SECRETION OF PROTEIN AND NUCLEIC ACIDS IN THE INTESTINAL JUICE OF DOGS IN THE COURSE OF 24 HOURS WITH INTAKE OF PROTEIN-RICH AND PROTEIN-DEFICIENT FOODS

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The periodic activity of the intestines in dogs appears morphologically in the accumulation of epithelial cells in the form of epithelial tubes and subsequent detachment of the tubes, their fragments and the individual cells and entry into the lumen of the intestine where they form the mass of the solid component of the intestinal juice. The liquid component of the juice accumulates in the apertures of the tubes and periodically secretes, together with the solid component, into the lumen of the intestine [4, 5]. A certain amount of secreted cellular protein forms a part of the solid and liquid components of the juice in the intestinal lumen. According to the observations of V. M. Rubeli, in healthy dogs 2.5-6.5g protein are secreted daily in the intestinal juice [6].

Together with the protein, in both components of the intestinal juice, M. I. Razumov found by histochemical methods nucleic acids desoxyribonucleic (DNA) and ribonucleic (RNA), but their quantity was not determined. In the tissues of the small intestine in rats the quantity of RNA, according to P. M. Belyaev, is inconstant and falls when the animals are fed with non-rich food, containing 1.5 % protein [2].

We studied the secretion during the course of 24 hours of protein and nucleic acids in the intestinal juice of an isolated segment of the lower section of the small intestine in dogs fed on protein-rich and protein-deficient food.

EXPERIMENTAL METHOD

3 dogs were used in the experiment: two weighed between 11-15 kg, and one 37.5 kg. The periodically secreted juice was collected from an isolated segment of the intestine (according to Tir), the lower third of the small intestine, 18-20 hours after feeding. The solid component was separated from the liquid component of the intestinal juice by centrifugal force for 10 minutes at 2500 revolutions per minute. In both components of the juice the percentage content of protein and nucleic acids were determined. The amount of protein in the juice was determined according to the nitrogen method of Kjeldahl and the amount of nucleic acids according to the phosphorus method of Schmidt-Tannhäuser with the application of a photoelectric colorimeter.

In the first half of the experiment the animals were kept on rich food with 24.2% protein and, in the course of 24 hours, received 5.2g protein, 1g fat and 14.5g carbohydrates per kilogram body weight, which amounted to 80 calories per kilogram body weight of the animal. The proportion of fats, protein, carbohydrates and of salts and vitamins was the same as in human diet. After carrying out the necessary investigations on the basis of a rich diet the animals were switched to a protein-deficient diet and kept on it for a month. In the protein-deficient diet, the calorific content of protein was reduced to 2.7%. A constant caloric content was maintained by adding to the animal food corresponding amounts of fats and carbohydrates. Deficiencies of phosphorus, iron and vitamins in the diet were compensated for in the form of solutions (L. S. Fomina).

After the animals had been kept on a protein-deficient diet for a month they were sacrificed. When dissected, the length of all the parts of the intestines was measured, and the size of the isolated segment and the site of its excision determined.

Before the dogs were switched to a protein-deficient diet and before they were sacrificed, 24-hour specimens of intestinal juice were collected periodically. The dogs were put on the bench at 9 a. m., at 4 p.m. they were taken out in the street, fed, and again put on the bench until 9 a.m. the following morning.

EXPERIMENTAL RESULTS

Our investigations showed that the general quantity of the intestinal juice, proteins and nucleic acids secreted by the isolated segment of the intestine, in the course of 24 hours, varied in different animals and was dependent on the length of the isolated segment (see Table).

Secretion of Protein and Nucleic Acids by Small Intestine of a Dog on a Rich Diet

Dog	Length of isolated segment in cm	Concentration in ration %	Weight of dog in kg	Amount secreted during 24 hours by isolated segment											
				Of intestinal juice in g			Of in g			Of desoxyribonucleic acid in mg.			Of ribonucleic acid in mg.		
				Total	In solid component	In liquid component	Total	In solid component	In liquid component	Total	In solid component	In liquid component	Total	In solid component	In liquid component
Rishik	9	24.2	15	4.5	2.9	1.6	137.4	122.1	15.3	7.59	7.46	0.13	4.24	4.17	0.07
		2.7	13.5	5.0	2.2	2.8	98.9	79.2	19.7	6.98	5.73	1.25	3.18	2.46	0.72
Pushok	11	24.2	11	4.5	2.8	1.7	144.0	113.8	31.0	10.47	10.20	0.27	7.76	7.70	0.06
	11	2,7	10	5	2.3	2.7	131.6	95.1	36.5	9.62	9.30	0.32	6.81	6.30	0.51
Drushok	18	24.2	37.5	8.5	4.0	4.5	219.9	166.6	53.3	16.00	12.00	4.00	9.72	8.10	1.62
	18	2.7	30	18.4	3.3	15.1	147.9	102.6	45.3	15.31	7.11	8.20	8.10	6.20	1.90

However, when a conversion was made of the length of the isolated segment of the lower section of the small intestine to 1 cm, the indices indicated in the Table for all the dogs were approximately uniform; with rich food for a 1 cm length of isolated segment there was from 412 to 500 mg intestinal juice in all the dogs.

