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DEPENDENCE OF PANCREAS SECRETION ON EXTERNAL TEMPERATURE AND INSOLATION

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Abstract

High temperature and insolation as a climatic factor have a significant impact on the body. The reaction of the body to the action of high temperature and insolation is extremely diverse and complex. Under their influence, water-salt metabolism is disturbed, which leads to profound changes in the activity of the cardiovascular system, digestive and excretory organs, the morphological composition and properties of blood change. [1; 2; 3; 4; 5; 6; 7].

High temperature and insolation in our region is considered as one of the most important environmental factors. Having a moderate dose of positive - adaptive, to a large extent - damaging effect on nerve endings, melanocytes and other skin formations, indirectly causes various structural changes in the internal organs.

Taking into account the complex mechanism of both physiological and pathological effects of high temperature and insolation, as well as the significant contribution of pancreatic enzymes in the hydrolysis of food products, we determined the purpose of this study.

The aim of the study was to evaluate enzyme homeostasis and secretion of enzymes by the pancreas of rats at high temperature and insolation.

Methods and techniques for conducting experiments and observations.

The experiments were carried out on white laboratory outbred male rats, weighing 180-200 g, in different periods of the year - in autumn (at an ambient temperature of 200 - 250 C) and in summer (at an ambient temperature of 370 - 400 C).

Experimental animals were divided into 2 groups. The first group of intact animals (control group) were not exposed to any effects. The second group of animals was subjected to acute insolation in the sun. The effect of a single 30-minute exposure to the sun in the summer (July) with a radiation power of 10 watts (18,000 watts in 30 minutes) at an air temperature of 370 - 400 C was studied.

The nutrition of control and experimental rats was the same protein-carbohydrate diet. There was always a vessel with drinking water in the cage. Rats

Table 1.*Secretion of enzymes by the pancreas and depending on the ambient temperature*
(M±m, p <)

Enzymes	Temperature 20-25°C (control)	Temperature 37-40°C without insolation	Temperature 37-40°C with insolation
Амилаза ед/г	$\frac{1427 \pm 64,6}{100}$	$\frac{199,9 \pm 5,7(0,001)}{14 \pm 0,4(0,001)}$	$\frac{425,3 \pm 10,0(0,001)}{30 \pm 2,7(0,001)}$
Липаза ед/г	$\frac{65,4 \pm 3,1}{100}$	$\frac{43,0 \pm 2,5(0,001)}{66 \pm 3,7(0,001)}$	$\frac{72,0 \pm 3,1(0,1)}{110 \pm 4,8(0,1)}$
Общая протеаза ед/г	$\frac{221,0 \pm 13,3}{100}$	$\frac{75,9 \pm 1,6(0,001)}{34 \pm 0,7(0,001)}$	$\frac{129,0 \pm 5,7(0,01)}{58 \pm 2,8(0,001)}$
Общий белок мг/г	$\frac{4,4 \pm 0,8}{100}$	$\frac{1,7 \pm 0,07(0,05)}{39 \pm 1,6(0,001)}$	$\frac{0,9 \pm 0,09(0,05)}{20 \pm 2,0(0,001)}$
Бикарбонаты ммоль/л	$\frac{11,0 \pm 0,4}{100}$	$\frac{3,5 \pm 0,2(0,001)}{32 \pm 1,8(0,001)}$	$\frac{7,0 \pm 0,2(0,01)}{64 \pm 2,3(0,001)}$

Note - numerator unit./g
- denominator as a percentage of control indicators.

immediately before slaughter, they were under ether anesthesia and they were killed by decapitation, their blood was collected.

After the animals were slaughtered, their pancreas was removed. Enzymes - amylase, total proteolytic activity, lipase and total protein were determined in the pancreatic homogenate and in the blood serum. Enzymatic activity and total protein content were related to 1 g of glandular tissue, and this was considered as the release (debit) of this enzyme and total protein. The obtained data were compared with control indicators.

The results of the study showed (Table 1) that the high temperature of the external environment inhibits the activity of all the enzymes we studied. But under the influence of the thermal factor, the production of various pancreatic enzymes varies unequally. Thus, at a high external temperature, the enzymatic activity was 14±0.4 for amylase, 66±3.7 for lipase, and 34±0.4 for proteases in percent (against the control data taken as 100%) (against the control data taken as 100%).

