



## Managing type 1 diabetes around exercise

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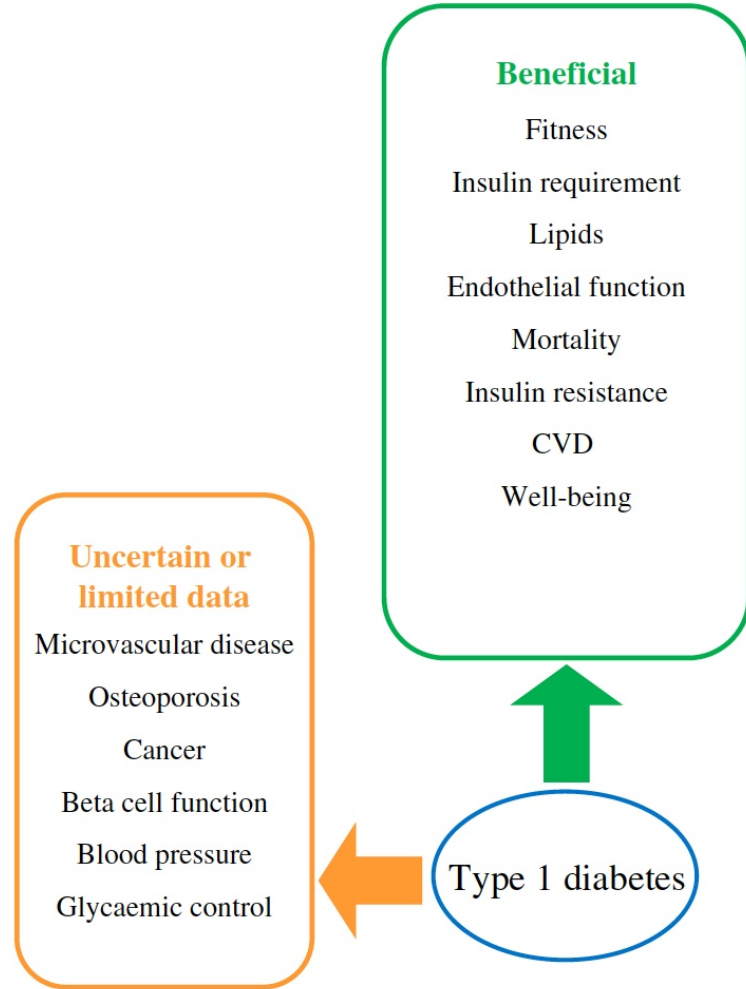
Rob Andrews – University of Exeter

# Learning objectives

1. What are the benefits and barriers to exercise in people with T1D
2. what you need to think about before you exercise
3. what options are available for managing glucose during exercise
4. what options are available for managing glucose after exercise

# What are the health benefits of exercise in T1D?

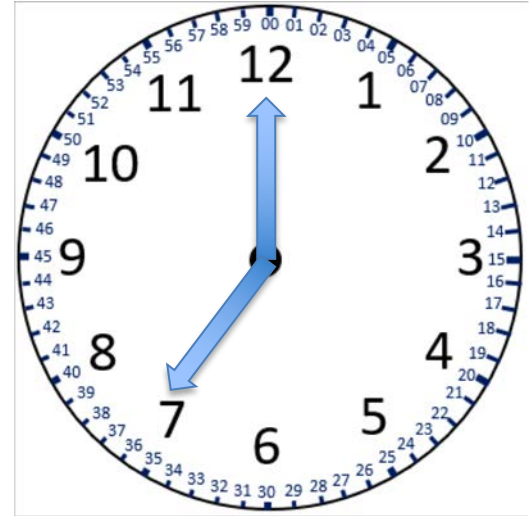
Chimen Diabetologia 2012



# So how much exercise do people with T1D do?



Non T1D: 53 minutes MVPA/day

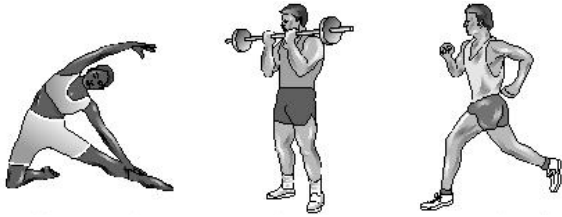


T1D: 37 minutes MVPA/day

Diabetes  
specific  
barriers to  
exercise in  
adults with  
new-onset and  
established  
T1D

New onset T1D	Established T1D
<ul style="list-style-type: none"><li>• Hypoglycaemia (both actual and fear of)</li><li>• Lack of knowledge/confidence in managing diabetes</li><li>• Advice from healthcare professionals to stop exercising</li><li>• Planning (e.g. checking blood glucose)</li><li>• Feeling overwhelmed by diagnosis.</li></ul>	<ul style="list-style-type: none"><li>• Loss of control of diabetes</li><li>• Lack of knowledge on the management of diabetes for exercise</li></ul>

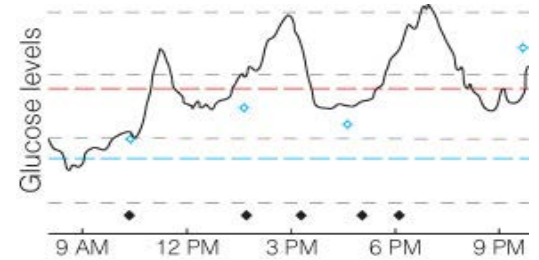
# Considering exercise – three things to think about



What exercise you are going to do?



What time you will exercise?



What has your Glucose level been in the last 24 hrs and what is it at the start of exercise?

# The exercise – three things you need to know

- What type of exercise are you going to do?
- What will the intensity of the exercise be?
- How long will you exercise for?



