Supplemental Material

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Figure 1: Data flow diagram for participant eligibility and data selection.

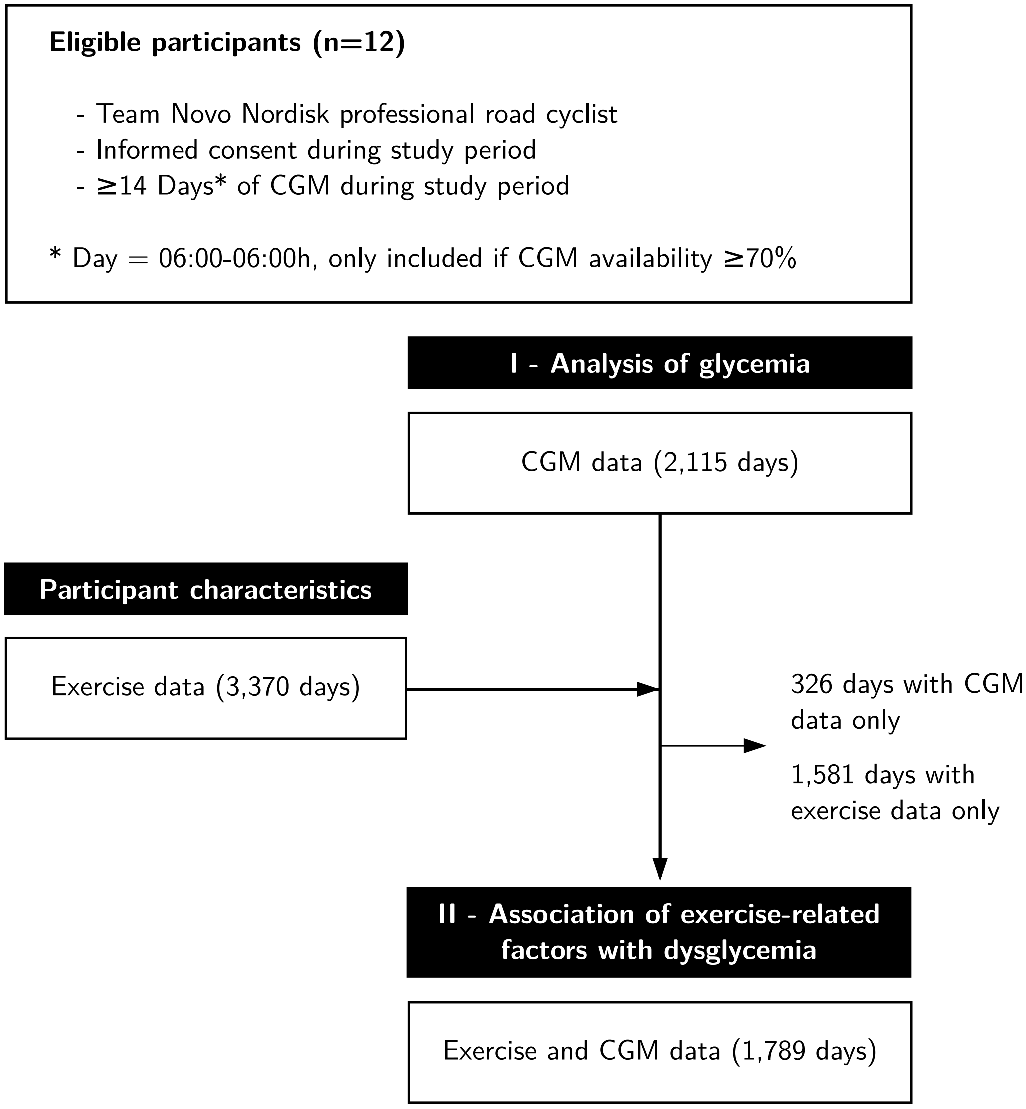

Table 1: Description of exercise-related factors and environment variables.

