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## RAPID COMMUNICATION

# Age-Dependent Changes of Baroreflex Efficiency in Dahl Rats: Effects of High Salt Intake

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## Summary

The age-dependent changes in baroreflex control of heart rate were studied in inbred Dahl rats. At the age of 8 weeks the baroreflex slope was significantly greater in salt-resistant (R/Jr) than in salt-sensitive (S/Jr) rats fed a low-salt diet. The reverse was true in 16-week-old animals. High salt intake (8 % NaCl diet for 4 weeks) suppressed baroreflex efficiency in both age groups of S/Jr animals whereas no effects occurred in R/Jr rats. Baroreflex slope was, however, significantly lower in young S/Jr rats with a severe form of salt hypertension than in adult salt-loaded S/Jr rats in which only a moderate blood pressure elevation was observed.

**Key words**

Baroreflex – Heart rate – Mean arterial pressure – Age – Salt intake – Phenylephrine

Less efficient baroreflex control of heart rate was observed in young prehypertensive salt-sensitive Dahl rats kept on a low salt intake (Gordon *et al.* 1981, Miyajima and Bunag 1986). High salt intake increased the difference in baroreflex efficiency between outbred salt-sensitive (DS) and salt-resistant (DR) rats. Ferrari and Mark (1987) reported that high salt intake sensitized baroreceptors in DR but not in DS animals. Other investigators observed reduced baroreflex responses in salt-loaded DS but not in DR rats (Miyajima and Bunag 1987, Brown *et al.* 1989). Andresen (1989) found that high salt intake potentiated the pre-existing difference in baroreceptor pressure threshold. The threshold increments was greater in DS than in DR rats.

The aim of our study was to evaluate baroreflex control of heart rate in inbred salt-sensitive (S/Jr) and salt-resistant (R/Jr) Dahl rats aged 8 and 16 weeks and to investigate the effects of high salt intake on baroreflex efficiency in young and adult rats of both genotypes.

Seventy-seven inbred male S/Jr and R/Jr Dahl rats were obtained from our breeding colony which was derived from original breeding pairs kindly provided by Dr. John P. Rapp (Toledo, Ohio). Animals were fed either a low-salt (0.3 % NaCl) or a high-salt (8 % NaCl) diets. The consumption of the latter diet began at the age of 4 or 12 weeks (young and adult groups, respectively) and lasted 3–4 weeks. Carotid artery and jugular vein of anaesthetized rats (Pentobarbital Spofa, Prague, 40 mg/kg) were cannulated at the age of 8 weeks (young) or 16 weeks (adult). The body temperature was maintained at 37 °C by an infra-red heated table. Graded doses of phenylephrine (0.5, 1, 5 and 10 $\mu$g/kg, Sigma, St. Louis) were administered intravenously as bolus injections in a volume of 0.5 ml/kg. Pressor responses and respective changes of heart rate as well as stabilized baseline values of blood pressure and heart rate were registered using MP-15 transducers (Micron Instruments, Los Angeles) connected to HP 7702B recorder. Phasic pressure signal was sampled at 100 Hz frequency by means of 12-bit A/D converter (PCL-718, Advantech Ltd, Taiwan) and stored on PC hard disc for further data analysis. Baroreflex gain was evaluated from peak pressor

