Additional insulin is necessary to prevent rise in blood glucose after fat-protein-rich meals in type 1 diabetes

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57th ESPE 2018 Meeting ATHENS GREECE 27-29 September 2018

UNIVERSITÄTS KLINIKUM TÜBINGEN

Background

High amounts of protein in meals increase blood glucose in patients with type 1 diabetes. Fat delays the increase of blood glucose. Till now we do not know the amount of insulin necessary to prevent the increase of blood glucose after a fat and protein rich meal (FPRM).

Aim

To find the insulin dosage to normalize glucose levels after a FPRM.

Patients

Sixteen patients with type 1 diabetes (mean±SD; Age 19.7±2.7 years; diabetes duration 12.0±5.7 years; HbA1c 7.4±0.75%).

Methods

Application of a FPRM as evening meal with 20% vs. 40% insulin additionally compared to a standard meal (SM) or carbohydrates only. Insulin was administered as regular insulin for patients with ICT, or as a 4 hours delayed bolus in patients on pump therapy (for meal composition see Fig. 1 and Table).

Recording of glucose levels during 12 hours after the meal was carried out with CGM (Enlite-Sensors, Medtronic Corporation). Comparison of Glucose levels between FPRM and SM and calculation of additional insulin amount based on 100 g of proteins as a multiple of the carbohydrate unit.

Results

Glucose levels (mean, mg/dl) 12 hours after the meal with 20% vs. 40% vs. dose for SM were 103.5 vs. 103.0 vs. 82.0. Glucose-AUC during 12 hours after the meal with 20% vs. 40% vs. dose for SM were 1489 vs. 1488 vs. 1415 mg/dl/12 h (no significant differences). Glucose levels in the target range with 20% vs. 40% more Insulin were 60% vs. 69% (Chi-Square-Test, $p<0.01$). Glucose levels <60 mg/dl did not increase by use of 40% more Insulin. 40% of insulin additionally corresponds to the 2.15 fold carbo-hydrate unit for 100 g of Protein.

Conclusion

We suggest giving additional insulin corresponding after a FPRM for the protein part of the meal, if the amount is exceeding that of a SM (~30 g of protein).

To normalize glucose levels after a FPRM we recommend the extra administration of double the dose used per one carbohydrate unit for 100 g protein.

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Figure 1: Study meal

	FPRM			SM		
Food components	g	kcal	%	g	kcal	%
Cabohydrates	57	235	24	70	287	50
Proteins	92	379	39	28	115	20
Fat	39	361	37	19	177	30
Fibers (included)	7			10		
Total		974	100		579	100

Table: Composition of the meals

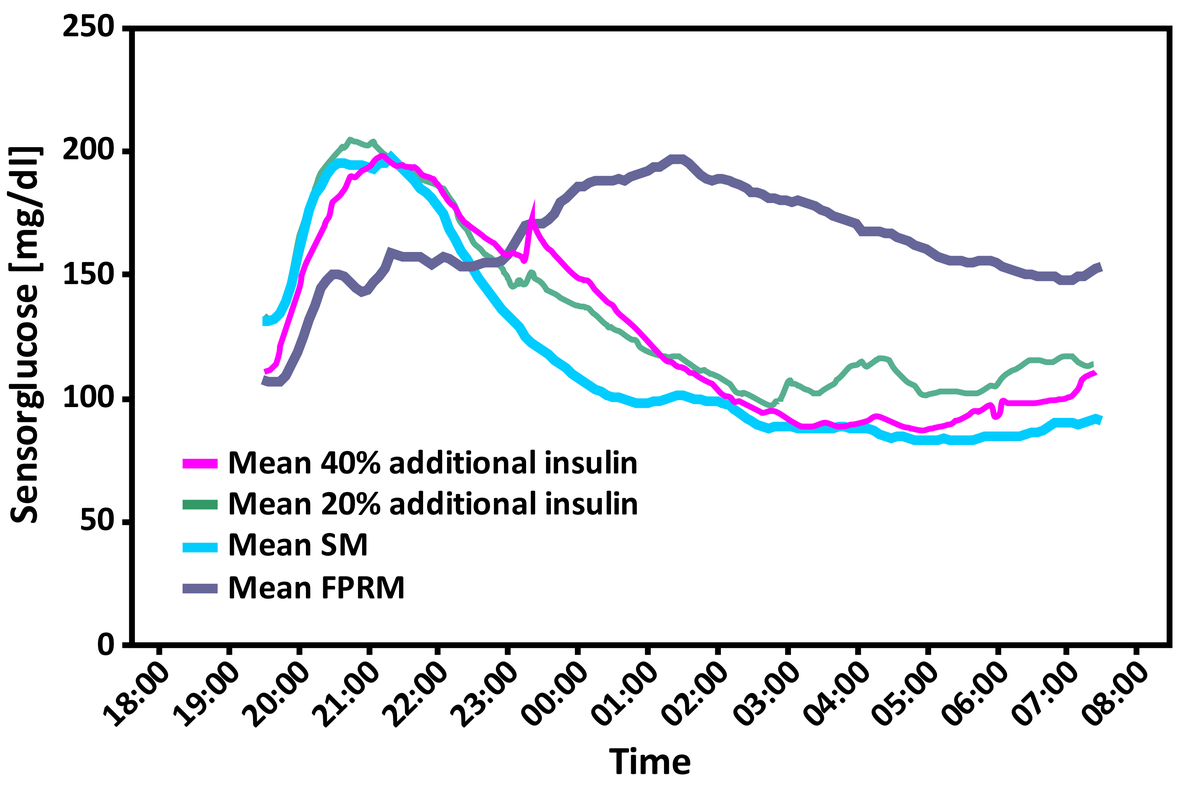

Figure 2: Mean Glucose levels after FPRM, FPRM with 20% or 40% insulin additionally and after SM. No sig. difference between levels after SM and FPRM with 20% or 40% insulin additionally

Figure 3: Study population