Variable	Units	Description
Competitive aspect		
Competition	[y/n]	Whether any exercise during the day was part of a competition.
Core exercise metrics		
Duration (T)	[s]	Total duration of all the exercises during the day.
Intensity factor (IF)	-	Power output normalized for variability in cycling conditions to obtain a more accurate depiction of power expenditure (i.e., *normalized power*), which is divided by a participant's functional threshold power (FTP) [1], i.e., $$\mathrm{IF} = \left(\frac{1}{T} \sum_{t \in T} \left(\frac{1}{30} \sum_{n=0}^{29} P(t-n) \right)^4 \right)^{1/4} \mathrm{FTP}^{-1} \quad (1)$$
Variability index (VI)	-	Metric for smoothness or variability of the power output during exercise, i.e., $$\mathrm{VI} = \left(\frac{1}{T} \sum_{t \in T} \left(\frac{1}{30} \sum_{n=0}^{29} P(t-n) \right)^4 \right)^{1/4} \left[\frac{1}{T} \sum_{t \in T} P(t) \right]^{-1} \quad (2)$$
Power		
Time in power zone ...	[min]	Time spent in personal Coggan power zones, based on fractions of the participant's FTP [1], i.e., $$\sum_{t \in T} \mathbf{1}_z(P(t)) \text{ with } z = \dots \quad (3)$$
... 1 (Active recovery)		... < 56% of FTP
... 2 (Endurance)		... 56 to 76% of FTP
... 3 (Tempo)		... 76 to 91% of FTP
... 4 (Lactate threshold)		... 91 to 106% of FTP
... 5 (VO_{2max})		... 106 to 121% of FTP
... 6 (Anaerobic capacity)		... > 121% of FTP
Heart rate		
Time in heart rate zone ...	[min]	Time spent in personal Coggan heart rate zones, based on fractions of the participant's lactate threshold heart rate (LTHR) [1], i.e., $$\sum_{t \in T} \mathbf{1}_z(HR(t)) \text{ with } z = \dots \quad (4)$$
... 1 (Active recovery)		... < 69% of LTHR
... 2 (Endurance)		... 69 to 84% of LTHR
... 3 (Tempo)		... 84 to 95% of LTHR
... 4 (Lactate threshold)		... 95 to 106% of LTHR
... 5 (VO_{2max})		... > 106% of LTHR
Environment		
Day in season	-	Day in the competitive season, starting from the participant's personal start of the season.
Travel	[y/n]	Whether any travelling has taken place on the respective day or the two days preceding it. Travel is defined as a change of countries, identified using the GPS location of the exercise, or a change of timezones, excluding any changes due to daylight saving time (DST).
Temperature	[°C]	Average temperature during the exercise.
Altitude	[m]	Average altitude of the exercise.

Quantities: t = time [s]; P(t) = power at time t [W]; HR(t) = heart rate at time t [bpm]; FTP = functional threshold power [W]; LTHR = lactate threshold heart rate [bpm]; DST = daylight saving time.

Table 2: Number of participants that met the consensus targets from Battelino et al. [2] on glycemic control over a competitive season. We distinguished between the entire study period (2,115 days), non-competitive exercise (NCE) days (1,536 days), and competitive exercise (CE) days (256 days). Statistics were calculated for five phases of the day: entire day, wake, exercise, recovery, and sleep. Data are n [%].

	Entire day (06:00–06:00h)		**Wake** (06:00–00:00h)		**Exercise**		**Recovery** (4h post-exercise)		**Sleep** (00:00–06:00h)	
Overall (2,115 days)										
Mean glucose [mg/dL]	-	-	-	-	-	-	-	-	-	-
Glycemic variability [%]	4	[33.3%]	4	[33.3%]	5	[41.7%]	7	[58.3%]	3	[25.0%]
CGM readings [%] in ...										
... hypoglycemia (<70 mg/dL)	4	[33.3%]	6	[50.0%]	6	[50.0%]	8	[66.7%]	4	[33.3%]
... hypoglycemia L2 (<54 mg/dL)	5	[41.7%]	7	[58.3%]	9	[75.0%]	8	[66.7%]	4	[33.3%]
... hypoglycemia L1 (54-69 mg/dL)	4	[33.3%]	4	[33.3%]	5	[41.7%]	8	[66.7%]	4	[33.3%]
... target range (70-180 mg/dL)	5	[41.7%]	5	[41.7%]	7	[58.3%]	3	[25.0%]	7	[58.3%]
... hyperglycemia (>180 mg/dL)	6	[50.0%]	5	[41.7%]	7	[58.3%]	3	[25.0%]	9	[75.0%]
... hyperglycemia L1 (181-250 mg/dL)	7	[58.3%]	7	[58.3%]	8	[66.7%]	4	[33.3%]	10	[83.3%]
... hyperglycemia L2 (>250 mg/dL)	5	[41.7%]	5	[41.7%]	4	[33.3%]	5	[41.7%]	7	[58.3%]
Non-competitive exercise (NCE; 1,536 days)										
Mean glucose [mg/dL]	-	-	-	-	-	-	-	-	-	-
Glycemic variability [%]	4	[33.3%]	4	[33.3%]	5	[41.7%]	7	[58.3%]	4	[33.3%]
CGM readings [%] in ...										
... hypoglycemia (<70 mg/dL)	4	[33.3%]	4	[33.3%]	6	[50.0%]	8	[66.7%]	4	[33.3%]
... hypoglycemia L2 (<54 mg/dL)	5	[41.7%]	7	[58.3%]	9	[75.0%]	8	[66.7%]	4	[33.3%]
... hypoglycemia L1 (54-69 mg/dL)	4	[33.3%]	4	[33.3%]	5	[41.7%]	8	[66.7%]	4	[33.3%]
... target range (70-180 mg/dL)	5	[41.7%]	5	[41.7%]	7	[58.3%]	4	[33.3%]	6	[50.0%]
... hyperglycemia (>180 mg/dL)	7	[58.3%]	6	[50.0%]	7	[58.3%]	3	[25.0%]	10	[83.3%]
... hyperglycemia L1 (181-250 mg/dL)	7	[58.3%]	8	[66.7%]	8	[66.7%]	4	[33.3%]	10	[83.3%]
... hyperglycemia L2 (>250 mg/dL)	5	[41.7%]	5	[41.7%]	4	[33.3%]	4	[33.3%]	7	[58.3%]
Competitive exercise (CE; 256 days)										
Mean glucose [mg/dL]	-	-	-	-	-	-	-	-	-	-
Glycemic variability [%]	4	[36.4%]	5	[45.5%]	8	[72.7%]	6	[54.5%]	6	[54.5%]
CGM readings [%] in ...										
... hypoglycemia (<70 mg/dL)	7	[63.6%]	8	[72.7%]	11	[100%]	7	[63.6%]	5	[45.5%]
... hypoglycemia L2 (<54 mg/dL)	8	[72.7%]	8	[72.7%]	10	[90.9%]	8	[72.7%]	6	[54.5%]
... hypoglycemia L1 (54-69 mg/dL)	6	[54.5%]	7	[63.6%]	10	[90.9%]	7	[63.6%]	6	[54.5%]
... target range (70-180 mg/dL)	5	[45.5%]	5	[45.5%]	3	[27.3%]	3	[27.3%]	6	[54.5%]
... hyperglycemia (>180 mg/dL)	6	[54.5%]	5	[45.5%]	3	[27.3%]	4	[36.4%]	7	[63.6%]
... hyperglycemia L1 (181-250 mg/dL)	7	[63.6%]	7	[63.6%]	3	[27.3%]	5	[45.5%]	9	[81.8%]
... hyperglycemia L2 (>250 mg/dL)	5	[45.5%]	5	[45.5%]	2	[18.2%]	5	[45.5%]	7	[63.6%]

