



# The Effect of Footwear on Rotational Torques in Country Swing Dance

Hunter Perala, Margaret Wilson, Boyi Dai

Division of Kinesiology and Health, University of Wyoming

# Dancing at University of Wyoming



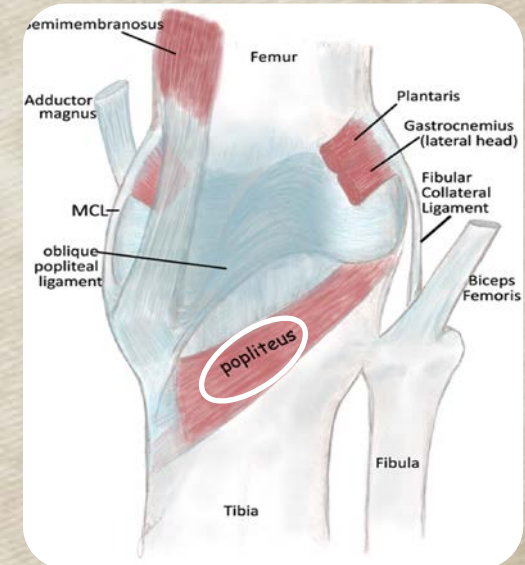
Background → Procedure → Results → Conclusion

# Lower Extremity Injuries in Dance

- Lower extremity injuries are the most common injuries among dancers (Steinberg et al., 2013; Fulton et al., 2014)
- Repetitive dancing movements of spinning, sliding, and landing lead to high injury rates to the foot, ankle, and knee (Fulton et al., 2014)

# Rotational Movements

- Rotational loads to the knee can strain ligaments (Ahmed, et al., 1987).
- A ballroom dancer who suffered a popliteus tendon injury of the knee joint when performing the syncopated spin (Christine & Elly, 2001)
- Type of spin in country swing dancing



# Footwear, biomechanics, and injury risk

- Footwear
  - Styles of shoes
  - Midsole thickness
  - Shock absorbance
- Biomechanics
  - Postural control
  - Pressure distribution
  - Landing forces
- Footwear and rotational loading?

# Purpose and Hypothesis

- Purpose: to examine the effect of different footwear on the peak rotational torque during a rotational movement in country swing dance.
- Hypothesis: the leather bottom boots would result in the lowest peak rotational torque compared with the rubber bottom boots, barefoot, and running shoes.

# Subjects

- Six male and eight female country swing dancers
  - age:  $20.6 \pm 1.5$  yrs
  - height:  $1.72 \pm 0.07$  m
  - mass:  $69.4 \pm 8.7$  kg
  - dance experience:  $4.6 \pm 4.4$  yrs

