 %, 5.19% respectively). This difference was statistically significant. Mothers of parity 4 and 5 showed a risk of having low birth weight baby 6.09 times that of mothers of parity 2 and 3.

Table 11: Distribution of cases and controls according to height of mother

Sr. No.	Height (cm)	Cases	Controls
1	< 145 cm	49 (37.69%)	47(18.08%)
2	≥ 145 cm	81 (62.31%)	213 (81.92%)
3	Total	130 (100%)	260 (100%)

χ^2=17.97, df = 1, P= 0.000 , OR= 2.74 (1.70 - 4.40) (Significant)

Table 11 shows that more number of cases had a height < 145cm than the controls (37.69 %, 18.08 % respectively).This difference was statistically significant. Mothers with a height < 145 cm showed a risk of having low birth weight baby 2.74 times that of mothers with a height ≥ 145 cm.

Table 12: Distribution of cases and controls according to postpartum weight of mother

Sr. No.	Weight (kg)	Cases	Controls
1	<45 kg	61(46.92%)	73(31.74 %)
2	≥45 kg	69 (53.08%)	157(68.26%)
3	Total	130 (100%)	260 (100%)

χ^2 = 8.19, df =1, P = 0.004, OR = 1.90 (1.22 - 2.95) (Significant)

Table 12 shows that comparatively higher number of cases were having weight of < 45 kg as compared to controls (46.92%,31.74% respectively).This difference was statistically significant .Maternal weight < 45 kg showed a risk of having low birth weight baby 1.90 times that of mothers with weight ≥ 45 kg.

Table-13: Distribution of cases and controls according to adequacy of antenatal visits

Sr. No.	ANC visits	Cases	Controls
1	Inadequate	58 (44.62%)	75 (28.85%)
2	Adequate	72 (55.38%)	185 (71.15%)
3	Total	130 (100%)	260 (100%)

χ^2= 9.59, df = 1, P= 0.001, OR= 1.98 (1.28 - 3.07) (Significant)

Table 13 shows that higher number of women in both groups received 4 or more ANC visits. However, the number of women who received inadequate ANC visits were more amongst the cases (44.62%) than the controls (28.85%).This difference was statistically significant. Mothers who received inadequate ANC visits showed a risk of having low birth weight baby 1.98 times that of mothers who received adequate ANC visits.

Table-14: Distribution of cases and controls according to time of antenatal registration

Sr. No.	Time of antenatal registration	Cases	Controls
1	2^{nd}, 3^{rd} trimester	41 (31.54%)	63 (24.23%)
2	1^{st} trimester	89 (68.46%)	197(75.77%)
3	Total	130 (100%)	260 (100%)

χ^2= 2.36, df =1, P= 0.12, OR= 1.44(0.90-2.29) (Not significant)

Table 14 shows that registration after first trimester was seen more in case group than control group (31.54%, 24.23% respectively). However, this difference was statistically not significant.

DISCUSSION

This study was done to identify the maternal risk factors associated with low birth weight and to find out the strength of association of significant factors. In present study, the incidence of low birth weight was 27.73 %, which was more than that observed in National Family Health Survey-3 (21.5%). 9This could be because present study was carried out in a tertiary care hospital where many of the pregnant women were referred from the peripheral centres due to high risk pregnancy.

Table 1 showed that there were more number of female babies in case group (53.08%) than control group (48.85%). However, this difference was statistically not significant. [X2=0.62, df = 1, P=0.43, OR=1.18 (0.77-1.80)] A possible explanation for this finding could be small sample size of this study. This finding was in accordance with that of a study conducted by,

H.S. Joshi et al[28] where proportion of low birth weight was 32.59% in males and 36.37 % in females; however this difference was found statistically insignificant.

Similarly, Choudhary et al[51] (X2=0.070,P>0.05),Sarthak Sengupta And Minakshi Barua [24] (x2=0.42) and Selina Khatun and Mahmudur Rahman[30] found that female sex of the newborn had no association with low birth weight. Ashtekar et al[16] concluded that there was no difference in the average birth weight of male and female babies (P>0.05). Contradictory to this, Kramer[2] found that males had a higher birth weight and lower risk of IUGR compared to females. He calculated that the relative risk of IUGR (for females) was 1.19. However, Kramer pointed out that the influence of infant sex on birth weight depends upon the population being studied, and the effect may be greater in developing countries than in developed countries.

