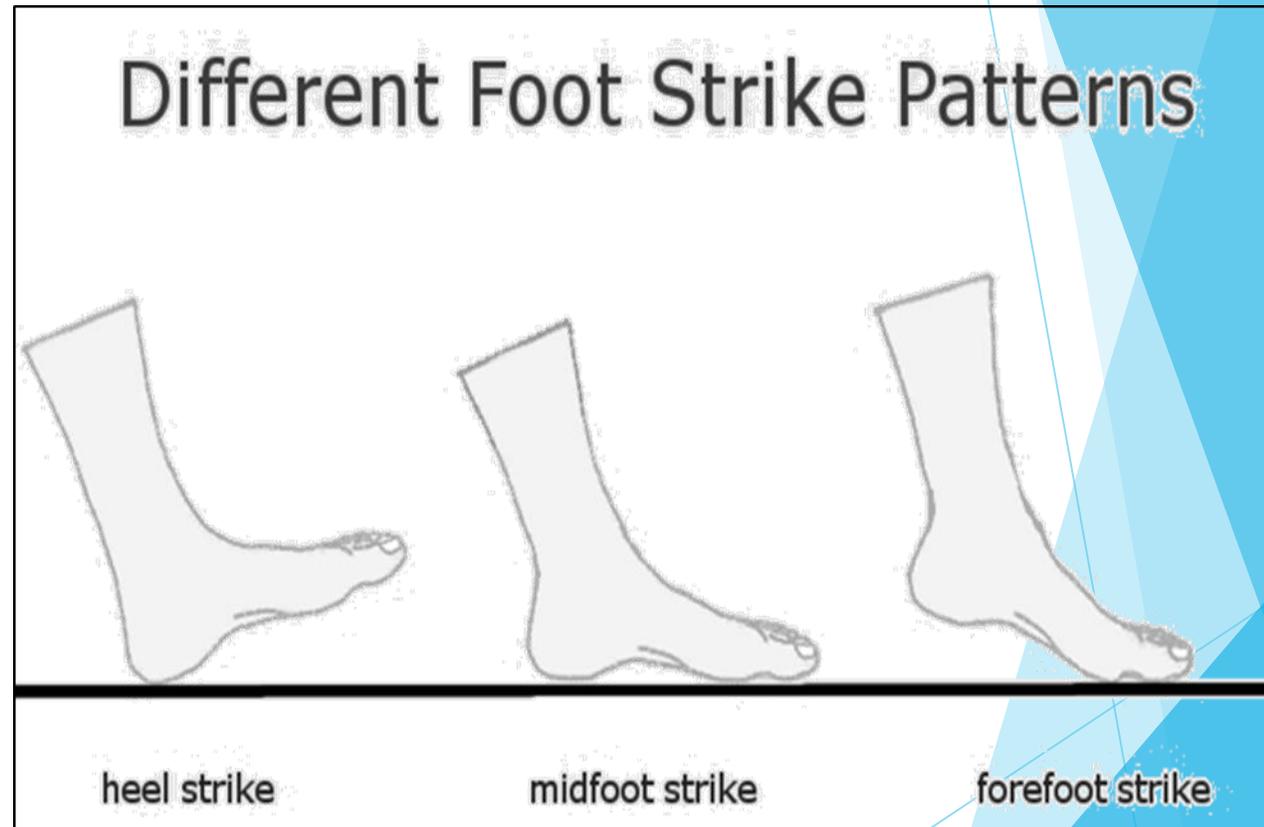


Acute Changes to Foot Strike Pattern Effects on the Biomechanics and Ground Reaction Forces in Collegiate Recreational Runners