# Coefficients of Static Friction

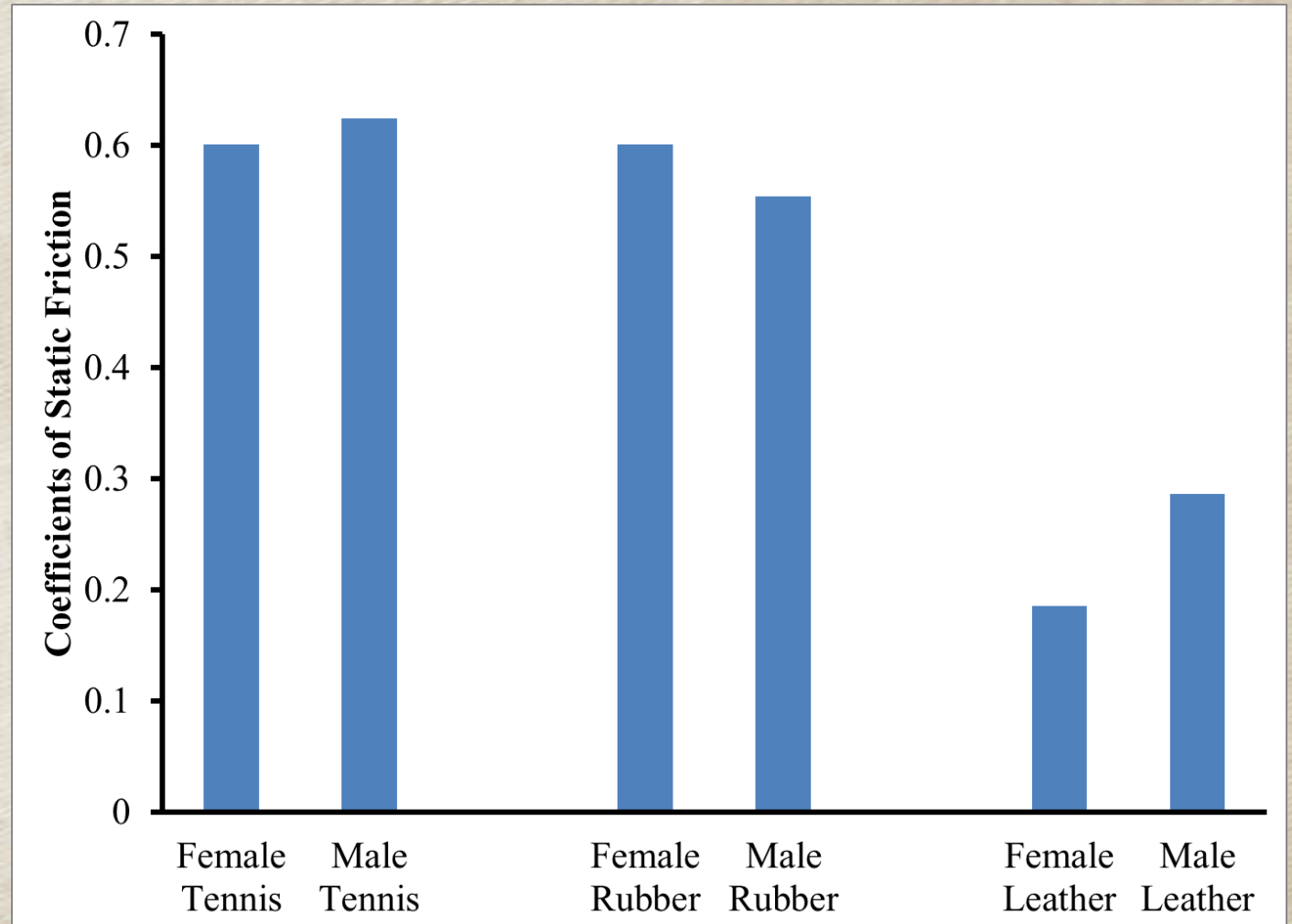
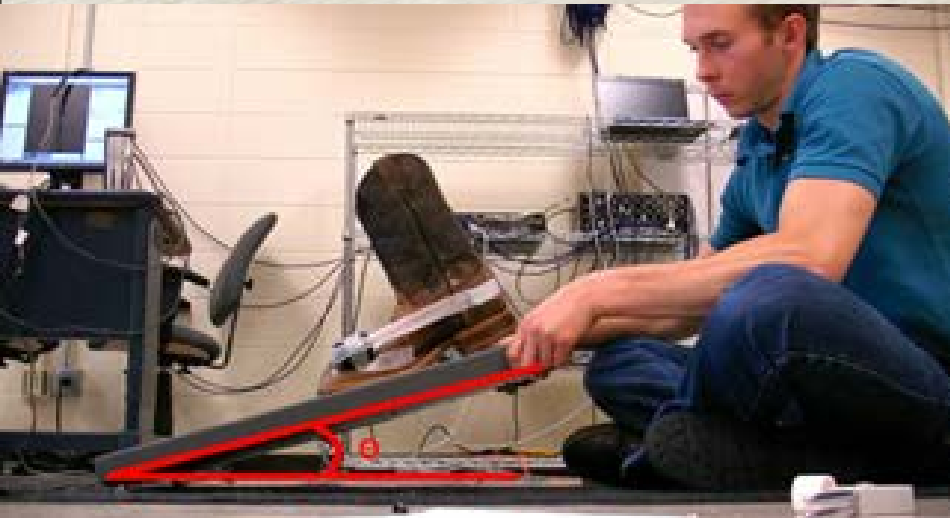


