The impact of parental biometry, demographics and fetal gender on fetal long bones length

Mahamid N, Porat S
Hadassah medical organization, Jerusalem, Israel

Objective
We aimed to examine the differential associations between parental height, weight, BMI, gestational weight gain, fetal gender and demographic parameters with the length of fetal long bones throughout pregnancy.

Methods
This was a prospective study conducted in the Ob/Gyn ultrasound unit at Hadassah Ein-karem hospital. 80 pregnant women with non-malformed singleton pregnancies were recruited between 16-42 weeks of gestation during routine ultrasound exams. Patients were selected using strict criteria, ensuring only healthy parents and normal fetuses were included. The lengths of fetal long bones were measured sonographically by only one examiner. Parental height and weight were measured. Maternal pre-pregnancy weight was self-reported by the mother. Weight gain during pregnancy and parental BMI were calculated. Parental medical and socio-demographic status were obtained. The correlation coefficient between each long bone length and any of the tested variables was calculated, and tested for significance. The same analysis was also performed in subgroups defined by gestational age and sex.

Results
Maternal height, maternal pre-pregnancy weight and maternal weight during pregnancy were associated with femur length (p-values = 0.009, 0.044 and 0.015 respectively). Maternal height, paternal height and parental average height were associated with tibia length (p-values = 0.007, 0.020 and 0.001 respectively). Maternal height and parental average height were associated with fibula length (p-values = 0.014 and 0.013 respectively). For humerus length: Maternal height, parental average height, maternal pre-pregnancy weight and maternal weight during pregnancy at the examination time were associated with humerus length (p-values = 0.018, 0.015, 0.009 and 0.031 respectively). Maternal pre-pregnancy weight and fetal gender were associated with ulna length (p-values = 0.016 and 0.031 respectively). Only fetal gender was associated with radius length (p-value = 0.031). By looking at subgroups; defined gestational age and parental height correlations were observed mainly after 31 weeks of gestation. Maternal weight (pre-pregnancy and during pregnancy) correlations were observed mainly in 22-31 weeks. Parental heights (especially maternal height), were associated with all fetal long bones in the female group but not in the male group. More associations were seen between maternal weight in female fetuses. In linear regression analysis, the bones of the lower extremities were mainly affected by parental height. Femur length was mainly affected by maternal height, whereas the length of the tibia and fibula were mainly affected by parental average height. The bones of the upper extremities on the other hand, were less affected by the parental height and mainly affected by maternal weight. Maternal pre-pregnancy weight affected the humerus and ulna lengths. Ulna and radius lengths were also affected by the fetal gender.

Conclusion
Different long bones show different patterns of associations with parental biometry and fetal gender. This finding indicates that the growth of each long bone is governed by unique biological processes and probably specific genes. We still don't know how pathological processes of growth (like placental IUGR) can impact those processes. Furthermore, it is less clear if an association exists between antenatal and postnatal growth of long bones and what parameters (if any are) shared by the two processes.