

The functional parameters of renin-angiotensin-aldosterone system in obese patients

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Introduction: Renin-angiotensin-aldosterone system (RAAS) plays a significant role in the development of arterial hypertension (AH) in obese patient. Angiotensinogen expression in adipose tissue decreases during fasting and increases in case of overeating, that leads to changes in blood pressure (BP). The aim of the study was to assess the impact of obesity on the activity of RAAS and its role in the development of hypertension.

Methods: 60 women, mean age 28.0 ± 2.1 years, body mass index (BMI) 37.7 ± 1.2 kg/m² participated in the study. Subjects were divided into groups depending of the AH presence: the 1st group consisted of 28 women with normal BP (systolic BP 115.6 ± 1.28 mm Hg; diastolic 81.0 ± 3.0 mm Hg). 32 women with AH (systolic BP 166.6 ± 5.4 mm Hg; diastolic BP 96.0 ± 3.2 mm Hg) were included in the 2nd group. 15 healthy normal weight women (19-25 years old, BMI 10.4 ± 2.3 kg/m²) were included in the control group. NaCl consumption not less than 5 g per day was recommended to all patients.

Plasma aldosterone concentration and renin activity were measured by radioimmunoassay with an automatic analyser («Immunotech», France). Blood samples were taken every 4 hours during the day (8, 12, 16, 20, 24, 4 h) to evaluate the circadian rhythm of aldosterone secretion.

Results: In all obese patients plasma Na⁺ and K⁺ concentrations were normal. Urinary potassium excretion did not differ significantly from the control group ($P > 0,05$), sodium excretion was significantly decreased ($P < 0,05$). Both groups of obese patients have demonstrated low basal plasma renin activity compared with the control group ($P < 0.001$). Plasma renin activity values were not significantly different in the 1st and the 2nd groups (1st - $1,4 \pm 0,06$, 2nd - $1,15 \pm 0,004$ ng/ml/h., control group $2,18 \pm 0,2$ ng/ml/h). Morning aldosterone level was increased in the 1st group. At the same time, morning aldosterone level in the 2nd group was higher in comparison with the 1st group and with the control group (1st - $413,8 \pm 20,6$ pmol/l; 2nd - $664,1 \pm 26,6$ pmol/l; control group - $290,0 \pm 19,6$ pmol/l).

Circadian rhythm of aldosterone in the control group was characterized by a maximum concentration in the morning hours (4-8h) and lower concentration during the day, evening and night hours. A circadian rhythm of aldosterone in patients of the 1st group did not differ from the control group, while the 2nd group demonstrated an inversion of the circadian rhythm of aldosterone with maximum at midnight (24.00 h. - $960,4 \pm 140,7$ pmol/l; 8.00 h. - $597,6 \pm 96,1$ pmol/l, $P < 0,05$).

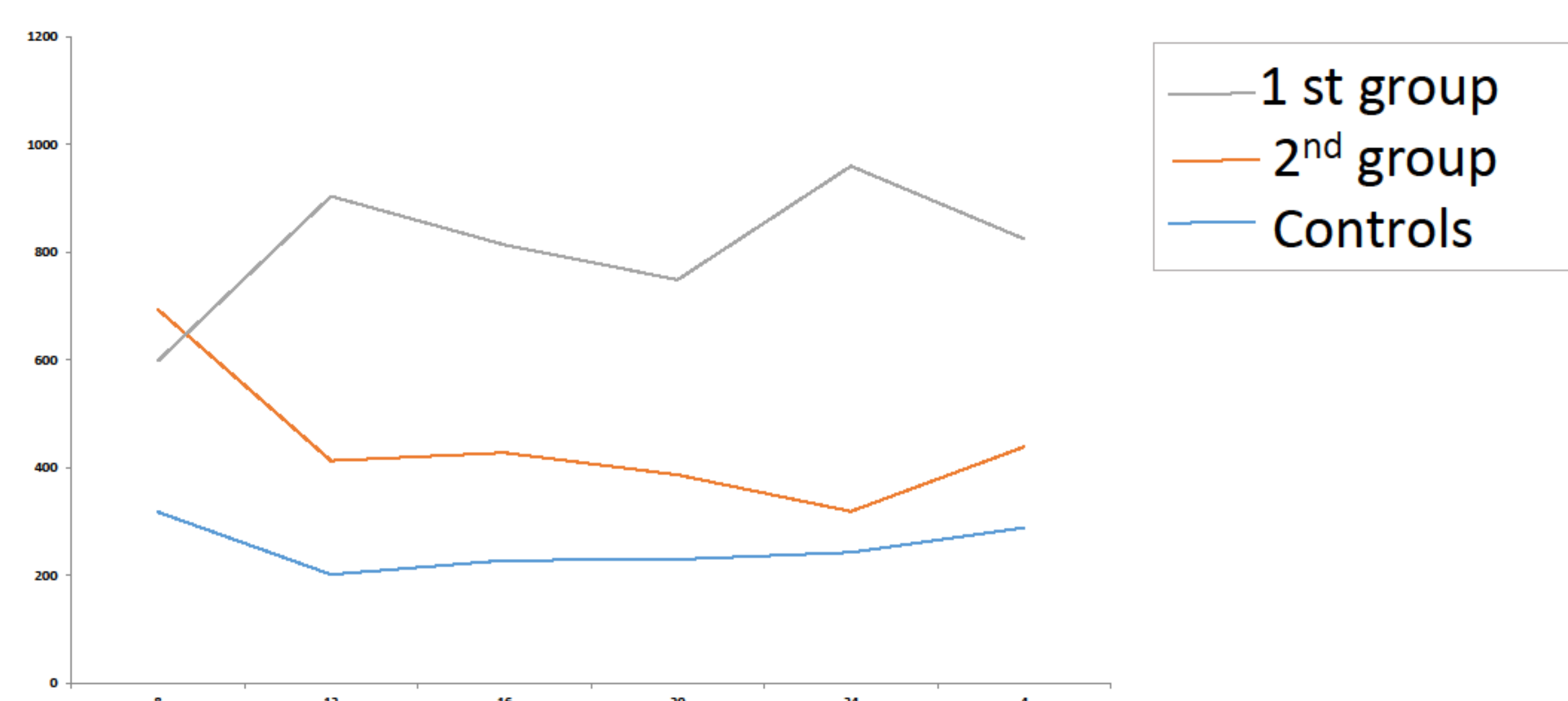
Basal aldosterone concentration and plasma renin activity in obese women with AH, obese women without AH and controls

