SHORT COMMUNICATION

Predictors of Birthweight – *A Cross Sectional Study*

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This study was conducted to find out the anthropometric, biosocial and obstetric predictors of birthweight in Kerala. The study sample consisted of 599 consecutive liveborn babies delivered at SAT Hospital, Medical College, Thiruvananthapuram and their mothers in November 2001. Details of maternal history, anthropometry, and biosocial and demographic factors were recorded. Birthweight was primary outcome variable. Multivariate analysis revealed that the biologically acceptable predictors of birthweight of a baby in our population are maternal height (P<0.001), parity (P<0.001) gestational age (P<0.001), pregnancy induced hypertension(P=0.05) and history of low birthweight in the previous pregnancy(P=0.05).

Keywords: *India, Low birthweight, maternal height.*

The weight of an infant at birth is an important indicator of health and nutrition prior to and during pregnancy and a powerful predictor of infant survival, growth and development. Low birthweight (LBW) babies (<2500 g) contribute to majority (65-70%) of the neonatal mortality(1,2). It has also been implicated in the childhood onset of adult diseases including type II diabetes mellitus, hypertension, coronary heart disease, chronic respiratory disease and even some forms of cancer-Barker hypothesis(3). Thus, it is important to determine predictors of low birthweight to facilitate appropriate preventive measures and timely action.

Birthweight is said to be determined by sociodemographic, biological, genetic, fetal and obstetric factors. A study from India, showed that birthweight is linearly correlated with maternal height and pre-pregnant weight(4). Another study demonstrated that socioeconomic status, anemia, antenatal care and pre-pregnant height and weight have the highest population attributable risk for low birth weight(5).

In those parts of the country where, provision of adequate natal care and antenatal care including prevention of anemia have already been taken care of, the next priority would be community intervention programs for adolescent future mothers to improve the pre-pregnant height and weight, which is now feasible under the National Rural Health Mission (NRHM). This would necessitate local data on modifiable predictors of birthweight. We conducted this study to find out the anthropometric, biosocial and obstetric predictors of birthweight in Kerala, with the specific hypothesis that maternal height is a predictor of birthweight in our population.

METHODS

The study sample consisted of 599 consecutive live born babies delivered in one month at SAT Hospital, Medical College, Thiruvananthapuram and their mothers. Those who died in the labor room or were born with obvious external congenital anomalies or had clinical evidence of intrauterine infections, were excluded. The main tool used was a pre-piloted structured questionnaire probing specific details of biosocial, demographic and obstetric factors, developed after discussions with colleagues from

obstetrics, pediatrics and social sciences faculty. Clinical interview of each mother was done separately, 24-72 hours post-partum in the postnatal ward. Computed gestational age was expressed in completed weeks. Maternal height was taken using an anthropometric rod calibrated every day and maternal weight was taken using a single balance calibrated every day. Pre-pregnancy weight was calculated from the present weight, using the method referred to by Morse, *et al.*(6).

Weight of the baby was taken soon after delivery using an electronic weighing machine standardized to the nearest 5 g and calibrated daily for accuracy. Birthweight (as a continuous variable) was considered as the primary outcome measure. Simple linear regression was employed for univariate analysis. Multiple linear regression was used taking birthweight as the dependant variable and maternal height and other parameters as the independent variables. $P<0.05$ was considered significant.

RESULTS

Complete data of 599 mother infant pairs who entered into the study were available for analysis. Of these, there were 325 boys and 264 girls. There were 466 full term appropriate for gestational age (AGA) babies, 89 babies with term intrauterine growth retardation (IUGR) and 44 preterm babies below 37 week gestation. Weight ranged from 950 g to 4150g [mean (SD); 2783.4 (492.37) g]. Both the birthweight and maternal height were normally distributed.