# Three types of exercise



## **AEROBIC**

Hiking  
Golf  
Road cycling  
Cycle tour  
Mountain biking  
Distance running  
Distance swimming  
Marathon



## **ANAEROBIC**

Weight lifting  
Body Building  
Dressage  
Fencing  
Track and field events  
Sprinting  
Archery  
Wrestling

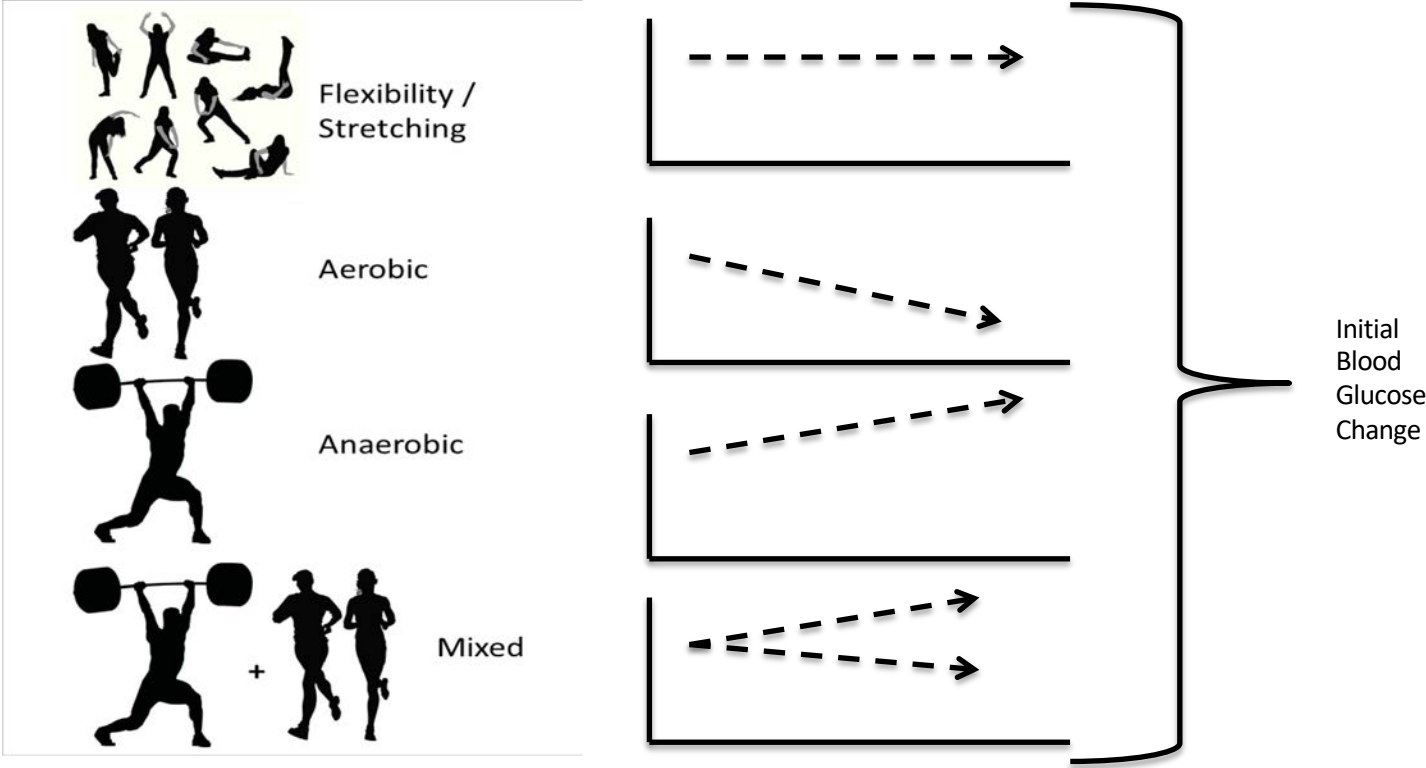


## **FLEXIBILITY**

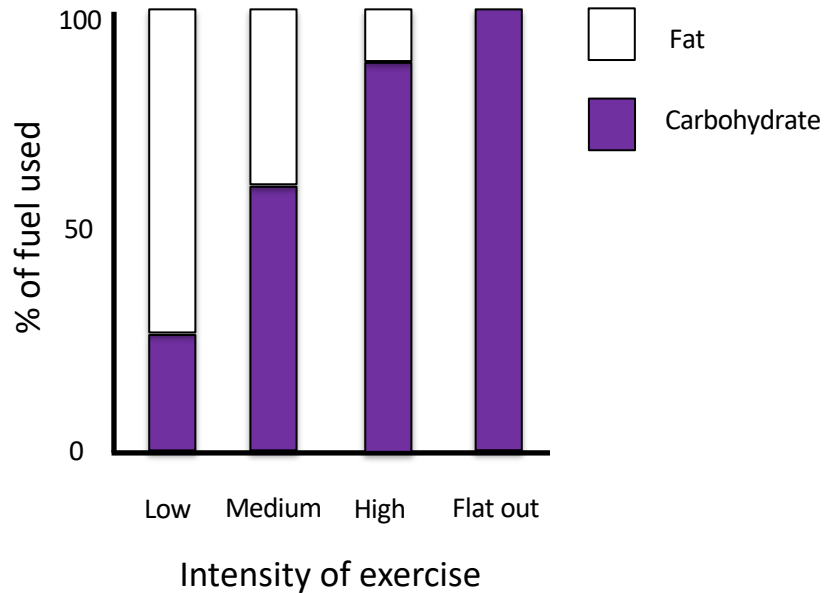
Stretching  
Yoga



# Glucose responses to different exercises in T1D



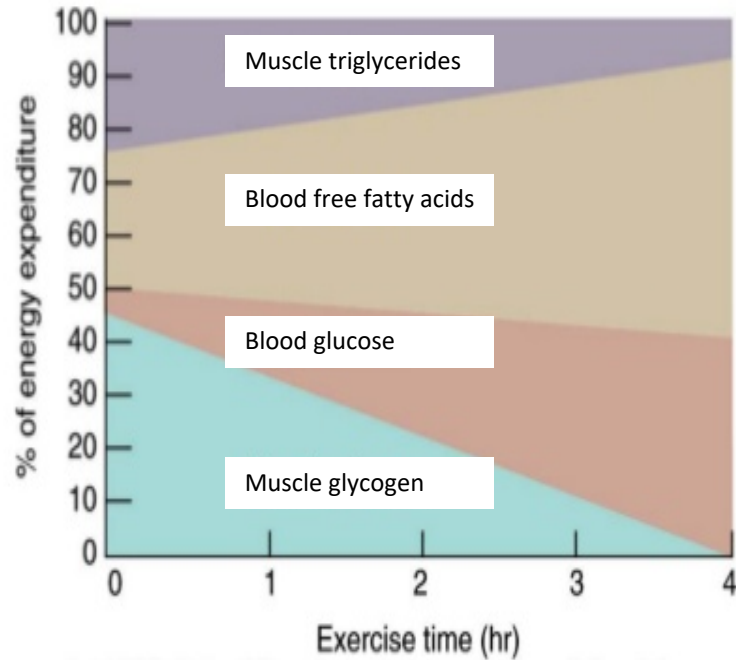
# Intensity of exercise



- Glucose is used at all intensities of exercise