Thesis Project by Patrick Brown

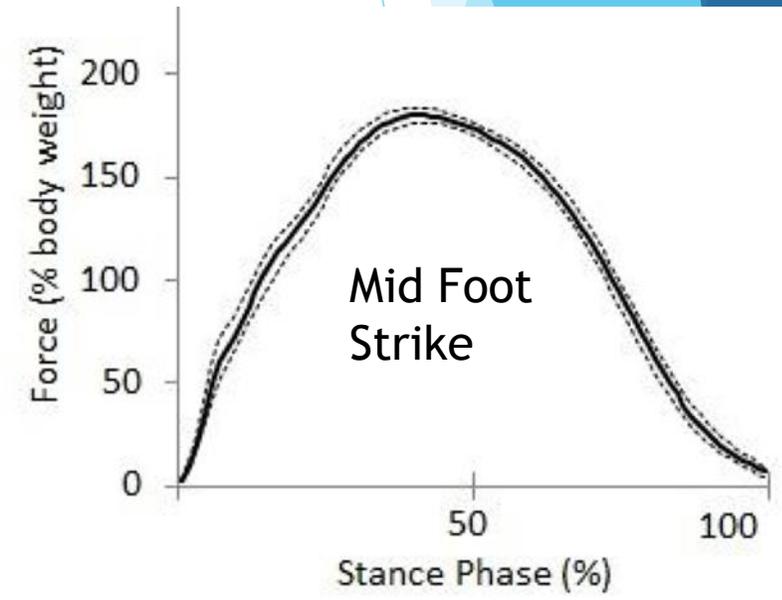
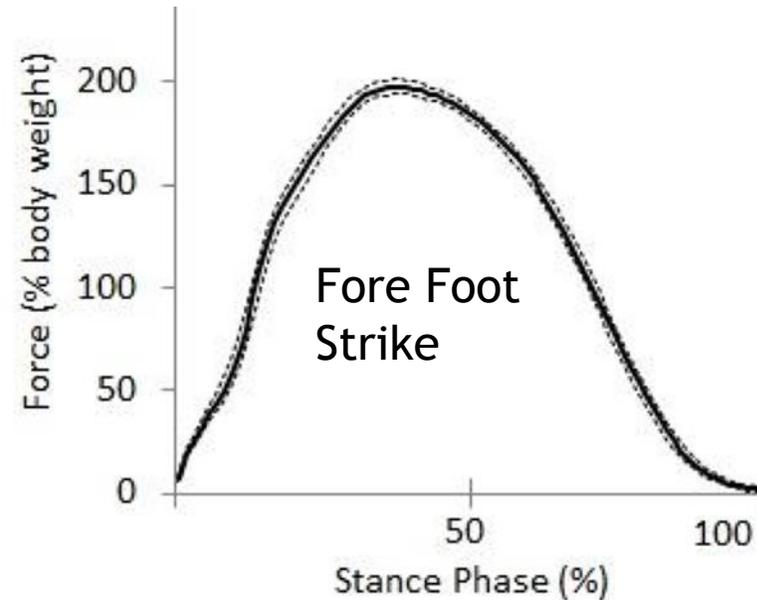
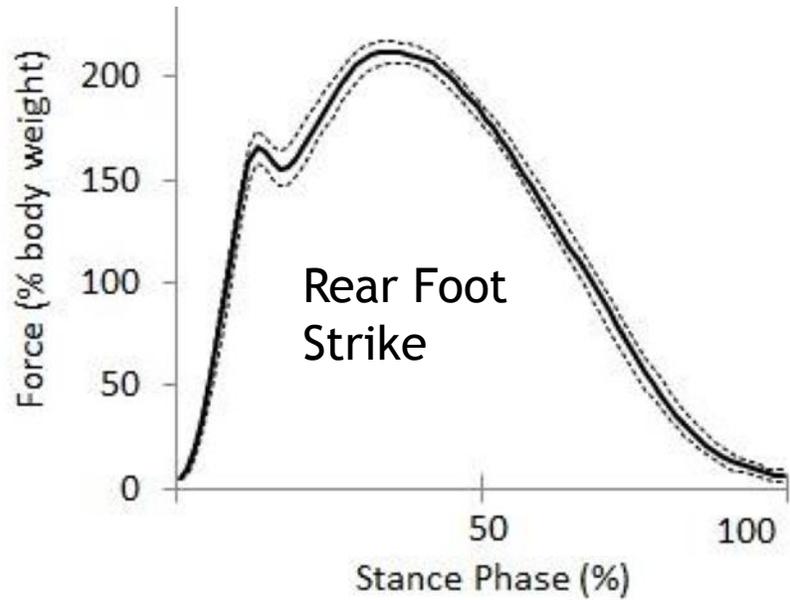
Key Terms

- ▶ The foot strike pattern continuum
- ▶ Habitual/Non-habitual foot strike pattern



