

Influence of omega-3 polyunsaturated fatty acids on blood pressure and some physiological parameters of female rats fed with a diet high in saturated fat and salt

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Many western diets, although nutritionally adequate in most respects, may be deficient in omega-3 fatty acids. Recent data from our group (Sinclair, unpub) shows reduced neural DHA levels in animals maintained on a diet high in saturated fat, a diet not dissimilar to that of western societies. Furthermore, diets high in salt and saturated fats have been associated with elevated blood pressure in human populations and salt-loaded male stroke-prone spontaneously hypertensive rats (SHR-SP). Omega 3 PUFA are anti-hypertensive in these rat models (1). In the rats, the omega-3 PUFA were also associated with decreased kidney to body weight ratio, improved sodium excretion and retardation of the development of proteinuria.

We examined the effect of differing omega-3 fatty acid supply in a diet otherwise high in saturated fat and sodium, and in a non-hypertensive rat model. Female Sprague Dawley rats ($n = 5$ / group) were raised on one of three different diets: high saturated fat, high salt (2% NaCl) with omega-3 fatty acid (HFHS+); high saturated fat, high salt without omega-3 fatty acid (HFHS-); low saturated fat, low salt with omega-3 fatty acid (C+). Diet was provided to the pregnant mothers from conception and to the female pups until 25 weeks of age. The rats had free access to diet and water and were maintained in metabolic cages that allowed for the collection of urine. Food and water intakes, blood pressure (tail cuff), and leptin levels (RIA) were measured. During experimental conditions, food was removed for 24 h and the intake of water and urine loss was determined. Following the food deprivation period, food was returned and intake measured after 2 and 24 h.

HFHS animals weighed more than C+ rats ($p < 0.05$), although circulating levels of leptin were similar for the 3 groups. Systolic blood pressure (mmHg) was similar in the three groups (HFHS -, 139 ± 5 ; HFHS +, 136 ± 8 , C+, 138 ± 5). During the food deprivation period, urinary excretion of sodium was higher ($p < 0.05$) in HSHF - than in the other 2 groups. Elevated level of protein excretion was found in a few animals, not specific to any dietary group. Some pathological lesions were observed in the kidneys of rats that had the intense proteinuria.

The results confirm that female hormones have a protective effect on salt-induced hypertension (2). The difference in urinary sodium excretion may be related to the changes in the glomerular capillary pressure and then glomerular filtration rate (GFR), due to variation in renal eicosanoid metabolism. Reduced GFR may have favourable effects on kidney function.

1. Rayner TE, Howe PR. Purified omega-3 fatty acids retard the development of proteinuria in salt-loaded hypertensive rats. *J Hypertens* 1995; 13: 771–80.
2. Hinojosa-Laborde C, Lange DL, Haywood JR. Role of female sex hormones in the development and reversal of Dahl hypertension. *Hypertension* 2000; 35: 484–489.