

Stereoselective effects of 3-hydroxybutyrate on glucose utilization of rat cardiomyocytes

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Abstract

In researches of ketone bodies, D-3-hydroxybutyrate (D-3HB) is usually the major one which has been investigated; in contrast, little attention has been paid to L-3-hydroxybutyrate (L-3HB), because of its presence in trace amounts, its dubious metabolism, and a lack of knowledge about its sources. In the present study we determined the distributions of enantiomers of 3-hydroxybutyrate (3HB) in rat brain, liver, heart, and kidney homogenates, and we found the heart homogenate contained an enriched amount of L-3HB (37.67 microM/mg protein) which generated a significant ratio of 66/34 (D/L). The ratio was altered to be 87/13 in the diabetic rat heart homogenate. We subsequently found this changed ratio of D/L-3HB may contribute to reduce glucose utilization in cardiomyocytes. Glucose utilization by cardiomyocytes with 5 mM of D-3HB was decreased to 61% of the control, but no interference was observed when D-3HB was replaced with L-3HB, suggesting L-3HB is not utilized for the energy fuel as other ketone bodies are. In addition, the reduced glucose utilization caused by D-3HB gradually recovered in a dose-dependent manner with administration of additional L-3HB. The results gave the necessity of taking L-3HB together with D-3HB into account with regard to glucose utilization, and L-3HB may be a helpful substrate for improving inhibited cardiac pyruvate oxidation caused by hyperketonemia.