Figure 1a: Leather bottom  
boots

Figure 1b: Rubber bottom  
boots

Figure 1c: Running shoes

# Coefficients of Static Friction



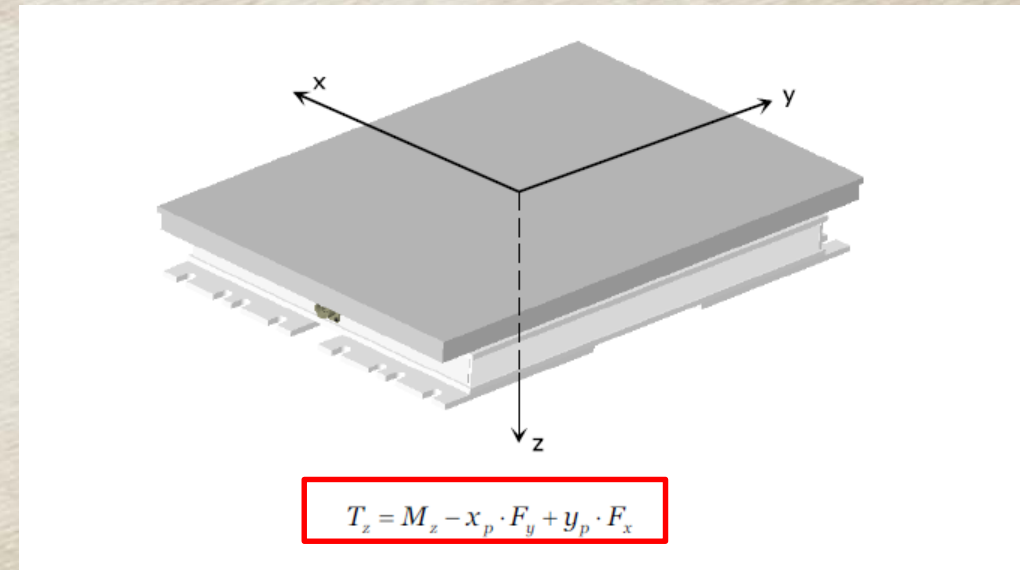
# Procedure

- Warm-up
- Rotational movement
- Two force plates at 1000 Hz



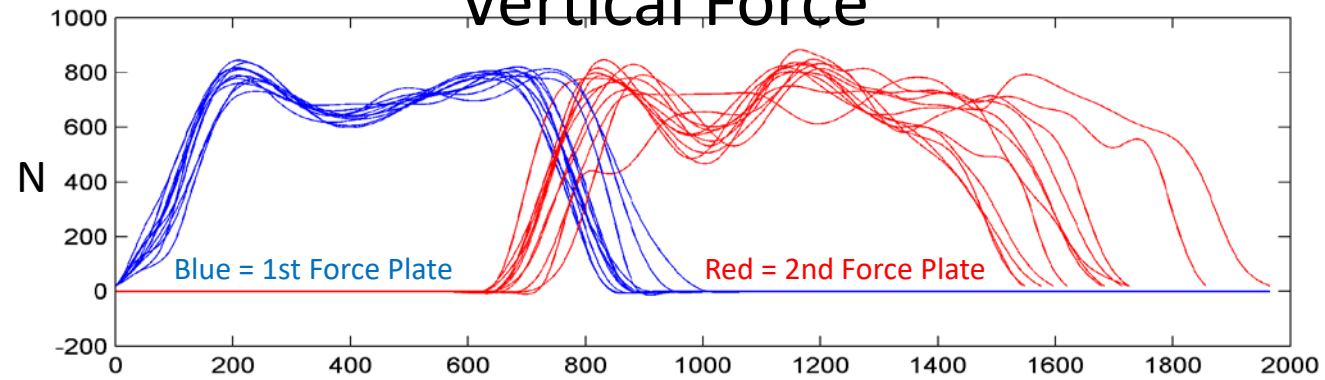
# Data Analysis

- Ground reaction forces and moments were filtered at a low-pass cutoff frequency of 10 Hz, and then used to calculate the free rotational torque (Holden & Cavanagh, 1991).
- The peak rotational torque when the subject was spinning on the right leg was calculated.
- Paired t-tests
- Type I error rate at 0.05

