"Learning about body composition is very important because it is the right marker to measure body fat, and if you have the right marker you can know exactly what the situation is in the country."

—Noorjehan Joonus, Head, Biochemistry Services, Central Health Laboratory, Mauritius

(Photo: L. Viegas Assumpcao/IAEA)

A health policy with atomic precision in Mauritius

By Luciana Viegas Assumpcao

A gust of economic prosperity is sweeping through Mauritius, a bustling island nestled in the Indian Ocean. While mounting affluence has brought opportunity, it has also given rise to unhealthier habits. For many countries, growing wealth often means growing waistlines and the accompanying preventable diseases. To better understand the impact of nutrition on national health, countries like Mauritius are turning to nuclear techniques.

"There is growing interest in studying nutrition to better target health interventions and assess their impact," said Cornelia Loechl, Head of the IAEA's Nutrition Section. "Many countries, like Mauritius, now face a double burden — where undernutrition and micronutrient deficiencies coexist with overweight and obesity — increasing the risk of diet-related, non-communicable diseases."

In the last few decades, the gross domestic product of Mauritius has tripled, thanks largely to tourism and the textile industry, and the country now boasts one of the highest income per capita in Africa. Comprehensive health care is free, and regional health centres service the majority of the population.

But a rise in fast food consumption, coupled with a decline in physical activity and increased life expectancy, have led to the country now having the highest rates of obesity and diabetes in Africa. Non-communicable diseases have soared, becoming responsible for 80% of deaths in 2016, with diabetes alone accounting for 24% of mortality, and cancer killing around 12%.

"The pattern of cancer in Mauritius is very different from that in mainland Africa," said Shyam Manraj, Director of Laboratory Services and National Cancer Registry Coordinator at the Ministry of Health and Quality of Life. "The country has the highest rate of breast, colorectal and endometrial cancer in the continent. These types of cancer are commonly linked to diet."

To tackle this growing burden, the authorities in Mauritius have decided to improve the monitoring of obesity and its impact. With the help of the IAEA, it has carried out several studies since 2009 to measure body composition using a stable isotope method called the deuterium dilution technique (see The Science box). These studies paint a more accurate picture than those using standard measurements, such as the body mass index (BMI).

Results of body composition studies using isotopic techniques led the Government of Mauritius to place stricter controls on food sold in canteens, such as this one at the Baichoo Madhoo Government School.
(Photo: L. Viegas Assumpcao/IAEA)

"The deuterium dilution technique helps to determine the amount of body fat and fat-free mass," said Loechl. "This is important because there are negative health consequences associated with a higher amount of body fat."

The national Central Health Laboratory in Mauritius first started to look at the magnitude of obesity in children aged 6 to 13 to find out when they started to become overweight, and what health risks that could carry. The results showed that the BMI for that age group underestimated obesity and overweight in both boys and girls, and that chronic diseases were just around the corner for many young people. "We found an increase in insulin resistance, which means the children are predisposed to non-communicable diseases, especially diabetes," said Noorjehan Joonus, Head of Biochemistry Services at the Central Health Laboratory, who is leading these studies.

"We communicated the results to the Ministries of Health and Education, and there has been an increase in physical education

Children in Mauritius drink deuterium-enriched water for a study to assess their body composition.
(Photo: L. Viegas Assumpcao /IAEA)

at schools," Joonus added. "They now have physical activity every day, rather than on a weekly basis."

In addition, the government has stepped up other measures: an existing tax on sugar was raised, and stricter controls were placed on food sold at schools. They also increased nutrition counselling in all regional health centres. "When you are in the phase of pre-diabetes it is reversible, but once you become diabetic it is irreversible, so we offer diet advice at an early stage," said Anju Gowreesunkur, a nutritionist at the Ministry of Health and Quality of Life.

Mauritius has since expanded studies to different population groups. Along with deuterium dilution, the laboratory has started to use dual-energy X-ray absorptiometry, or DXA, scans to study the link between body composition, insulin resistance, and breast and colorectal cancers. The DXA technique provides information on body fat distribution (see The Science box), which is important as fat around the organs (visceral fat) carries a greater risk of chronic diseases, such as diabetes.

"These studies are actually helping us to work out our cancer control programme," said Joonus. The country plans to set up a training course for the region on isotope applications for nutrition assessments at the University of Mauritius, in collaboration with the IAEA. "Learning about body composition is very important because it is the right marker to measure body fat, and if you have the right marker you can know exactly what the situation is in the country."

With better data, Mauritius plans to continue to improve its nutrition policies to prevent diseases, so that wealth and prosperity do not get in the way of the nation's health. "As we say, 'you are what you eat'. Research has continuously shown that diseases can be prevented or delayed by just eating the right food," Gowreesunkur said.

THE SCIENCE

Deuterium dilution and DXA

The **deuterium dilution** method works by drinking water with a known amount of deuterium, a stable isotope of hydrogen. An isotope is an atom of the same element (hydrogen, in this case) that has the same number of protons, but a different number of neutrons. Isotopes of an element have a different atomic weight, allowing researchers to trace them based on mass.

After a few hours, when the deuterium is fully mixed in with the water in the body, a saliva sample is taken as representative of the body's water content. The concentration of deuterium in the saliva can then be measured. Since the amount of deuterium consumed and the concentration of it in the body's water are both known, the body's total water content can be calculated. Once researchers know the total amount of body water, they can work out the proportions of fat and fat-free mass in the body, which is called body composition.

DXA, or **dual-energy X-ray absorptiometry**, is an imaging technique for assessing body fat distribution. Using a whole-body scanner, X-rays with two different energy levels are passed through the body. The two energy beams are absorbed differently by different body tissues. The DXA machine measures how much energy is absorbed by the different tissues and converts those measurements into images. By overlaying these images, the relative proportions of bone mineral, fat tissue and lean soft tissue can be visualized and calculated.

DXA was mainly designed to measure bone mineral density in adults to diagnose osteoporosis. However, the scanner can also measure body composition with a high degree of accuracy. The major advantage of DXA is that it measures regional fat deposition, which is where the body fat is situated. This is important because fat deposited around the organs (visceral fat) bears a greater health risk.