Key Terms

▶ Ground Reaction Forces



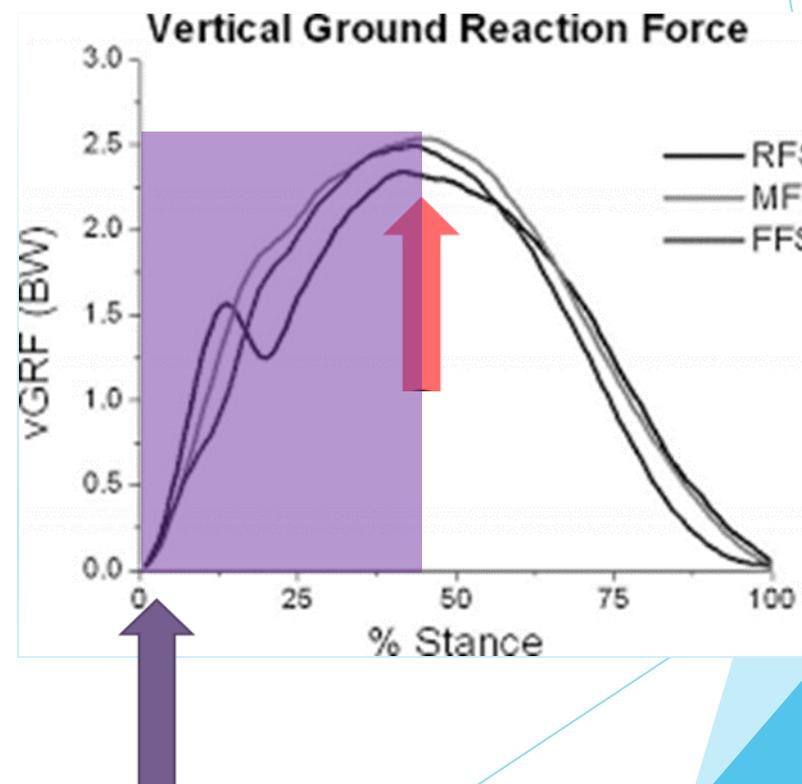
Key Terms

▶ Peak Acceleration

$$\text{Acceleration}_{\text{peak}} = (\text{Force}_{\text{peak}} - \text{Mass} * \text{Gravity}) / \text{Mass}$$

▶ Average Acceleration

- ▶ Touch Down to Peak



Purpose

Habitual Foot Strike

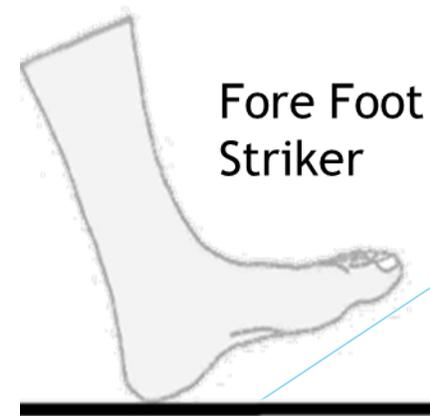


Vs.

Non-habitual Foot Strike



Vs.



Previous Studies

▶ Cadence

- ▶ (Karamanidis, et al., 2004), (Wellenkotter, et. al., 2014), (Altman & Davis, 2012)
(Lenhart, et. al., 2014)

▶ Stride Length

- ▶ (Bonacci, 2014), (Thompson, et al., 2014), (Altman & Davis, 2012)

▶ Ground Reaction Force Curves

- ▶ (Schmitz, et al., 2013), (Cole, et. al., 1995), (Thompson, et al., 2014),
(Wellenkotter, et al., 2014), (Karamanidis, et. al., 2004), (Kernozeck, et al., 2014)

Unanswered Questions

Are there differences in:

The Peak Acceleration in a

1. rear foot striking condition?
2. forefoot-striking condition?

