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INFLUENCE OF MATERNAL ANTHROPOMETRIC CHARACTERISTICS ON BIRTH WEIGHT OF NEWBORN

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ABSTRACT

Background: Birth weight is an indicator of health and nutritional status of mothers as well as predictor of infant health and development.

Objective: To find out influence of maternal anthropometric characteristics on Birth weight.

Methods: The present Community based prospective study was conducted in the field practice areas of Department of Community Medicine, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh. Registered pregnant women who were in their first trimester and whose Expected Date of Delivery lie within our study period of one year were considered for study.Data was analyzed using SPSS version 20. Percentages, and Chi Square Test used.

Results: Prevalence of LBW was found to be 40%. The mean birth weight of all the 160 newborns was 2.58 kg (with SD ±0.55 kg). Statistically significant association was found between height, weight gain and birth weight of newborn.

Conclusion: Nutritional status of mother has to be improved not only during pregnancy, but also in her early childhood by undertaking food supplementation programs implemented through National Health Programs that improve the weight gain during delivery and result in improved fetal outcome.

Keywords: Birth weight, Maternal anthropometry, Newborn, Pregnancy.

INTRODUCTION

Birth weight is a reliable index of intrauterine growth and is one of the major factors that determine child survival and physical and mental development .[1]

Maternal height could affect intrauterine growth through either genetic or environmental (physical) mechanisms. Part of the mother's genetic potential would be passed on to the fetus, and any deficit in her stature, regardless of its etiology, could impose physical limitations on the growth of the uterus, placenta, and fetus.[2] Low birth weight girls, in the absence of positive intervention to break the cycle, grow poorly, become stunted women and are more likely to give birth to LBW babies.[3]

Maternal pre-pregnancy weight is influenced by both genetic and environmental factors. Even after correcting for stature, body weight is in part genetically determined, and genes that control adi-

posity or lean body mass could, theoretically, be expressed in the newborn. .[2]

Pregnancy weight gain means the laying down of fat stores, growth of breast and uterine tissues, increased plasma volume, growth of the fetus and placenta, and amniotic fluid. There is association between poor weight gain and LBW, especially in adolescent pregnancies .[4, 5, 6] Body Mass Index reflects nutritional status of mother which directly affects the growth of foetus. Therefore this study was conducted to estimate prevalence of Low Birth Weight neonates and influence of maternal anthropometric characteristics on birth weight of newborn.

MATERIALS AND METHODS

The present community based prospective study was conducted in the field practice areas of the Urban and Rural Health Training Centers, Department of Community Medicine, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh. The study subjects included in the study were residents of four registered areas of the urban health training center and seven registered villages of rural health training centre. Study design was approved by Institutional Ethical Committee. A census of current pregnant women in their first trimester was prepared with the help of ASHA and medico-social worker of our study area. Subsequent pregnancies were identified for next three months by periodic visits. These registered pregnant women who were in their first trimester and whose Expected Date of Delivery lie within our study period of one year were considered for study. Three home visits were made (two in antenatal period, one in post natal period).

I visit: As soon as she gets enrolled, data on sociodemographic factors was collected. Obstetric and dietary history was taken. A complete per abdomen examination, clinical profile along with anthropometric measurements and Blood Pressure was undertaken.

II visit: Between 32-36 weeks of gestation, Information regarding any medical illness during course of pregnancy. Data on number of tetanus toxoid injections and iron-folic acid tablets consumed during pregnancy was recorded. Weight gain, fundal height, abdominal girth and Blood Pressure was recorded .

III visit: After delivery of newborn, questions regarding outcome of delivery and complications during delivery were asked. Sex of the newborn was noted. Examination of both mother and newborn was done to rule out any complications.

Weight of the baby was recorded (Institutional delivery –from record, home delivery-within 48 hrs of birth). Data was analyzed using SPSS version 20. Frequency, means, standard deviation was calculated. Chi square test and Fisher's exact test was applied wherever applicable. The value of $p<0.05$ was considered as significant and $p<0.001$ was considered as highly significant for this study.

RESULTS

Out of 185 study subjects in their first trimester who planned to deliver in our study areas, 20 (10.8%)subjects had to be excluded as 15 (8.1%) had abortion, and 5 (2.7 %) were lost to follow up. Hence study sample of 165 were followed up with three home visits. Out of these 5 (3.0 %) females were excluded as 2 (1.2 %) had twin delivery and had 3 (1.8 %) still births. Hence statistical analysis was done of 160 subjects.

