Late Afternoon Vigorous Exercise Increases Post-Meal but Not Overnight Hypoglycaemia in Adults with Type 1 Diabetes Managed with Automated Insulin Delivery

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No Disclosures

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Background – Exercise and health for diabetes

TYPE 1 DIABETES
BENEFITS OF EXERCISE AND RECOMMENDATIONS

BENEFITS[1,2]	ADA RECOMMENDATIONS[3]
▪ Lipid profile (↑HDL; ↓Trig; ↑LDL size)	▪ 150 minutes per week aggregate
▪ Weight reduction	▪ Avoid 2 consecutive days without physical activity
▪ Blood pressure	▪ Resistance exercise 2-3 times per week
▪ Insulin sensitivity / glucose control	
▪ Complication reduction	
▪ Psychological well-being	

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[1] *Bohn B, et al. Diabetes Care 2015;38:1536–1543.* [2] *Kriska AM, et al. J Clin Epidemiol 1991;44:1207–1214.*
[3] *Colberg SR, et al. Diabetes Care 2016;39:2065-2079.*

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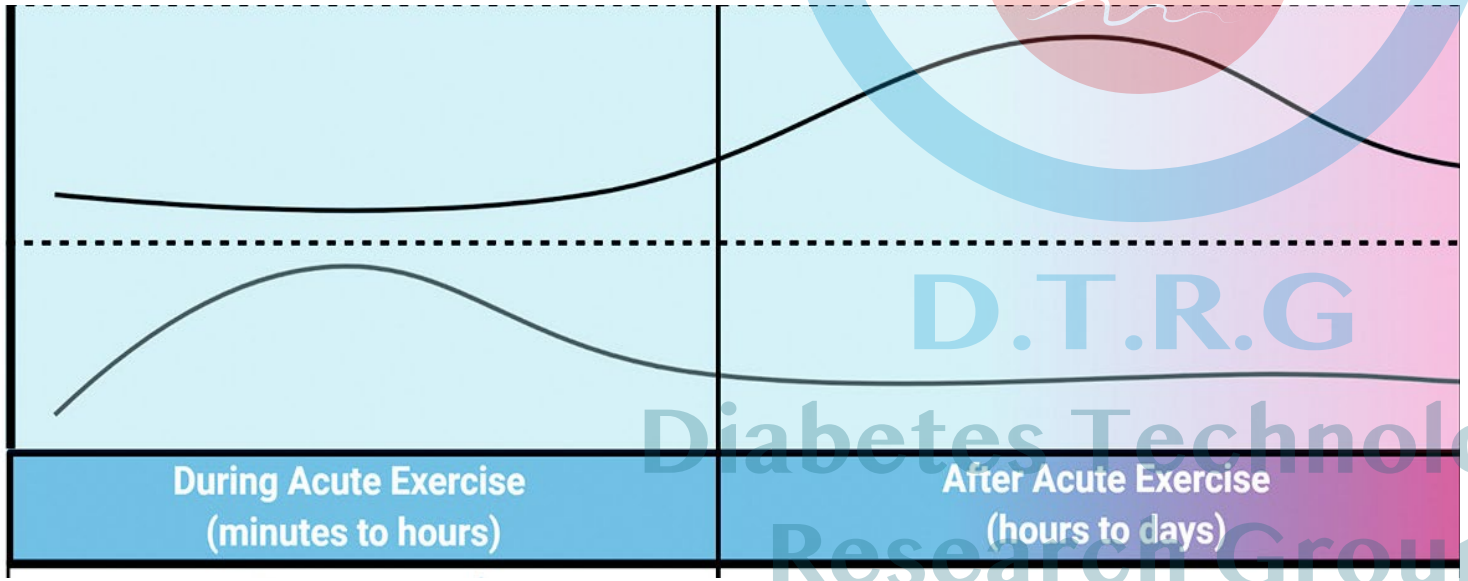
Background – Exercise and insulin sensitivity

- The impact of exercise upon glucose control extends beyond the period of physical activity and immediately following exercise



Insulin-Mediated Glucose Uptake

Contraction-Mediated Glucose Uptake

Gillen et al. Applied Physiology, Nutrition, and Metabolism 2021.

