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Aging may worsen the effects of a high-salt diet

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Aging is associated with a number of changes that cause the body to function less efficiently, including the way the body controls water and sodium levels. Research has shown that as humans and animals age, they are less able to regulate sodium and water retention, urine concentration and thirst compared to their younger counterparts. A new article in the *American Journal of Physiology—Regulatory, Integrative and Comparative Physiology* finds that age significantly impaired the ability of rats to get rid of excess sodium when exposed to a high-salt diet. These findings could have implications for salt consumption in the elderly; they suggest older people could be at greater risk for the negative consequences of consuming a high-salt diet.

"Changes in the control of sodium and water balance is a major characteristic of the normal human aging process and includes a decrease in thirst, urinary concentrating ability and capacity to excrete water and electrolytes," the authors wrote. Normally, the body responds to an increase in salt in the diet by producing more urine to flush out the excess sodium. But this response is blunted in older people. "These changes in fluid and electrolyte regulation can put the elderly at increased risk for disorders of hyponatremia (due to water retention) or hypernatremia (as a result of sodium retention), which can cause central nervous system dysfunction and also negatively impact medication effectiveness, resulting in adverse clinical events and surgical outcomes as well as other physiological functions," the researchers added.

Hong Ji, MD, and colleagues at Georgetown University, in collaboration

with researchers at St. Louis University and Nova Southeastern University, looked at aldosterone, a steroid hormone made by the adrenal gland. Aldosterone helps to control the body's amount of fluid and electrolytes—minerals such as sodium, potassium and calcium in the blood that help regulate bodily functions and processes. Aldosterone production is regulated by angiotensin type 1 (AT1) receptors, which become activated upon binding the peptide hormone angiotensin II. Previous research has found that aldosterone decreases with age and becomes less responsive to changes in the environment.

To investigate how age affected aldosterone levels and the animals' response to dietary sodium, the research team put young and old rats on a low-sodium diet. They observed that old rats ate and drank less than the young rats at the start of the study and had lower levels of aldosterone. After two weeks, all of the rats were switched to a high-salt diet for six days. In response, all of the rats showed a decrease in the level of plasma aldosterone, but the decrease was significantly less in old rats. The young rats drank and urinated more. While the old rats also drank more water, it took them longer to increase their water intake and they still drank less than the younger rats. The small increase in water did not help the old rats to produce more urine or more diluted urine, suggesting that they were not effectively clearing the excess sodium they consumed.

"The main findings of this study are that aging impaired the adrenal AT1 receptor response to a dietary sodium load in male Fischer rats," the researchers wrote. "The number of adrenal AT1 receptors were not reduced as rapidly in response to a high salt diet compared to the young animals. These age-associated effects on adrenal AT1 receptors correlated with reduced water intake and plasma aldosterone with little change in urine volume, urine osmolality or plasma AVP (antidiuretic hormone)."

The article "Aging-related impairment of urine concentrating mechanisms correlates with dysregulation of adrenocortical angiotensin type 1 receptors in male Fischer rats" is published in the *American Journal of Physiology*—Regulatory, Integrative and Comparative Physiology. It is highlighted as one of this month's "best of the best" as part of the American Physiological Society's APSselect program.

More information: Hong Ji et al. Aging-related impairment of urine concentrating mechanisms correlates with dysregulation of adrenocortical angiotensin type 1 receptors in male Fischer rats, *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology* (2015). DOI: 10.1152/ajpregu.00131.2015

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