Time spent in glycaemic ranges and carbohydrate intake during cycling in professional cyclists with type 1 diabetes

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INTRODUCTION

For athletes with type 1 diabetes (T1D), an additional issue is the management of glycaemia over many hours of an acute exercise session. Nutritional intake is an essential component in optimising endurance performance in elite cyclists [1, 2] . Though modern continuous glucose monitoring systems offer enhanced opportunities to view glycaemic fluctuations during prolonged cycling, little research has explored the link between fuel intake and resultant glycaemia during acute cycling performance.

Aim: This observational study examined in-ride interstitial glucose data and nutritional intake in a UCI-accredited professional cycling team with T1D over a nine-day training camp.

METHODS

- Sixteen male professional road cyclists with T1D (age 27 ± 4 years, T1D duration 11 ± 5 years, BMI 21.6 ± 1.5 kg·min^{-2}, HbA1c 6.8 ± 0.6 %, $\dot{V}O_{2max}$ 71.3 ± 3.9 ml·kg·min^{-1}) on multiple daily injections performed eight rides over nine days lasting between 2 and 6 hours, traversing 56 to 182 km/day at 60-75% maximum heart rate.
- Cycle glycemic information (G6, Dexcom) was collected over 9 days of training and stratified into pre-defined glycaemic ranges i.e. Time spent in hypoglycemia (level 1 [54–70 mg·dL^{-1}] and 2 [<54 mg·dL^{-1}]), euglycemia (EU [71-180 mg·dL^{-1}]), and hyperglycemia (level 1 [181-299 mg·dL^{-1}]and 2 [>299 mg·dL^{-1}]). In-ride glycaemic data were uploaded and subsequently analyzed for time spent (%) within each range.
- For each ride, individualised in-ride nutritional intake was recorded and quantified by the research team. The nutrient composition of all ingested products was described directly from the manufacturing labels and reported as median (range).
- Data were tested for normal distribution via Shapiro–Wilk test and group differences were analyzed by means of Kruskal-Wallis or one-way ANOVAs with independent t-tests performed (P≤ 0.05).

RESULTS

		Time spent (%)				
		L2 hypo <54 mg·dL^{-1}	L1 hypo 54–70 mg·dL^{-1}	EU 71-180 mg·dL^{-1}	L1 hyper 181-299 mg·dL^{-1}	L2 hyper >299 mg·dL^{-1}
Ride Number	Ride 1	0	0	86	14	0
	Ride 2	0	11	80	9	0
	Ride 3	5	8	79	8	0
	Ride 4	0	1	81	18	0
	Ride 5	0	1	83	16	0
	Ride 6	0	0	71	24	5
	Ride 7	0	1	70	27	2
	Ride 8	0	0	76	22	2
	Average	*1* ± 2	*3* ± 4	*78* ± 6	*17* ± 7	*1* ± 2

Table 1. Time in glycemic ranges over 9 days training, stratified into pre-defined glycaemic ranges.

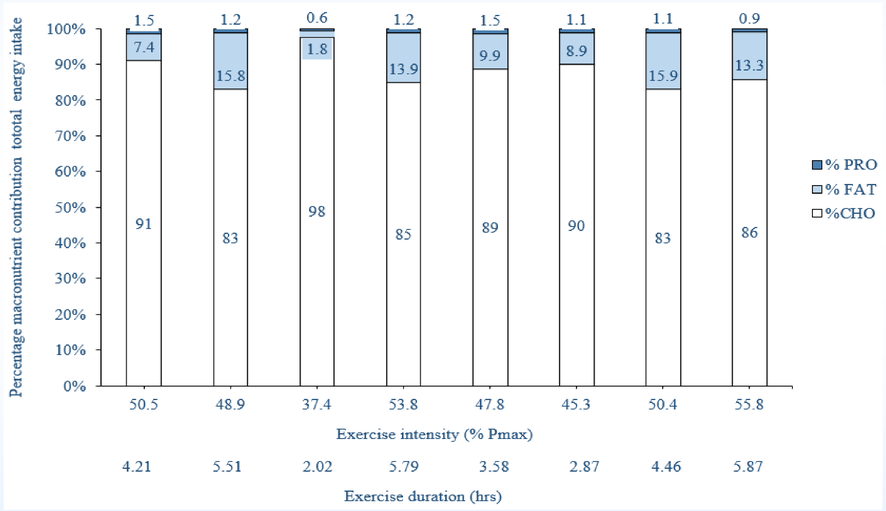

Figure 1. Percentage contribution of each macronutrient to the total in-ride energy intake with reference to exercise duration and intensity. Data are presented as mean ± SD. n=16. PRO; Protein. FAT; Fat. CHO; Carbohydrates. P; Power. hrs; Hours

Average percentage time spent in euglycemia during cycling was 78 ± 6% (daily range 70-86%). Time spent in L1 hypoglycemia during cycling was 3 ± 4% (range 0-11%), whilst time spent in L2 hypoglycaemia was 1 ± 2% (range 0-2%). No hypoglycemic event required assistance. Percentage time spent in L1 hyperglycemia during cycling was 17 ± 7% (range 8-27%,), and L2 hyperglycaemia was 1 ± 2% (range 0-5%).

The contribution of carbohydrates (CHO), fat and protein to total in-ride energy intake was 83.8 ± 15.4, 12.6 ± 8.1 and 1.2 ± 0.6%, respectively. The majority of CHO were derived from high GI foods i.e. 58.2 ± 12.9% of total CHO calories, irrespective of ride duration (P=0.232).

Macronutrient intake was dependent on cycle duration with greater CHO intake rate on longer rides (2-hour cycle: 20 (range 4-82 g.h^{-1}) vs. 6-hour cycle: 51 (range 17-86 g.h^{-1}).

CONCLUSION

Professional cyclists with T1D maintained a large proportion of time in a euglycemic range during intense cycling sessions over a nine-day training period. The low occurrence of in-ride hypoglycemia, mostly at Level 1, suggests a protective role for consumption of carbohydrate-rich foods to maintain glycaemia, especially during longer rides. However, time spent in Level 1 hyperglycemia during cycling was notable and should be monitored.

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