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Influence of maternal autonomy and socioeconomic factors on birth weight of infants in India

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ABSTRACT

Introduction: Child's birth weight (BW) is an important aspect not only during childhood but also affects morbidity and mortality in adulthood. The focus of this study is to examine the role of different socioeconomic factors, along with women's decision-making autonomy on the determination of infant BW. **Methods**: The dataset was obtained from the National Family Health Survey, India (2005-06). The respondents were women of reproductive age (15-49 years) having at least one living child at least five years old preceding the survey. This study considered only the last single live birth child having a recorded BW at the time of delivery. **Results:** The results showed that 19% of the infants were born with low birth weight (LBW) with regional variations ranging from 13% to 27%. The mean BW of infants of mothers from high autonomy category was 2.90±0.645 kg, while that of mothers with low autonomy was 2.75±0.702 kg. The proportion of LBW infants was significantly higher among mothers with low education, short stature, low BMI and poor wealth index category. Percentage of LBW infants were lower among mothers with autonomy including taking care of their own health (18% versus 21% who were not), making large purchases (17% vs 22%), visiting relatives (18% vs 22%), and allowed to go to the market (18% vs 22%). **Conclusion:** The findings indicated that the mother's freedom of movement and financial independence were significantly associated with infant's BW in India. Attention should be given to improving the socio-economic conditions and empowerment of Indian women.

Keywords: Low birth weight, women autonomy, body mass index, wealth index, Indian National Family Health Survey

INTRODUCTION

Infant's birth weight (BW) is an important factor that influences morbidity and mortality, not only during childhood but also during adulthood. Epidemiological observations depicted that infants born with low birth weight (LBW) (lower than 2,500 g; WHO, 2002) is approximately 20 times more likely to die than heavier babies, due to a wide range of poor health outcomes. In spite of constant efforts to improve maternal and child health care (MCH), the number of LBW infants is still remarkable throughout the world. Half of the children with LBW were born in South Asia and among

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these countries, India and Bangladesh have the highest prevalence of LBW (30%) (UNICEF, 2013).

The etiology of BW is the result of complex interactions among various social, economic and reproductive health factors. Several maternal factors are also significantly associated with LBW (Singh *et al.*, 2009; Cleland, 2010). Maternal nutritional status is one of the important determinants of newborn BW, as poorly nourished mothers give birth of higher percentage of LBW infants compared to those of better nourished mothers (Amosu & Degun 2014; Dharmalingam, Navaneetham & Krishna Kumar, 2010). Other studies also recognised that low body mass index (BMI), short stature, anaemia and/or other micronutrient deficiencies of mothers increase the risk of having LBW infants (Ohlsson & Shah, 2008). Variables associated with maternal status, such as education and occupation (Cleland, 2010) and with child nutritional status (Frost, Forste & Hass, 2005) are associated with child survival. However, the association is not universal as mothers, irrespective of their education, may be constrained by gender-biased rules that restrict opportunities to make decisions and mobility (Agee, 2010; Thang & Popkin, 2003). As in other South Asian Countries, Indian women's inferior social status within the household adversely affect their health and that of their children.

Recent studies emphasised on women's decision-making autonomy as a measure of BW. Women's autonomy is a complex and multidimensional phenomenon and in this study it was measured by some household decision-making indicators. A study from Bangladesh documented that women's decision making autonomy has an independent effect on LBW outcome after controlling all other independent variables, indicating that women autonomy has a positive effect on the reduction of LBW (Sharma & Kader 2013).

In India, there are few studies on the association of women autonomy and BW. Chakraborty & Anderson (2011) showed positive association between women's autonomy and infant BW. The present study examines the association between autonomy and BW along with the regional variations in India, given that India is a multi-ethnic, multi-cultured country with regional development disparities.

MATERIALS AND METHODS

The present data set was obtained from the National Family Health Survey 3 (NFHS 3, 2007), which was conducted by International Institute of Population Sciences (IIPS), Mumbai, in collaboration with the Ministry of Health and Family Welfare, in 2005-06. The study was conducted among the women of reproductive age (15-49) having at least one living child at least five years old preceding the survey.