The Average Acceleration in a

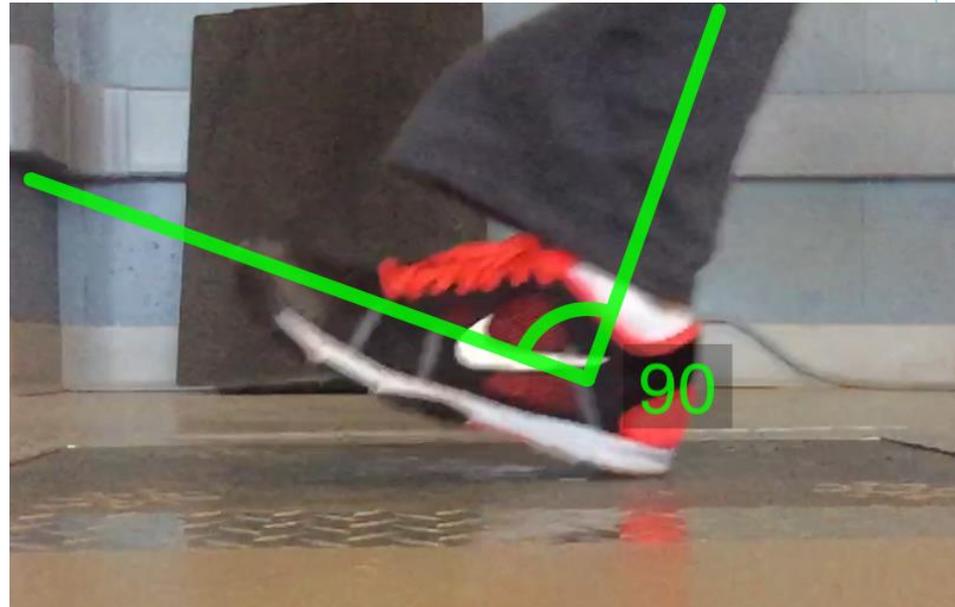
3. rear foot striking condition?
4. forefoot striking condition?

Participants

- ▶ College aged men and women: Between 18 and 24
 - ▶ n= 25, RFS:16, FFS:9, MFS:0
- ▶ Training status: Can run/jog 5km or 3 miles without stopping
 - ▶ Runs at a recreational level
- ▶ Injury status: Free of lower extremity injuries and are in good apparent health.

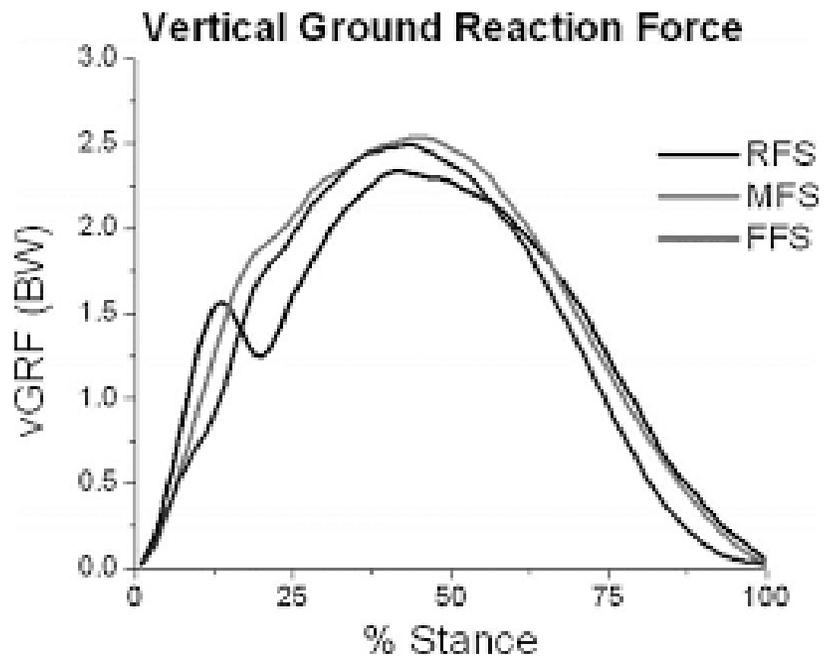
Instruments

- ▶ Bertec 3 Dimensional Force Plate utilizing the Motis 32 software system
- ▶ iPhone 6 Plus camera utilizing the Hudl application for slow motion video analysis

