Correlation between Maternal and Neonatal Anthropometric Parameters-A Cross Sectional Study

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ABSTRACT

Background: The incidence of low birth weight (LBW) babies is higher in India as compared to developed world**.** Maternal and neonatal anthropometry data are the stronger predictors of neonatal morbidity and mortality**. Aim:** To study the relationship between maternal and neonatal anthropometry. **Methods:** This was a prospective cohort study. A total of 121 pregnant women providing consent were enrolled in this study. Maternal anthropometric measurements such as weight, height, BMI, mid arm circumference were recorded in international system of unit(SI).New born anthropometric measurement such as weight, length, mid arm circumference (MUAC), chest and head circumference were recorded at birth in SI and correlated. **Results:** Mother's height was significantly lower in LBW neonates as compared to mothers of Normal Birth Weight (NBW) neonates.BMI was also significantly higher in mothers of LBW neonates as compared to mothers of NBW neonates ($P<0.05$).There was no statistically significant difference in mothers' weight, MUAC and Weight gain during pregnancy in the two groups.
Conclusion: Maternal height and BMI were found significant association with the LBW babies. Improvement in the maternal nutritional status can lead to better neonatal anthropometric indices which can be helpful in decreasing the neonatal morbidity and mortality.

Keywords: Maternal anthropometry, Neonatal anthropometry, maternal height, LBW

INTRODUCTION

Neonatal period is the most vulnerable period of life. The leading causes of neonatal mortality are LBW, prematurity, infections, birth trauma, accounting for 80% of neonatal deaths [1]. Anthropometry is a non-invasive, easy, low cost and simple measurement of different lengths, widths, skin folds, and circumferences of the human body for the purpose of evaluation of the body sizes and proportions. These indicators can be of great help especially in developing countries [2]. Birth weight and length are the most widely used measurements just after birth. Smaller neonates are at higher risk of several morbidities and mortality. Maternal health and nutrition as well as environmental influences and antenatal care have been linked to neonatal birth weight in some studies [3]. According to the World Health Organization (WHO), neonates with birth weights of less than 2500 gram are considered as low birth weight (LBW) irrespective of gestational age. The LBW subdivisions include very low birth weight, which is less than 1500 gram, and extremely low birth weight, which is less than 1000 gram [4]. Identifying neonates with birth weight less than 2500 gram is critical since below this value infant mortality begin to rise rapidly [5]. Therefore, LBW is considered to be associated with a greater risk of early childhood death than is associated with normal birth weight [6]. According to the WHO, the global prevalence of LBW is 15.5%, which accounts for about 20.6 million LBW infants born each year, 96.5% of them in developing countries [7]. LBW is a consequence of either preterm (<37 weeks of gestation) delivery or intrauterine growth retardation (IUGR) or of both. In developing countries, 11 % of all full-term new-burns are LBW due to IUGR; a rate six times higher than in developed countries [8]. Body size is evidently proportional to age and it relates to the newborn throughout early years, until the time of skeletal merge. Thus, size of newborn at birth reflects the average growth rate for that infant from conception to

birth [9]. The causes of low birth weight are multi-factorial associated with environmental, demographic, social and cultural characteristics [10].

Aims & objectives: The purpose of this study was to evaluate the maternal and neonatal anthropometric parameters and their correlation

MATERIALSAND METHODS

This was an observational based prospective cohort study conducted at tertiary care hospital government Medical college & Hospital at Jalgaon, from November 2022 to October 2023.

Inclusion criteria:

- Maternal age 18-35 year
- Singleton pregnancy
- Term pregnancy between 37 weeks to 42 weeks
- Pregnant women who provide written informed consent for the study

Exclusion criteria:

- Twin pregnancy
- Preterm and post-term newborn
- When no clear data of gestational age available
- Any maternal illness affecting birth weight (anemia, pregnancy induced hypertension, gestational diabetes mellitus)
- Pregnant women with active TORCH infection.
- Pregnant women who not provide written informed consent for the study

Maternal anthropometric measurements such as post pregnancy weight, height, mid arm circumference and triceps skin fold thickness were recorded at the time of enrollment**.** New born anthropometric (birth weight, length at birth, foot length and circumference of mid arm, chest and head) measurements were recorded within 24 hours of birth. Using New Ballard Score, the physical and neurological maturity scoring calculated and gestational age was assessed, then matched with the gestational age as calculated by history of maternal last menstrual period. Newborn weight less than 2.5kg considered low birth weight babies. All maternal and neonatal anthropometric parameters were correlated between them.

