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THE PANCREATIC ENZYME SECRETION AND ITS IMPORTANCE IN PROCESS OF HOMEOSTASIS

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Relevance of the work The acinar (acinose) and ductular (excretory) cells of the pancreas produce proteins, primarily enzymes, that are part of the juice, while the latter produce electrolytes, particularly bicarbonates, which are of great functional importance. The mechanism of action of these cells varies, producing products of different composition [3; 4].

Key words: Enthyme, secretion, hopmeostasis, pancreas.

ME'DA OSTI BEZINING FERMENT SEKRETSIYASI VA UNING GOMEOSTAZDAGI AHAMIYATI

Me'da osti bezi shirasi uning atsinar (atsinoz) va duktular (chiqaruv yo'li) hujayralarining mahsulidir. Birinchi qismi – shira tarkibidagi, asosan fermentlardan iborat bo'lgan, oqsillarni, ikkinchi qismi esa - elektrolitlarni, funksional jihatdan muhim ahamiyat kasb etuvchi bikarbonatlarni ishlab chiqaradi. Tarkib jihatdan har xil mahsulotlarni ishlab chiqaruvchi bu hujayralarning faoliyat mexanizmi farqlidir [3; 4].

Kalit so'zlar: ferment, sekretsiya, gomeostaz, me'da osti bezi.

СЕКРЕЦИЯ ФЕРМЕНТОВ ПОДЖЕЛУДОЧНОЙ ЖЕЛЕЗЫ И ЕЕ ЗНАЧЕНИЕ В ГОМЕОСТАЗЕ.

Сок поджелудочной железы является продуктом ее ацинарных и протоковых клеток. Первая часть производит белки, которые представляют собой в основном ферменты, содержащиеся в соке, а вторая часть производит электролиты и функционально важные бикарбонаты. Механизм действия этих клеток, продуцирующих разные по содержанию продукты, различен [3; 4].

Ключевые слова: фермент, секреция, гомоестаз, поджелудочная железа.

INTRODUCTION.

There are multiple cycles in the secretory activity of merocrine and micromerocrine acinous cells. N.K. Permyakov and colleagues [5] state that secretory activity is divided into five stages: the admission of essential substances into cells, the production of primary sap, the accumulation of sap, the transportation of sap, and the release of sap.

To a certain degree, these cycles are conditional; they are continuous and lack cellular synchronization. Divergent views exist about the secretory cycle and its cycles [7; 8].

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MATERIALS AND METHODS

With the exception of the mammary gland during lactation, the rate of protein synthesis in the pancreatic cells is significantly higher than that of any other organs in the body. Protein is one of the high-molecular compounds found in pancreatic juice. The granular endoplasmic reticulum (GER) membrane contains ribosomes, which are responsible for the synthesis of secretory proteins. The secretory cycle, which repeats itself—the synthesis, production, transport, and secretion of sap—begins with secretory protein synthesis.

Incorporation of 3H-leucine to the protein began to be seen in the GER 5-7 minutes after administration, Golgi 7-17 minutes after, zymogen granules 17-37 minutes after, and protein in the juice 47-90 minutes after. Pallade had previously shown incorporation of a protein precursor, 3H-leucine, into the pancreas [3; 4].

Secretory pancreatic proteins represent 90% of all proteins synthesized in acinar cells and the rest are in the form of enzymes. If calculated as dry matter, acinar cells produce 20mg of enzymes, which is 107 molecules of enzymes per minute [9].

A large portion of the enzymes released from the pancreas into the intestine are absorbed into the blood and secreted from there as part of the pancreatic juice, according to S. Rothman and co-authors [12], who also claim that such a rapid synthesis of enzyme proteins in the pancreas is unlikely to be realistic. In other words, enteropancreatic enzyme circulation is seen, which is comparable to enterohepatic bile acid circulation.

Pancreatic juice provides 6–20 g of digestive enzymes to the human duodenum daily [3; 4]. Through two mechanisms, the pancreas helps maintain the blood's hydrolytic enzyme homeostasis. The first is when the gland releases hydrolytic enzymes into the bloodstream, and the second is when the blood absorbs them again.

RESULTS AND DISCUSSION

The secretory function of the pancreas is well documented [1; 10; 11; 12; 13]. One of the processes that guarantees the stability of the cytoplasmic composition is resection. One of the oldest roles of the cell, excretion, evolved into the process of resection, which maintains the balance of hormones and enzymes in the internal environment of multicellular organisms.

