ORIGINAL ARITICLE

Bio-social predictors of low birth weight- a prospective study at a tertiary care hospital of north Karnataka, India

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Article Cycle

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Abstract

Background: Low Birth Weight is a multi-factorial problem of health and social concern Worldwide. India accounts for 40 % of Low birth weight (LBW) babies of the developing World and more than half of those in Asia. Despite the multitude of services rendered to improve maternal health care, LBW remains a public health problem in India. **Objective:** To determine bio-social predictors of low birth weight amongst the institutional births in North Karnataka, India. **Methods:** A prospective hospital based study was conducted in Belgaum district of north Karnataka during July 2012-March 2013. A total of 426 pregnant women registered within 20 weeks of gestation during July–September 2013; eventually delivered in the same hospital were included in the study. Birth weight was measured by a digital weighing scale of 100 gram accuracy. Data were collected through individual interviews using pretested questionnaire. Data were analyzed by SPSS (16.0 Version). Descriptive statistics and multivariate regression were applied. P value < 0.05 considered significant. **Results:** Mean age of the subjects was 23.2254±3.09 years. About 96.7% were literates. Mean age at first pregnancy was 21.37±2.70 years. Low birth weight was observed amongst 22.5% new borns (Mean weight: 2089.58±268.31Gram). Almost 10.0% were preterm births. Paternal education and occupation, socio-economic status, religion, maternal blood group and gestation age at delivery were found to be the independent and significant bio-social factors predicting the low birth weight. About 68.0% variations in the birth weight were explained by these predictors. **Conclusion:** Low paternal education and occupation (farmers/laborers), low socio-economic status, maternal blood group (A is protective) and prematurity were found to be independent bio-social predicators of LBW. Programme targeting paternal education may be useful and study of biological plausibility associated with the maternal blood group is recommended.

Key Words

Bio-Social, predictors, Low Birth Weight, prospective, North Karnataka

Introduction

Worldwide, estimated 130 million babies born annually(1); out of whom 15.5% born with weight less than 2500 Gram (gm).(2) Major mass (95.6%) of Low birth weight (<2500gm) babies born in developing countries.(2,3) India accounts for 40% of Low birth weight (LBW)

babies of the developing World and more than half of those in Asia.(2) National Family Health Survey-3 reported that the prevalence of LBW was 23% in rural and 19% in urban areas in India.(4) There is the wide range of variation in the prevalence of LBW amongst Indian states; where 7.6% was reported in Mizoram and 32.7 % in Haryana. Proportion of the LBW in Karnataka (18.7%) was lower than the national average (21.5%).(4,5)

LBW is a sensitive indicator for predicting the chances survival, childhood growth and cognitive development and a reflector of the obstetrics and peri-natal care. It is one of the leading causes of early neonatal death and predisposes cardiovascular and metabolic disorders in the adult life.(3,6) Although, LBW is an issue of social and health concern, specific interventions targeting the reductions of LBW are scanty. A multi-centric study from India revealed that multiple micronutrient supplementations during pregnancy do not make significant impact to improve the birth weight.(7) Complexity in determination and quantification of predictors for LBW remain challenges to reduce LBW below 10% in India.(8)

Systematic reviews on LBW identified that LBW is a multi-factorial problem of health and social concern Worldwide.(9) Estimation of relative effects of predictors is an important researchable issue. It will be eventually useful to prioritize them according to their relative importance during the designing of LBW reduction strategies.

Aims & Objectives

In this context, an attempt has been made to determine bio-social predictors of low birth weight amongst the institutional births in North Karnataka, India.

Methods

A prospective study was conducted in Belgaum district of North Karnataka during July 2012 to March 2013. It was conducted at the 1000 bedded tertiary care charitable hospital; attached to the KLE University's Jawaharlal Nehru Medical College. All pregnant women registered within 20 weeks of gestation in the antenatal Outpatient Department (OPD) of Obstetrics and Gynecology during July–September 2013; were included in the study. All enrolled subjects were followed up till delivery. The birth weight was recorded using standardized digital weighing machine with 100 gm accuracy. Abortions, twin deliveries, still births and follow up lost subjects were excluded. Data were collected through individual interview at OPD and maternity wards using pretested questionnaire. Data were analyzed by Statistical Package for Social Sciences (SPSS-16 version) software and the results were presented in narrative and tabular forms. Percentage, mean, standard deviation, Chi square, Fisher's Exact Test and Odds ratio were calculated; and p value <0.05 considered significant. Ethical clearance was obtained from Ethical Committee of KLE University, Karnataka and written informed consent was taken from study subjects.