Som et al[13] also found that higher percentage of females (19.37%) were having low birth weight as compared to male babies (15.43%) and this difference was statistically significant (P= 0.0083).

Table 2-a, 2-b, 2-c showed that the majority of mothers (44.61% in the case group and 50.77% of mothers in the control group) were between 20-24 years age. We found that maternal age < 19 years was significantly associated with low birth weight. Maternal age < 19 years had a risk of having low birth weight 2.10 times that of maternal age 20-29 years [$\chi 2$ =4.97 ,df= 1, P= 0.02, OR=2.10 (1.08-4.10)].

Teenage (13-19 years) pregnancies are a common phenomenon in India, in spite of legal constraints (legal age of marriage for women being 18 years as per amendment of 1978). The Government of India also recommended that the first childbirth should not be before 20 years of maternal age (Ministry of Health and Family Welfare, 1992).[15]

In the present study, mothers with age group > 30 years were comparatively more in case group (15.32%) than controls (8.37%). Maternal age >30 years showed a statistically significant association with low birth weight. However, a higher risk was not seen. [$\chi 2$ =3.86, df = 1, P= 0.04, OR=1.98 (0.99-3.94)]. These findings were also comparable with retrospective community based study conducted by Selina Khatun and mahmudur rahman[30] who reported that extremes of age to be associated with low birth weight ($\chi 2$=141.501

p<0.001). Low birth weight babies mostly come from the mother of <19 and >30 age group (81.5%).

Similarly, Som et al[13] found that mothers below age of 20 years gave birth to significantly lighter babies .There was an increasing trend of birth weight with mother's age. H. Hayat et al[48] found that, maternal age was an important factor in low birth weight babies and the incidence of low birth weight decreased with increase in maternal age and this difference was statistically significant(p <0.01).

Samiran Bisai et al[15] found that the rate of low birth weight decreased with the increasing age of mothers after 18 years. The rate of low birth weight increased slightly after the age of 28 years. The young mothers (age < 19 years) delivered a higher rate of low birth weight baby than those mothers aged 19 year onwards(x2= 13.8, p<0.005). Contrast to these findings, Afshan Bhatti et al[34] found that the commonest age group in both case and control groups was 19-34 years in which 82.7% of cases and 89.3% of controls were found, however the difference of age distribution was statistically not significant (P = 0.141). Similarly, Biswas R. et al[17] found an insignificant association ($\chi 2 = 0.03$, p>0.05).

Table 3-a,3-b showed that most of the cases delivered at 34 wks of gestation (26.92%)followed by 35 wks of gestation(19.23%) and most of the controls delivered at 39 wks of gestation (21.92%) followed by 38 wks of gestation(20.00%). More number of cases delivered at a gestation of less than 37 wks (60.77%) as compared to controls (26.15%).This difference was statistically significant. Preterm delivery showed a risk of having low birth weight 4.37 times that of term delivery [$\chi 2$=44.21, df = 1, P=0.000, OR=4.37 (2.79-6.84)]. Similar results were seen in a study done by Shah U P et al [47] .They compared low birth weight babies with gestational age at delivery, preterm deliveries (<37 weeks) accounted for 80% as compared to 48.4% in the full term deliveries. Gestational age at delivery was found to be significantly associated with birth weight of new born ($\chi 2$= 6.37, P =0.01).

Contradictory to these findings, Samiran Bisai et al[15] found that among all births 9.97% were preterm (< 37 weeks of gestation) and 90.03% were term (37- 41 weeks gestational age) neonates. Similarly, among all low birth weight babies, 80.16% were term and 19.84% were preterm.

Table 4 showed that overall most of the participants were from rural area (72.31%). More number of cases lived in a rural area (78.46 %) as compared to controls (69.23%). However, this difference was statistically not significant. [χ2=3.68, df = 1, P=0.054, OR=1.61(0.98-2.65)]. Similarly, P. S. Thomre et al[22] [P=0.96, OR=0.99 (0.60 - 1.62)] and Selina Khatun and Mahmudur Rahman[30] found no association between area of residence and low birth weight.

