An Examination of the Metabolic and Muscular demands of the FreeMotion Fitness™ Freestrider™

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This research examining the aerobic and muscular demands of exercise on the Freestrider, demonstrates:

- *High amounts of muscle activation is elicited by the demands of the Freestrider with alterations in the muscles targeted based on stride frequency and level of resistance.*
- *Heart rate and oxygen consumption patterns demonstrate the ability of an exerciser to perform various exercise intensities ranging from light- to maximal- exertion.*

Measurement and Analysis

Recent research conducted under the direction of Dr. Matthew Rhea, Director of Human Movement at A.T. Still University, was conducted to evaluate changes in metabolic demands and muscle activation during exercise of various intensities on the Freestrider.

To examine the changes in muscle recruitment and activity on the Freestrider, 10 healthy men (ages 18-36 years) completed two sessions on the Freestrider with EMG activity among 7 muscle groups monitored. In session one, subjects performed 3 minutes of exercise at 60 RPMS, level 5 resistance with two different stride lengths: short and long. For the short stride length, marks were placed on the tracks to guide the subject on range of motion. For long stride, subjects were instructed to complete strides as long as possible while maintaining the cadence. In session two, subjects completed two conditions similar to the first session, however, resistance was set at level 15. Therefore, 4 conditions were compared: 1- short-stride, low resistance, 2-

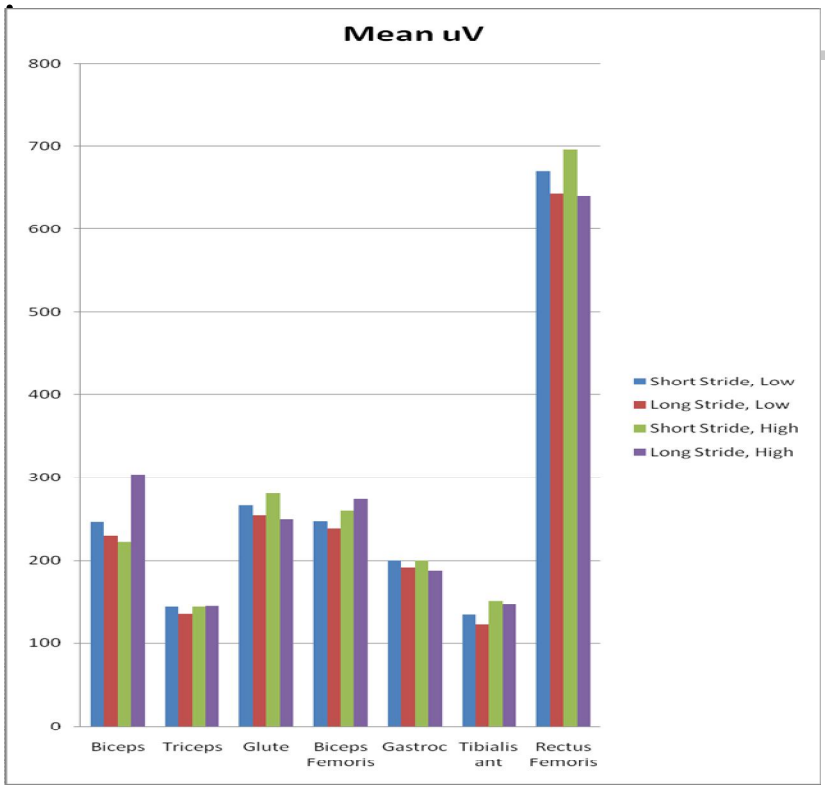
long-stride, low resistance, 3- short-stride high resistance, 4- long-stride high resistance.

