


Gene Response of the Gastrocnemius and Soleus Muscles to an Acute Aerobic Run in Rats

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ABSTRACT

Genes can be activated or inhibited by signals within the tissues in response to an acute bout of exercise. It is unclear how a particular aerobic exercise bout may influence two muscles with similar actions to the activity. Therefore, the purposes of this investigation was to determine the gene response of selected genes involved in the "stress" response of the gastrocnemius (fast-twitch) and soleus (slow-twitch) muscles to a single two hour aerobic exercise bout in female Sprague-Dawley Rats at the 1 hour time point after the exercise.

Exercised rats were run (n=8) for 2 hours at 20 m.min⁻¹ and one hour after the completion of the bout had their soleus (S) and gastrocnemius (G) muscles removed. Age and timed matched sedentary control rats had both S and G muscles removed also. RNA was isolated from all muscles. Real-time PCR analysis was performed on the following genes: NFκB, TNFα, and Atf3. GAPDH was used as the housekeeping gene for both muscles. S muscle showed more genes altered (n = 52) vs G (n = 26). NFκB gene expression was 0.83 ± 0.14 in the exercised S but was + 1.36 ± 0.58 in the exercised G and was not significantly different between the muscles. TNFα was altered 1.30 ± 0.34 in the exercised S and 1.36 ± 0.71 in the exercised G and was not significantly different between the muscles. The gene Atf3 was significantly altered at 4.97 ± 1.01 in the exercised S, while it was not significantly altered in the exercised G (0.70 ± 0.55). This study demonstrates that an acute bout of aerobic exercise can alter gene expression to a different extent in both the S and G muscles. It is highly likely that muscle recruitment was a factor which influenced the gene expression in these muscles. It is interesting to note that some genes were similarly activated in these two muscles but other genes may

demonstrate a varied response to the same exercise bout depending on the type of muscle.

Key words: Aerobic exercise, skeletal muscle, gene response

Key Points

- The soleus (primarily slow twitch) and the gastrocnemius (primarily fast type) do not respond the same to a given exercise bout.
- There are gene transcription differences in stress genes between the 2 muscles.
- The results of exercise studies should be carefully viewed as the muscle used in measurements may not provide an adequate representation of all skeletal muscles.

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