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Research Article

Predictors of low birth weight in antenatal women

Abstract

Background: Low birth weight is a reflection of the health care infrastructure and human development in a country. Elimination of low birth weight is essential to achieve a greater life expectancy and quality of life. There are several risk factors for low birth weight which range from maternal, nutritional, genetic and other factors. This study was carried out to evaluate the antenatal predictors of low birth weight.

Methods: This cohort study was carried out among 185 antenatal women who presented in first trimester in our hospital. After eliciting history and detailed anthropometric measurement, hemoglobin was estimated to assess the anemia status. The participants were followed up till delivery. The birth weight of the baby was taken immediately after delivery and recorded. Statistical analysis was done by EPI2005 package.

Results: Among 185 women studied 48.6% of them were undernourished. There was a significant association between low BMI and low birth weight. Low birth weight was 34% in underweight women while its 18% in normal women after excluding preterm. Height and weight as an individual factor for low birth weight shows negative results.

Conclusion: Underweight pregnant women at booking show increased risk of having low birth weight in babies. The BMI at booking in first trimester usually reflects the pre-pregnant BMI as the weight gain in first trimester is less. This study implies a role of improving pre-pregnant nutritional status of mother which in turn implies neonatal outcome.

Introduction

A country's development is directly proportional to the health status of its people. Health is an essential component in various indices which reflect the development, like human development index, quality of life, etc. There are several indicators of health, of which life expectancy and birth weight are dynamic and key indicators of health. These indicators indirectly reflect on the health infrastructure and health care delivery systems in the country. One of the indicators, namely low birth weight is of serious concern in benchmarking the public health infrastructure of a country. It has always been an important subject of nation's concern and focus of national health policy.

A baby's birth weight is a strong indicator of both maternal and child health and nutrition. A baby born with low birth weight is bound to face several health consequences from low levels of immunity, increased risk of infections, reduced muscle strength, impaired cognition and increased risk of several non-communicable diseases [1]. The consequences of low birth weight has been analyzed for several decades till now. According to Barker theory and Brenner's hypothesis, fetal malnutrition is responsible for premature deaths and morbidity in adult life. Some of the key illnesses linked with low birth weight include arterial hypertension, ischemic cardiomyopathy, cerebrovascular accidents and a gamut of other non commmunciable diseases like diabetes mellitus, chronic obstructive lung diseases and syndrome X [2].

Birth weight is the first weight of the newborn measured immediately after birth. A newborn is said to be of low birth weight when it weighs less than 2500 grams [3]. Globally, more than 20 million infants are born with low birth weight, constituting 15.5% of the total births of which 95.6% belong to the developing countries [4,5]. It has been estimated that half of all the perinatal deaths and one-thirds of all the infant deaths are a consequence of low birth weight [6]. In India, 20% of the newborns have low birth weight [7].

There are several established determinants of low birth weight, ranging from maternal smoking, poor diet, low body mass index, nutritional deficiencies like anemia, etc [8]. There are several studies which have linked socioeconomic

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status with low birth weight. In developing countries, poverty, lack of literacy and poor socioeconomic status are the key determinants of low birth weight. However, in rare situations, low birth weight could be a consequence of genetic factors, including congenital malformations, especially in developed countries.

Considering the importance of birth weight in determining the development of a country, there is a growing need to evaluate the determinants of low birth weight. It is essential to prove the causality of the problem, in order to devise preventive strategies. A thorough knowledge on the predictors and determinants of low birth weight will help in not only creating awareness to impart knowledge to the antenatal women, but also to constitute mechanism of early detection of low birth weight and appropriate management techniques for the same.

Objective

* To estimate the prevalence of maternal and social risk factors of low birth weight.
* To evaluate the correlation between risk factors and low birth weight.
* To estimate the prevalence of low birth weight.

Methodology

Study setting and study participants

This study was carried out as a cohort study for a period of two years in our tertiary care hospital. All the antenatal women who visited to our hospital during the study period were included in the study. The participants were selected during their first trimester visit for antenatal care. The participants were selected by convenient sampling. A total of 185 antenatal women participated in this study.

Ethical approval and informed consent

Approval was obtained from the institutional ethics committee prior to the commencement of the study. Each participant was explained in detail about the study and informed consent was obtained prior to the data collection.

