Steno Diabetes Center Copenhagen
Department of Clinical Research, Diabetes Technology

Danish Diabetes Academy

Glucose response to low-dose glucagon after high versus low carbohydrate diet

A 12-week randomised crossover study

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POSTER 114
(to see the main study)

BACKGROUND

Low-dose glucagon effectively treats mild hypoglycaemia for individuals with type 1 diabetes.

However, the effect of low-dose glucagon to treat mild hypoglycaemia diminishes after one week of low carbohydrate diet.

It remains unclear, whether longer period of low carbohydrate diet may affect the glucose response to low-dose glucagon.

AIM

To compare the glucose response to low-dose glucagon after

12 weeks of **low carbohydrate diet (LCD <100 g carbohydrate daily)**

and

12 weeks of **high carbohydrate diet (HCD >250 g carbohydrate daily)**

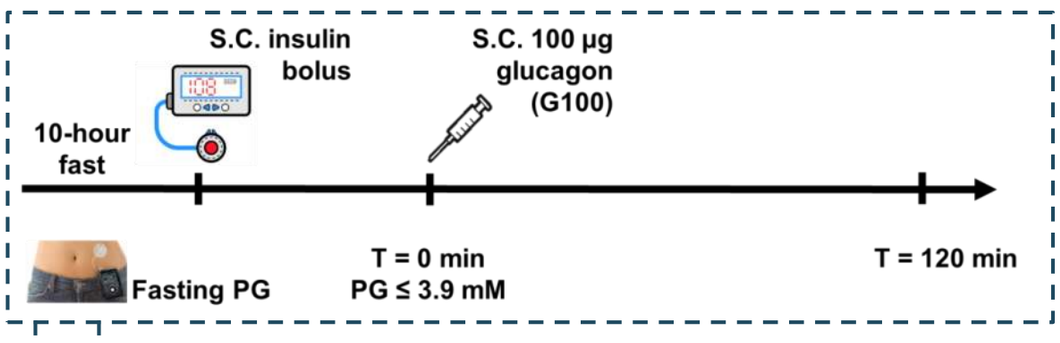
in adults with type 1 diabetes.

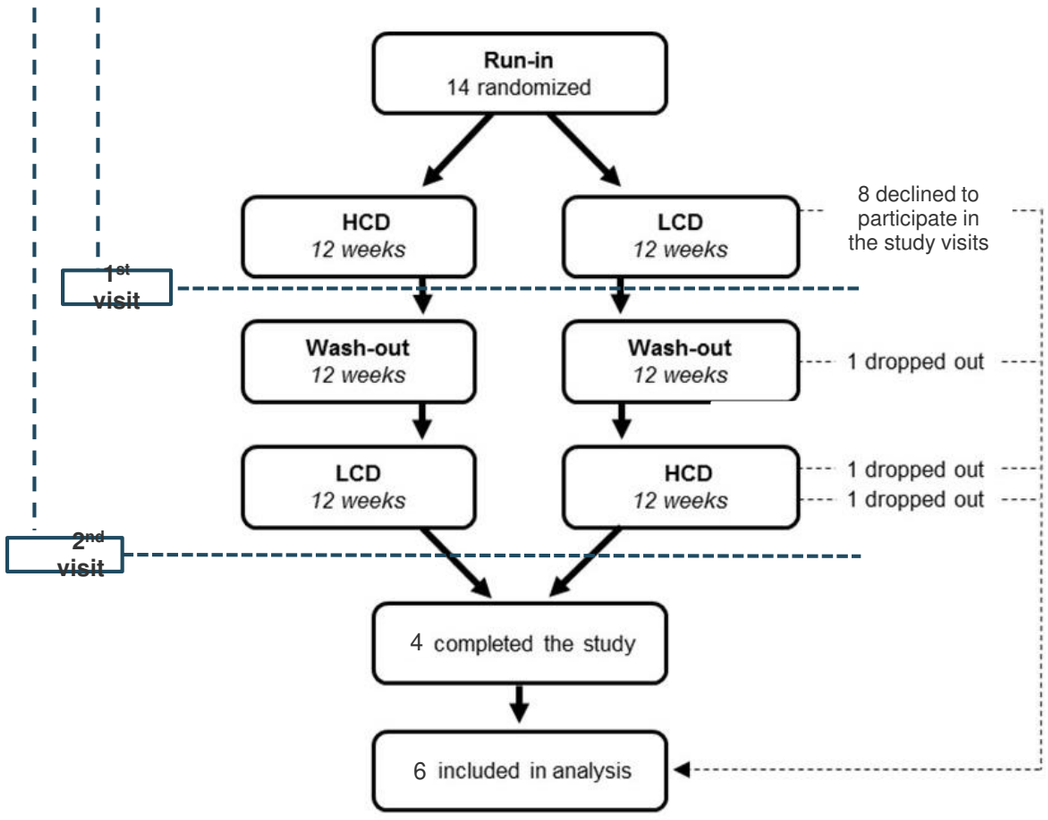
METHODS

Study design: A randomized open-label crossover study with two 12-week intervention periods separated by a 12-week washout.