The present study considered only the last single live birth child having a recorded BW at the time of delivery. No pregnant women were considered for this study. A total of 15,130 children along with the socioeconomic and demographic backgrounds of the mothers were taken. The factors that were considered here are residence pattern, mother's education and occupation, mother's age at birth, wealth index (as a proxy of household economic status), religion and ethnicity[1]. Wealth index[2] was generated on the basis of some household assets and evolved by IIPS as poorest, poorer, middle, richer and richest (NFHS 3, 2007). Wealth index is categorised as poor, middle and rich, while for regression analysis, it was grouped as poor (poor or middle) and rich. Women's autonomy is a multidimensional concept and in this study, women's decision

making autonomy is defined as women's personal power in the household and her ability to make and execute independent decisions for herself or her close family members. This was seen to be closely associated with maternal and child health outcomes (Woldemicael, 2007; Shroff et al., 2009; Senarath & Gunawardena, 2009). Decision making on autonomy was questioned for the following eight aspects:

1) own health care,
2) making household purchases for household daily needs,
3) making household large purchases
4) visiting relatives
5) going to a health facility
6) going to market
7) having bank account
8) having money for her own use

These questions were originally developed by NFHS 3 (2007). Questions 1-4 are grouped here as household decision, Questions 5-6 are grouped as mobility-related autonomy and Questions 7-8 are grouped as financial autonomy. For the household decision, the responses are given as

a) three points for 'respondent alone decision'
b) two points for 'joint decision' and
c) one point for 'no involvement in these matters'.

The same coding was used for mobility. For financial autonomy, three points for 'having bank account' and 'money for own use' and one point for no financial autonomy. The scores were then added so that the range becomes 8-24 with a mean score 14.7. For the autonomy index, scores ≤13 are considered as low autonomy, scores between 14-18 are medium autonomy and scores ≥19 are considered as high autonomy.

In India, wide regional variations were observed in infant and maternal mortality (Singh *et al.*, 2011). The states were grouped into zones: North Zone North-East East Central West and South (NFHS 3, 2007).

Chronic Energy Deficiency (CED) (BMI as proxy indicator) and height of the mother (nutritional effect of long-term undernutrition) were determined. as an explanatory variable in the regression model. According to WHO (1995) classification, BMI <18.50kg/m2 is termed as underweight, in between 18.50 and 24.99 kg/m2 as normal and ≥25.00 kg/m2 as overweight and obese. A cut-off point of 145 cm was used for short stature (NFHS 3, 2007). Mumbare *et al.* (2012) termed a person to be short or non-short according to the height is <145.0 cm or ≥145.0 cm respectively.

Bivariate association of BW with each covariate was found through percentage distribution. Logistic regression was undertaken to determine the association between various independent socio-economic and autonomy-related factors with the LBW of the infants. Binary logistic regression was done with BW as a categorical dependent variable with a value as '1' for LBW and '0' for non-LBW.

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[1]Three groups for religion – Hindu Muslim and Others. Ethnicity is defined only for Hindu religion: General Castes (GC), Scheduled Castes (SC) and Scheduled Tribes (ST).

[2]Wealth index represents the economic status of the households. This index is based on 33 household assets and housing characteristics. Each household asset is assigned a weight (factor score) generated through principal component analysis, and the resulting asset scores are standardized to make the mean to be as zero and the variance as one (Gwatkin *et al.*, 2000). Each household is then assigned a score for each asset and the scores are summed for each household and individuals are ranked according to the score of the household. The sample is then divided into five quintile groups starting from lower strata to higher strata like --- poorest, poorer, medium, richer and richest. Thus, there are 20 percent of the household population in each wealth quintile.

Odds ratio >1 indicates probability of being LBW is higher than the reference category and if it is <1, then the result is reverse i.e. probability is lower than the reference category and if odds are close to 1, then no difference from reference category is observed. The statistical analyses were conducted using SPSS version 16.0 (IBM Corp., USA).

