

Human Health



Using Nuclear Techniques to Assess Breastfeeding Practices for Better Nutrition and Health

SUMMARY

1. Appropriate feeding practices in the early months and years of life are important to achieve optimal growth, development and health.
2. Awareness of the important role that breastfeeding plays in preventing malnutrition needs to be increased.
3. The IAEA is supporting Member States in using stable isotope techniques to evaluate activities to improve infant and young child feeding practices.

INTRODUCTION

Exclusively breastfed means that the infant receives only human milk; no other liquids or solids are given, not even water, with the exception of when a child needs oral rehydration solutions, drops and syrups of vitamins, minerals or medicines for health.

The World Health Organization (WHO) recommends that infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development and health. Thereafter, to meet their evolving nutritional requirements, infants should

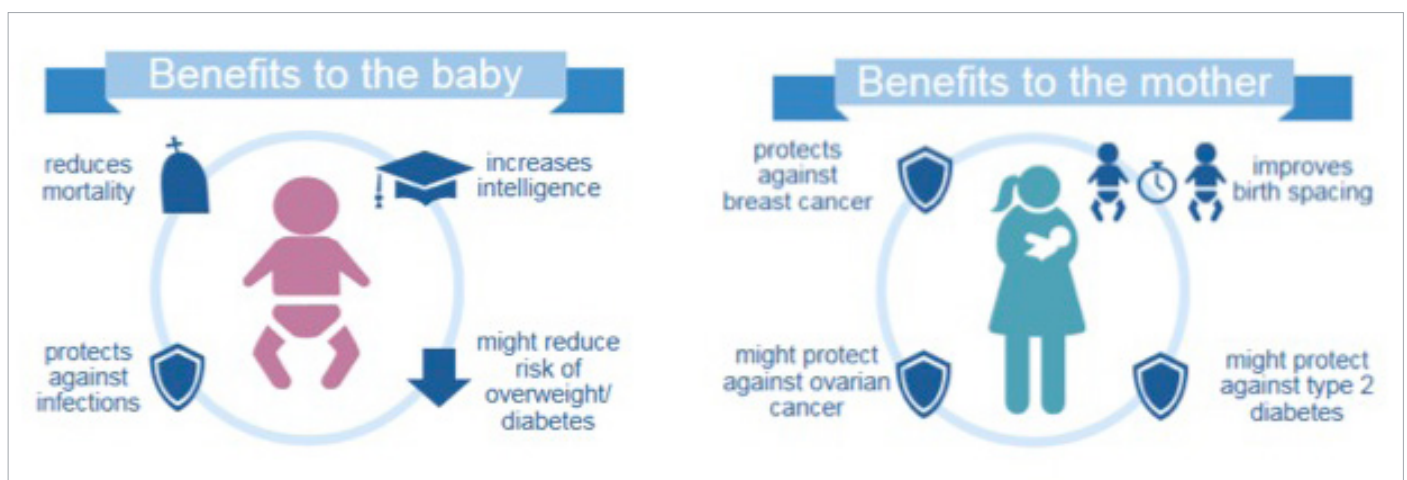
receive nutritionally adequate and safe complementary foods, while continuing to breastfeed for up to two years or beyond.¹

The benefits of breastfeeding to infants are now well established (see infograph below). It is estimated that universal breastfeeding could avert 823 000 infant deaths each year.²

Good nutrition, in particular over the first 1000 days from conception to age two, promotes healthy brain development and body growth.³ During infancy and early childhood, inappropriate feeding practices, poor nutrient intake and frequent infections can result in stunting, which affects about 159 million children under five years of age in low and middle income countries.⁴ There is evidence linking early life undernutrition and increased risk of chronic, non-communicable diseases in adulthood, including cardiovascular disease, diabetes and cancer.⁵

Breastfeeding also benefits the mother.² Scientific evidence and research have demonstrated that breastfeeding improves birth spacing and protection against breast cancer. In addition, it might protect against ovarian cancer and reduce the risk of type 2 diabetes (see infograph below).