Contradictory to our findings, Padda P. et al[40] found that higher prevalence of low birth weight was found among mothers living in rural areas (38.0%) as compared to those living in urban areas (31.5%). This difference was found to be statistically significant ($p<0.05$).

Table 5 showed that higher number of mothers in both case and control group were Hindus (74.62%, 80.77% respectively) followed by Buddhists (14.62%, 10.00% respectively). 09.23% of cases were Muslims as compared to controls (08.85%).

Table 6 showed that the majority of mothers belonged to joint families in both groups (74.62%, 81.92% respectively).More number of cases were belonged to nuclear family than the controls (25.38%,18.08% respectively).However, the difference was statistically not significant [X2=2.83,df =1, P=0.09, OR=1.54 (0.92 – 2.55)]. Similar results were observed by Biswas R. et al[17] (χ2=3.30, $p>0.050$) and Selina Khatun and Mahmudur Rahman30, who found a non significant association between type of family and low birth weight.

Contradictory to our findings, Padda P. et al[40] found that low birth weight was higher in mothers belonging to nuclear families (38.6 %) as compared with those belonging to joint families (30.9 %) ($p<0.01$). Similarly, Choudhary et al[51] found that nuclear families were associated with low birth weight (X2=37.644, P = 0).

Table 7-a, 7-b showed that majority of cases and controls belonged to class IV (36.92%) followed by class III (23.08%) and majority of controls belonged to class III (40.00%) followed by class II (30.00%). More number of mothers in case group belonged to class IV and V (51.54%) as compared to controls (22.69%).A statistically significant difference was seen. Mothers of socioeconomic class IV and V showed a risk of having low birth weight 3.62 times that of mothers of socioeconomic class I, II, III [χ2= 32.97, df =1, P = 0.000, OR =3.62 (2.31-5.68)].

Deshpande Jayant D. et al[39] carried out a case control study .In this study lower socioeconomic status (Class IV+V) was significantly associated with low birth weight [OR=1.68(1.04-2.71), P=0.04]. Findings of the present study also confirmed the findings of studies done by, Joshi S.M. et al12 where incidence of low birth weight decreased with an increase in the socioeconomic status ($p<0.05$).

Selina Khatun and Mahmudur Rahman[30] found that mothers whose yearly per capita income was below average showed significant association with loe birth weight. ($\chi2=74.465$, $P<0.001$). While, Afshan Bhatti et al[34] observed that , in both case and control groups, low or middle socio-economic status was predominant and statistically similar proportion was observed in both groups that revealed a nonsignificant association of low or middle socioeconomic status with low birth weight (X2=3.82, P=0.148).

Table 8 showed that most of the mothers were housewives in both groups (70.77%, 80.38% respectively) followed by agricultural labourers (20.77%, 13.07% respectively).

Table 9-a, 9-b showed that the maximum number of cases and controls had studied up to middle school (43.85%, 50.39% respectively). Very few mothers in both groups had studied up to higher secondary and above (4.61%, 5.00% respectively). Very few mothers were illiterate (2.30%, 10.38% respectively).

More number of cases had education less than high school as compared to controls (71.54%, 61.15% respectively). This difference was statistically significant. Mothers with education less than high school showed a risk of having low birth weight 1.59 times that of mothers with education upto and above high school. [$\chi2=4.08$, df =1, P = 0.04, OR= 1.59(1.01-2.51)] In a study conducted by Sachdeva P. et al[32] incidence of low birth weight was found to be highest in women who were illiterate, followed by women educated up to school level with comparatively less incidence, while least incidence of low birth weight was observed in women, who were educated up to higher secondary and above level. This observation was found to be statistically significant (P=0.006). Deshpande Jayant D. et al[39] carried out a case control study where the percentage of illiterate and primary education was more in cases (35.5%) as compared to control group (24.5%). Illiteracy was significantly associated with low birth weight [OR=1.69(1.1-2.61), P= 0.02)].

