Maternal Vitamin D Affects Child's Bone Mass

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HARROGATE, ENGLAND — A mother's vitamin D status in late pregnancy is predictive of her child's lumbar spine volumetric bone density at age 9, a prospective study has shown.

The findings add to the growing body of evidence confirming that a woman's diet while pregnant can influence her child's later bone mass, said Nicholas W. Harvey, B.Chir.

The results of the population-based investigation also point to the potential efficacy of preventive measures to protect children's bone health, Dr. Harvey said in a presentation at the annual conference of the National Osteoporosis Society. "Vitamin D supplementation in pregnant women who are deficient may optimize peak accrual of bone mineral in their offspring," he stated.

Checking vitamin D status and recommending supplements for women who are deficient could reduce fractures in future generations.

The investigation included 210 children of mothers enrolled in a larger cohort study of maternal nutrition and fetal development conducted by Dr. Harvey and his colleagues at the MRC environmental epidemiology unit of the University of Southampton (England). The mothers completed a questionnaire regarding their diet and lifestyle beginning from early pregnancy.

Anthropometric measures were recorded, including mid–upper arm circumference, which is a potential indicator of maternal nutritional status. The mothers gave venous blood samples in late pregnancy for the measurement of 25-hydroxyvitamin D levels and other nutrients. Concentrated umbilical cord blood was collected at birth to measure calcium, albumin, and phosphate.

The investigators recorded the child's size and weight at birth. When the children reached age 9 years, they underwent dual-energy x-ray absorptiometry (DXA) for bone mass measurement. Because bone mineral density measured by DXA represents the areal density (grams per square centimeter) rather than the volumetric density (grams per cubic centimeter) of bone, the investigators generated mathematical estimates of volumetric bone density from the DXA measurements of bone mineral content and bone area.

"When studying bone mineral density during growth, the differences [between volumetric and areal BMD] have to be taken into consideration," Dr. Harvey explained. As bones grow, the volume increases at a faster rate than the area, so the areal bone density will increase even if the volumetric density remains stable.

At 9 years, the boys in the study group (112) were significantly taller than the girls, and had higher age-adjusted lumbar spine bone mineral content and bone area but lower volumetric bone mineral density. After adjustment for child age and gender, maternal vitamin D was positively correlated with childhood volumetric BMD. "There was a threshold in the relationship, such that mothers in the lowest fifth of the [vitamin D] distribution had children with significantly lower volumetric bone mineral density at age 9 than those in the remaining four-fifths," Dr. Harvey said.

Maternal mid–upper arm circumference and vitamin D supplementation in late pregnancy both had significant positive associations with volumetric BMD, while social class, maternal smoking, and umbilical cord phosphate, calcium, and albumin levels did not. Calcium from the cord blood was predictive of increased bone mass, but not volumetric BMD, Dr. Harvey noted.

In a multivariate model, both maternal mid–upper arm circumference and low serum vitamin D remained significant predictors of childhood volumetric BMD status, he said.

The findings are especially timely, given that vitamin D deficiency is re-emerging as a significant problem among pregnant women and their infants, particularly among groups with dark skin or low skin exposure to sunlight, Dr. Harvey said. Checking a mother's vitamin D status and recommending sufficient supplementation for women who are deficient are simple steps "that could potentially reduce fractures in future generations," he said. ■