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Achilles Tendon Stiffness of Division 1 Track and Field Athletes

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Study Design

This is a cross-sectional research study.

Purpose

The purpose of this study is to identify if there are factors that correlate with Achilles tendon stiffness among Division 1 track and field athletes.

Background

Previous research does not examine Achilles tendon stiffness of Division 1 track and field athletes. There is limited evidence surrounding Achilles tendon stiffness and the factors of height, weight, BMI, sex, sport, and injury history.

Methods

Participants volunteered via online sign-up. In order to be eligible for this study, the participant must be a University of South Dakota active track or field athlete, identify as male or female, and be 18 to 24 years of age. Each participant read and signed a consent form prior to obtaining measurements. The measurements obtained from each participant included height and weight, along with 3 Achilles tendon stiffness measurements on each lower extremity via the MyotonPRO. Demographic data was collected before measurements, which included information pertaining to the participant's track and field event, personal records, sex, oral contraceptive use, and history of injury from the waist down. Each participant was uniquely coded in order to maintain confidentiality.

Data Analysis

Data analysis was conducted using SPSS software. The tests administered included a Shapiro-Wilk Test of Normality, T-Test, Pearson Correlation, and Inter-Class Correlation.

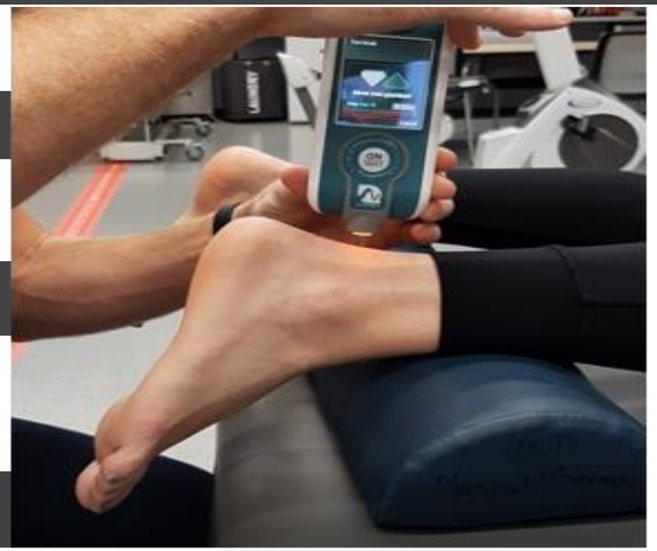

Image 1. Subject Position During Data Collection

Subjects were positioned prone with a bolster anterior to their distal lower leg to allow a relaxed position for tendon measurements. The measurements were completed at the midline of the Achilles tendon between the medial and lateral malleoli. The average of 6 measurements, 3 per tendon, were used to calculate the mean Achilles tendon stiffness of each athlete.

Table 1. Eligible Participant Characteristics

	Track and Field Athletes (N = 51)
Male	15 (29.41%)
Female	35 (68.63%)
Other	1 (1.96%)
Average BMI (kg/m^2)	22.66 kg/m^2
Average Height (cm)	171.38 cm
Average Weight (kg)	66.96 kg
Number of Endurance Athletes	28
Number of Power Athletes	22
IAAF Score Range	701-1160
Number of Athletes with Previous Injury	36
Average Age (yrs)	19.63 yrs

Abbreviations: cm, centimeters; kg, kilograms; yrs, years; BMI, body mass index; kg, kilograms; m^2, meters squared; IAAF, International Amateur Athletic Federation; N/A, not applicable.

Results

Table 2. Tests of Normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Avg Stiffness	.080	50	.200*	.983	50	.676

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 3. Histogram of Average Stiffness

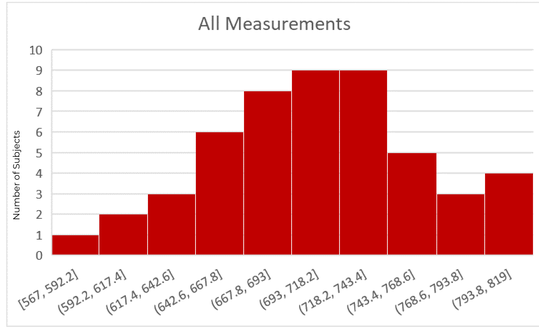

Table 4. Descriptive Statistics of Achilles Tendon Data

Achilles Tendon Stiffness		
Mean		703.62
Minimum		598.17
Median		705.25
Maximum		826.00
95% CI	Lower Bound	688.30
	Upper Bound	718.94

Significant Findings

- Increased mean stiffness in males vs. females (p-value = <0.001)
  - Males: 745 N/m (95% CI: 696.73 N/m, 792.85 N/m)
  - Females 686 N/m (95% CI: 639.4 N/m, 732.56 N/m)
- Negative correlation (-0.523) with height and stiffness in males (p-value = 0.045)
- Increased mean stiffness in male injury vs. male non-injury groups (p-value = 0.018)
  - Injury: 767 N/m (95% CI: 721.22 N/m, 813.90 N/m)
  - Non-Injury: 710 N/m (95% CI: 684.22 N/m, 737 N/m)

Insignificant Findings

- Correlations between age, weight, BMI, and performance
- Mean differences in power vs. endurance and injury vs non-injury in females

Intraclass Correlation = 0.894

Conclusion

Various factors including sport-specific participation, differing frequency or method of routine exercise, sex differences, and other demographic components may contribute to tendon properties. These factors have the ability to impact sport performance and the risk for injury. Results from this study showed increased stiffness in males compared to females and in athletes with previous injury. Due to contradicting results in the literature and this study, future research is needed to definitively identify the factors that contribute to tendon stiffness and the impact on sports performance and injury risk.

Limitations

Limitations include small sample size, unequal male to female ratio, timing of measurement collection, lack of information obtained about participant's previous injury history, measurement consistency, and homogeneity of subjects. Further research should include a larger sample size, diverse participant demographics, increased detail of injury history, and the inclusion of participants active in other sport activities.

Clinical Relevance

At this point in time, results from this study do not provide significant value for clinicians in terms of patient performance and injury risk. However, our results are key building blocks to future research surrounding the impact Achilles Tendon stiffness has on those factors. In order to one day graduate to being able to manipulate tendon stiffness as a means of maximizing performance capabilities and reducing the risk of injury, it is imperative that we gain a better understanding of what is 'optimal.' Continued research into tendon stiffness and its relationship with athletic performance and injury is warranted.

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