While, Rakesh K. Nayak et al[49] found that, about 78.47% of the mothers were literate with 3.46% having post SSLC education and 0.69% having completed graduation. Associations was not significant for mother's literacy status (p= 0.572). Afshan Bhatti et al[34] also found that, majority of women in both groups were illiterate and education was statistically not significant between two groups (x2=3.64, P=0.303). Similarly, Choudhary et al[51] found a nonsignificant association between educational status of mother and low birth weight (X2=4.672, df= P > 0.05).

Table 10-a, 10-b, 10-c showed that most of the mothers in both groups were primiparas (60%, 48.08% respectively), followed by parity 2 (20%, 38.08% respectively). There were more number of primiparous mothers among cases as compared to controls (66.67%, 49.41% respectively). This difference was statistically significant. Primipararus mothers showed a risk of having low birth weight 2.04 times that of mothers of parity 2 and 3 [χ2= 9.62, df =1, P = 0.001, OR= 2.04 (1.29 -3.23)].

Mothers of parity 4 and 5 showed a risk of having low birth weight baby 6.09 times that of mothers of parity 2 and 3 [χ2= 15.43, df =1, P = 0.000, OR= 6.09 (2.27-16.34)]. Similar results were seen in a study done by Gagan A. et al,[44] where the prevalence of low birth weight among primiparous mothers was found to be 42.86% and it fell up to parity 4 and rose in parity of >5(23.80%).

Rakesh K. Nayak et al[49] reported that the risk of low birth weight was higher among primigravida (11.8%) and among grandmultipara with 5 or more pregnancies (p=0.002). K.S Negi et al [29] reported a increased risk of low birth weight for primiparous women (OR =3.21, p < 0.01) compared to mutiparous women. Afshan Bhatti et al[34] found that proportions of primiparous women were high in cases and statistically significant association found with low birth weight (P < 0.001). In contrast, Choudhary et al51(X2= 0.101, P > 0.05) and M.K. Sharma et al[18] found that association between primiparity and low birth weight was not significant. Selina Khatun and Mahmudur Rahman[30] found that there was no association between primiparity and grand multiparity alone or combined with low birth weight.

The mean height of mothers in the study group was 146+/-7.68 cm which was lower than the mean height of mothers belonging to the control group (147.42+/-5.69 cm) Table 11 showed that majority of cases had a height < 145cm than in the controls (37.69 %, 18.08 %

respectively). This difference was statistically significant. Mothers with a height less than 145 cm showed a risk of having low birth weight 2.74 times that of Mothers with a height > 145 cm [χ2=17.97, D .F= 1, P= 0.000 , OR= 2.74 (1.70 - 4.40)]. In a hospital based case control study done by D.Acharya et al[27] maternal height < 145 cm was associated with a higher risk of low birth weight [OR=4.48(1.75-11.5)].

Padda P. et al[40] found that about 77.6 % of the mothers with height < 145 cm delivered low birth weight babies whereas, among mothers with height >145 cm only 32.7 % delivered low birth weight (p<0.01). Contradictory to these findings, Biswas R. et al17 (χ2 =2.13, P>0.05) and Choudhary et al[51] (x2= 0.4180, P > 0.05) found that maternal height <145 cm had nonsignificant association with low birth weight.

The mean weight of mothers in the study group was 46.24+/-9.49 which was lower than the mean weight of mothers in the control group (49.88+/-5.59) Table 12 showed that comparatively higher number of cases were having weight of < 45kg as compared to controls (46.92%, 31.74% respectively). The difference was statistically significant. Mothers with postpartum weight < 45 kg showed a risk of having low birth weight 1.90 times that of mothers with postpartum weight > 45 kg [χ2 = 8.19, df =1, P = 0.004, OR = 1.90 (1.22 - 2.95)]. The mean weight of mothers in the study group was 46.24+/-9.49 which was lower than the mean weight of mothers in the control group (49.88+/-5.59) These finding were consistent with the study done by M. A. Ullah et al[25] who measured maternal weight at 3rd trimester and found that maternal weight < 50 kg had statistically significant association with low birth weight (X2=23.23).

In a cross sectional study done by P.S.Thombre et al,[22] it was found that number of mothers with weight <40kg (postnatal weight) were more in low birth weight group (54.3%). This difference was found to be significant [OR=0.15(0.07-0.33), p<0.001].

