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Elucidation of Exercise-Established Mechanism on Salt Intake in SPORTS Rats: Crosstalk of Salt and Metabolism-Related Signal Molecules in Locomotor Activity

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Summary

Purpose & Methods: We have established an original line from rats of Wister strain that had unique characteristic of high voluntarily wheel-running, named SPORTS (Spontaneously Running Tokushima-Shikoku) rats. Male SPORTS rats were fed on normal- (0.5% Na), high- (2.0% Na) or low-sodium (0.05% Na) diets for 6 weeks after weaning. Blood pressure (BP) was measured using tail-cuff system. A locomotor activity was performed by wheel cage system (voluntary activity) and open field system (spontaneously physical activity). At the end of each period, rats were sacrificed and blood samples were collected for metabolic parameters.

Ghrelin and Obestatin with a feeding promotion action have a variegated body-adjustment function of the energy metabolism regulation, the anti-inflammatory mechanism, the sympathetic nerve control and the cardiovascular system protection. Therefore, we also administered Ghrelin and Obestatin in the intracerebroventricular lesion of the SPORTS rats to examine the effects on the voluntary exercise.

Results: The high salt diet significantly decreased a voluntary activity with a wheel running cage, but did not affect the oxygen consumption, while low salt diet significantly increased a voluntary activity. Body weight was higher and food and water consumption was lower on a low-salt diet, and the opposite was observed on a high salt intake. Ghrelin significantly decreased a voluntary activity with a wheel running cage, but did not affect the oxygen consumption, while Obestatin did not inhibit the Ghrelin-induced decrease in a voluntary activity.

Discussion: Besides the known effect of low and high salt intake on blood pressure, the present data indicate that the voluntary activity are influenced by salt restriction and overload. Ghrelin negatively controls the voluntary exercise with a wheel running cage through the center nerve system. These effects of physical activity are possibly due to increased and decreased metabolic signals respectively, induced by high and low salt intake. Thus, Ghrelin might be new key molecules for the biological regulation of voluntary exercise.