Original Research Article

Impact of maternal physical activities, rest, sleep, paternal education and addiction as determinants of low birth weight in India: a single hospital survey in Madhya Pradesh

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Abstract

Background: Birthweight continues to be the leading infant health indicator and the main focus of infant health policy. Low birthweight babies are at a higher risk of mortality and morbidity in most low-income countries. However, the physical activity level of pregnant women and its association with low birthweight is not well studied in India, especially Central India. **Materials & Methods:** About 1000 live newborns on 1st day of birth and their mothers were studied from Department of Obstetrics and Gynaecology and Intensive neonatal care, Department of Pediatrics of a tertiary care teaching hospital between January 2016 to December 2019. Examinations of mother and newborns were carefully carried out in all cases recorded on a pretested and predesigned proforma. **Results:** Mothers, who were advised bed rest for any of the cause, gave birth to more number of LBW babies. Among the women who were working outside beside the routine household work, the unskilled workers had more of LBW babies while skilled workers had less number of LBW babies. This was statistically very highly significant. About 503 mothers who took rest in the afternoon of 1-2 hrs, 377 of them (75%) gave birth to NBW babies. Rest more than 1-2 hrs, showed similar results. About 300 mothers who could not take post lunch rest in the afternoon 83% of them gave birth to LBW babies. This was statistically very highly significant. The number of LBW babes was more with paternal literacy of higher secondary or more than that. The difference was much marked in babies whose fathers were technically educated. This was statistically very highly significant. **Conclusion:** Mothers educated till Primary School and unskilled workers had higher prevalence of LBW babies. However after graduation in both parents, the LBW and prematurity increased after showing reduction with Higher Secondary education. Socioeconomic factors reflected on maternal health. Our study demonstrated that both maternal and paternal factors could affect birth weight. The assumption that antepartum bed-rest treatment is effective in preventing preterm birth and preventing fetal growth restriction or birth weight.

Keywords: Newborn, low birth weight (LBW), normal birth weight (NBW), physical activity, antepartum bed rest, India

Introduction

Low birth weight (LBW) is defined as a birth weight of less than 2500 g (up to and including 2499 g), as per the World Health Organization (WHO) [1]. This definition of LBW has been in existence for many decades. In 1976, the 29th World Health Assembly agreed on the currently used definition. Prior to this, the definition of LBW was '2500 g or less'. Low birth weight is further categorized into very low birth weight (VLBW, <1500 g) and extremely low birth weight (ELBW, <1000 g) [1]. Low birth weight is a result of preterm birth (PTB, short gestation <37 completed weeks), intrauterine growth restriction (IUGR, also known as fetal growth restriction), or both [2].Low birth weight (LBW) continued to be a significant public health problem, globally, with the highest prevalence in low- and middle-income countries (LMICs). The United Nations Children's Fund reported a global LBW rate of 14.6%, and more than 91% of LBW infants are born in LMICs [3]. Physical activity in pregnancy has been shown to influence perinatal outcomes [4-7]. However, as physical activity parameters such as type, intensity and timing during pregnancy might exert different maternal and fetoplacental adaptations, the effects of various physical activity stimuli on birth weight need a thorough investigation [8-10]. Aim of the present study was to find out the incidence of LBW in this region and to identify various risk factors responsible for it so that high risk mothers can be detected earlier. It will help in future to suggest adequate measures to improve the birth weight of babies, which in turn will help in reducing the neonatal and infant mortality and morbidity and improve the wellbeing of children. Study was done to explore the impact of maternal physical activities, rest, sleep, paternal education and addiction as determinants of low birth weight in India: a single hospital survey in Madhya Pradesh. The study would reveal distribution of LBW in various socioeconomic,

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occupational, ethnic, environmental and literacy groups and its comparison with normal birth weight. The study also revealed the frequency and extent of various epidemiological factors affecting birth weight.

