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Towards a better understanding of calcium isotopes as tracers of bone mineral balance: Expanding the Caltech Bone Health Study to older populations

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Osteopenia and osteoporosis—diseases characterized by progressive reductions in bone mineral density (BMD)—affect a significant portion of the aging population, particularly postmenopausal women. Current clinical best practice for diagnosing osteoporosis is through dual-energy x-ray absorptiometry (DXA). One promising, non-invasive method to screen for osteoporosis and BMD involves measuring calcium isotopes $\delta^{44/42}$Ca (expressed in units of permil) in urine and/or blood. Bone formation preferentially incorporates lighter calcium isotopes into the bone mineral mass, leaving bodily fluids enriched with lighter isotopes during periods of bone loss and heavier isotopes during bone formation. Although the potential of Ca isotopes for monitoring BMD has been recognized for over two decades [1], only recent advancements have made the technique fast, affordable, and potentially suitable for clinical application (*e.g.*, [2-4]).

Here, we aim to expand our recently initiated Bone Health study [4] by focusing on older participants (age > 50), as a first step towards a large-scale population study of Ca isotopes in populations at risk for osteopenia and osteoporosis. To do so, a new collaboration has been established between Caltech and a local healthcare clinic, at which volunteers are being recruited for collection of urine samples, and associated metadata about demographics, health and lifestyle factors. Since trial subjects include healthy individuals, and those at risk of, or diagnosed with, osteoporosis, an examination of both sensitivity and specificity is possible. Calcium isotope ratio measurements on the first 100 urine samples from participants recruited at the clinic will be presented and include samples from 18 individuals diagnosed with osteoporosis.

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