

# <sup>13</sup>C-Mixed Triglyceride Breath Test

<sup>13</sup> C-Mixed Triglyceride	
	Molecular weight: 752.0 g/mol
	Enrichment: 99 %
	Labeled C-atoms: 1
	Dosage: 150 mg

## Metabolism

1,3-distearyl-2-{carboxyl-<sup>13</sup>C}octanoylglycerol, the so-called <sup>13</sup>C-Mixed Triglyceride passes the stomach and is digested by lipase activity in the duodenum <sup>1</sup>. The two distearyl groups have to be hydrolyzed by pancreatic lipase before absorption and metabolism of the <sup>13</sup>C-octanoyl monoglyceride <sup>2</sup>. Thus, the oxidation to <sup>13</sup>CO<sub>2</sub> is dependent on the rate-limiting step of hydrolysis of the fatty acids in positions 1 and 3 <sup>3</sup>.

## Applications of <sup>13</sup>C-Mixed Triglyceride Breath Test

The <sup>13</sup>C-Mixed Triglyceride Breath Test assesses duodenal pancreatic lipase activity. It is therefore useful for the investigation of severe exocrine pancreatic insufficiency <sup>4,5</sup>. If applied under strict conditions even mild to moderate forms can be assessed with high sensitivity and specificity <sup>6</sup>.

The patient should have fasted for 10 hours prior to the test. The patient must not drink carbonated water or soft drinks prior to the test since that might interfere with the results. In addition oxygen supplementation should be avoided because increased oxygen content in exhaled breath can influence <sup>13</sup>CO<sub>2</sub> measurement by NDIRS <sup>7</sup>.

## Test Performance Procedure (see IRIS<sup>®</sup> Operating Manual for additional information)

1. Mix 150 mg of <sup>13</sup>C-Mixed Triglyceride with 0.25 g of butter per kg body weight and prepare it with 100 g of bread.
2. Collect zero (basal) breath sample as described in manual.
3. Enter patient height and weight into the IRIS<sup>®</sup>-3 or IRIS<sup>®</sup>-Doc Software.
4. Allow the patient to eat the prepared bread.
5. Collect breath samples as shown below (Table 1).
6. Analyze all 13 breath samples with IRIS<sup>®</sup>-3 or IRIS<sup>®</sup>-Doc.

#1 Bag	#2 Bag	#3 Bag	#4 Bag	#5 Bag	#6 Bag	#7 Bag	#8 Bag	#9 Bag	#10 Bag	#11 Bag	#12 Bag	#13 Bag
0 min	30 min	60 min	90 min	120 min	150 min	180 min	210 min	240 min	270 min	300 min	330 min	360 min

Table 1: <sup>13</sup>C-Mixed Triglyceride Test Sample Collection

## Results and interpretation

The pancreatic function is assessed by the 6 hour cumulative <sup>13</sup>CO<sub>2</sub> excretion. This can be calculated by the IRIS<sup>®</sup>-Software, if the correct values for height and weight are entered. Vantrappen *et al.* found normal values to be at 35.6 % ± 2.8 % <sup>4</sup>. Another study by Swart *et al.* resulted in a normal value of 33.6 % ± 4.6 % <sup>1</sup>. For detection of disease-diminished lipase output Vantrappen *et al.* suggested a cut-off value of 22 % cumulative CO<sub>2</sub> after 6 hours (sensitivity 0.89, specificity 0.81) <sup>4</sup>.

The two figures below show examples of curves for a 5-hour test set-up, taken from Löser *et al.*<sup>5</sup>.

