Paradoxical natriuretic peptide resetting in astronauts

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Human studies in space provide unique and often unexpected findings regarding the role of terrestrial gravity for human cardiovascular and renal regulation. While vascular volume is shifted towards the head, which would be expected to increase natriuretic peptide (NP) release, preliminary observations suggested the opposite. Therefore, we assessed natriuretic peptide regulation on different controlled sodium diets in space and on Earth.

Eight male astronauts (50±2.8 yrs.) ingested higher (5.5 g/day) and low sodium (2g/day) diets for five days each on Earth and on the International Space Station (ISS) in alternating order. Dietary nutrient intake was individually tailored and kept constant. At day five of each intervention, midregional-pro atrial NP (MRproANP), N-terminal pro B-type NP (NTproBNP), and aldosterone in blood, urinary sodium excretion, and body mass were measured.

On Earth, MRproANP was 71.86±4.39 pmol/L on moderately high and 65.13±6.71 pmol/L on low sodium intake. In space, MRproANP was 44.61±4.26 pmol/L on high and 31.37±4.02 pmol/L on low sodium intake ($p<0.001$ between sodium intakes, $p<0.01$ between Earth and space). Similarly, NTproBNP responded to changes in sodium intake ($p<0.001$) and was regulated at lower levels in space ($p=0.008$). Serum aldosterone concentrations decreased on higher sodium intake but did not differ between space and Earth ($p<0.001$ between sodium intakes, $p=0.95$ between Earth and space). Body mass did not differ between low and high sodium intake, either on Earth or in space (space: low sodium 83.7±3.1 kg, higher sodium 84.4±3.1 kg, Earth: low sodium 87.1±3.6 kg, higher sodium 87.2±3.2 kg).

In conclusion, NP release while responding to changes in sodium intake is paradoxically reset to lower levels in space. The mechanisms may have implications for volume regulation and cardiovascular health during long-term space travel.