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CONTROVERSIES in
Continuous Glucose Monitoring

Optimum Subcutaneous Glucose Sampling and Fourier Analysis of Continuous Glucose Monitors

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Abstract

Background:

The objective of this article was to focus on the application of harmonic decomposition to continuous glucose monitor (CGM) measurements. We show evidence of an attenuation of fast variations of interstitial glucose when compared to blood in type 1 diabetes mellitus (T1DM) and, using information theory, propose optimal sampling schedules associated with the use and study of CGMs.

Method:

Using a cohort of 26 T1DM subjects, wearing two Navigator™ sensors for 1 to 3 days, we analyzed the frequency content of each glucose signal and derived across subject frequency cutoffs using discrete Fourier transform and common signal processing techniques.

Results:

We observed a significant difference in the frequency content of blood glucose compared to interstitial glucose in T1DM, providing evidence toward the existence of a diffusion process between blood and interstitial glucose, acting as a low-pass filter. Furthermore, we obtained a 15-minutes sampling schedule for optimal comparison of CGM values to blood reference.

Conclusion:

Blood glucose and interstitial glucose have different dynamics, as shown by harmonic analysis, and these differences have consequences on advisable schedules for accuracy studies of CGMS.

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Abbreviations: (BG) blood glucose, (CGM) continuous glucose monitor, (IG) interstitial glucose, (T1DM) type 1 diabetes mellitus

Keywords: blood glucose, Fourier, harmonic analysis, interstitial glucose, Nyquist, optimal sampling schedule

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