Evaluation of Three Continuous Glucose Monitoring Systems during Exercise and Meal Challenges

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Introduction and objectives:

Continuous glucose monitoring (CGM) has become an essential tool in diabetes management. In order to use CGM for treatment decisions, CGM systems have to be reliable over a wide range of glycemia as well as in situations with rapidly changing glucose levels such as exercise or in the postprandial state.

In this monocentric study we evaluated the performance of 3 commercially available continuous glucose monitoring (CGM) systems in patients with type 1 diabetes.

Study Design:

- 12 patients with type 1 diabetes were investigated over a period of 12h at the clinical research center
- Baseline characteristics: age 33 ± 11 years, 42% women, BMI 22.5 ± 2.4 kg/m², diabetes duration 17 ± 12 years, HbA1c 7.6 ± 1.1%
- 3 CGM systems (Abbott Libre, DexCom G4 Platinum, Medtronic Enlite) were worn in parallel by the subjects
- The sensors were inserted 24h prior to the experiment
- Calibrations were performed according to manufacturers' instructions (G4 and Enlite); no calibration was required for Libre (factory-calibrated)
- Routine clinical conditions were mimicked by meal tests with increased insulin doses and exercise tests (Figure 1)
- Reference plasma glucose samples were taken every 5 minutes throughout the study and measured with Super GL analyzer
- Accuracy was assessed by mean absolute relative difference (MARD) for each CGM system overall, during exercise and postprandially

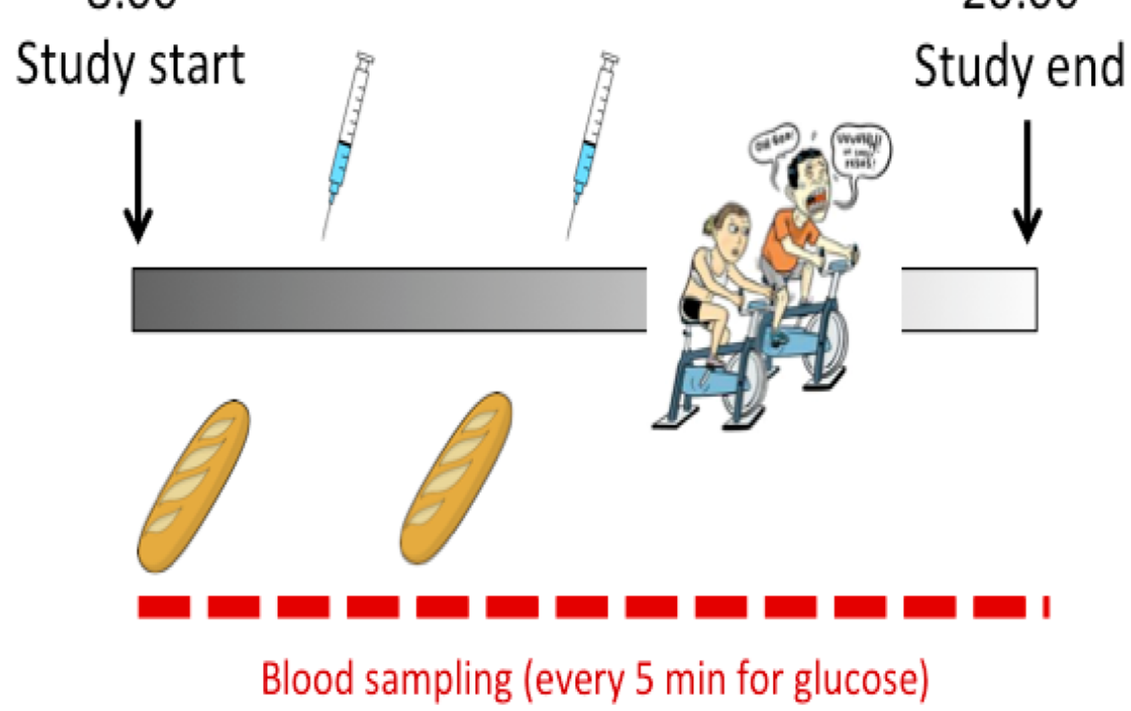


Figure 1: Study schedule
Patients were using 3 CGM systems in parallel over 12 hours. Subjects received two standardized meals (60g CHO each) along with 180% of their usual insulin dose and performed two bouts of 15min exercise.

Results: Are indicated in Table 1.