Data collection

A structured interview schedule was used to collect data regarding the demographics of the study participants. A detailed maternal and antenatal history was recorded followed by physical examination, including the measurement of height and weight of the mother. Hemoglobin levels were measured by cyanmethhemoglobin method to evaluate the presence of anemia. The antenatal mothers were followed up till their delivery and the birth weight of the infant was recorded on a standardized weighing scale.

Operational definition

Low birth weight was defined the weight of the new born below 2500 grams [3]. A hemoglobin level of less than 11g/dl was labeled as anemia. It was further graded as mild (10-10.9g/dl); moderate (7-9.9g/dl); severe (4-7g/dl) and very severe (<4g/dl) [9].

Data analysis

Data was entered and analyzed using EPI2005 package. Percentages were computed to express the prevalence of risk factors and incidence of low birth weight. Mean birth weight and mean maternal weight were also tabulated.

Results

This study was carried out among 185 antenatal women visiting our tertiary care hospital. The mean age of the study participants was 21.02± 2.3 years. A majority of the participants (56.8%) belonged to class V socioeconomic status classified as per modified B.G. Prasad's classification. About 57.3% of the participants were primi. The background characteristics of the study participants are given in table 1.

The prevalence of risk factors of low birth weight is given in table 2. In this study, about 90(48.6%) of the participants were

Table 1: Background characteristics of the study participants.

S. No	Characteristics	Frequency N=185	Percentage (%)
1	**Age (in years)**		
	Less then 20	59	31.9
	20 – 24	110	59.5
	25 & above	16	8.6
2	**Socioeconomic status (as per Modified B.G. Prasad's classification)**		
	I	-	-
	II	12	6.5
	III	24	13.0
	IV	44	23.8
	V	105	56.8
3	**Parity**		
	1	106	57.3
	2	67	36.2
	3	11	5.9
	Above 3	1	0.5

Table 2: Prevalence of risk factors of low birth weight among the study participants.

S. No	Characteristics	Frequency N=185	Percentage(%)
1	**Body Mass Index (kg/m^2)**		
	Underweight (<19.8)	90	48.6
	Normal (19.8 - 26)	89	48.1
	Overweight (26.1 - 29)	6	3.2
	Obese (>29)	-	-
2	**Anemia (g/dl)**		
	Mild (10 – 10.9)	49	26.5
	Moderate (7 – 10)	83	44.9
	Severe (4 – 7)	7	3.8
	Very Severe (< 4)	1	0.5
	Nil (≥ 11)	45	24.3

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found to be underweight. The mean Body Mass Index (BMI) of the study participants was 19.8kg/m². Moreover, estimation of hemoglobin levels showed that 83(44.9%) participants were moderately anaemic (7-10g/dl).

The incidence of low birth weight is given in table 3. It was observed that 47(25.4%) of the participants delivered low birth weight babies. About 3(1.6%) of the participants underwent abortion, and 5(2.7%) of the participants delivered pre term babies.

The interrelationship between the predictive risk factors of low birth weight is given in table 4. This study observed a significant association between socioeconomic status and anemia among the study participants. There was a significant variation in the mean hemoglobin levels with increase in the socioeconomic status (p=0.0063)

The association between body mass index and birth weight is given in table 5. There was a significant difference observed in the birth weight of the infants between the BMI groups. Underweight mothers were more at risk of delivering low birth weight babies, compared to mothers with normal or overweight mothers (p <0.05).

Discussion

This study was conducted with an objective of establishing the predictors of low birth weight. The incidence of low birth weight in our study was 25.4%. Bharati et al in her study reported that 20$ of Indians deliver low birth weight babies, which is similar to our finding [7]. The state wise prevalence of low birth weight showed that in Tamil Nadu the prevalence of low birth weight was 21.4% as per NFHS data of 2005-06.

Table 3: Incidence of low birth weight among the study participants.

S. No	Birth weight	Cases (N=185)	
		Frequency (n)	Percentage (%)
1	Low B.W. (<2.5 kg)	47	25.4
2	Normal (2.5 – 3.0 kg)	77	41.6
3	Above normal (> 3 kg)	53	28.6
4	Abortion	3	1.6
5	Pre term	5	2.7
	Mean B.W. (kgs) S.D. (kgs)	2.71 0.4	

Table 4: Interrelationship with the risk factors of low birth weight.

