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The nerve-link in regulating the intestinal absorption in rats

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The absorption of glucose is effected exclusively in the region of the small intestine (REYNELL and SPRAY, 15).

According to AKTINSOV, PARSONS and SMYTH (1) 70-80 % of the glucose disappearing from the intestine is accounted for as glucose in the mesenteric venous blood, 7-17 % as lactic acid, and insignificant amouts as carbon dioxide, alanin ad pyruvic acid. The intestinal absorption is a process complicately regulated by numerous endogenous and exogenous factors. The participation of the endogenous factors in the regulation of this absorption, the influence of vitamins, the temperature of the environment, the oxygen contents of the inspired air, etc., have been brought out by many authors, (cf. CORDIER, 4).

In a whole succession of works (10-14) PONZ and coll., consider the absorption of the glucose under the influence of some chemical agents (phloridzine, iodoacetate, selenite, uranyl, Ce^{+++} Cu^{++}, arsenite, sodium azide, fluoride, cytochrome C, a.o.), as well as of the blood oxygen supply to the mucose and the *p*H of the intestinal contents.

The question about the participation of the nervous system in the regulation is, however, inadequately emphasized in scientific literature. Nevertheless, PAVLOV (9) and VEDENSKY (18) drew attention to the leading part of the central nervous system in all directions of the organism at normal conditions. BIKOV (3) and his School enlightened experymentally the par-

ticipation of the central nervous system in the tissular processes of the organism.

KOURTSIN (6) has studied the absorption of the glucose at a disturbed functional state of the cerebral cortex in dogs with a chronic Thiry-Vella fistula, and has found that same diminishes sharply compared to normal animals.

CORDIER and CHANEL (5) have noted a slowing down of the absorption in rats after their narcotisation with chloroform, ether, dial and pentotal.

VALETTE and ANGLAND (17) have obtained the same results with dogs rabbits and guinea pigs at pentothal, chloralose and urethan narcosis.

The reasons for this, according to CORDIER (4), can be rather varied : disturbance in the cells' metabolism, inhibition of the oxidative synthesis of the adenosintriphosphate, and temporaly circulatory disturbances.

We undertook the study of the intestinal absorption of glucose when the nevous-link in this regulation is interrumped, blocking the synapsis.

Material and methods

The tests were carried out on rats with a body weight of 112-196 g. There were formed three groups of rats : a control-group consisting of 9 rats, of these 6 were narcotized with urethan, and 3 non-narcotized, and two test-groups of 6 and 3 rats each. The first test-group, consisting of 6 nercotized rats were treated with Megaphen-Bayer, and the other 3 non — narcotized rats — with Nicotin. During test time the rats were at the same conditions, and received milk, oats, and dough balls, according to BARGETON and coll. (2).

In order to block the nervous system synapsis, we used the clasic ganglionic poison Nicotin and the new synthetic Megaphen-Bayer. Both of them have a selective action, on the nervous synapsis and block them in larger dosis, preventing the transmission of nerve impulses. During our tests we iniected 10 mg/Kg of Nicotin subcutaneously and 10 mg/Kg of Megaphen intramuscular.

The tests were carried out in two ways : in some cases the ganglionic blocking agents were applied to rats narcotized by Urethan ; in others, to non-narcotized animals. Thus, the narcotic (Urethan) influence on the absorption would be shown.

Urethan (1g/Kg, in 25 % sol) was subcutaneosly iniected to one control-group and to the rats treated with Megaphen. The rats treated with Nicotin were not narcotized.

We carried out the tests for the intestinal absorption of

glucose according to the SOLS and PONZ (16) method, with 0.3 M sugar solution and 25 cm. intestinal loops. Glucose was determined according to the micro-method of WILLSTATTER and SCHUDEL (19).

The absorbed glucose was calculated from the difference between the initial and the residual. According to our previous experiments, such narcotics as Urethan, produce absolutely insignificant functional disturbances in the organism. This is probably because in its molecule Urethan has two antagonistic chemical groups: amide-NH_2, exciting, and ethyl-C_2H_5-depressing.

The figures are the average of two succesive absorptions of 30 minutes each in the same rat. The infused quantity of 0.3 M glucose solution has been in almost all cases 7.5 ml. (5.4 mg/ml).

The temperature of the glucose solution as well as of the physiological solution for washing the intestinal loop is 39°C.

Results

The results on the absorption of glucose in narcotized and non-narcotized rats are shown in tables I and II.

TABLE I

Intestinal absorption of 0.3 M glucose in rats narcotized by Urethan (1 g/Kg body weight)

Ord. Nr.	Sex.	Body weight in g.	Initial glucose mg.	Absorption time (min.)	Absorbed glucose (mg)	Absorption %
1	M	157	40.5	30	32	79
2	M	137	40.5	30	32	79
3	M	138	50	30	32.20	64
4	M	160	46	30	30.76	66.7
5	M	185	38.2	30	33.9	88.7
6	M	196	40.5	30	26	64.1
		average	42.8		31.1	73.6

TABLE II

Intestinal absorption of 0.3 M glucose in non-narcotized rats

Ord. Nr.	Sex.	Body weight in g.	Inicia' glucose (mg.)	Absorption time (min.)	Absorbed glucose (mg.)	Absorption %
1	M	105	40.5	30	26	64
2	M	125	36	30	23.2	67
3	F	233	40.5	30	26.4	65.1
		average	39		25.2	65.3

Table I shows that absorption of glucose in the intestinal region, with Urethan narcosis is about 31.1 mg or comprises 73.6 (average) of the whole infused quantity. The absorption in the control group varies between 64.1 % to 88.7 %.