RESULTS

This study showed that among 15,130 children, 19.3% were of LBW (Table 1). The proportion of LBW infants was higher among mothers residing in rural areas (21.2%) compared to urban areas (17.8%). LBW infants were more prevalent among teenage mothers aged ≤19 years (26.4%) compared to other age groups. The proportion of LBW was higher among Hindu (20.2%) and Muslim (20.6%) mothers compared to the other religions (13.6%). The prevalence of LBW decreases with increase in mother's educational level and wealth index grades.

The proportion of low LBW was high among mothers working in the labour (23.2%) and agro-related (22.2%) categories, compared to professional jobs (e.g. teachers, doctors, lawyers). While the overall prevalence or LBW was 19.3%, this study found LBW varied from 27.2% in North zone followed by Central (22.7%), West (21.7%) and East (20.4%) zones. The prevalence of LBW was lower (17.9%) among the mothers who had completed at least four antenatal visits during their pregnancy compared to others. Sex of the infant plays a role in the determination of BW. LBW prevalence was higher among female (20.8%) than male (18.1%). The proportion of LBW with respect to socio-economic and demographic variables were all statistically significant.

Association of BW with mother's autonomy and health are depicted in Table 2. LBW outcome was high among the mothers with independent or joint autonomy about their own health care compared to mothers without autonomy. For household daily or large purchase, the proportion of LBW was high among the women with no autonomy. The proportion of LBW was the lowest among the mothers with independent mobility.

Women having money for their own use or bank account are of lower risk of giving birth of LBW babies. LBW was statistically higher among underweight (24.9%), and short height mothers (26.5%) than mothers with normal BMI. Table 3 shows the association between LBW (dependent variable) and different explanatory variables along with regional variations using binary logistic regression analysis. Most of the predictors showed significant associations with the risk of occurrence of LBW, except for residence. Mothers engaged in manual work or household activities have significantly higher odds of giving birth to LBW babies compared to those in service/professional category. The risk of delivering LBW infant was significantly high among the mothers of 'low education' compared to higher, 'poor wealth index' category compared to rich, 'Hindu or Muslim religions' compared to 'Others', 'non-tribal' in contrast to tribal group.

Regional variation in infant BW was also diverse in India. The regression model showed that the risk of LBW was significantly high among the babies of different zones compared to the North-East Zone. The only exception was found in the South Zone where no difference was observed. The mother's age should be a part in the risk to give birth of LBW infants. In this analysis, no such pattern was found, though teen-age mothers showed a significant risk at 10% level, which was not our consideration in the present study. Underweight and short

Table 1. Relationship between BW and mother's socioeconomic and other variables

Socio-economic and demographic variables	*N*	*LBW (%)*	*Mean BW (kg)*	*SD*
Residence				
Urban	8565	17.8	2.87	0.641
Rural	6565	21.2	2.83	0.695
Occupation				
Domestic work	11053	19.4	2.84	0.946
Prof/clerical/sales	1616	13.9	2.95	0.656
Agro-related	1511	22.2	2.83	0.768
Labour	950	23.2	2.82	0.712
Education				
Primary	4084	25.0	2.79	0.763
Secondary	8381	18.4	2.85	0.634
Higher	2665	13.6	2.94	0.584
Wealth index				
Poor	2025	24.5	2.79	0.778
Middle	2530	22.5	2.82	0.700
Rich	10575	17.6	2.87	0.631
Religion				
Hindu	11042	20.2	2.82	0.664
Muslim	1883	20.6	2.86	0.672
Others	2205	13.6	3.01	0.641
Tribe/Non-tribe				
Tribe	1562	12.7	3.06	0.668
Non-tribe	13568	20.1	2.83	0.661
Zone				
North	2075	27.2	2.72	0.689
Northeast	2646	13.0	3.05	0.657
East	1970	20.4	2.81	0.679
Central	1638	22.7	2.78	0.748
West	2827	21.7	2.80	0.669
South	3974	15.7	2.87	0.577
Mother's age at birth				
<=19 years	1570	26.4	2.75	0.709
20-35	13104	18.5	2.86	0.656
36 and above	456	19.1	2.94	0.722
Sex of the baby				
Male	8296	18.1	2.89	0.676
Female	6834	20.8	2.80	0.648
INDIA (overall)	15130	19.3	2.85	0.665

statured mothers were more prone to give birth to LBW infants compared to others. Female children were significantly more susceptible to the risk of LBW compared to male children.

