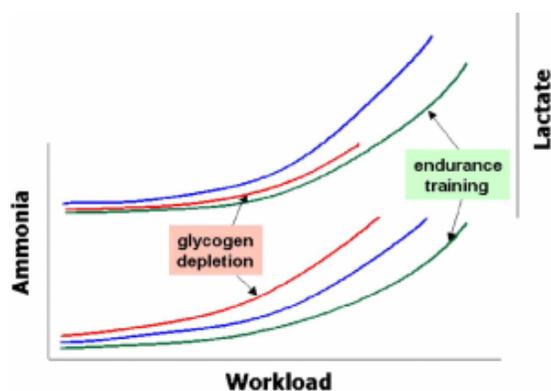


## THE EFFECT OF REDUCED CARBOHYDRATE DIET ON AMMONIA-LACTATE RATIO AT 102% OF MLSS.

D.J. Smith and A. Petrie – Human Performance Laboratory, Faculty of Kinesiology, University of Calgary.

### Introduction

Depletion of muscle glycogen stores and the attenuation of blood lactate is a condition regularly observed after several bouts of endurance exercise on one day or after repeated high intensity bouts on consecutive days (1). However, the behavioural patterns of blood lactate and ammonia are qualitatively different where, at the same workload, lactate decreases while ammonia increases significantly (2).



**Fig 1:** Different effects of endurance training and glycogen depletion on blood lactate and NH<sub>3</sub> in a GXT (Schulz and Heck, 2003).

### Objective

The purpose of this study was to establish a test to determine if an athlete is in a reduced glycogen state by comparing the blood ammonia and lactate response to a 35 min cycling bout at approximately 102% of maximum lactate steady state (MLSS) power output in both a normal and reduced carbohydrate (CHO) diet.

### Setting

Human Performance Laboratory, Faculty of Kinesiology, University of Calgary, Alberta.

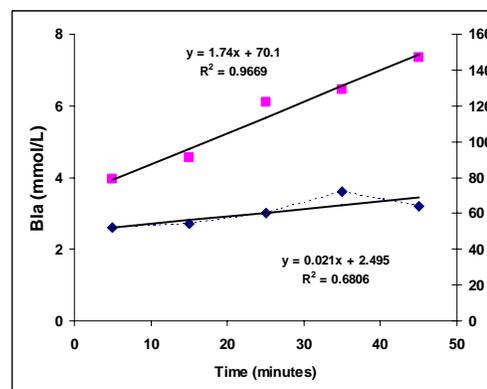
### Participants

Six trained male cyclists ( $75.8 \pm 8.7$  kg) with a mean relative MAP of  $5.22$  W·kg<sup>-1</sup>, and  $57.0 \pm 3.3$  ml·kg<sup>-1</sup>·min<sup>-1</sup> participated in a Neupert-Smith MLSS test (Neupert, unpublished thesis, 2007) followed by a familiarization ride 1 (R1) and 5 (R2-6) additional cycling bouts at approximately  $102\% \pm 1.5$  of MLSS over the course of 15 days.

### Methodology

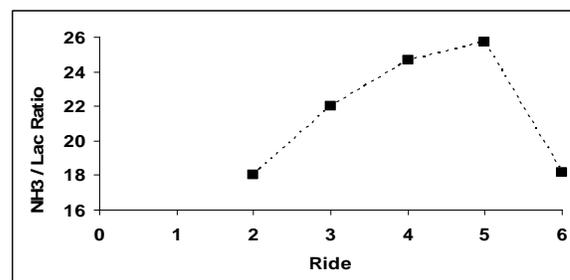
During R1 and R2 subjects followed a normal diet of 52% CHO with R3, 4 and 5 following a lower CHO diet of 45%, 40%, and 40% CHO respectively, concluding with R6 at a normal CHO diet of 54%. Serial blood samples were taken every 10 min starting at minute 5 during the 102% MLSS rides.

### Main Results



**Fig 3:** Response of lactate and NH<sub>3</sub> in a typical subject in a reduced CHO state during constant load exercise at 102% of MLSS.

The ammonia-lactate ratio at 35 minutes during R2 was 18.0 and increased to 25.7 at R5. It returned to 18.1 at R6 (normal CHO), demonstrating that there was a trend towards an increasing ratio during a lower CHO diet. Although none of the changes were significant, the lactate values decreased from  $6.3$  mmol·L<sup>-1</sup> at 35 min of R2, to a low of  $4.9$  mmol·L<sup>-1</sup> during R5 before returning to  $6.2$  mmol·L<sup>-1</sup> for ride R6.



**Fig 4:** The mean ammonia lactate ratio at 35 minutes during each ride.

### Discussion/Conclusion

It can be concluded that there was a trend towards an increase in the ammonia-lactate ratio during a reduced glycogen state and these trends could be exaggerated with the application of an even lower carbohydrate diet. Thus, ammonia and lactate response during constant load exercise or as previous demonstrated in a GXT by Roeykens et al. (2) can be used to identify a reduced glycogen state.

### References

- Schulz, H. & Heck, H. (2003). Glycogen depletion as indication for ammonia determination in exercise testing. *Eur. J. Sport Sci.* 3(3):1-9.
- Roeykens, J., Magnus, L., Rogers, R., Meeusen, R. & De Meirleir, K. (1998). Blood ammonia-heart rate relationship during graded exercise is not influenced by glycogen depletion. *Int. J. Sports Med.* 19:26-31.