Materials and methods

About 1000 live newborns on 1st day of birth and their mothers were studied from Department of Obstetrics and Gynaecology and Intensive neonatal care, Department of Pediatrics of a tertiary care teaching hospital between January 2016 to December 2019. Selection of cases was done into two groups based on their birth weight. Institutional ethics committee permission and individual consent was taken before enrolment of study participants. Newborns weighing less than or equal to 2500 gms were put under category of LBW and those weighing more than 2500 gms were designated as normal birth weight babies (control group). Examinations of mother and newborns were carefully carried out in all cases recorded on a pretested and predesigned proforma. Socioeconomic status of parents was noted. Maternal history like obstetric, antenatal care, diet, physical exertion during different trimesters, duration of rest in pregnancy, any associated acute or chronic systemic disease before or during pregnancy and its duration, drugs and radiation exposure during 1st two trimesters were noted.

Besides anthropometric measurements general and systemic examination was done. Whenever pre-pregnancy weight was known or recorded on antenatal examination cards was noted. Serial recordings of weight of mother, if available were noted for knowing weight gain. Hb estimation, blood pressure recording and urine examination for albumin data was captured. Weight of the baby was taken on a beam and pan type weighing scale (detectoscale). Placenta of 297 newborns was weighed on that scale just after delivery and removal of maximum possible clots and cutting the cord. The frequency distribution tables for various variables were calculated in the standard way, Chi square test was used to test for dependence of one factor over the other.

Results

The present study comprises observations made on 1000 newborns and their mothers admitted in a tertiary care teaching hospital, Indore, Madhya Pradesh.

Table 1: Distribution of cases according to weight and gestational age

Wt (gms)	Total No.	%	Preterm	%	Term	%	Post term	%
1000-1500	37	7.4	35	24.1	2	0.7	-	-
1501-1750	35	7	25	17.2	10	2.9	-	-
1751-2000	78	15.6	35	24.1	41	11.6	2	25
2001-2250	142	28.4	30	20.7	108	31.2	4	50
2251-2500	208	41.6	20	13.8	186	53.6	2	25
Total	500	100%	145	100%	347	100%	8	100%
2501-3000	405	81	8	88.9	319	80	78	85
3001-3500	80	16	1	11.1	68	17	11	12
>3500	15	3	-	-	12	3	3	3
Total	500	100%	9	100%	399	100%	92	100%

X^2= 163.1829, p<0.001

In LBW group 145 (29%) were preterm, 347 (69.4%) term and 8 (1.6%) post term while in LBW group 399 (79.8%) were term. Only 9 (1.8%) were borderline preterm and remaining 92 (18.4%) were post-term. This difference was statistically very highly significant [Table 1].

Table 2: Birth weight in different gestational ages

Parameters	Preterm	Term	Post-term
Mean	1860 gms	2570 gms	2785 gms
S.D.	442.04	400.22	300.09
Range	1050-3050 gms	1250-3650 gms	1850-3950 gms
t	18.43	-	6.44
P value	<0.001		<0.001

Table 2 shows that mean birth weight of preterm babies was 1860±442.044 gms and of term babies 2570±400.72 gms. This observed difference was statistically significant (t=18.43, p<0.001). Similarly mean birth weight of postterm babies was 2785±300.09 gms. The difference from term babies was statistically very highly significant (t=6.44, p<0.001).

Table 3: Distribution of cases according to maternal age

Maternal Age (Yrs)	LBW	%	NBW	%	Total	%
<18	40	8	14	2.8	54	5.4
18-20	86	17.2	49	9.8	135	13.5
21-25	237	47.4	277	55.4	514	51.4
26-30	114	22.8	140	28	254	25.4
>30	23	4.6	20	4	43	4.3
Total	500	-	500	-	1000	-
Mean	22.9 yrs	-	23.8 yrs	-	23.4 yrs	-

X^2= 32.3335, p<0.001

Below 20 years, 25.2% were low birth weight babies and 12.6% normal birth weight babies. After 30 years, again number of low birth weight babies was higher than control group [Table 3].

