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A population-based approach to assess the heritability and distribution of renal handling of electrolytes

Flore Moulin [1], Belen Ponte [2], Menno Pruijm [3], Daniel Ackermann [4], Yassine Bouatou [5], Idris Guessous [6], Georg Ehret [7], Olivier Bonny [3], Antoinette Pechère-Bertschi [8], Jan A Staessen [9], Fred Paccaud [1], Pierre-Yves Martin [5], Michel Burnier [3], Bruno Vogt [4], Olivier Devuyst [10], Murielle Bochud [11]

Affiliations + expand

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Abstract

The handling of electrolytes by the kidney is essential for homeostasis. However, the heritability of these processes, the first step in gene discovery, is poorly known. To help clarify this, we estimated the heritability of serum concentration, urinary excretion, renal clearance, and fractional excretion of sodium, potassium, magnesium, calcium, phosphate, and chloride in a population-based study. Nuclear families were randomly selected from the general population in Lausanne, Geneva, and Bern, Switzerland, and urine collected over 24-hour periods. We used the ASSOC program (S.A.G.E.) to estimate narrow sense heritability, including sex, age, body mass index, and study center as covariates in the model. The 1128 participants, from 273 families, had a mean age of 47 years, body mass index of 25.0 kg/m^2, and an estimated glomerular filtration rate (CKD-EPI) of 98 mL/min/1.73 m^2. The heritability of serum concentration was highest for calcium, 37% and lowest for sodium, 13%. The heritability of 24-hour urine clearances, excretions, and fractional excretions ranged from 15%, 10%, and 16%, respectively, for potassium to 45%, 44%, and 51%, respectively, for calcium. All probability values were significant. The heritability for phosphate-related phenotypes was lower than that for calcium. Thus, the serum and urine concentrations as well as urinary excretion and renal handling of electrolytes are heritable in the general adult population. The phenotypic variance attributable to additive genetic factors was variable and was higher for calcium. These results pave the way for identifying genetic variants involved in electrolyte homeostasis in the general population.