EXERCISE IS MEDICINE…
But what's the optimal dose?

A GUIDE FOR DIABETES CARE

Drew Harrisberg - Exercise Physiologist

MY OBJECTIVE:

To convince you that exercise is NOT medicine.

DREW'S DAILY DOSE

Does exercise improve blood glucose levels in people living with diabetes?

It depends…

DREW'S DAILY DOSE

MY “AHA” MOMENT

The Day Exercise Became Medicine

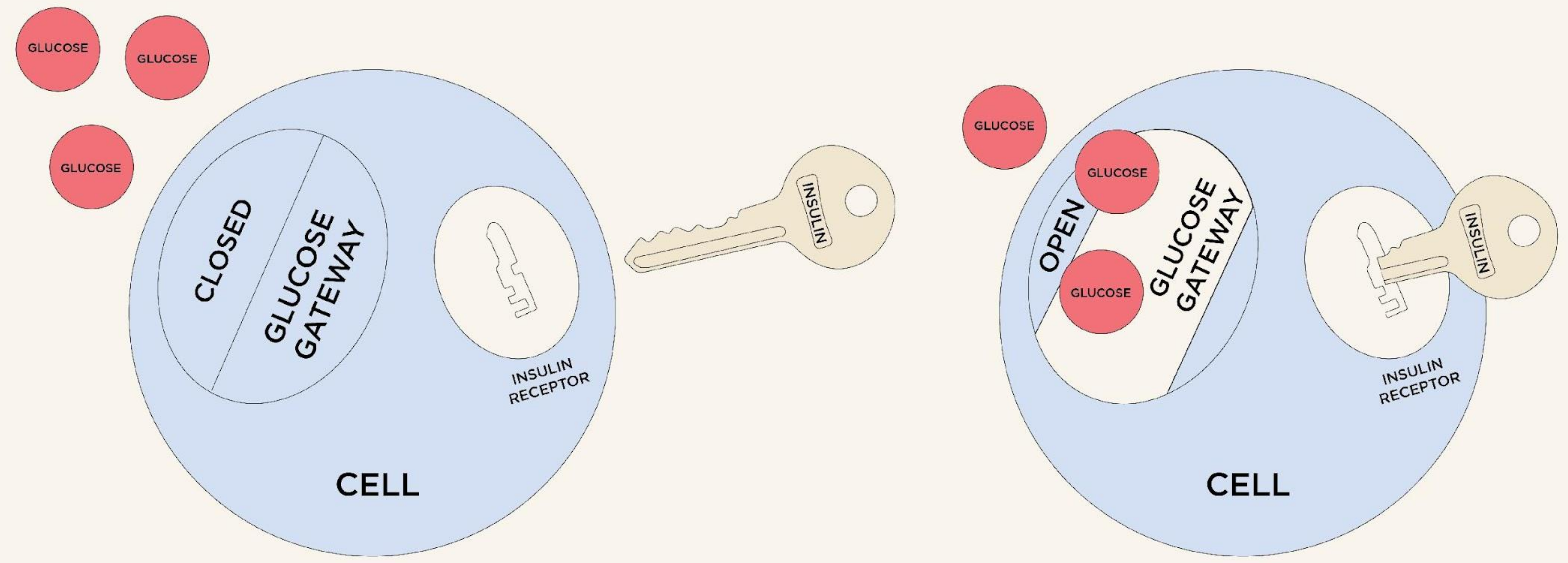
Pre-Workout Meal
Blood Glucose: 25mmol/L