- At low intensity the main fuel used is fat
- At high intensity the main fuel used is glucose

Romijn *et al.*, *Am J Physiol* 1993;  
Van Loon *et al.*, *J Physiol* 2001

# Length of exercise



- Little blood glucose used during first 30mins of exercise
- More blood glucose used with longer duration exercise

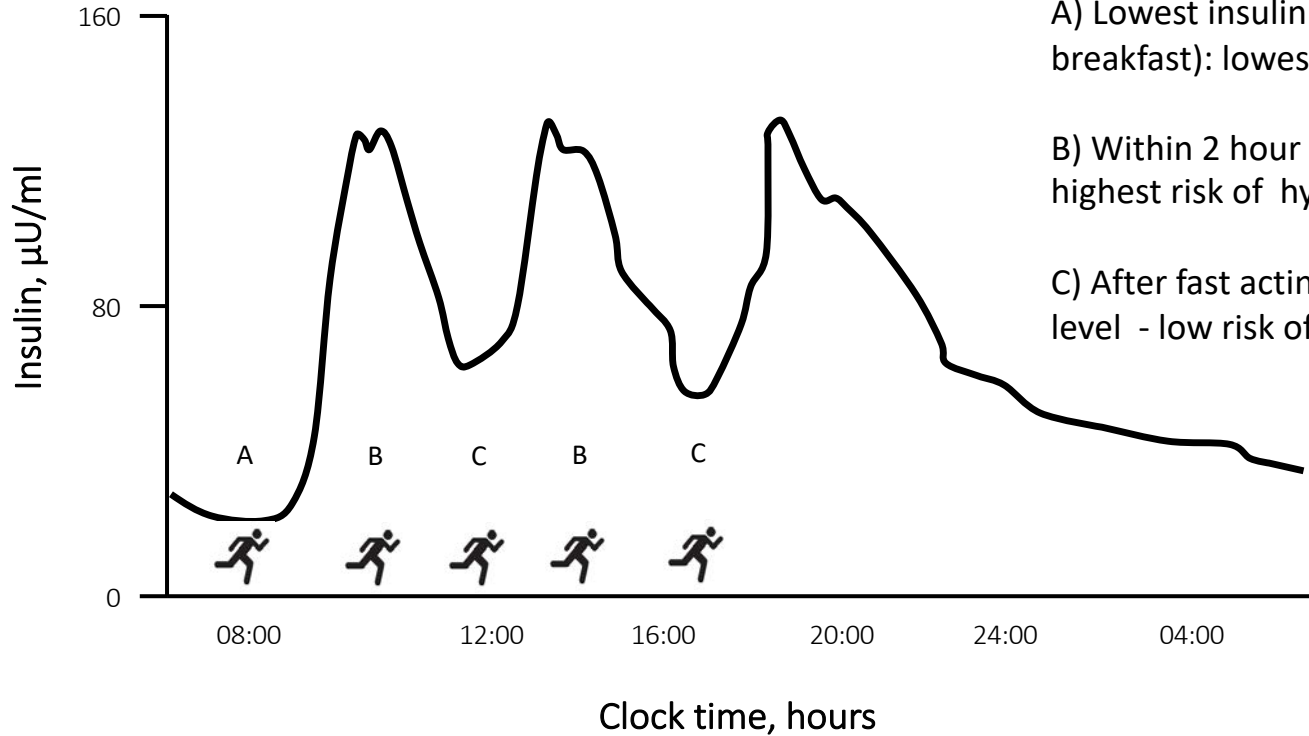
Romijn *et al.*, *Am J Physiol* 1993;  
Van Loon *et al.*, *J Physiol* 2001

## Time of day – three things to think about

- How much insulin do you have on board?
- When did you last eat?
- Are you exercising in the morning or afternoon?



