Gender Differences in Acetyl Group Accumulation with Exercise

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Introduction

Differences in substrate utilization between men and women during exercise remain controversial. To date, the majority of data describing exercise fuel metabolism has been assessed from muscle tissue samples obtained before and after exercise. More recently, proton magnetic resonance spectroscopy (^{1}H-MRS) has been used to non-invasively assess metabolism with exercise in both men and women [1,2]. Kreis and colleagues reported the accumulation of acetyl groups (2.13 ppm) which were associated with acetylcarnitine [1]. The purpose of this study was to compare muscle acetyl levels at rest and following 1 h of submaximal cycle ergometry in fitness-matched men and women.

Subjects and Methods

Eighteen moderately active men (n=9) and women (n=9) matched in age, activity level, dietary intake (kcal/FFM), nutrient composition (%fat, carbohydrates, and protein), and cardiovascular fitness (VO_2max) participated in this study. Subjects reported for exercise and MR study 10 hrs following their last meal. Following a 5 min warm-up, subjects exercised continuously for 60 min at 65 ± 5% of their previously determined VO_2max. Subjects ingested 400ml of water prior to exercise and followed a body mass adjusted hydration protocol during exercise to minimize dehydration.

^{1}H localized MRS: Pre- and post-exercise ^{1}H-MR spectra were acquired using a 3T whole body imaging system (Signa, Platform 4.5; GE Medical Systems) Axial T_1 weighted images were acquired from the thigh of subject's dominant leg. The leg was carefully aligned parallel to the B_o field. A 15 mm^3 voxel was selected in the mid-vastus lateralis muscle of the right leg using quadrature extremity coil. Water suppressed proton spectra (PRESS; TE=45ms, TR=2s, 128 average) were obtained before and after exercise. The data were further processed using jMRUI ver. 2.1 [3]. Time domain fitting was performed using the Lorentzian line shape. The water signal was quantified as a single peak resonating at 4.7 ppm and was analyzed by Hankel Lanczos squares single values decomposition. The acetyl group peak area was estimated from the singlet peak resonating at 2.13 ppm. Change in metabolite contents were estimated using the unsuppressed internal water reference from the same voxel [4].

Results

Subjects volunteering for this study were similar in age and VO_2max expressed as ml/kg·FFM·min^{-1} (P>0.05). Pre-exercise dietary intake and nutrient composition were similar between men and women (P>0.05). Acetyl peak area were significantly higher in women than men at rest and post-exercise (P<0.05) (Table 1). Following exercise, both men and women and men significantly increased (p<0.05) acetyl group accumulation from baseline values. Baseline acetyl group peak areas were not correlated with aerobic capacity, physical activity level or age.

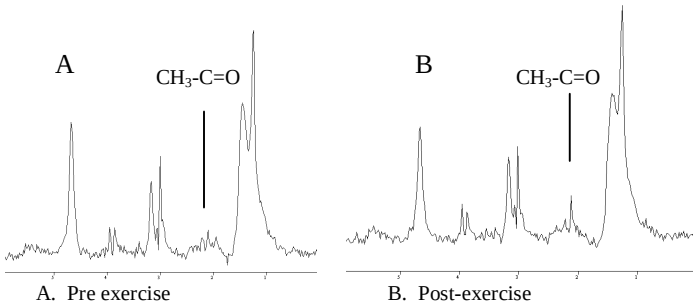
Discussion and Conclusion

To our knowledge, this is the first reported data comparing rest and exercise acetyl group accumulation between genders. Our data supports previous work by Kreis and colleagues who found acetyl group accumulation in active skeletal muscle [1]. Differences in baseline levels of acetyl group appear to be gender specific and may influence underlying metabolism at rest and during exercise. Circulating hormonal levels may play an important role in explaining gender differences in exercise substrate utilization. Our data provides evidence of gender differences in substrate selection with aerobic exercise.

Table 1

	Pre-exercise	Post-exercise	P-value
Women	$7.3 \times 10^5 \pm 4.8 \times 10^{5\,\&}$	$1.38 \times 10^6 \pm 4.9 \times 10^{5*,\&}$	P<0.05
Men	$3.4 \times 10^5 \pm 2.1 \times 10^5$	$6.2 \times 10^5 \pm 1.9 \times 10^{5\,*}$	P<0.05

&=Women significantly higher than men (P<0.05) *=Post-exercise significantly increased from pre-exercise values (P<0.05)



A. Pre exercise B. Post-exercise

References

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Acknowledgments

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