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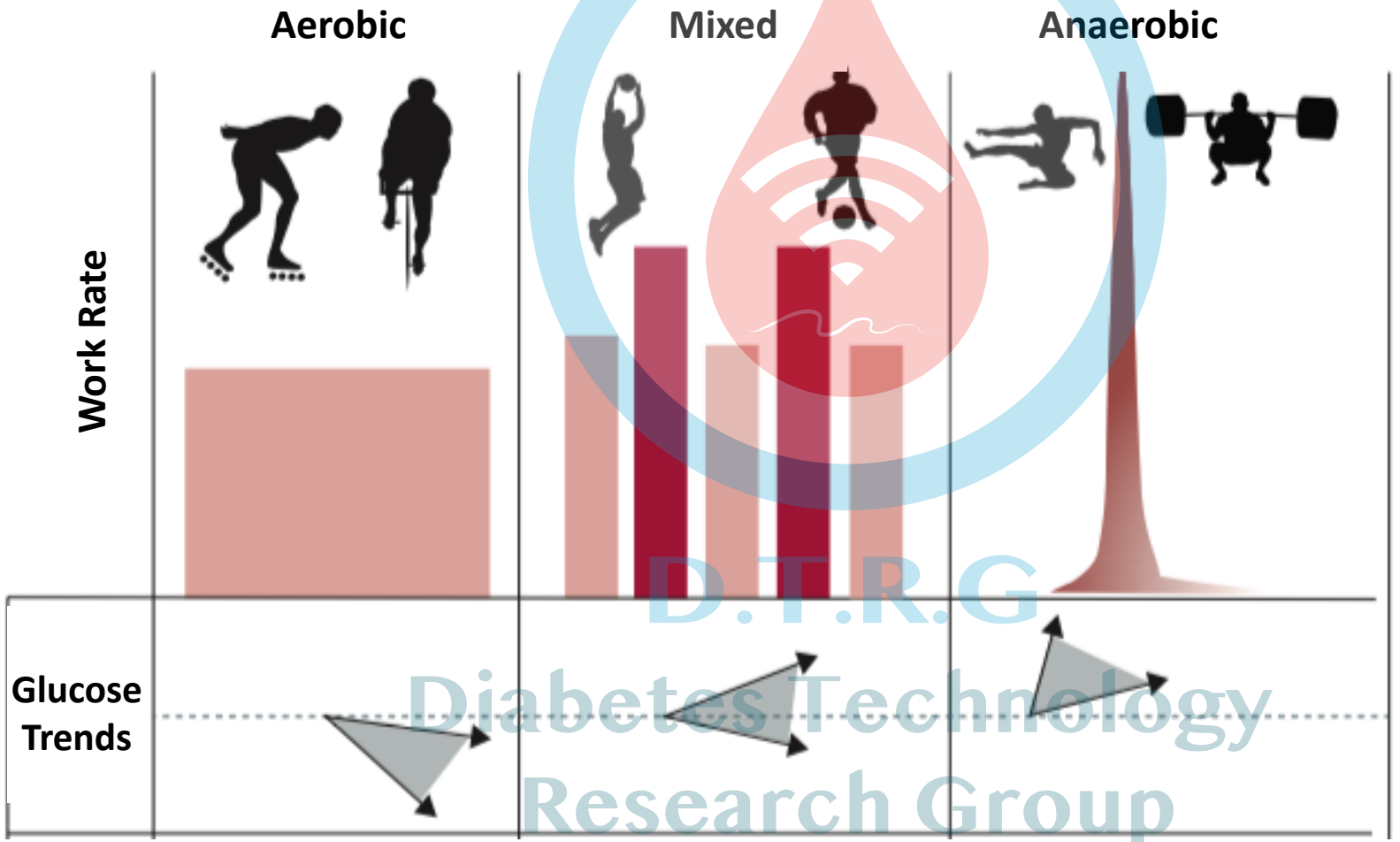
Background – During exercise with type 1 diabetes



Riddell et al. The Lancet Diabetes and Endocrinology 2017

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Background – Automated Insulin Delivery Systems

- Automatically adjust insulin delivery to maintain glucose target
- Significantly improve glucose control in people with type 1 diabetes
- Have limitations during exercise and following exercise when insulin requirements are variable

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Aims

The primary aim of this analysis was to examine **late evening and overnight glycaemia** following **aerobic, anaerobic and resistance exercise** in adults with type 1 diabetes using automated insulin delivery – compared to a control day with no antecedent exercise – with a specific **focus on hypoglycaemia**.

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Participant Cohort

Sample Size	30
Age (years)*	38 [9]
Sex (female / male)	14F / 16M
BMI kg/m^{2*}	26.3 [3.4]
Duration of Diabetes (years)*	23 [10]
HbA1c (% / mmol/mol)#	7.1 [1] / 54 [11]
V02 max (ml/kg/min)*	37.5 [11.1]

**Mean (SD); #Median (IQR)*

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Protocol

Moderate Intensity Exercise	**MEAL** ~4h pre-ex	**Temp Target** Set 2h pre-ex	**MIE** Exercise @ 3-5pm	• **40min** @ **40% Peak Power** Output
High Intensity Exercise	**MEAL** ~4h pre-ex	**Temp Target** Set 2h pre-ex	**HIIE** Exercise @ 3-5pm	• **40min:** 5min warm-up **4 x 4min @ 80% Peak Power** w/ 3min rest
Resistance Exercise	**MEAL** ~4h pre-ex	**Temp Target** Set 2h pre-ex	**RE** Exercise @ 3-5pm	• **40min** whole-body strength circuit 5 exercises x 4 sets 1 set warm up @ 40% 3RM **3 sets 80% 3RM for 8 reps**

