

GIM, Simulation Software of Meal Glucose–Insulin Model

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Abstract

Background:

A simulation model of the glucose–insulin system in normal life conditions can be very useful in diabetes research, e.g., testing insulin infusion algorithms and decision support systems and assessing glucose sensor performance and patient and student training. A new meal simulation model has been proposed that incorporates state-of-the-art quantitative knowledge on glucose metabolism and its control by insulin at both organ/tissue and whole-body levels. This article presents the interactive simulation software GIM (glucose insulin model), which implements this model.

Methods:

The model is implemented in MATLAB, version 7.0.1, and is designed with a windows interface that allows the user to easily simulate a 24-hour daily life of a normal, type 2, or type 1 diabetic subject. A Simulink version is also available. Three meals a day are considered. Both open- and closed-loop controls are available for simulating a type 1 diabetic subject.

Results:

Software options are described in detail. Case studies are presented to illustrate the potential of the software, e.g., compare a normal subject vs an insulin-resistant subject or open-loop vs closed-loop insulin infusion in type 1 diabetes treatment.

Conclusions:

User-friendly software that implements a state-of-the-art physiological model of the glucose–insulin system during a meal has been presented. The GIM graphical interface makes its use extremely easy for investigators without specific expertise in modeling.

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Abbreviation: (PID) proportional-integral-derivative

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