USING NUCLEAR TECHNIQUES TO DETECT *HELICOBACTER PYLORI* INFECTION

Breath is sampled by blowing through a straw into a glass tube, and then putting the cap on the tube to seal it, or by blowing into a bag, depending on which method will be used to analyse the samples (tubes for analysis by isotope ratio mass spectrometry; bags for analysis by non-dispersive infrared spectroscopy).

(Photo: T. Ahmad, Pakistan)

Helicobacter pylori (H. pylori) is present in all countries the world over. More than 50% of the world's population harbour *H. pylori* in their upper gastrointestinal tract. It can negatively influence nutrition by affecting the uptake of iron and zinc and by increasing susceptibility to diarrhoeal disease. Beyond that, *H. pylori* is also a major cause of stomach diseases like chronic gastritis, and elevates the risk of developing stomach cancer.

The carbon-13 urea breath test is a quick and non-invasive diagnostic test to detect the presence of *H. pylori*. The patient drinks urea labelled with stable carbon isotopes (^{13}C) that is dissolved in orange juice or citric acid to make sure it coats the entire surface of the stomach, thereby improving the test's accuracy. If *H. pylori* is present, it metabolizes the urea and, after 30 minutes, produces carbon dioxide labelled with the stable carbon isotope ($^{13}CO_2$), which can be detected in the breath analysis (Fig. 8).

The IAEA has been undertaking research into *H. pylori* and its consequences for nutrition since 1999, and over the last 15 years, has worked with 25 low- and middle-income Member States to utilize and implement the carbon-13 urea breath test.

The IAEA is also continuing its research into the effect of *H. pylori* infection on gastric acid secretion and on iron and zinc absorption in asymptomatic individuals from developing countries. Gastric acid is essential for the conversion and absorption of micronutrients such as iron and zinc. The IAEA is also testing a new non-invasive way to measure gastric acid secretion using stable isotopes.

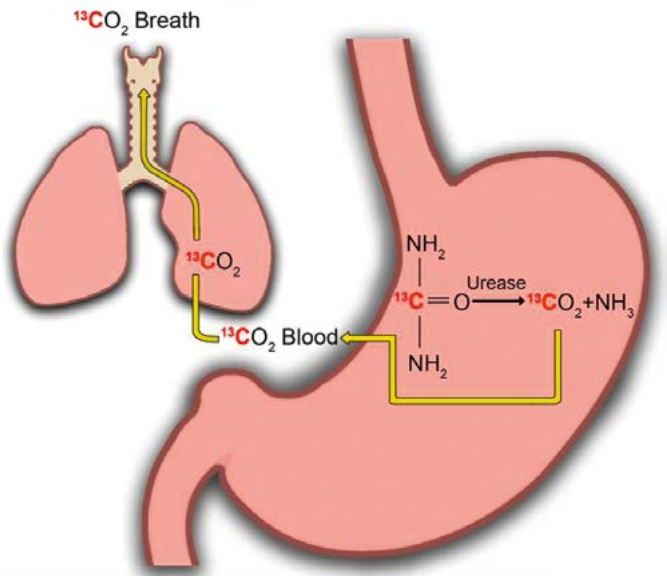

Fig. 8: The principle of the carbon-13 urea breath test

The bacterium *Helicobacter pylori* can survive in the acid conditions of the stomach, because it produces large amounts of the enzyme urease. When urea labelled with ^{13}C reaches the acid environment of the stomach, urease hydrolyses the urea to produce ^{13}C -labelled carbon dioxide ($^{13}CO_2$) and ammonia. The ammonia helps to neutralise the acid. The labelled CO_2 quickly enters the blood and is carried to the lungs, where it is excreted in the breath. The enrichment of ^{13}C in breath CO_2 within 30 minutes is an indication of the presence of *H. pylori* in the stomach.

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