# Prevailing insulin levels

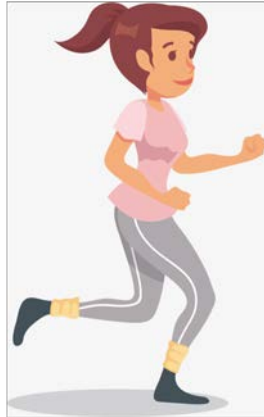


A) Lowest insulin level on waking (pre-breakfast): lowest risk of hypoglycaemia here

B) Within 2 hour window of fast acting insulin: highest risk of hypoglycaemia here

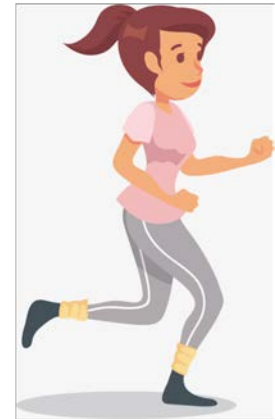
C) After fast acting insulin: second lowest insulin level - low risk of hypoglycaemia

# Morning or afternoon exercise?



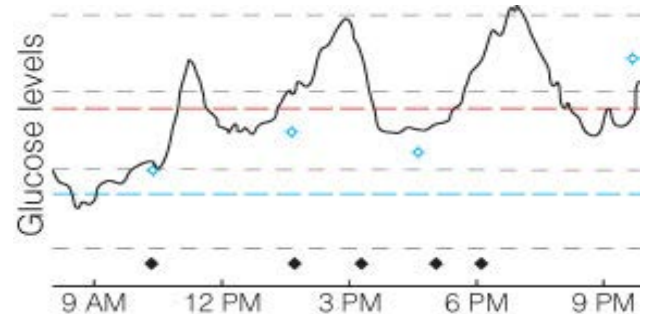
Greater risk of hypo if  
exercise undertaken  
after 4pm

Insulin resistance  
Wakefulness



## Glucose level– three things to think about

- Have you had a hypo in the last 24 hours?
- What has been happening to your glucose in last hour?
- What is your current blood glucose?



# Hypoglycaemia and exercise

Type of hypo	Risk of hypo with exercise
Severe hypoglycaemic episode (needed help from someone else) in last 24 hours.	<p>Risk of hypoglycaemia with exercise and after exercise is very high.</p> <p><b>Advice is not to exercise on that day</b></p>
Hypoglycaemic episode self treated in last 24 hours.	<p>Higher risk of hypoglycaemia with exercise and after exercise</p> <p><b>Advice is to</b></p> <ol style="list-style-type: none"><li><b>1. Not to do lone events/ training</b></li><li><b>2. Monitor more frequently</b></li><li><b>3. Check blood overnight</b></li></ol>



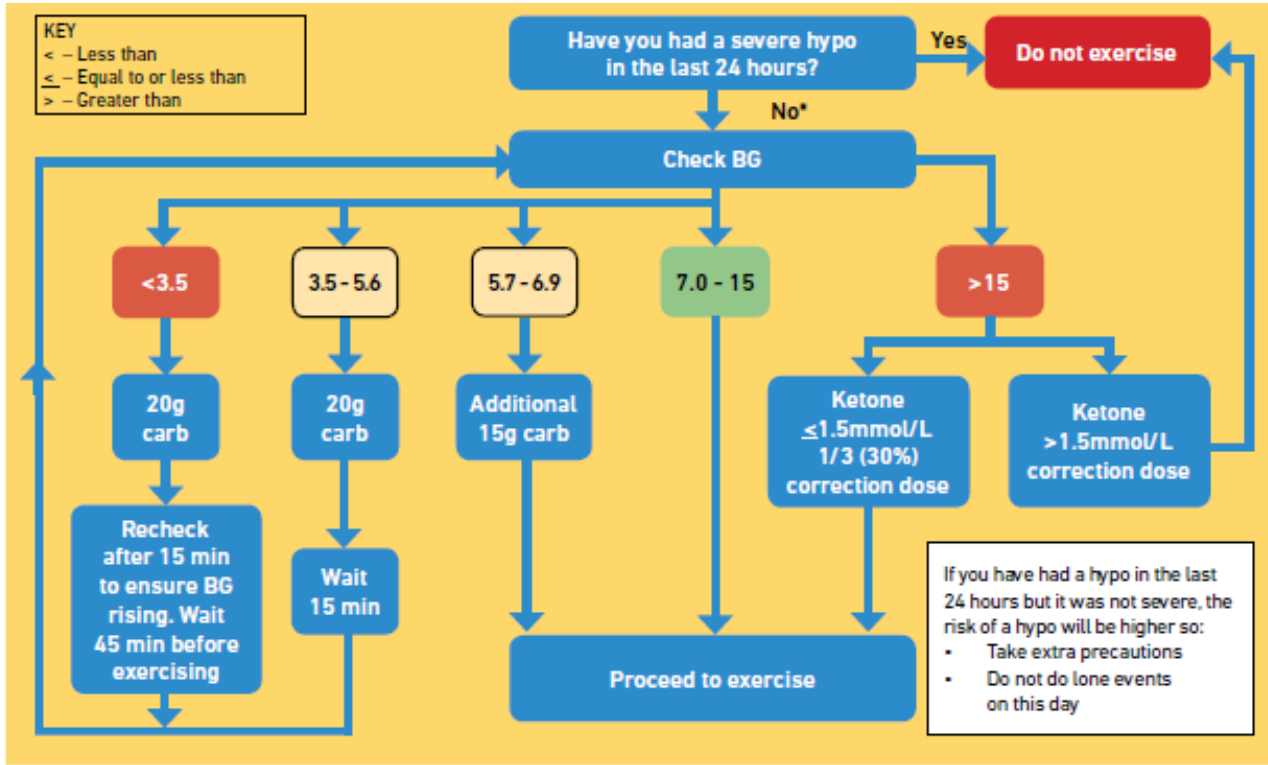
# Direction of glucose



Although both have of these show glucoses in target range for exercise, response to exercise is likely to be different