A total of 712 pregnant women (gestational age <20 weeks) were registered in the antenatal OPD during study period; out of whom, 137 were excluded due to their plan to deliver outside or refused to participate. Out of the 575 enrollments, 36 were excluded as they had abortion, still births or twin delivery and 113 (19.65%) were lost to follow up. Hence, the complete information pertinent to 426 subjects was analyzed for further statistical treatment.

Result

Socio-demographic characteristics: About two–fifth (40.8%) subjects were from urban areas whereas majority (59.2%) was from rural

residences. Municipal corporation and contentment boards were considered urban areas. Majority (57.3%) of the study subjects were 20-24 years (Mean age: 23.22±3.09 years). Mean age of urban residents was higher than those who were from rural residence (24.09±3.09 Vs 22.62±2.80 years). Overall, 96.7 % were literates where the large number of subjects (69.5%) had 5-10 years of formal schooling. Almost all subjects were housewives and 83.6% belonged to joint family. Almost 71.0% had e”5 members in a family (median: 6). Majority (85.4%) were Hindus. A great majority had d”4th class and negligible proportion (0.5%) had 1st class socioeconomic status according BG Prasad’s classification for 2013.10 More than three-fifth (62.9%) subjects had first pregnancy during 20-24 years of life with more than a quintile (21.6%) conceived during their adolescent ages (Mean age: 21.37±2.70) as shown in Table 1.

Magnitude of Low birth weight and preterm births: Almost a quarter (22.5%) of the new born had birth weight less than 2500 gm. The mean birth weight of new born was 2699.53±443.86 gram. Mean birth weight of male newborn was higher than the females. Similarly, babies born from urban mothers and Multi-gravida mothers had higher mean birth weight than the babies born from rural and primi-gravida mothers. Mean birth weight amongst the low birth weight baby was 2089.58±268.31. Mean duration of the gestation at delivery was 38.6432±2.05 weeks with almost one-tenth delivered prematurely (Table 2).

Bio-Social predictors of Low Birth Weight: In bivariate analysis, parental age, educational status and occupation, socio-economic status, type of family, numbers of members/family, religion, gravida and gestational age at delivery were found to be significant factors associated with the birth weight of a new born while there was no statistical relationship between birth weight of newborns and maternal residence, sex of newborn, marital relationship and age at first pregnancy (Table 3).

Proportion of LBW was higher amongst the babies born to adolescent mothers (62.5%) as against e”25 year’s old mothers. The higher proportion of LBW was observed amongst those newborns whose father was <30 years, had low education and occupation (farmers, labors, services holders) as against the > 30 years old, high education and private/business workers respectively. Similarly, subjects who had poor socio economic status, joint families, e”5 members/family, Hindu and Jain, blood group AB, primi-gravida and premature delivered higher proportions of LBWs as against those having better socio-economic status, nuclear families, Muslims, blood group O, multi-gravida and full terms.

The variables which were found to be statistically significant Chi square test were further subjected for multivariate regression analysis. After controlling all the potential confounders, paternal education and occupation, socio-economic status, religion, blood group and gestational age at delivery were found to be independent significant bio-social predictors of LBW. Odds of occurrence of LBW was 3.5 times more likely amongst the babies whose father had d” tenth standard education as compared those who had higher education. Higher paternal education perhaps plays an enabling role in decision making in relation to the maternal health care. The mothers with low socio-economic status had more than 59 times higher odds of delivering LBW baby. Hindu and Jain had multiple times (OR: 11.14, 235.98) higher odds of favoring LBWs as compared to the Muslim births, nevertheless; the association may be due to the variations in subjects under each category. The mothers having Blood Group ‘A’ were found to be significantly less at risk of delivering LBW babies as against ‘O’ group

mothers. Risk of having LBW amongst preterm births was multifold higher than full term births (Table 4). Almost 68 % prediction was explained by the model which shows good model fit (p=0.89).

