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Analyzing the effects of lactose on calcium absorption in premature infants using HR-ICP-Mass Spectrometry

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With advances in neonatal care, premature infants are surviving at increasing rates. During the third trimester of pregnancy, the bone mineral content of infants rapidly increases. It is therefore becoming essential to accurately mimic the womb environment to maintain growth and sustain the health of premature infants as if they were in utero. Regulating calcium absorption in premature infants is crucial primarily for bone formation, as 99% of the calcium in the human body is found in the bones and the teeth. The effect of lactose containing formulas on calcium absorption in premature infants has not been well established. Concerns have been noted in the scientific community regarding lactose intolerance especially in premature infants, as lactase, the enzyme responsible for lactose digestion, is most readily detectible during the third trimester of pregnancy. In this study, in conjunction with Dr. Laura Hillman of the University of Missouri Hospital, each infant was fed lactose and maltose formulas during different weeks using a dual tracer method in which two calcium isotopes were administered, ^{44}Ca orally and ^{46}Ca intravenously. Urine samples were collected after 24 hours. Analysis related natural abundances of calcium isotopes to the measured values in the urine. Polyatomic ion interferences were differentiated from the calcium peaks by analyzing the samples at a resolution of 4000. Mathematical corrections for interferences caused by titanium and doubly charged strontium were determined by measuring the specific isotopes ^{47}Ti and $^{87}Sr^{++}$ and using known natural abundances of the interfering isotopes to correct each calcium count rate. Mathematical calculations relate the enriched isotope ratio measurements of ^{44}Ca and ^{46}Ca to calcium absorption. Analysis regarding the effect of lactose on calcium absorption is ongoing. Our data precision on the ICP-MS was acceptable with percent relative standard deviations (%RSD) for external precision over the course of a week at 1.4, 2.2, 0.71, and 1.4 for isotope ratios ^{42}Ca: ^{43}Ca, ^{42}Ca: ^{44}Ca, ^{42}Ca: ^{46}Ca, and ^{42}Ca: ^{48}Ca respectively. Daily internal precision (%RSD) values were .37, 1.3, .69, and 1.5. The precision shows the viability of utilizing HR-ICP-MS analysis for calcium isotope ratios.