Commentary: Maternal calcium intake and offspring cardiovascular risk factors

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In this issue of the Journal, Morley, Carlin and Dwyer¹ look for associations between maternal calcium supplementation and offspring blood pressure, lipid profile and markers of glucose homeostasis. They found that children whose mothers took calcium supplements during pregnancy have a better lipid profile at nine years of age and suggest that calcium availability could permanently programme lipid metabolism during foetal life. Systematic reviews provide rather strong evidences of inverse associations between birthweight and hypertension² and glucose intolerance³ in later life. It has been proposed that adverse conditions in utero, such as foetal under-nutrition, can result in metabolic and physiological ‘programming’ of functions of the body with lifelong effects on disease risk. But can lipid metabolism be programmed? A recent systematic review of studies in humans does not support a link between birthweight and blood lipid levels.⁴ However, the authors stated that more data is needed to make any definitive conclusions. The evidence in animals is much stronger, showing that under-nutrition during gestation permanently changes lipid metabolism.⁵

The focus of most studies on programming in humans is on birthweight, although numerous experiments have shown that minor alterations to the diets of pregnant animals, which may not even change their offspring’s body size at birth, can produce lasting changes in their physiology and metabolism.⁶

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In this context, calcium can be seen as a strong candidate for programming effects. There is now a substantial body of evidence showing the key role of calcium intake in the regulation of lipids’ metabolism. Intracellular calcium plays a key role in regulating adipocyte lipid metabolism and triacylglycerol storage. These effects have been linked to the effect of calcitropic hormones, and in particular to 1,25-dihydroxyvitamin D, that is highly responsive to variations in daily calcium consumption and can stimulate rapid increases in intracellular calcium. As Morley et al. have stated, these intriguing hypotheses should be tested in the follow-up into childhood or adulthood of randomized controlled trials of calcium supplementation conducted during pregnancy.

Such evidence does exist for the effect of calcium supplementation during pregnancy on the child’s blood pressure, but the result of such studies does not agree with Morley et al.’s findings. We have shown that maternal calcium supplementation is associated with lower systolic blood pressure in the offspring at 7 years of age, particularly among overweight children, and Hatton et al. found a similar effect in the offspring at 2 years of age. The effect of calcium supplementation on hypertension during pregnancy has been found only in populations with low calcium intake, suggesting that differences in dietary maternal calcium intake between population might explain the absence of an effect in this new study. Also, the children were 9 years of age in this study, and programming effects on blood pressure seems to be less evident as children approach adolescence. Finally, because of the observational nature of the design, an imbalance in other intervening factors might have diluted the effect. These might include differences in post-natal exposures to dietary calcium or other determinants of blood pressure. Calcium supplementation in these mothers is likely to be associated with other variables that could influence the outcomes.

In the light of this emerging new evidence current recommendations for calcium consumption during pregnancy might need a revision. In the past the rationale for the recommendations had been guided by metabolic studies and consequently the amount recommended is the one necessary to obtain a maternal positive balance. No recommendation is based on the amount needed also by the foetus and consequently to avoid changes in the foetus to adapt to the deficient situation. Calcium is only one component of the diet and many other nutrients could also play a foetal programming role. Considering this situation a major concern is the status in the developing world with known deficits in their diets. It is estimated that the mean calcium intake in the world is 472 mg/day, with an average intake of 860 mg/day in the developed world and 346 mg/day in developing countries. It is well known that children born in the developing world have higher mortality and morbidity, poorer growth and performance than the ones born in the developed world. Under-nutrition during foetal life might be responsible for a significant proportion of these inequalities, but effective interventions to improve this situation are lacking. A recent systematic review has shown that only balanced protein energy supplementation and calcium are effective in improving foetal growth and birthweight. Increasing calcium intake during pregnancy might also have an effect on offspring blood pressure, and in view of the results of Morley’s paper, the lipid profile might also be improved. Attainment of an appropriate calcium intake during pregnancy appears a feasible intervention that could have significant public health implications. Consequently, research in this area is a priority that could result in interventions with significant effects in the lifespan and quality of life of future generations.

References