Therefore, under the influence of the heat factor, dissociation occurs between the rates of protein synthesis of various enzymes, that is, heat stress affects the protein synthesis of various enzymes in the same animal species in different ways, which probably needs to be taken into account when compiling diets under conditions of exposure to heat. factor a.

In experiments with exposure of rats to the sun, i.e. when the solar-thermal effect was reproduced, somewhat different results were obtained than in experiments with the action of only heat. Under solar-thermal exposure, the lipolytic activity of the pancreas remains unchanged, and the activity of

other enzymes decreases, but the decrease in amylolytic and proteolytic activity is less pronounced than with the action of only one thermal factor.

Suppliers of hydrolytic enzymes into the blood from among the digestive glands are salivary, gastric glands, pancreas, liver and small intestine [3].

Pancreatic enzymes are transported into the blood through several proven mechanisms: from the lumen of the small intestine, from destroyed acinocytes, from the lumen of the ductal system of the gland, and by incretion of enzymes by pancreatic acinocytes. The quantitative ratio of these transport routes may vary depending on the functional state of the gland and small intestine, the permeability of their histohematic barriers, and the level of blood supply to the gland.

The results obtained by us on blood enzymes in rats, depending on the ambient temperature and exposure to insolation, are shown in Table 2. As can be seen from this table, at a comfortable temperature (200 - 250 C, control group), amylase activity in the blood is quite high, it equals 529, 0±14.0. In the blood, lipolytic activity is much lower than its amylolytic activity.

In the blood, the regularity noted by us is repeated in terms of the severity of the activity of the enzymes amylase and lipase in the pancreatic homogenate, i.e. amylolytic activity is much higher than its lipolytic activity. But, their activity in the blood is many times lower than in the pancreatic homogenate. This once again confirms the view that the pancreas is one of the sources of blood enzymes.

The content of total protein in the blood is 67.3±4.3. This means that in the blood this indicator, the content of total protein is much higher than in the homogenate of the pancreas. Not only enzymatic proteins circulate in the blood, but others are also contained.

Table 2. Blood enzyme in rats depending on temperature external environment (M±m, p <)

Enzymes	Temperature 20-25^{0}C (control)	Temperature 37-42^{0}C without insolation	Temperature 37-42^{0}C with insolation
Amylase	$\frac{529,0 \pm 14,0}{100}$	$\frac{227,1 \pm 0,99(0,001)}{43 \pm 0,4(0,001)}$	$\frac{253,2 \pm 2(0,001)}{48 \pm 0,4(0,001)}$
Lipase	$\frac{15,1 \pm 0,2}{100}$	$\frac{4,9 \pm 0,6(0,001)}{32 \pm 3(0,001)}$	$\frac{3,2 \pm 0,1(0,001)}{21 \pm 2(0,001)}$
total protein	$\frac{67,3 \pm 4,3}{100}$	$\frac{61,8 \pm 4,2(0,1)}{92 \pm 6(0,1)}$	$\frac{34,0 \pm 3,9(0,01)}{51 \pm 5,1(0,001)}$

Note - numerator unit./g

- denominator as a percentage of control indicators.

At high ambient temperatures, the activity of enzymes in the blood decreases. Amylolytic activity of the blood of experimental animals is 2.3 times, and lipolytic activity is 3.1 times less than such indicators of control. This means that high temperature suppresses not only the secretion of enzymes, but also reduces their incretion into the blood.

The content of total protein at high temperature remains unchanged.

Somewhat different results were obtained under the combined effect of high temperature and insolation. At the same time, the activity of enzymes in the blood decreases, but their severity is not the same.

With their combined effect on experimental animals, the decrease in amylolytic activity is less pronounced than when exposed to only the thermal factor. And the lipolytic activity of the blood per turnover is more suppressed under the combined solar-thermal effect than under the action of heat alone. Hence it is noticeable that between these enzymes there is a kind of competition, the suppression of the activity of one of them enhances the synthesis of the other. Apparently, the protein synthesis of these enzymes is carried out from one common substrate, the increased consumption for the synthesis of one of them leads to a decrease in the synthesis of the other.

Simultaneous exposure to heat and insolation reduces the content of total protein in the blood. This means that the combined effect of solar-thermal exposure suppresses more protein synthesis in the body of experimental animals. This slows down the protein synthesis of all proteins, not just the enzymatic protein.

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