Discussion

In our study, majority (59.2%) of the subjects were from rural areas. Similar findings are reported from Tamil Nadu and North India where more than seventy percent subjects were from rural areas.(11,13) Almost 90.0 % subjects were 20-29 years old. Findings of this study corroborates with a study from Maharastra, India and an Ethiopian study where more than 90 % subjects were above 20 years.(12,14,15) As against this, majority (58.5%) of the subjects in Uttarakhand, India were <20 years.(13) Higher numbers of adolescents in their study might be due to the higher incidence of early marriage followed by subsequent early conception. Mean age of the subjects was 23.22±3.09 years which is consistent with the studies from Tamil Nadu, Maharashtra, and Ahmadabad, India while it was lower than the Ethiopian findings. (11,13, 14,16) Almost all were housewives/agriculture workers and almost seven out of every ten subjects had d"4th class socio-economic status. Similar observations were made by Agrawal et al.(12) More than a quintile (21.6%) subjects conceived during their adolescent ages. The proportion of adolescent pregnancies was lower than that was reported in Nagpur (41.9%) in 1994.(17) This variation might be due to the increased level of awareness, improved access to health services and education services and enactment of law regarding the minimum age at marriage in India.

The mean birth weight of newborn was 2699.53±443.86 gram. It was lower than that was reported in a study from Haryana, India, Nigeria, Bangladesh and Ethiopia and higher than that was observed in Ahmadabad and Kolhapur, India.(14,16,18-22) Low birth weight was prevalent amongst 22.5 %. Wide variations was observed with the 11.8 % in Tamil Nadu and the highest in Uttrarakhand (40%) in hospital based studies.(11,12,14-16,18,23,24,25,26,27) NFHS-3 also reported the wide variations in the proportion of LBW, ranging from 7.7 % in Mizoram to the highest (32.5%) in Haryana, 18.5 % in Karnataka with 21.5 % national averages.(4) Mean birth weight amongst the low birth weight baby was 2089.58±268 gram. It was lower than the two studies conducted in Mumbai and Kolhapur and higher than that was reported from western Maharastra.(14,18,24) Mean duration of the gestation at delivery was 38.64±2.05 weeks with almost ten percent being preterm deliveries. Mean gestation observed in a study from Ahmadabad was almost similar to our findings. However, proportion of preterm deliveries in their study was almost 20.0 % higher than our findings.(16)

Paternal Education and occupation were found to be the significant predictors for LBW. The Newborns whose father was farmers/laborers or service holders had higher odds of having LBW as against the private workers/business workers. Our findings are concurrent to the findings of Deshpande and Som.(14,28) Significantly higher proportion of the mothers belonging in low socioeconomic status delivered LBW babies as compared to those mothers with higher SES. This finding is in agreement with the several national and international studies.(12,16-18,24,26,30) Chances of delivering LBW amongst the mothers having Blood group was 'A' significantly low when compared with the mothers of 'O' blood group. Preterm births had multifold higher risk of LBW as compared to full term births which is consistent with the several national and international studies.(14-16,18)

Conclusion

The proportion of LBW amongst the mothers delivering in a tertiary hospital was 22.5%. Low paternal education and occupation (farmers/laborers), low socio-economic status, maternal blood group (A is protective) and prematurity were found to be independent bio-social predicators of LBW. Programmes targeting on paternal education may be useful and investigations of biological plausibility associated with the maternal blood group is recommended.

