

Invited Speaker Plenary 2: Vitamin D & Bone Health

Do calcium and vitamin D in pregnancy influence offspring health?

R Morley

Clinical Epidemiology and Biostatistics Unit, University of Melbourne Department of Paediatrics and Murdoch Children's Research Institute, Royal Children's Hospital, Melbourne, VIC

There has been much interest in the observed association between size at birth and risk of cardiovascular disease in adult life, but from a public health perspective we need to study factors that are potentially modifiable, rather than fetal growth or birth size.

Calcium - Adult offspring of rat dams with experimental calcium deficiency had higher blood pressure than offspring of control dams.¹ In a cross-fostering study, spontaneously hypertensive rat pups suckled by calcium deficient mothers had higher mean arterial pressure, regardless of maternal calcium intake during pregnancy.² In humans a negative association between maternal calcium intake and infant blood pressure was noted in two observational studies^{3,4} and in an experimental study, where systolic blood pressure in children of women given calcium supplements in pregnancy was lower than in children of controls.⁵ This association was significantly stronger with increasing BMI ($P = 0.0001$ for interaction) and strongest in children with BMI >17.5.

In 147 twin pairs in Tasmania, we tested the hypothesis that maternal calcium supplementation might also influence other risk factors for cardiovascular disease in their offspring. Children of supplemented mothers had lower geometric mean triacylglycerol, total cholesterol (T-C) and LDL-cholesterol (LDL-C) than other children. After adjustment for potential confounding factors, geometric mean ratios [95% CI] were 0.86 [0.75, 0.98], 0.94, [0.90, 0.99] and 0.90, [0.83, 0.98] respectively. The association with T-C and LDL-C was seen only among children with BMI >17.5: estimated ratios 0.85 [95% CI 0.79, 0.92] T-C and 0.79 (0.70, 0.90) for LDL-C (p for interaction 0.001 and 0.009 respectively).⁶ There was no significant association between maternal calcium supplementation and child size at birth and follow up, blood pressure, fasting glucose or insulin or HDL cholesterol. These findings are of potential significance for public health, and need to be replicated in other cohorts.

Vitamin D - Vitamin D is a potent steroid hormone that plays an important role in bone health, but is also involved in the regulation of cell proliferation and differentiation, so is potentially of great importance during gestation. In animal studies offspring of vitamin D deficient mothers have higher offspring blood pressure and altered brain^{7,8} and kidney development (Black, unpublished). In humans data from randomised controlled trials of vitamin D supplementation during pregnancy have yielded somewhat inconsistent results regarding birth size of their offspring, a summary measure of fetal growth, though most have been conducted in populations with low vitamin D concentrations.⁹

In an observational study in Geelong, comprising largely Caucasian women, we examined the relationship between maternal 25-hydroxyvitamin D level (25-OHD) and parathyroid hormone (PTH) concentrations at 28-32 weeks of gestation and infant birth size measures, including knee-heel length measured accurately by knemometry. Gestation length was 0.7 weeks [95% CI -1.3, -0.1] shorter and knee-heel length 4.3 mm smaller [-7.3, -1.3] in infants of 27 mothers with low 25-OHD (<28 nmol/L) at 28-32 weeks. There was little evidence that low maternal 25-OHD was associated with other birth measures, and no evidence of linear association with maternal 25-OHD concentration. Maternal PTH concentration at 28-32 weeks was positively related to knee-heel length, birth weight and mid-upper arm and calf circumferences. These associations were independent of 25-OHD concentration.

Conclusion - Maternal calcium supplementation and vitamin D adequacy during gestation may be important for offspring health. Our findings regarding maternal PTH and offspring birth size require further study.

References

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