S.E. Status (B.G. Prasad Scale)	Anaemia										Hb%	
	Nil		Mild		Moderate		Severe		Very Severe		Mean	S.D.
	No	%	No	%	No	%	No	%	No	%		
1 (-)	-	-	-	-	-	-	-	-	-	-	-	-
2 (12)	-	-	2	16.7	9	75	1	8.3	-	-	9.01	1.33
3 (24)	3	12.5	4	16.7	17	70.8	-	-	-	-	9.51	1.07
4 (44)	11	25	15	34.1	17	38.6	1	2.3	-	*	10.09	1.4
5 (105)	31	29.5	28	26.7	40	38.1	5	4.8	1	1.0	9.93	1.67
'p'	0.0063 (Significant)											

Table 5: Association between body mass index and low birth weight.

BMI	Birth Weight											
	LBW		Normal		Above Normal		Abortion		Preterm		Mean	SD
	No	%	No	%	No	%	No	%	No	%	No	%
Under weight (90)	31	34.4	32	35.6	21	23.3	3	3.3	3	3.3	2.65	0.42
Normal (89)	16	18.0	42	47.2	30	33.7	-	-	1	1.1	2.77	0.37
Over Weight (6)	-	-	3	50.0	2	33.3	-	-	1	16.7	2.82	0.31
Obese (-)	-	-	-	-	-	-	-	-	-	-	-	-
'p'	**0.039 Significant**											

[10] In another study done by Rajeshwari et al in Chennai, the prevalence of low birth weight was 25.8%, similar to our study. In another study done in Vellore, the prevalence of low birth weight was 17%, while the same in Karnataka was 22.5%, which was similar to our study [11].

The prevalence of underweight mothers was high in our study (48.6%). Moreover, a majority of the participants (44.9%) were moderately anemic. Our study has highlighted that Body mass index of the mothers, anemic status and socioeconomic status are key risk factors for low birth weight. A significant association was observed between underweight mothers and low birth weight babies (p<0.05). There are several studies which established the risk factors of low birth weight. In a study done by Sananpanichkul P, anemia was present in 13.2% of the participants. Poor weight gain during pregnancy was associated with low birth weight among the mothers [12]. In a study done by Zhao R, the prevalence of underweight among pregnancy women was 16.3% which is much lesser than our findings [13]. A meta-analysis done by Han Z et al proved that underweight women were at increased risk of delivering low birth weight babies, with a relative risk (RR) of 1.48. Moreover, there is also equal and significant risk of preterm births in underweight women, as established by this meta-analysis [14].

There are several pathophysiological mechanisms underlying the relationship between maternal body mass index and low birth weight. There is the evident mechanism of lack of nutrients in underweight mothers, which in turn results in undernourishment of the infants as a result of which, low birth weight ensues. In developing countries like India, this link is accentuated by the presence of poor socioeconomic status, and widespread prevalence of anemia. Our study also emphasized the statistically significant relationship between socioeconomic status and anemia (p<0.001).

Apart from the evidences which substantiate the need for an increase in the maternal body weight, an in-depth analysis of the rate of increase in the weight gain in the infants, proportional to the unit increase in the body mass index, will effectively validate the association. Moreover, there are several confounders like maternal age, parity, maternal illnesses and other personal habits like smoking and alcohol use, which also have a significant role in determining the birth weight of the newborns.

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Conclusion

Our study has substantiated the incidence of low birth weight among the catchment population of our tertiary care hospital. It also clearly elucidated the predictors of low birth weight in newborns, namely socioeconomic status, body mass index of mothers and anemia in pregnancy. There is a growing need at health infrastructure levels by targeting this problem at a significantly early stage. Despite several reproductive health initiatives of the public health care system, there should be a paradigm shift in targeting adolescent girls, rather than catching up the women during pregnancy. Mass efforts should be implemented in raising the level of awareness among adolescent girls, and also to tackle the problem of anemia and other nutritional deficiencies in the adolescent girls, in order to have a healthy and viable pregnancy and outcome.

Our study has provided scope for future research to be directed towards developing a mathematical model to predict the unit rise in the weight of the fetus in relation to the unit change in the maternal risk factors namely hemoglobin levels, body mass index and various other factors like parity and maternal age.

Limitation

This study has emphasized on the high incidence of low birth weight and also elaborated on the predictive risk factors in the mothers. However, the role of several confounders like parity, gestational age, smoking status and presence of other systemic illnesses were not analyzed.

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