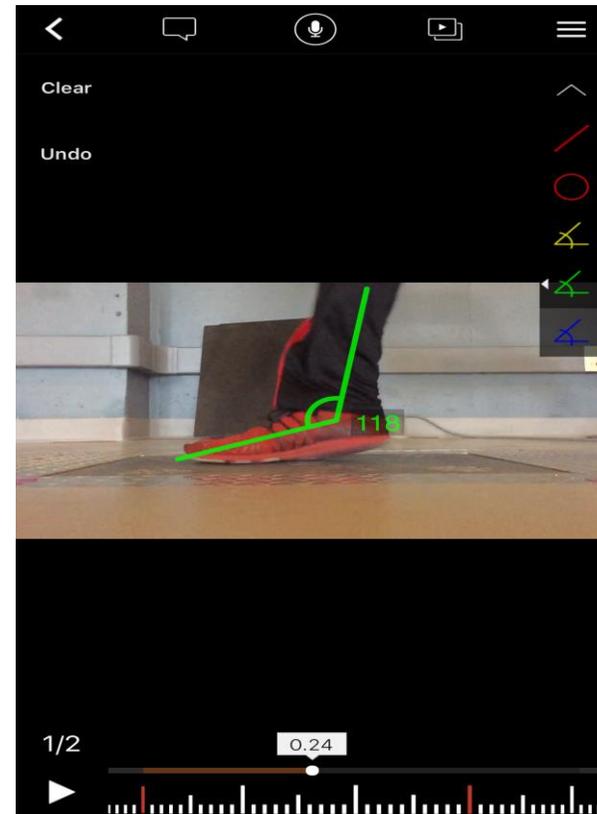


Measures

- ▶ Ground Reaction Forces in Newtons over time for a foot strike at 480Hz.
- ▶ Slow motion video capture 720p in 240 frames per second.



https://runnersrationale.files.wordpress.com/2012/10/altman_davis_figg2.jpg



Equipment



- ▶ Medical Scale
- ▶ For body mass to be used to normalize data and to measure height with the length function.

▶ Treadmill

- ▶ Used to warm up and to acclimate runners to non-habitual foot strike patterns.



