Original Research Article

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20210243

Socio-economic and nutritional determinants associated with low birth weight among urban and rural Rajasthan: a case control study

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Received: 01 December 2020 **Revised:** 16 January 2020 Accepted: 18 January 2020

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ABSTRACT

Background: A baby's weight at birth is associated with mortality risk during the first year, developmental problems in childhood and also with the risk of various diseases in adulthood.

Methods: It was a hospital-based case control study conducted from 1st January 2019 to 30th June 2020 in a tertiary care hospital in Udaipur, Rajasthan. Mothers who delivered low birth weight baby (LBW) at the hospital, during the study period were taken as cases and controls were selected after matching. Total 86 cases and 172 controls were included in the study. A pre-structured questionnaire was used to collect information given by mothers.

Results: Mean age was 28±4.51 years. Low birth weight was found to be significantly associated with sociodemographic variables such as rural area, caste and lower socio-economic status. Birth weight was also associated with weight gain during pregnancy, iron folic acid and calcium supplements and protein powder intake.

Conclusions: Sociodemographic variables and maternal nutrition are the key determinants that need to be addressed to reduce the prevalence of LBW in India. Implementation of health promotion strategies are needed to address these factors effectively.

Keywords: India, Low birth weight, Nutrition, Socio economic

INTRODUCTION

World Health Organization (WHO) defines LBW (low birth weight) as birth weight less than 2.5 kg. Low birth weight is a major challenging public health problem and with both short and long-term associated consequences.1 There are more than 20 million births a year in the world and 15% to 20% of all births are low birth weight. Most of these (>95%) of LBW infants are born in developing countries. In India, almost one third of (30-35%) the babies are LBW. India accounts for almost 40% of low birth weight babies in the overall developing countries.2

Proportion of babies with LBW is regarded as a sensitive index of nation's health and development.3 LBW babies have greater risk of dying in the first few weeks of life and neonatal period.^{2,4} Worldwide, more than half of newborn mortality is due to LBW. It restricts their growth and development in the childhood and in later life. LBW is found to be associated with increased risk of developing learning disabilities and behavioural disorders, presenting children and adolescents with major challenges in terms of their education and subsequently quality of life.5 Evidence suggests that LBW is also associated with development of non-communicable diseases such as childhood hypertension, cardiovascular disease, metabolic syndrome, and diabetes in adulthood.^{6,7}

Multiple causes are responsible for LBW, with complex interactions of range of factors like genetic, sociodemographic reproductive, cultural and environmental factors. Despite of a national level reproductive, maternal, neonatal and child health program, burden of LBW has little changed in India. It could be due to failure to tackle the root cause of LBW. Hence, identifying the risk factors for LBW have the potential role in formulating effective strategies for reducing LBW in our country. Many states in India have been able to curb the proportions of low birth weights. However, Rajasthan, a north western state in India, has been performing poor in women and child health related indicators for decades. The context of Rajasthan sets the stage for the poor maternal and child health, both in terms of its terrain and the sociocultural environment of women's lives.

The aim of the present study was to assess the risk factors associated with LBW in urban and rural Rajasthan, India.

METHODS

It was a hospital-based case control study conducted from 1st January 2019 to 30th June 2020 in a tertiary care hospital in Udaipur, Rajasthan. Purposive, consecutive sampling was used to select cases and matched controls. Mothers who delivered at the hospital, during the study period were taken and the purpose of study was explained to them. After taking the written consent, the prestructured and pre designed questionnaire was filled according to the information given by mothers during their stay at hospital. The mother with LBW babies (<2.5 kg) were assigned as cases and were matched with comparable controls (mother with healthy baby) from the hospital itself. The socioeconomic status was determined using B.G. Prasad scale (used for both rural and urban).⁸ Sample size was calculated using following formula,

$$N = \frac{r+1}{r} \left[\frac{(Z_{\alpha} + Z_{1-\beta})^2 P(100 - P)}{(P_1 - P_2)^2} \right]$$

Where.