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Tables

TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS

Variables	Numbers	%
Residence		
Urban	174	40.8
Rural	252	59.2
Age (in years)		
<20	32	7.5
20-24	244	57.3
25-29	124	29.1
≥30	26	6.1
Mean age : Urban - 24.09±3.09	Rural : 22.62±2.80	Total : 23.2254±3.09
Education		
Illiterate and primary	14	3.3
Lower secondary and secondary	296	69.5
Pre- University and university	116	27.2
Occupation		
Housewife	414	97.2
service holders/business	12	2.8
Type of family		
Nuclear	70	16.4
Joint	356	83.6
Numbers of Family members in a family		

≤ 4	124	29.1
≥5	302	70.9
Median numbers of family members - 6.0, Minimum-Maximum (2-36)		
Religion		
Hindu	364	85.4
Muslim	50	11.7
Jain	12	2.8
Socioeconomic status (monthly per-capita income)		
I	2	0.5
II	50	11.7
III	72	16.9
IV	148	34.7
V	154	36.2
Age at first pregnancy (in years)		
<20	92	21.6
20-24	268	62.9
≥25	66	15.5
Mean age = Urban : 21.87±3.02	Rural : 21.03±2.41	Total : 21.37±2.70

TABLE 2: MAGNITUDE OF BIRTH WEIGHT AND PRETERM BIRTHS

Variables	Numbers	%
Birth weight (in Gram)		
Low Birth Weight (< 2500gram)	96	22.5
Normal Birth Weight (≥2500gram)	330	77.5
Weeks of gestation at delivery (completed weeks)		
Preterm (<37)	44	10.3
Full term (≥37)	382	89.7
Mean birth weight		
Male : 2721.34±467.89	Female : 2678.715±419.67	Overall Mean birth weight: 2699.53±443.86
Urban: 2713.90±448.97	Rural: 2689.60±440.91	
LBW: 2089.58±268.31	Normal : 2876.96±305.89	
Primi-gravida: 2693.19±503.11	Multi-gravida: 2704.82±388.49	
Mean gestation at delivery :		38.64±2.05 weeks

TABLE 3: RELATIONSHIP BETWEEN SOCIO-DEMOGRAPHIC CHARACTERISTICS AND BIRTH WEIGHT

Predicting Factors		Birth weight		Statistics
		<2500gm	≥2500 gm	
Residential place	City	36	138	χ2=0.57, p>0.05, df=2
	Village	60	192	
Maternal Age	<20	20	12	χ2=32.18 , p=0.001*, df=2
	20-24	50	194	
	≥25	26	150	
Paternal Age	<30	66	178	χ2=6.66, p=0.01*, df=1
	≥30	30	152	
Education	Illiterate and primary	2	12	χ2=6.59, p=0.01*, df=1
	up to secondary	58	238	
	PUC and University	36	80	
	(category I and II were clubbed together for the calculation of χ2)			
Paternal education	≤ secondary	64	176	χ2=5.37, p=0.02*, df=1
	PUC and University	32	154	
Occupation	Housewife	96	318	

	Services	0	12	Fisher's Exact Test =3.59, p >0.05
Paternal Occupation	Farmer	40	84	χ2=21.44, p =0.001* df=3*
	Service	12	28	
	Private works/business	18	146	
	Laborers	26	72	
Socio-economic Class	I-III Class	4	120	χ2=37.35, p=0.01*, df=1
	IV-Vth Class	92	210	
Family type	Nuclear	6	64	χ2=9.35, p =0.002*, df=1
	Joint	90	266	
No. of Family Members	≤ 4	20	104	χ2=4.11, p=0.04*, df=1
	≥5	76	226	
Religion	Hindu and Muslim	88	326	χ2= 12.55 p=0.001*, df=1 (Yate's correction)
	Jain	8	4	
New born sex	Male	50	158	χ2=0.52, p>0.05, df=1
	Female	46	172	
Maternal Blood group	A	28	114	χ2=29.93, p=0.001*, df=3
	B	20	86	
	AB	22	16	
	O	26	114	
Consanguinity	Consanguineous	20	76	χ2=0.20, p>0.05, df=1
	Non- Consanguineous	76	254	
Gravida	Primi	54	140	χ2=5.32, p=0.01*, df=1
	Multi	42	190	
Maternal age at first pregnancy	<20	26	66	χ2=3.79, p>0.05, df=1
	20-24	60	208	
	≥25	10	56	
Gestational age at delivery	Preterm(<37)	42	2	χ2=147.46, p=0.001* df=1 (Yate's correction)
	Full term (≥37)	328	54	

