6342

Glycogen Formation in Rats After Administration of Diets High in Galactose, Glucose, and Lactose.

H. J. DEUEL, JR., EATON M. MACKAY AND M. GULICK.

From the Department of Biochemistry, University of Southern California School of Medicine, Los Angeles, and the Scripps Metabolic Clinic, La Jolla.

It has been shown[1] that galactose exerts a greater ketolytic action than does glucose when administered to fasting humans or to subjects on a protein-fat diet. Moreover, a superior nitrogen sparing action was usually noted after the ingestion of galactose than that found after a similar amount of glucose. In both cases the better effect of galactose was demonstrated not only by the lower level to which these constituents were depressed but also by the more prolonged persistence of the effect. One explanation for this discrepancy is that the glycogen content of the animal may remain at a higher level for a longer time after galactose than after glucose administration. Cori,[2] however, found that galactose was a very poor glycogen former in rats as compared with glucose although he made no studies at longer than 4-hour intervals after the sugars were fed.

This investigation was made to ascertain the quantitative relationships in glycogen storage when longer periods of starvation had elapsed following the administration of diets high in glucose, galactose, lactose, or a mixture of glucose and galactose. Besides the sugar under investigation which comprised 44 to 46% of the diet, casein (20%), yeast (10%), lard (20%), salt (4%), and cellu (2%) made up the food. Adult male rats were used. Three rats of each group of 6 served as controls, while the remaining ones were fed galactose after an appropriate period of fasting following the administration of the above diet. The galactose was fed by stomach tube in 50% solution in a dose of 0.50 gm. per 100 sq. cm. of body surface. The control animals were killed at the same time as the galactose fed ones. Amytal was used as an anesthetic. The tissues were immediately frozen in a CO_2 snow-ether mixture after being removed from the body and weighed in this condition. Glycogen was determined by a combination of the Pfluger method and the Shaffer-Hartmann procedure.

The glycogen content of both liver and muscles of the galactose-

[1] Deuel, H. J., Jr., Gulick, M., and Butts, J. S., *J. Biol. Chem.*, 1931, **92**, 23.

[2] Cori, C. F., *J. Biol. Chem.*, 1926, **70**, 577.

TABLE I.
Glycogen content of 3 fasted rats.

Previous diet	Food intake per rat gm. daily	Liver %	Muscle %	Heart %
33 hr. fast				
Glucose	10.2	0.13	0.19	0.59
Galactose	14.1	0.37	0.29	0.52
Galactose-Glucose	18.7	2.12	0.32	0.46
54 hr. fast				
Glucose	19.1	0.23	0.19	
Galactose	17.5	0.77	0.32	
Lactose	8.2	0.39	0.28	

TABLE II.
Glycogen content of 3 fasted rats after galactose administration.

Previous diet	Food intake per rat gm. daily	Liver %	Muscle %	Heart %	Galactose retained %
24 hr. fast before galactose.		Animals killed 9 hrs. later			
Glucose	12.6	1.53	0.27	0.64	52.6
Galactose	10.9	2.23	0.28	0.70	52.1
Glucose-Galactose	9.9	1.80	0.27	0.68	48.3
48 hr. fast before galactose.		Animals killed 6 hrs. later.			
Glucose	17.4	1.26	0.28		60.8
Galactose	16.2	1.56	0.34		63.2
Lactose	8.1	0.97	0.29		68.1

fed control animals far exceeded that of the glucose control rats, although no distinctive differences were found in the case of heart glycogen. In addition the rats which received galactose after a previous fasting period had higher values for liver glycogen if they had previously been on a galactose diet than if they had eaten the glucose diet. The muscle glycogen in these animals exceeded that of the fasting glucose controls but approximated the value of the fasting galactose control animals. The results with lactose are intermediate. One very high result was found with the galactose-glucose series which may be accounted for by the high food intake of these animals. The results after the administration of galactose make it evident that considerable glycogen may be formed after galactose is given. The higher glycogen values for the galactose-fed animals can not be attributed to higher food intake of these rats. In only one case of the 4 groups of animals was the intake of food higher in the galactose rats than in the glucose animals. This does not take into consideration, moreover, the loss of galactose in the urine. Further experimental work is being made at shorter and longer intervals of fasting.