

# Intraperitoneal insulin administration in pigs: Effect on circulating insulin and glucose levels

Ilze Dirnena-Fusini<sup>1,2</sup>, Marte K. Åm<sup>1,2,4</sup>, Sven M. Carlsen<sup>1,2,4</sup>, Anders L. Fougner<sup>1,3</sup>, Sverre C. Christiansen<sup>1,2,4</sup>

<sup>1</sup>Artificial Pancreas Trondheim – The APT research group ([www.apr-norway.com](http://www.apr-norway.com))

<sup>2</sup>Department of Clinical and Molecular Medicine

<sup>3</sup>Department of Engineering Cybernetics

Norwegian University of Science and  
Technology (NTNU), Trondheim, Norway

<sup>4</sup>Department of Endocrinology, St. Olav's  
University Hospital, Trondheim, Norway

## Background

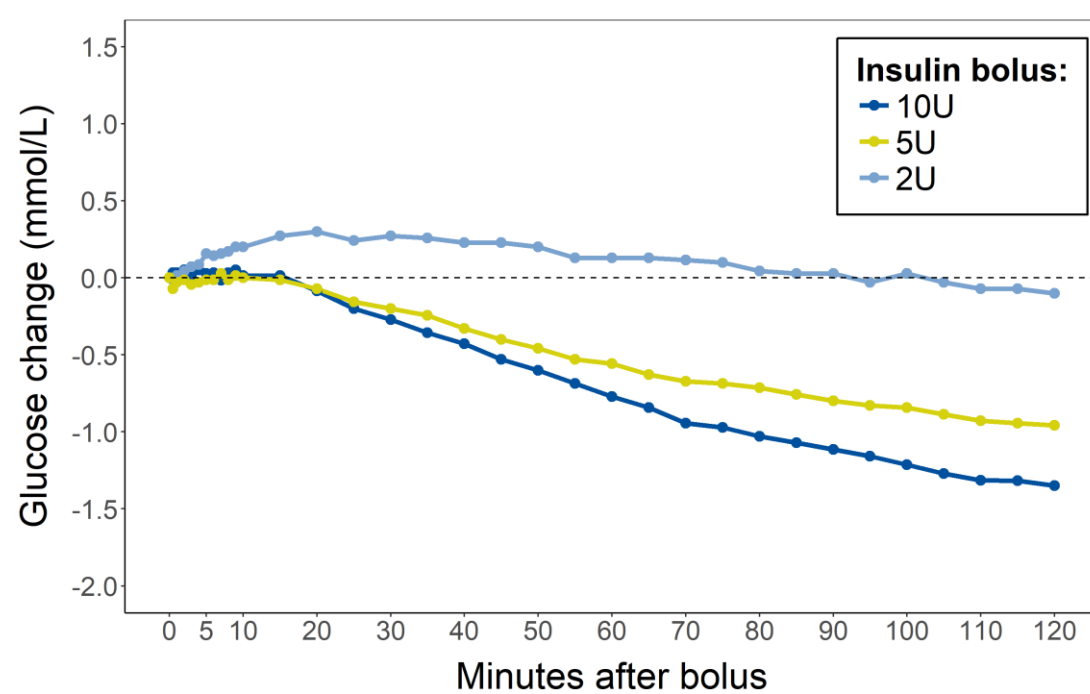
- Aim:** Investigate the effect of intraperitoneal (IP) insulin boluses with respect to insulin absorption and the effect on blood glucose levels.
- Motivation:** Limited available information about glucose response and insulin changes after IP insulin administration. Previous studies have not sampled often enough to build suitable mathematical models of IP insulin absorption.

