Investigating Alterations and Adaptations in Running Mechanics to Minimize Injuries and Increase Performance in Ultramarathon Runners

Leegan Boudreau and Jami Anderson
Goals

• Identify changes in kinematics during ultramarathon running
• Study which kinematic changes are harmful vs helpful
• Propose adaptive training
• Gain insight on health benefits and risks of extreme exercise
What is an Ultramarathon?

- Categorized as any race longer than a typical 26.2 mile marathon
  - Divided into races that are either distance specified or time specified.
- Can be held on roadways or trails (Mountain Ultramarathon or MUM)
Injuries

• Common injury:
  • Knee
  • Stress fractures in foot
    • Women are more at risk
• Compared to shorter distance runners, ultra runners have higher risk of stress fracture
• Injuries more prevalent in younger, less experienced runners
Why is this study important?

- Ultramarathon running has increased exponentially in the past few years
  - Number of races increased 1000% over the last 10 years
  - American ultramarathon runners increased from 18,000 in 2003 to 105,000 last year
- Little is know about how the body adapts to extreme exercise
- Understanding how to efficiently compete at this level can have other applications
Previous Studies

• Most studies compared sub-elite vs elite groups
• Kinematic trends observed in elite runners:
  • Higher oscillating frequency
  • Reduced aerial time
  • Reduced vertical GRF
  • Reduced COM oscillating amplitude
• Increased step frequency reduces GRFs
• Increase stiffness in the leg, which corresponds to a smaller knee flexion angles, which together reduces GRFs
Limitations of Previous Studies

- Lack of diversity in gender
- Most studies conducted on treadmills
- Neglect harsh gradients associated with MUMs
- Research conducted outside of racing conditions
- Research conducted over short distance and not reflective of typical “ultra” distances
Proposed Research

- Diverse participant pool
- Divide into 3 groups
  - Novice
  - Moderate
  - Elite

- Force Plate
  - GRF
- Motion Capture
  - Knee flexion angle
  - Aerial Time
  - Contact Time

- Initial Testing
  - Evaluate biomechanics
  - Mimic Ultra Environment
- Evaluation Phase
  - Create training protocol
- Final Testing
  - Reevaluate using same methods as initial testing
Conclusion

- Study effectiveness of training protocol on sub-elite runners performance
- By increasing sub-elite runners performance we are decreasing their likeliness of injury
- Release successful aspects of training protocol for applications such as:
  - Ultramarathon running
  - Marathon running
  - Extreme Mountain Trekking
References


Questions?