Each session was preceded by a control day without any antecedent exercise for comparison

Exercise bouts completed in random order and separated by at least 1 week

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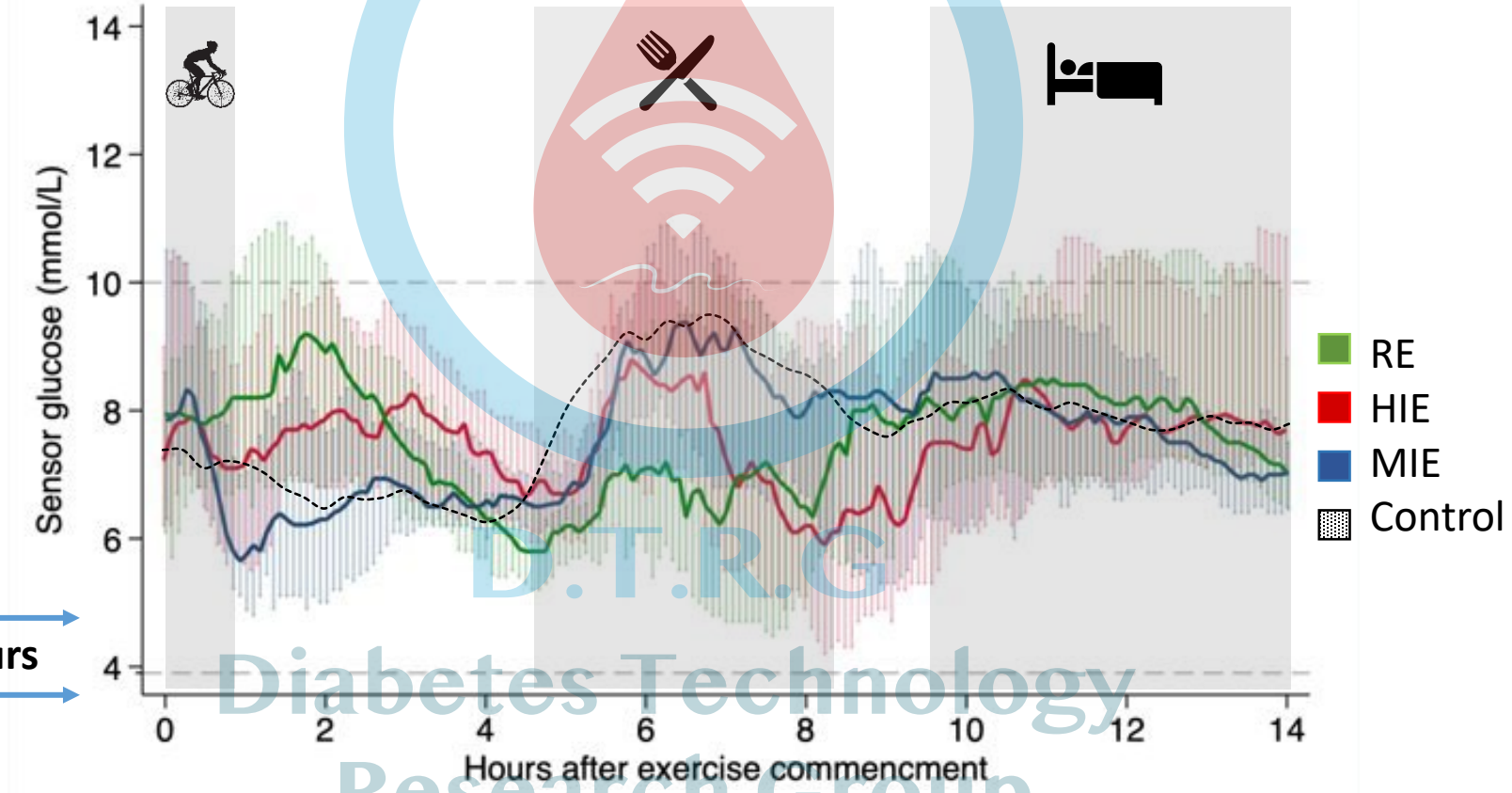
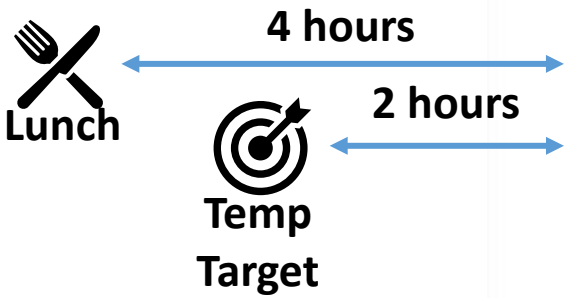
Results