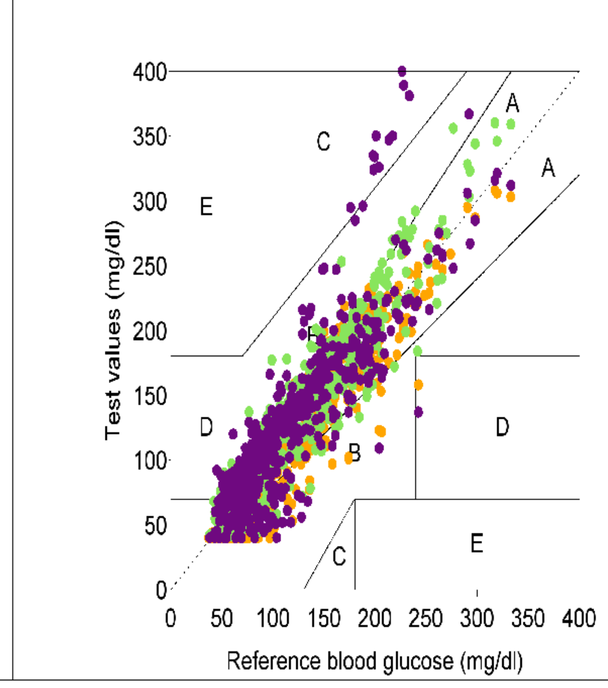
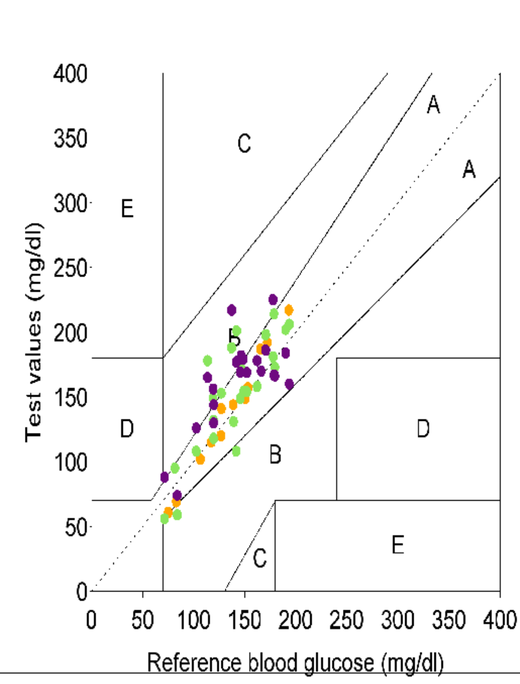
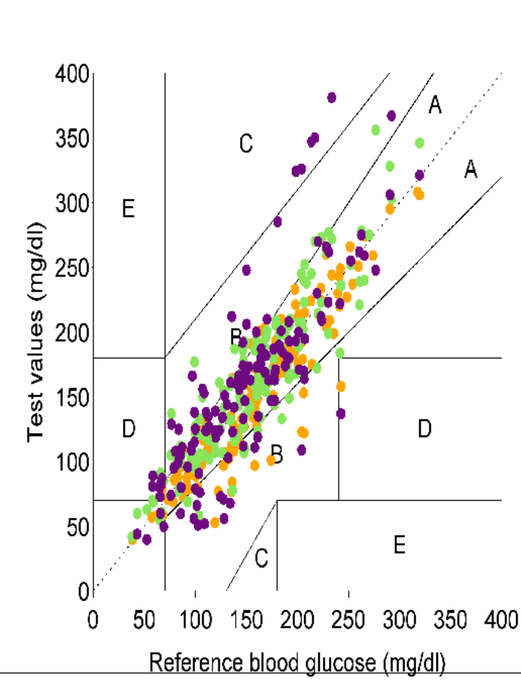
		Overall		Exercise		postprandially	
MARD	Abbott Libre	13.2 ± 10.9%	(N=462)	8.7 ± 5.9%	(N=13)	11.7 ± 10.5%	(N=124)
	DexCom G4 Platinum	16.8 ± 12.3%	(N=540)	15.7 ± 14.6%	(N=24)	15.1 ± 12.5%	(N=149)
	Medtronic Enlite	21.4 ± 17.6%	(N=502)	19.4 ± 13.5%	(N=22)	20.5 ± 17.9%	(N=138)
Clarke Error Grids							

Table 1: Accuracy metrics and Clarke Error Grids. Sensor performance during different conditions.

Conclusions:

Sensor performance was similar during the whole investigational period compared to exercise or the postprandial state. The Abbott sensor showed superior performance during all study phases. CGM might become an important tool to avoid exercise-related hypoglycemia which needs to be proven in large-scale studies.

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