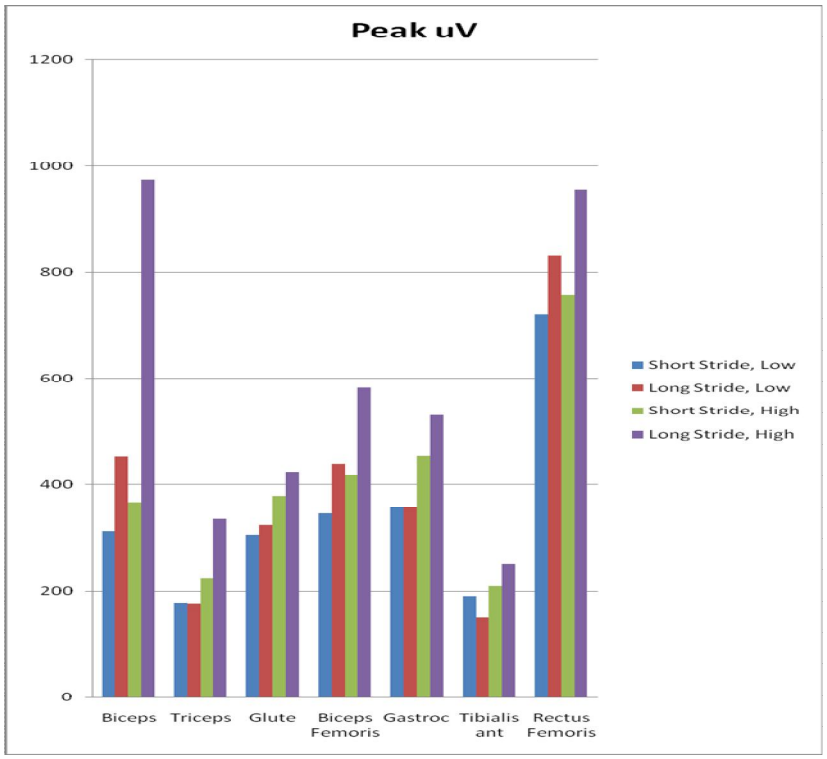
The Noraxon Myosystem EMG analysis hardware and software was utilized to monitor and compare muscle activity in the following muscle groups for all conditions: Gastrocnemius, anterior tibialis, rectus femoris, biceps femoris, gluteus maximus, biceps, and triceps. Both mean and peak muscle activity was averaged during minute two of each three minute stage. Muscle activity was then compared for changes based on stride length and resistance levels.

To evaluate the metabolic demands during exercise on the Freestrider, 15 healthy adults (ages 18-45, 11 male/4 female) performed several graded protocols while being monitored for gas exchange. The TrueOne 2400 Metabolic Cart (Parvo Medics) was utilized to monitor oxygen consumption during each trial. Subjects performed exercise at different stride frequencies against levels 1, 5, 10, 15, and 20 resistances. Oxygen consumption and heart rate was used to identify the level of aerobic demand achievable on the Freestrider.

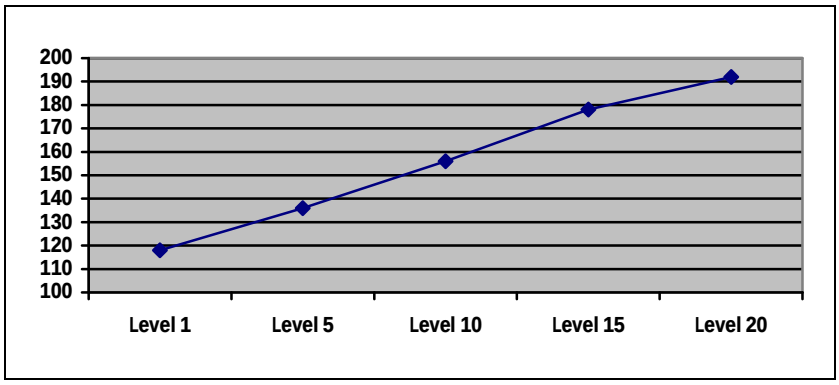
Results

The data demonstrated changes in activity with both stride length and resistance. Rectus femoris is the primary muscle group under all conditions on the Freestrider. During short stride length repetitions, gluteus maximus contributes more to force generation than the biceps femoris (hamstring) with this relationship switching during longer stride lengths. Longer stride lengths result in slightly less rectus femoris activity, although it remains the predominant muscle group. Gastrocnemius activity is higher during shorter strides than longer strides. Increases in resistance results in greater muscle activity in all muscle groups in terms of peak muscle activity. In order to create high levels of force rapidly, fast-powerful contractions are elicited. High resistance, long stride lengths therefore simulates a neuromuscular condition similar to high speed running. At high resistance, the biceps begins to contribute much more to force production, making this condition a demanding upper body exercise as well. The following figures demonstrate mean and peak muscle activation in various muscle groups with different speeds and levels of resistance.





Heart rate and oxygen consumption data demonstrated that the Freestrider offers a metabolic demand that can be adjusted with speed and resistance to achieve a workout ranging from light- to maximal-intensity. Subjects reached 100% of age-predicted maximal heart with high-speed stride frequencies (75 RPMs) and resistance levels of 15 and 20. Lower speeds with low resistance resulted in increases in heart rate to levels suggested by the American College of Sports Medicine for the development of aerobic fitness. The following figure represents the change in heart rate at 75 RPMs at different levels of resistance.



Implications for Exercise Prescription

These data suggest that changing stride length and resistance on the Freestrider can result in different muscle activity:

- To target the calf and gluteus, shorter strides should be used.
- To target the hamstrings, longer strides are optimal.
- Higher resistance results in increased peak force in all muscle groups, with added demand on the upper body.
- The use of stride frequency and programmed resistance allows the exerciser to achieve an aerobic workout ranging from light- to maximal-intensity