Statistical analysis: Descriptive statistics will be used to express the data as percentages, mean and standard deviation. Statistical comparisons will be performed using Fischer's exact test. P value < 0.05 will be considered statistically significant

RESULTS

A total of 121 pregnant mothers were enrolled and analysed in the present study. On comparing the mothers anthropological parameters in low and normal birth weight neonates we observed that mother's height was significantly lower in LBW neonates as compared to height of mothers of NBW neonates. There was no statistically significant difference in mothers' weight, MUAC and Weight gain during pregnancy in the two groups. BMI was also significantly higher in mothers of LBW neonates as compared to mothers of NBW neonates (P<0.05).

Table 1: Maternal anthropometric parameters in relation to birth weight of neonate

Maternal anthropometric	LBW	NBW	P value
Height (cm)	148.39±5.27	154.42±6.64	<0.0001
Weight (kg)	52.12±7.34	52.70±5.90	0.658
MUAC(cm)	24.98±2.35	25.33±1.93	0.417
BMI (m^2)	23.62±3.71	22.27±2.66	0.030
Weight gain (kg)	8.29±0.75	8.52±0.65	0.096

Pearson correlation test was performed to see the correlation of mothers height with the neonatal anthropometry, we observed the significant positive correlation of mothers height with the neonates weight (r=0.490, p<0.0001) and neonates length (r=0.410, p<0.0001) was observed scattered dot plot between mothers height and baby's birth weight

Table 2: Correlation of mother height with neonatal anthropometry

Neonatal anthropometry	r	P
Weight	0.490	0.0001
Length	0.410	0.0001
MUAC	0.53	0.563
Head Circumference	0.146	0.110

No significant correlation of neonates birth weight and other anthological variables was seen with mothers' weight.

Table 3: Correlation of mother weight with neonatal anthropometry

Neonatal anthropometry	r	P
Weight	0.140	0.127
Length	0.120	0.898
MUAC	- 0.43	0.640
Head Circumference	-0.102	0.264

No significant correlation of neonates' birth weight and other anthological variables was seen with mothers MUAC.

Table 4: Correlation of mother MUAC with neonatal anthropometry

Neonatal anthropometry	r	P
Weight	0.080	0.381
Length	0.48	0.601
MUAC	-0.124	0.177
Head Circumference	-0.012	0.893

Significant correlation of weight gain during pregnancy was seen with neonate's birth weight only was seen

Table 5: Correlation of mother weight gain with neonatal anthropometry

Neonatal anthropometry	r	P
Weight	O.183	0.044
Length	0.083	0.367
MUAC	-0.128	0.163
Head Circumference	-0.048	0.599

DISCUSSION

The multiple factors are responsible for the fetal development and LBW babies include the ethnicity/race, socioeconomic status, maternal nutritional status; anemia, smoking, alcoholism, drug abuse and maternal anthropometric features. Most of the studies have focused on one or two socio-demographic or nutritional factors, very little literature could be found which has made simultaneous evaluation of anthropometric parameters or multiple parameters. Body measurements at birth usually include BW, length, and HC which is a simple tool that reflects infant's brain growth and development Maternal height was the most important parameter which significantly associated with the risk for LBW babies, Significant positive correlation of mothers height with the neonates weight ($p<0.0001$) was observed in the present study, similar findings reported by Sanghvi et al [11],Elshibly EM, et al [12] and Zhang et al [13].As mother height increased incidence of LBW decrease and minimum incidence was observed when mother height was 152 centimeters and more. In our study maternal BMI was significantly associated with the neonatal LBW, the higher percentage of LBW newborns may be explained by the high percentage of obese mothers by many other researchers: Ford ND, et al [14], Singh S, et al [15] and Tosson et al [16].In our study we did not observed any association with arm circumference with the birth weight. However a study conducted by Ramlal et al [17] show a significant association of

maternal mid arm circumference with LBW. Current study found no significant difference between the LBW and NBW neonates in relation to maternal weight, some researchers have found that using a pre pregnancy weight of less than 40 kg is a useful cutoff to predict women who will deliver low birth weight babies [18-19]. Correlation of maternal Mid Upper Arm Circumference (MUAC) and neonatal anthropometry will help us in strengthening adolescent health status as MUAC reflects pre pregnancy nutritional status. In our study no significant correlation found between maternal MUAC with the neonatal anthropometry, in contrast to that study done by Rani N, et al [20] observed significant correlation between maternal MUAC and Neonatal birth weight ($p<0.0001$).The studied population showed significant relationship between the maternal height and maternal BMI with the neonatal anthropometry i.e. birth weight.

CONCLUSION:

There is definite positive association of maternal height to that of the birth weight of the newborn**.**BMI has inverse relation with birth weight of newborns significant correlation of weight gain during pregnancy is the birth weight of newborn was observed. Amongst all maternal anthropometric parameters in relation to birth weight of neonate maternal height is the best predictor.

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