B Supplemental Methods

Regression equations The regression equation used in the analysis of the association between exercise and dysglycemia is

$$\underbrace{\log \frac{p_{id}}{1-p_{id}}}_{\text{odds of dysglycemia}} = \Big(\beta_0 + \overset{\text{random intercept}}{\alpha_{0i}}\Big) + \underbrace{\Big(\beta_1 + \overset{\text{random slope}}{\alpha_{1i}}\Big) x_{1id}}_{\text{exercise variable of interest}} + \underbrace{\beta_2 x_{2id} + \ldots + \beta_k x_{kid}}_{\text{environmental variables}} + \epsilon_{id} \tag{5}$$

with $p_{id} = \mathbb{P}(y_{id} = 1)$. In this model, we used a random intercept α_{0i} and random slope α_{1i} for the variable of interest to account for participant-specific variation. The exercise variable of interest x_{1id} is any of the variables under "Competitive aspect", "Core exercise metrics", "Power", and "Heart rate" in Table 1. Environmental variables $x_{2id}, \ldots, x_{kid}$ are all the variables under "Environment" in Supplemental Table 1. For each exercise variable of interest, and for each binary dependent variable (i.e., the occurrence of hypo-/hyperglycemia during exercise/recovery/sleep), a separate model was fitted. Hence, Figure 2 in the main manuscript is a composite figure, comprising the results of multiple independent analyses, and should not be interpreted as the result of a single regression analysis.

References

[1] Allen, H. and Coggan, A. (2012). *Training and Racing with a Power Meter, 2nd Ed.* VeloPress.

[2] Battelino, T., Danne, T., Bergenstal, R. M., Amiel, S. A., Beck, R., Biester, T., Bosi, E., Buckingham, B. A., Cefalu, W. T., Close, K. L., Cobelli, C., Dassau, E., DeVries, J. H., Donaghue, K. C., Dovc, K., Doyle, 3rd, F. J., Garg, S., Grunberger, G., Heller, S., Heinemann, L., Hirsch, I. B., Hovorka, R., Jia, W., Kordonouri, O., Kovatchev, B., Kowalski, A., Laffel, L., Levine, B., Mayorov, A., Mathieu, C., Murphy, H. R., Nimri, R., Nørgaard, K., Parkin, C. G., Renard, E., Rodbard, D., Saboo, B., Schatz, D., Stoner, K., Urakami, T., Weinzimer, S. A., and Phillip, M. (2019). Clinical targets for continuous glucose monitoring data interpretation: Recommendations from the international consensus on time in range. *Diabetes Care*, 42(8):1593–1603.