Table 4: Distribution of cases according to maternal literacy

Maternal literacy	LBW	%	NBW	%	Total	%
Illiterate	229	45.8	174	34.8	403	40.3
Primary pass	63	12.6	46	9.2	109	10.9
Middle pass	74	14.8	46	9.2	120	12
Higher sec.	102	20.4	145	29	247	24.7
College (Non technical)	32	6.4	83	10.2	115	11.5
Technical Edu	-	-	6	1.2	6	0.6

/Professional						
Total	500		500		1000	

X^2= 42.8134, p<0.001

Illiterate mothers and those who were upto middle pass had significantly more number of LBW babies (73.2%) while mothers possessing higher education. This was statistically very highly significant [Table 4].

Table 5: Distribution according to type of physical exertion in different trimesters

Type of physical exertion	LBW	NBW	Total
1st Trimester			
Rest or bed rest	09	06	15
Routine household work	469	466	935
Farmer or labour work	20	11	31
Working in service	2	17	19
2nd Trimester			
Rest or bed rest	8	3	11
Routine household work	469	469	938
Farmer or labour work	20	11	31
Working in service	3	17	20
3rd Trimester			
Rest or bed rest	14	6	20
Routine household work	448	468	916
Farmer or labour work	35	9	44
Working in service	3	17	20

1st trimester X^2= 20.473, p<0.001

2nd trimester X^2= 18.887, p<0.001

3rd trimester X^2= 28.337, p<0.001

It was obvious from the table that maximum numbers of mothers was house wives and were doing routine house hold work during pregnancy. In these mothers there was not much difference in the number of LBW and NBW babies. Mothers, who were advised bed rest for any of the cause, gave birth to more number of LBW babies. Among the women who were working outside beside the routine household work, the unskilled workers had more of LBW babies while skilled workers had less number of LBW babies. This was statistically very highly significant [5].

Table 6: Distribution according to average hours of sleep in the night

Duration of sleep	LBW	%	NBW	%	Total	%
<4 hrs	14	2.8	-	-	14	1.4
4-6 hrs	120	24	43	8.6	163	16.3
7-9 hrs	334	66.8	420	84	754	75.4
>10 hrs	32	6.4	37	7.4	69	6.9
Total	500		500		1000	

X^2= 60.5455, p<0.001

Maximum number (75.4%) of mothers had sleep of 7-9 hours in the night. Mothers who took rest less than this period gave births to more number of LBW babies as compared to number of normal birth weight babies. Mothers who took rest in night <4 hrs gave birth to NBW baby. This was statistically very highly significant [Table 6].

Table 7: Distribution according to average hours of rest in the afternoon

Duration of rest	LBW	%	NBW	%	Total	%
30 min	06	1.2	-	-	6	0.6
31-60 min	89	17.8	29	5.8	118	11.8
1-2 hrs	126	25.2	377	75.4	503	50.3
2-3 hrs	28	5.6	29	5.8	57	5.7
>3 hr	-	-	14	2.8	14	1.4
Occasional rest	2	0.4	-	-	2	0.4
No rest	249	49.8	51	10.2	300	30
Total	500		500		1000	

X^2= 315.3233, p<0.001

About 503 mothers who took rest in the afternoon of 1-2 hrs, 377 of them (75%) gave birth to NBW babies. Rest more than 1-2 hrs, showed similar results. About 300 mothers who could not take post lunch rest in the afternoon 83% of them gave birth to LBW babies. This was statistically very highly significant [Table 7].

Table 8: Distribution of cases according to paternal literacy

Paternal education	LBW	%	NBW	%	Total	%
Illiterate	149	29.8	91	18.2	240	24
Primary pass	51	10.2	17	3.4	68	6.8
Middle pass	89	17.8	72	14.4	161	16.1
Higher sec.	134	26.8	217	43.4	351	35.1
College (Non technical)	74	14.8	91	18.2	165	16.5
Technical Edu /Professional	3	0.6	12	2.4	15	1.5
Total	500		500		1000	

X^2= 59.59, p<0.001

The number of LBW babes was more with paternal literacy of higher secondary or more than that. The difference was much marked in babies whose fathers were technically educated. This was statistically very highly significant [Table 8].

