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Bone buffering of acid and base in humans.

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The sources and rates of metabolic acid production in relation to renal net acid excretion and thus acid balance in humans have remained controversial. The techniques and possible errors in these measurements are reviewed, as is the relationship of charge balance to acid balance. The results demonstrate that when acid production is experimentally increased among healthy subjects, renal net acid excretion does not increase as much as acid production so that acid balances become positive. These positive imbalances are accompanied by equivalently negative charge balances that are the result of bone buffering of retained H+ and loss of bone Ca2+ into the urine. The data also demonstrate that when acid production is experimentally reduced during the administration of KHCO3, renal net acid excretion does not decrease as much as the decrease in acid production so that acid balances become negative, or, in opposite terms, there are equivalently positive HCO3- balances. Equivalently positive K+ and Ca2+ balances, and thus positive charge balances, accompany these negative acid imbalances. Similarly, positive Na+ balances, and thus positive charge balances, accompany these negative acid balances during the administration of NaHCO3. These charge balances are likely the result of the adsorption of HCO3- onto the crystal surfaces of bone mineral. There do not appear to be significant errors in the measurements.