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Formation Of Pancreas Secretory Activity And Enzyme Homeostasis In Postnatal Ontogenesis

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Abstract

Experiments were performed on white, outbred rats of different ages (15 days, 1 month, 2 months, 3 months and 4 months). After reaching a certain age, they were decapitated under anesthesia and their pancreas was removed. During decapitation, blood was collected. Amylolytic and lipolytic activity was determined in the filtrate and blood serum, the activity of these enzymes was studied in postnatal ontogeny in the pancreas and blood. Amylase and lipase enzymes were fully formed in the pancreas of rats at the age of 4 months, and in the blood at 3-4 months of age. These changes in the amylolytic and lipolytic activities in the pancreatic tissue and blood of rats depend on the change in their feeding pattern (transition from lactotroph to mixed diet), increased energy expenditure, and changes in the enteropancreatic recirculation of these enzymes.

Key words: *The pancreas, enzyme, homeostasis, postnatal ontogeny.*

The relevance of work: The pancreas synthesizes protein at a very high rate. 90% of this secretory protein is enzyme protein, synthesized in acinar cells.

If calculated as dry matter, 20 mg of enzyme or 107 enzyme molecules are synthesized in acinocytes per hour [13]. According to S. Rothman et al. [17], enzyme protein cannot be synthesized in the pancreas at such a rate, and a large part of the enzymes secreted into the intestine are reabsorbed into the blood, from where they pass into the gland and are again secreted into the juice

That is, enteropancreatic circulation of enzymes, such as bile acids, occurs. In humans, 6-20 g of digestive enzymes from pancreatic juice enter the duodenum per day [6].

Pancreatic juice contains enzymes that hydrolyze all the macronutrients (proteins, fats, carbohydrates) that humans consume.

Our recognition of the "endo-exocrine principle" (duocrine) [13] of the digestive glands emphasizes that the enzymes of these glands are present in the blood. Digestive enzymes that enter the blood are in different states: zymogenic, activated or inactive, bound or unbound to specific inhibitors, adsorbed or unadsorbed to plasma proteins and shaped elements, and free from such bonds. The degree of such bonds varies among different enzymes.

The release of hydrolytic enzymes into the blood is based on several mechanisms. The first of these is that enzymes are absorbed into the blood from the small intestine [1; 2; 3; 4; 15; 16; 17]. According to V. Varro [18], the reason for the appearance of digestive enzymes in the blood is the fragmentation of glandulocytes, that is, apoptosis of glandulocytes.

The next mechanism is the secretion of enzymes in the glands, that is, the enzymes move from the acinus and small excretory channels to the interstitium, and from there to the blood and lymph [8; 9; 10; 11; 12; 16; 17].

This depends on the ratio of transport pathways, the functional state of the gland and small intestine, the permeability of their histohematological barriers, the pressure in the excretory tract, the level of blood supply to the gland, and other stress factors.

In clinical and diagnostic practice, enzymes whose synthesizing organs and cells are known are determined in the blood. The category of such enzymes includes gastric proteinase (pepsinogen), salivary α-amylase, pancreatic proteinases (trypsin, chymotrypsin, elastase), lipase and α-amylase [7].

The purpose of work: It consists in studying the formation of the activity of hydrolytic enzymes in the pancreas and blood of rats of different ages.

Methods of conducting experiments on animals: The experiments were done on white, outbred rats of various ages in the institute's vivarium. The rats were controlled from birth and fed a diet consisting of protein, fat, and carbohydrates. After reaching certain ages (15 days, 1 month, 2 months, 3 months, and 4 months), they were decapitated under anesthesia and their pancreases were removed. During decapitation, blood was collected.

The glands were mixed with physiological saline in a ratio of 1:10 to prepare a homogenate. Amylolytic and lipolytic activity in the filtrate and blood serum was determined by colorimetric method. The results were compared with the indicators of 15-day-old rats, and the formation of the activity of these enzymes in the pancreas and blood during postnatal ontogenesis was analyzed.

Analysis of the obtained results: Age-related changes of amylolytic and lipolytic activity in pancreatic tissue and blood serum of rats of different ages are reflected in table 1.

Table № 1

Index of hydrolytic enzymes in pancreatic homogenate and blood serum of rats of different ages (M±m)

The age of rats	The pancreas homogenate		Blood serum	
	Amylase	Lipase	Amylase	Lipase
15 кунлик	166,6±6,5	187,2±4,2	46,4±5,1	28,2±1,6
1 ойлик	332,0±11,0**	131,8±7,2**	59,3±4,6	25,4±4,5
2 ойлик	295,0±23,0**	205,0±24,0	61,8±5,1	44,4±5,1*
3 ойлик	364,3±13,0**	176,5±18,1	79,3±1,9**	41,2±0,7**
4 ойлик	1427,0±81,0**	242,0±16,0*	68,8±3,0*	39,6±1,5**

Definition *reliability level of the difference of enzyme activity of rats of different ages from the 15-day rat index.

It depends on physiological processes in the body, including changes in the activity of digestive enzymes (α-amylase, lipase), growth and development of the digestive tract, formation of the control process, metabolic shifts, and the influence of the external environment. Enzyme activity depends on the formation of organs in young organisms, metabolic stability in mature organisms, and involution of glandular cells in old organisms.

Among the animals we tested, the youngest were 15-day-old rats, and their performance was compared with that of other age groups. The activity of enzymes (amylase, lipase) studied in our experiments changed in pancreatic homogenate and blood serum as the age of rats increased. The amylolytic activity in glandular tissue was almost doubled in 1-month-old rats compared to 15-day-old rats and remained at the same level in 2-3-month-old rats.

Amylolytic activity in the pancreatic tissue of 4-month-old rats reached its highest level, 8.5 times higher than that of 15-day-old rats, and 4.3 times higher than that of 1-3-month-old rats.

