



A Case Control Study to Elucidate the Effects of Maternal Anthropometric Characteristics and Other Factors on Birth Weight of Newborn

Jaya V Suryavanshi¹, Poonam P Shingade²

Financial Support: None declared
Conflict of Interest: None declared
Copy Right: The Journal retains the copyrights of this article. However, reproduction is permissible with due acknowledgement of the source.

How to cite this article:

Suryavanshi JV, Shingade PP. A Case Control Study to Elucidate the Effects of Maternal Anthropometric Characteristics and Other Factors on Birth Weight of Newborn. Natl J Community Med 2018; 9(4): 318-321

Author's Affiliation:

¹Assistant Professor, Dept of Community, Medicine, Gulbarga Institute of Medical Sciences, Gulbarga; ²Assistant Professor, Dept of Community, Medicine, ESIC MC, Gulbarga

Correspondence

Dr. Suryavanshi Jaya V
Jayaad77@gmail.com

Date of Submission: 13-10-15

Date of Acceptance: 25-04-18

Date of Publication: 30-04-18

ABSTRACT

Background: Birth weight reflects mother's health and nutritional status during pregnancy. This study was conducted to measure the effect of various maternal factors on birth weight; and also to study the strength of association between risk factors and low birth weight.

Methods: A case-control study was conducted among neonates delivered in tertiary care Hospital from June 2013 to July 2014 among mothers who delivered in the hospital and their singleton newborns. Birth weight was measured for all newborns and these mothers undergone anthropometric measurements and were asked relevant questions.

Results: The proportion of low birth weight was 27.73%. Maternal age of more than 30 years (odds ratio 1.98; $\chi^2=3.86$, $P=0.04$), gestational age at the time of birth (OR 4.37; $\chi^2=44.21$, $P=0.000$) occupation of mother (OR 1.69, $\chi^2=4.54$, $P=0.03$) maternal height <145 cm (OR 2.74, $\chi^2=17.97$, $P=0.000$), maternal weight <45 kg (OR 1.90, $\chi^2=8.19$, $P=0.004$) and complications during pregnancy (OR 1.78 $\chi^2=6.55$, $P=0.01$) have a significant association with LBW infant.

Conclusion: LBW rate was higher when Maternal age more than 30, early gestational age at the time of birth, occupation of mother, maternal height <145 cm, maternal weight < 45 kg and complications during pregnancy.

Key words: Birth weight, maternal anthropometry, maternal complications during pregnancy.

INTRODUCTION

Low birth weight has been defined by the World Health Organization as weight at birth of less than 2,500 grams. Birth weight 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 birth weight infants.¹ A number of indicators of early maturity of newborn are accepted worldwide, but there is no agreed overall definition. The most commonly used indicator of newborn maturity is birth weight.² Approximately 14% of infants in low-income countries weigh less than 2.5 kg at birth - many are born preterm.³ The incidence of

low birth weight, defined as the proportion of newborns weighing less than 2,500 grams, is monitored through both health system surveillance and household surveys. In 2013, nearly 22 million newborns—an estimated 16 per cent of all babies born globally that year—had low birth weight. Among regions, South Asia has the highest incidence of low birth weight, with one in four newborns weighing less than 2,500 grams. South Asia also has the highest rate of infants not weighed at birth, at 66 per cent.⁴

Infant birth weight is a significant predictor of the immediate and future health status of a newborn. Low birth weight (LBW) is a major public health concern and one of the strongest single risk factors

for early neonatal mortality and morbidity.⁵ In the perinatal period, low birth weight infants are in a critical state with regard to survival, and approximately half of all neonatal deaths are directly or indirectly linked to low birth weight.⁶

Furthermore, it is a significant factor associated with higher probabilities of infection, greater susceptibility to childhood illness, lower chances of child survival, long-term physical and mental deficiencies, and problems related to behavior, learning, and psychosocial improvements during childhood.⁷

METHODOLOGY

Study design: This is a hospital based case control study. **Study area:** The study was done in postnatal care ward of Obstetrics and Gynaecology department. **Sampling technique:** Purposive sampling was done. All the deliveries occurred during the study period were recorded. Out of total mothers delivered during the study period 130 mothers were included in as cases and 260 mothers were included as controls. Case to Control ratio was kept at proportion of 1:2.

