Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v29i04.5280

A STUDY OF RELATIONSHIP BETWEEN MATERNAL ANTHROPOMETRY AND NEONATAL ANTHROPOMETRY

Meghali Joharapurkar[1*]

[1*]Department of Food and Nutrition, Sevadal Mahila Mahavidyalaya, Nagpur

***Corresponding Author:** Meghali Joharapurkar
*Department of Food and Nutrition, Sevadal Mahila Mahavidyalaya, Nagpur

ABSTRACT

Background: Anthropometric measures are quantitative assessments of human body size, form, and nutritional status. Maternal and neonatal anthropometry data are the stronger predictors of neonatal morbidity and mortality.

Objective: To study the relationship between maternal anthropometric measurements and neonatal anthropometry.

Methods: A total of 215 pregnant women were selected from Government Hospitals of Nagpur City in the last trimester. A structured questionnaire was made which consisted of questions related to demographic and socio-economic profile and anthropometric measurements. Interview cum questionnaire method was used for eliciting information. The maternal anthropometry viz., height, weight and mid arm circumference were recorded as per standard methods. Neonatal anthropometric measurements viz., birth weight, crown heel length, head circumference, chest circumference and mid upper arm circumference were measured by standard techniques.

Results: The results of anthropometric measurements of maternal height showed positive and significant correlations with birth weight, head circumference and mid upper arm circumference of new-borns ($p < 0.01$). Weight gain of pregnant mothers showed positive and significant correlations with birth weight, crown heel length, head circumference and mid upper arm circumference of new-borns ($p < 0.01$). Mid upper arm circumference of mothers showed positive, marked and significant correlations with birth weight and head circumference ($p < 0.01$). BMI of pregnant mothers showed positive and significant correlations with birth weight of new-borns ($p < 0.01$).

Conclusion: It can be concluded that better maternal anthropometry leads to better neonatal anthropometry.

Keywords: Maternal anthropometry, Maternal height, Neonatal anthropometry.

INTRODUCTION

Anthropometry (derived from the Greek Anthropos: human and, Metron: measure) refers to the systematic measurement of the physical characteristics of the human body, primarily body weight, body size, and shape. Anthropometric assessments are simple, portable, non-invasive, and inexpensive measurements that can be used to provide insight into health, and nutritional status (Padilla et al. 2021). Maternal body frame is the first determinant of neonatal biometrics predominantly their birth weight and length, which are closely related to perinatal morbidity and mortality. It is also known that mother's nutritional status is a key indicator of infant's and its early growth features. Birth weight and length are clearly related to mother's nutritional and

anthropometric factors respectively. The anthropometric measurements that are commonly used as indices for growth and development are height, weight and mid-arm circumference. The growth of neonates is reported to be influenced by some maternal variables such as age, parity, social class and ethnicity. It was reported that maternal anthropometry is a potentially valuable tool in the evaluation of pregnancy status and prediction of birth weight. Several maternal factors such as age, body height, pre-gestational body weight, gestational weight gain, parity, gestational age, smoking during pregnancy, ethnicity, general health status, and dietary habits during pregnancy may influence the foetal growth which manifests in birth length and birth weight (Patra and Sarangi, 2017). Although maternal anthropometry is routinely conducted during antenatal clinic visits, this important public health tool is often under-utilized for ensuring optimal pregnancy outcomes (Onubogu et al.2017). Hence, the present study investigates the relationship of maternal anthropometric measurements and neonatal anthropometry.

MATERIALS AND METHODS

The present study comprised of a total 215 pregnant women who were selected from Government Hospitals of Nagpur City in the last trimester. A structured questionnaire was made which consisted of questions related to demographic and socioeconomic profile and anthropometric measurements. Interview cum questionnaire method was used for eliciting information. The maternal anthropometry viz., height, weight and mid arm circumference were recorded as per standard methods (Jelliffe, 1966). The anthropometric measurements of neonates' viz., birth weight, crown heel length, head circumference, chest circumference and mid upper arm circumference were measured by standard techniques. The birth weight was noted from the hospital records. All the measurements were taken within 24 hours after the birth. The data obtained were analyzed using percentage, mean and standard deviations. Correlations were computed using Pearson's Product moment Coefficients. The data thus collected was analyzed statistically and results were interpreted accordingly.

