



Mid Atlantic Regional Chapter of the American College of Sports Medicine

45th Annual Scientific Meeting, November 4th- 5th, 2022
Conference Proceedings

International Journal of Exercise Science, Issue 9, Volume 11



Arch Stiffness Does Not Determine Running Economy in Recreational Runners

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Running economy is a primary determinant of endurance performance and is determined by a variety of physiological and biomechanical factors. Foot anthropometrics, including arch stiffness and Achilles tendon moment arm length, may improve running economy by increasing the elastic energy storage or ankle extensor moment generated while running. Prior research examining the relationship between anthropometric factors and running economy has only been conducted at high testing velocities (e.g., > 16 km/hr) in well-trained runners. **PURPOSE:** To determine the relationship between foot length, arch stiffness, and running economy in recreational runners and low testing velocities. **METHODS:** Foot anthropometrics and running economy was measured in 16 trained endurance athletes (age 20.5 ± 0.4 yrs, height 172.0 ± 1.8 cm, and mass 68.53 ± 2.40 kg). Foot Length (FL), Arch Stiffness Index (ASI), Achilles Tendon Moment Arm Length (ATML), maximal oxygen consumption (VO_{2max}), and running economy (RE) were assessed. RE was measured as the oxygen consumption during running at velocities of 9.9 km/h and 11.9 km/h at a 1% grade. Data is reported as Mean \pm SE, and the relationship between foot anthropometrics and running economy was assessed with linear regression ($\alpha=0.05$). **RESULTS:** Absolute and relative VO_{2max} values were 3.68 ± 0.19 L/min and 52.96 ± 1.51 mL/kg/min, respectively. ASI was 1513.0 ± 174.3 A.U. with a standing foot length of 25.4 ± 0.4 cm. Subject oxygen consumption at 9.9 km/h and 11.9 km/h was 34.90 ± 0.80 mL/kg/min and 41.02 ± 0.82 mL/kg/min, respectively. There was no correlation between ASI, FL, AHI, and RE ($p>0.05$). **CONCLUSION:** Arch stiffness and Achilles tendon moment arm do not determine running economy at low testing velocities in recreational runners. Therefore, at low running velocities, running economy may be impacted by other physiological and biomechanical factors.