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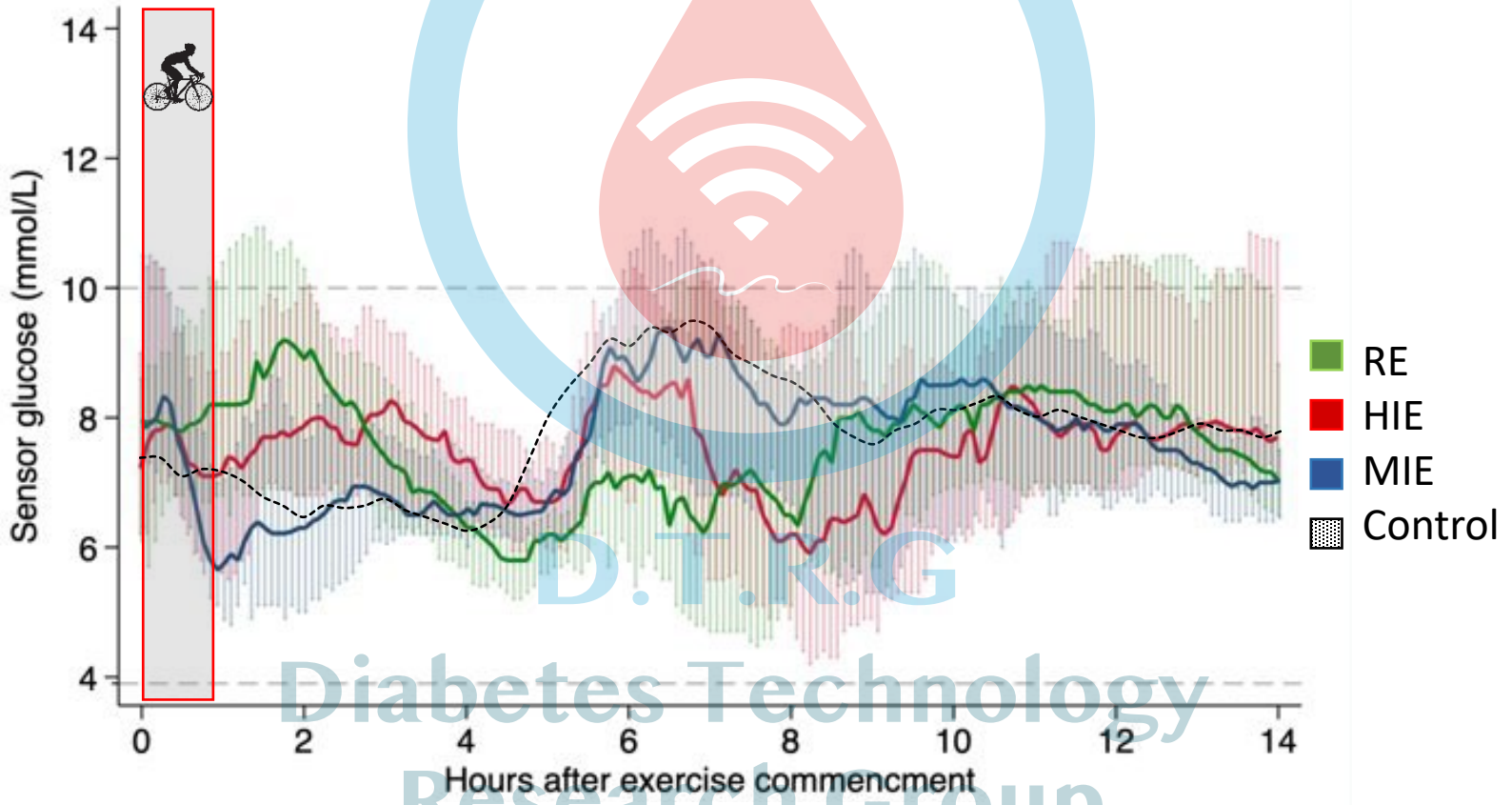
Results – During Exercise