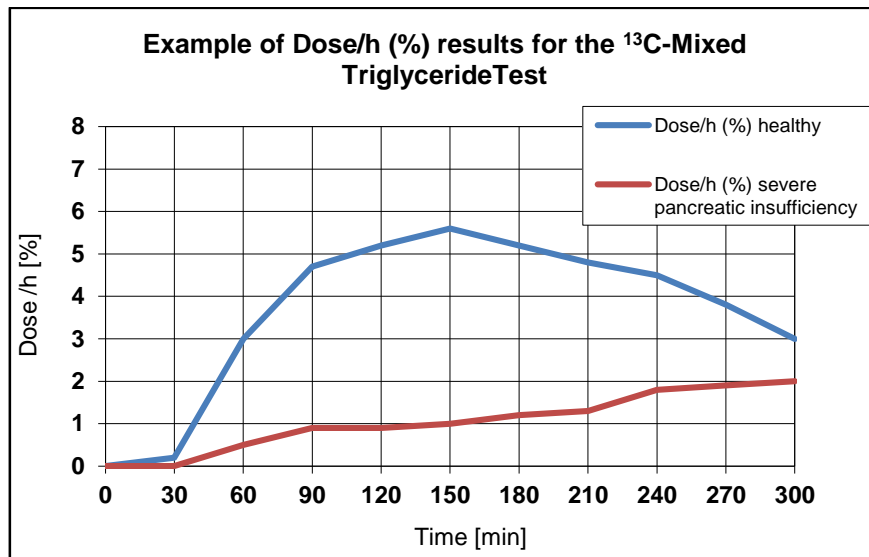


Fig. 1: Example of <sup>13</sup>C-Mixed Triglyceride breath test, Dose/h curve (see Löser et al. <sup>5</sup>)

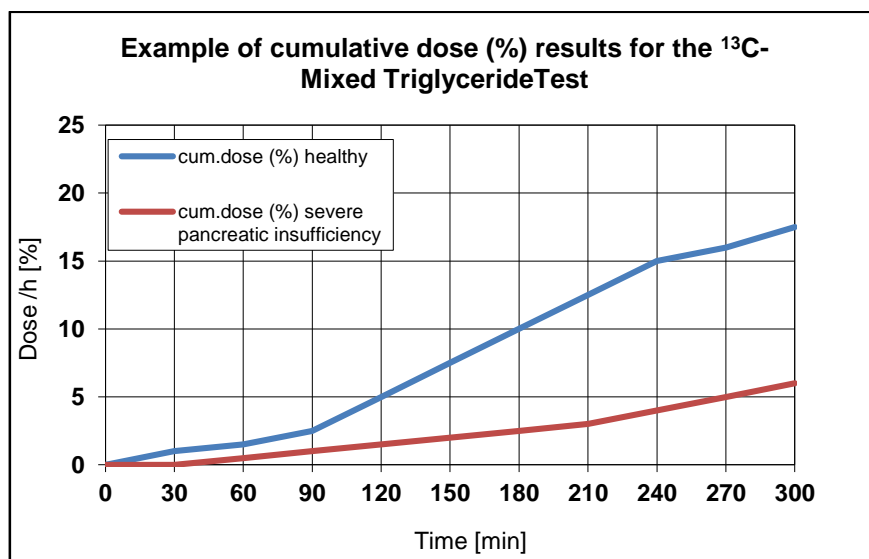


Fig. 2: Example of <sup>13</sup>C-Mixed Triglyceride breath test, cum.dose curve (see Löser et al. <sup>5</sup>)

As the results are dependent on the test set-up and the population, it is strongly recommended that each laboratory establishes its own reference values.

## References

1. Swart, G. R. *et al.* Evaluation studies of the <sup>13</sup>C-mixed triglyceride breath test in healthy controls and adult cystic fibrosis patients with exocrine pancreatic insufficiency. *Digestion* 58, 415–420 (1997).
2. Van Dijk-van Aalst, K. *et al.* <sup>13</sup>C mixed triglyceride breath test: a noninvasive method to assess lipase activity in children. *J. Pediatr. Gastroenterol. Nutr.* 32, 579–585 (2001).
3. Ghoo, Y. F., Vantrappen, G. R., Rutgeerts, P. J. & Schurmans, P. C. A mixed-triglyceride breath test for intraluminal fat digestive activity. *Digestion* 22, 239–247 (1981).
4. Vantrappen, G. R., Rutgeerts, P. J., Ghoo, Y. F. & Hiele, M. I. Mixed triglyceride breath test: a noninvasive test of pancreatic lipase activity in the duodenum. *Gastroenterology* 96, 1126–1134 (1989).
5. Löser, C., Brauer, C., Aygen, S., Hennemann, O. & Fölsch, U. R. Comparative clinical evaluation of the <sup>13</sup>C-mixed triglyceride breath test as an indirect pancreatic function test. *Scand. J. Gastroenterol.* 33, 327–334 (1998).
6. Keller, J., Brückel, S., Jahr, C. & LAYER, P. A modified <sup>13</sup>C-mixed triglyceride breath test detects moderate pancreatic exocrine insufficiency. *Pancreas* 40, 1201–1205 (2011).
7. Riecke, B., Neuhaus, P. & Stockmann, M. Major influence of oxygen supply on <sup>13</sup>CO<sub>2</sub>:<sup>12</sup>CO<sub>2</sub> ratio measurement by nondispersive isotope-selective infrared spectroscopy. *Helicobacter* 10, 620–622 (2005).