Full-body Workout
60 Minutes

Post-Workout
Blood Glucose: 5 mmol/L

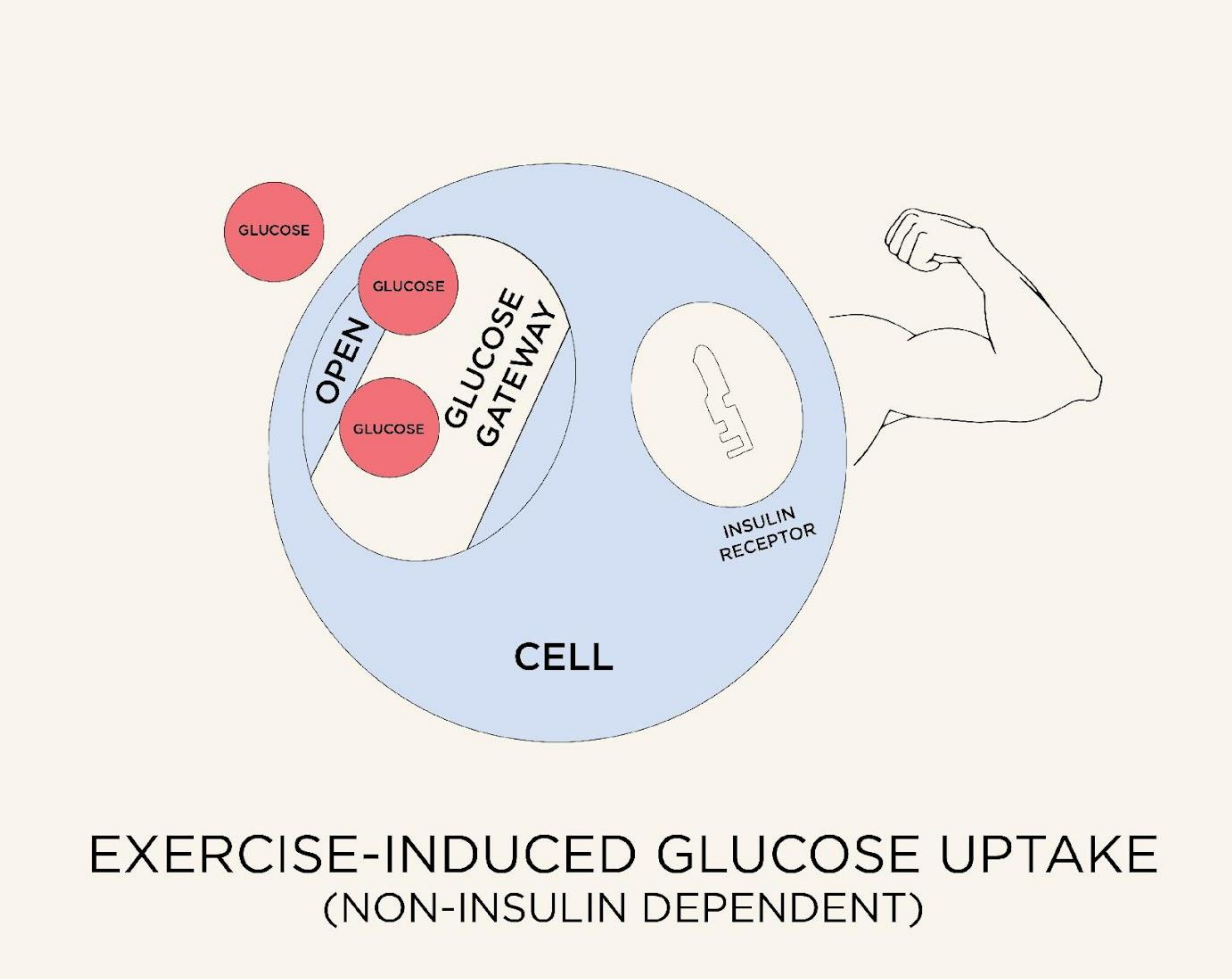
DREW'S DAILY DOSE

INSULIN-MEDIATED GLUCOSE UPTAKE



HEALTHY INSULIN SENSITIVE CELL

EXERCISE-INDUCED GLUCOSE UPTAKE



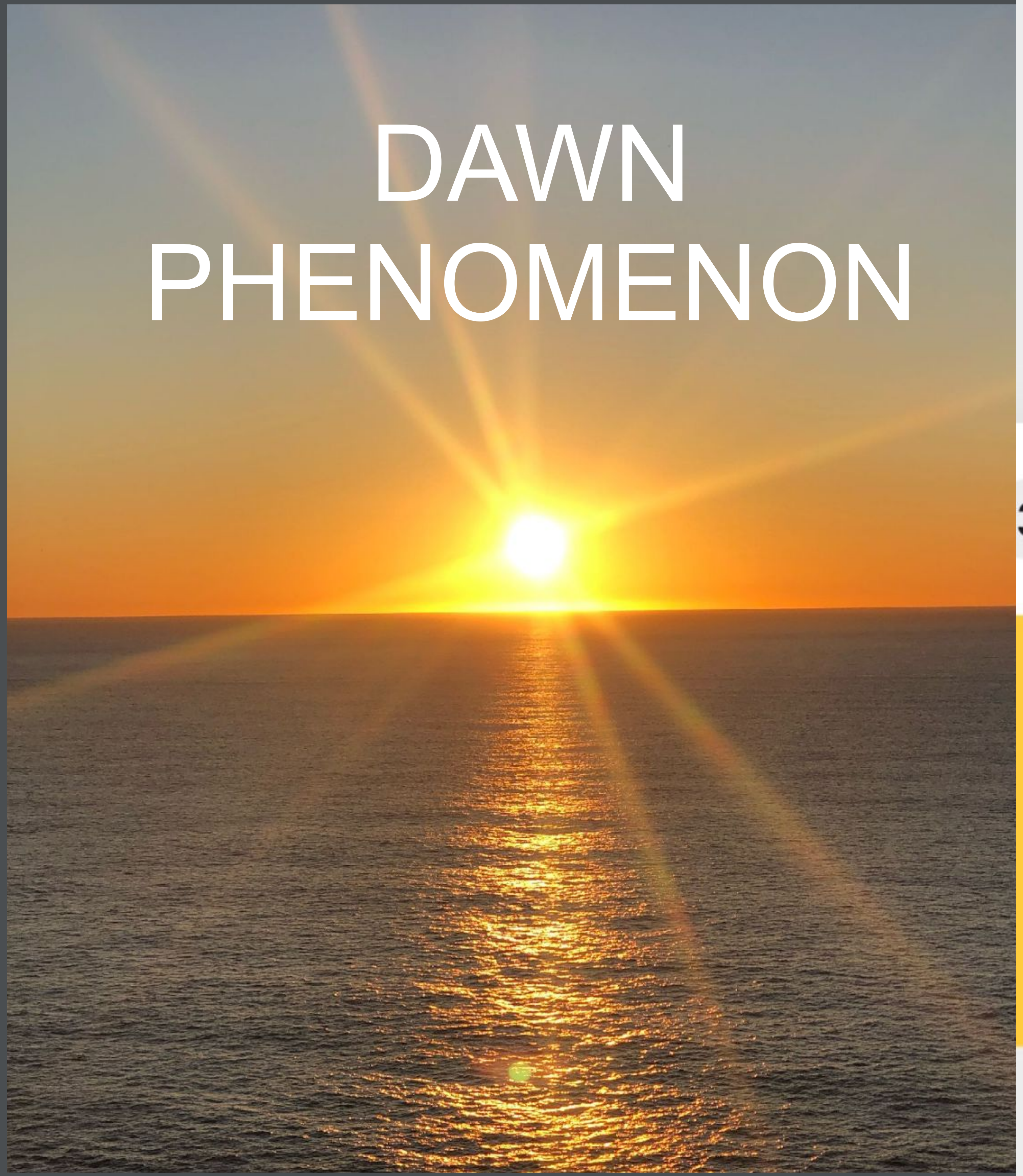
- GLUT4 translocation
- Non-insulin-mediated glucose uptake
- Contraction-mediated glucose uptake
- Exercise-induced glucose uptake

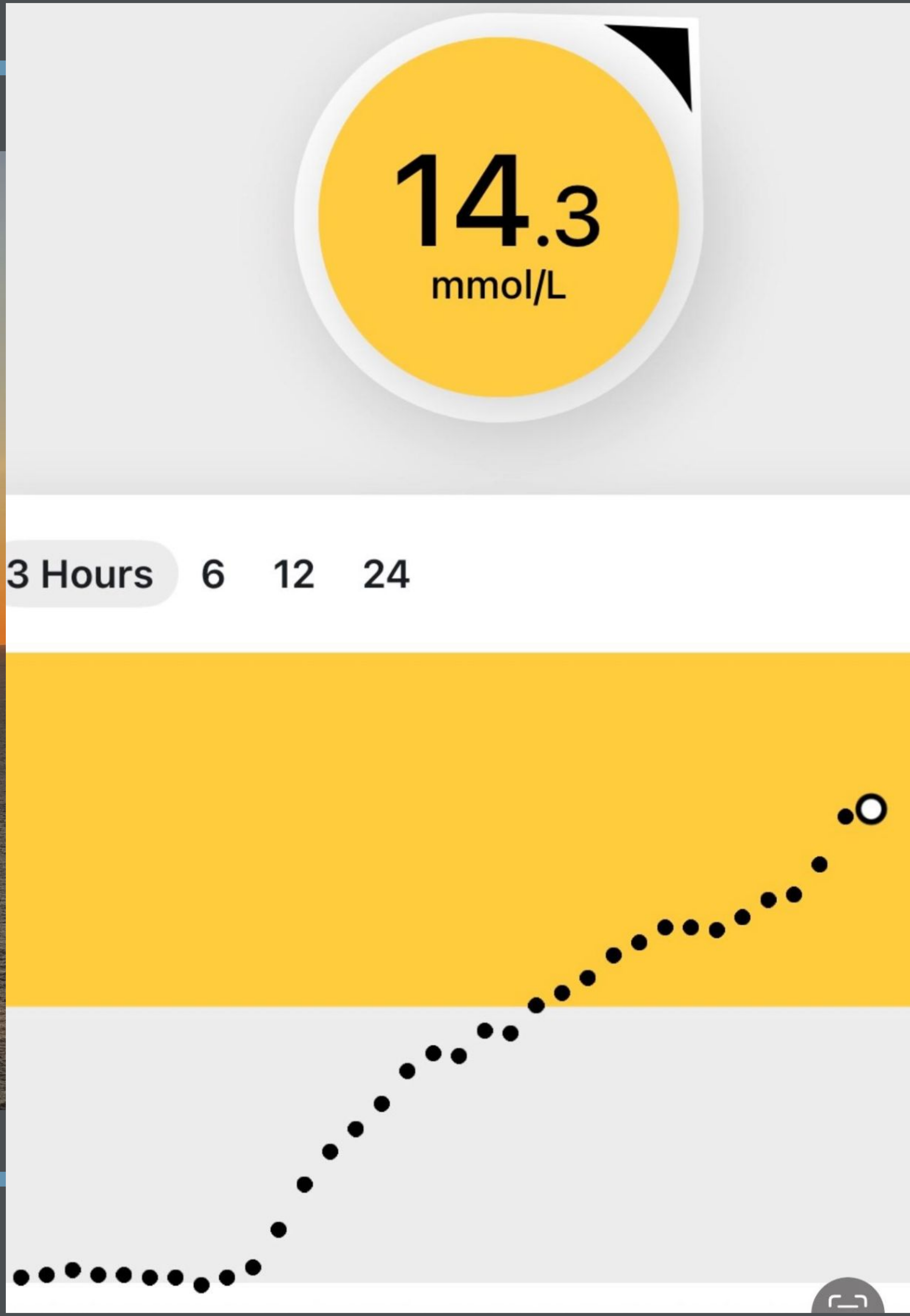
Note: this mechanism is site-specific!

