



Timing of pre-exercise basal insulin infusion rate reduction to prevent exercise-induced hypoglycemia in adults with type 1 diabetes using insulin pump therapy: preliminary results

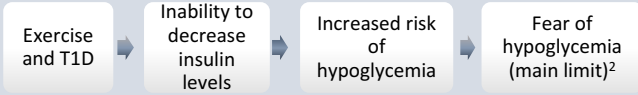
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Background and Rational

Regular exercise should be encouraged in most patients with type 1 diabetes (T1D) for its cardiometabolic and overall well-being benefits¹.



Possible types of adjustment:

- Prandial insulin dose reduction
- Carbohydrate supplementation
- **Reduction of basal insulin infusion rate in patients with insulin pump³**

Few studies have investigated the **pre-exercise optimal timing** at which patients should **implement insulin infusion reduction to prevent exercise-induced hypoglycemia**.

Objective and Hypothesis

Objective:

To compare the efficacy of three strategies to prevent exercise-induced hypoglycemia during a **45 min exercise at 60% VO_{2peak}** (moderate intensity), 3 hours after a standardized meal in adults with T1D:

1. Reduce insulin basal rate by 80% 40 minutes prior to exercise (T-40);
2. Reduce insulin basal rate by 80% 20 minutes prior to exercise (T-20);
3. Reduce insulin basal rate by 80% at the time of exercise (T0).

Primary hypothesis:

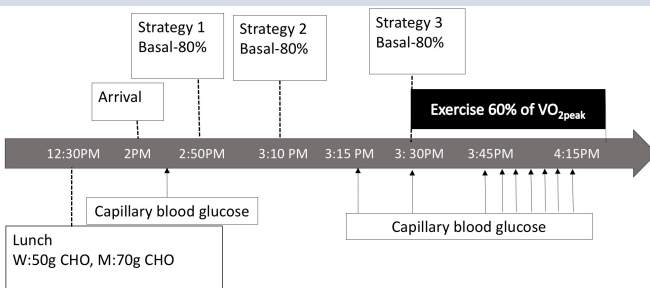
The time spent in hypoglycemia (< 4.0 mmol/L) will be less when the basal insulin rate is reduced 40 minutes prior to exercise compared to a reduction at the time of exercise.

Material and Methods

Participants: ≥18 years old, type 1 diabetes ≥1 year, treated with insulin pump >3 months.

Exercise: 45 minutes on ergometer, moderate intensity, 3h after a standardized lunch

Capillary blood glucose measured 60 min and 15 min before exercise, at onset of exercise, 15 minutes later and then every 5 minutes until the end of exercise.



Results

Table 1: Baseline Characteristics of Participants (8W, 7M), Planned sample size = 23

Characteristics	Mean±SD [Min - Max]
Age (years)	36±16 [19-70]
BMI (kg/m ²)	25.1±3.8 [20.5-33.2]
Waist circumference (cm)	86.8±12 [73.4-111]
HbA1c (%)	7.2±0.9 [5.2-8.6]
VO ₂ peak (ml/kg/min)	32.8±5.6[22.5-41.3]

Table 2 : Main Outcomes (15 subjects)

Outcome	T-40	T-20	T0	P value
Starting glucose levels (mmol/L)	7.9 ±3.1	6.9 ±2.0	6.9 ±2.5	0.436
% of time spent < 4.0 mmol/L	4[0-43]	37 [0-46]	17 [0-48]	0.281
% of time spent 4.0–10.0 mmol/L	65 [24-100]	63 [54-96]	65 [48-100]	0.444
Decrease in glucose levels during exercise	-3.0 ± 2.8	-3.4 ± 3.1	-3.1 ± 2.8	0.344
Time before first hypo < 4.0 mmol/L (minutes)	24.2± 14.0	24.7±9.4	19.1±11.2	0.594
# hypoglycemia < 3.5 mmol/L, with oral treatments	5	9	7	-

Results are presented by means ±SD or median [IQR]

- In total, 45 interventions were conducted of which 47% induced at least one hypoglycemic episode (< 3.5 mmol/L).
- Hypoglycemic risk during such exercise is important: only 3 participants never had to treat a hypoglycemic episode.

Conclusion

According to these preliminary results for a 45 minutes moderate intensity (60% VO_{2peak}) exercise starting 3h after the last meal, earlier timing and/or larger insulin infusion rate reduction and/or combination with carbohydrate intake should be tested in a larger group of patients to prevent exercise induced hypoglycemia.

References and Acknowledgements

References:

- 1.Chimen M, Kennedy A, et al. Diabetologia. 2012;55(3):542-51.
- 2.Brazeau AS, et al. Diabetes Metab. 2012;38(2):164-70.
- 3.Riddell MC, et al. Lancet Diabetes Endocrinol. 2017

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