



# Maternal Smoking during Pregnancy and its Association with Low Birth Weight

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## Abstract

**Introduction:** Maternal smoking has been an important risk factor for low birth weight (LBW), preterm birth as well as small for gestational age. In this study, we try to analyze the association of maternal smoking during the different stages of pregnancy with outcome of birth weight.

**Methods:** This is a cross-sectional hospital-based study, which was undertaken comprising of 1240 singleton live born baby in a Tertiary Care Teaching Hospital, Nepal. The enrollment occurred between June 2012 and May 2016 (Four years) among mothers who smoked any time during the current pregnancy. Based on the amount of smoking, the mothers with cigarette smoking were divided into four groups which includes: preconception, the first trimester, second trimester and third trimester. The data analyses were performed using Logistic regression and 95% confidence interval along with p-value. A p-value < 0.05 was considered statistically significant.

**Results:** Of a total of 1240 singleton births, 328 (26.5%) were LBW. Among them, 149 (12.1%) of the mothers reported smoking during pregnancy. When compared with the nonsmoking groups, all the maternal smoking groups had higher incidences of LBW infants, especially when the mothers smoked > 10 cigarettes / day and during any stage of conception.

**Conclusions:** Smoking during pregnancy is associated with an increased incidence of LBW among the infants. In addition, the newborns of mothers who smoked > 10 cigarettes / day were most susceptible to having LBW, irrespective of the stage of pregnancy during which the mothers smoked.

## Introduction

Maternal smoking during pregnancy has been proposed to be one of the most critical preventable factors that can affect the fetus and mother herself.<sup>1,2</sup> The risk is independent of the other known risk associations, including previous pregnancy, parity, maternal height, weight, social class and race.<sup>3</sup>

There are many studies carried out in different ethnic groups that have consistently revealed that maternal smoking is associated with elevated prevalence of low birth weight (LBW) and preterm deliveries.<sup>4,6</sup> The mechanisms through which smoking leads to negative effects during pregnancy have not been fully understood. Nicotine

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causes reduction in placental circulation, leading to lower maternal weight gain and negative fetal outcomes, such as small for gestational age (SGA), LBW and also compromised fetal neurological development.<sup>7</sup> Although there are many studies confirming the relationship between maternal smoking and LBW, they have not considered the dose–response effect of smoking.<sup>8,9</sup> Also, there is no national data on the prevalence of smoking during pregnancy, nor are there estimates on smoking cessation during pregnancy. However, hospital-based study carried out in eastern Nepal, reported that 19.2% of pregnant women were smokers.<sup>10</sup> Therefore, the aim of this study was to analyze the effect of different intensities of smoking by pregnant mothers on birth weight of the newborn.

## Methods

This is a hospital-based, cross-sectional study conducted in tertiary care Teaching Hospital, Nepal. Ethical clearance was taken from the institutional review committee. Data were obtained from 1,240 women enrolled in a hospital-based outpatient clinic during pregnancy and postpartum. Enrollment occurred between May 2012 and June 2016 (Four years). Brief questionnaire regarding basic socio-demographics and cigarette smoking during prenatal, first, second and third trimester was noted. The mothers were divided into four groups according to the amount of smoking during preconception, the first trimester, second trimester and third trimester. Mothers who have given multiple births or still birth baby, mothers having diseases during pregnancy and those who refused to give consent were excluded from the study. The data were also collected on potentially confounding sociodemographic, medical and behavioral variables.<sup>11</sup> Sociodemographic variables included: age; education; employment; occupation; economic status and residence (Urban / rural). Medical variables included data on obstetrical history, namely: first pregnancy; the interval between deliveries, only for multiparous women. The quality of prenatal care was also investigated using the variables: place of care (Public service facility, private service facility); number of ANC visits, and use of both folic acid (As of the first prenatal visit) and iron sulfate (As of the 20<sup>th</sup> week of gestation) (Yes / no). Finally, presence of any problems during gestation were also investigated. The outcome variable was birth weight of an infant which was measured in grams. The data analyses were performed using logistic regression and 95% confidence interval along with p-value. Relationships were considered significant if  $p < 0.05$ . All analyses were performed using the Statistical Package for the Social Sciences SPSS v 20.0.

## Results

There were 1,240 mothers with live singleton births, with a mean age of 29.5 years (Range 17 to 42 years) Table 1. Overall mean birth weight was found to be  $2.65 \pm 0.536$  kg. Out of total, 26.5% ( $n = 328$ ) newborns were weighing less than 2500 gms with mean birth weight among LBW  $1.96 \pm 0.412$  kg. Among LBW, 108 (9.3%) were LBW associated with maternal smoking

shown in (Table no. 2). LBW was mostly seen in mother of age group  $> 35$  years and  $< 20$  years with 54.2% and 29.5% respectively Table 1.