**Alternatively,  
Check BG twice in the previous  
half hour**

# Simple flowchart for glucose and exercise



## Addition information for Libre

Confirm with BG reading if

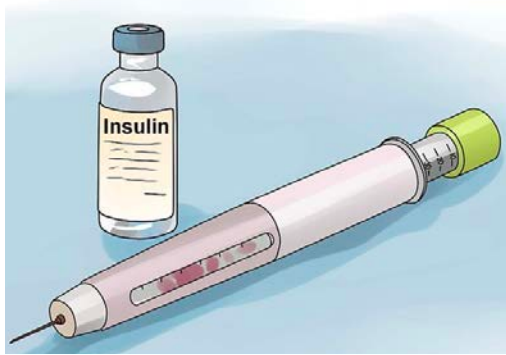
- Glucose <6.0
- Glucose >15

If ↑ and glucose 5.7-6.9: no need for extra carbs, proceed to exercise. Stick to advice if in any other range

If ↓ and glucose 5.7-6.9: take twice as much carbs at 20 and 40 minutes into exercise

If ↓ and glucose 7.0-9.0: take 15 grams of carbs at start of exercise

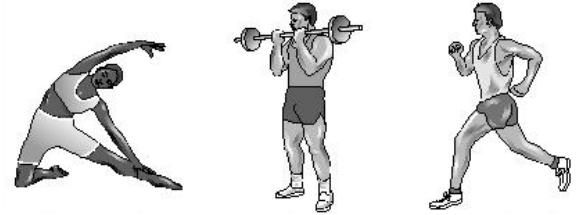
# Three ways to manage glucose during exercise



Insulin

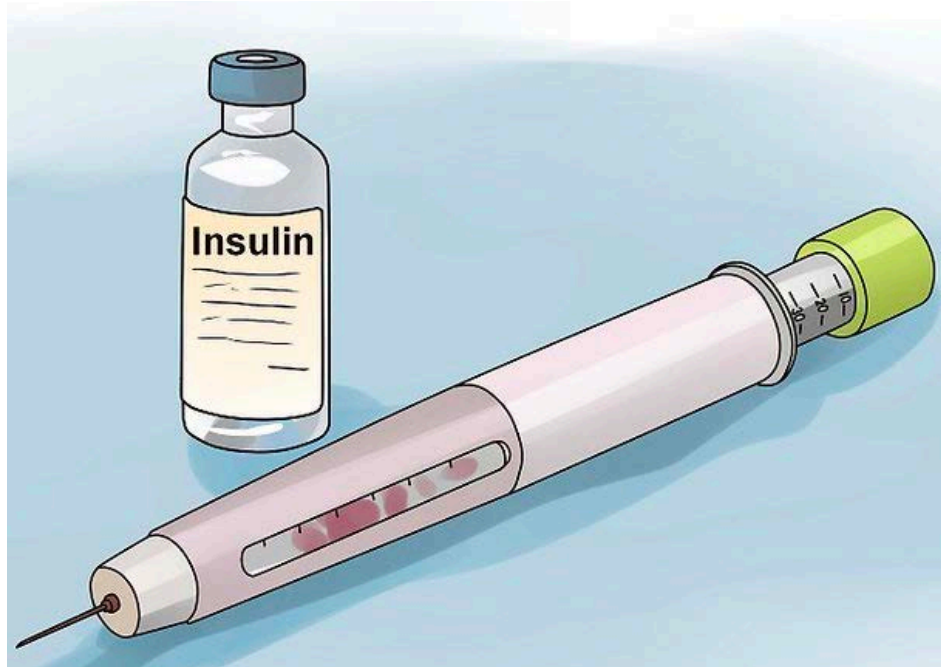


Carbohydrate



Exercise

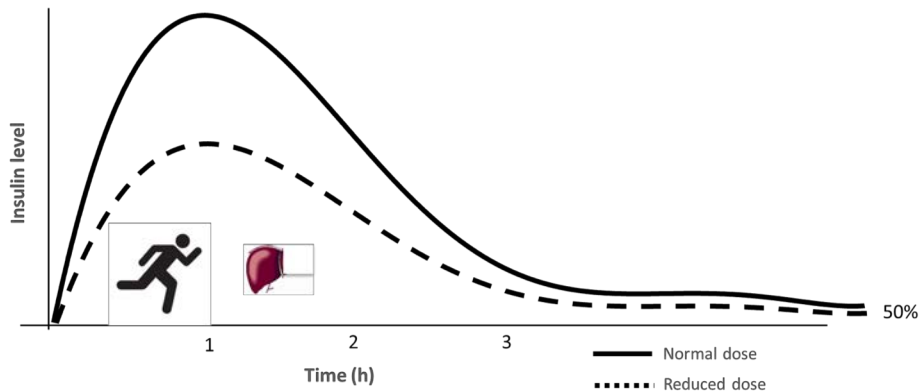
# Using insulin to manage glucose during exercise



# Simple strategy for meal-insulin

If exercising within 2 hours of quick acting (bolus) insulin

- Reduce pre-exercise fast acting (bolus) insulin by 50%



# Simple strategy for basal insulin on pumps

- Reduce basal insulin by 50% one hour before starting exercise
- Return to usual basal rate at the end of exercise