Table 9: Distribution of cases according to paternal addiction

Paternal addiction	LBW	%	NBW	%	Total	%
Bidi/cigarette/smoking	77	15.4	6	1.2	83	8.3
Alcohol drinking	17	3.4	-	-	17	1.7
None	406	81.2	494	98.8	900	90
Total	500		500		1000	

About 105 of the fathers were addicted, out of them 83 (8.3%) were smoking cigarette or bidi in the houses during pregnancy of the mothers. About 77 of them (92.7%) gave birth to LBW babies. About 17 fathers, who were taking alcohol during pregnancy of their wives delivered LBW baby. This was very statistically significant [Table 9].

Discussion

LBW is associated with increased risk of diabetes mellitus, hypertension and cognitive dysfunction later during life [11]. But it is still not rare in developing countries with the overall prevalence was 15.9%.To lower the incidence of LBW, it is very important to identify risk factors. Research have found maternal age, education level, BMI, ethnicity, socio-economic level, medical disease before and during pregnancy, health care and traffic air and noise pollution were related to LBW [11-13].

That having no formal education was associated with increased likelihood of having delivered a LBW baby was not perhaps surprising as different measures of socioeconomic disadvantage are associated with adverse delivery outcomes such as LBW [14-16]. The mechanisms associated with LBW among the less educated may include poor diet as a result of low income and low dietary literacy. Studies have reported that milk consumption which may be a feature of high socioeconomic position during pregnancy was associated with increased neonatal size. Limited education may also result in limited access to prenatal care, especially in settings where clients or their health insurance are expected to pay for service. This is not expected to be an issue as prenatal care attendance was controlled for in our analysis. Studies had however hypothesized that educated women are more likely to adhere to health messages either because of their social circumstances or the cognitive priming that education affords [16-19].

Antepartum bed rest is currently used in an attempt to prevent preterm birth by approximately 71–87% of USA obstetricians and, to a lesser extent, in Canadian physicians and midwives to prevent preterm birth, despite questions regarding its effectiveness and safety [20-23]. The use of bed rest as a treatment in healthcare dates to the early 1900s [23]. Antepartum bed rest is used to prevent preterm labor, and as a treatment for pregnancy-related complications such as preterm rupture of membranes, placenta previa, incompetent cervix, fetal growth retardation, preeclampsia and multiple gestation [24]. There are two assumptions behind antepartum bed-rest treatment; that bed rest is effective in preventing preterm birth, and that bed rest is safe for mothers and their fetuses/infants [24].

Maternal weight change predicted infant birth weight (P = 0.05). Bed rest treatment is ineffective for improving pregnancy weight gain. Lower infant birth weights across all gestational ages suggest that maternal weight loss during bed rest may be associated with an increased risk of fetal growth restriction. A randomized trial comparing women with high-risk pregnancies who are ambulatory with those on bed rest is needed to determine whether bed rest treatment, underlying maternal-fetal disease, or both influence inadequate maternal weight gain and poor intrauterine growth [25].

Women were categorised as active or inactive based on the ACOG recommendations. In total, 79.1% and 45.2% of women met the guidelines in the second and third trimesters, respectively. The overall time spent and total energy expenditure was significantly higher in the second trimester ($p < 0.001$). We found no relationship between physical activity during pregnancy and neonatal birth weight. This study indicates that a considerable reduction of time and total energy expenditure occur as pregnancy progresses. Physical activity during pregnancy does not appear to significantly affect neonatal birth weight [26].

It was obvious from the present study that maximum numbers of mothers was house wives and were doing routine house hold work during pregnancy. In these mothers there was not much difference in the number of LBW and NBW babies. Mothers, who were advised bed rest for any of the cause, gave birth to more number of LBW babies. Among the women who were working outside beside the routine household work, the unskilled workers had more of LBW babies while skilled workers had less number of LBW babies. This was statistically very highly significant.

In Legesse M e al study, 47.2% of mothers were involved in vigorous physical activities at work or home, and a significant proportion of them took part in activities that required squatting and standing for longer hours during their third trimester. Moreover, being involved in high intensity physical activity along with the warm weather would consequently lead to small for gestational age fetus and low birthweight [27].