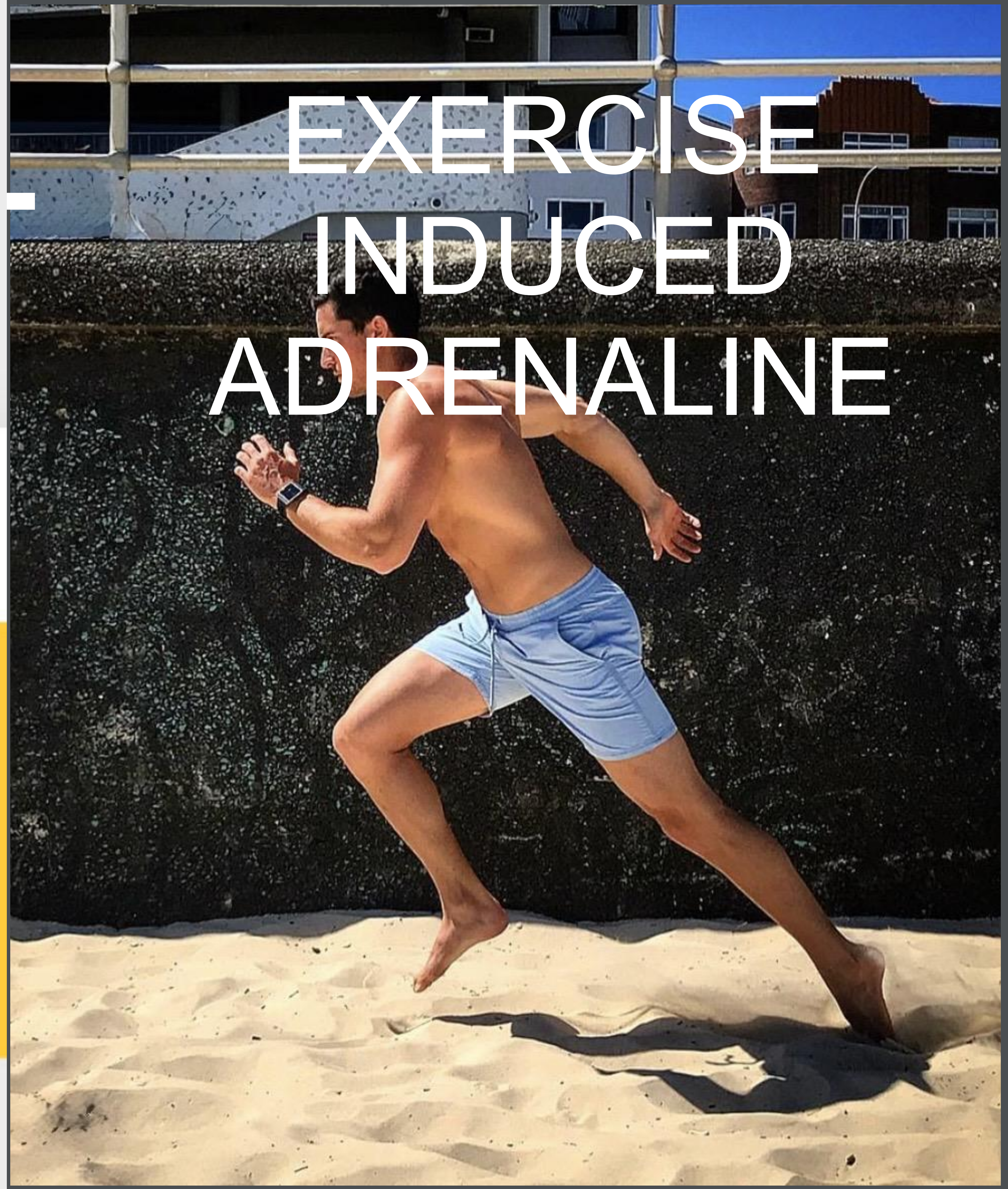
DREW'S DAILY DOSE

Exercise became my hammer & every glucose elevation was a nail

MY "OH NO" MOMENT







GLUCOSE KINETICS

SECTION 6: PUSATILE AND PHASIC INSULIN RELEASE IN NORMAL AND DIABETIC MEN | FEBRUARY 01 2002

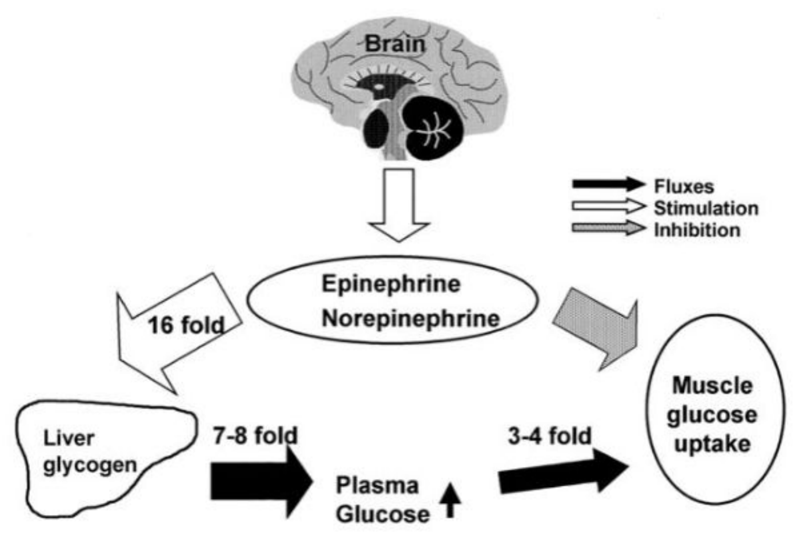
Intense Exercise Has Unique Effects on Both Insulin Release and Its Roles in Glucoregulation: Implications for Diabetes FREE

Errol B. Marliss; Mladen Vranic

American Diabetes Association.

From: **Intense Exercise Has Unique Effects on Both Insulin Release and Its Roles in GlucoregulationImplications for Diabetes**

Diabetes. 2002;51(suppl_1):S271-S283. doi:10.2337/diabetes.51.2007.S271



DREW'S DAILY DOSE

THE DOSE MAKES THE MEDICINE

Just like medication, exercise has a **therapeutic window and a pharmacological profile**.

Too little — no benefit.
Too much or mistimed — side effects (hypo, hyper)

What matters is the **prescription:**

- The **type** (aerobic, resistance)
- The **dose** (duration, volume, intensity)
- The **frequency** (how often it's administered)
- The **onset of action** and the **duration of action**
- The **timing** (relative to insulin, meals, and time of day)
- The **intensity** (light vs moderate vs vigorous)
- Drug **interactions** (insulin on board?)

