Chile combats obesity in children using nuclear techniques

By Laura Gil

Information gathered using nuclear-related technology helped policymakers in Chile adjust nutrition programmes.
(Photo: A. Gorišek/IAEA)

About 80 million people in Latin America are covered, to one extent or another, by national nutrition programmes. In Chile, one of the reasons why these interventions are more effective today than ever before is nuclear-related technology. This technology enables better diagnosis of malnutrition and provides accurate information to guide and evaluate targeted interventions.

"Whilst nutrition programmes in the early 1990s focused on measuring children's weight, championing weight gain, they failed to take other factors into account," said Ricardo Uauy, Director of the Institute of Nutrition and Food Technology (INTA) at the University of Chile. "They helped to combat undernutrition, but at the same time aggravated, in many cases, overweight and obesity among children."

In Latin America, as in other regions, children have become progressively more sedentary, taking less exercise and eating more fat-rich foods. According to the 2017 joint child malnutrition estimates by the United Nations Children's Fund (UNICEF), the World Health Organization (WHO) and the World Bank Group, almost 4 million children under five years of age are overweight in the region, many of them also suffering from a deficiency of essential nutrients such as iron, zinc and vitamin A.

Nuclear techniques can help to determine the human body's uptake from food and utilization of these nutrients.

Gradually, with the help of the IAEA, nutrition scientists like Uauy started assessing children's body composition and energy expenditure — something that nuclear-related techniques enable them to do. They started discovering exactly how a child's weight was divided into fat and fat-free body mass, how the child was taking up and using minerals, and how much of the energy was being used to exercise or was being stored as fat. Accumulating excess body fat and being sedentary — not getting enough exercise — are major risk factors for obesity.

"These tools were adopted by several countries in the region because they were showing us a changing reality," Uauy said. "It became clear that obesity, especially amongst low-income groups, was a problem as important as undernutrition, and that there was a need to change diets and decrease sedentary living."

Childhood obesity increases the risk of diet-related non-communicable diseases, including several forms of cancer, high blood pressure and type II diabetes. In addition, Chilean scientists working at INTA have recently discovered that girls

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who are obese typically mature earlier and have their first menstrual period at an earlier age, which leads to a higher rate of early pregnancies.

Losing weight

These findings helped policymakers in Chile adjust nutrition programmes, which now provide for higher-quality diets, reduced energy intake from fats and sugar and increased physical activity. As a result, despite rising living standards and sedentary lifestyles, obesity has not increased in the country.

"We've been coming up with diverse and accessible diets, especially for those who cannot afford to eat expensive nutritious food every day," Uauy said. "But we believe it is not enough to inform consumers. We have to make the healthy option the easiest option. This includes formulating and selling the right foods with the right balance between energy and nutrients, and making labels on food items easier to understand by all consumers."

When nutritionists at INTA started collaborating with the IAEA, obesity among pre-school children in a pilot project stood at 10.7% (2001 figures). By 2009, they had managed to reduce the number of calories in school meals and increase children's daily physical activity, bringing the obesity rate among the children involved in the project down to 8.4%.

At the end of 2016, the programme covered three quarters of day-care centres under the jurisdiction of the National Board of Day-Care Centres (JUNJI in Spanish).

Other uses of nuclear-related techniques in nutrition: evaluating muscle health and breastfeeding

The IAEA also supports scientists in the use of nuclear and isotopic techniques to measure human milk intake in breastfed infants, evaluate the bone health of the elderly, track how the body takes in, uses, and retains important nutrients, measure vitamin A reserves and determine how well iron and zinc from local foods and diets are utilized by the body.

For example, the IAEA is currently supporting scientists in Chile in applying stable isotopes and other nuclear-related techniques to studying muscle health and changes in physical activity in the elderly.

"Nuclear-related techniques allow us to do a very exact diagnosis," said Carlos Márquez, nutritionist at INTA. "And diagnoses are important when treating the elderly, since many times it is easier to prevent diseases than to cure them."

The data they are gathering using nuclear-related techniques, Márquez hopes, will help policymakers take measures that will increase elderly people's health and quality of life.

THE SCIENCE

How nuclear-related techniques help measure body fat

To determine precisely the amount of fat in a child's body, for example, scientists use stable isotopes and assess the total body water content. They mark water with deuterium (2H), a stable isotope of hydrogen, and make the child drink it. The water is marked ($2H_2O$) but is non-radioactive and therefore has no adverse health consequences. Scientists take samples of the child's saliva or urine before and after they drink the marked water.

Fat is water-free, by definition. When a boy or girl drinks the marked water, it is evenly distributed in the body's fat-free tissue in a few hours. The marked water that scientists collect and analyse represents the amount of water that the child's lean tissue has absorbed. This helps the scientists determine how much of the child's weight is non-fat — and thus, after calculating the difference, how much fat the children are storing.

To learn more about how stable isotopes work, read: www.iaea.org/topics/childhood-obesity

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The IAEA has been helping Chile tackle malnutrition for over 10 years by transferring nuclear and nuclear-related technology, training scientists, organizing expert visits and fellowships and providing materials and equipment.