

Exercise in Closed-Loop Control: A Major Hurdle

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Abstract

Background:

People with type 1 diabetes mellitus (T1DM) are at risk for exercise-induced hypoglycemia. Prevention of such hypoglycemia in a closed-loop setting is a major challenge. Markers for automated detection of physical activity could be heart rate (HR) and body acceleration counts (AC). Correlations between HR, AC, and glucose concentrations before and after moderate intensity exercise were examined in T1DM patients during open-loop control.

Method:

Eleven T1DM subjects treated with an insulin pump performed moderate intensity exercise of 30 min. Glucose profiles, insulin concentrations, HR, and acceleration were measured.

Results:

Mean (range) glucose decrease during exercise was 1.4 (0 to 3.3) mmol/liter. The mean increase in HR was 45.2 beats per minutes (15 to 106 bpm). Mean increase in AC was 18,000 (3,000 to 25,000). No correlations were seen between the glucose drop and HR or AC. A trend was observed between the increase in HR and increase in AC.

Conclusion:

Moderate intensity exercise resulted in increased HR and body AC while it decreased glucose concentrations but, in this real-time setting, no association could be demonstrated between the glucose decrease and increase in HR or AC.

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Abbreviations: (AC) acceleration counts, (ACM) accelerometer, (bpm) beats per minute, (CGM) continuous glucose monitoring, (CSII) continuous subcutaneous insulin infusion, glucose transporter type 4 (GLUT-4), (HR) heart rate, (T1DM) type 1 diabetes mellitus

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