Physiologically active substances are released into the internal environment by a variety of cells in the body, not just endocrine and neuroendocrine cells [2]. The newly released collection "Mechanisms of passage of substances in the blood through the salivary gland membrane barrier" from the VSM Biochimmak IBL-Hamburg company demonstrates:

1. Acinar cells are traversed by substances with a molecular weight of less than 1900 D;
2. Filtration allows substances weighing less than 400 D to pass through the cell membrane’s pores.
3. selective movement across the cell membrane; a) lipophilic molecules passively diffusing (e.g. G. steroids) via the membrane of the cell; b) active transport via protein channels (e.g. G. peptides); c) enzyme pinocytosis.

It is stressed that the three previously mentioned mechanisms (a, b, and c) are responsible for the selective transport of reabsorption.

Any material, including glandular products, can be transported by glandulocytes from the blood and interstitial fluid and secreted into the juice. Our lab has demonstrated that the state of the enzymes, whether they are free or bound to blood proteins, determines how much of them are secreted by the kidneys and extrarenal system [94, 103, 204].

The blood's protein-enzyme binding dynamics are distinct; it rises during hypofermentation and falls during hyperfermentation. A specific quantity of the injected

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enzymes is carried in the bloodstream attached to proteins and formed elements. Enzyme homeostasis and the preservation of blood enzyme depots are significantly impacted by this variable binding.

Resecretion is another term for the process by which the secretions of different glands or the endosecretory products of a specific gland can be carried through the blood [85]. Physiologically active substances must be transported into glandulocytes by their membrane carriers.

When it comes to producing enzymes, protein-synthesizing glands outperform electrolyte-synthesizing glands.
This implies that "their" products are expelled by the glands more quickly than "foreign" ones. Hepatocytes' excretion of bile acids is a glaring illustration of this.

While the enteroglandular and glandulohematoglandular circulation of enzymes is only discussed in specialized scientific articles or monographs, the enterohepatic circulation of bile acids and bile pigments is well known and even covered in textbooks.

Studying how the pancreas maintains enzyme homeostasis is the goal. techniques used in research. Twenty (intact) adult male white laboratory rats weighing 150–200 g were examined for hydrolytic enzymes in their pancreas and serum.

The rats were not subjected to any external influences. The rats were housed in the department's vivarium and fed a diet high in carbohydrates and proteins. The rats' cages were always stocked with water .

Rats were put to sleep and then decapitated. Then the pancreas was separated. After the decapitation, the blood that was released was gathered. In order to create a homogenate, it was combined with physiological solution in a 1:10 ratio to the gland's weight.
The enzyme activity of lipase, amylase, and total protease as well as the amount of total protein in the filtrate were assessed after the homogenate was filtered. At the same time, we looked at the blood's total protein content and the activity of the enzymes lipase and amylase.

The proportion of 1 gram of pancreatic mass was used to measure enzyme activity, and the relationship between the enzymes in the pancreas and blood was investigated.
analysis of the outcomes. According to our findings in the experimental rat control group (Table 1), amylolytic activity (1460±56.0 units/g) has the highest index among the enzymes in the pancreatic tissue homogenate. Acinocytes produce this enzyme, which hydrolyzes the β-1,4-glucoside bonds in carbohydrates.

The hydrolysis of starch results in the formation of amylase, maltotriose, and dextrins. Salivary amylase aids in the initial hydrolysis of carbohydrates in the stomach, pancreatic β-amylase aids in the subsequent process, and multiple disaccharidases aid in the intestinal step.
Rat pancreatic tissue homogenate showed total proteases as the second most active enzymes (230.0±6.1 units/g). Trypsinogen, hemotrypsinogen, procarboxypeptidases, and proelastases are examples of proteolytic enzymes that are produced in the pancreatic acinocytes and released into the duodenum in an inactive, zymogenic state. Acinocytes produce this enzyme, which hydrolyzes the β-1,4-glucoside bonds in carbohydrates.

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Total proteases were the second most active enzymes in the rat pancreatic tissue homogenate, with 230.0±6.1 units/g.

Proteolytic enzymes are produced in the pancreatic acinocytes and released into the duodenumas procarboxypeptidases, hemotrypsinogen, trypsinogen, and proelastases in a zymogenic, inactive state.

Table 1

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Enzyme activity in rat pancreatic tissue homogenate at rest (control group) in μl/g (M±m) n=5

№	Enthymes	The homogenate of pancreas
1	Amilase	1460±56,0
2	Lipase	70,1±3,1
3	General protease	230,0±6,1
4	General protein	4,5±0,3
5	Bicarbonates	10,0±0,4

Note: n=5 the number of rats

Trypsin was produced from the trypsinogen molecule. As soon as the first trypsin is formed, trypsinogen becomes more activated. I. Morozov. 1. demonstrated that proenteropeptidase, also known as proenterokinase, is produced in enterocytes and released into microvilli [130]. Trypsinogen-enteropeptidase is activated by this enzyme, which is activated by another enteral enzyme called duodenases. Trypsin is the enzyme that activates the remaining proteolytics.