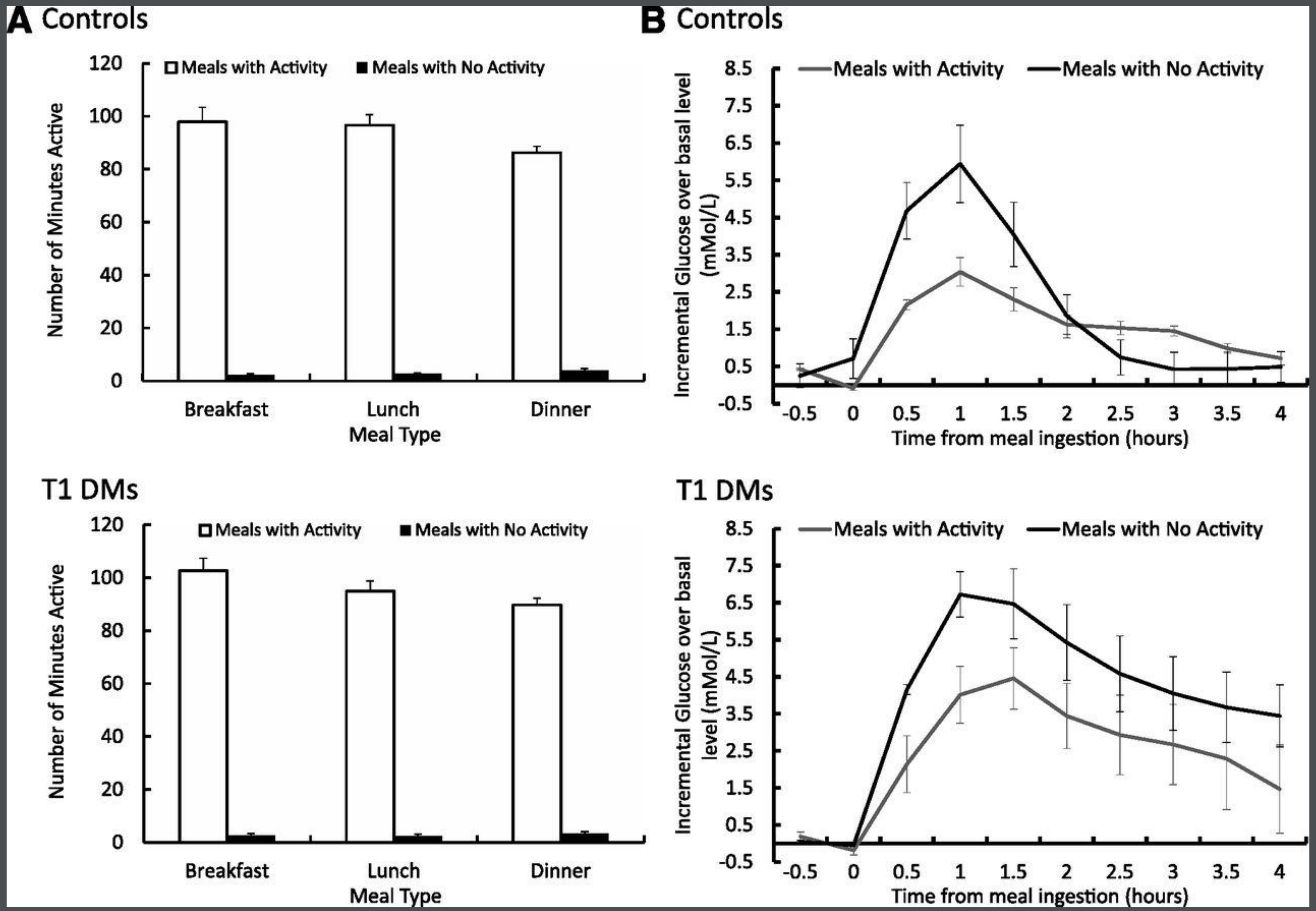
DREW'S DAILY DOSE

WALKING AFTER A MEAL

CLINICAL CARE / EDUCATION / NUTRITION / PSYCHOSOCIAL RESEARCH | NOVEMBER 14 2012

The Effect of Walking on Postprandial Glycemic Excursion in Patients With Type 1 Diabetes and Healthy People

Chinmay Manohar, MS; James A. Levine, MD; Debashis K. Nandy, MD; Ahmed Saad, MD; Chiara Dalla Man, PHD; Shelly K. McCrady-Spitzer, MS; Rita Basu, MD; Claudio Cobelli, PHD; Rickey E. Carter, PHD; Ananda Basu, MD; Yogish C. Kudva, MD



CONTROLS: **Walking after meals cut the Post-meal excursion by ~53%**

T1D: Walking after meals **cut the post-meal excursion by ~59%**

DREW'S DAILY DOSE

WALKING BEFORE A MEAL

The effect of walking before and after breakfast on blood glucose levels in patients with type 1 diabetes treated with intensive insulin therapy

Kunio Yamanouchi [a], Ryuzo Abe [b], Akira Takeda [c], Yoshihito Atsumi [d], Motoaki Shichiri [e], Yuzo Sato [f]

Condition	Starting Glucose (07:00 h)	Peak Glucose (1-hr post meal)	Glucose 2.5 h After Meal	AUC (h·mM)	Outcome
Control (No Walk)	9.0 mM	13.6 mM	~9.0 mM	11.8	Normal rise and gradual fall
Walk Before Breakfast	8.0 mM	15.0 mM	~11.0 mM	17.8	No improvement — glucose stayed high
Walk After Breakfast	8.8 mM	15.3 → 11.0 mM ↓	~7.5 mM	3.8 ↓	Significant reduction in post-meal glucose

WALKING

The effect of walking before and after breakfast on blood glucose levels in patients with type 1 diabetes treated with intensive insulin therapy

Kunio Yamanouchi [a], Ryuzo Abe [b], Akira Takeda [c], Yoshihito Atsumi [d], Motoaki Shichiri [e], Yuzo Sato [f]

Key Takeaway

A **30-minute walk starting ~15 min after breakfast** markedly **reduces and shortens** the post-meal glucose spike in people with type 1 diabetes.

Walking **before breakfast** offered **no benefit** — glucose stayed higher for longer

HIIT

CLINICAL CARE/EDUCATION/NUTRITION/PSYCHOSOCIAL RESEARCH | NOVEMBER 19 2018

Optimal Insulin Correction Factor in Post–High-Intensity Exercise Hyperglycemia in Adults With Type 1 Diabetes: The FIT Study FREE

EXERCISE PROTOCOL

25min HIIT session
3x 5-min bouts (30s on: 30s off)
5 mins rest between bouts

17 subjects completed 71 exercise trials, of which 64 (90%) resulted in **hyperglycemia**

HIIT EFFECT ON HBA1C..

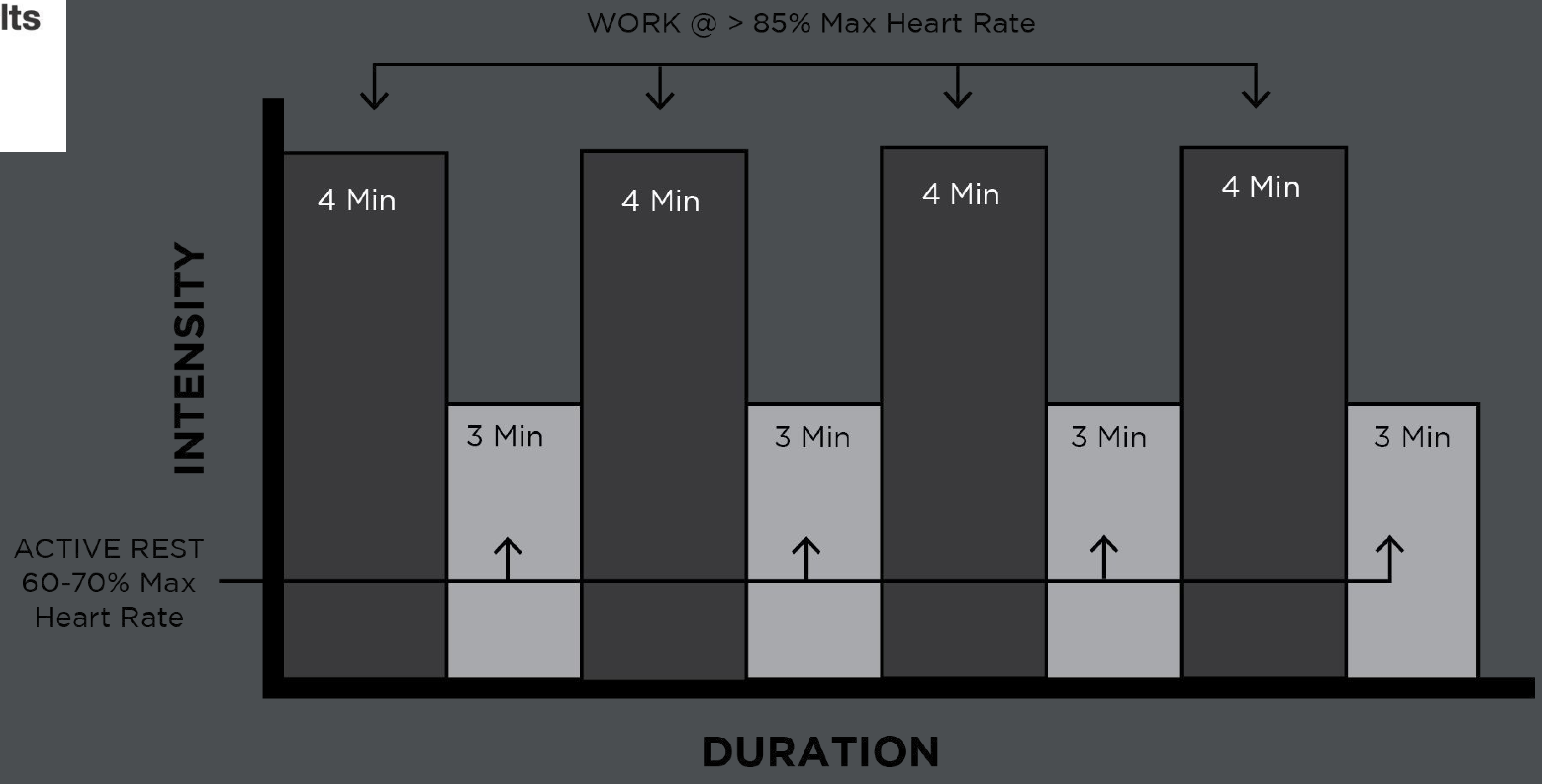
What happens to HbA1c if you do HIIT 3x/wk for 12 weeks?