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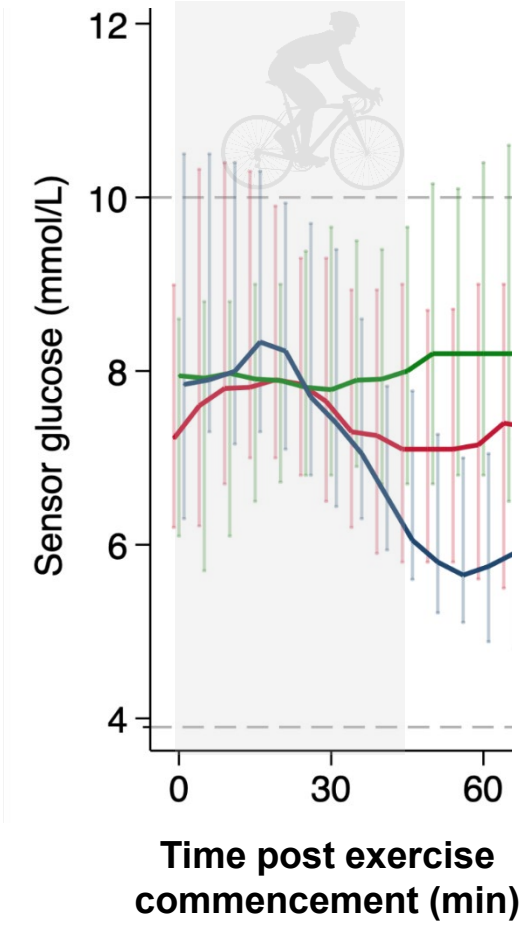
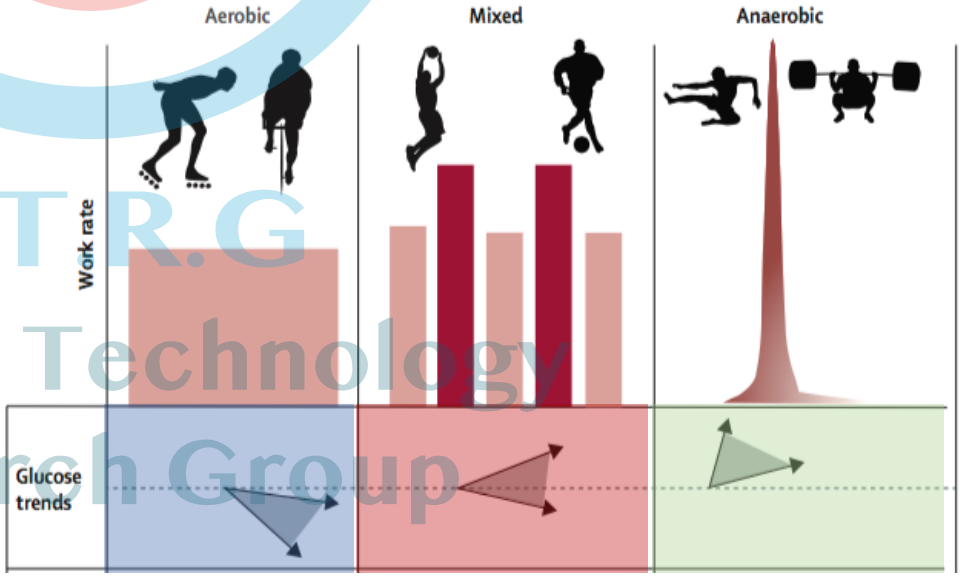
Results – During Exercise



- Glucose response during exercise was as expected
- MIE: Glucose decrease (~3mM average)
- HIE: No change
- RE: Slight increase



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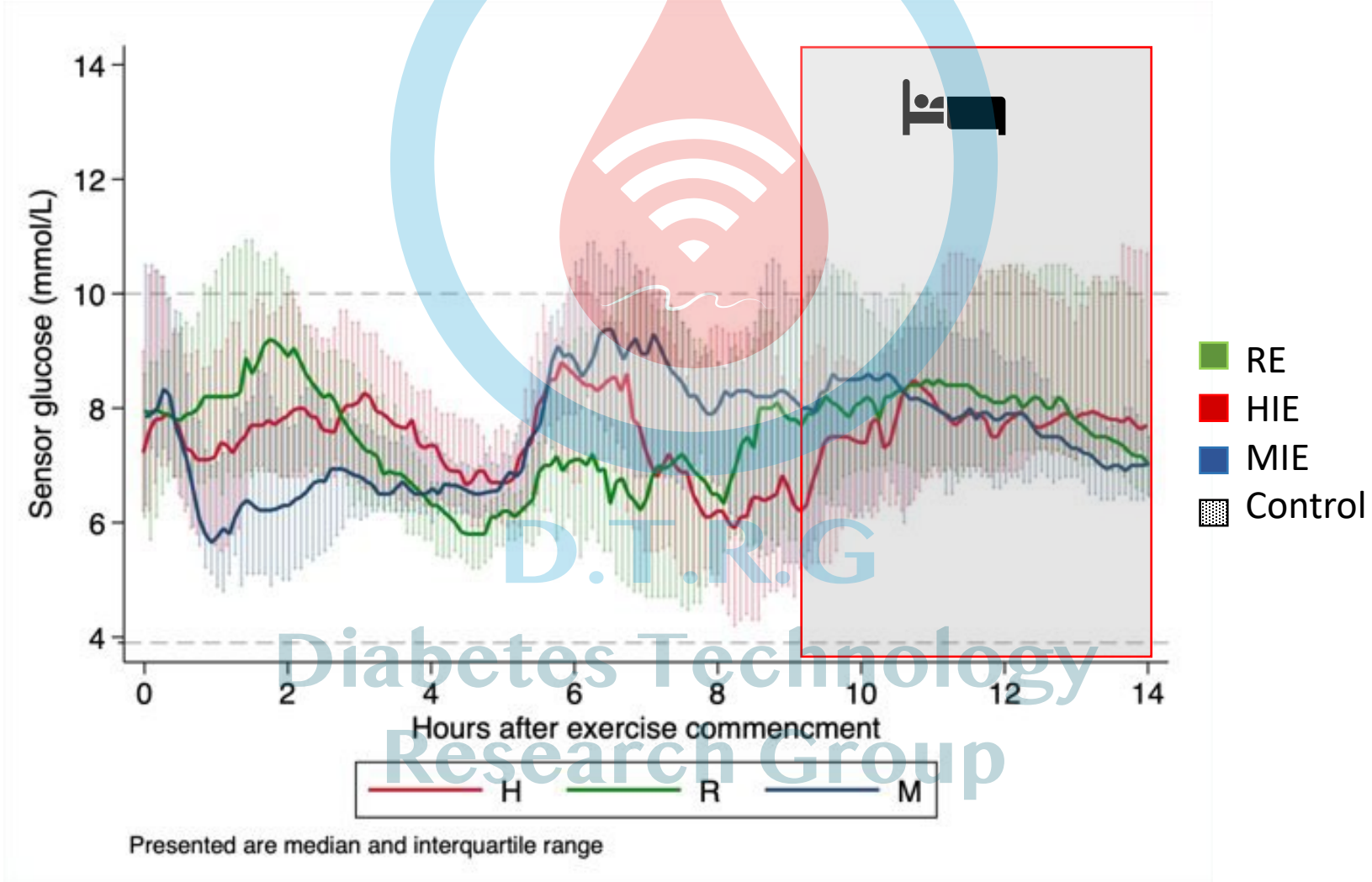
Results - Overnight



