THE EFFECT OF RESISTANCE TRAINING ON CHARACTERISTICS OF EQUINE MUSCLE

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INTRODUCTION

One of the most devastating injuries that can occur in racehorses is strain or tear of the superficial digital flexor (SDF) tendon of the front leg, known in lay terms as “bowed tendons”. Part of the function of this tendon is to absorb shock during exercise. Rehabilitation is key for recovery, but healing is slow and recurrence is common.[1] Therefore, studies of rehabilitation of this injury in horses are critical.

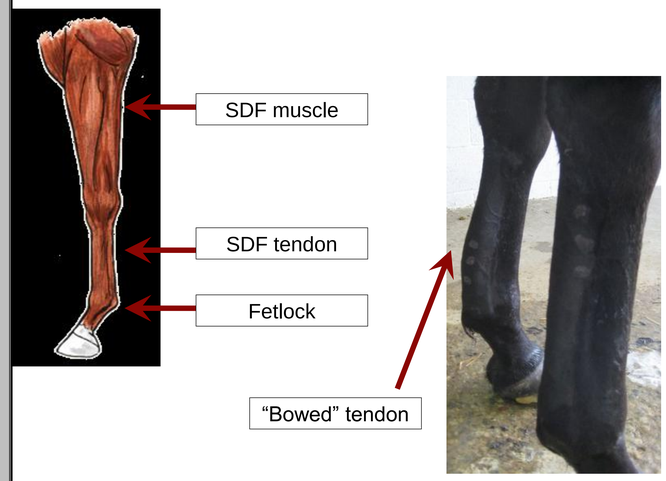
SDF tendon strain in horses likely has a multi-factorial etiology. One cause may be that fatigue in the SDF muscle leads to decreased support, over-extension of the fetlock joint, and resultant tearing of the tendon.

A previous study, performed at the University of Minnesota, suggested that tendon strain may be the result of the SDF muscle’s low energy stores compared to other equine muscles,[2] making SDF tendons more prone to fatigue and injury. Thus, if training programs are designed to increase resistance to fatigue, it is possible that this type of injury may be prevented.[2]

In humans, one way to strengthen and improve muscle energy stores is through resistance training. Resistance training can be employed in horses through the use of underwater treadmills. This project is part of a larger study that compared the effect of underwater treadmill exercise and land treadmill exercise on muscle characteristics and cardiovascular fitness. This project studied effects of underwater training on muscle fiber size and type in horse muscle. The results from this study may help to develop rehabilitation programs for treatment or prevention of SDF tendon strain.

PURPOSE

This study aims to determine whether underwater treadmill exercise changes muscle fiber size and muscle fiber type distribution in horse muscle compared to land treadmill exercise.



HYPOTHESIS

❖ Muscle fiber diameter will increase with training. Further, a greater increase in muscle fiber diameter will be seen with horses undergoing underwater treadmill exercise compared to land treadmill exercise.

❖ Muscle fiber types will become more aerobic (more % of type 2A fibers) with training. Further, this change will be even greater with horses undergoing underwater treadmill exercise compared to land treadmill exercise.

MATERIALS AND METHODS

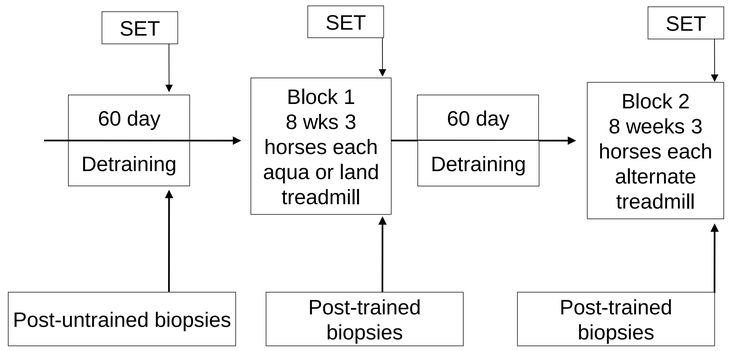
❖Six Quarter Horses received 4 periods of de-training and training: Rest 1, Land, Rest 2, and Water.

