Correspondence

Nutrition and Fetal Aortogenesis

The link between a low birth weight and higher rates of cardiovascular disease in adult life has been confirmed in many epidemiological studies¹⁾. According to the fetal origin hypothesis, or Barker hypothesis, cardiovascular diseases may be programmed during certain periods of intrauterine life^{2, 3)}. A disproportionate fetal growth can occur because different tissues have critical periods of growth at different times. In the human aorta the scleroprotein content varies, so an important difference was observed in the aortogenesis. The rates of elastin synthesis increase to a maximum in the perinatal period (late gestation and first weeks). Collagen has a steady increase during intrauterine life reaching a plateau at term⁴⁾.

We studied the association between intrauterine growth retardation (IUGR) and histomorphological changes in the aorta. The project was designed to test the fetal origin hypothesis with regard to the composition of the aortic wall using an established animal model in which IUGR was induced by a low protein (LP) diet (9% casein)⁵⁾. The aortae of the rat's offspring were examined at the ages of 4, 8 and 12 weeks and compared with the aortae of the offspring on an isocaloric normal diet (18% casein). Morphometrically, the offspring from LP-diet fed rats presented variable results: In the 4 and 8 weeks old male and female animals less elastin and more collagen in the LP-diet animals with a statistically significance in the 8 weeks old male subgroups was found. These findings may account for a reduction in the "material" stiffness of the LP-aortae with further changes in vessel dimensions and elasticity.

With the exception of one subgroup (8 weeks old male, isocaloric normal diet), the scleroproteins showed similar ratios in the examined groups, i.e. more collagen than elastin was found. Most results of the scleroprotein analysis can be attributed to the hypothesis of reduced elastin synthesis. A structural replacement of elastin with collagen leads to an increased aortic stiffness which further leads to higher pulse pressure and systolic hypertension in later life. Once established,

the elastin deficiency cannot be corrected due to the extremely low turnover of this protein⁶⁻⁸⁾. Our studies showed that the fetal aortogenesis seems to be affected by nutritional factors in a more complex manner.

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References

- 1) Ellison PT: Evolutionary perspectives on the fetal origins hypothesis. *Am J Hum Biol*, 2005; 17:113-118
- 2) Barker DJ: Fetal and infant origins of adult disease. BMJ Publishing Group, London, 1992
- 3) Barker DJ, Gluckman PD, Godfrey KM, Harding JE, Owens JA, and Robinson JS: Fetal nutrition and cardiovascular disease in adult life. *Lancet*, 1993; 938-941
- 4) Berry CL, Looker T, and Germaine J: Nucleic acid and scleroprotein content of the developing human aorta. *J Pathol*, 1972; 108:265-274
- 5) Langley SC and Jackson AA: Increased systolic blood pressure in adult rats induced by fetal exposure to maternal low protein diets. *Clin Sci (Lond)*, 1994; 86:217-222
- 6) Greenwald SE and Martyn CN: Impaired synthesis of elastin during fetal and infant life as a cause of raised adult blood pressure. *Am J Hypertens*, 1999; 12:169-177
- 7) Martyn CN and Greenwald SE: Impaired synthesis of elastin in walls of aorta and large conduit arteries during early development as an initiating event in pathogenesis of systemic hypertension. *Lancet*, 1997; 350:953-955
- 8) Martyn CN and Greenwald SE: A hypothesis about a mechanism for the programming of blood pressure and vascular disease in early life. *Clin Exp Pharmacol Physiol*, 2001; 28:948-951

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