Patient-specific Glucose Metabolism Models for Model Predictive Control of T1DM Glycemia

Cescon, Marzia; Johansson, Rolf

2012

Link to publication

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Patient-specific Glucose Metabolism Models for Model Predictive Control of T1DM glycemia

Marzia Cescon  Rolf Johansson
Department of Automatic Control, Lund University
marzia.cescon@control.lth.se  rolf.johansson@control.lth.se

Background
In recent years, model predictive control (MPC) has been shown to outperform other control approaches to automatic glycemia regulation in diabetic subjects, becoming the most popular choice for the control algorithm [2]. In such a strategy, a model capable of representing the effect of insulin and carbohydrates on blood glucose evolution which is patient-specific, physiologically relevant, parsimonious, yet able to accurately forecast blood glucose is a crucial component affecting significantly the system performance.

Objective
Estimate data-driven individualized glucose-insulin interaction models suitable for exploitation in a MPC framework.

Methods

Results
All the estimated models were stable, the peak response of BG to 1 [U] fast-acting insulin being \(-12.45\pm10.85\) [mg/dL] while that to 10 [g] carbohydrates being \(10.56\pm7.44\) [mg/dL]. Cross validation via model-based predictions achieved prediction error standard deviation 14.19\pm8.45 [mg/dL] and 26.22\pm15.04 [mg/dL] on 30- and 60-minutes-ahead prediction, respectively.

Discussion
Population mean values reported in the literature [1] were used for the parameters appearing in the meal model and in the insulin kinetics model, disregarding the inter-personal variability. Moreover, age of the subject, disease duration, BMI, insulin sensitivity, \(\beta\)-cells responsivity and probably many more unknown factors related to both the quantitative and qualitative responses to inputs were not considered. Last, the modeling process was possible due to the very rich and unique database.

Conclusions
The investigation provided sound and valid individual-specific low-complexity models suitable for application in model-based blood glucose control.

Acknowledgments
This research was supported by the European project DIAdvisor™ [4].

References

Advanced Technology and Treatments for Diabetes, Barcelona 2012