

# Carbon-13 mixed triglycerides breath test

## Principle

The principle of the **13 C-mixed triglyceride breath test (MTG-BT test)** is the cleavage of this substrate by pancreatic lipase. 13 C-MTG substrate is a triglyceride with 13 C-labeled octanoate in position 2 and stearate in positions 1 and 3. Pancreatic lipase cleaves the triglyceride and 13 C-octanoate is further oxidized in the liver (beta-oxidation of fats). The amount of 13 CO<sub>2</sub> in the exhaled air is determined by a breath test analyzer. A variant is a test with another substrate for lipase - Hiolein. The specificity of the assay depends on the structure of the substrate, which affects the kinetics of hydrolysis.

## Performing of the MTG-BT test

The patient must be fasting and must discontinue the pancreatic replacement at least 24 hours before the start of the test. Indirect stimulation with the test meal includes crispy cornbread with 50 g of fat (preferably vegetable margarine) to which 100 mg of C 13-labeled triglyceride is added. An air sample is taken before serving the test meal, and then for 6 hours at 30-minute or 60-minute intervals. Samples can be analyzed by IRMS (isotope-ratio mass spectrometry) or IR type analyzers. The evaluation is the cumulative output in 6 hours, which in percent of the administered substrate expresses the degree of pancreatic insufficiency. The limit of the standard is 22 % for the MTG-BT test when calculating the cumulative output using BSA (body surface area calculated using the patient's height and weight). More accurate values can be calculated using BMR (basal metabolic rate) taking into account the sex and age of the patient. The limit of the standard for calculating BMR is 30 %.

## The clinical significance

The MTG-BT test is of clinical importance in the differential diagnosis of malabsorption syndrome, as a functional test of exocrine pancreatic function and for long-term follow-up of patients with chronic pancreatitis. Breath tests with 13 C-mixed triglycerides (MTG-BT) or 13 C-Hiolein are indirect functional tests of pancreatic exocrine function and can be used to monitor the success of pancreatic replacement therapy.

## Links

### Sources

- se svolením autora převzato z KOCNA, Petr. *GastroLab : MiniEncyklopedie laboratorních metod v gastroenterologii* [online]. ©2002. Poslední revize 2011-01-08, [cit. 2011-03-04]. <<http://www1.lf1.cuni.cz/~kocna/glab/glency1.htm>>.
- HERZOG, DC, et al. 13C-labeled mixed triglyceride breath test (13C MTG-BT) in healthy children and children with cystic fibrosis (CF) under pancreatic enzyme replacement therapy (PERT): a pilot study. *Clin Biochem.* 2008, vol. 41, no. 18, s. 1489-92, ISSN 0009-9120 (Print), 1873-2933 (Electronic). PMID: 18817766.
- DOMÍNGUEZ-MUÑOZ, JE, et al. 13C-mixed triglyceride breath test to assess oral enzyme substitution therapy in patients with chronic pancreatitis. *Clin Gastroenterol Hepatol.* 2007, vol. 5, no. 4, s. 484-8, ISSN 1542-3565 (Print), 1542-7714 (Electronic). PMID: 17445754.
- SLATER, C, et al. Advantages of deuterium-labelled mixed triacylglycerol in studies of intraluminal fat digestion. *Rapid Commun Mass Spectrom.* 2006, vol. 20, no. 2, s. 75-80, ISSN 0951-4198 (Print), 1097-0231 (Electronic). PMID: 16331742.
- DOMÍNGUEZ-MUÑOZ, JE, et al. Effect of the administration schedule on the therapeutic efficacy of oral pancreatic enzyme supplements in patients with exocrine pancreatic insufficiency: a randomized, three-way crossover study. *Aliment Pharmacol Ther.* 2005, vol. 21, no. 8, s. 993-1000, ISSN 0269-2813 (Print), 1365-2036 (Electronic). PMID: 15813835.
- DUMASY, V, et al. Fat malabsorption screening in chronic pancreatitis. *Am J Gastroenterol.* 2004, vol. 99, no. 7, s. 1350-4, ISSN 0002-9270 (Print), 1572-0241 (Electronic). PMID: 15233677.
- RITZ, MA, et al. Evaluation of the 13C-triolein breath test for fat malabsorption in adult patients with cystic fibrosis. *J Gastroenterol Hepatol.* 2004, vol. 19, no. 4, s. 448-53, ISSN 0815-9319 (Print), 1440-1746 (Electronic). PMID: 15012784.
- SCHUETTE, SA, et al. Effect of triglyceride structure on fecal excretion of 13C-labeled triglycerides. *J Am Coll Nutr.* 2003, vol. 22, no. 6, s. 511-8, ISSN 0731-5724 (Print), 1541-1087 (Electronic). PMID: 14684756.
- SUN, DY, et al. Clinical application of 13C-Hiolein breath test in assessing pancreatic exocrine insufficiency. *Hepatobiliary Pancreat Dis Int.* 2003, vol. 2, no. 3, s. 449-52, ISSN 1499-3872 (Print). PMID: 14599958.
- SLATER, C, et al. Analysis of 13C-mixed triacylglycerol in stool by bulk (EA-IRMS) and compound specific (GC/MS) methods. *Isotopes Environ Health Stud.* 2002, vol. 38, no. 2, s. 79-86, ISSN 1025-6016 (Print), 1477-2639 (Electronic). PMID: 12219984.
- VAN DIJK-VAN AALST, K, et al. 13C mixed triglyceride breath test: a noninvasive method to assess lipase activity in children. *J Pediatr Gastroenterol Nutr.* 2001, vol. 32, no. 5, s. 579-85, ISSN 0277-2116 (Print), 1536-4801 (Electronic). PMID: 11429520.
- WUTZKE, KD, et al. Triglyceride oxidation in cystic fibrosis: a comparison between different 13C-labeled tracer

substances. *J Pediatr Gastroenterol Nutr.* 1999, vol. 29, no. 2, s. 148-54, ISSN 0277-2116 (Print), 1536-4801 (Electronic). PMID: 10435651.

- ADAMEK, RJ, et al. <sup>13</sup>C-mixed triglyceride CO<sub>2</sub> exhalation test. Investigation with an isotope selective, non dispersive infrared spectrophotometer of indirect function of the exocrine pancreas. *Dtsch Med Wochenschr.* 1999, vol. 124, no. 5, s. 103-8, ISSN 0012-0472 (Print), 1439-4413 (Electronic). PMID: 10076549.
- LÖSER, C, et al. Comparative clinical evaluation of the <sup>13</sup>C-mixed triglyceride breath test as an indirect pancreatic function test. *Scand J Gastroenterol.* 1999, vol. 33, no. 3, s. 327-34, ISSN 0036-5521(Print), 1502-7708 (Electronic). PMID: 9548629.
- BRADEN, B, et al. Monitoring pancreatin supplementation in cystic fibrosis patients with the <sup>13</sup>C-Hiolein breath test: evidence for normalized fat assimilation with high dose pancreatin therapy. *Z Gastroenterol.* 1997, vol. 35, no. 2, s. 123-9, ISSN 0044-2771 (Print), 1439-7803 (Electronic). PMID: 9066102.
- LEMBCKE, B, et al. Exocrine pancreatic insufficiency: accuracy and clinical value of the uniformly labelled <sup>13</sup>C-Hiolein breath test. *Gut.* 1996, vol. 39, no. 5, s. 668-74, ISSN 0017-5749 (Print), 1468-3288 (Electronic). PMID: 9026480.