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Overweight, Hypertension and Renal Dysfunction in Adulthood of Neonatally Overfed Rats

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Accelerated growth in early infancy has been associated with later cardiovascular and metabolic diseases. We recently showed that postnatal overnutrition led to hyperleptinemia, obesity and the acquired reset of key intrarenal hormone systems in the juvenile male rats. In this study, we investigated the influence of overnutrition during neonatal periods on the development of lifelong renal pathophysiological changes in adult offspring rats. Three or 10 male pups per mother from rat pup litters were assigned to either the overnutrition or control groups during the first 21 days of life. The effects of early postnatal nutrition excess on body weight, blood pressure, blood glucose and potential renal changes related to obesity were measured by 3 and 6 months of age, respectively. Smaller litter male pups persistently weighed heavier than controls between 7 days and 6 months of age ($p<0.05$). By 3 and 6 months of age, there were no differences of kidney weight per body weight ratio, blood glucose and plasma leptin levels between the two groups. However, increased systolic, diastolic and mean blood pressure levels were observed in obese 6 month-old rats ($p<0.05$). Serum creatinine was increased in each 3 and 6 month-old obese rats ($p<0.05$). ED-1 positive macrophages and glomerulosclerosis were also increased by overnutrition at 3 and 6 months of ages ($p<0.05$). Apoptotic cortical renal cells increased in neonatally overfed 6 month-old rats ($p<0.05$). In immunoblots and immnnohistochemistry, matrix metalloproteinase (MMP)-9 protein expressions decreased and tissue inhibitor of MMP-1, tumor necrosis factor-α, osteopontin and adiponectin expressions increased in obese 3 month-old rats ($p<0.05$). In contrast, increased MMP-9 and osteopontin expressions were found in obese offsprings of 6 months old ($p<0.05$). Renin, angiotensin II type (AT) 1 and AT2 receptor expression was not changed. Our data demonstrates that postnatal overfeeding leads to lifelong obesity and renal dysfunction. Obesity induced by early postnatal overnutrition may have a detrimental impact on kidney structure, function and intrarenal inflammatory cytokines.

Key Words: 영양, 비만, 신기능 저하
Nutrition, Obesity, Renal Dysfunction