Simple linear regression taking birthweight as the dependant variable and each of the study variables as the independent variables revealed that maternal height, weight, BMI, gestational age in weeks, parity, history of low birthweight or infertility, pregnancy induced hypertension, and antepartum hemorrhage contributed significantly to the birthweight. Sex of the baby, education of mother and father, per capita income, passive smoking, previous abortion, antenatal care, maternal age and anemia were not found to be related to birthweight on univariate analysis. Variables found significant by simple linear regression on univariate analysis were entered into the multiple linear regression analysis model in step-wise manner. The final model for the prediction of birth weight consisted of 5 variables; height of the mother ($P<0.001$), gestational age in weeks ($P<0.001$), parity ($P<0.001$), presence of pregnancy induced hypertension ($P<0.005$) and history of low birthweight ($P<0.01$) (***Table* I**).

The model shows that an increase in maternal height of 1 cm contributes to an increase of 13g in birthweight. The prolongation of 1 week of gestation was associated with an increase of 142g in birthweight. Nullipara were likely to have a baby with a birth weight 148g less, compared to multiparous women. History of pregnancy induced hypertension was associated with a decrease of 94g in the birthweight and the history of low birthweight baby in the past was associated with a decrease of 169g in birth weight. The final model had R^2 of 0.342 (adjusted 0.336) meaning that 34% of the variance in birthweight is explained by these predictors.

TABLE I PREDICTORS OF BIRTHWEIGHT ON MULTIVARIATE ANALYSIS

Models	Unstandardized Beta coefficient	*t*	95% Confidence limit		*P* value
			lower	upper	
Constant	–4661.69	–8.92	–5687.53	–3635.84	0.000
Height	13.04	5.41	–217.31	–78.52	0.000
Gestational age	141.98	15.29	123.74	160.22	0.000
Parity	–147.92	4.18	–217.31	–78.52	0.000
Pregnancy induced hypertension	–93.91	–2.06	–183.08	–4.74	0.039
History of LBW	–168.88	–2.50	–301.43	–36.34	0.013

WHAT THIS STUDY ADDS?

- Predictors of birthweight in Kerala include maternal height, parity, gestational age, pregnancy induced hypertension, and history of low birthweight in the previous pregnancy.

We also compared independent variables by individual *t*-statistic, which indicated the relative magnitude of unique contribution of each variable to the overall variability in birthweight. In our model, gestational age in weeks is the largest contributor to the explained variation in birthweight.

DISCUSSION

The study has shown that biologically acceptable predictors of birthweight of a baby operating in our population are; maternal height (anthropometric variable), parity (biosocial variable), gestational age, pregnancy induced hypertension, and history of low birthweight in the previous pregnancy (obstetric variables). Maternal height as a significant predictor of birthweight has been well supported in the literature from all over the world as well as from community studies in India(4,5). Alam DS, *et al*.(7) from rural Bangladesh have also studied the influence of maternal anthropometry on birthweight and concluded that it had a positive association with the maternal height. Though height of the mother is ultimately influenced by genetic factors, it can be modified during the pre-adolescent and adolescent periods of rapid growth spurt.

We have included in the study all variables known to be biologically related to the outcome but we have not been able to include the variables like physical activity and psychological support during pregnancy due to logistic reasons. Perceived prenatal social support have been reported as a predictor of infant birthweight(8). In the final model we have included only height, gestational age, parity, pregnancy induced hypertension and history of LBW in the previous pregnancy, as this model was found to be the best (R^2=0.342) for using maternal height as a predictor for birthweight. No additional advantage was obtained by including maternal weight and BMI, which were found to be independently significant in univariate analysis.

In a prospective hospital based study Nahum, *et al.*(9) reported that the significant predictors of birthweight are maternal height, gestational age, parity, third trimester maternal weight gain rate and fetal gender. These prospectively measurable variables explained 33% of the variance in the birthweight and predicted birthweight to within 10.8%. The other important variable found significant in our study was gestational age in weeks. It is very well known that the birthweight is a product of gestational age and intrauterine growth.

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