Case - Low birth weight (LBW): According to the WHO definition, infants with birth weight less than 2500 gm are low birth weight irrespective of age of gestation.¹

Control - Normal birth weight (NBW): Infant birth weight \geq 2500 gm.¹

Exclusion criteria: Stillbirths, congenital malformations, multiple pregnancy, and mothers who refuse to participate in the study were excluded from the study. **Study period:** The data was collected during June 2013 to July 2014

Data collection: A written consent was obtained from each mother recruited for this study. The participants were interviewed using a pre-tested standard structured questionnaire. Study variables were recorded. Complication recorded were pregnancy induced hypertension, preeclampsia, oligohydramnios, polyhydramnios, severe anaemia, antepartum hemorrhage, gestational diabetes. The maternal weight was measured by circular, string type portable new weighing machine. Maternal height was measured in cms by drawing metric scale on wall. Information regarding birth weight was obtained from the available birth records. Data was compiled and analysis was done using Microsoft excel 2007. 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: It was observed that most of the mothers belonged to rural area (72.31%). Majority of mothers in case and control groups were Hindus (74.62%, 80.77% respectively) and majority of mothers belonged to joint families (74.62%, 81.92% respectively). Mean birth weight was 2703.51 ± 290 grams. Amongst the cases, the mean birth weight was 2204.67 ± 481.8 grams and amongst the controls it was 2952.93 ± 201.98 grams.

Table 1: Relationship of various maternal factors with birth weight

Maternal factors	LBW (n=130)(%)	NBW (n=260)(%)	OR	P value
Maternal age (years)				
>30	17(15.32)	20(8.37)	Ref	0.04
20-29	94(83.18)	219(91.63)	1.98	
Gestational age at the time of birth				
<37 wks	79(60.77)	68(26.15)	Ref	0.00
>37 wks	51(39.23)	192(73.85)	4.37	
Maternal occupation				
Working	38(29.23)	51(19.62)	Ref	0.03
Housewife	92(70.77)	209(80.38)	1.69	
Maternal weight				
<45 kg	61(46.92)	73(31.74)	Ref	0.004
>45 kg	69 (53.08)	157(68.26)	1.9	
Maternal height				
< 145 cm	49(37.69)	47(18.08)	Ref	0.00
> 145 cm	81(62.31)	213 (81.92)	2.74	
Residence				
Rural	102(78.46)	180(69.23)	Ref	0.054
urban	28 (21.54)	80 (30.77)	1.61	
Sex of the newborn				
Female	69(53.08)	127(48.85)	Ref	0.43
Male	61(46.92)	133(51.15)	1.18	
Complications during pregnancy				
Yes	51(39.23)	69(26.54)	Ref	0.01
No	79(60.77)	191(73.46)	1.78	

LBW= Low Birth Weight; NBW=Normal Birth Weight

Table 1 shows a statistically significant association was seen between maternal age >30 years and low birth weight. It is observed that mothers with age group > 30 years were comparatively more in case group (15.32%) than control group(8.37%). This difference was found statistically significant. 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. A statistically significant difference was seen between working outside the house and having low birth weight baby. It was seen 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. 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. 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%). However; this difference was statistically not significant. There were more number of female babies (53.08%) in case group than control group (48.85%). However, this difference was statistically not significant. The number of women who had complication during pregnancy was significantly higher in the case group than in the control group (39.23 %, 26.54% respectively). This difference was statistically significant. Women who had complication during pregnancy showed a higher risk of having low birth weight baby.

DISCUSSION

In 2011, Indian Statistical Institute reported nearly 20% of new born have LBW in India.⁸

In our study, the proportion of low birth weight was 27.73 %, which is more than that, this could be because present study was carried out in a tertiary care hospital where many of the pregnant women were referred from the peripheral centers due to high risk pregnancy.

