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Study of response to continuous intravenous injection of large amounts of glucose.

By J. D. BOYD, H. M. HINES and C. E. LEESE. (Introduced by J. T. McClintock).

[*From the Physiological Laboratory, College of Medicine, State University of Iowa, Iowa City.*]

Realizing that no isolated series of observations, such as blood sugar curves, the degree of glycosuria, the gas exchange nor the tissue analysis, is adequate in itself as a measurement of carbohydrate capacity, an attempt has been made to ascertain the response elicited by intravenous injection of glucose continuously for several hours, by means of simultaneous studies of blood sugar, hemoglobin, pH and CO₂ content of plasma, urine volume and sugar, respiratory quotient and heat production. The method of study differed from that of Woodyatt and others in that more factors were correlated, larger amounts of sugar were administered, and the recovery period was observed for several hours. Unanesthetized dogs on standard diet were used. The method of administration was essentially the same as employed by Woodyatt.¹ Glucose in 30 per cent solution was given at the rate of 4 gm. per kilo per hour. Indirect calorimetry was used to measure gas exchange.

It was found that under similar conditions, the response of the same dog to the standard injection on various occasions was remarkably uniform throughout. Values from different dogs were in fair agreement.

Sugar rapidly left the blood, 80 per cent to 100 per cent disappearing as rapidly as injected. There was usually a peak in the blood sugar concentration curve during the first half hour, after which the divergence was considerable, varying more in different dogs than in the same animal. After injection there was a rapid return to normal limits requiring only ½ to 1 hour. In some cases distinct hypoglycemia ensued.

Hemoglobin fell moderately during the injection, soon returning to normal following its close. Fluctuations in pH were

¹ Woodyatt, Sansum and Wilder, *J. Am. Med. Assn.*, 1915, lxx, 2067.

slight, never exceeding 0.1, and usually less than 0.05. Carbon dioxide content usually fell.

Urine volume increased markedly during the injection, somewhat exceeding the amount of water injected. During the recovery period it was markedly diminished. Glycosuria appeared coincident with hyperglycemia, and ceased abruptly after injection.

The respiratory quotient rose with the onset of sugar administration, and varied moderately during injection, averaging about 0.96. In a few cases it slightly exceeded 1.0. At a varying interval after injection it fell, in a few cases to values less than the resting level, even though a large amount of the injected glucose remained unoxidized. It will be necessary to consider the fall in the CO_2 content of the plasma in the interpretation of these changes. Heat production, which increased with injection, fell soon after its close, to its initial, or a lower level. The decline was more rapid than that of the respiratory quotient.

Through calculation of the maximum amount of carbohydrate combustion which might have occurred during the experiment, and deducting this and the urinary sugar from the amount injected, it was found that after a 4-hour injection, an average of about seven grams per kilo had been retained by the animal.

The injection did not seem to have any deleterious effects on the animal. There was a rise of 1 to 2 degrees centigrade during, and a quick fall to normal after, the injection. After the experiment the animals would eat their diet, and as a rule the animals receiving numerous injections gradually gained in weight.