ABSTRACT

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Title: The Effect of Fat on Sensor Glucose Values in Patients with Type 1 Diabetes Using an Artificial Pancreas System
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Background: In persons with Type 1 Diabetes, optimal postprandial glycemic control is challenging without considering meal composition. The standard of care for bolus dose calculations is solely carbohydrate based. However, it is well known that dietary fat and protein impact postprandial glucose excursions. Automated insulin delivery systems adjust insulin delivery every 5 minutes based on data from a continuous glucose monitoring device. They are reliable under basal conditions, but are challenged in handling glucose disturbances after meals.

Methods: We compared the glycemic response to dinners with both low and high fat content for 8 hours after eating with patients using an artificial pancreas system during an outpatient multicenter clinical trial. Participants with diagnosed Type 1 diabetes were between 3 and 61 years old. They were allowed to eat meals of their choice, but 50% of the dinners in participants over 12 years of age had to be high fat. The carbohydrate, protein and fat content of each meal was recorded. Meals were categorized as high (≥30g) or low fat (≤15 g) and analyzed.

Results: Data was obtained from 28 individuals with Type 1 diabetes: children ages 2-5 (n=8), adolescents ages 12-17 (n=10), and adults 18 and older (n=10). 112 meals were recorded. 60 were excluded due to missing CGM data, snack consumption, and bolus mistiming. Of the remaining meals, 12 were low fat and 27 high fat. High-fat meals had lower blood glucose values than the low-fat meals within the first hour of eating, averaging 4% of time <70 mg/dL compared to 0% with low-fat meals. High-fat meals showed higher sensor glucose values from 90 minutes to 3 hours after eating and were >140 mg/dl 39.8% of the time compared to 22.1% for low-fat meals. High-fat meals had a slower rate of rise in the first 30 minutes and a higher rate of rise after 60 minutes.

Conclusions: These results reveal that the artificial pancreas system was partially able to control the effects of a high fat meal, but limitations of carbohydrate-reliant bolus calculations remain, emphasizing the need for an algorithm that accounts for fat content.

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