So, 4-month-old rats have reached a mature level, and the activity of the amylase enzyme synthesized in the pancreas has reached a level that can fully support the metabolism of carbohydrates in this organism.

Age-related changes in blood amylolytic activity were somewhat different. This is because amylolytic activity in the blood is formed by pancreatic (P) and salivary (S) α-isoamylases. They have a species-specific quantitative ratio, and in human blood the ratio of these isoamylases is almost equal [7].

In our observation, the amylolytic activity in the blood of rats of different ages had age-related characteristics. The lowest values were observed in 15-day-old, 1-month-old, and 2-month-old rats (Table 1). The amylolytic activity in the blood of 3-4-month-old rats increased by 50-70% compared to those of 3-4-month-old rats.

The majority of amylase in the blood is bound to plasma proteins. The presence of amylase bound to proteins depends on their affinity for each other, and this state keeps the enzyme in a kind of depot.

In hypoamylasemia, their affinity increases and the protein-bound portion of amylase in the blood increases. Protein-bound amylase circulates in the blood and its renal excretion is reduced because the protein-bound enzyme cannot be filtered by the glomerular membrane of the nephron. In hyperamylasemia, the binding of amylase to protein decreases, making it easier to excrete through the kidneys.

The second enzyme we studied was lipase, and we studied its activity in pancreatic tissue in laboratory animals of different ages.

Lipolytic activity in the pancreatic tissue of rats of different ages in our study had age-related characteristics. The lowest index was observed in 1-month-old rats (Table 1), whose blood lipolytic activity was significantly reduced compared to 15-day-old rats.

Lipolytic activity in the pancreatic tissue of 2- and 3-month-old rats was comparable to that of 15-day-old rats. This activity in the blood of 4-month-old rats increased by 30-40% compared to 15-day-old rats.

Lipase is secreted into the blood mainly from the pancreas. [5]. Human blood lipase is a product of many glands, including the liver [3].

Lipolytic activity in the blood of rats of different ages had a specific pattern. In 15-day-old and 1-monh-old rats, the activity of this enzyme in the blood was at its lowest level, while in 2-4-month-old rats, this activity increased by 40-60%.

The conclusion: It can be concluded that these changes in amylolytic and lipolytic activities in the pancreatic tissue and blood of rats are associated with changes in their feeding pattern (switching from lactotrophic to mixed feeding), increased energy expenditure, and changes in the recirculation of these enzymes between the pancreas and the blood.

The list of the used literature

1. Aliev A.A. Lymph and lymphobrashchenie u produktovykh jivotnykh.-L.: Nauka. - 1982. -288p.
2. Blagovidov D.F., Sarkisov D.S. Compensatory processes after resection of the pancreas. - M.: Medicine, 1976.-136p.
3. Gubergritz N.B. Practical pancreatology. Donetsk. 2008. 318 p.
4. Korotko G.F., Kovalenko O.K. Hydrolysis of lymph and incretion of pancreatic enzymes // Physiol. Journal. USSR - 1978. - T.63, No. 11. -S.41-49.
5. Korotko G.F. Fermenty pishchevaritelnykh zhele v krovi (essay on enzyme homeostasis). Tashkent: Medicine. 1983. 212 p.
6. Korotko G.F. Secretion podjeludochnoy signs. 2nd dop. Izd. Krasnodapr: Izd. KGMU. 2005. 256p.
7. Korotko G,F. Secretion slyunnyx izlej i elementi salivodiagnostikei. M.: ID Academy Estestvoznania. 2006,192 p.
8. Korotko G.F. Recirculation fermentov pishchevaritelnyx indicated. - Krasnodar. 2011. 143p.
9. Makarova T.M., Voskanyan S.E., Korotko G.F., Sapin M.R. Morphofunctional determinants of vnutriprotokovy regulation of salivary and subventricular secretions. Quick. doc. Vseros. Nauchno-prakticheskoy conference "Physiological science - clinical gastroenterology", Essentuki, 2001.- P.83.
10. Permyakov N.K., Podolsky A.E., Titova G.P. Ultrastructural analysis of the secretory cycle of the pituitary gland. - M.: Medicine, 1973. - 238p.
11. Pulatov A.S. Secretsiya i recretsiya fermentov tonkoy kishki i rol v ee deyatelnosti inkretiruemoy amilazy. Autoref. Diss. Doc. Med. Nauk. - Kazan, 1978. 26p.
12. Ransberger K., Noy S. Enzyme and enzyme therapy. Munich. Med. Obshch. Izuch. Enzymov. 1994. – 243 p.
13. Shechtman M.M., Korotko G.F., Burkov S.G. Physiology and pathology of organ pishchevarenia and iberemennyx. - Tashkent: Medicine, 1989. - 160 p.
14. Gorelick FS, Jamieson JD. Structure-function relationship of the Pancreas. In: Physiol. Of the gastrointestinal tract (Sec. ed.). Raven-Press-New York. - 1986. - Vol. 2. – P. 1089-1108..
15. Hara H., Narakino H. Enhancement of pancreatic secretion by dietary protein in rats with chronic diversion of bile-pancreatic juice from the proximal small intestine // Pancreas.-1994. - Vol. 9. -No. 2. -P. 275-279.
16. Miyasaka K., Nakamura R., Funakoshi A. et al. Stimulatory effect of monitor peptide and human pancreatic secretory trypsin inhibitor on pancreatic secretion and cholecystokinin release in conscious rats // Pancreas/ -1989. Vol. 4. No. 2. - P. 139-144.
17. Rothman S.S. Passage of proteins through membranes old assumptions and new perspectives // Am. J. Physiol. - 1980. - V. 238. - P. 391-402.