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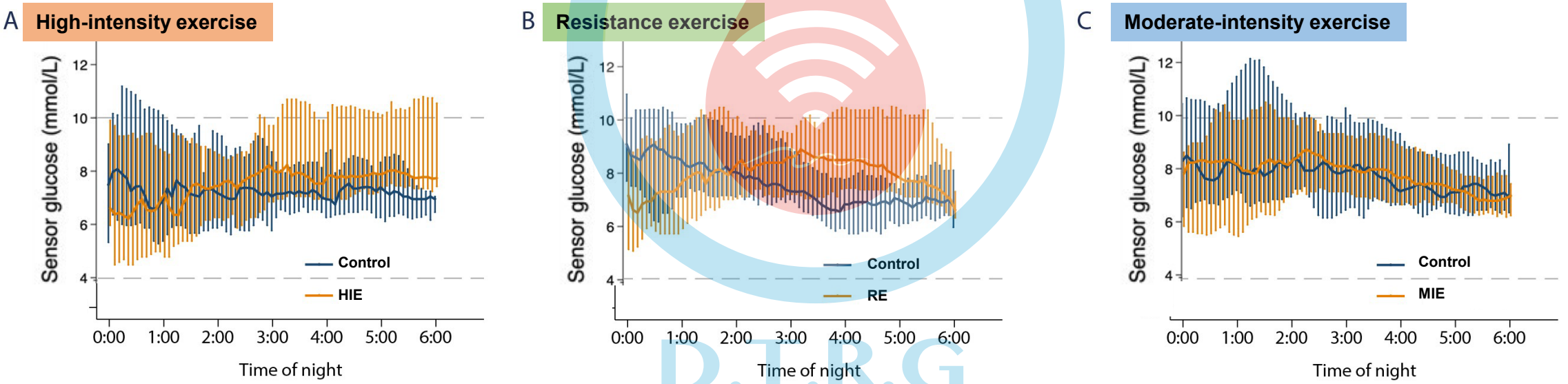
Results – Overnight (00:00 – 06:00)



- **Hypoglycaemia risk overnight following exercise is very low when using automated insulin delivery**
- **No significant difference** between nights post-exercise and nights with no antecedent exercise.

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Results – Postprandial Period

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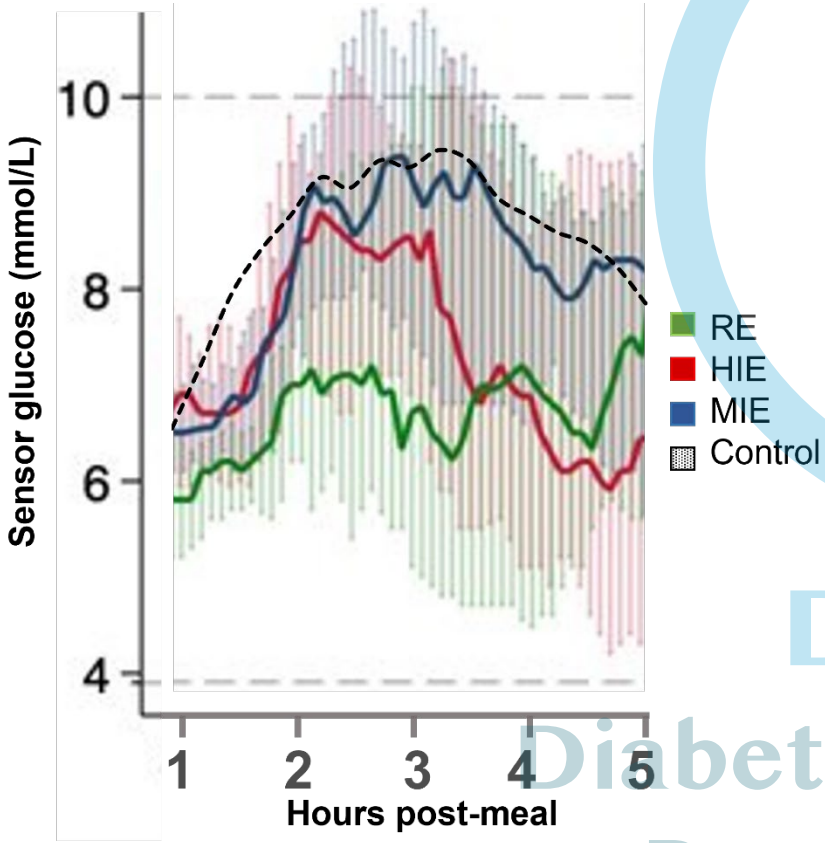
Results – Postprandial Period



