

Changes in the Respiratory Quotient Produced by Subcutaneous Injection of Dioxyacetone and Glucose.

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Evidence on the availability of dioxyacetone and glucose by the animal organism has led to opposing conclusions. Rabinowitch¹ and Mason² have found that dioxyacetone is more readily oxidized than glucose. Ringer and Frankel³ have shown that in diabetic dogs dioxyacetone is synthesized to glucose. Campbell, Fletcher, Hepburn and Markowitz,⁴ obtaining similar results, concluded that dioxyacetone presents no advantage to the organism, since it must be converted to glucose, prior to oxidation. In the present experiments the availability of these two substances has been studied after subcutaneous injection.

Fifteen experiments were performed on a trained dog, in which 10 grams of the substance studied, dissolved in 10 cc. of warm water, were injected subcutaneously. Seven experiments were performed using dioxyacetone, seven using glucose, and one employing sucrose. The dog had been trained to lie quietly with a leak-proof mask on its head, the expired air being collected through Sadd valves into a spirometer. Air was collected before injection, a second sample of air was taken in the first 3 or 5 minutes after injection, and the subsequent collections of air were taken in 5 to 10-minute periods thereafter. An interval of 3 minutes between collections was required for the removal of samples of the collected air from the spirometer. These air samples were kept in glass sampling tubes over mercury and analyzed for CO₂ and O₂ by means of the Haldane-Henderson apparatus.

In the first 5 minutes after injection of dioxyacetone, 5 experiments, starting with an average respiratory quotient of .80, yielded a respiratory quotient of .92, while in 15 minutes the respiratory quotient rose to 1.03. The remaining 2 dioxyacetone experiments, starting with a higher respiratory quotient, due to the feeding of sucrose on the night prior to the experiment, showed an average pre-injection value of 1.14. Five minutes after injection the respiratory quotient was 1.15. After 15 minutes it was 1.17, and at the 1/2 hour was 1.23. Fifty-five minutes after injection the respiratory quotient was found to be 1.31.

Five of the 7 glucose experiments, starting with a basal respiratory quotient of .73, rose in 15 minutes to .76, in 27 minutes to .77, and in 50 minutes to .80. Two glucose experiments, starting with an average respiratory quotient of .87 rose to 1.00 in 27 minutes. The 40th minute respiratory quotient was .98, and in the 55th minute was .97.

Following the same technique, a control experiment performed with sucrose yielded no change in the respiratory quotient over the period of 1 hour.

CONCLUSIONS.

Dioxyacetone, in contradistinction to glucose, caused an immediate and considerable rise in the respiratory quotient, the average increase being .19 for the first 15 minutes. Glucose caused a rise of only .04 in 15 minutes and .07 in one hour. These results indicate that dioxyacetone is more readily available than glucose when administered subcutaneously.

In experiments now in progress we are studying the rates of absorption of glucose and dioxyacetone after subcutaneous injection. If these experiments do not indicate a slower absorption of glucose, as compared with that of dioxyacetone, it might be concluded that dioxyacetone is more readily oxidized in the normal animal. On the other hand, if the data show that dioxyacetone is absorbed more rapidly than glucose it would manifestly be impossible to ascribe a more rapid rise in respiratory quotient in the case of dioxyacetone to its greater susceptibility to oxidation, unless quantitative evidence on the rates of absorption, and the rates of oxidation, were at hand.

¹ Rabinowitch, I. M., *J. Biol. Chem.*, 1925, lxxv, 55.

² Mason, E. H., *J. Clin. Inv.*, 1926, ii, 521, 533.

³ Ringer, A. I., and Frankel, E. M., *J. Biol. Chem.*, 1914, xviii, 233.

⁴ Campbell, W. R., Fletcher, A. A., Hepburn, J., and Markowitz, J., *J. Pharmacol. and Exp. Ther.*, 1926, xxvii, 258.