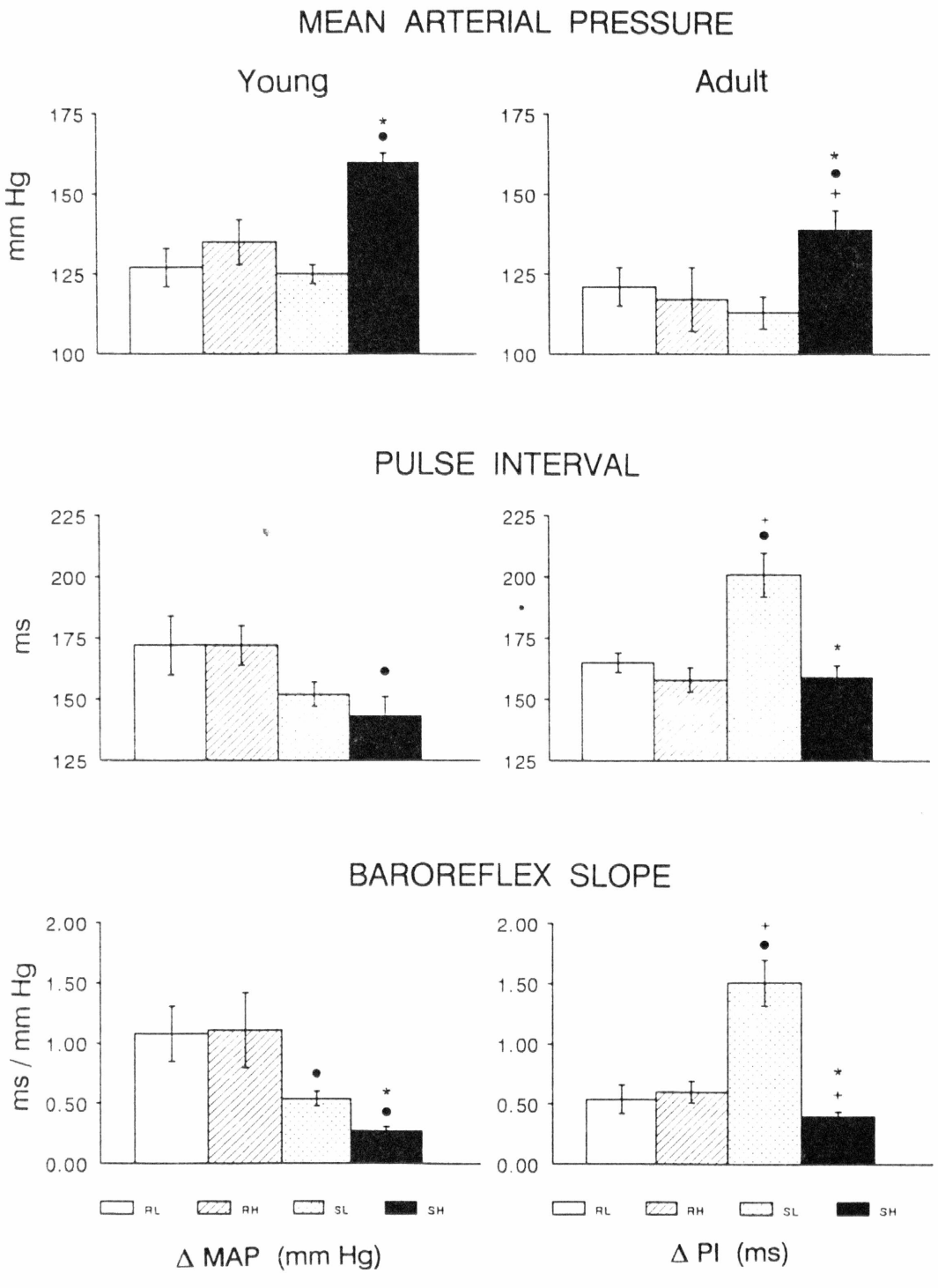


**Fig. 1**
Mean arterial pressure, pulse interval and baroreflex slope in young (8-week-old) and adult (16-week-old) salt-resistant (R/Jr) and salt-sensitive (S/Jr) Dahl rats that were fed either a low-salt (L) or high-salt diet (H) for 4 weeks. Data are means ± SEM. The number of animals was 8–10 per group. Significant differences ($p<0.05$) from animals fed a low-salt diet are indicated by asterisks, from R/Jr rats by dots and from the respective young group by crosses.