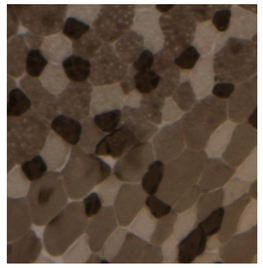
- The horses all went through the same 60 day detraining period (Rest 1), and then 3 horses were trained for 8 weeks on the land treadmill and the other 3 were trained on the water treadmill. After the 8 week training regimen, all horses again went through a 60 day detraining period (Rest 2). After Rest 2 the horses were again trained for 8 weeks on either the land or water treadmill, whichever one they had not previously been trained on.

❖After each period, a standardized exercise test (SET) was performed and biopsies of the superficial digital flexor and middle gluteal muscles were collected from each horse.

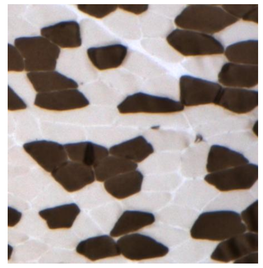
❖To determine the muscle fiber types and diameters, 10µm thick sections of post-exercise muscle samples were stained with nictotinamide adenine dinucleotide (NADH) tetrazolium reductase and ATPase activity was altered with pre-incubation in pH 4.2, 4.6, and 10.3, so the different fiber types were stained darker or lighter depending on their type.

❖For each biopsy the proportion of type 1, 2A and 2B fiber types was determined and the minimum and maximum diameter of 25 fibers per samples was measured.



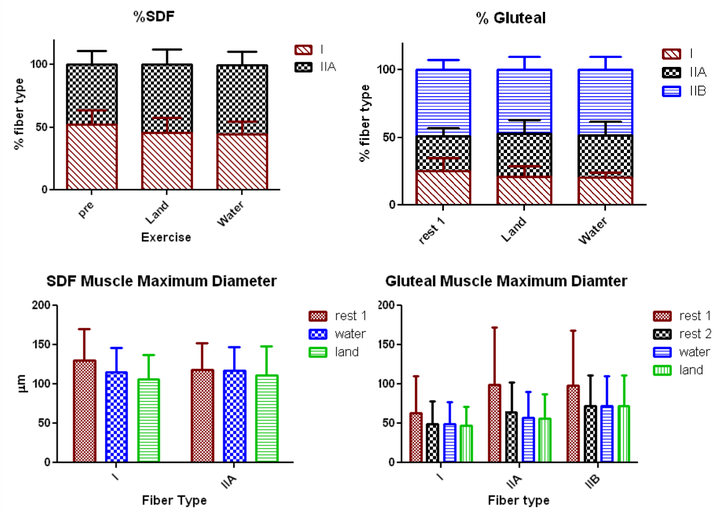


Gluteal Muscle ATPase stain



SDF muscle ATPase stain

RESULTS



CONCLUSIONS

❖ Initial statistical analysis using ANOVA for repeated measures found no significant differences ($p < 0.05$) between groups.

❖ Some interesting trends were noted:

- With both water and land training a shift toward more type 2A fibers was noted in both SDF and gluteal muscles, indicating improved aerobic capacity with both types of training.
- With both water and land training maximum and minimum fiber diameters showed a trend to decrease which is consistent with previous studies of muscle fiber diameter response to training in horses. The reason for this is unclear.

❖ Further analysis is ongoing.

BIBLIOGRAPHY

1. Dowling, B. A., A. J. Dart, D. R. Hodgson, and R. W. Smith. “Superficial Digital Flexor Tendonitis in the Horse.” *Equine Veterinary Journal* (2000): 369-78.
2. Firshman, A., and S. Valberg. “The Effect of Resistance Training of Whole Body Fitness and Metabolic Characteristics of Superficial Digital Flexor Muscle. UMEC Grant Proposal (2010).