Glucose-6-Phosphate Dehydrogenase Activity in the Mucosa and Musculature of the Duodenum and Stomach of Rats with Alimentary-Conditioned Reflex

LANDAU and WILSON[1,2], using labelled glucose, demonstrated that the pentose-phosphoric cycle is active in the intestinal mucosa in the hamster and in humans. BELL and SHERRATT[3] demonstrated the formation of hexosephosphate from ribose-phosphate in rat and guinea-pig intestinal mucosa specimens. SRIVASTAVA[4,5] studied and demonstrated the existence of some enzymes of the pentose-phosphate cycle in the intestinal mucosa, obtaining lactic acid from ribose-5-phosphate. SRIVASTAVA[5] also studied the properties of glucose-6-phosphate dehydrogenase (G-6-PDH) in rat intestinal mucosa and considered that induction of this enzyme might be influenced by hormonal[6], alimentary[7] or nervous pathways[6]. ROSSI[8] observed no significant alterations in G-6-PDH activity in the denervated muscle and, hence, raised doubts concerning the nervous induction of this enzyme, although in other studies both ROSSI[9] and MCCAMAN[10] showed that G-6-PDH activity increases in mice with muscular dystrophy.

The present paper proposes to study the variations of G-6-PDH activity in the mucosa and musculature of the stomach and duodenum of rats fed on a normal diet (permanent) and rats with alimentary conditioned reflex.

Material and method. Sprague Dawley male rats, aged 18 months and weighing 180–200 g were used. A food stereotype was induced in the animals by feeding them for 6 months at the same hour (08.00), during 60 min (08.00–09.00). The animals with an alimentary reflex were sacrificed before their feeding time (07.45), during alimentation (08.15) and 4 h after being fed (13.00).

Control animals were likewise killed each time. The stomach and duodenum were collected, washed in cold normal saline and, after drying on filter paper, the mucosa was separated from the musculature by scraping. The samples collected were weighed and cold homogenized with a 0.25 *M* saccharose solution.

The homogenates were centrifuged, also in the cold, at 14,000 rpm for 20 min, and the supernate was used for determining G-6-PDH activity by optical testing at 340 nm according to Warburg[11,12].

Results and discussions. From the Table, it will be seen that in the animals with an alimentary stereotype, G-6-PDH activity in the mucosa and musculature of both the stomach and duodenum is reduced, 4 h after feeding time (13.00), in comparison to that of specimens of the same organs 15 min before (07.45) or during feeding time (08.15). A significant increase occurs in the activity of the enzyme before feeding time in the rats with alimentary conditioned reflex sacrificed before receiving their food.

In the control animals with a permanent diet, i.e. without hour restrictions, no significant changes were found with respect to the hour at which they were killed. Of particular importance appears to be, in our data (see Table), the increase that takes place in the activity of the enzyme in all the samples studied, but especially in the duodenal mucosa of the animals with alimentary-conditioned reflex, sacrificed before feeding time. In this instance, G-6-PDH appears to be induced by nervous pathways, or at any rate conditioned by nervous reflex activity.

Induction with an alimentary substrate, such as that described by TEPPERMAN[7] is excluded, since the animals of this lot were sacrificed before receiving their food. Even if induction were mediated by humoral factors, the nervous reflex factor is present.

Decrease in the activity of the enzyme 4 h after the animals received their food, might be considered as a consequence of the increase in proteinase activity (cathepsin) within the cells studied, which would condition a quantitative intracellular decrease of the enzyme investigated, at the hour considered. Inactivation of the enzyme during this period is less likely, since in the tests used for determining enzymatic activity, identical, optimal saturation conditions with the substrate (G-6P) and coenzyme (NADP) were used. Investigations are now being carried out in this direction.

Résumé. Les résultats obtenus démontrent que les animaux à réflexe conditionné alimentaire présentent, s'ils sont sacrifiés avant l'heure du repas, une augmentation de l'activité de la G-6-PDH dans la muqueuse et la musculature du duodénum et de l'estomac. Quatre heures après l'administration de la ration alimentaire, l'activité de l'enzyme diminue d'environ 75%.

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G-6-PDH activity in the mucosa and musculature of the duodenum and stomach in control rats and rats with alimentary conditioned reflex (μmol/g per min)

Animals	No.	Duodenum		Stomach	
		Mucosa	Musculature	Mucosa	Musculature
Control	12	2.12 ± 0.82	0.96 ± 0.21	1.83 ± 0.59	1.79 ± 0.50
With alimentary reflex killed at 07.45 h	6	3.10 ± 0.17	1.21 ± 0.17	2.98 ± 0.28	2.95 ± 0.13
With alimentary reflex killed at 08.15 h	6	2.64 ± 0.70	1.45 ± 0.50	3.53 ± 0.35	3.15 ± 0.14
With alimentary reflex killed at 13.00 h	6	0.80 ± 0.14	0.77 ± 0.28	2.05 ± 0.70	1.90 ± 0.60

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