CARDIOVASCULAR AND METABOLIC RISK | JULY 09 2020

Effect of High-Intensity Interval Training on Glycemic Control in Adults With Type 1 Diabetes and Overweight or Obesity: A Randomized Controlled Trial With Partial Crossover FREE

4 x 4 PROTOCOL

4 ROUNDS:
4 mins work @ >85% HRmax
3 mins active recovery @ 60-70%HRmax



No significant difference in HbA1c between the 2 groups after 12 weeks

HIIT vs MICT

High-Intensity Interval Training Improves Aerobic Capacity Without a Detrimental Decline in Blood Glucose in People With Type 1 Diabetes

FREE

Sam N Scott, Matt Cocks, Rob C Andrews, Parth Narendran, Tejpal S Purewal, Daniel J Cuthbertson, Anton J M Wagenmakers, Sam O Shepherd

The Journal of Clinical Endocrinology & Metabolism, Volume 104, Issue 2, February 2019, Pages 604–612,

Subjects exercised 3x/wk for 6 weeks

HIIT group - 10x 1-min bouts

MICT group - steady state at 65% max

HIIT vs MICT

High-Intensity Interval Training Improves Aerobic Capacity Without a Detrimental Decline in Blood Glucose in People With Type 1 Diabetes

FREE

Sam N Scott, Matt Cocks, Rob C Andrews, Parth Narendran, Tejpal S Purewal, Daniel J Cuthbertson, Anton J M Wagenmakers, Sam O Shepherd

The Journal of Clinical Endocrinology & Metabolism, Volume 104, Issue 2, February 2019, Pages 604–612,

6-Week Training Outcomes: HIIT vs MICT in Type 1 Diabetes

Outcome	HIIT	MICT	Key Difference
Blood Glucose During Exercise	STABLE ↓ 0.2 mmol/L	LARGE DROP ↓ 5.5 mmol/L	HIIT prevented exercise-induced hypoglycaemia; MICT caused marked drop
Overnight / Nocturnal BGL	↓ TIR (57 → 33%) ↑ hyperglycaemia (33 → 63%)	↑ TIR (60 → 71 %) ↓ hyperglycaemia	HIIT worsened overnight control; MICT improved it
VO_2peak	↑ 14 %	↑ 15 %	Equal improvement — both enhanced CRF
Arterial Stiffness (aPWV)	↓ 12 %	↓ 12 %	Equal improvement — both improved vascular health
Training Time per Week	60 min (3 × ~20 min)	120–150 min	HIIT achieved same benefits in **half** the time

DREW'S DAILY DOSE

HIIT vs MICT

6-Week Training Outcomes: HIIT vs MICT in Type 1 Diabetes

High-Intensity Interval Training Improves Aerobic Capacity Without a Detrimental Decline in Blood Glucose in People With Type 1 Diabetes

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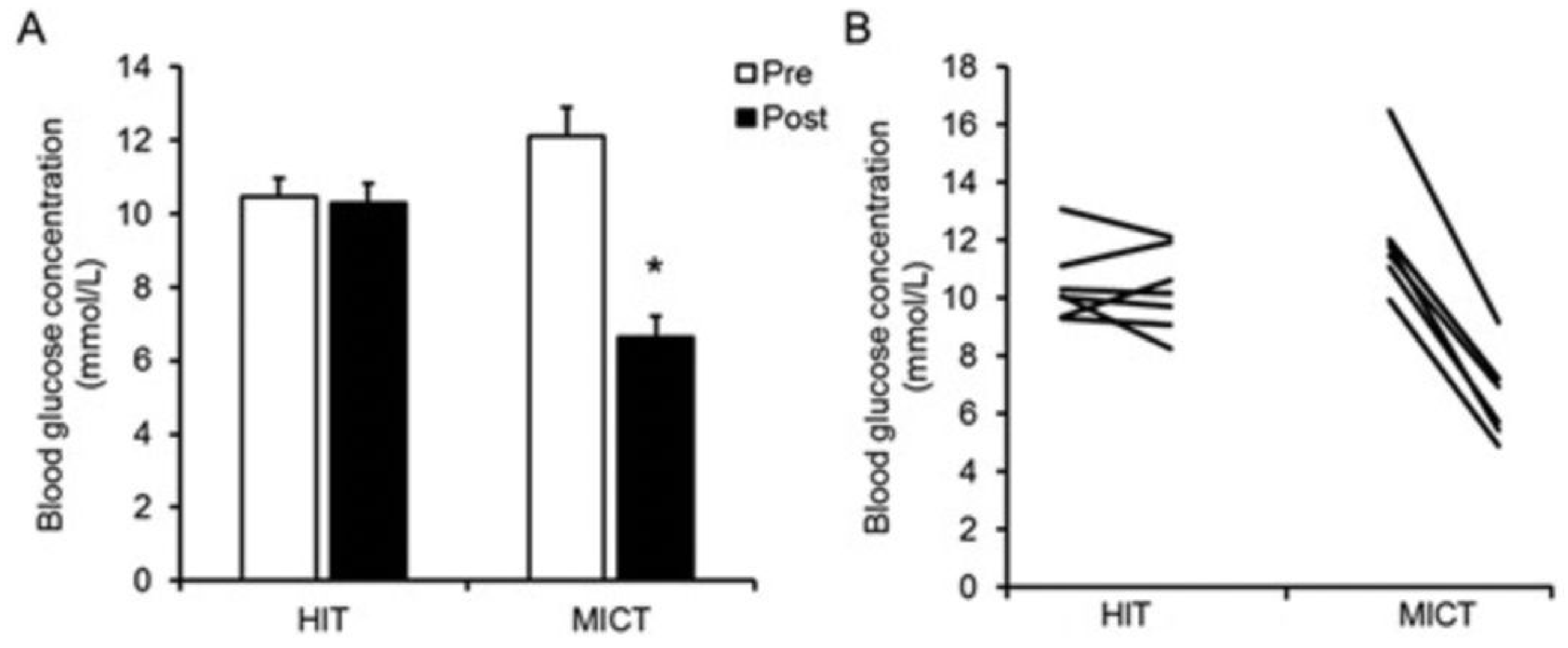
Sam N Scott, Matt Cocks, Rob C Andrews, Parth Narendran, Tejpal S Purewal, Daniel J Cuthbertson, Anton J M Wagenmakers, Sam O Shepherd

The Journal of Clinical Endocrinology & Metabolism, Volume 104, Issue 2, February 2019, Pages 604–612,

Figure 2.



FASTED vs FED HIIT

Why did HIIT cause a large spike in one study and remain stable in another?

