# FOOD AND NUTRITION BULLETIN

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## SUPPLEMENT

## Use of Nuclear and Isotopic Techniques for Addressing Nutritional Problems

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# Preface

This *Food and Nutrition Bulletin* supplement represents the proceedings of a symposium on the Use of Nuclear and Isotopic Techniques for Addressing Nutritional Problems. There were five scientific sessions, namely advances in isotopic and nuclear-related methods for nutrition research, isotopic methods for nutrient measurements and energy metabolism, tracer techniques in nutrient metabolism and applications, tracer techniques for evaluating nutritional interventions, and a workshop on stable isotopes in nutrition: opportunities, perspectives, and harmonization. These sessions provide a basic frame of reference for the scope of technical activities carried out by the International Atomic Energy Agency, and formed an integral part of the scientific program at the 17th International Congress of Nutrition held in Vienna, Austria, August 27–31, 2001.

This Congress focused attention on the global social and economic costs of malnutrition and pollution from environmental contaminants, which are enormous. It also helped put into place the commitments to address the issues of health, nutrition, and environment through national and international interventions.

In meeting these challenges, the global nutrition community recognizes the significance of nuclear and isotopic (especially stable isotopic) techniques for accurate and, in some cases, non-invasive measurement of nutrient utilization, nutrient status of the body, and related metabolism. The application of isotopic techniques is well suited for determining the success of food supplementation programs and other interventions aimed at combating many forms of malnutrition. In particular, the doubly labeled water method has been proven to be an accurate tool to study human body composition and energy metabolism while the use of nitrogen-15 has been accepted as an efficient approach to study protein turnover and amino acid metabolism. As analytical tools stable isotopes are now seen to be invaluable, since there is virtually no health risk involved in their use. They are therefore preferred for work in humans, especially in infants and pregnant women. The application of these tools is increasingly recognized as commonplace, since naturally occurring elements exist as a mixture of two or more stable non-radioactive isotopic forms. There are heavy stable isotopes (e.g., $^{54}Fe$, $^{56}Fe$, $^{57}Fe$, $^{58}Fe$, $^{64}Zn$, $^{66}Zn$, $^{68}Zn$, $^{70}Zn$) and light stable isotopes (e.g., $^{1}H$, $^{2}H$, $^{13}C$, $^{12}C$, $^{15}N$, $^{14}N$, $^{16}O$, $^{17}O$, $^{18}O$). Stable isotopes are thus used in measurements by determining the changes in the ratio of different isotopes. They can be administered either orally (water, food, etc.) or intravenously (in required form) and incorporated into metabolic products, such as body water, urea, or $CO_2$. Stable isotopes can be sampled in saliva, milk, breath, urine, and stool. The ratio of minor to major isotopes can then be determined by isotope ratio mass spectroscopy, infrared absorption, or emission spectroscopy.

Within the United Nations, several initiatives are being implemented to alleviate micronutrient deficiencies that are of major public health concern in nutrition. The International Atomic Energy Agency (IAEA) is contributing to these efforts by offering technical solutions to improve nutrition monitoring techniques and by identifying effective strategies in nutrition intervention schemes as currently applied in several developing countries. Thus, for many years the IAEA activities in nutrition research have strengthened the use of isotope techniques as tools to evaluate human nutritional status and environmental health.

The IAEA supports activities related to nutrition and environment through research, capacity building, and technical cooperation activities. Coordinated research projects are developed on well-defined research topics for bringing together scientists from developing and industrialized countries to seek solutions to selected problems. Studies supported by the IAEA cover a broad range of problems that include iron-deficiency anemia, protein-energy malnutrition, micronutrient deficiencies with special reference to child health and maternal nutrition and nutrition during pregnancy, osteoporosis, obesity, infection, food composition, and food fortification.

Technical cooperation is aimed at meeting developmental priorities through the application of scientific

and technical capabilities. One such IAEA program of technical activities aligns with the Plan of Action of the World Summit for Children by focusing primarily on improving the heath status of children. The IAEA's program to improve child health includes four principal components: technologies for evaluating child nutrition and dietary status, technologies for control of communicable diseases, technologies for screening childhood diseases, and radiation therapy. These technical packages, along with associated human resource components provide a useful link to national health care, prevention, and disease control programs in member states. Appropriate uses of isotope evaluations result in more children achieving their full potential for growth, performance, and economic contribution to society. At the same time long-term costs to health services are reduced through optimally implemented interventions. In implementing these projects the IAEA works with a network of institutions (spread in many parts of the world) capable of using isotope techniques in analytical studies.

The IAEA operates on the premise that science and technology must serve human development, and the unique and diverse analytical tools referred to in this report are examples of how the Agency and its counterpart institutions contribute to poverty alleviation, food security, and human health priorities. In the interim years until the next Congress, the member states and secretariat of the IAEA will be working to advance the science and technologies that improve human nutrition into new challenges such as the bioavailability of essential micronutrients, such as vitamin A or carotenoids, and quality of life issues and diseases of aging, such as non-insulin dependant diabetes mellitus, coronary heart disease, and obesity. Through its continued collaboration with the international nutrition community the IAEA expects the next Congress to further strengthen the linkage between isotope studies, nutritional status, quality of life, and human development.

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