The association between maternal autonomy and infant BW is shown in Table 4. It was found that economic independence or involvement was associated with less likelihood of infant LBW. The analysis confirmed that the women who play prominence role in large household purchase had significantly lower risk of LBW infants compared to others. Women with no bank account or have no money of their own exhibited higher risk of LBW babies compared to the reference group. Independent mobility also played an important role in the risk of LBW. Table 4 showed that the women with independent mobility to visit health facility alone, were at significantly lower risk of LBW infants compared to the other category (having no access).

Table 2. Relationship between infant BW and mother's decision making autonomy

Mother's Autonomy	*N*	*LBW (%)*	*Mean BW (kg)*	*SD*
Mother's household say on				
Own health care				
Respondent alone or with others[1]	10287	18.4	2.87	0.656
Other	4843	21.4	2.81	0.682
Large purchase				
Respondent alone or with others	8612	17.2	2.89	0.652
Others	6518	22.2	2.80	0.679
Daily needs				
Respondent alone or with others	9538	18.1	2.88	0.657
Others	5592	21.4	2.80	0.676
Visit to relatives				
Respondent alone or with others	10184	18.0	2.88	0.650
Others	4946	22.0	2.80	0.692
Independence of mobility				
Go to health facility				
Allowed alone	8841	17.4	2.89	0.655
Allowed with others	5782	21.8	2.81	0.675
Not allowed	507	24.7	2.79	0.688
Go to market				
Allowed alone	9565	17.7	2.88	0.653
Allowed with others	4153	22.3	2.80	0.685
Not allowed	1412	21.7	2.83	0.679
Financial autonomy				
Have bank account				
No	11749	20.4	2.83	0.674
Yes	3381	15.6	2.92	0.627
Have money for own use				
No	8515	20.7	2.83	0.669
Yes	6615	17.6	2.88	0.659
Overall autonomy				
High	8082	16.6	2.90	0.645
Average	4497	21.3	2.82	0.672
Low	2551	24.4	2.76	0.702
Antenatal visit				
No/incomplete	3714	23.6	2.81	0.752
Complete	11416	17.9	2.87	0.634
Mother's BMI				
Underweight	3694	24.9	2.73	0.683
Normal	8756	18.2	2.87	0.654
Overweight/obese	2680	15.3	2.96	0.653
Mother's height				
Short (<145cm)	1359	26.5	2.69	0.665
Not-short (>=145cm)	13771	18.6	2.87	0.663
India	15130	19.3	2.85	0.665

[1] i.e., accompanied with other members.

Consequently, the results also predicted that mothers with no antenatal visits (at least four visits during pregnancy regardless of the specified routine) were more inclined to give birth to LBW infants compared to those who had at least four antenatal visits. Mother's nutritional status, measured through BMI, showed a direct association with infant BW. It was found that the odd ratios of giving

Table 3. Logistic regression showing the association of risk factors of BW with respect to different socio-demographic factors†