Both exercise protocols were a similar type, dose, and intensity

CLINICAL CARE/EDUCATION/NUTRITION/PSYCHOSOCIAL RESEARCH | NOVEMBER 19 2018

Optimal Insulin Correction Factor in Post–High-Intensity Exercise Hyperglycemia in Adults With Type 1 Diabetes: The FIT Study FREE

High-Intensity Interval Training Improves Aerobic Capacity Without a Detrimental Decline in Blood Glucose in People With Type 1 Diabetes

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Sam N Scott, Matt Cocks, Rob C Andrews, Parth Narendran, Tejpal S Purewal, Daniel J Cuthbertson, Anton J M Wagenmakers, Sam O Shepherd

The Journal of Clinical Endocrinology & Metabolism, Volume 104, Issue 2, February 2019, Pages 604–612,

No IOB —> BGL spike

IOB —> stable BGL

Drug interaction and timing.

SPRINTS

The Effect of a Short Sprint on Postexercise Whole-Body Glucose Production and Utilization Rates in Individuals with Type 1 Diabetes Mellitus FREE

A. J. Fahey, N. Paramalingam, R. J. Davey, E. A. Davis, T. W. Jones, P. A. Fournier

The Journal of Clinical Endocrinology & Metabolism, Volume 97, Issue 11, 1 November 2012, Pages 4193–4200, https://doi.org/10.1210/jc.2012-1604

Published: 01 November 2012 **Article history** ▾

Subjects performed **1x maximal 10-second sprint** on a **cycle ergometer, followed by 2-hr rest.**

Blood glucose ↑ by ~1.2 mmol/L within 30 min (T1D).

The glucose rise wasn't from extra liver glucose, but from a temporary reduction in muscle uptake driven by the catecholamine surge after the sprint.

Even a **10-second sprint** can stabilise or raise glucose in T1D

SPRINTS AFTER MICT

PATHOPHYSIOLOGY / COMPLICATIONS | MARCH 01 2006

The 10-s Maximal Sprint:
A novel approach to counter an exercise-mediated fall in glycemia in individuals with type 1 diabetes

FREE

Vanessa A. Bussau, BSC (HONS); Luis D. Ferreira, PHD; Timothy W. Jones, MD; Paul A. Fournier, PHD

PROTOCOL

Subjects with T1DM gave normal insulin dose with breakfast

Then pedalled on a cycle ergometer at moderate intensity for 20 min

Then immediately engaged in a maximal 10-s cycling sprint (sprint trial) or rested (control trial)

SPRINTS *AFTER* MICT

PATHOPHYSIOLOGY / COMPLICATIONS | MARCH 01 2006

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Vanessa A. Bussau, BSC (HONS); Luis D. Ferreira, PHD; Timothy W. Jones, MD; Paul A. Fournier, PHD

	Control (No Sprint)	Sprint Condition	Interpretation
Pre-exercise glucose	~10.5 mmol/L	~10.6 mmol/L	Similar baseline across trials
During moderate exercise	↓ by ~3.1 mmol/L	↓ by ~3.0 mmol/L	Comparable glucose fall during cycling
Post-exercise (2hrs)	Further ↓ by ~3.6 mmol/L → continued decline	**Stable** — no further fall after sprint	Sprint **prevented early post-exercise hypoglycaemia**
Epinephrine	Minimal change	**↑ ~5-fold immediately after sprint**	Catecholamine surge triggered
Norepinephrine	Minimal change	**↑ ~3-fold after sprint**	Supports sympathetic activation

Conclusion: A 10-second all-out sprint after moderate exercise stabilised blood glucose for 2 hours in T1D — preventing post-exercise hypoglycaemia

DREW'S DAILY DOSE

SPRINT *BEFORE* MICT

> Diabetologia. 2007 Sep;50(9):1815-1818. doi: 10.1007/s00125-007-0727-8. Epub 2007 Jun 22.

A 10-s sprint performed prior to moderate-intensity exercise prevents early post-exercise fall in glycaemia in individuals with type 1 diabetes

V A Bussau [1], L D Ferreira [1], T W Jones [2] [3], P A Fournier [4]

Subjects ate breakfast and administered insulin

2 hours later they performed an all-out 10s sprint immediately before 20 mins of moderate intensity cycling

Diabetologia. 2007 Sep;50(9):1815-1818. doi: 10.1007/s00125-007-0727-8. Epub 2007 Jun 22.

A 10-s sprint performed prior to moderate-intensity exercise prevents early post-exercise fall in glycaemia in individuals with type 1 diabetes

V A Bussau [1], L D Ferreira [1], T W Jones [2 3], P A Fournier [4]

SPRINT BEFORE MICT

Variable	Control (No sprint)	Sprint before moderate exercise	Key takeaway
Glucose during 20 min cycling	↓~ 2.9 mmol/L	↓~ 2.9 mmol/L	Sprint did *not* prevent the drop during exercise.
Glucose change during 45 min recovery	↓ 1.23 mmol/L	**Stable**	Sprint prevented the **early post-exercise fall in glucose.**
Noradrenaline (norepinephrine)	Small rise	Large rise	Catecholamine surge may explain the stabilisation.

Conclusion: The **10-second sprint before moderate exercise** prevented the **early post-exercise fall in glucose** in T1D.

RESISTANCE TRAINING AM vs PM

Morning (Fasting) vs Afternoon Resistance Exercise in Individuals With Type 1 Diabetes: A Randomized Crossover Study FREE

Saeed Reza Toghi-Eshghi, Jane E Yardley

The Journal of Clinical Endocrinology & Metabolism, Volume 104, Issue 11, November 2019, Pages 5217–5224, https://doi.org/10.1210/jc.2018-02384

Published: 18 June 2019 **Article history** ▾

PROTOCOL

40 mins resistance training
3x8 reps for 7 exercises
7 am fasted OR 5 pm fed

RESISTANCE TRAINING AM vs PM

Outcome	Morning (Fasted)	Afternoon (Fed)	Interpretation / Takeaway
Blood Glucose During Exercise	Increased	Decreased	Morning fasted RE causes a mild glucose **rise**; afternoon RE causes a **drop**.
60 min Post-Exercise Glucose	~10.9 mmol/L	~7.9 mmol/L	Post-exercise glucose remained **higher** after morning session
6-h Mean Glucose	11.5 mmol/L	9.1 mmol/L	Trend toward higher post-exercise glucose in morning
Glycaemic Variability	2.7 mmol/L	2.0 mmol/L	**Higher variability** after morning exercise (P = 0.019).
% Time in hypergylcemia	62%	11.6%	**Significantly more time in hyperglycaemia** after morning
Hypoglycaemia (≤ 3.9 mmol/L)	0%	0%	No hypoglycaemic events in either condition.
Overall Glycaemic Pattern	↑ glucose, ↑ variability, ↑ hyperglycaemia	↓ glucose, ↓ variability	Morning RE safer for avoiding lows; afternoon RE better for lowering glucose.