Known Benefits of Breastfeeding for Infants and Mothers



(J. Bové/IAEA)



A technician analysing deuterium samples at a Fourier transform infrared spectrometer laboratory in Kenya. (Photo: C. Mwangi and S. Oiyee)

GLOBAL TARGET ON EXCLUSIVE BREASTFEEDING AND TRACKING PROGRESS

According to a 2013 study, global exclusive breastfeeding rates remain low with a marginal increase in rates in low and middle income countries from 25% in 1993 to 36% in 2013. Continued breastfeeding rates dropped slightly from 76% to 73.3% in the same period.²

Recognizing the importance of exclusive breastfeeding, the World Health Assembly in 2012 set the global target to increase the rate of exclusive breastfeeding in the first six months up to at least 50% by 2025. Breastfeeding can contribute to achieving the Sustainable Development Goals (SDGs) such as zero hunger, and good health and well-being.

Many governments carry out programmes to promote exclusive breastfeeding. However, there is limited information on the quantities of human milk consumed, the exclusivity of the breastfeeding and to what extent the introduction of other foods into the infants' diets affects continued breastfeeding from six months of age onwards. Efforts to improve national data collection to provide reliable and informative data on breastfeeding patterns are a global health priority.

HOW STABLE ISOTOPE TECHNIQUES CAN HELP

Isotope techniques are useful to determine if an infant is exclusively breastfed or not, as well as how much human milk the infant consumes. These techniques, along with the regular monitoring of breastfeeding patterns, can provide crucial feedback to programme implementers and allow for scaling up of interventions. There is also need for periodic population-wide assessments to enable the monitoring of global breastfeeding trends.

Currently, much of the available data on breastfeeding practices rely on self-reported data from mothers on what kind of foods and liquids they feed their children. To measure the quantity of human milk consumed, the conventional method requires the infant to be weighed before and after each feed, which can be laborious. This is where stable isotope techniques can play a particularly important role.

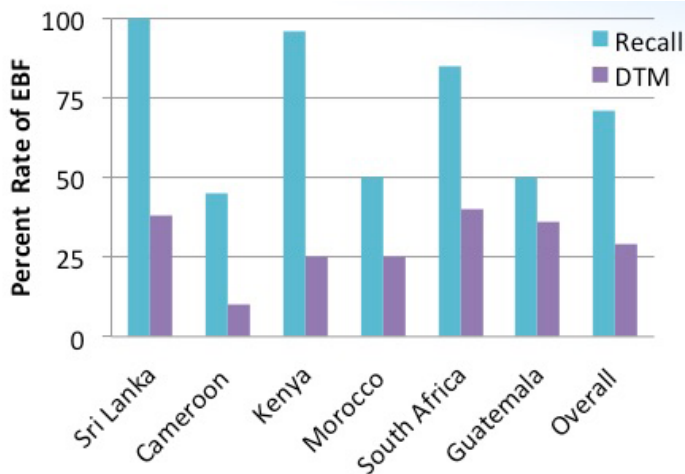
A non-radioactive nuclear technique, known as the deuterium oxide dose-to-mother (DTM) technique^{6,7} offers a way to obtain accurate and objective information on breastfeeding practices, in particular on the exclusivity of breastfeeding. This technique assesses breastfeeding practices by tracking the flow of deuterium, a stable (non-radioactive) isotope of hydrogen occurring naturally in small amounts, from the mother to her infant.



Saliva sampling in infant for DTM technique. (Photo: E. Aguilar)

Exclusive Breastfeeding Rates

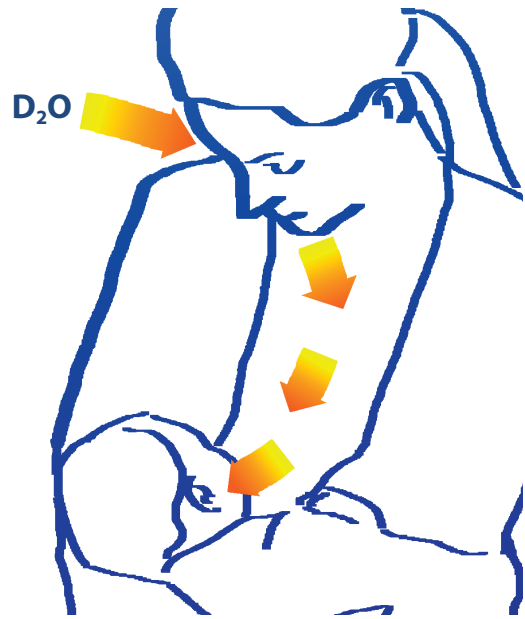
Comparison of exclusive breastfeeding (EBF) in the first six months of life based on maternal recall and dose-to-mother (DTM) technique.