In the rat pancreatic tissue homogenate, the lipase enzyme (70.1±3.1 IU/g) is the third most active enzyme. The primary and exclusive enzyme that hydrolyzes triglycerides in food is pancreatic lipase. Triglycerides are insoluble in water, so lipase has an impact on the fat's surface. The rate at which a fat droplet is hydrolyzed increases with its surface area. As a result, bile acid-activated lipase is essential for the breakdown of fat particles. In acinocytes, this enzyme is produced and released in an active form.

In contrast to phospholipases, lipase is limited to acting on emulsified triglycerides and is unable to act on the gland's acinar cells. Intestinal lipolysis also greatly depends on colipase. In the first section of the small intestine, colipase binds to lipase under the influence of bile acids, increasing its activity and lowering its pH optimum from 9 to the actual 6-7 degrees.
Colipase promotes lipase activity in the microvilli region, aids in its adsorption to the small intestine's mucous membrane, and stops it from migrating in the chyme's aboral direction. Pancreatic tissue had a total protein content of 4.5±0.3 mg/g (Table 3.1). It has been observed that the pancreas produces a lot of proteins, with 90 percent of them being enzyme proteins, which are synthesized in acinar cells [106,107].

Salivary glands, the stomach, the pancreas, the liver, and the small intestinal glands all release hydrolytic enzymes into the bloodstream [106]. The pancreatic glands (β-amylase, lipase, trypsinogen, and trypsin inhibitors) and the gastric glands (pepsinogens 1 and 2) are the most researched and diagnostically significant of these.

Pancreatic enzymes enter the bloodstream through a number of pathways, including the small intestine, broken-up acinocytes, gland secretion, and acinocyte enzyme secretion. These processes may occur in varying amounts, depending on the gland's and the small intestine's functional state, the permeability of their histohematological barrier, the pressure in the excretory tract, and the amount of blood supply. The blood of rats in the control group had lipolytic activity of 16.0±0.2 and amylolytic activity of 560.0±11.0, as shown in Table 2.

Blood has a high level of amylolytic activity and a significantly lower level of lipolytic activity, which is the same pattern of enzyme activity seen in pancreatic tissue (Table 3.3). But compared to the activity in the pancreatic tissue, their quantity in the blood is many times lower. This suggests that the pancreas is a major contributor to the origin of these blood enzymes, as they are secreted into the bloodstream during this process. The presence of a positive correlation between these enzymes' activity in the pancreatic tissue homogenate and blood (Table 3.3) supports the aforementioned conclusion.

This measure is r=0.64 for amylolytic activity and r=0.48 for lipolytic activity. The blood's total protein content is many times greater than the pancreatic tissue's total protein content. Its content in the blood is significantly higher, at 60.1±2.7, if the indicator in the pancreas is 4.5±0.3. The total protein in blood and pancreatic tissue hardly correlates with one another; the correlation coefficient is r=0.18. This is so because blood's total protein is made up of both blood-specific proteins and enzyme proteins. Blood's total protein content is many times greater than this measure in pancreatic tissue.

If the indicator's value in the pancreas is 4.5±0.3, it is much higher in the blood (60.1±2.7). r=0.18 indicates that there is essentially no correlation between the blood and the total protein in the pancreatic tissue. This is because blood-specific proteins are included in the total protein content of the blood in addition to enzyme proteins.

Table 2

In a resting state (control group), the activity of enzymes in rat blood serum was measured in units of µl/ml (µm) n=5

№	Enthymes	Blood serum
1	Amylase	560,0±11,0
2	Lipase	16,0±0,2
3	General protein	60,1±2,7

Table 3

Pancreatic tissue homogenate and blood serum correlation between enzyme activity and total protein amounts (R±mr)

№	Enthymes	Correlational coefficient
1	Amylase	0,60
2	Lipase	0,48
3	General protein	0,80

CONCLUSION

The following conclusions can be made based on the analysis of our findings:

1. Proteins, fats, and carbohydrates are nearly all hydrolyzed by the enzymes produced by the rat pancreas. The composition of pancreatic juice differs in their ratio. The highest amylolytic activity, proteolytic activity, and lowest lipolytic activity are all found in the juice.

2. The presence of amylase and lipase enzymes in the blood is several times lower than in the pancreatic tissue; however, there is a correlation between the two, and the positive and high correlation coefficient suggests that the pancreas secretes these enzymes into the blood.

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