When the dogs were kept for one month on a diet containing 2.7% protein, the amount of juice secreted periodically in the course of 24 hours increased in all animals. In our experiments for 1 cm length of the isolated segment of the lower section of the small intestine, the amount of juice fluctuated within wider limits; from 456 to 1007 mg. The increased secretion of intestinal juice occurred on account of a more copious secretion of its liquid component. The amount of the solid component of the juice, on a protein-deficient diet, fell noticeably in all animals, as has been noted by L. S. Fomina [7].

As our investigations showed, the percentage protein content of both portions of the intestinal juice, collected from the lower section of the small intestine, when the animals were fed with food containing 24.2% protein, was not uniform. The bulk of it was secreted in the solid component of the juice and in the various animals it amounted to 4-4.5-6.2% in the solid component. The protein content of the liquid component fluctuated from 0.8-1.8%. Taking the solid and liquid components as a whole and making a conversion on the length of the isolated segment to 1 cm, a uniform amount of protein was secreted in 24 hours by all the animal on a rich diet, 12-15 mg (composed o 9.3-13.6 mg in the solid and 1.2-2.9 mg in the liquid component).

With protein-deficient foods the secretion of protein in the intestinal juice of all the dogs fell perceptibly and did not exceed 7-12 mg for 1 cm length of the isolated segment.

Study of the secretion of nucleic acids showed that in the intestinal juice of animals fed on protein-rich food there was always more desoxyribonucleic acid than ribonucleic acid; the amount of desoxyribonucleic acid in the solid component of the juice varied from 0.26-0.36%, the ribonucleic acid content of the solid component fluctuated within broader limits – 0,14-0.27%.

On the length of isolated intestinal segment converted to 1 cm, on a rich diet, in 24 hours, the amount of nucleic acids secreted in both the solid and liquid components of the juice varied from 1.3-1.7 mg, 1.1-1.6 mg being secreted in the solid component of the intestinal juice.

On a protein-deficient diet alongside the fall in protein there was a fall in the secretion of nucleic acids. It fell in all the dogs, in 24 hours, by 0.16-1.8 mg on every centimeter length of the isolated segment.

In all the dogs there was also a regular fall in the individual amounts of desoxyribonucleic and ribonucleic acids secreted by the segment during 24 hours when the dogs were on protein-deficient diets; the percentage contents of the acids in the various animals showed variation in changes.

It is known that the greatest amount of the solid component of the juice is secreted in the upper portion of the small intestine and the least amount in the lower section. Consequently the indices obtained by us for the lower section cannot be extended to the whole intestine. However, in order to get an idea, even if only of the minimum amounts of the juice, proteins and nucleic acids, secreted by the intestines during 24 hours, we made a conversion to the whole length of the small intestine. The following values were obtained. In dogs weighing 11-15 kg in which the intestine measured 160-180 cm the wet periodical secretion from the mucosa of the small intestine of dogs on a rich diet there was secreted daily: 65-85 g intestinal juice, 41-54 g solid component, 2.1-2,6 protein and 240-270 mg nucleic acids, there being a corresponding increase in those indices in the larger dog weighing 37.5 kg and with a 270 cm long small intestine: the intestinal juice rising to 127 g, the solid component to 60 g, protein to 3.3 g, nucleic acids to 386 mg.

A conversion of the finding to the whole length of the small intestine shows that with protein deficient diet the secretion of the intestinal juice, its protein content and nucleic acid content, correspondly changed in all the animals. The amount of juice on account of a more intensive secretion of the liquid component increased to 73-95 g (against 65-86 g) and in the large dog to 275 g (against 127 g). The other indices in all dogs fell regularly: solid component to 33-44 g (against 41-54g), protein to 1.9-2.1 g) (against 2.1-2.6 g), nucleic acids to 200-230 mg (against 240-270 mg). In the large dog the solid part fell to 49 g (against 60 g), protein to 2.2 g (against 3.3 g), nucleic acids to 343 mg (against 386 mg).

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