Table 1- Means of maternal anthropometric measurements (n=160)

	Rural	Urban	Total
Mean Weight ± S.D.	47.0±5.6	54.2±6.0	50.3±6.8
Mean Height ± S.D.	148.1±6.4	159.8±4.8	153.4±8.2
Mean B.M.I ± S.D.	21.5±2.1	21.4±2.8	21.5±2.4

Table -2: Maternal anthropometric characteristics and birth weight of baby (n=160)

Characteristics	Birth weight		Total (n=160)	P value
	LBW (n=64)	NBW (n=96)		
Height				
< 145 cm	20 (55.5)	16 (44.5)	36 (22.5)	**0.030**
≥ 145 cm	44 (35.5)	80 (64.5)	124 (77.5)	
Weight in first trimester				
< 45 kg	16 (41.0)	23 (59.0)	39 (24.4)	**0.880**
≥ 45 kg	48 (39.7)	73 (60.3)	121 (75.6)	
Body Mass Index (BMI)				
< 18.5	11 (55.0)	9 (45.0)	20 (12.5)	**0.259**
18.5-24.9	50 (38.8)	79 (61.2)	129 (80.6)	
25.0-29.9	3 (27.3)	8 (72.7)	11 (6.9)	
Weight gain during pregnancy				
< 5 kg	10 (58.8)	7 (41.2)	17 (10.63)	**0.003**
5-6.9 kg	27 (57.4)	20 (42.6)	47 (29.38)	
7-8.9 kg	18 (34.6)	34 (65.4)	52 (32.5)	
9-10.9 kg	8 (22.2)	28 (77.8)	36 (22.5)	
≥ 11 kg	1 (12.5)	7 (87.5)	8 (5)	

LBW= Low Birth weight; NBW= Normal Birth Weight
Figure in parenthesis indicate percentage

Out of total 160 live newborns, 64 were low birth weight babies. Thus the prevalence of LBW was found to be 40%. In rural areas prevalence was more of LBW babies (54.7%) as compared to urban areas (45.3%). The mean birth weight of all the 160 newborns was 2.58 kg (with SD ±0.55 kg).

Majority of females both of rural (64.8 %) and urban (93.1 %) areas had height ≥ 145 cm. It was seen that 63.6% of females of rural had pregnancy weight ≥45 kg whereas in urban areas majority (90.6 %) were of ≥ 45 kg. In our study it was seen that only 6.7 % of females of rural areas and 2.8 % of urban areas had weight gain of ≥ 11 kg. It was seen that most of females both in rural (89.8 %) and urban (69.4 %) areas had normal BMI (18.5-24.9). Table-1 shows mean anthropometric measurements.

Table-2 shows association between maternal stature and birth weight of baby. In our study we found significant association (p=0.030) between maternal stature and birth weight of newborn. LBW was found to be lower (35.5 % vs 55.5 %) in mothers with height more than or equal to 145 cm. The difference was found to be statistically significant.

Association between weight in first trimester and birth weight of baby is shown in Table-2. As shown in table, in our study more percentage of low birth weight babies were found in females whose weight in first trimester was < 45 kg (41.0 %) but no significant association (p=0.880) between pregnant females weight and birth weight of baby was found.

Table-2 depicts relationship between weight gain during pregnancy and birth weight of baby .The proportion of low birth weight increased as the maternal weight gain during pregnancy decreased. This difference was found statistically significant (χ^2 =16.4,df=4, p=0.003).

As shown in Table-2, proportion of low birth weight decreases with increase in maternal body mass index, however the association was not statistically found to be significant (p=0.259).

DISCUSSION

Birth weight is an indicator of health and nutritional status of mothers as well as predictor of infant health and development. The size of baby at birth has an important bearing on survival so, birth weight is commonly used as the yardstick of the maturity .[7]

Krammer did meta-analysis of the English and French language medical literature published from 1970 to 1984and has identified 43 potential factors for low birth weight. The factors vary from one area to another, depending upon geographic, socio-economic and cultural factors. Thus it is necessary to identify factors prevailing in a particular area responsible for low birth weight, so as to plan the strategy to tackle this important problem .[2]

India alone accounts for one third of the global burden of LBW. The prevalence of low birth weight babies is 22.5% as estimated by NFHS-3 (23% in rural and 19% in urban areas). Prevalence of low birth weight in our study is approximately similar to prevalence of LBW of Aligarh (37.4 %) according to Annual Health Survey conducted by Government of India[8] but higher than that as estimated by NFHS-3.[9]

A mother's height during pregnancy is determined by three factors: her genetic potential for growth; her state of skeletal maturity; and the effect of environmental influences during the period of skeletal immaturity. These factors differ in their modifiability. Genetic potential is presumably fixed, but delayed child-bearing among young adolescents and, over the long term, general improvements in nutrition might be achieved by interventions.[2]

In a study conducted in the department of Obstetrics and Gynaecology and Paediatrics of JIPMER by Ushadevi et al (2012),[10] 27.12% had height less than 145 cm, 30.78% had height between 146 and 150 cm, 36.71% had height between 151 and 155 cm, 4.07% had height between 156 and 160 cm and 1.31% had height more 161 cm. There was increase in birth weight with increasing maternal height. The association was found to be statistically highly significant between mean birth weight and maternal height (p < 0.001).