Table 1. Sociodemographic status of the participants

Variables	LBW (N = 328)	NBW (N = 912)	Newborn babies (1240)	p-value
Maternal age				
< 20 years	73 (29.5%)	175 (70.5%)	248	< 0.05
20 - 25 years	76 (21.3%)	284 (78.7%)	360	
26 - 30 years	65 (25 %)	195 (75 %)	260	
30 – 35 years	28 (13.8%)	184 (86.2%)	212	
> 35 years	86 (54.2%)	74 (45.8%)	160	
Education				
No	84 (76.5%)	26 (23.5%)	110	NS
Primary	110 (16.4 %)	557 (83.5%)	667	
Secondary	60 (25.0%)	180 (75%)	240	
Higher	74 (33.2%)	149(66.8%)	223	
Occupation of mother				
Housewife	263 (36.2%)	463 (63.8%)	726	< 0.05
Government job	35 (25.7 %)	101 (74.3%)	136	
Private job	30 (7.9 %)	348 (92.1%)	378	
Economic Status				
Upper	04 (4.5%)	83 (95.5%)	87	< 0.05
Middle upper	36 (10.9%)	292 (89.1%)	328	
Lower upper lower	85 (18.6%)	372 (81.4%)	457	
Lower middle	109 (42.57%)	147 (57.4%)	256	
Lower	94 (83.9 %)	18 (16.1%)	112	
Residence				
Urban	100 (12.1%)	728 (87.9%)	828	NS
Rural	228 (55.3%)	184 (44.6 %)	412	

\*NS- Not Significant

The incidence of LBW was 72.7% among mothers who smoked during pregnancy compared to those who were non-smokers (20.1%) Table 2.

Table 2. Showing comparison between the birth weight with the smoking habit of mother

Smoking habit	Birth category		Total	P-Value
	LBW (%)	NBW (%)		
Smoker	108 (72.7%)	41 (27.3%)	149 (100%)	< 0.05
Non-Smoker	220 (20.1 %)	871 (79.9 %)	1091(100%)	
Total	328 (26.5%)	912 (73.5%)	1240 (100%)	

\*LBW- Low birth weight, \*\*NBW- Normal birth Weight  
 LBW was more obvious in infants whose mothers smoked > 11 - 20 cigarettes / day during any stage of pregnancy. The proportions of LBW in maternal smoking before pregnancy, during the first trimester, during the second and third trimesters were found to be 86.2%, 7.4%, and 6.4%, respectively as shown in Table 3.

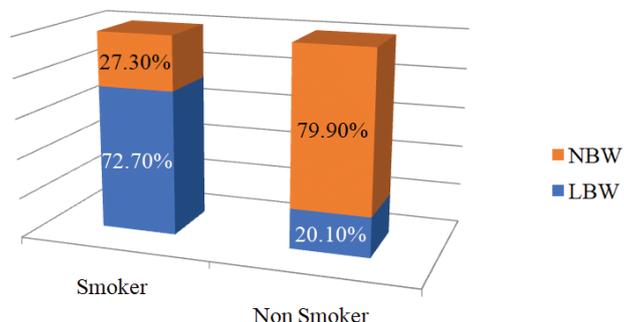
Table 3. Frequencies of maternal smoking among LBW babies

S.No	Characteristics	Percentage NBW, n (%) among smoker	LBW among smoker n (%)	P-Value
1.	Non – smoker	871 (79.9 %)	220 (20.1 %)	0.018
2.	Preconception	130 (87.2%)	93 (86.2%)	0.036
	10 cigarette / day	119 (92.1%)	83 (89.2%)	
	11 - 20 cigarette / day	8 (6.9%)	7 (7.5%)	
3.	> 20 cigarette / day	3 (1%)	3 (3.3 %)	0.023
	1 <sup>st</sup> trimester	11(7.3%)	8 (7.4%)	
	1-10 cigarette / day	10 (98.6%)	7 (87.5%)	
	11 - 20 cigarette / day	1 (1.4%)	1 (12.5%)	
4.	> 20 cigarette / day	0	0	0.031
	Second and third trimester	8 (5.3%)	7 (6.4%)	
	1 -10 cigarette / day	7 (96.6%)	6 (85.7 %)	
	11 - 20 cigarette / day	1 (3.4%)	1 (14.2%)	
	> 20 cigarette / day	0	0	

\*LBW- Low birth weight, \*\*NBW- Normal birth weight

Mothers who smoked during different stages of pregnancy gave birth to LBW babies compared to mothers who are non-smokers as shown in figure 1. Our study revealed an inverse correlation between birth weight and the number of cigarettes smoked per day. In addition, the newborns of mothers who smoked > 10 cigarettes / day were most susceptible to having LBW, irrespective of the stage of pregnancy during which the mothers smoked.