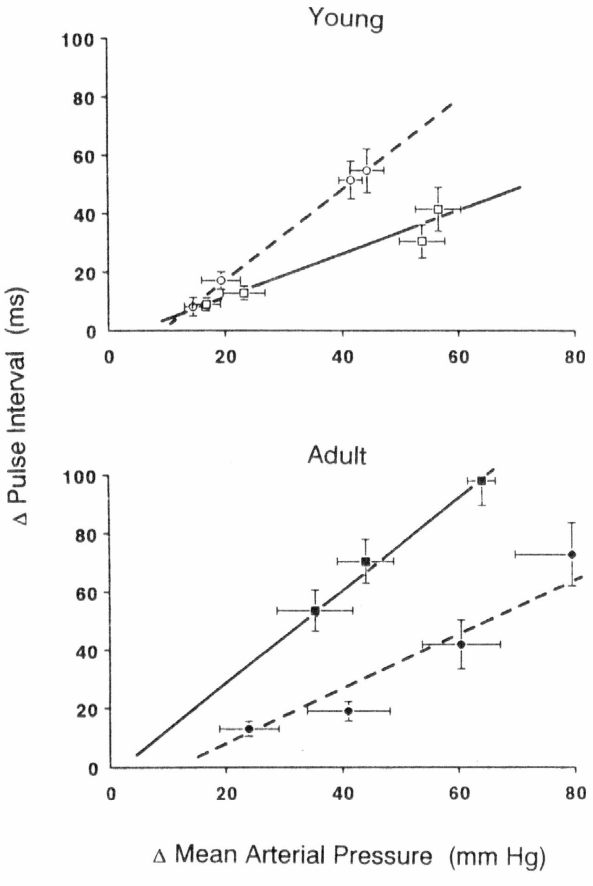


**Fig. 2**
Phenylephrine baroreflex slopes (calculated from peak changes of pulse interval and mean arterial pressure) in young 8-week-old (open symbols) and adult 16-week-old (full symbols) salt-resistant R/Jr (circles) and salt-sensitive S/Jr Dahl rats (squares) that were fed a low-salt diet. Data are means ± SEM.

responses and associated peak reflex changes of heart rate occurring in the first 30 s after phenylephrine administration. In each rat the baroreflex slope was calculated by a linear regression analysis of the changes in pulse interval and mean arterial pressure. Data were expressed as means±SEM and evaluated by one-way-analysis of variance.

Blood pressure was higher in young salt-loaded S/Jr rats as compared to adult ones. Pulse interval was shortest in young salt-hypertensive S/Jr rats whereas prolonged values were observed in adult S/Jr rats fed a low-salt diet (Fig. 1). Baroreflex slope was greater in R/Jr than in S/Jr rats aged 8 weeks (Fig. 2). This was evident not only in rats fed a low-salt diet but especially in salt-loaded animals (Fig. 1). It should be noted that under the conditions of a low salt intake the efficiency of baroreflex decreased with age in R/Jr rats but increased in S/Jr ones. Consequently, in 16-week-old animals baroreflex slope was much greater in S/Jr than in R/Jr rats (Fig. 2). High salt intake lowered baroreflex efficiency not only in young but also in adult S/Jr rats but the baroreflex slope remained significantly steeper in adult salt-loaded S/Jr rats than in young S/Jr animals with a pronounced salt hypertension (Fig. 1). Dietary salt loading never affected baroreflex slope in R/Jr animals.

Baroreflex slope correlated positively with initial values of pulse interval ($r=0.523$, $n=69$, $p<0.001$) and negatively with initial mean arterial pressure ($r=-0.308$, $p<0.01$). Our study revealed in young inbred salt-sensitive (S/Jr) Dahl rats a baroreflex abnormality which was similar to that earlier reported in outbred salt-sensitive (DS) animals (Gordon *et al.* 1981, Miyajima and Bunag 1986). High salt intake induced a further suppression of baroreflex efficiency in young S/Jr rats but not in R/Jr animals. This is in a good agreement with some findings in outbred Dahl rats (Miyajima and Bunag 1987, Brown *et al.* 1989). Surprising age-dependent changes in the baroreflex control of heart rate were observed in rats of the two genotypes fed a low-salt diet. Baroreflex efficiency decreased with age in R/Jr rats whereas the opposite was true in S/Jr animals. It should be mentioned that Andresen (1989) disclosed a nearly identical suprathreshold pressure sensitivity in aged outbred DS and DR rats although a significantly lower suprathreshold pressure sensitivity was revealed in young DS rats compared to DR ones (Andresen *et al.* 1989). High salt intake lowered baroreflex efficiency in both age groups of S/Jr rats without affecting baroreflex function in either group of R/Jr rats. Nevertheless, baroreflex slope in adult S/Jr rats with a moderate hypertension was significantly higher than that seen in young S/Jr rats which developed a severe form of salt hypertension. It remains to be elucidated whether these differences in baroreflex efficiency are a consequence or a cause of the different age-dependent hypertensive response to high salt intake which is known to be greater in young rats (Zicha *et al.* 1986) including Dahl salt-sensitive strains (Dahl *et al.* 1968, Zicha *et al.* 1977).

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**Reprint Requests**
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