Socio-demographic variable	*Odds ratio*	*p-value*	*95% CI*	
			Lower limit	*Upper limit*
Residence				
Rural	1.086	0.086	0.983	1.193
Urban	1.000			
Mother's occupation				
Domestic work	1.188	0.030	1.017	1.387
Agro-related	1.090	0.408	0.889	1.337
Labour	1.360	0.005	1.097	1.687
Prof/clerical/sales	1.000			
Mother's education				
≤Primary	1.844	0.000	1.585	2.146
Secondary	1.381	0.000	1.210	1.575
Higher	1.000			
Wealth index				
Poor	1.225	0.000	1.098	1.367
Non-poor	1.000			
Religion				
Hindu	1.236	0.006	1.064	1.436
Muslim	1.254	0.017	1.041	1.511
Others	1.000			
Tribe/non-tribe				
Non-tribe	1.379	0.001	1.145	1.660
Tribe	1.000			
Zone				
North	2.337	0.000	1.984	2.752
South	1.007	0.927	0.861	1.179
East	1.307	0.002	1.101	1.550
Central	1.703	0.000	1.428	2.030
West	1.643	0.000	1.404	1.924
North east	1.000			
Mother's age at birth				
≤19 years	1.224	0.139	0.937	1.600
20-35	0.858	0.222	0.671	1.097
36 and above	1.000			
Sex of child				
Female	1.220	0.000	1.124	1.325
Male	1.000			

†Dependent variable: LBW=1, other=0 (reference category)

birth to low BW infants among short height and underweight mothers were significantly high compared to the reference category.

DISCUSSION

LBW is a major public health problem due to its association with high morbidity and mortality of infants (Lawn, 2005). The results of the present study have shown that the prevalence of LBW is 19.3% in the study population. Along with other variation, regional variation was prominent where it varies from 13% to 27% in India. Most important reason for regional differences on prevalence

Table 4. Logistic regression showing the association of risk factors of BW with respect to maternal autonomy and other factors†

Autonomy related variables	*Odds ratio*	*p-value*	*95% CI*	
			Lower limit	*Upper limit*
Own health care				
Respondent alone or with others	0.994	0.899	0.899	1.098
Other	1.000			
Large purchase				
Respondent alone or with others	.792	0.000	0.708	0.885
Others	1.000			
Daily needs				
Respondent alone or with others	1.066	0.261	0.953	1.192
Others	1.000			
Visit to relatives				
Respondent alone or with others	.939	0.266	0.840	1.049
Others	1.000			
Allowed to mobility				
Go to health facility				
Allowed alone	.700	0.008	0.537	0.913
Allowed with others	.816	0.109	0.636	1.047
Not allowed	1.000			
Go to market				
Allowed alone	1.047	0.627	0.870	1.259
Allowed with others	1.108	0.244	0.933	1.316
Not allowed	1.00			
Financial autonomy				
Have bank account				
No	1.161	0.008	1.039	1.296
Yes	1.000			
Have money for own use				
No	1.097	0.038	1.005	1.197
Yes	1.000			
Mother's BMI				
Underweight	1.479	0.000	1.352	1.618
Normal or other	1.000			
Mother's height				
Short (<145 cm)	1.509	0.000	1.327	1.717
Not-short (>=145 cm)	1.000			
Antenatal visit				
No/incomplete	1.297	0.000	1.184	1.422
Complete	1.000			
Overall autonomy				
Low	1.356	0.000	1.238	1.485
Medium	1.317	0.000	1.171	1.481
High	1.000			

†Dependent variable: LBW=1, other=0 (reference category)

of LBW is that India's different regions are endowed with different natural and human resources like education. The regional disparities inherited from colonial rule, which have increased in the post-independence period because of faulty unified and centralised planning, political structure, and social norms and traditions. Proportion of LBW infants was found to be more frequent in rural areas (21.2%) compared to urban areas (17.8%). This was not only because

of the economic conditions of the households but also may be due to their poor access to medical and educational facilities. Among different socioeconomic and other factors, women's education, type of occupational activities, wealth index (which is a proxy of household economic status), ethnicity (SC, ST) and mother's age at birth were found to be the important predictors of infant LBW.

Earlier studies showed that women with no or primary education were more susceptible to LBW infants (Som *et al.*, 2004; Khatun & Rahman, 2008). Our results corroborate that women of primary or no education were at higher risk (OR=1.844) of delivering LBW infants. The frequency of LBW was significantly high among mothers belonging to Hindu and Muslim communities compared to other religious groups. Relating to caste hierarchy, non-tribal women had significantly higher odds (OR=1.379) compared to tribal women. The fact may be that religion or ethnicity are linked to various cultural practices, which in turn may affect infant BW.

