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Abstract

Background: A direct relationship between salt intake and blood pressure is widely accepted. However, the relationship between changing salt intake, salt excretion, and total-body sodium (TBNa) is inferred but not known. Without such basic knowledge, the mechanisms leading to the blood pressure elevation cannot be determined.

Purpose: We tested the hypothesis whether or not long-term dietary salt restriction from 12g/day to 9g/day and 6g/day significantly lowers blood pressure in healthy volunteers during the Mars500 campaign. We sought to perform long-term balance studies to monitor sodium retention, sodium losses, TBNa and their relationships to any changes in blood pressure.

Methods: We investigated daily Na+ balance and blood pressure in crewmembers participating in the Mars500 campaign, a simulated space flight to Mars. The normal young men lived in the Mars500 simulator in a completely self-sustaining, thermoconstant environment for 105 and 520 days, and consumed a diet with a salt content of 12 g per day for the first 40 days of the study, which then was gradually decreased to 9 g per day for the 2nd third, and for to 6 g per day for the 3rd third of the isolation period. The longer duration of the 520-day study allowed re-exposition to the original 12 g salt intake level.

Results: Reduced salt intake lowered blood pressure in the subjects; with reexposition, blood pressure increased to initial levels. The blood pressure-lowering effect of reduced salt intake was uncoupled from changes in sodium balance, while increased and decreased potassium balance reflected low- and high-salt intake respectively. Salt balance, body weight, extracellular fluid, and TBNa were independent of salt intake. Ultra long-term constancy in salt intake did not lead to a constant urinary sodium excretion, although salt excretion over each diet period was 90-95

Conclusions: We conclude that even moderate salt reduction induces relevant blood pressure decrease in healthy normotensive subjects. The findings on day-to-day sodium balance must recast thinking about how homeostasis of internal environment composition and blood pressure are achieved. The findings will lead to novel studies of long-term salt regulation and disposition that could have mechanistic value concerning the blood pressure-related effects.