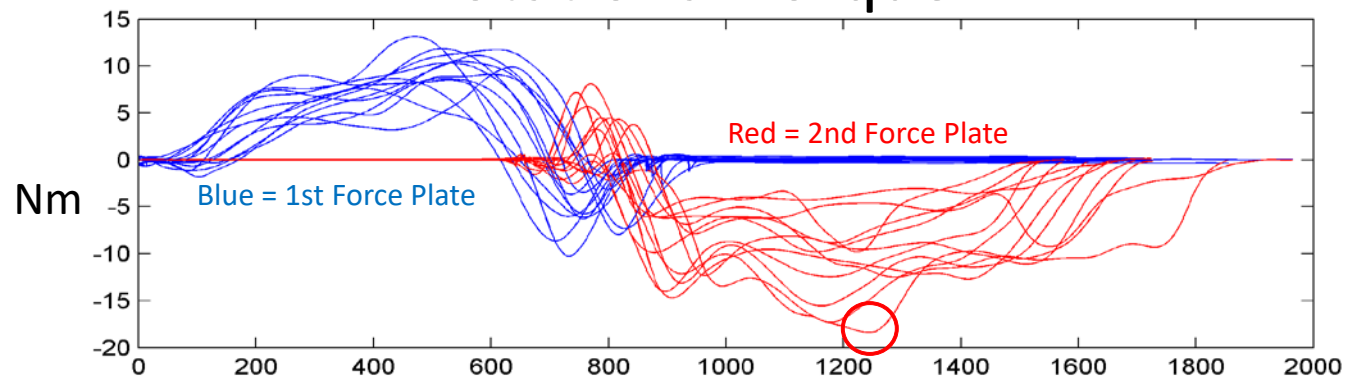


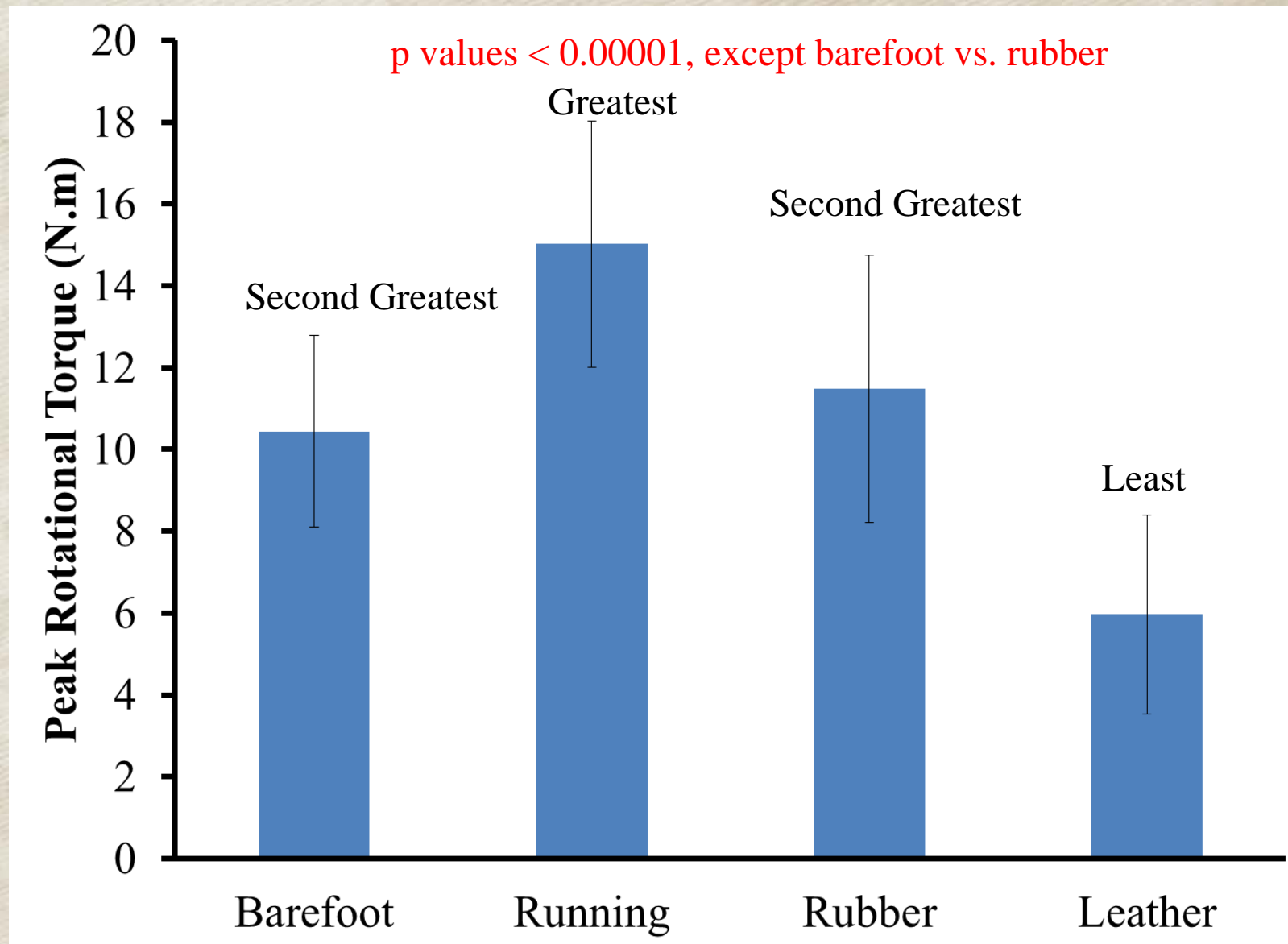


## Vertical Force



## Rotational Torque





# Discussion

- Support the hypothesis that leather bottom boots would result in the lowest peak rotational torque
- Implications for injury prevention and performance training
- Limitations

# Conclusion

- Rotational torque in country swing dancing is lowest when wearing leather bottom western style boots. Decreased rotational torques may be associated with decreased risk of injuries and improved performance.
- In practical application, it is recommended that country swing dancers wear leather bottom boots instead of rubber bottom boots, running shoes, or being barefoot.

# References

- Steinberg, N., Siev-Ner, I., Peleg, S., Dar, G., Masharawi, Y., Zeev, A., & Hershkovitz, I. (2013). Injuries in female dancers aged 8 to 16 years. *Journal of Athletic Training, 48*(1), 118-123. doi:10.4085/1062-6050-48.1.06
- Fulton, J., Burgi, C., Canizares, R. C., Sheets, C., & Butler, R. J. (2014). Injuries presenting to a walk-in clinic at a summer dance intensive program: A three-year retrospective data analysis. *Journal of Dance Medicine & Science, 18*(3), 131-135.
- Ahmed, A. M., Hyder, A., Burke, D. L., & Chan, K. H. (1987). In-vitro ligament tension pattern in the flexed knee in passive loading. *Journal of Orthopaedic Research : Official Publication of the Orthopaedic Research Society, 5*(2), 217-230.
- Christine, T. L., & Elly, T. (2001). Internal rotation knee injury during ballroom dance: A case report. *Journal of Dance Medicine & Science, 5*(3), 82-86.
- Holden, J. P., & Cavanagh, P. R. (1991). The free moment of ground reaction in distance running and its changes with pronation. *Journal of Biomechanics, 24*(10), 887-897.