Influence of the foot strike pattern in the morphological properties of the calf muscles and Achilles tendon

José Roberto de Souza Júnior[1,2,3], Estevão de Souza Diniz[2,3], Leandro Andrade Moreira[1,2], Beatriz Tavares Manoel Galvão[1], João Luiz Quagliotti Durigan[2,3], Rita de Cássia Marqueti[2,3]

[1]Physical Therapy Department, University Center of the Federal District, Brasília, Brazil

[2]Laboratory of Muscle and Tendon Plasticity, University of Brasília, Brasília, Brazil

[3]Laboratory of Molecular Analisys, University of Brasília, Brasília, Brazil

Email: joserobertofisio@gmail.com

Summary

Foot strike pattern (FSP) may affect running economy and injury risk. This study examined morphological differences in the calf muscles and Achilles tendon among 31 triathletes using ultrasound and shear-wave elastography. Based on video analysis, participants were classified as non-rearfoot or rearfoot strikers. No significant between-group differences were found in the assessed variables, suggesting that FSP did not lead to distinct structural adaptations in these structures.

Introduction

Foot strike pattern (FSP) plays a crucial role in running biomechanics and has been associated with running economy and injury risk [1]. It is well known that differences in muscle and tendon morphology may influence running efficiency and susceptibility to injuries among athletes [2]. However, whether variations in FSP lead to distinct structural adaptations in the calf muscles and Achilles tendon remains unclear. Therefore, this study aimed to examine differences in the morphological properties of the calf muscles and Achilles tendon in triathletes based on their FSP during running

Methods

This cross-sectional study included 31 triathletes with at least one year of regular sports practice.

Researchers used portable ultrasound to measure the fascicular length (mm), and pennation angle (°) of the soleus, lateral gastrocnemius, and medial gastrocnemius muscles, as well as the tendon length (cm), and cross-sectional area (mm^2) of the Achilles tendon. Achilles tendon stiffness (m/s) was also evaluated using shear-wave elastography.

The FSP was determined using videos recorded in the sagittal plane. Participants were divided into two groups according to the part of the foot that touched the ground during landing: (I) Non-rearfoot strikers: landed with the whole foot or only with the ball of the foot; (II) Rearfoot strikers: landed with the heel first.

Results and Discussion

Nineteen participants were classified as non-rearfoot strikers and twelve as rearfoot strikers. No between-group differences were found for sex, age, height, body mass, and body mass index (all P>0.05).

Table 1: General characteristics of the participants (n=31)

	NRFS	RFS	P*
Sex			
Male	13 (68.4%)	7 (58.3%)	0.567
Female	6 (31.6%)	5 (41.7%)	
Age, y	40.2 ± 9.1	36.8 ± 9.6	0.167
Body mass, kg	70.4 ± 11.1	65.3 ± 9.3	0.101
Height, cm	173.6 ± 9.8	171.6 ± 11.2	0.301
BMI, kg/m^2	23.2 ± 2.6	22.1 ± 2.1	0.112

Data presented as count (%) or mean ± standard deviation. BMI, Body Mass Index. *Level of significance of P<0.05

No significant between-group differences were found for the fascicle length and pennation angle of the calf muscles, and for the morphological properties of the Achilles tendon (all P>0.05).

Table 2: Morphological properties of the calf muscles and Achilles tendon (n=31)

	NRFS	RFS	P*
Soleus			
Fascicle Length, mm	6.5 ± 1.7	7.1 ± 2.2	0.186
Pennation angle, °	16.9 ± 4.6	16 ± 4.6	0.302
Medial gastrocnemius			
Fascicle Length, mm	6.8 ± 0.8	6.7 ± 1.3	0.442
Pennation angle, °	15.2 ± 2.3	16 ± 3.1	0.249
Lateral gastrocnemius			
Fascicle Length, mm	9 ± 2.4	7.4 ± 1.4	0.252
Pennation angle, °	11.5 ± 2.5	13.1 ± 3.4	0.071
Achilles tendon			
Tendon length (cm)	21.1 ± 2.3	20.4 ± 2.1	0.202
CSA (mm^2)	0.7 ± 0.2	0.6 ± 0.1	0.110
Stiffness (m/s)	8.4 ± 0.9	8.2 ± 1.3	0.826

Data presented as mean ± standard deviation. CSA, Cross-sectional area. *Level of significance of P<0.05

Conclusions

The morphological properties of the calf muscles and Achilles tendon showed no significant differences between non-rearfoot and rearfoot strikers.

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References

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