Proc EDTA–ERA (1985) Vol 22

SALT PREFERENCE IN PREGNANT HYPERTENSIVE RATS

M Sabbatini, M Altomonte, G Conte, C Esposito, G Romano, F Uccello, P Veniero, V E Andreucci, **A Dal Canton**

Department of Nephrology, II Faculty of Medicine, University of Naples, Naples, Italy

Summary

This study was carried out in female pregnant Münich-Wistar rats with 2-Kidney, 1-clip Goldblatt hypertension, using clipped non-pregnant hypertensive rats as controls. Metabolic studies were performed in the first two weeks of pregnancy and the corresponding period for non-pregnant rats. These consisted of daily measurement of systolic blood pressure (tail-cuff method), body weight, and salt and water balance. Both tap water and 0.41 per cent saline solution were available in metabolic cages. Daily introduction of saline, total Na^+ intake, and total Na^+ excretion were greater in pregnant hypertensive than in non-pregnant hypertensive rats. Daily apparent Na^+ retention was equal in pregnant hypertensive and non-pregnant hypertensive rats. These results indicate a marked saline preference in pregnant hypertensive rats.

Introduction

Recently we have shown that pregnant hypertensive rats (2-Kidney, 1-clip Goldblatt hypertension) have increased salt and water turnover (i.e. increased urinary excretion associated with increased oral intake) in comparison with non-pregnant hypertensive animals. In our previous study, however, both pregnant and non-pregnant animals were given hypotonic saline to drink, with no access to tap water. This policy was necessary to recruit a consistent number of pregnant rats with steady hypertension [1]. Due to the obligatory intake of fluid as saline solution, therefore, we were not able to distinguish whether the main thrust to increased salt and water turnover in pregnant rats was enhanced thirst (appetitie for free water) or salt preference.

This study was carried out to further elucidate the mechanism of increased turnover in pregnant hypertensive rats.

Methods

The study was performed in adult female Münich-Wistar rats, in which a silver clip (0.2mm, i.d.) was placed on the right renal artery, under light ether anaesthesia. Since this manoeuvre may raise the blood pressure to a variable degree, systolic blood pressure was monitored daily (tail-cuff method) and only rats with systolic blood pressure steadily between 140 and 180mmHg were included in the study. After clipping, the rats were allowed to recover for two weeks and then were housed in metabolic cages in which both tap water and hypotonic saline (70mmol NaCl/L) were available to drink (two-bottle, self selecting test). After one week (to accustom to metabolic cages), one group (n=9) were mated (pregnant hypertensive rats), the others (n=14) were used as non-pregnant hypertensive controls. All the rats were fed on a standard chow containing 0.12mmol NaCl/g.

Metabolic studies were performed during the first two weeks of gestation and in the corresponding period in controls. These consisted of daily determination of blood pressure, body weight, and daily measurement of saline, water and food intake, urinary volume and urinary and faecal excretion of sodium and potassium.

Results

Blood pressure values were similar in pregnant hypertensive and non-pregnant hypertensive rats (176±7.3mmHg vs 170±6.0mmHg, NS). The results of our metabolic studies are summarized in Table I.

TABLE I. Daily sodium and water balance in pregnant hypertensive and non-pregnant hypertensive rats. The data are expressed as mean±SD

	$Saline_I$ ml	H_2O_I ml	$Na_{I\text{-}tot}$ mEq	Na_E mEq	H_2O_E ml	$\triangle Na$ mEq	$\triangle H_2O$ mEq
PH	28.2 ±7.2	10.9 ±2.0	3.5 ±0.5	2.6 ±0.5	18.8 ±5.0	0.9 ±0.2	20.2 ±2.1
NPH	12.9 ±1.4	14.6 ±3.4	2.3 ±0.3	1.5 ±0.3	10.5 ±3.0	0.7 ±0.2	17.6 ±2.2
p	<0.001	<0.005	<0.001	<0.001	<0.001	NS	<0.05

$Saline_I$: saline intake; H_2O_I = tap water intake; $Na_{I\text{-}tot}$ = total sodium intake; Na_E = total sodium excretion; H_2O_E = water excretion; $\triangle Na$ and $\triangle H_2O$ = apparent salt and water balance, respectively

PH – pregnant hypertensive rats; NPH – non-pregnant hypertensive rats

Pregnant hypertensive rats showed a marked preference for saline compared to non-pregnant hypertensive rats ($p<0.001$), whereas the latter ingested more tap water ($p<0.005$). Total sodium intake was consistently greater in pregnant hypertensive rats than non-pregnant hypertensive rats ($p<0.001$). This was largely accounted for by increased saline intake, but was due in part also to increased salt intake from food (1.57±0.1 vs 1.35±0.24mEq/day, $p<0.005$).

Significant changes occurred also in sodium and water excretion that were higher in pregnant hypertensive rats than in non-pregnant hypertensive rats ($p<0.001$ and $p<0.001$, respectively). However, $\triangle Na^+$, that is the apparent sodium retention per day ($\triangle Na$ = sodium intake – sodium excretion), was similar in the two groups, while $\triangle H_2O$ was higher in pregnant hypertensive rats compared with non-pregnant hypertensive rats ($p<0.05$). Finally, K^+ excretion was statistically different in pregnant hypertensive rats compared with non-pregnant hypertensive rats ($p<0.05$).

Discussion

This study shows a marked salt preference in pregnant hypertensive rats in comparison with non-pregnant hypertensive controls. The increased intake of salt in pregnant hypertensive rats was associated with increased urinary excretion. These results do not indicate whether the increased salt turnover in pregnant hypertensive rats was due to a primary rise in salt appetite or to a primary increase in urinary loss of salt. A clue to understand the mechanism of raised salt turnover may be given by the behaviour of salt balance. This is expected to be more positive in pregnant hypertensive rats than in non-pregnant hypertensive rats, because pregnancy needs salt retention both to build up the product of conception [2] and to expand the maternal ECF volume [3]. If salt intake would be primarily increased in pregnant hypertensive rats, therefore, salt balance would be even more positive. In our study, in contrast, salt balance was similar in pregnant as in non-pregnant rats, suggesting that increased urinary salt excretion was the primary event leading to enhanced salt turnover in pregnant hypertensive rats.

References

1 Dal Canton A, Esposito C, Altomonte M et al. *Nefrologia, Dialisi, Trapianto 1984;* 107
2 Churchill SE, Bengele HH, Alexander EA. *Am J Physiol 1980; 239:* R143
3 Dal Canton A, Conte G, Esposito C et al. *Kidney Int 1982; 22:* 608