In the present study, maternal age >30 years showed a statistically significant association with low birth weight. These findings were also comparable with retrospective community based study conducted by Selina Khatun and Mahmudur Rahman⁹ 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%).

Most of the cases in our study delivered at 34 wks of gestation (26.92%) and most of the controls delivered at 39 wks of gestation (21.92%). 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. Similar results were seen in a study done by Shah U P et al¹⁰. 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 ($\chi^2= 6.37$, $P = 0.01$).

It was found that in our study, more number of cases were working outside the house (29.23%) as compared to controls (19.62%). The difference was statistically significant [$\chi^2=4.54$, $df = 1$, $P = 0.03$, $OR= 1.69$ (1.04 -2.75)]. Similarly, Selina Khatun and Mahmudur Rehman⁹ ($\chi^2=10.254$, $p<0.01$), Deshpande Jayant D. et al¹¹ [$OR=3.16$ (1.12-8.87) $P=0.03$], Agarwal et al¹² ($p<0.000$) found a significant association between working mothers and 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). It was observed that majority of cases had a height < 145cm than in the controls (37.69 %, 18.08 % respectively). This difference was statistically significant. In a hospital based case control study done by D. Acharya et al¹³ maternal height < 145 cm was associated with a higher risk of low birth weight [$OR=4.48$ (1.75-11.5)]. Similarly, 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 [$\chi^2 = 8.19$, $df = 1$, $P = 0.004$, $OR = 1.90$ (1.22 - 2.95)]. In our study, 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 findings were consistent with the study done by M. A. Ullah et al¹⁴, who measured maternal weight at 3rd trimester and found that maternal weight < 50 kg had statistically significant association with low birth weight ($X^2=23.23$). In a cross sectional study done by P.S.Thombre et al¹⁵, 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), $p<0.001$]. In contrast to our study, Choudhary et al¹⁶ revealed no significant association between maternal height ($X^2=0.4180$, $P > 0.05$), maternal weight ($X^2= 1.832$, $P > 0.05$) and low birth weight.

It was observed that The number of women who had complication during pregnancy were significantly higher in the case group than in the control group (39.23 %, 26.54% respectively). This difference was found significant ($\chi^2=6.55$, $P=0.01$). These findings were in accordance with other studies done by H.S.Joshi et al¹⁷, where they found a highly significant association between a history of complications during pregnancy and low birth weight ($P<0.001$). More number of cases lived in a rural area (78.46 %) as compared to controls (69.23%). However, this difference was statistically not significant [$\chi^2=3.68$, $df = 1$, $P=0.054$, $OR=1.61$ (0.98-2.65)]. Similarly, P. S. Thomre et al¹⁵ [$P=0.96$,

OR=0.99 (0.60 - 1.62)] and Selina Khatun and Mahmudur Rahman⁹ found no association between area of residence and low birth weight. We found that there was more number of female babies in case group (53.08%) than control group (48.85%). However, this difference was statistically not significant [$\chi^2=0.62$, $df = 1$, $P=0.43$, $OR=1.18$ (0.77-1.80)]. This finding was in accordance with that of a study conducted by, H.S. Joshi et al¹⁷ where proportion of low birth weight was 32.59% in males and 36.37 % in females; however this difference was found statistically insignificant.

CONCLUSION

In present case control study, the proportion of low birth weight is 27.73 %. Univariate analysis showed statistically significant association between maternal age >30 years, gestational age at the time of birth, working mother, maternal height <145 cm, maternal weight < 45 kg and complications during pregnancy. LBW is the strongest determinant of infant morbidity and mortality in India. LBW is public health problem, caused by factors that are easily modifiable and early identification of significant risk factors associated with LBW is required in order to provide essential care for mothers during antenatal period and their newborns.