RESULTS AND DISCUSSION

Socio-demographic Profile:

The socio demographic profile of the mothers showed that the majority of pregnant women (55.35%) were in the age group of 20-25 years. The mean age of women was found to be 24.43 ± 3.24 years. About 40.47% belonged to the nuclear family. 58.14 % and 17.21% pregnant women had education up to SSC and HSSC respectively. The mean monthly per capita income of pregnant women was Rs. 678.60 ± 554.25.

Mean Maternal Anthropometric Measurements

The mean anthropometric measurements of pregnant women are shown in Table 1. In the present study, the mean height of mother was found to be 154.07 ±4.55cm. Tabrizi and Saraswathi (2012) reported that the mean height of pregnant women was 159.1cm. Srikanth and Kumari, (2015) observed the mean height of pregnant women was 1.5meters with a SD of 0.06. Tayade et al. 2018 reported the maternal mean height was 154.43±5.39 cm. In the present study, the mean pre-pregnancy weight, weight in last trimester and gain in weight of pregnant women were found to be 46.82 ± 5.30 kg, 54.74±6.08 kg and 7.92±2.21 kg respectively. According to a study reported by Tayade et al. 2018, the maternal mean pre-pregnancy weight was 47 ± 5.77 kg. Tabrizi and Saraswathi (2012) reported that the mean weight gain during pregnancy was 11.8 kg. The mean MUAC of mothers of the present study was 22.07 ± 1.78 cm. The mean BMI (kg/m^2) of mothers of present study was 19.75 ± 2.00 kg/ m^2. Srikanth and Kumari, (2015) reported the mean BMI as 23.03 with a SD of 4.07. According to Tayade et al. (2018) the mean BMI of pregnant women was 19.78 ± 2.56 (kg/m2) respectively.

Table 1: Mean Maternal Anthropometric Measurement of Pregnant Women

Sr. No.	Maternal Anthropometric Measurements	N = 215 Mean ± SD
1	Height (cm)	154.07 ± 4.55
2	Pre-pregnancy Weight (kg)	46.82 ± 5.30
3	Weight (kg)	54.74 ± 6.08
4	Gestational weight Gain (kg)	7.92 ± 2.21
5	Mid Upper Arm Circumference (cm)	22.07 ± 1.78
6	BMI (kg/m^2)	19.75 ± 2.00

Mean Neonatal Anthropometry

The mean neonatal anthropometric measurements of new-borns are shown in Table 2. In the present study, the mean birth weight of new-borns was found to be 2.51 ±0.43 kg. The average crown heel length of neonates was 48.02 ± 1.53 cm. The mean head circumference of neonates was 32.45 ± 1.57 cm. The mean chest circumference of new-borns was 30.34 ± 1.22 cm. The mean mid upper arm circumference of neonates was 9.08 ± 1.14cm. Biswas et al. (2008) reported 2.6 kg as mean birth weight. According to Choudhary et al. (2013) the mean birth weight of new-borns was 2.57±0.36 kg. Srikanth and Kumari, (2015) reported the mean birth weight of babies was 2931.22 grams with a SD of 303.23. The mean length was 49.59 cm with a SD of 2.24 and mean head circumference was 33.63 with a SD of 1.55. The mean birth weight was 2941.64 g (SD 424.04 g) (Gunawardane et al. 2018).

Table 2: Mean Neonatal Anthropometry Measurements

Sr. No.	Anthropometric Measurements	N=215 Mean ± SD
1	Birth weight(kg)	2.51 ± 0.43
2	Crown heel length(cm)	48.02 ± 1.53
3	Head Circumference (cm)	32.45 ± 1.57
4	Chest Circumference (cm)	30.34 ± 1.22
5	Mid upper arm circumference (cm)	9.08 ± 1.14

Correlation Coefficient between Maternal Anthropometry and Neonatal Anthropometry

Maternal Height and Neonatal Anthropometry

The correlation coefficient between maternal anthropometry and neonatal anthropometry is shown in Table 3.In the present study, the height of mother's showed positive significant correlations with birth weight ($r = 0.232$, $p < 0.01$), crown heel length ($r = 0.166$, $p < 0.05$), head circumference ($r = 0.177$, $p < 0.01$) and mid upper arm circumference ($r = 0.177$, $p < 0.01$) of neonates**.** Birth weight and length were associated with height ($r=0.1933$; $p<0.01$ and $r=0.2556$; $p< 0.01$respectively) by Kanade et al. (2008). Ugwa (2014) also reported a strong positive correlation of maternal height with birth weight ($r = 0.25$) and was statistically significant ($p< 0.001$). Krishna et al. (2018) reported that there was a statistically significant positive correlation between birth-weight and maternal height ($r=0.301$).