Diets: Individual isocaloric meal plans meeting the carbohydrate criteria were developed for each participant for each intervention period.

Study visits: After each diet period, mild hypoglycaemia was induced by a subcutaneous insulin bolus in the fasting state. When plasma glucose (PG) reached 3.9 mmol/L, 100 µg glucagon (GlucaGen®, Novo Nordisk) was given subcutaneously, and PG was measured frequently for 120 min.





Participant flowchart: Study participants are a subpopulation from another study (poster 114). HCD: high carbohydrate diet; LCD: low carbohydrate diet.

Participant characteristics: Median (IQR)

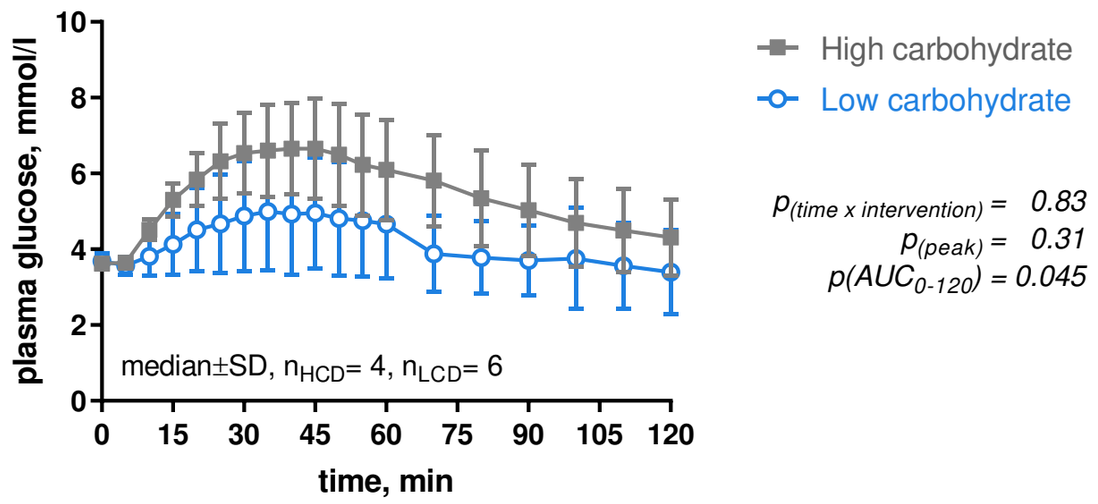
- Females / males (numbers) 5 / 1
- Age 37.5 (28-52) years
- Diabetes duration 18.5 (16-29) years
- Body weight 72.3 (69-77) kg
- Body mass index 25.0 (24.5-25.2) kg/m^2
- HbA1c 57.0 (55-60) mmol/mol
- Insulin pump use 9.5 (6-11) years
- Pre-study daily carbohydrate intake 139 (109-142) g/day

Diet adherence and insulin use:

Parameters	HCD (N=4)	LCD (N=6)	HCD vs LCD P value
Energy intake, kJ	9460 (8364-9740)	9043 (8053-9799)	0.18
Carbohydrate intake, g	254 (193-259)	95 (86-97)	0.002
Change in weight, kg	1.4 (1-2)	-2.8 (-4 to -0.5)	0.07
Ketones, mmol/l	0.10 (0.1-0.2)	0.25 (0.1-0.3)	0.03
Total insulin dose, units /day	39.8 (33-52)	35.6 (31-39)	0.014
Total insulin bolus, units /day	25.6 (24-28)	14.4 (13-17)	0.012
Total insulin basal, units /day	14.8 (14-23)	17.9 (15-23)	0.68

Data are median (IQR). HCD: high carbohydrate diet. LCD: low carbohydrate diet.

Glucose response to s.c. 100 µg glucagon:



Data are median (SD). HCD: high carbohydrate diet (grey). LCD: low carbohydrate diet (blue).

12 weeks of low carbohydrate diet reduces the glucose response to low-dose glucagon in individuals with type 1 diabetes.

CONCLUSION

In individuals with type 1 diabetes, glucose response to 100 µg subcutaneous glucagon bolus was attenuated after 12 weeks of low carbohydrate diet compared with 12 weeks of high carbohydrate diet.

Therefore, carbohydrate intake should be considered when low-dose glucagon is used to treat mild hypoglycaemia.

Funding: Danish Diabetes Academy supported by the Novo Nordisk Foundation