RESORPTIVE AND DIGESTIVE FUNCTIONS OF THE INTESTINE IN DOGS EXPOSED TO HIGH TEMPERATURES AND INSOLATION

K. Rakhimov

UDC 612.33.014.43

Temporary exposure of dogs to a high temperature (38-40°) and to insolation has no significant effect on the character of elevation of the blood hexose curve after mono-, di-, and polysaccharide loading.

A high air temperature, especially when combined with insolation, inhibits the secretion of digestive enzymes. This raises the question whether hydrolysis of food substances is inhibited also under these conditions.

The object of the present investigation was to study the hydrolytic and resorptive functions of the intestine by carbohydrate loading during exposure to sunlight and heat.

EXPERIMENTAL METHOD

Experiments were carried out in the summer on three dogs with a duodenal fistula. The increase in blood hexose concentration was compared after introduction of a 10% solution of glucose, sucrose, or starch into the intestine in a dose of 1 g/kg body weight at a normal temperature (23-26°) and during exposure of the animal for a short time (2 h) to a high temperature (38-40°) and insolation. Blood was taken from the femoral vein before and 5, 15, 30, and 60 min after injection of the carbohydrates. The blood hexose level was determined by Nelson's method as modified by Ugolev [3] and expressed in mg%.

EXPERIMENTAL RESULTS AND DISCUSSION

The dynamics of elevation of the blood hexose level in one dog at a normal temperature after introduction of the various carbohydrates into the intestine is illustrated in Fig. 1. An increase in blood hexose concentration was found 5 min after loading, to reach a maximum after 15 min, and falling considerably by 60 min.

It is interesting to note that 5 min after introduction of glucose or sucrose into the intestine the increase in the blood hexose concentration was almost identical. The hexose level in samples taken 15 and 30 min after sucrose loading was slightly lower than after administration of glucose. When soluble starch was introduced into the intestine, the increase in hexose concentration was much smaller than after introduction of equivalent doses of glucose or sucrose. Ugolev [3,4] showed that splitting of oligosaccharides takes place mainly on the outer surface of the intestinal cells, thus favoring the rapid absorption of products of hydrolysis. The results now obtained give further evidence that the rate of hydrolysis of disaccharides (sucrose) is not the limiting factor. They also agree with the fact that during hydrolysis of polysaccharides (starch), absorption is limited by the velocity of digestion in the lumen of the intestine and not of contact digestion.

Insolation experiments showed that a short exposure to high temperature and insolation has no significant effect on the character of the blood hexose curve after mono-, di-, and polysaccharide loading (Fig. 2).

However, the actual increase in blood hexose concentration during the first 5 min after administration of glucose was much smaller under these conditions than at a normal air temperature. Later the difference was no longer significant. At a high temperature it is possible that glucose transport is inhibited only in the proximal parts of the intestine, remaining relatively unchanged in the distal parts.

Department of Physiology, Institute of Zoology and Parasitology, Academy of Sciences of the Uzbek SSR, Tashkent (Presented by Academician V. N. Chernigovskii). Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 67, No. 2, pp. 35-37, February, 1969. Original article submitted February 27, 1968.

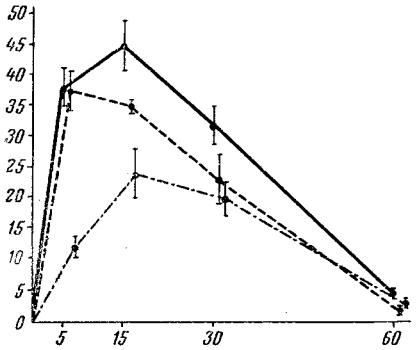

Fig. 1. Blood hexose curve after introduction of glucose (continuous line), sucrose (dashes), and soluble starch (dots and dashes) into the duodenum at a normal temperature. Abscissa, time of taking blood (in min); ordinate, increase in hexose concentration (in mg%).

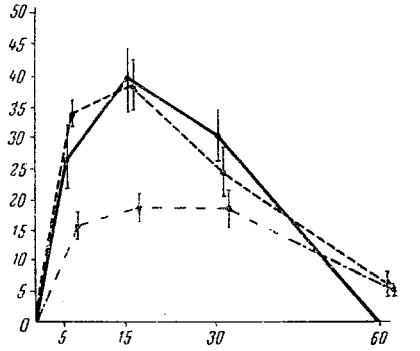

Fig. 2. Blood hexose curve after introduction of glucose, sucrose, and soluble starch into the duodenum during exposure to a high temperature and insolation. Legend as in Fig. 1.

The increase in blood hexose concentration during and after sucrose loading was comparatively constant under different temperature conditions, presumably because of the special nature of the mechanisms of assimilation of these substances. Disaccharides, unlike monosaccharides, are not transported through the intestinal membrane [5], but undergo preliminary hydrolysis by the action of disaccharidases bound to the surface of the intestine [3,4]. The rate of increase of the blood hexose concentration after introduction of disaccharides into the intestine thus depends, above all, on the state of contact digestion.

Acute experiments on albino rats [2] showed that the ability of the intestinal surface to hydrolyze sucrose is unchanged during a short exposure to sunlight and high temperatures.

Hence, neither experiments with sucrose loading nor direct determination of the disaccharidase activity of the intestinal surface revealed any inhibition of sucrose assimilation under the influence of brief exposure to a high temperature and insolation.

A brief exposure to a high temperature and insolation likewise had no effect on the increase in blood hexose concentration after starch loading. Consequently, the rate of digestion of starch and of absorption of its hydrolysis products are not lowered under these conditions. An earlier study [1] showed that exposure to a high temperature causes an increase in the adsorption of pancreatic amylase by the intestinal surface. It may be postulated that under these conditions a compensatory increase in the hydrolytic power of the intestinal surface with respect to polysaccharides takes place.

LITERATURE CITED

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