REFERENCES

1. United Nations Children's Fund, World Health Organization. Low Birth weight: Country, Regional and Global Estimates. New York, NY UNICEF 2004.
2. Kramer MS. Determinants of low birth weight—Methodological assessment and meta analysis. *Bull WHO* 1987, 65: 663-737.)
3. Lee AC, Katz J, Blencowe H, Cousens S, Kozuki N, Vogel JP, et al.; Cherg SGA-preterm birth working group. National and regional estimates of term and preterm babies born small for gestational age in 138 low-income and middle-income countries in 2010. *Lancet Glob Health*. 2013 Jul;1(1):e26-36. [http://dx.doi.org/10.1016/s2214-109x\(13\)70006-8](http://dx.doi.org/10.1016/s2214-109x(13)70006-8) PMID: 25103583
4. UNICEF global databases, 2014, based on Multiple Indicator Cluster Surveys (MICS), Demographic and Health Surveys (DHS) and other nationally representative surveys, 2009–2013
5. Assefa N, Berhane Y, Worku A. Wealth status, mid upper arm circumference (MUAC) and antenatal care (ANC) are determinants for low birth weight in Kersa, Ethiopia. *PLoS One*. 2012;7(6):e39957. [PMC free article] [PubMed]
6. Lau C, Ambalavanan N, Chakraborty H, Wingate MS, Carlo WA. Extremely low birth weight and infant mortality rates in the United States. *Pediatrics*. 2013;131(5):855-860. [PubMed]
7. Metgud CS, Naik VA, Mallapur MD. Factors affecting birth weight of a newborn—a community based study in rural Karnataka, India. *PLoS One*. 2012;7(7):e40040. [PMC free article] [PubMed]
8. Office of the Registrar General. Sample Registration System Statistical Report 2011. New Delhi: Ministry of Home Affairs, Government of India; 2013 Sep. Available at: http://censusindia.gov.in/vitalstatistics/SRS_Bulletins/SRS_BulletinsSeptember_2013.pdf Accessed on 1 July 2017.)
9. Selina Khatun and Mahmudur Rahman. Socioeconomic determinants of low birth weight in Bangladesh: A multivariate approach. *Bangladesh Med Res Counc Bull*. 2008;34: 81-86
10. Shah U. P., Parikh S. B., Bala D. V. Effect of different maternal factors on birth weight in the Odhav ward of Ahmedabad Municipal Corporation: A Case Control Study. *Healthline pISSN 2239-337X/eISSN 2320-1525 January-June 2013 ;4(1) :58-60*
11. Deshpande Jayant D., Phalke D.B., Bangal V. B., D. Peeyuusha, Bhatt Sushen. Maternal risk factors for low birth weight Neonates: a hospital based case-control study in rural area of western Maharashtra, India. *National Journal of Community Medicine*. Oct-Dec 2011; 2 (3): 394-398.
12. Kiran Agarwal, Ashok Agarwal, V. K. Agrawal, Pooja Agrawal, Varsha Chaudhary. Prevalence and determinants of low birth weight among institutional deliveries. *Annals of Nigerian Medicine*. Jul-Dec 2011;5 (2): 48-52
13. Acharya D, Nagraj K, Nair NS, Bhat HV. Maternal determinants of intrauterine growth retardation: a case control study in Udupi District, Karnataka. *Indian J Community Med*. 2004;29:181-83.
14. M. A. Ullah, M. J. Haque, M. A. Hafez, Merina Khanam. Biological risk factors for low birth weight in rural Rajshahi. *TAJ* 2003; 16 (2) : 50-53
15. P. S. Thomre, A. L. Borle, J. D. Naik, S. S. Rajderkar. Maternal Risk Factors Determining Birth Weight of Newborns: A Tertiary Care Hospital Based Study. *International Journal of Recent Trends in Science And Technology*, ISSN 2277-2812 E-ISSN 2249-8109, 2012;5 (1) : 03-08
16. A. K. Choudhary, Asha Choudhary, S. C. Tiwari, R. Dwivedi. Factors associated with low birth weight among newborns in an urban slum community in Bhopal. *Indian Journal of Public Health*; January-March, 2013 57(1): 20- 23.
17. H.S. Joshi, S.H. Subba, S.B. Dabral, S. Dwivedi, D. Kumar, S. Singh. Risk factors associated with low birth weight in newborns. *Indian journal of community medicine*. October December 2005 ; 30(4):142-143