EMG Activity in the Lower Portion of the Rectus Abdominis Muscle

Nicole Lien
Other Contributing Members: Shannon Bullard, Leslee Dinsdale, Allison Thomas
Introduction
Previous Studies

- Rectus abdominis is one muscle with no difference between upper and lower portions during muscle activation \(^{(2)}\)
- Numerous studies conducted and show exercises with leg raises produce highest EMG activity \(^{(2-4)}\)
- Normalizing statistical EMG data allows for better comparison across subjects \(^{(2,3)}\)
- No prior research indicated if gender of a subject affects the amount of EMG activity during abdominal exercise
- No research had been done to investigate a correlation between EMG activity and heart rate during different abdominal exercises
Which abdominal exercise for women and men is most effective in stimulating the lower portion of the rectus abdominis muscle as measured by muscle activity through an EMG reading?
**Methods**

- 30 subjects age 18-24; 15 female; 15 male
- Placed 3 electrodes: ground on Anterior Superior Iliac Spine (hip bone), other two electrodes placed 3 cm lateral and 2 cm inferior to umbillicus

Electrode Locations
Methods Continue

- Subject wore heart rate monitor
- Exercise according to predetermined order
- Three exercises; Pilates One Hundred, Reverse Crunch, Ball
- Take resting HR and exercising HR at 15 sec into each exercise
- Measure EMG every 10 sec and average to find change from baseline
- Three min rest period between
Ball Exercise
Reverse Crunch

1. Do not swing your hips up into the air.
2. Lower your body back down towards the floor.
Results

- We found a difference in EMG activity between men and women for the three different exercises.

For women the average change in EMG activity:
- Pilates One Hundred $\Delta 0.1903 \pm 0.10$ mV
- The reverse crunch $\Delta 0.2406 \pm 0.10$ mV
- The ball exercise $\Delta 0.2527 \pm 0.11$ mV

For men the average change in EMG activity was:
- Pilates One Hundred $\Delta 0.2239 \pm 0.10$ mV
- The reverse crunch $\Delta 0.3656 \pm 0.16$ mV
- The ball exercise $\Delta 0.3323 \pm 0.14$ mV
We found a difference in heart rate in men and women when performing the three different exercises.

For women the average change in heart rate
- Pilates One Hundred 22.4 +/- 11.2 BPM
- The reverse crunch 11.92 +/- 17.1 BPM
- The ball exercise 25.6 +/- 9.8 BPM

For men the average change in heart rate
- Pilates One Hundred 20.66 +/- 11.8 BPM
- The reverse crunch 27.80 +/- 13.7 BPM
- The ball exercise 23.73 +/- 8.2 BPM
Results: Men

Men: Change in EMG Activity from Baseline During Exercise

**Type of Exercise**
- Pilates One Hundred
- Reverse Crunch
- Ball

**EMG Activity (millivolts)**
- Mean Average EMG Activity: 0.2239, 0.3652, 0.3323
- Standard Deviation: 0.1, 0.16, 0.14

Men: Change in Heart Rate During Exercise

**Type of Exercise**
- Pilates One Hundred
- Reverse Crunch
- Ball Exercise

**Heart Rate (BPM)**
- Mean Average Heart Rate: 20.6667, 27.8, 23.7333
- Standard Deviation: 11.81, 12.99, 8.25
Results: Women

Women: Change in EMG Activity from Baseline During Exercise

- Pilates: 0.1903 (0.1), 0.2406 (0.1), 0.2527 (0.1)
- One Hundred: 0.1, 0.1, 0.1
- Reverse Crunch: 0.1 (0.1), 0.1
- Ball: 0.11 (0.1)

Women: Change in Heart Rate from Baseline During Exercise

- Pilates: 22.4, 11.2
- One Hundred: 11.92, 17.1
- Reverse Crunch: 25.6, 9.8
- Ball: Exercise

Type of Exercise

EMG Activity (milivolts)

Heart Rate (BPM)
In contrast to our hypothesis, our results show that the Pilates One Hundred did not stimulate the highest EMG signal. In addition, our results differed in EMG activity between the two sexes.

- For women, the ball exercise elicited the highest EMG activity
- For men, the reverse crunch elicited the highest EMG activity.
- For women, the ball exercise achieved the greatest change in heart rate
- For men, the reverse crunch achieved the greatest change in heart rate