RESISTANCE TRAINING AM vs PM

Morning (Fasting) vs Afternoon Resistance Exercise in Individuals With Type 1 Diabetes: A Randomized Crossover Study FREE

Saeed Reza Toghi-Eshghi, Jane E Yardley

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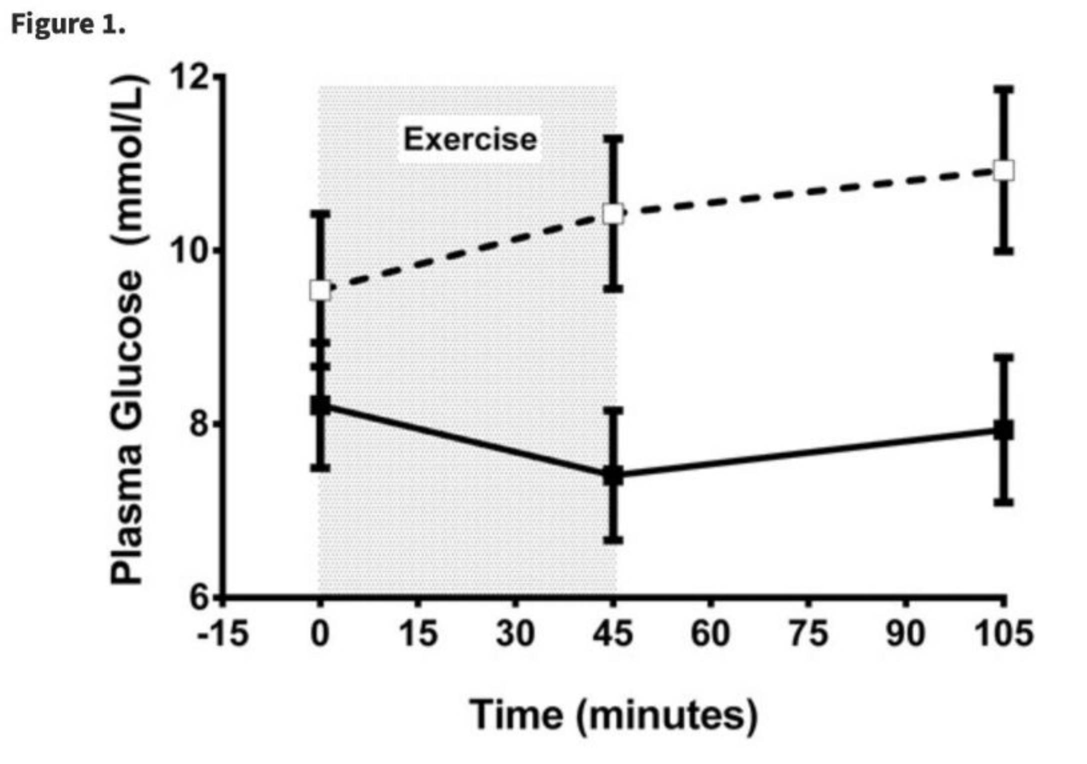
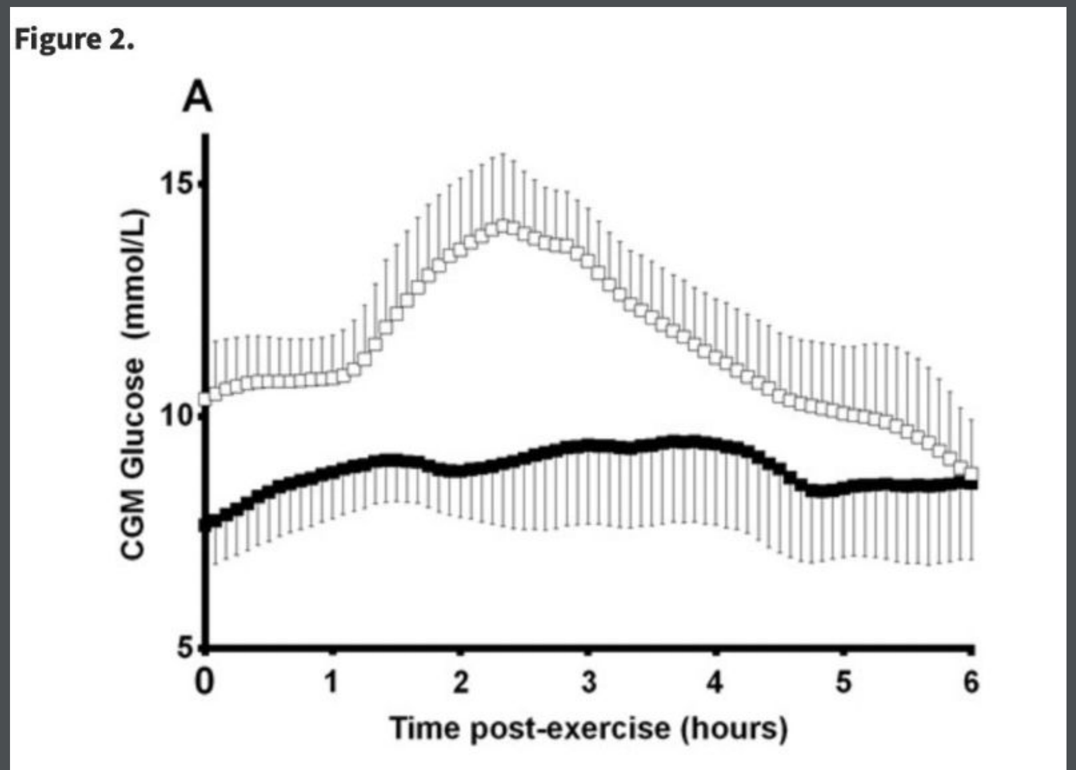




WHITE BOXES = FASTED A.M RE
BLACK BOXES = FED EVENING RE

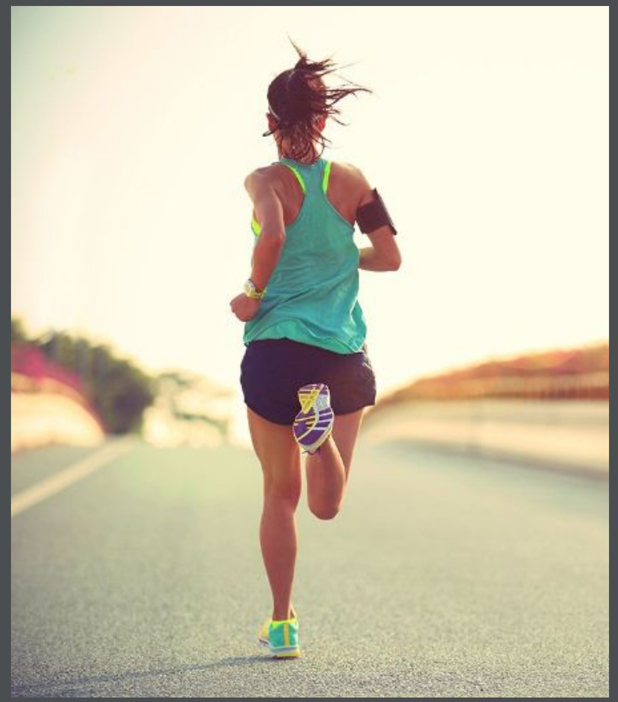
Conclusion:
The **timing** of resistance training matters in T1D — schedule **morning fasted sessions** for those prone to lows, and **afternoon sessions** for those seeking glucose-lowering effects.

AEROBIC vs RESISTANCE

Original Research

Effect of Aerobic and Resistance Exercise on Glycemic Control in Adults With Type 1 Diabetes

Ravi Reddy PhD [a], Amanda Wittenberg MS [b], Jessica R. Castle MD [c], Joseph El Youssef MBBS [a, c], Kerri Winters-Stone PhD [d], Melanie Gillingham PhD [b], Peter G. Jacobs PhD [a]



Subjects completed either RT or AE 90 minutes after meal with IOB

Aerobic exercise: treadmill at ~60% VO_2max
Resistance training: 8–12 reps of 5 upper/lower body exercises at 60–80% 1RM

Control: no structured exercise.

AEROBIC vs RESISTANCE

Outcome Measure	Aerobic Exercise (AE)	Resistance Training (RT)	Key Takeaway
Blood Glucose Change During Exercise	↓ 3.94 mmol/L	↓ 1.33 mmol/L	AE caused a **much larger glucose drop** — higher risk of exercise-induced hypoglycaemia. RT produced smaller, safer decline.
24-Hour Time in Range (3.9–10 mmol/L)	~ 60 %	~ 70 %	RT significantly **improved 24-h glucose stability** vs control and AE. AE showed no significant improvement vs control.
Total Daily Insulin (24 h post-exercise)	No significant change	↓ vs control	RT **reduced insulin requirements**, suggesting improved insulin sensitivity.
Hypoglycemia Incidence	Higher during exercise	Lower during exercise	RT safer acutely for people prone to lows.
Overall Glycemic Control (short-term)	Similar to control	Improved vs control	Only RT week showed **better overall 24-h glucose profile**.

