Acute molecular responses to resistance exercise with low skeletal muscle glycogen levels and different carbohydrate availability in young healthy males

Pim Knuiman1, Maria Hopman1-2, Roland Hangelbroek1, Martijn Redegeld1, Jeroen Wouters3, Luc van Loon4 & Marco Mensink1

Introduction

It has been postulated that when endurance and resistance exercise are combined within the same day, ingestion of carbohydrates in the pre-resistance exercise period is required to amplify the intramuscular anabolic signals in the post-resistance exercise period.

Aim & hypothesis

We aimed to examine the effects of LOW and HIGH pre-exercise carbohydrate ingestion on mRNA expression patterns of genes associated with mitochondrial biogenesis, protein degradation and substrate metabolism after a bout of resistance exercise with low skeletal muscle glycogen levels. Based on previous findings, it is hypothesized that the intramuscular response in the post-resistance exercise period is not affected by the amount of carbohydrates in the pre-resistance exercise period.

Methods

N = 14
Age = 21 ± 2
BMI = 22
VO2max = 51 ± 5

Results

(mRNA responses)

Figure 3. mRNA responses of HBEGF (left) and PDK4 (right). *Significantly different compared to baseline (P < 0.05). ‡Significant different between LOW and HIGH condition (P < 0.05).

Figure 4. mRNA responses of MURF1 (left) and MAFbx (right). *Significantly different compared to baseline (P < 0.05).

Figure 5. mRNA responses of SIRT1 (left) and PGC-1α (right). *Significantly compared to baseline (P < 0.05).

Conclusions

- There was no difference in post-resistance exercise muscle glycogen levels between the LOW and HIGH carbohydrate condition.

- HBEGF, MURF1, MAFbx, SIRT1 responded as a result of exercise. PDK4 mRNA expression was higher for LOW at 3h post-resistance compared to the HIGH condition. mRNA levels of PGC-1α remained unchanged over the course of the day.

- Intramuscular mRNA expression after a resistance exercise with low muscle glycogen levels was not affected by the amount of carbohydrates in pre-exercise meal.

- PDK4 was differentially expressed between LOW and HIGH groups, suggesting a shift towards fat oxidation and reduced glucose oxidation in the LOW condition.