- Postprandial sensor glucose was higher in MIE and control compared to HIE and RE
- Vigorous intensity exercise results in greater post-exercise insulin sensitivity in the short-term
- **RE had significantly more time spent in hypoglycaemia in the postprandial period compared to MIE and control**

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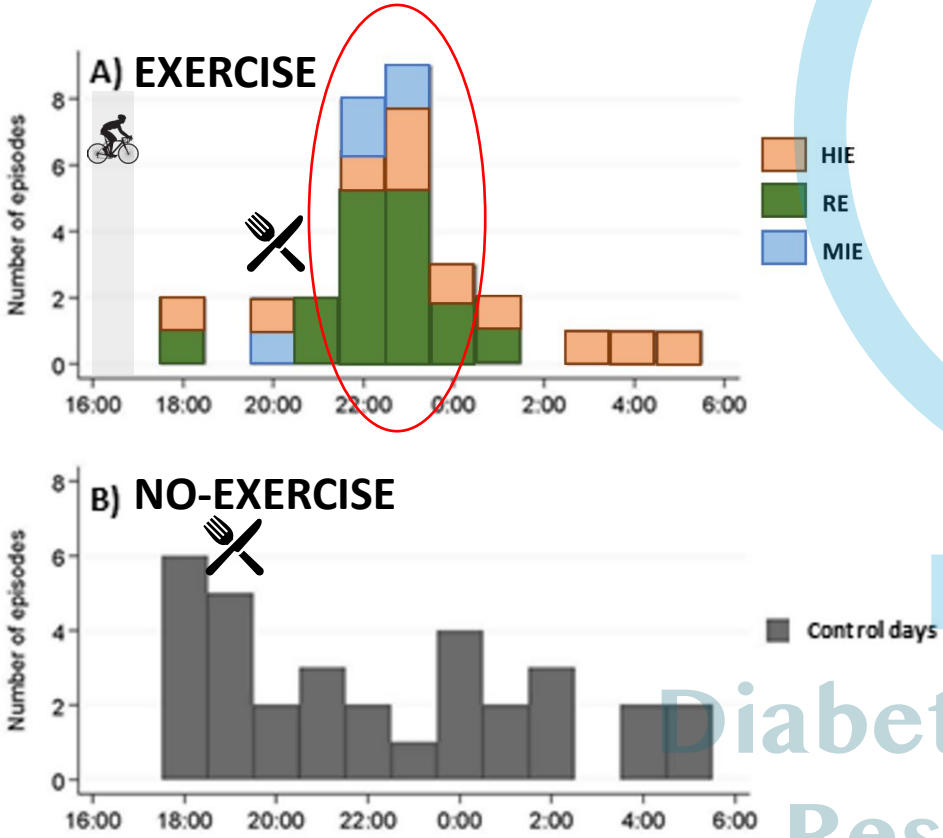
Results - Postprandial Period