* Statistically significant (p<0.05)

TABLE 4: ESTIMATION OF LEVEL OF RISK FOR LBW ASSOCIATED WITH INDEPENDENT PREDICTORS

Variable/ category	No. of LBW (%)	Unadjusted Odds ratio			Adjusted Odds ratio		
		OR	95% CI	p Value	OR	95% CI	p value
Maternal age							
<20	20(62.5)	7.94	3.46-18.25	0.001*	3.22	0.69-14.93	0.13
20-24	50(20.5)	1.22	0.72-2.07	0.44	0.42	0.16-1.06	0.06
≥25	26(17.3)	1	ref	-	1	ref	-
Paternal age							
<30	66 (27.0)	1.87	1.15-3.04	0.01*	2.35	0.93-5.92	0.20
≥30	30(16.5)	1	ref		1	ref	-
Maternal Literacy (Academic Grade)							
≥Pre/University (≥11th)	36 (31.0)	1.87	1.56-3.04	0.01*	1.75	0.62-4.90	0.28
≤Secondary (10th)	60 (19.4)	1	ref		1	ref	-
Paternal education (formal schooling)							
≤ 10th	64 (26.7)	1.75	1.08-2.81	0.02*	3.57	1.28-9.97	0.01*
≥11th	32(17.2)	1	ref		1	ref	-
Paternal Occupation							
Farmer	40 (32.3)	3.86	2.08-7.16	0.001*	1.32	0.46-3.76	0.62
Service	12(30.0)	3.47	1.50-8.01	0.003*	12.48	2.76-56.41	0.001*

Laborers	26(26.5)	2.92	1.50-5.68	0.002*	1.74	0.57-5.28	0.32
Private works/business	18(11.0)	1	ref	-	1	ref	-
Socioeconomic Classification							
I-III Class	4 (3.2)	1	ref	0.001*	1	ref	-
IV-V Class	92 (30.5)	13.14	4.71-36.66		59.14	10.08-346.76	0.001*
Family Type							
Nuclear	6(8.6)	1	ref	0.004*	1	ref	-
Joint	90 (25.3)	3.60	1.51-8.61		1.825	0.33-9.81	0.48
Family Members							
≤ 4	20(16.1)	1	ref	0.04*	1	ref	-
≥5	76(25.2)	1.74	1.01-3.01		0.74	0.26-2.01	0.57
Religion							
Hindu	86(23.6)	7.42	1.76-31.18	0.006*	11.27	1.76-72.16	0.01*
Jain	8(66.7)	48.0	7.5-306.82	0.001*	235.98	7.46-7462.48	0.002*
Muslim	2(4.0)	1	ref	-	1	ref	-
Maternal Blood Group							
A	28(19.7)	1.07	0.59-1.95	0.80	0.12	0.03-0.39	0.001*
B	20 (18.9)	1.02	0.53-1.94	0.95	0.75	0.28-1.98	0.56
AB	22 (57.9)	6.02	2.78-13.04	0.001*	2.18	0.35-13.41	0.40
O	26 (18.6)	1	ref	-	1	ref	-
Gravida							
Primi	54 (27.8)	1.75	1.10-2.76	0.01*	2.195	0.90-5.32	0.08
Multi	42 (18.1)	1	-		1	ref	-
Gestation at delivery (in weeks)							
Preterm (<37)	42(95.5)	127.56	29.99-542.38	0.001*	1285.87	127.93-12924.05	0.001*
Full term (≥37)	54(14.1)	1	ref		1	ref	-