The tests carried out in non-narcotized animals (Table II) show that the absorption is almost the same : it varies from 64 to 67 %, with an average of 65.3 %

Thus, the intestinal absorption of glucose in narcotized and non-narcotized animals falls between 65.3 and 73.6 %, for a period of 30 minutes.

TABLE III

Intestinal absorption of 0.3 M glucose in non-narcotized rats, blocking the nerve-synapsis with Nicotin (10 mg/Kg)

Ord. Nr.	Sex.	Body weight in g.	Initial glucose (mg.)	Absorption time (min.)	Absorbed (mg.)	Absorption %
1	F	167	40.5	30	8.6	21.2
2	F	157	40.5	30	7.2	17.7
3	F	184	40.5	30	6.5	16.0
		average	40.5		7.4	18.3

Blocking the nerve-synapsis by Nicotin injections (Table III), the absorbed quantity of glucose fell from 25.2 mg in non-narcotized rats, to 7.4 mg or from 65.3 % to 18.3%.

Blocking the nerve-synapsis by Megaphen (Table IV) in urethanized rats the reduction is from 31.1 mg to 8.1 mg. or from 73.6 % to 20.7 %.

TABLE IV

Intestinal absorption of 0.3 M glucose in urethanized rats, blocking the nerve-synapsis with Megaphen (10 mg/Kg)

Ord. Nr.	Sex.	Body weight in g.	Initial glucose (mg.)	Absorption time (min.)	Absorbed glucose (mg.)	Absorption %
1	M	193	40.2	30	4.3	10.6
2	M	196	40.2	30	9.2	22.8
3	M	112	40.2	30	9.7	24.1
4	F	178	40.2	30	8.3	20.6
5	F	137	40.5	30	11.8	29.1
6	M	136	32.4	30	5.7	17.5
		average	38.9		8.1	20.7

As we have shown, the blockage of the nerve-synapsis by

Nicotin, as well as by Megaphen, reduces the intestinal absorption of glucose about three and half times.

Discussion

The synapsis comprises a neuro-humoral connection wich may be influenced electively by various ganglionic poisons. It can be affected not only by the specific N-choline-reactive substances but also by the narcotic group. At Narcotics, interfering the mediatory action of the acetylcholine, hamper the transmission of the nerve impulses. Some of the narcotics are more activ than others : the barbiture derivates, cholaric a.o., and at minimum the Urethan.

But CORDIER (4) rightly states that in narcotics, various factors may come into action influencing the clear nerve-action.

Our experiments with ganglionic blocking agents, had the purpose to discontinue the nerve-system in the synapsis in narcotized as well as in non-narcotized rats.

We have observed that with and without Urethan, a reduction of the absorption takes place. With Urethan the absorption is even greater probably due to the summing of the effects of the ganglionic-blocking agents with the above narcotic mentioned factors.

Our experiments carried out with ganglionic-blocking agents without narcosis, confirm our earlier researches, regarding Urethan's influence on the organism. The approximately same results obtained on the absorption, with and without Urethan narcosis, show that Urethan do not affect the absorption of glucose, in difference to other narcotics (luminal, barbituric acid, a.o.).

We have compared, in provisional tests, the glucose absorption in narcotized animals with Chloralose-Luminal and with Urethan. With Chloralose-Luminal the absorption is diminished, while with Urethane it is not effected. Ours results coincide with those of WIELBRANDT and LASZT (20) who have found that the Urethan has no influence on the absorption of glucose in rats.

The structural similarity of Urethan with some natural metabolites of the organism (e. g., urea) renders it probably less toxical.

The tests carried out with ganglionic blocking agents (Nicotin and Megaphen) show that the nervous-system has a leading part in the absorption capacity of the intestine. Blocking it, the absorption diminishes three and half times. Consequently the nervous-system should be regarded, in these processes,

as a very important factor, which, if blocked, will produce a strong disturbance of the absorption.

Summary

1. The intestinal absorption in urethanized and non-narcotized rats is studied according to SOLS and PONZ'S (16) methodics. The quantity of the absorbed 0.3 M glucose solution for a period of 30 minutes in the urethanized rats is of an average of 73.6 %, while in the non-narcotized rats is of 65.3 %.

2. The absorption in the urethanized, and non-narcotized rats is almost the same. The Urethan has no special influence on the absorption of the glucose in the small intestine.

3. By ganglionic-blocking agents (Nicotin and Megaphen), the ganglionic cells of the nerve-synapsis are blocked, and as consequence the intestinal absorption falls 3 ½ times, compared to the normal : from 73.6 % to 20.7 % in the urethanized rats and 65.3 % to 18.3 % in the non-narcotized ones.

4. The nervous link in regulating the intestinal absorption of glucose may be blocked in non-narcotized rats, and giving us the opportunity to account the purely nerve-influence in the regulation of this process.

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