Maternal Anthropometric Determinants of Low Birth Weight: A Mini Review

Ujjwal Mollah[1*] and Samiran Bisai[2]

1. Department of Physiology, Raja N. L. Khan Women's College, Midnapore, West Bengal, India.
2. Department of Anthropology & Tribal Studies, Sidho Kanho Birsha University, Purulia, West Bengal, India.
* Corresponding Author: anarulujjwalmollah@gmail.com

"The health and wellbeing of the fetus is dependent upon the health & nutrition of the mother (not the father!) because she is both the seed as well as the soil where in baby is nurtured for 9 months." - Meharban Singh

Abstract

Low Birth Weight (LBW) is a major public health burden in India. It is an important determinant of post natal growth and survival. In India, about 12.4% of neonates born with LBW during 2015-16 based on statistics of Health Management Information System (HMIS). It is found that Rajasthan (25.5%), Odisha (19.1%), Assam (16.7%), West Bengal (16.4%), Haryana (14.9%) and Madhya Pradesh (14.1%), have higher incidence of LBW. Present review found maternal anthropometric indicators such as weight during pregnancy is good predictors of LBW. So, gestational age specific weight cut-offs may be useful to identify high risk pregnancy in primary health care setting rather than existing norm. However, more population specific study on this relationship is required; birth weight is considered as good indicator of human biological variation from Anthropological perspective.

Keywords: Low Birth weight, Biological variation, Maternal weight, Infant mortality

Introduction

The 21st century has witnessed numerous progressions in the reproductive propensities of population, the innovations and management of childbirth, and the newborn care. All through this period birth weight has been, and keeps on being, a focal point of professional and social interest. The fundamental source of concern lies in the ramifications of birth weight, and especially of low birth weight (LBW); babies weight at birth less than 2.5kg.

LBW is an outcome of intrauterine growth retardation (IUGR) or preterm birth (born before 37 weeks), or both. It is well established that babies born with low weight have extreme rates of morbidity and mortality from infectious disease due to impair immune function as well as malnutrition. Globally 3.07million newborn dies during first 28days of life. Ashworth (1998) found four times higher risk of neonatal deaths among baby's birth weight between 2.0-2.5 kg compared to birth-weight of 2.5-3.0 kg, and 10 times higher risk than in baby's birth weight between 3.0-3.5 kg. They also suffered from growth failure; stunting start for the neonatal period through youth and are gauge to represent around 33% of all deaths occurring in the first year of life. In India, there is a positive association with LBW and infant mortality rate due to LBW as per statistical data of Health Management Information System (HMIS) statistics on

2015-2016. State wise prevalence of LBW and infant mortality rate due to LBW are presented in figure 1. The HMIS data make known that Rajasthan (25.5%), Odisha (19.1%), Assam (16.7%), West Bengal (16.4%), Haryana (14.9%), Madhya Pradesh (14.1%), Maharashtra (13.7%) and Tamil Nadu (12.8%) have higher incidence of LBW.

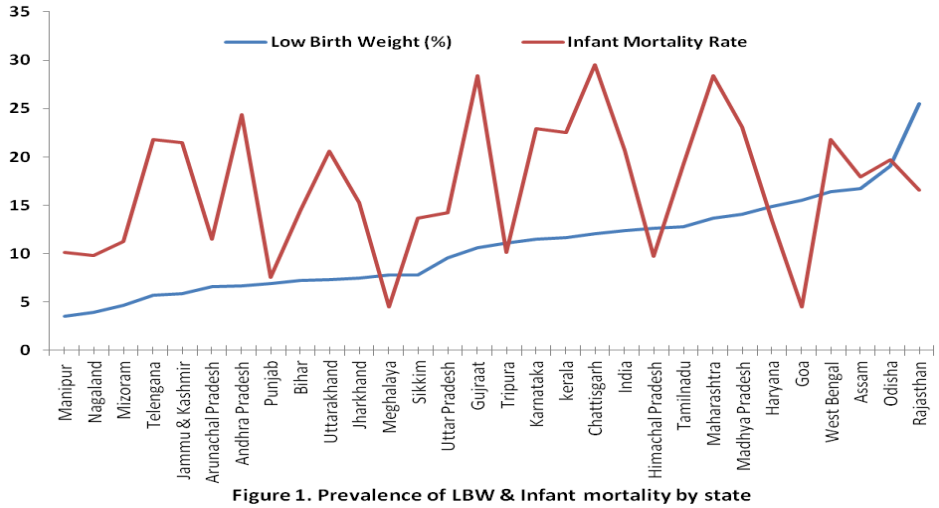

Figure 1. Prevalence of LBW & Infant mortality by state

Babies born with low weight make obvious major growth retardation, as be a sign of by low body weights, length and head circumference compared to their normal weight peers. They experienced delayed skeletal growth and development (Villar et al., 1990). As a result growth-retarded girls turn out to be adult women as undernourished, are probably going to bring forth LBW babies, and accordingly sustaining an endless loop through generation (Ashworth and Feachem, 1985). In developing countries including India with a higher occurrence of LBW, IUGR is a significant segment of LBW contrasted to pre-maturity. IUGR component of LBW is associated with nutritional anthropometric parameter of the mother, like maternal weight, weight gain, body mass index (BMI), height, head and arm circumferences. It is also shown to be good predictors of birth weight and child survival (Kramer 1987, WHO 1995).