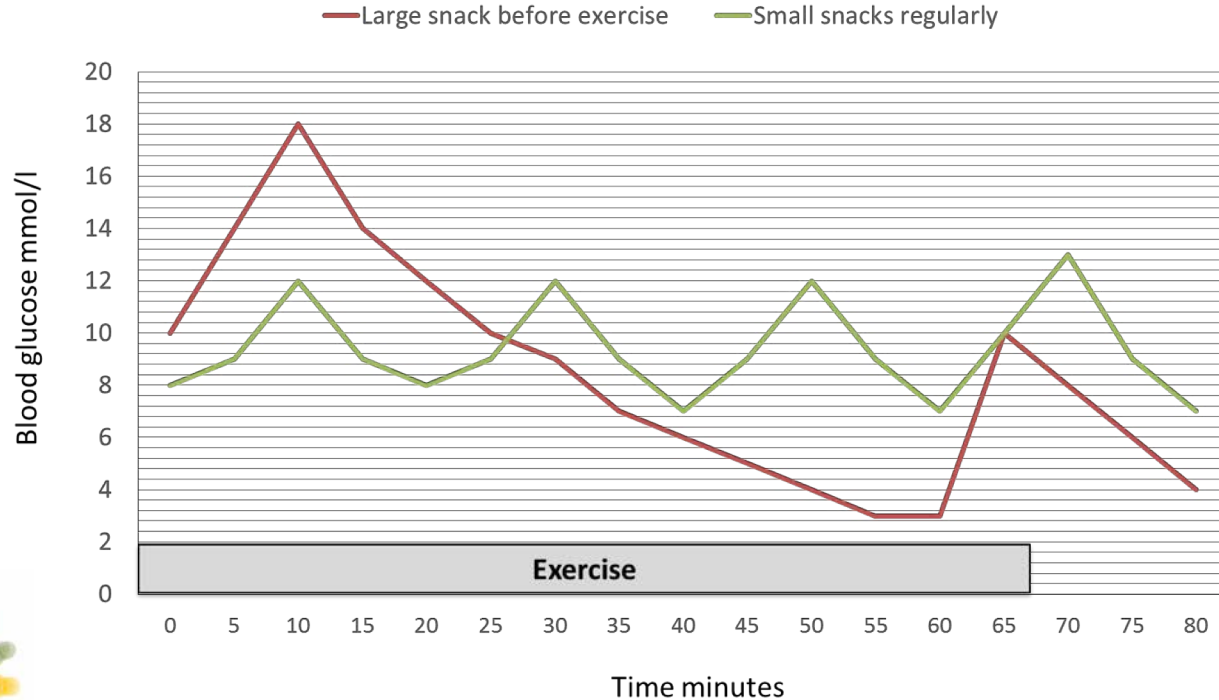


## Using carbohydrate to manage glucose during exercise



# Simple carbohydrate regime

Start with 60g/hour, move onto to 30g/hour or to other strategies



Taking something every 20 minutes will keep blood glucose stable





# Carbohydrate intake during exercise

CGM Glucose level	Trend arrow(s)	Action	Comments
<5.0 mmol/L	None or downward trending	15-20g CHO 	Stop exercise if blood glucose $\leq 3.9$ mmol/L
5.0-6.1 mmol/L	↘ Libre	15g CHO 	
5.0-6.1 mmol/L	↓ Libre	20g CHO 	
6.1-6.9 mmol/L	↘ or ↓ Libre	8g CHO 	
>7.0 mmol/L		No action	

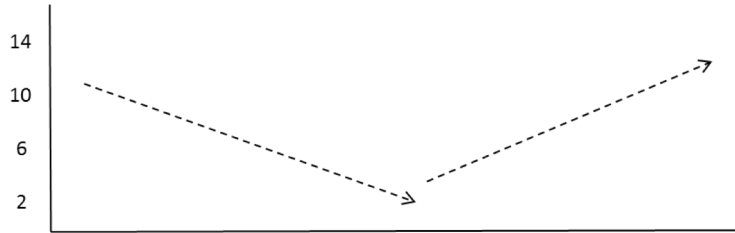
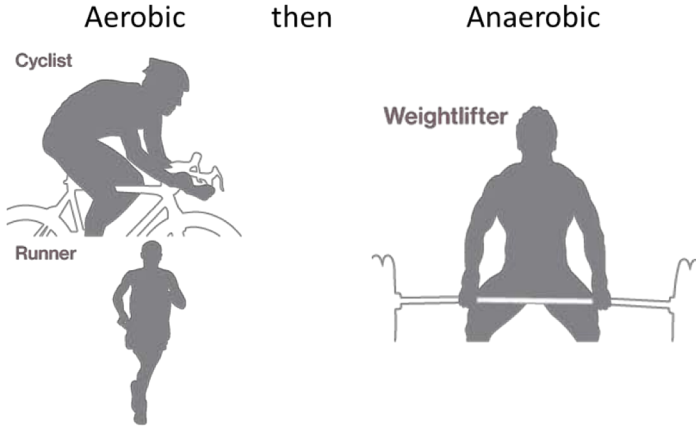


# Using exercise to manage glucose during exercise

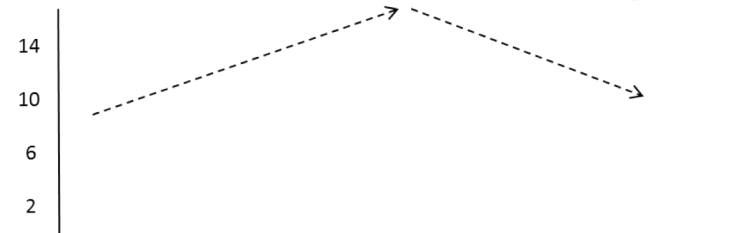
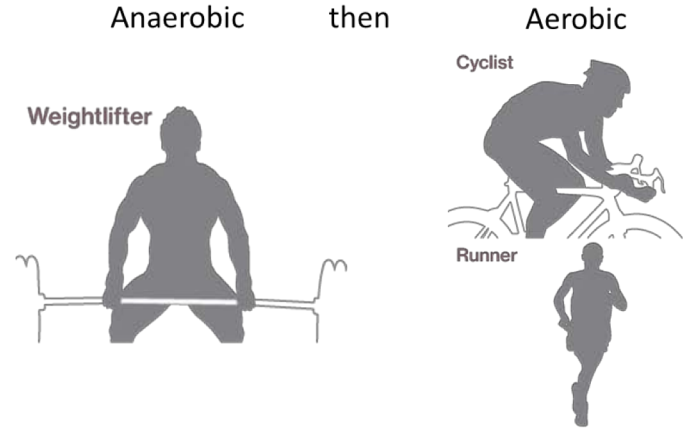