Procedures

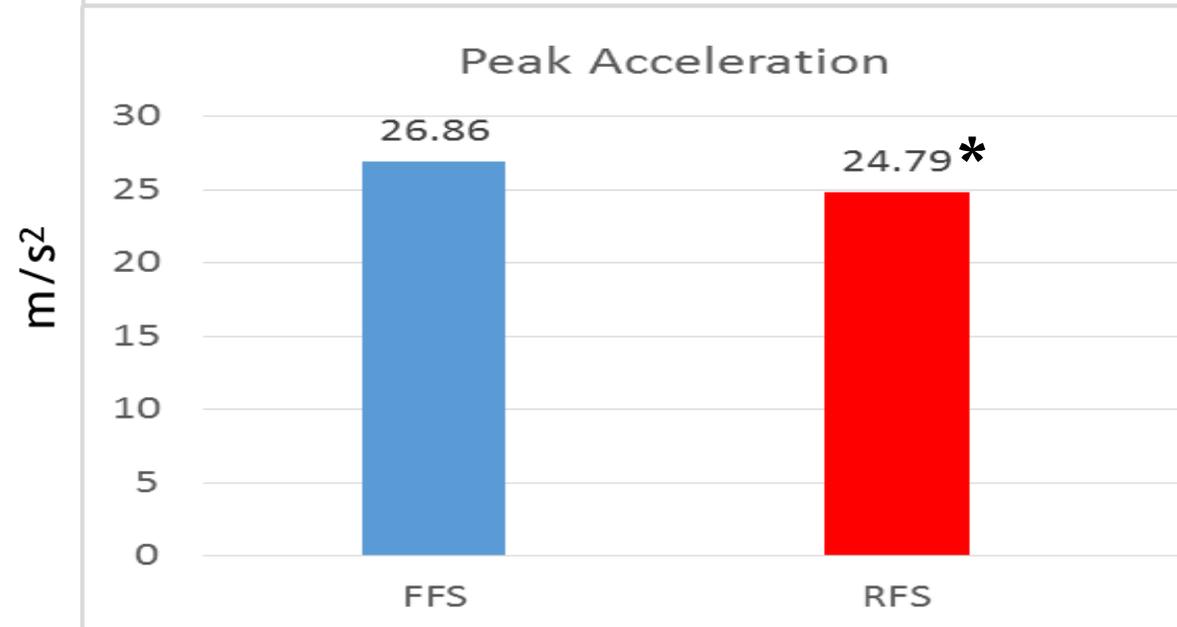
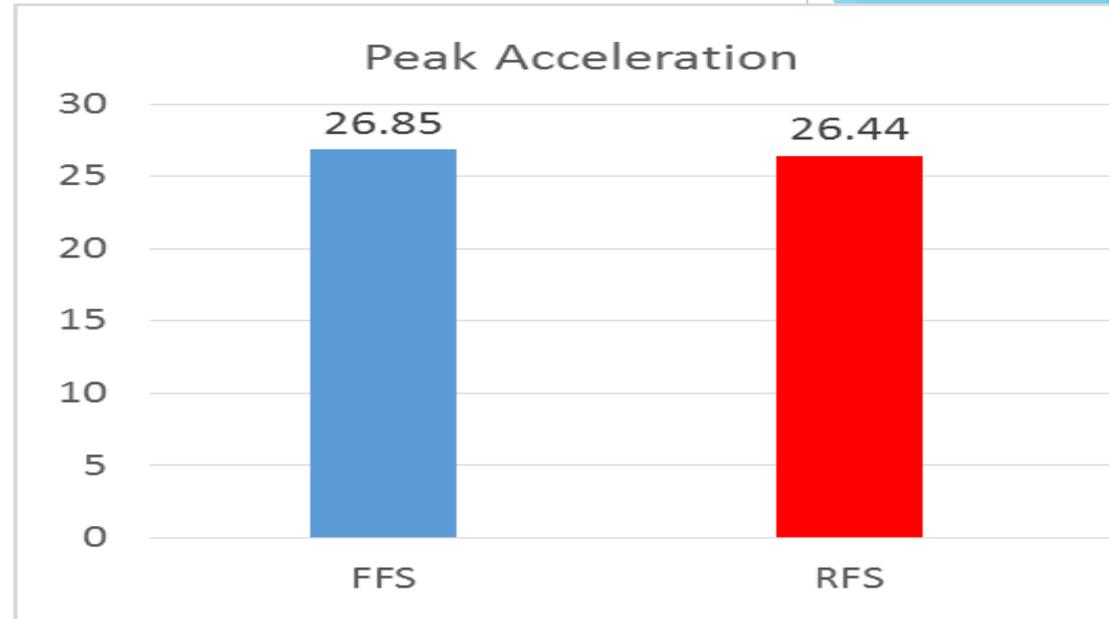
- ▶ Informed consent and adapted PAR-Q
- ▶ Measures of body mass and height were taken
- ▶ Habitual foot strike
 - ▶ Treadmill use
 - ▶ Force plate runway use
- ▶ 1st Random Non-Habitual Foot Strike Pattern
 - ▶ Treadmill use
 - ▶ Force plate runway use
- ▶ 2nd Random Non-Habitual Foot Strike Pattern
 - ▶ Treadmill use
 - ▶ Force plate runway use

Analysis

- ▶ Independent Samples T-Test: $n=25$
 - ▶ The peak acceleration
 - ▶ The average acceleration

