Objective: To evaluate muscle activation by surface electromyography in recreational runners throughout a one-mile run. Design: Randomized, within subject design Setting: Human Performance Laboratory at Research Institute Participants: Thirty recreational runners (15 males, 15 females; age: 30.9±8.9 years; height: 175±7.5 cm; mass: 70.3±12.1 kg). Interventions: Participants ran a total of one mile on a treadmill at zero percent incline. They were asked to run at a pace comparable to their daily training pace. Surface Electromyography (EMG) data was collected for 0.05 miles at each of the following increments: 0.20-0.25, 0.45-0.50, 0.70-0.75, and 0.95-1.0 miles Main Outcome Measures: EMG output of the Rectus Femoris, Tensor Fascia Latae, Gluteus Medius, and Gluteus Maximus during dynamic muscle activation Results: Throughout the one-mile testing period, runners showed a decrease in hip muscle activation in all four muscle analyzed. Females activated the Gluteus Maximus (p=0.001), the Rectus Femoris (p=0.001) and the Tensor Fascia Latae (p=0.014) at a greater capacity than males. Conclusions: These findings indicate that in as little as a one-mile run, recreational runners’ hip muscles exhibit fatigue. Because no little research reports on the activation of hip musculature throughout a specified distance. These results can assist Athletic Trainers with injury evaluations as well as developing evidence-based rehabilitation protocols.

Background

• Running has become an increasingly popular sport for people of all ages
• Between 19.4% and 79.3% of runners experience a lower extremity, running related injury each year 1
• Many variables contribute to the efficiency of running cadence and rate of running related injury.
• A complete understanding of hip muscle activation throughout a period of running has not been evaluated with surface EMG in previous literature.

Research Question

To what extent does recreational runners’ hip strength change throughout a one-mile run?

Statistical Analysis: Repeated measures ANOVA was conducted with gender as a between-subject factor for each muscle. Post hoc comparisons of average muscle contractions at the four time measurements during the one-mile run were made with Tukey’s honestly significant difference (Tukey’s HSD).

Methodology

• Surface EMG through Biopac Systems Inc. (Version 4.1; Goleta, CA) was used to quantify hip muscle activation in the following four muscles: Rectus Femoris, Tensor Fascia Latae, Gluteus Medius, and Gluteus Maximus.
  • Electrode pads were placed approximately 2 cm apart at the midpoint between the origin and insertion of each muscle
• Following a 5-minute warm-up, Dynamic hip strength was analyzed while participants ran one mile at a pace comparable to their normal, daily training pace on a treadmill
  • EMG data was collected at each of the following time increments throughout the one-mile testing period
    0.20-0.25 miles
    0.45-0.50 miles
    0.70-0.75 miles
    0.95-1.0 miles

Results

Rectus Femoris (Figure 1):
• Females activated the Rectus Femoris at higher capacities than males (F(1,115)=11.41, p<0.001, n=0.051)
• There was no statistically significant difference in Rectus Femoris activation throughout the one mile (F(3,115)=2.06, p=0.109)

Tensor Fascia Latae (Figure 2):
• Females activated the Tensor Fascia Latae at higher capacities than males (F(1,115)=6.193, p=0.014, n=0.051)
• There was a statistically significant decrease in TFL activation between the first and fourth observations (p=0.061)

Gluteus Medius (Figure 3):
• Gender differences were not statistically significant for the Gluteus Medius (F(1,115)=0.859, p=0.356)
• There was statistically significant decrease in Gluteus Medius activation between the first and fourth observations (p=0.056)

Gluteus Maximus (Figure 4):
• Females activated the Gluteus Maximus at higher capacities than males (F(1,115)=14.51, p<0.001, n=0.112)
• There was statistically significant decrease in Gluteus Maximus activation between the first and third observations (p=0.015) and between the first and fourth observations (p=0.0074)

Conclusions

All four hip muscles showed a significant decrease in activation level in as little as one mile of running. It remains unclear if this decrease was due to muscle fatigue or a gait normalization period on the treadmill. Observation of greater muscle activation in female runners was consistent with past reports which analyzed different speeds and inclines. The results of this study should guide Athletic Trainers to complete a thorough, dynamic hip muscle evaluation in recreational runners.

Future Research

• Future researchers should consider the following modifications:
  • Dynamic muscle activation testing period greater than one-mile
  • Analyzing muscle activation in conjunction with running kinematics
  • Observing muscle activation at various speeds and inclines
  • Measuring muscle activation with intramuscular EMG rather than surface EMG

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References