| | Controls | 1 st group | 2 nd group |
|--------------------|------------------|-----------------------|-----------------------|
| PRA ng/ml/h | $2,18 \pm 0,21$ | $1,4 \pm 0,06^*$ | $1,15 \pm 0,004^*$ |
| Aldosterone pmol/l | $290,0 \pm 19,6$ | $413,8 \pm 20,6^*$ | $664,1 \pm 26,6^* **$ |

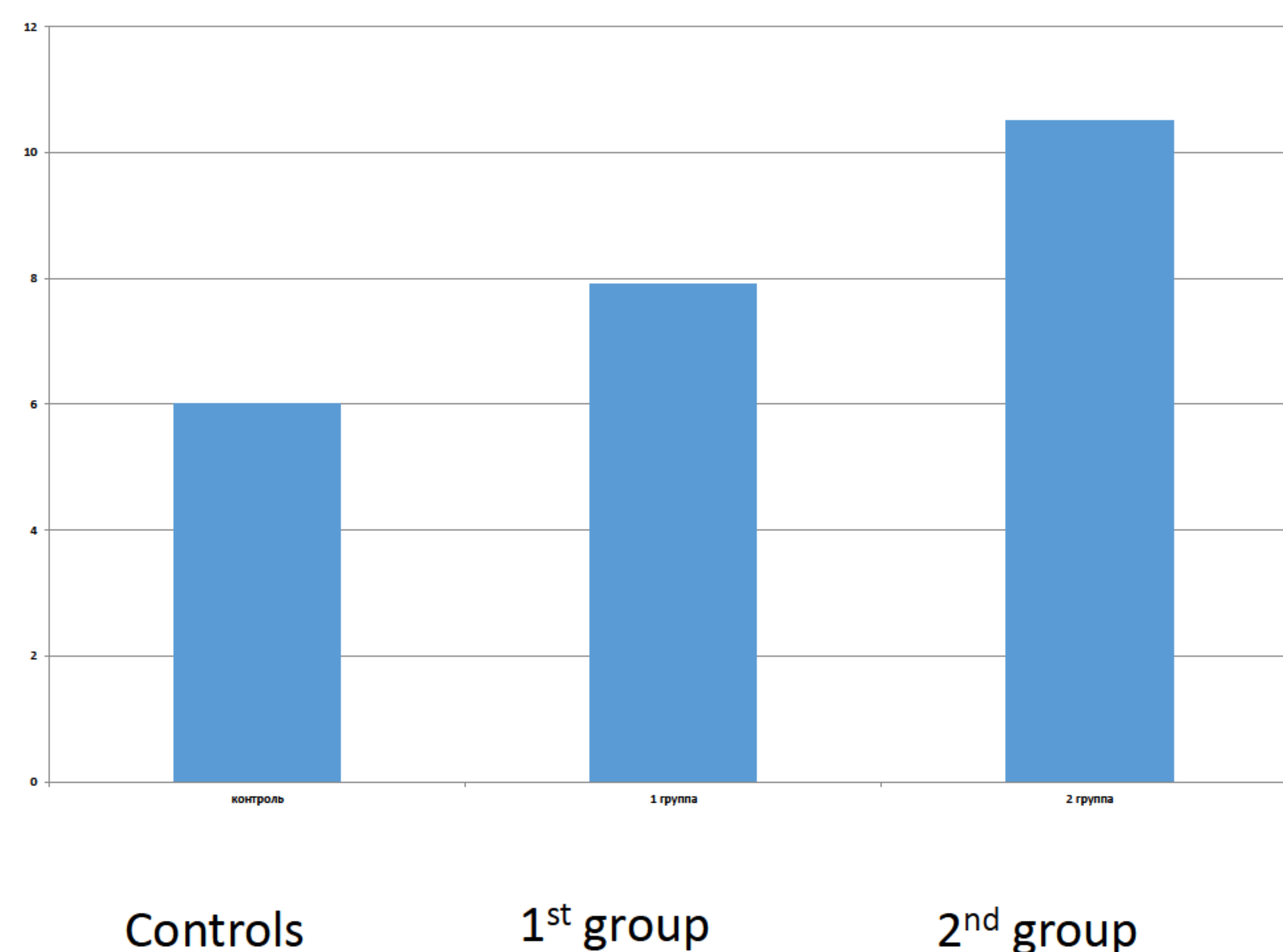
* $P < 0,001$ – with controls

** $P < 0,001$ – between the 1st and the 2nd group

Circadian aldosterone production



Aldosterone-PRA ratio in 3 groups



Conclusions:

1. Plasma aldosterone concentration in the morning hours was elevated in the obese patients without hypertension.
2. Obese hypertensive patients had inverse aldosterone biorhythm with maximum at midnight.