K.S.Negi et al [29] also found that, maximum number of low birth weight babies in their study were delivered by mothers whose gestational weight at third trimester was less than 45kg (P<0.01,OR =8.2). Similar results were seen by Pandey S. et al[43] [OR=7.0 (3.3-14.73)] and D.Acharya et al[27] where maternal weight of < 45 kg was a significant risk factor for IUGR [OR= 7.0 (3.3- 14.73)].

In contrast to our study, Choudhary et al[51] revealed no significant association between maternal height (X2=0.4180, P > 0.05), maternal weight (X2= 1.832, P> 0.05) and low birth weight. Table 13 showed that higher number of women in both groups received 4 or more ANC visits. However, the number of women who received inadequate ANC visits were more amongst the cases (44.62%) than the controls (28.85%).The difference was statistically significant.

Mothers who received inadequate ANC visits showed a risk of having low birth weight 1.98 times that of mothers who received adequate ANC visits [$\chi 2$= 9.59, D .F. =1, P= 0.001, OR= 1.98 (1.28 - 3.07)]. Similar results were seen in a study conducted by Selina Khatun and Mahmudur Rahman[30] where a positive effect of number of antenatal care visit on birth weight was seen. Those mothers who received 4 or more antenatal care visits gave birth to higher birth weight babies in comparison to mothers who received less than 4 antenatal care visit ($\chi 2$= 268.678,p<0.001).

In a study done by S.D.Singh et al[20] mothers with one antenatal visit had almost six times higher risk of having a low birth weight baby in comparison to mothers who had 5 or more antenatal visits (p < 0.001). Kramer[2] found that the number of ANC visits a woman received was not a significant risk factor for delivery of a low birth weight baby. Similarly, Biswas R. et al[17] ($\chi 2$ =2.62, df =1 p>0.05), Afshan Bhatti et al [34] (x2=2.482, p<0.289) found a non significant association between total ANC visits and low birth weight.

Table 14 showed that registration after first trimester was seen more in case group than control group (31.54%, 24.23% respectively).However, this difference was statistically not significant [$\chi 2$= 2.36, df =1, P= 0.12, OR= 1.44(0.90-2.29)]. These findings were similar to that of Biswas R. et al[17] ($\chi 2$=1.11, df=2 ,P>0.05) where most of the controls were registered at 12-16 wks(73.9%) and most of the cases were registered at gestational age of > 16 wks (33%).A non significant association was found between time of registration of pregnancy and low birth weight. While, in studies done by Selina Khatun and Mahmudur Rahman[30] ($\chi 2$=219.054, P<0.001), Deshpande Jayant D.et al[39] [OR=2.18(1.42-3.35) P=0.0004], P.S.Thombre et al[22] (p< 0.001) found that the birth weight of babies significantly influenced by the time of registration.

CONCLUSION

In present case control study, the incidence of low birth weight found was 27.73 %. Univariate analysis showed following factors to be significantly associated with low birth weight- Maternal age, gestational age at the time of birth, low socioeconomic status, occupation of mother, low education of mother, primiparity, parity of 4 and 5,maternal height <145 cm ,maternal weight < 45 kg,less than 4 ANC visits, inadequate intake of IFA tablets, complications during pregnancy, bad obstetric history, severe and moderate anaemia, addiction of mother, household heavy physical activity of mother.

RECOMMENDATIONS

Based on the study findings the following recommendations are made

1. It was observed that, mother's age <19 years was significantly associated with birth weight of the newborn. This is due to the fact that early marriages give rise to teenage pregnancies when the girl is not fully developed physically and mentally. So, there should be strict implementation of the marriage act with active participation of community.
2. Literacy can be increased by means like literacy classes for school dropouts and adult illiterate females.
3. Nutritional factors like maternal height, weight and anemia were significantly associated with low birth weight. Improvement of nutritional status of women through proper health education through mass media, school curriculum, social organizations such as mahila mandal, adult education forum likely to help.
4. It was observed that inadequate ANC visits were significantly associated with low birth weight. Health education regarding proper ANC care can be provided by village level workers such as gram sevikas, panchayat members and health workers.

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