Higher and prolonged lead exposures were associated with higher risk of LBW birth and preterm birth; however, details of timing of exposure in relation to pregnancy were not available in detail to assess direct effect [28]. One study reported a higher risk of LBW births and another reported a higher risk of preterm births among fathers who had a high school education only, compared with fathers who had a college education. One small study reported a 200-g reduction in birthweight with regular alcohol use; other studies reported no difference in the risk of LBW birth or pre term births with different levels of paternal alcohol use [28, 29].

Paternal alcohol use has been associated with a number of adverse reproductive outcomes in laboratory animals and there is one epidemiologic report of a detrimental effect on infant birth weight. To expand the epidemiologic evidence, data from the Child Health and Development Studies were analyzed. Data collected from the onset of prenatal care in 10,232 women enrolled in the Kaiser Foundation Health Plan and residing in the San Francisco East Bay area between June 1959 and September 1966 were available, including information on the mother's report of paternal alcohol consumption and a number of potential confounders. Pregnancy outcomes included preterm delivery (< 37 weeks completed gestation), moderately low birth weight (1,501-2,500 g), very low birth weight (< or = 1,500 g), small-for-gestational-age (< 10th percentile of weight for gestational age), and mean birth weight. Paternal alcohol use, analyzed in intervals from 0 to 2.0 or more drinks per day, showed no association with any of the outcomes of interest. Adjusted prevalence odds ratios ranged from 0.7 to 1.5, with no indication of a monotonic dose-response gradient. Mean birth weight was also virtually unrelated to paternal alcohol use. Compared with the earlier report, this population had a very modest level of alcohol consumption.

Nonetheless, within the range that was studied there appears to be no association between paternal alcohol use and birth outcome [30]. In the present study about 105 of the fathers were addicted, out of them 83 (8.3%) were smoking cigarette or bidi in the houses during pregnancy of the mothers. About 77 of them (92.7%) gave birth to LBW babies. About 17 fathers, who were taking alcohol during pregnancy of their wives delivered LBW baby. This was very statistically significant. Heavy maternal alcohol consumption during pregnancy has been associated with fetal growth retardation, but whether more moderate consumption also is associated remains a controversial issue. Windham GC et al examined moderate consumption in 1233 women with singleton livebirths, by calculating a weighted average of weekly consumption in the first 20 weeks from questions that asked about alcohol consumption before pregnancy, as well as any changes during the first half of pregnancy. The adjusted odds ratio for ("moderate") consumption of three or more drinks per week for low birthweight was 2.6 [95% confidence limits (CL) = 1.2, 5.7], and that for intrauterine growth retardation was 2.3 (95% CL = 1.2, 4.6). Examining the joint effect of smoking with alcohol consumption revealed associations that differed by outcome; we found a synergistic effect for low birthweight, but not for intrauterine growth retardation. Moderate alcohol consumers had an average birth-weight decrement of 143 gm, which varied by smoking. There was little association of alcohol consumption with preterm delivery (< 37 weeks). Paternal alcohol consumption was not associated with any of the fetal growth measures after adjustment for other variables [31].

Conclusion

Mothers educated till Primary School and unskilled workers had higher prevalence of LBW babies. However after graduation in both parents, the LBW and prematurity increased after showing reduction with Higher Secondary education. Socioeconomic factors reflected on maternal health. Our study demonstrated that both maternal and paternal factors could affect birth weight. The assumption that antepartum bed-rest treatment is effective in preventing preterm birth, preventing fetal growth restriction and increasing gestational age of birth and infant birthweight is not supported by research. The assumption that antepartum bed-rest treatment is safe – that is, without major adverse effects for mother and or infant – is not supported by research. About 105 of the fathers were addicted, out of them 83 (8.3%) were smoking cigarette or bidi in the houses during pregnancy of the mothers. About 77 of them (92.7%) gave birth to LBW babies. About 17 fathers, who were taking alcohol during pregnancy of their wives delivered LBW baby. This was very statistically significant.

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