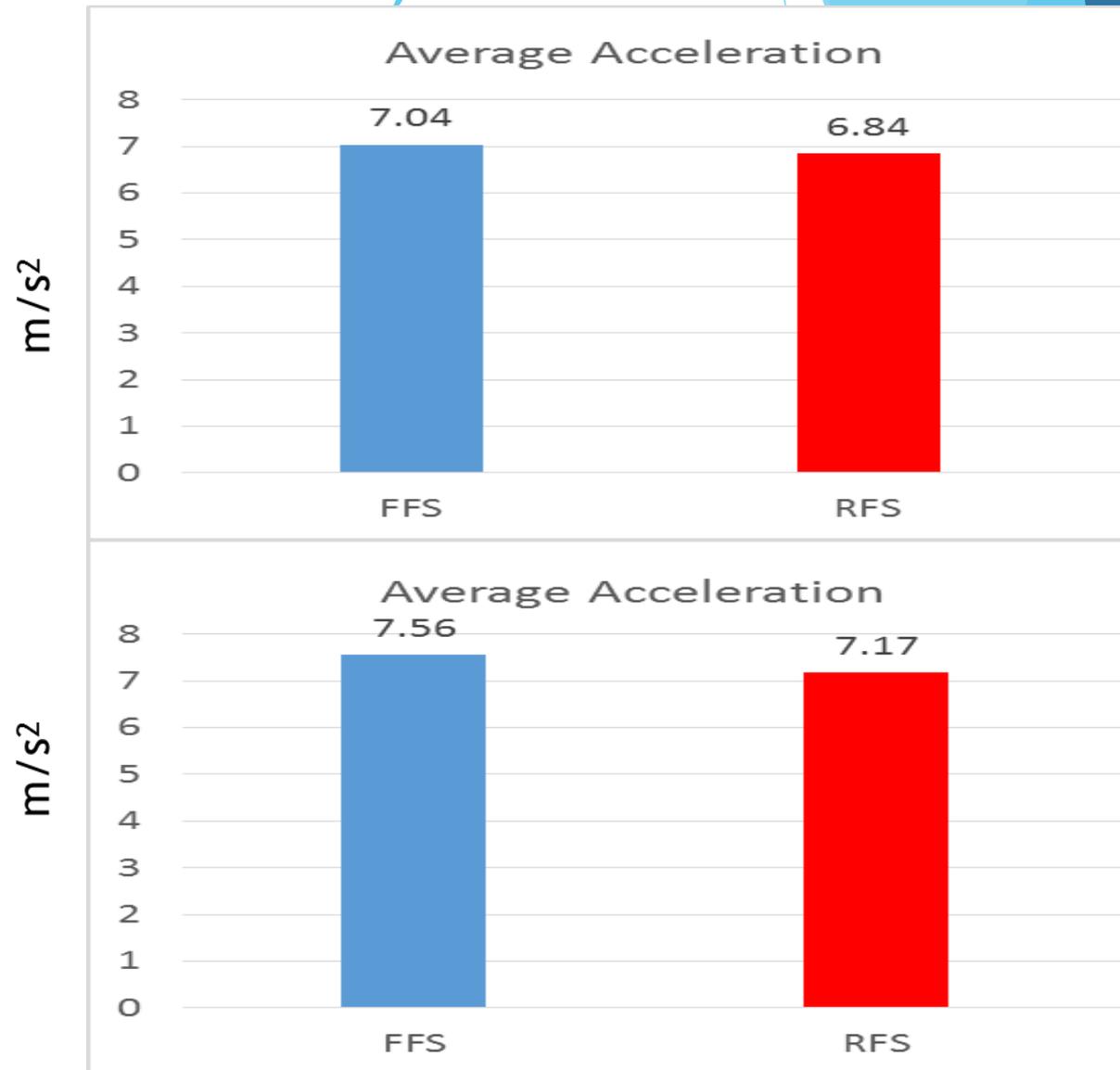
Results: Peak Acceleration

1. There were **no significant differences** in Peak Acceleration in a rear foot striking condition, $t(23) = -.373$, $p = .712$.
3. There was **a significant difference** in Peak Acceleration in a fore foot striking condition, $t(23) = 2.059$, $p < .05$.
 - ▶ The fore foot strikers had a higher peak acceleration ($m = 26.86 \pm 1.66$) than the rear foot strikers running in a fore foot striking condition ($m = 24.79 \pm 2.72$).



Results: Average Acceleration (Touch Down to Maximum Peak)

2. There were **no significant differences** in average acceleration (touch down to peak) in a rear foot striking condition, $t(23) = .921$, $p = .366$.
4. There were **no significant differences** in average acceleration (touch down to peak) in a fore foot striking condition, $t(23) = -.245$, $p = .808$.



Discussion

▶ Peak Acceleration

- ▶ Why the significant differences?
- ▶ No time involved

▶ Average Acceleration

- ▶ Touch Down to Peak= Time Involved

▶ What does this mean for runners?

- ▶ its how the body copes is amazing

Acknowledgements

Research Mentor/Advisor: Dr. Bauer

Area of Statistics: Dr. True

Assistance and Access with the Biomechanics
Lab: Dr. McGinnis

Data Collection Assistant: Ms. Caitlin Rasefske

Athletic Department and Kinesiology

Department: Use of apparatus and facilities

Thank you for your time!

Questions?