 Z_{α} is 95% confidence level = 1.96

 $Z_{1-\beta}$ is 80% power of study = 0.8413

P is prevalence of LBW in India = 30% ⁹

Q = 100 - P = 70%

 $(P_1 - P_2)$ is difference in proportion to be 10%

r = 2 as ratio of control to cases taken to be 2:1.

Thus, total sample size of 258 study subjects was considered among which 86 were to be the cases of LBW and 172 were the control group with normal weight of baby.

Inclusion criteria

All mothers delivering at the hospital, who gave consent to participate in the study.

Exclusion criteria

Mothers who refused to participate in the study.

Statistical analysis

Data entry was done in MS Excel and statistical analysis was done using SPSS IBM version 21. Descriptive analysis was done using mean and SD, ratio, proportion and percentage.

Inferential analysis was done using test of significance using Student t test (unpaired) and Chi Square test. p<0.05 was considered as level of statistical significance.

Ethical considerations

For the study, Institutional ethical clearance was obtained from the institution ethical committee. Informed written consent was taken from study participant after explaining purpose and objective of the study. Data confidentiality and privacy was maintained at all stages of the study. Option to exit the study was kept open to participants at all times.

RESULTS

In this study, total of 258 study subjects participated (86 cases and 172 controls). Mean age of the study subjects was found to be 28.41±4.51 years. Out of the total, majority (70.16%) were in the age group of 25-34 years.

Table 1 shows sociodemographic variables of the study participants. Out of the total women, majority of cases (69.8%) were from rural area, which was significantly higher than 30.3% cases from urban area. Mean age of cases was comparable to that of controls. About 52% of the participants belonged to general category. However, out of the total 136 women from general category, 25.7% were cases. Out of the total 40 females belonging to scheduled tribes (ST), 55% were cases, followed by 55% cases from schedule caste (SC). There was also statistically significant difference between socio economic status of cases. Highest proportion of cases were from socioeconomic class IV and V.

Table 2 shows the nutritional variables of the cases and controls. Out of the total females who had weight gain less than 10 kg during pregnancy had significantly higher proportion of cases (70.5%) as compared to the females with higher weight gain (25%). Intake of Iron and folic acid tablets (IFA) was associated with lower proportion of low birth weight babies. Similarly, women with history of calcium intake had significantly lower proportion of cases as compared to women whom had not consumed calcium supplements during pregnancy (29.9% versus 62.9%).

Intake of protein powder was associated with lower proportion of cases (22.3% versus 73%). However, women with haemoglobin levels <11 mg/dl had higher

percentage of cases, but the difference was not statistically significant.

Table 1: Sociodemographic variables of the study subjects.

Variables		Total (258)	Cases (86)	Control (172)	P value	
Residence	Rural	134 (51.94)	60 (69.77)	74 (43.02)	<0.001	
	Urban	124 (48.06)	26 (30.23)	98 (56.98)		
Age (mean±SD)		28.41±4.51	28.59±5.23	28.31±4.12	0.27	
Caste	General	136 (52.71)	35 (40.7)	101 (58.72)		
	OBC	62 (24.03)	14 (16.28)	48 (27.91)	<0.01	
	SC	20 (7.75)	11 (12.79)	9 (5.23)	<0.01	
	ST	40 (15.50)	26 (30.23)	14 (8.14)		
Socioeconomic status	I	27 (10.47)	6 (6.98)	21 (12.21)		
	II	74 (28.68)	29 (33.72)	45 (26.16)		
	III	97 (37.6)	24 (27.91)	73 (42.44)	0.04	
	IV	52 (20.16)	24 (27.91)	28 (16.28)		
	V	8 (3.10)	3 (3.49)	5 (2.91)		

Table 2: Nutritional variables of the study subjects.