Pre pregnancy Weight and Neonatal Anthropometry

In the present study, pre pregnancy weight of mothers showed positive and significant correlations with birth weight ($r = 0.342$, $p < 0.01$), crown heel length ($r = 0.159$, $p < 0.05$), head circumference ($r = 0.250$, $p < 0.01$) and chest circumference ($r = 0.175$, $p < 0.05$) and mid upper arm circumference ($r = 0.181$, $p < 0.01$) of newborns. Birth weight was associated with pre pregnancy weight ($r = 0.2259$, $p < 0.01$) by Kanade et al. (2008).

Present Weight and Neonatal Anthropometry

A marked positive and significant correlation was observed between present weight of pregnant mothers and birth weight ($r = 0.454$, $p < 0.01$) whereas crown heel length ($r = 0.225$, $p < 0.01$), head circumference ($r = 0.344$, $p < 0.01$) chest circumference ($r = 0.186$, $p < 0.01$) and mid upper arm circumference ($r = 0.293$, $p < 0.01$) of new-borns showed positive and significant correlations.

Ugwa (2014) also reported a strong positive correlation of maternal weight with birth weight (r = 0.48) and was statistically significant (p< 0.001).

Gain in Weight and Neonatal Anthropometry

Weight gain of mothers showed positive and significant correlations with birth weight (r = 0.427, p < 0.01), crown heel length (r = 0.236, p < 0.01), head circumference (r = 0.344, p < 0.01) and mid upper arm circumference (r = 0.370, p < 0.01) of newborns. According to Krishna et al. *(*2018) a statistically significant positive correlation between birth-weight and maternal gestational weight-gain (r=0.233).

Mid Upper Arm Circumference (MUAC) and Neonatal Anthropometry

Mid upper arm circumference of mothers showed positive, marked and significant correlations with birth weight (r = 0.471, p < 0.01) and head circumference (r = 0.402, p < 0.01) whereas crown heel length (r = 0.290, p < 0.01), chest circumference (r = 0.234, p < 0.01) and mid upper arm circumference (r = 0.395, p < 0.01) of newborns showed low positive and significant correlations. According to Krishna et al. (2018) a statistically significant positive correlation between birth-weight and maternal MUAC(r=0.222). Vasundhara et al. (2020) who measured maternal MUAC showed a positive correlation with birth weight, crown heel length, and head circumference of the neonates.

Maternal Body Mass Index (BMI) and Neonatal Anthropometry

BMI of mothers showed low positive and significant correlations with birth weight (r = 0.246, p < 0.01) and correlation with head circumference (r = 0.176, p < 0.05) of newborns. According to Jananthan et al. (2009) significant positive correlation was observed between birth weight (BW) and maternal BMI (r=0.24). Mitra et al. (2012) also reported a significant correlation between birth weight with maternal BMI (r = 0.52, P < 0.0001). According to Ugwa (2014), maternal BMI showed a weak positive correlation with birth weight (r=0.28) and was statistically significant (p< 0.001). Srikanth and Kumari (2015) observed a positive correlation between maternal BMI and weight of neonate, r value was 0.391 with a p- value of .005 which is highly significant at 0.01 levels.

Table 3: Correlation Coefficient between Maternal Anthropometry and Neonatal Anthropometry

Maternal Anthropometry	**Neonatal Anthropometry**				
	Birth Weight (BW) (kg)	**Crown Heel Length (CHL) (cm)**	**Head Circumference (HC) (cm)**	**Chest Circumference (CC) (cm)**	**Mid Upper Arm Circumference (MUAC) (cm)**
Height (cm)	0.232**	0.166*	0.177**	0.126	0.177**
Pre-pregnancy Weight (kg)	0.342**	0.159*	0.250**	0.175*	0.181**
Last Trimester Weight (kg)	0.454**	0.225**	0.344**	0.186**	0.293**
Gain in Weight (kg)	0.427**	0.236**	0.344**	0.091	0.370**
Mid Upper arm Circumference (cm)	0.471**	0.290**	0.402**	0.234**	0.395**
Body Mass Index (kg/m^2)	0.246**	0.077	0.176*	0.112	0.099

* p< (0.05), ** p< (0.01)

CONCLUSION

The present study was carried out to assess the relationship between maternal anthropometry and neonatal anthropometry. It can be concluded from the study that mid upper arm circumference (MUAC) of pregnant mothers was positively and significantly correlated with birth weight, crown heel length, head circumference, chest circumference and MUAC of infants. Gain in weight and height of pregnant mothers showed a positive and significant correlation with all neonatal anthropometric measurements except chest circumference. However, the BMI of the mother showed a positive and significant correlation with only birth weight and head circumference. So, it can be concluded that better maternal anthropometry leads to better neonatal anthropometry. It can be further extrapolated that nutritional status of the mother contributes heavily towards the nutritional status of the neonatal child and it can be concluded that a healthy mother would deliver a healthy newborn.

