Lipase

Lipase (triacylglycerolacylhydrolase, EC 3.1.1.3) is a glycoprotein with 420,449 amino acid residues and a molecular weight of 46,000–56,000 for pancreatic lipase and 32,000–39,000 for serum lipase.

It is a hydrolytic enzyme that cleaves triacylglycerols with fatty acids with a chain longer than 12 carbons, in the presence of bile acids it cleaves fat into monoacylglycerols and diacylglycerols. The cleaving of fatty acids in the *sn*-1 and *sn*-3. positions are prefered . Similiarly to α-amylase lipase is produced by pankreatic glandular cells and secreted into the intestinal lumen in pancreatic juice. The concentration gradient between pancreatic tissue and serum lipase is about 20,000: 1.

Serine in the Asp-His-Ser chain is necessary for enzymatic hydrolysis; The pH optimum is between 7.5 and 10, depending on the reaction conditions; The pI value of the described enzyme forms is between 5.80 and 7.4. In addition to pancreatic lipase, there are other forms of triacylglycerol lipase, such as liver lipase, which can be distinguished by atoxyl inactivation (pancreatic lipase is resistant).

Determination of lipase activity

Determination of lipase activity involves various procedures:

- enzymatic cleavage of the natural substrate;
- enzymatic breakdown of chromogenic and fluorogenic substrates;
- immunological methods (ELISA, latex agglutination).

Nephelometric and turbidimetric turbidimetric techniques based on the cleavage of the natural substrate triacylglycerol are most commonly used . Most lipase enzyme assay kits also contain co-lipase. The turbidimetric determination of lipase activity is based on the clarification of the oil emulsion by the action of lipolytic activity. However, this process can also be influenced by other components of the serum, such as the so-called clarification factor pseudolipase. These are most often circulating IgM type imunokomplexes. For the differential determination of serum pancreatic lipase in addition to pseudolipase using a standard turbidimetric procedure, a procedure based on the inactivation of pseudoplipase by β-mercaptoethanol was developed, which leads to the dissociation of IgM complexes. Newer chromogenic assays are based on an enzyme cascade of lipase that cleaves 1,2-diacylglycerol, glycerol kinase, glycerol-3-phosphate oxidase, and peroxidase with a chromogenic product. A completely new type of technique for the determination of pancreatic lipase is based on changing the conductivity of the solution by releasing fatty acids from the substrate - triolein; it is detected by an acoustic sensor and the measured value is the frequency response.

Normal values

up to 1 μkat / l

Clinical significance

Lipase determination is of clinical importance especially in acute pancreatitis, but it is used significantly less diagnostically than α-amylase determination. The main reason is the technical problems that the lipase determination brought until recently. For these reasons, a number of very different methods for the determination of lipase have emerged, the results of which are very difficult to compare and standardize, as an example, reference limits. However, the diagnostic benefit of determining pancreatic lipase levels is significantly higher than that of α-amylase. Serum lipase levels remain significantly longer than amylase levels after acute pancreatitis (increased lipase activity after 14 days is described). Due to the fact that serum lipase has its origin mainly in pancreatic cells, its determination provides a significantly higher specificity, comparable to the specificity of the pancreatic isoenzyme α-amylase. In urine, lipase is undetectable and not determined by conventional procedures. The macroform also exists for lipase, but again this assay is not used diagnostically. Determination of stool lipase as a marker of pancreatic function has also not been successful. Due to the high specificity, the immunological detection of lipase is designed for practice, especially in the field of acute medicine, by a simple latex test.

Links

- ws: Lipáza

Source

- with permission of the author taken from KOCNA, Petr. *GastroLab : MiniEncyclopedia of laboratory methods in gastroenterology* [online]. ©2002. The last revision 2011-01-08, [cit. 2011-03-04]. <http://www1.lf1.cuni.cz/~kocna/glab/glency1.htm>.