IAEA Member States such as Cameroon, Guatemala, Kenya, Morocco, South Africa and Sri Lanka have used the objective DTM technique to assess exclusive breastfeeding compared to maternal self-reports on what foods and liquids have been fed to the child since birth or in the 24 hours preceding the survey. The study findings reveal that the data based on maternal self-reports are often biased, and tend to overestimate the exclusive breastfeeding rate by about 40% at three to six months of age (see graph above).

HOW THE DTM TECHNIQUE WORKS

A lactating mother is given a very small dose of deuterium oxide (D_2O), which is water enriched with deuterium (99.8% of the heavier isotope of hydrogen atoms known as deuterium). The deuterium is distributed throughout her body within a few hours and is incorporated into her milk. Deuterium in the infant's body comes only from the milk consumed during breastfeeding. Over a period of 14 days, samples of saliva are collected from the mother and child. The amount of deuterium in the saliva is analysed to determine how much of the deuterium given to the mother appears in the infant's saliva. From this information, the volume of human milk consumed by the infant and whether the infant has consumed water from other sources can be determined. The DTM technique also provides information on the body composition of the mother.



Dose-to-Mother Technique

The mother consumes deuterium oxide. The deuterium mixes with water in her body including the milk the infant drinks. The saliva of both the mother and child is enriched with deuterium. This can be measured with sensitive equipment.

IAEA SUPPORT

The IAEA's support to Member States has steadily increased and at present it is supporting over 30 Member States in Asia and the Pacific, Africa, Europe, and Latin America and the Caribbean in the use of stable isotope techniques to assess the success of the promotion of exclusive breastfeeding for the first six months of an infant's life.

Through these projects, the IAEA is helping its Member States to gain competencies in applying the safe DTM technique, which provides accurate and objective data on breastfeeding practices. The findings from these projects will inform decision-makers as well as other interested stakeholders on the effectiveness of breastfeeding promotion campaigns in support of the WHO's recommendation of exclusive breastfeeding for the first six months and the global nutrition target to increase exclusive breastfeeding rates in the first six months to at least 50% by 2025.

Increased awareness of the DTM technique, knowledge of its importance, and establishment of adequate technical capacity to use the technique are key issues

that need to be addressed to allow the wider application of it in monitoring the impact of breastfeeding promotion interventions.

RECOMMENDATIONS FOR CONSIDERATION

1. Member States are encouraged to assess their national training needs related to the use of the DTM technique for assessing breastfeeding patterns.
2. Member States are encouraged to develop capacity to use the DTM technique for integrating it in their routine demographic and health surveys.
3. Member States are encouraged to use the DTM technique to support national monitoring of progress towards achieving the global nutrition target on exclusive breastfeeding.

REFERENCES

1. World Health Organization, Global Strategy for Infant and Young Child Feeding (2003)
<http://www.who.int/nutrition/publications/infantfeeding/9241562218/en/>
2. VICTORA C.G., BAHL R., BARROS A.J., et al., Breastfeeding in the 21st century; epidemiology, mechanisms, and lifelong effect, *The Lancet* 387 (2016) 475–490
3. 1000 Days: <http://thousanddays.org/>
4. INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE, Global Nutrition Report (2016)
<http://globalnutritionreport.org/the-report/>
5. SINGHAL A., The role of infant nutrition in the global epidemic of non-communicable disease, *Proceedings of the Nutrition Society*, Vol 75, Issue 2 (2016) 162-168
6. COWARD W.A., Cole T.J., SAWYER M.B., et al., Breast-milk intake measurement in mixed-fed infants by administration of deuterium oxide to their mothers, *Hum Nutr Clin Nutr* 36 (1982) 141–148
7. INTERNATIONAL ATOMIC ENERGY AGENCY, Contributing Solutions for Nutrition, IAEA Bulletin 55-1 (2014)
<http://www.iaea.org/bulletin>

IAEA Briefs are produced by the Office of Public Information and Communication

Editor: Aabha Dixit • Design and Layout: Ritu Kenn

For more information on the IAEA and its work, visit www.iaea.org

or follow us on     

or read the IAEA's flagship publication, the [IAEA Bulletin](http://www.iaea.org/bulletin), at www.iaea.org/bulletin

IAEA, Vienna International Centre, PO Box 100, 1400 Vienna, Austria

Email: info@iaea.org • Telephone: +43 (1) 2600-0 • Facsimile +43 (1) 2600-7

