Stable isotopes to assess the intake of human milk in breastfed infants: The deuterium oxide dose-to-mother technique

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Introduction
WHO recommendation is exclusive breastfeeding up to 6 months and continue to breastfeed up to 2 years. In many countries, only limited information is available on breastfeeding practices (quantity of milk consumed by the babies, time of introduction of other food). The deuterium oxide dose-to-mother technique can help to overcome the practical problems linked to the test weighting, which is the conventional method to measure breastmilk intake. Deuterium oxide is metabolized in the body the same way as water and can be sampled in the form of saliva or urine. The enrichment of deuterium in saliva or urine can be measured by isotope ratio mass spectrometry (IRMS) or Fourier transform infrared spectrometry (FTIR). FTIR is easy to use and suitable for resource-limited settings.

Method
1-The deuterium oxide dose-to-mother technique (1, 2)
2- Analysis of samples
3-Deuterium kinetic
After the mother has taken the dose of D2O, the deuterium gradually disappears from her body and appears in the body of the baby. Deuterium in the baby’s body comes only from the milk consumed during breastfeeding. As the deuterium is eliminated from the mother’s body, the enrichment in her milk declines and therefore the enrichment in the baby’s body also falls.

4-Calculation of human milk intake
A mathematical model is used to determine how much of the deuterium given to the mother appears in the baby’s saliva. This is related to the amount of human milk consumed by the baby. This model also gives an estimate of the amount of water from sources other than its mother’s milk, and therefore whether the baby is exclusively breastfed or not.

Results (output)
1-Enrichment from 2 mother-baby pairs
Baby A is exclusively breastfed and baby B is not exclusively breastfed

2 -Fluid intake in breastfed babies

Results from a Technical Cooperation project:

Conclusion
The deuterium oxide dose-to-mother technique helps to assess breastfeeding practices. Stable isotopes techniques can be used to evaluate national breastfeeding promotion campaigns and can be applied in resource-limited settings.

References:
2 International Atomic Energy Agency. Stable Isotope Technique to Assess Intake of Human Milk in Breastfed Infants, IAEA Human Health Series n° 7, IAEA/NAHRES, Vienna, Austria (2010).