# Order of exercise types

Order 1

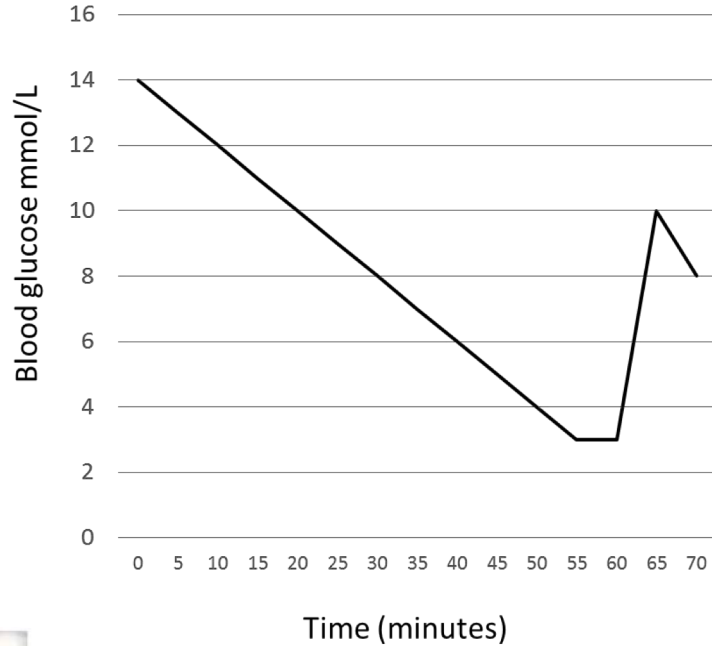


Order 2

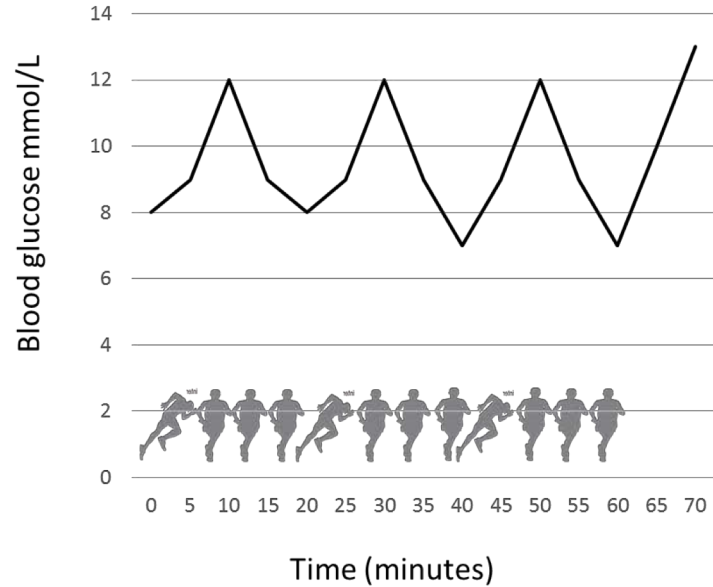


# Sprinting increases your glucose

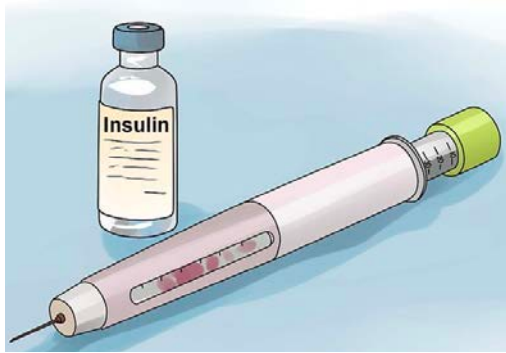
## Continuous exercise



## Continuous exercise + sprints



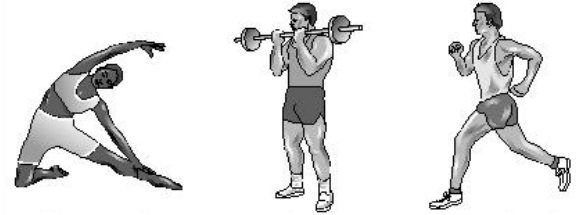
# Three ways to manage glucose after exercise