## Methods

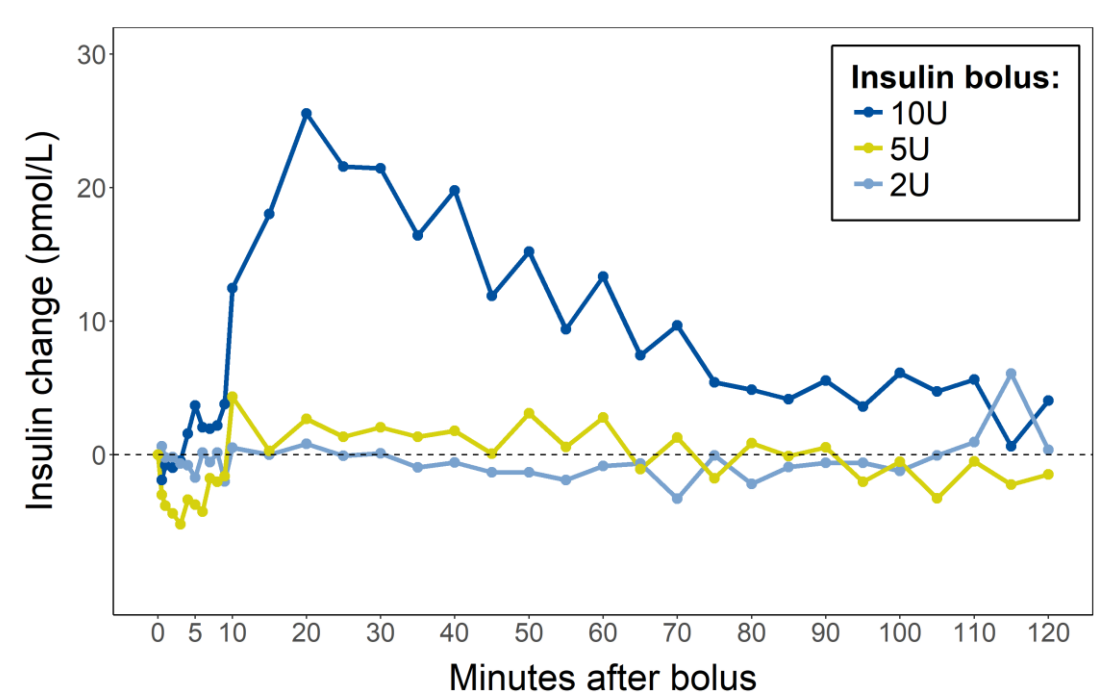
- 2U, 5U and 10U NovoRapid insulin (Novo Nordisk, Denmark) boluses administered in the upper right part of the peritoneal cavity of 6 pigs (36.0 – 42.6 kg).
- Endogenous insulin and glucagon production suppressed by a combination of octreotide and pasireotide.
- Stable continuous glucose infusion (8 g/h).
- Blood samples collected before and at least every 5 minutes for 120 min after insulin administration.
- Insulin measured with ELISA kits (Mercodia, Sweden).

## Results

### Glucose measurements:



### Insulin measurements:



## Discussion

- Insulin levels increased after 10–15 minutes.
- Blood glucose level decreased after 20 minutes in a dose dependent way.
- Measured insulin levels increased much more after 10U than after 5U of insulin. This may be explained by the amount of insulin exceeding the threshold of the liver.
- The oscillatory insulin levels observed at 1–8 mins and 25–75 mins are mainly due to results from one pig and is considered as an incidental observation.

## Conclusions

- IP insulin boluses lowers blood glucose levels in a dose dependent manner.
- There seems to be a threshold to the amount of insulin that can be bound during the first pass in the liver.
- These results provide data for modelling of IP insulin absorption and effect for developing an IP artificial pancreas.

## Acknowledgments

The animal experiments were conducted at the Comparative medicine Core Facility (CoMed), Norwegian University of Science and Technology (NTNU). CoMed is funded by the Faculty of Medicine at NTNU and Central Norway Regional Health Authority. The experiments were approved by Norwegian Food Safety Authority (FOTS no.12948).

Declaration of interest: There is no conflict of interest that could be perceived as bias in data interpretation and analysis.

Funding: This research is funded by The Norwegian Research Council (Project no.: 248872/O70), Central Norway Regional Health Authority and Johan Selmer Kvanes Endowment for Research and Combating of Diabetes.