Number of hypoglycaemic episodes



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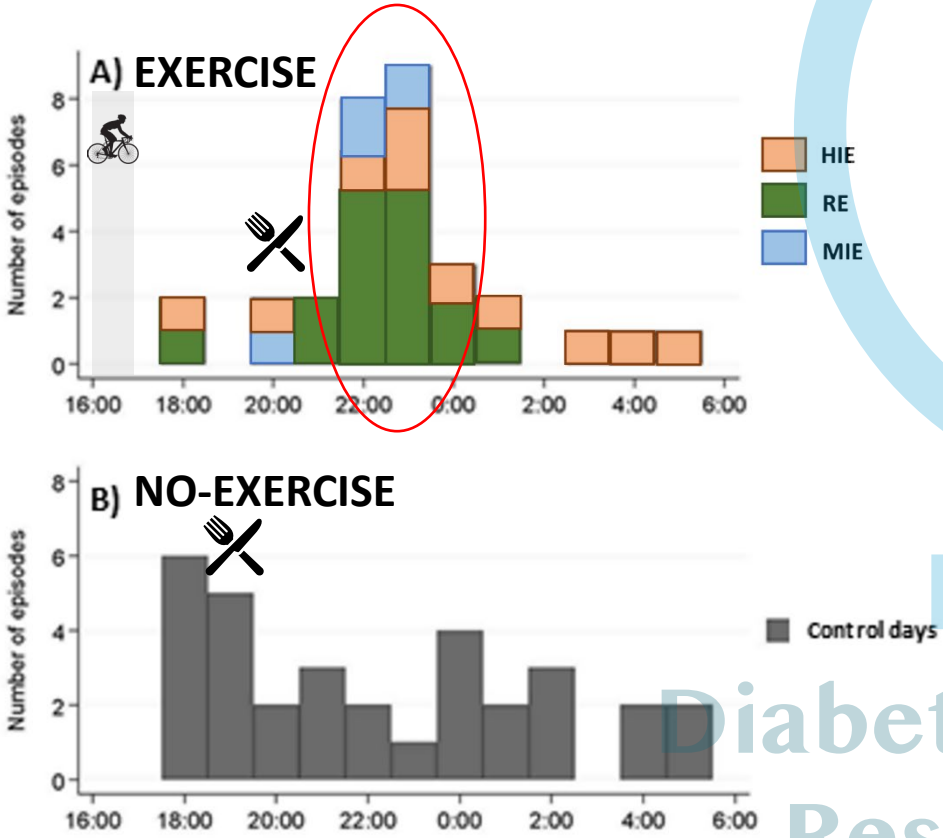
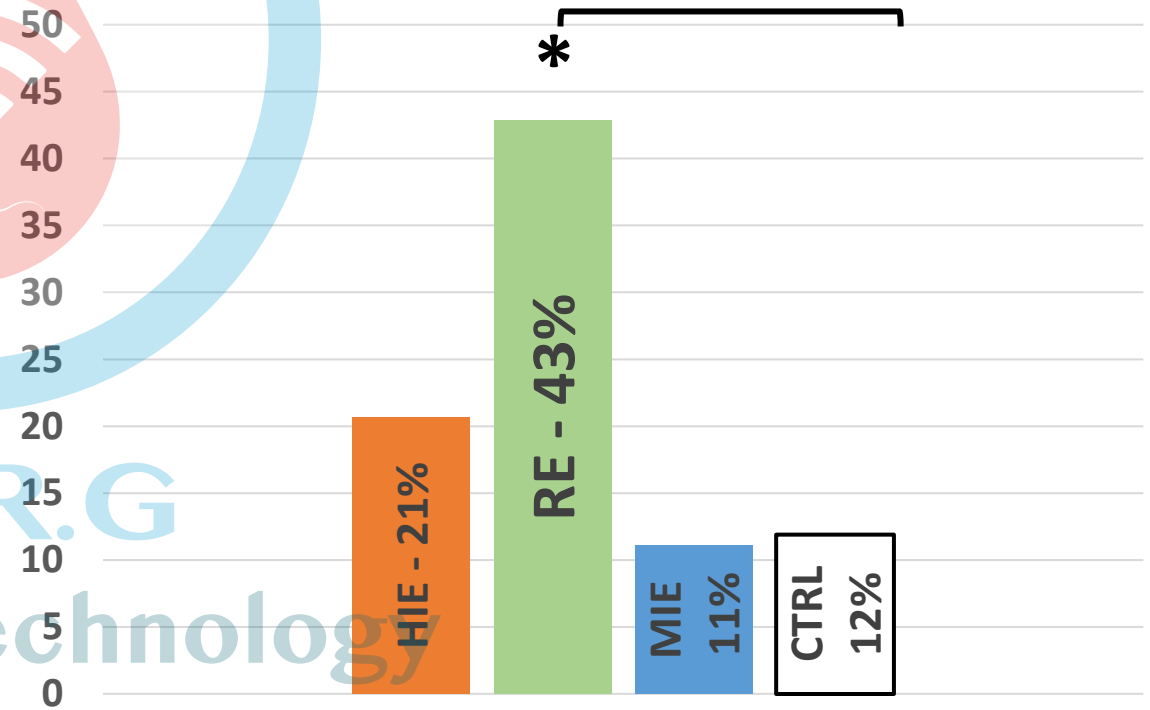
Results - Postprandial Period

Number of hypoglycaemic episodes



Percentage of participants to experience a postprandial hypo event



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Conclusions

People with T1D can feel reassured that post-exercise hypoglycaemia risk is low when using automated insulin delivery – across a spectrum of exercise modes

Low-Moderate intensity aerobic exercise:

- **Increased vigilance during exercise** even when appropriate preventative measures are undertaken.

High intensity exercise / resistance exercise:

- **Increase vigilance within several hours post-exercise.**
- Consider decreasing the insulin bolus for the **first meal post-exercise**.

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