Reference

- CARROLL, Jennifer K – HERRICK, Brian – GIPSON, Teresa. Acute Pancreatitis: Diagnosis, Prognosis, and Treatment. *American Family Physician* [online]. 2007, vol. 75, no. 10, p. 1513-1520, Available from <https: //www.aafp.org/afp/2007/0515/p1513.pdf>. ISSN 0002-838X.
- YAMADAA, Magohei – FUJITA, Toshio. New procedure for the measurement of pancreatic lipase activity in human serum using a thioester substrate. *Clinica chimica acta.* 2007, vol. 383, no. 1-2, p. 85-90, ISSN 0009-8981.
- AL-BAHRANI, Ahmed Z – AMMORI, Basil J. Clinical laboratory assessment of acute pancreatitis. *Clinica chimica acta.* 2005, vol. 362, no. 1-2, p. 26-48, ISSN 0009-8981.
- SMITH, Ross C – SOUTHWELL-KEELY, James – CHESHER, Douglas. Should serum pancreatic lipase replace serum amylase as a biomarker of acute pancreatitis?. *ANZ journal of surgery* [online]. 2005, vol. 75, no. 6, p. 399-404, Available from <https: //onlinelibrary.wiley.com/doi/pdf/10.1111/j.1445-2197.2005.03391.x? cookieSet = 1,>. ISSN 1445-1433.
- WALKOWIAK, J – LISOWSKA, A – PRZYSLAWSKI, J. Faecal elastase-1 test is superior to faecal lipase test in the assessment of exocrine pancreatic function in cystic fibrosis. *Acta paediatrica.* 2004, vol. 93, no. 8, p. 1042-1045, ISSN 0001-656X.
- GRANDVAL, P – DE CARO, A – DE CARO, J. Critical evaluation of a specific ELISA and two enzymatic assays of pancreatic lipases in human sera. *Pancreatology.* 2004, vol. 4, no. 6, p. 495-503, ISSN 1424-3903.
- WALKOWIAK, J – NOUSIA-ARVANITAKIS, S – LISOWSKA, A. Serum lipase after secretin stimulation detects mild pancreatic involvement in cystic fibrosis. *Journal of pediatric gastroenterology and nutrition.* 2004, vol. 38, no. 4, p. 430-435, ISSN 0277-2116.
- WALKOWIAK, J – HERZIG, KH – STRZYKALA, K. Comparison of the elasticity of elastase-1 and lipase labeling in the stool. *Development age medicine.* 2003, vol. 7, no. 2, p. 149-155, ISSN 1428-345X.
- STEINHAUER, JR – HARDY, RW – ROBINSON, CA. Comparison of non-diglyceride- and diglyceride-based assays for pancreatic lipase activity. *Journal of clinical laboratory analysis.* 2002, vol. 16, no. 1, p. 52-55, ISSN 0887-8013.
- PANTEGHINI, Mauro – CERIOTTI, Ferruccio – PAGANI, Franca. Recommendations for the routine use of pancreatic amylase measurement instead of total amylase for the diagnosis and monitoring of pancreatic pathology. *Clinical Chemistry and Laboratory Medicine* [online]. 2002, vol. 40, no. 2, p. 97-100, Available from <https: //www.degruyter.com/doi/abs/10.1515/CCLM.2002.017>. ISSN 1434-6621.
- TREACY, John – WILLIAMS, Anthony – BAIS, Renz. Evaluation of amylase and lipase in the diagnosis of acute pancreatitis. *ANZ Journal of Surgery* [online]. 2001, vol. 71, no. 10, p. 577-82, Available from <https: //onlinelibrary.wiley.com/doi/pdf/10.1046/j.1445-2197.2001.02220.x>. ISSN 1445-1433.
- PEZZILLI, R – TALAMINIL, G – GULLO, L. Behavior of serum pancreatic enzymes in chronic pancreatitis. *Digestive and Liver Disease.* 2000, vol. 32, no. 3, p. 233-237, ISSN 1590-8658.
- KEIM, V – TEICH, N – FIEDLER, F. A comparison of lipase and amylase in the diagnosis of acute pancreatitis in patients with abdominal pain. *Pancreas.* 1998, vol. 16, no. 1, p. 45-49, ISSN 0885-3177.
- – ARZOGLOU, P – RAMOS, P. Preparation and characterization of reference materials for human pancreatic lipase: BCR 693 (from human pancreatic juice) and BCR 694 (recombinant). *Clinical chemistry and laboratory medicine.* 2003, vol. 41, no. 2, p. 169-176, ISSN 1434-6621.
- CHASE, CW – BARKER, DE – RUSSELL, WL. Serum amylase and lipase in the evaluation of acute abdominal pain. *The American surgeon.* 1996, vol. 62, no. 12, p. 1028-1033, ISSN 0003-1348.
- MALFERTHEINER, P – ENRIQUE DOMÍNGUEZ-MUÑOZ, J. Clinical and laboratory diagnosis of acute pancreatitis. *Annali italiani di chirurgia.* 1995, vol. 66, no. 2, p. 165-170, ISSN 0003-469X.