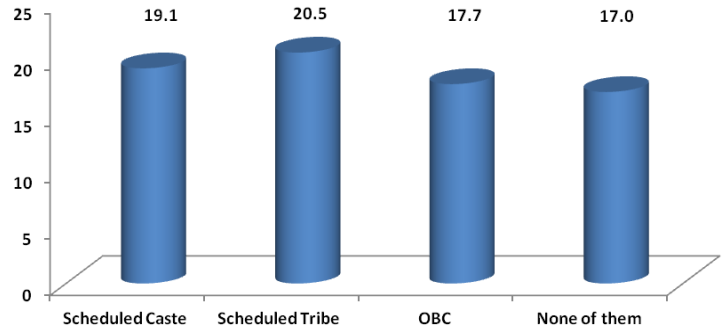

Figure 2. Low Birth Weight (%) by social group (NFHS-4, 2015-16)

Socio-economically weaker section populations have reliably recorded exceptionally high predominance of LBW (Figure 2). The occurrence of LBW is higher in Asia than somewhere else, prevalently on account of under-nutrition of the mother before and during pregnancy. Around 60% of South Asia and 40% in South East Asia women are underweight. In South Asia, 40% and more than 15 % of moms are thin and stunted. Thus, weight of an infant upon entering the world is a significant pointer of maternal wellbeing and nutrition during pregnancy.

Maternal anthropometry and birth weight

According to a study, maternal height was positively correlated with birth weight in Whites, Blacks and Asians (Pickett 2000), with birth weight increasing as maternal height increased (Bhatia 1985). Mothers who are less than 140 cm in height were more susceptible to deliver low birth weight baby (Deshmukh 1998); studies also found association of anemia, low socio-economic status and inadequate pregnancy weight gain with low birth weight (Hirve & Ganatra, 1994, Deshmukh 1998). Women with short stature are attaining on average 1kg less during pregnancy than their taller counterpart (Kleinman 1990). On the other hand, older women with higher parity were more likely to weigh less during their third trimester and have lower summed skinfolds. Since, lower skin folds were associated with better pregnancy outcome (Pike 2000). On the other hand, maternal lean body mass was found to be the most important determinant of birth weight (Kulkarni et al 2006). The study also revealed lean body mass explained 21 % of variation in birth weight.

It is well known fact that healthy women delivered healthy babies and undernourished women delivered underweight babies. It is evident that, maternal pre-pregnancy weight <40kg and <41kg was associated with a higher incidence of LBW (Hirve & Ganatra 1994, WHO 1995). Mohanty and his colleague (2006) reported maternal first trimester weight of <45 kg in was the best predictor for low birth weight. A hospital based study on Bengalee Hindu women reported maternal early second trimester pregnancy weight of <46.0 kg was the best cutoff for predicting low birth weight (Bisai et al 2007). In the same settings, another study found ≤48.0 kg in early third trimester was the best indicator of low birth weight baby (Bisai et al 2009). Karim and Mascie-Taylor (1997) has documented the best cut-off point for predicting LBW infants as maternal weight at term to be 50 kg. It is well established maternal weight before and during pregnancy is good predictor of LBW (Table 1). So, gestational age specific weight cut-offs may be useful to identify high risk pregnancy in primary health care setting rather than existing norm of weight. However, due to unavailability of weighing scale, application of mid-upper arm circumference (MUAC) more useful as low cost technology require minimum training and only 5 rupees tailoring tape to screen high risk pregnancy for LBW (Table 1). Henceforth, use of MUAC still remains the most practical tool for assessing nutritional status of pregnant women in the community settings.

Table 1. Maternal weight & MUAC criterion for screening high risk pregnancy for LBW

Studied by	Sample	Measured at	Cut-off	Statistical test	Risk of LBW
Maternal weight (kg)					
Hirve & Ganatra, 1994	1922	Prepregnancy	<40	RR (95%CI)	1.3 (1.09-1.54)
WHO, 1995	-	Prepregnancy	<41	OR	2.23
Mohanty et al, 2006	395	1st trimester	≤45	RR	2.27
Bisai et al, 2007	295	Early 2nd trimester	<46	RR (95%CI)	1.68 (1.19–2.38)
Bisai et al, 2009	233	Early 3rd trimester	≤48	OR (95%CI)	2.92 (1.56-5.51)
Karim & Mascie-Taylor, 1997	251	At term	<50	OR (95%CI)	4.58 (2.25-9.40)
MUAC (cm)					
Mohanty et al, 2006	395	1st trimester	≤22.5	RR	1.7
Sen et al, 2010	503	At delivery	<22	RR	3.6
Karim & Mascie-Taylor, 1997	251	3rd trimester	<22	OR (95%CI)	3.36 (1.68-6.79)
Karim & Mascie-Taylor, 1997	251	3rd trimester	<23	OR (95%CI)	5.01(1.42-17.89)
Dhar & Bhadra, 2008	316	During pregnancy	<24	OR (95%CI)	1.71 (0.89-3.32)

Conclusion and recommendation

There are dearth of studies on relationship between maternal anthropometry & low birth weight among tribal population in India. Such studies can potentially be used to highlight the severity and uniqueness of nutritional problems among underprivileged populations in India. Although, the causes of LBW are multi-factorial, it is associated with social & cultural characteristics, medical complication before and during pregnancy, environmental, demographic, genetic factors and nutritional variables, especially maternal anthropometry. Since, birth weight is also considered as an important parameter to understand the process of human biological variation. Thus, population specific study on birth weight is utmost need in India from the anthropological point of view.

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