Insulin

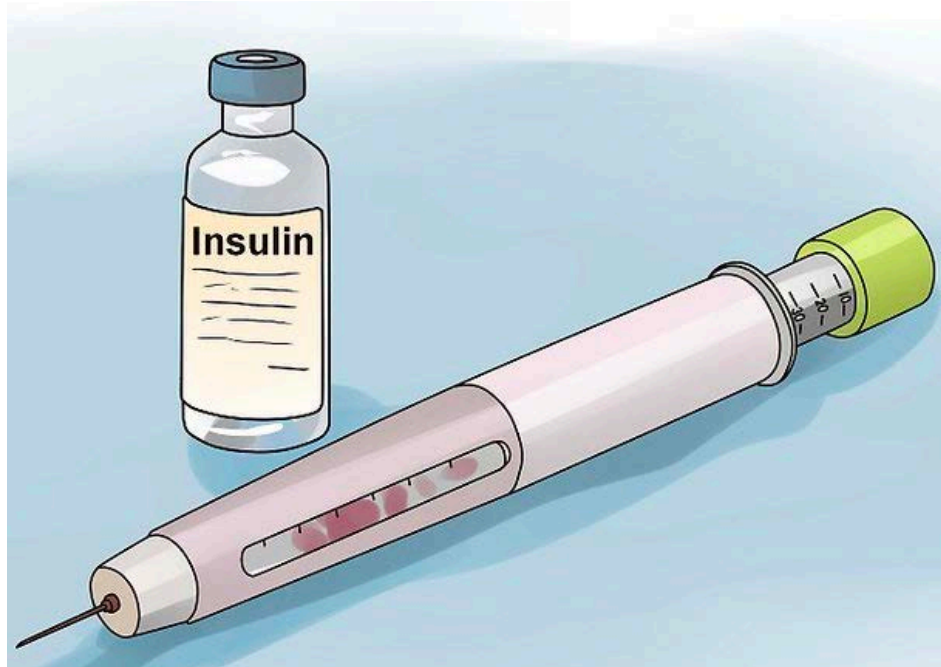


Carbohydrate

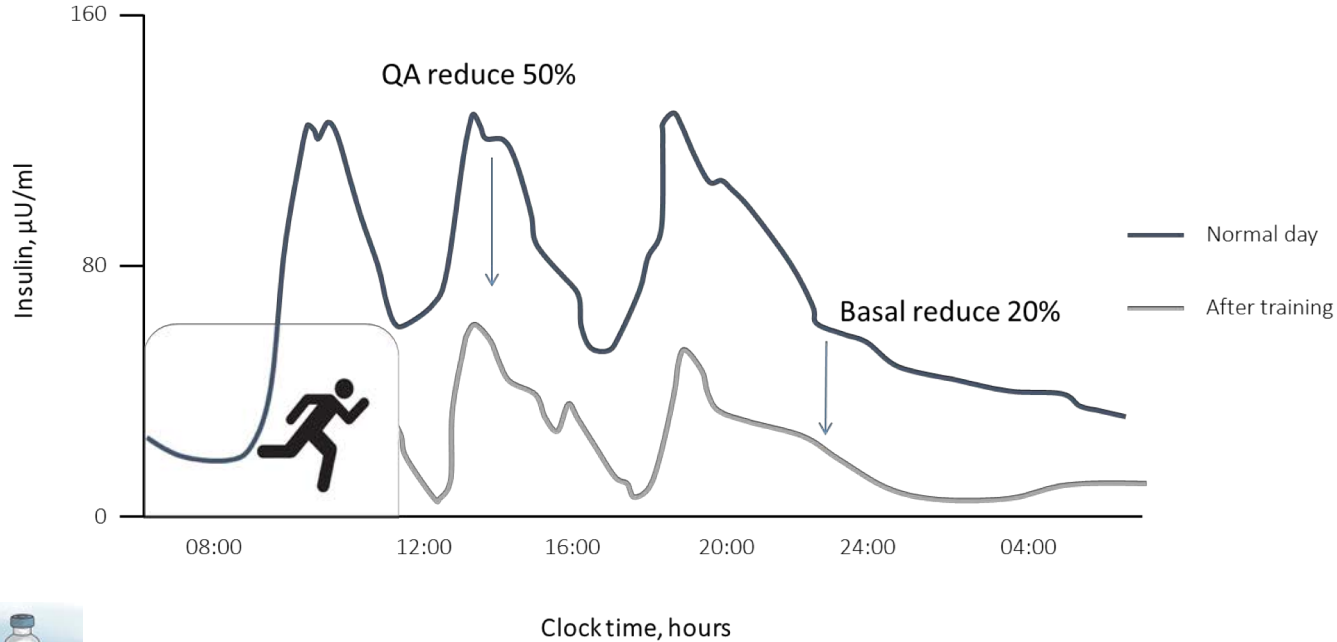


Exercise

# Using insulin to manage glucose post exercise



# Effect of exercise on Insulin sensitivity



# The 50-50-20 rule

- 50% reduction of normal bolus for next 2 meals
- 50% reduction of normal correction for the next 12 hours
- 20% reduction of normal evening background if:
  - after 4pm
  - over 2 hours of exercise
  - HIT at any time of the day
  - MDI - only applies to glargine / detemir / intermediate acting insulin
  - Pump - 20% reduction background for 6 hours from when gone to bed





# Using carbohydrate to manage glucose post exercise



## Three things to think about

- Is your daily carbohydrate correct?
- Are you taking a recovery meal after exercise?
- Do you need to have something before bed?

# Recovery food

Did you do more than 60 minutes moderate intensity exercise or more than 30 high intensity exercise?

No

No recovery food needed

Yes

Have food with carbohydrate and protein in Ratio 4:1. For example

Ham sandwich.



Milkshake



Cereal and milk



# Diet Strategies for nocturnal hypoglycemia

Consider bedtime snack with protein and complex carbohydrate if:

- exercised after 4 pm
- exercised more than 2 hours



# Using exercise to manage glucose post exercise



Exercise can help manage glucose post exercise in two ways

- Help to lower high glucose
- The more you do the easier the control

# Using exercise to lower glucose post exercise

**Weightlifting, Tag**  
**Sprinting, Diving, Swimming, Gymnastics,**  
**Wrestling, Dodge ball, Volleyball, Ice hockey, Track cycling**

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**Basketball, Football, Tennis, Lacrosse**  
**Skating**  
**Skiing (slalom & downhill), Field hockey**  
**Rowing (middle distance)**  
**Running (middle distance)**

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**In-line skating**  
**Cross country skiing**  
**Brisk Walking**

**Jogging**  
**Cycling**



Warm down

**Hyperglycemia**

**ANAEROBIC**  
**Short duration**  
**High-intensity**



**AEROBIC**  
**Longer duration**  
**Lower Intensity**

**Hypoglycemia**



# Learning objectives

1. Benefits and barriers to exercise in people with T1D
2. What you need to think about before you exercise
  - What exercise, what time, previous and prevailing glucose
1. What options are available for managing glucose during exercise
  - Insulin (basal/bolus/MDI/pumps), CHO (simple and ExCarbs), exercise
2. What options are available for managing glucose after exercise
  - Insulin (50:50:20 rule), CHO (recovery and daily requirements), exercise

- EXTOD patient day: 19<sup>th</sup> October in Glasgow
- EXTOD conference for HCPs: 18<sup>th</sup> October in Glasgow
- DTN Libre education programme: <https://abcd.care/dtn/education>
- 
- To come:
  - Website
  - EXTOD Buddies