Figure 1. Showing the comparison of birth weight with smoking habit of mother



\*NBW- Normal Birth Weight  
 \*LBW- Low Birth Weight

### Discussion

Cigarette smoking during pregnancy harms both the mother and her fetus. There is increased risk of LBW, preterm deliveries, respiratory distress syndrome and sudden infant death syndrome in infants born to mothers who smoke during pregnancy.<sup>12</sup> Infants with LBW are more likely to get infections and have more mortality and morbidity.<sup>13</sup> In our study, the prevalence of maternal smoking was 12.1% (149) which was less than a study done in eastern Nepal by Shrestha N et al.<sup>10</sup> In this study, the prevalence of tobacco use during pregnancy was 19.2% and LBW was 13.3% among tobacco users mothers with no significant correlation between LBW and smoking during pregnancy. The study contradicts from our study which may be attributed to the different time periods and the method of study conduction.

We also found that all the maternal smoking groups, irrespective of the period of smoking (During preconception or during the stages of pregnancy), revealed a higher incidence of LBW than the non smoking group (72.7% vs 20.1%). Similar findings were seen in the studies done in Japan and Lithuania.<sup>14,15</sup>

We analysed the LBW with maternal socioeconomic factors and found that low and lower middle socioeconomic groups have given higher LBW compared to middle and high socioeconomic factors which was statistically significant. Low socioeconomic factors may be associated with other harmful factors concurrent with maternal smoking during pregnancy.<sup>15</sup> In a study conducted by Dickute et al.<sup>15</sup> among 41,246 births in Lithuania, there was a significant difference found in the proportions of low educated (primary or basic) ( $p < 0.001$ ) or having the secondary school diploma ( $p < 0.01$ ). It also showed that approximately half of mothers of LBW babies had the secondary school diploma, while every fourth woman had the vocational education or university degree. This finding was similar to study conducted in Nepal<sup>10</sup> which showed a significant relation between smoker mother with low socioeconomic group and LBW infants. Previously reported factors

include behavioral factors, psychological distress, and biological factors including genital tract infection and inflammation and pathological placental changes, which may increase the adverse effect on birth outcomes of maternal smoking during pregnancy.<sup>16</sup>

This study confirmed the proportion of LBW infants born to teenage mothers and elderly mothers was higher than that in mothers aged 20 to 29 years, but the odds ratio of infants being LBW in smoking mothers were similar for all the age groups. These results indicate that teenage mothers and elderly mothers who smoked during pregnancy are at higher risk for having LBW infants than other age group. This result is consistent with other studies.<sup>6,10,17</sup>

Our study also showed that maternal smoking affects the infants during all stages of pregnancy, but the most significant effect occurs during late pregnancy, especially in the case of mothers who are heavy smokers, smoking more than 10 cigarettes. Bernstein et al<sup>18</sup> reported that maternal smoking during the third trimester was the strongest predictor of birth weight after adjusting for gestational age. Each cigarette smoked per day during the third trimester is estimated to contribute to a 27 grams reduction in the birth weight of the infant. An inverse correlation between birth weight and the number of cigarettes smoked per day was seen in this study. In addition, the newborn babies of mothers who smoked > 10 cigarettes / day were most susceptible to having LBW, irrespective of the stage of pregnancy during which the mothers smoked. This may be because mothers who were heavy smokers before pregnancy tended to continue smoking during pregnancy as well. Compared with developed countries, more men and fewer women smoke in developing countries, but smoking among girls and women is increasing in developing countries.<sup>10</sup>

Moreover, even low levels of tobacco use among reproductive age women raise concerns for public health not only because of potential effects of tobacco women themselves but also because smoking during pregnancy has been linked to preterm delivery, LBW and other fetal problems.<sup>14</sup> This study thus highlights an increased incidence of LBW among smoker mothers irrespective of the stage and the amount of cigarette smoking during any stage of pregnancy compared to non-smoker mothers.

## Conclusions

Our study revealed that there is an increased risk of LBW infants with mothers who smoked during pregnancy. The newborns of mothers who smoked > 10 cigarettes / day were most susceptible to having LBW, irrespective of the stage of pregnancy during which the mothers smoked.

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