Early age at marriage and teenage pregnancy are quite common in India (NFHS 3, 2007). The effect of mother's age on BW has been a matter of debate, with some studies reporting that teenage mothers are more likely to give birth to preterm infants and of LBW, and others suggest that incidence of LBW in younger adults can be explained in part by biological factors such as not attaining physical maturity and in part by socioeconomic differences which may confound results and weaken any conclusions regarding the effect of age (Joshi *et al.*, 2005; Negi, Khandpal & Kukreti, 2006). Our result confirms that teenage mothers were significantly more affected in delivering LBW babies compared to reference category. Mothers of 20-35 age groups, though not significant, showed that they were at lower risk of delivering LBW babies compared to mothers of 36 and above age group. It was presumed that household economic status played an important role in the determination of LBW in India (Som *et al.*, 2004). The present study also found that the maximum number of mothers giving birth to LBW infants belong to the poor socioeconomic category. The impact of socioeconomic status on LBW may be due to intrauterine growth retardation (IUGR) (Mavalankar, Gray & Trivedi, 1992; Fikree & Berenes, 1994). In such conditions, the infant's LBW stems primarily from mother's poor nutrition and health over a long period. Our result showed similarity with this study. It was observed that mothers with low BMI (underweight) or short stature are more vulnerable to LBW.

It is likely that women with primary or no education have low knowledge or awareness relating to health care practices which consequently may influence fetal growth. Complete or a good number of antenatal care visits may provide routine check-up of mothers with fetal problems (Dubey *et al.*, 2015; Paliwal *et al.*, 2013; Idris *et al.*, 2000). The present findings were similar. Our study also observed that maximum number LBW infants are coming from the mothers who were working as manual labour (30% more) compared to service group.

Similar observations were documented in earlier studies (Shahnawaz *et al.*, 2014). Results from this study have shown that women's poor nutritional status, reflected through low BMI (<18.5 kg/m2) had 48% higher odds of having LBW infants. These findings are in agreement with previous studies (Frederick *et al.*, 2008; Han *et al.*, 2011; Agarwal & Singh, 2012). Several studies examining the relationship between maternal height and LBW showed that shorter maternal height was associated with reduced fetal growth and LBW (Jananthan, Wijesinghe

& Sivananthewerl, 2009; Kramer, 2003; Ozaltin, Hill & Subramanian, 2010; Wills *et al.*, 2010) and concluded that the primary reason for this association was undernutrition/malnutrition.

In this study,the risk of delivering LBW infant was significantly high with odds of 51% or more among the short height women (<145 cm). Understanding the role of women's decision making autonomy in relation to BW is complex because of its multidimensionality and difficulty in formulating an appropriate measure. The results confirmed that women autonomy seemed to be a prime factor towards infant BW though different dimensions of autonomy might have different influences on BW.

Women's independent mobility orfinancial autonomy (money for own use) have much impact on her own health care. Periodic health check-up during pregnancy (antenatal visits) is important for maternal and child health. A study done by Bloom, Wypij & Das Gupta (2001) in North India showed that women's autonomy was the major determinant of maternal health care utilisation. Women with greater freedom inmovement were more likely to receive better antenatal care. Our results showed that women's independent mobility, having money for her own use and four or more antenatal visits had a lower chance of giving birth to LBW infants than their counterparts.

CONCLUSION

The present study found that along with different socioeconomic and related factors, women's autonomy showed a substantial influence on infant BW. In India, women's social position varied widely across regions affecting differences in BW. Therefore, along with the improvement of socioeconomic conditions of mothers, attention should be given to empower women the form of which may vary from region to region.

Authors' contributions

Shome S, performed data analysis, prepared the draft of the manuscript, reviewed the manuscript, reviewed and approved the final manuscript; Pal M, conceptualized and designed the study, adviced on the data analysis and interpretation, reviewed the manuscript, reviewed and approved the final manuscript; Bharati P, assisted in drafting of the manuscript, made critical revision of the manuscript, reviewed and approved the final manuscript.

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