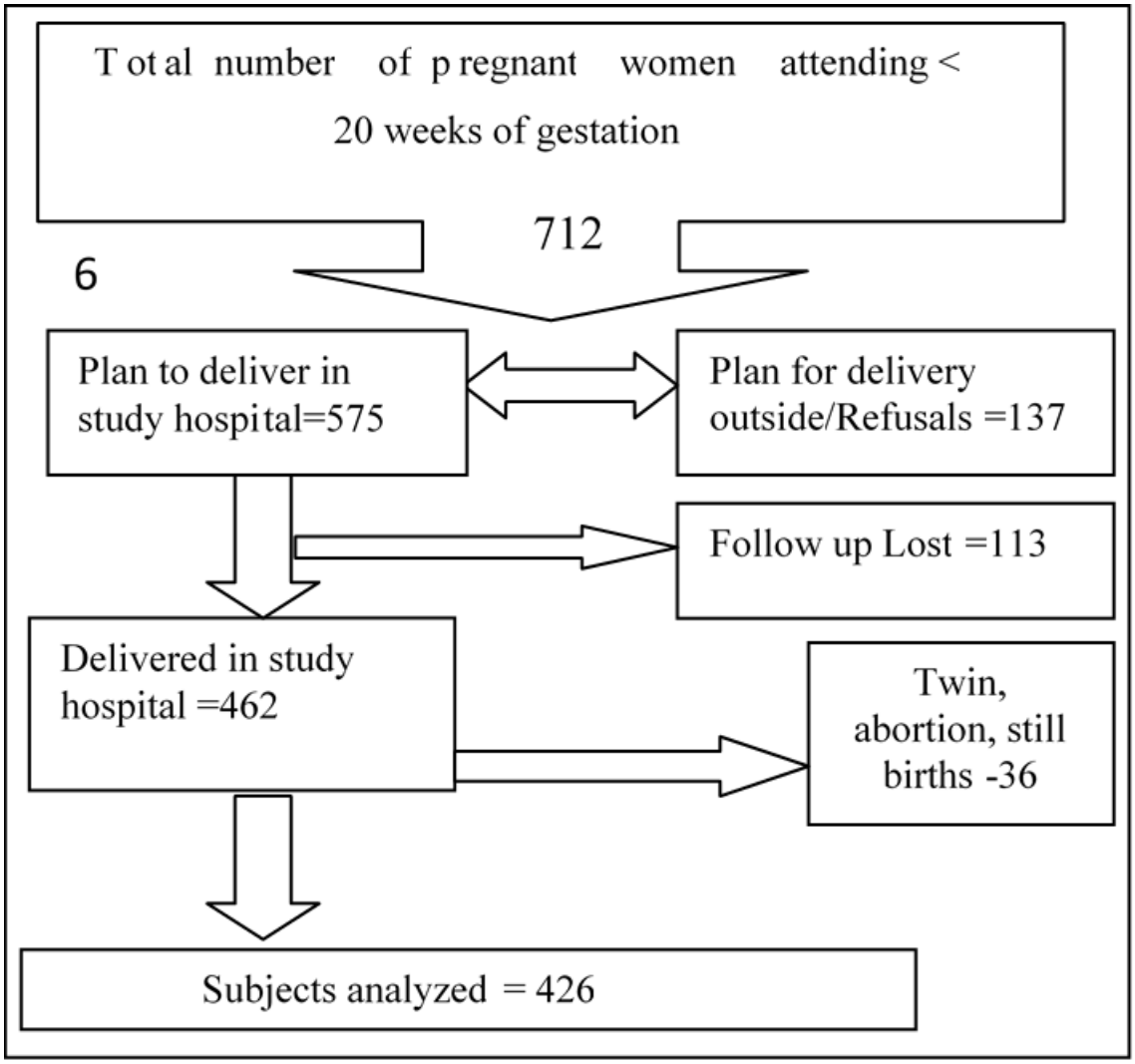
Variables entered on step 1: age, paternal age, maternal and paternal education, paternal occupation, socio-economic status, type of family, No. of member/family, religion, maternal blood group, gravida and gestation age.

Final model had following statistics: -2 Log likelihood = 202.42, Nagelkerke R^2=0.68.

Hosmer and Lemeshow Test: p=0. 89

Figures

FIGURE 1: FLOW CHART FOR SELECTION OF STUDY SUBJECTS


T ot al number of p regnant women attending < 20 weeks of gestation
712
6
Plan to deliver in study hospital=575
Plan for delivery outside/Refusals =137
Follow up Lost =113
Delivered in study hospital =462
Twin, abortion, still births -36
Subjects analyzed = 426