Variables		Total (258)	Cases (86)	Control (172)	P value
Weight gain	≥10 kg	214 (82.95)	54 (62.79)	160 (93.02)	<0.01
weight gain	<10 kg	44 (17.05)	31 (37.21)	13 (6.98)	
Homoglobin lovels	≥11	134 (51.9)	40 (46.5)	94 (54.7)	0.17
Hemoglobin levels	<11	124 (48.1)	46 (53.5)	78 (45.3)	
IFA tak aangumutian duning musananan	≥100	242 (93.8)	72 (83.72)	170 (98.84)	<0.01
IFA tab consumption during pregnancy	<100	16 (6.20)	14 (16.28)	2 (1.16)	
Coloium gunnlement inteles	Yes	231 (89.53)	69 (80.23)	161 (93.60)	0.001
Calcium supplement intake	No	27 (10.47)	17 (19.77)	10 (6.40)	
Duotoin novedou	Yes	202 (78.29)	45 (52.33)	157 (91.28)	< 0.001
Protein powder	No	56 (21.71)	41 (47.67)	15 (8.72)	

DISCUSSION

This study was conducted among 86 cases and 172 controls. Mean age was 28±4.51 years. Among the sociodemographic variables, rural area of living, caste, and lower socio-economic status were found to be significantly associated with low birth weight. These findings are supported by other authors. 10,11 It is likely that women with living in rural/tribal area and with lower socioeconomic status may not be aware of the factors responsible for low birth weight. There can be certain cultural beliefs or practices practiced by them which are not healthy during pregnancy. More over accessibility to adequate health care resources such as, good antenatal care may be poor which consequently influences foetal growth. Therefore, interventions to make the antenatal care services more acceptable and accessible to vulnerable women are important to reduce prevalence LBW in India. In this study, mother's weight gain during pregnancy additionally demonstrated a noteworthy relationship with low birth weight. Incidence of LBW was more in mothers who gained weight less than 10 kg during pregnancy. This result resembles with the finding of earlier studies. ^{12,13}

This study in resemblance with studies, revealed that during pregnancy consumption of sufficient IFA tablets, calcium supplement, and protein powder plays a vital role in delivering a healthy baby. 14,15 No statistically significant differences were apparent for birth weight in children born to mothers with haemoglobin levels of $\leq\!11$ mg/dl. A meta-analysis by Xiong et al reported similar findings, and a possible explanation could be that anaemia due to physiological fall in haemoglobin levels during late pregnancy (normal plasma volume expansions). 16

Birth weight is an extremely powerful predictor of an individual baby's survival and hence indicator of child's health in a state. At the end of tenth five-year plan in 2007, the Rajasthan's health infrastructure was nearly adequate. However, the overall average values hide the non-availability of infrastructure in the tribal/difficult areas of the state where there were shortfalls in terms of

subcentres, primary health centres and community health centres. ¹⁷

Additionally, with established caste divisions and social hierarchies, there is a highly-stratified, unequal society which remain relatively unchallenged by social or religious reforms. The rural/urban split for the private-sector health facilities is also uneven in whole country. Hence there is need to devise effective strategies for the proper implementation of national program guidelines for making the proper impact to improve the maternal and child health of vulnerable population.

CONCLUSION

The findings of this study showed that various sociodemographic factors and maternal nutrition considerably affect the birth weight of baby. Area of residence, caste, socioeconomic status, weight gain during pregnancy, iron folic acid and calcium supplements and protein powder intake were found to be significantly associated with low birth weight (LBW). Therefore, prevention strategies should be designed to tackle these multiple risk factors. Through ante natal care, it is possible to identity women who are at risk of having LBW babies.

Counselling regarding balanced diet and provision of iron folic acid tablets can be easily facilitated. In a diverse country like India, where urban rural differences and sociocultural characteristics play a considerable role in factors affecting maternal health, there is a need to construct specific approaches to tackle the problem of LBW. Focussing on these factors will not only prevent occurrence of LBW but also prevent problems associated with LBW such as child morbidity and mortality, thereby helping the country to achieve sustainable development targets.

ACKNOWLEDGEMENTS

We are grateful to all the participants of the study.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

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Cite this article as: Kabra M, Dixit M, Verma A, Hirani J, Mathur M. Socio-economic and nutritional determinants associated with low birth weight among urban and rural Rajasthan: a case control study. Int J Community Med Public Health 2021;8:807-11.