REFERENCES

1 Biswas, R., Dasgupta, A., Sinha, R. N., and Chaudhuri, R. N. (2008). An epidemiological study of low birth weight newborns in the District of Puruliya, West Bengal. *Indian Journal* of *Public Health*, *52*(2), 65–71.

2 Choudhary, A. K., Choudhary, A., Tiwari, S. C., and Dwivedi, R. (2013). Factors associated with low birth weight among newborns in an urban slum community in Bhopal. *Indian Journal Public Health*, *57*(1), 20-23.

3 Gunawardane, D. A., Dharmaratne, S. D., and Rowel, D. (2018). Relationship between maternal anthropometry and birth weight in a Sri Lankan cohort of term neonates. *Sri Lanka Journal of Medicine*, *26* (2), 4-12.

4 Jananthan, R., Wijesinghe, D. G. N. G., and Sivananthawerl, T. (2009). Maternal anthropometry as a predictor of birth weight. *Tropical Agricultural Research*, *21*(1), 89-98.

5 Jelliffe, D. B. (1966). The assessment of the nutritional status of the community (with special reference to field surveys in developing regions of the world). World Health Organization Geneva.

6 Kanade, A. N., Rao, S., Kelkar, R.S., and Gupte, S. (2008). Maternal nutrition and birth size among urban affluent and rural women in India. *Journal of the American College of Nutrition*, *27*(1), 137–145.

7 Krishna, C., Prakruthi, N., Parmar, P. V., and Lato, R. (2018). Maternal anthropometry and it's relationship to birth weight. *International Journal of Preventive, Curative & Community Medicine*, *04*(04), 48–53.

8 Mitra, S., Misra, S., Nayak, P., and Sahoo, J. P. (2012). Effect of maternal anthropometry and metabolic parameters on fetal growth. *Indian Journal of Endocrinology and Metabolism*, *16*(5), 754-758.

9 Onubogu, C. U., Egbuonu, I., Ugochukwu, E. F., Nwabueze, A. S., and Ugochukwu, O. (2017). The influence of maternal anthropometric characteristics on the birth size of term singleton South-East Nigerian newborn infants. *Nigerian Journal of Clinical Practice*, *20*(7), 852-859.

10 Padilla, C. J., Ferreyro, F. A., and Arnold, W. D. (2021). Anthropometry as a readily accessible health assessment of older adults. *Experimental Gerontology*, *153*, 111464.

11 Patra, S., and Sarangi, G. D. (2017). Association between maternal anthropometry and birth outcome. *Journal of Pediatrics Association of India, 6* (2), 85-94.

12 Srikanth, J., and Kumari, A. (2015). To study the correlation between maternal anthropometric measurements and new born birth size. *RGUHS Journal of Med Sciences, 5*(1), 6-8.

13 Tabrizi, F. M., and Saraswathi, G. (2012). Maternal anthropometric measurements and other factors: relation with birth weight of neonates. *Nutrition Research and Practice*, *6*(2), 132-137.

14 Tayade, S., Singh, R., Kore, J., and Gangane, N. (2018). Maternal anthropometric measurements, pre-pregnancy Body mass index, and fetal growth parameters - A rural experience. *Obstetrics and Gynecology Research, 01*(02), 51-64.

15 Ugwa, E. A. (2014). Maternal anthropometric characteristics as determinants of birth weight in North-West Nigeria: A prospective study. *Niger Journal Basic Clin Sci, 11* (1), 460-463.
16 Vasundhara, D., Hemalatha, R., Sharma, S., Ramalaxmi, B. A., Bhaskar, V., Babu, J., Vijaya, R. K., and Mamidi, R. S. (2020). Maternal MUAC and fetal outcome in an Indian tertiary care hospital: a prospective observational study. *Matern Child Nutr, 16*(2), e12902.