The regulation of calcium in Daphnia magna reared in different calcium environments

Tan, Qiao-Guo, Wen-Xiong Wang

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ABSTRACT: The specific content, dissolved uptake rate, dietary assimilation efficiency (AE), and efflux rate constant (k_e) of calcium (Ca) were quantified in juvenile (4-d) and adult (10-d) *Daphnia magna* cultured in low (0.5 mg L^{-1})- and high (50 mg L^{-1})-Ca environments using a radiotracer technique. Daphnids raised in the high-Ca environment had higher Ca contents than did those raised in the low-Ca environment, and juvenile daphnids had higher Ca contents than adults. Uptake from solution was the dominant source (97-100%) of Ca for daphnids. The maximum influx rate (J_{max}) was higher in juvenile daphnids (3.24-4.10 mg g dry weight [wt]$^{-1}$ h^{-1}) than in adults (1.51-1.62 mg g dry wt^{-1} h^{-1}), while the influx rates were comparable in different Ca environments. The half-saturation concentration (K_m) was 2.51-5.58 mg L^{-1}. The AEs of Ca declined exponentially with increases in food concentrations, and lower AE was observed in the higher Ca environment. The k_e of Ca (0.83-1.98 d^{-1}) was the highest among the elements whose k_e had been quantified in *D. magna*, and it was 1.8-2.4 times higher in the high-Ca environment. Excretion into water was the dominant route (60-85%) of Ca release from daphnids; another 15-40% of Ca was lost as molts. The regulation of Ca in daphnids is mainly accomplished through adjusting their efflux but not their influx of Ca; their regulation ability is very limited, which may lead to a poor performance in daphnids in Ca-deficient water.