DREW'S DAILY DOSE

RESISTANCE + AEROBIC = MAXIMUM BENEFIT

Resistance Training	Aerobic Training
↑ Insulin sensitivity for up to **72 hours**	↑ Cardiorespiratory fitness (CRF) — reduces CVD risk
↑ Non–insulin–mediated glucose uptake for **2–3 hours post-exercise**	↑ GLUT4 expression → improved glucose transport into muscle
Glycogen depletion → more "dry sponges" to soak up glucose later	↓ Visceral and total body fat
↑ **Muscle mass and strength** → bigger glucose "sponges"	↓ Blood pressure and resting heart rate
↑ **Bone density** and **tendon strength**	Improves **lipid profile** (↑ HDL, ↓ LDL & triglycerides)
↑ Lean mass → improved metabolic rate	Enhances **insulin sensitivity** (24–48 hours)

Meta-Analysis > Diabetes Res Clin Pract. 2014 Dec;106(3):393-400.
doi: 10.1016/j.diabres.2014.09.038. Epub 2014 Oct 7.

A systematic review and meta-analysis of exercise interventions in adults with type 1 diabetes

Jane E Yardley [1], Jacqueline Hay [2], Ahmed M Abou-Setta [3], Seth D Marks [4], Jonathan McGavock [5]

Some studies reported reductions in HbA1c following exercise interventions, but the **overall summary estimate** did *not* show a robust, consistent, statistically significant improvement across all studies

SUMMARY OF MODALITIES

Modality	Acute Effect on Blood Glucose (During & Post)	Chronic Effect on HbA1c	Other Key Benefits
HIIT	Often ↑ during workout; may ↓ post-exercise	No significant effect	↑ Cardiorespiratory fitness, ↑ insulin sensitivity
Sprints	Sharp ↑ during; delayed ↓ post-ex	No significant effect	↑ Insulin sensitivity, ↑ anaerobic capacity, ↑ time-efficiency, ↓ training time needed
	Gradual glucose ↓ during & after	↓ HbA1c — small to moderate	↑ CRF, ↓ BP, ↓ triglycerides,↑ insulin sensitivity
Resistance training	Stable or slight ↑	↓ HbA1c — moderate effect	↑ Muscle mass & strength, ↑ insulin sensitivity, ↑ bone density, ↓ insulin requirements
Combined (RT + Aerobic)	Balanced — RT rise may offset aerobic drop	↓ HbA1c — strongest overall effect	↑ CRF + strength, ↑ insulin sensitivity, ↓ cardiovascular risk, best overall metabolic profile

THE PROBLEMS WITH THE PHRASE…

"EXERCISE IS MEDICINE"

1. It implies you only take it when you're sick

Medicine is reactive. It's something you take **after** a problem appears to **treat** an illness.
Exercise is proactive. It's a **preventative**. It protects you **before** illness develops.

They say "Don't wait until you're thirsty to dig a well"
I say, don't wait until you're sick to start exercising.

2. It implies it's as easy as popping a pill

Medicine is passive — you swallow it and let it do the work.
Exercise takes effort — **you** have to put in the work.

3. It implies one dose works for everyone

Most medicines have a standardised dose.
Exercise doesn't.

Too little, and it's ineffective. Too much, and it becomes harmful.

That's why calling it medicine oversimplifies the nuance — it's more like a *personalised prescription.*

4. It neglects enjoyment

Strips away the pleasure, play, and freedom of movement — turning something fun into a chore or prescription.

EXERCISE *ISN'T* MEDICINE…

EXERCISE IS A PHARMACY

A pharmacy contains hundreds of compounds, each with unique effects on an array of health conditions.

But a pharmacy doesn't just stock drugs that *fix* problems when they arise — it also holds **vaccines** that prevent disease before it starts.

Exercise does both.

It can *treat* existing conditions and *protect* against future ones.
But it can also have unwanted side-effects.

The art lies in prescribing the **right type**, at the **right dose**, for the **right person**, at the **right time.**

HOW TO SUPPORT TRAINING WITH NUTRITION

UNDERSTANDING PLANT-BASED PROTEIN

Myth 1: Plant Protein Is "Incomplete"

All plants contain all 9 essential amino acids

Some plants are lower in certain amino acids than others

Grains are lower in lysine, and Legumes are lower in methionine.

UNDERSTANDING PLANT-BASED PROTEIN

Myth 2: Plant Protein Isn’t Bioavailable

This misconception originated from outdated animal studies where pigs were fed raw beans.

Humans don’t eat raw beans—we cook, soak, ferment, and sprout them.

These processes dramatically improve digestibility.

In human studies, the differences in digestibility between plant and animal protein are only a few percent.

For example:

- Soy protein protein isolate has a digestibilty score which is the same as whey, casein, and egg protein.
- Tofu, being less processed, has slightly lower digestibility but is still high — about 90–95% true protein digestibility.
- Tempeh (fermented soy): reported digestibility for tempeh is in the range of 92–94%, with improved amino acid availability compared to unfermented soybeans.
- Cooked legumes: (chickpeas ~89%, lentils ~84%, black beans ~83%)

PLANT PROTEIN VS ANIMAL PROTEIN

Clinical Trial > Sports Med. 2021 Jun;51(6):1317-1330. doi: 10.1007/s40279-021-01434-9. Epub 2021 Feb 18.

High-Protein Plant-Based Diet Versus a Protein-Matched Omnivorous Diet to Support Resistance Training Adaptations: A Comparison Between Habitual Vegans and Omnivores

Victoria Hevia-Larraín [1], Bruno Gualano [1 2], Igor Longobardi [1], Saulo Gil [1], Alan L Fernandes [1], Luiz A R Costa [1], Rosa M R Pereira [3], Guilherme G Artioli [1], Stuart M Phillips [4], Hamilton Roschel [5]

Clinical Trial > J Nutr. 2023 Jun;153(6):1680-1695. doi: 10.1016/j.tjnut.2023.02.023. Epub 2023 Feb 22.

Vegan and Omnivorous High Protein Diets Support Comparable Daily Myofibrillar Protein Synthesis Rates and Skeletal Muscle Hypertrophy in Young Adults

Alistair J Monteyne [1], Mariana O C Coelho [1], Andrew J Murton [2], Doaa R Abdelrahman [2], Jamie R Blackwell [1], Christopher P Koscien [1], Karen M Knapp [3], Jonathan Fulford [3], Tim J A Finnigan [4], Marlou L Dirks [1], Francis B Stephens [1], Benjamin T Wall [5]

Affiliations + expand

PMID: 36822394 PMCID: PMC10308267 DOI: 10.1016/j.tjnut.2023.02.023

High-protein plant-based diet (with soy protein powder) Vs. **protein-matched omnivorous diet (with whey protein powder)**

Both groups trained for 12 weeks, ate 1.6 g/kg protein, and supplemented accordingly.

Both groups gained the same muscle and strength.

Outcome	OMNI	VEG	Interpretation
Myofibrillar Protein Synthesis (MyoPS)	↑ ~12%	↑ ~12%	Exercise increased MyoPS equally in both groups
Lean Mass Gain	+2.6 kg	+3.1 kg	Similar muscle growth between diets
Thigh Muscle Volume	8.3%	8.3%	Identical improvements
Muscle Fiber Cross-Sectional Area (CSA)	33%	32%	Comparable hypertrophy
Muscle Strength	↑ across all groups	↑ across all groups	No difference in strength gains

DREW'S DAILY DOSE

HOW MUCH PROTEIN DO YOU NEED?

	Recommended Intake	Benefit
General Population	**0.8 g per kg body weight** (60 g/day for a 75 kg person)	Prevents deficiency — maintains basic health but may be suboptimal for performance or aging
Older Adults	**~1.2 g per kg body weight**	Helps preserve muscle mass, bone density, and functional strength
Athletes & Active Individuals	**~1.6 g per kg body weight**	Supports muscle growth, recovery, and exercise performance