Similar to our findings, in a study carried out at the obstetric in-patient department of NRS Medical College Hospital, Kolkata by Dasgupta et al (2004), [11] two-third (66.7 %) of babies born to mothers with height less than 145 cm were LBW. Srikrishna et al (2003)[12] in their cross-sectional descriptive study, found that the height of the mothers showed a significant positive association with low birth weight (χ2=194.4; p value: 0.000).

However study done by Biswas et al (2008)[13] conducted in Puruliya, West Bengal revealed no statistically difference between birth weight and height of mother.

Women in the lowest quartile for both pre-pregnancy weight and weight gain during pregnancy were found to be at highest risk (up to week 20, O R 5.6; up to week 36, O R 5.6) of producing an IUGR infant.[14] Normally a woman should gain 9-11 kg during her pregnancy.[14]

Agarwal et al (2012)[16] in their hospital based cross sectional study among 325 women observed that maximum prevalence of LBW was observed among mothers with pre pregnancy weight of less than 40 kg (80.96%.). In a hospital based study conducted by Ushadevi et al (2012)[10], 11.25% had weight less than 45 kg, 31.33% had weight between 46 – 50 kg, 34.71% had weight between 51 – 55 kg.

17.46% had weight between 56 – 60 kg and 5.24% patients had weight more than 61 kg. Dasgupta et al (2004)[11] carried out prospective study in Kolkata and analyzed that 53.8% babies born to mothers with weight less than 45 Kg in the early part of their pregnancy were found to be LBW.

Similar to our study a prospective cross sectional hospital based study conducted in a District Hospital at Perambalur, Tamilnadu by Dandekar et al (2014),[17] LBW was significantly associated with weight gain. Lower percentage of 26 (9.52%) LBW babies were born with mothers weight gain during pregnancy more than 6 kg. In a community based study carried out by Metgud et al (2012),[18] weight gain ≤4 kg during pregnancy was significantly associated with birth weight. [crude OR 6.0, (95% CI 3.7–9.6), p 0.001]. In a retrospective study carried out by Chang et al (2010)[19] in Taiwan weight gain during pregnancy was highly correlated with neonatal birth weight ($r = 0.334$, $p < 0.001$). There were significant differences between maternal weight gain and their neonatal body weight ($F = 9.486$, $p < 0.001$). Women with a pregnancy weight gain less than10 kg resulted in mean neonatal birth weight 113.94 gm lower than weight gain with 10 – 14 kg ($p = 0.085$), 237.62 gm lower than weight gain with 14 – 16 kg ($p = 0.003$), and 332.58 gm lower than weight gain over 16 kg ($p < 0.001$).

Naidu et al (1994)[20] reported the odds ratio for LBW among Indian mothers to be three times more in severe chronically energy deficient low BMI groups when compared to normal BMI groups

In a case-control study conducted in Hyderabad-Sindh by Memon et al (2005),[21] they found that maternal malnutrition expressed as body mass index<19 was associated significantly with LBW. Joshi et al (2010)[22] in study conducted in Nepal observed significant association between BMI of mother and LBW ($\chi^2=17.57$, $P<0.001$). Similarly in a study conducted by Joshi et al (2005)[23] in Allahabad observed that in mothers with BMI less than or equal 20 (kg/m2) 47.25% newborns were LBW. BMI ($\chi^2 = 17.57$, $p<0.001$) was found to be significantly associated with LBW. Srikrishna et al (2003)[24] in their cross-sectional study in Bangalore found no significant association between BMI of the mother and the birth weight. This was in contrast to the findings of the study from the National Institute of Nutrition where the proportion of LBW in each of the categories of BMI was compared with similar groups in the NIN study and the distribution of LBW was found to be significantly different ($p<0.01$). Saxena et al (2000)[25] in their longitudinal descriptive study found that overall 23.3 % women were having BMI < 18.5 kg/m^2. Majority of women (72.5 %) were having BMI in the range of 18.5-25.0 kg/m^2.

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