

ABSTRACT

Introduction: The Achilles tendon is one of the strongest, yet also one of the most frequently injured structures in the human body. One method used to assess the elasticity of musculoskeletal tissues is shear wave elastography, in which an acoustic impulse generates shear wave propagation, enabling quantitative evaluation of shear wave velocity and tissue shear modulus.

Aim: Assessment of the measurement reliability of the Mindray Resona I9 device and determination of reference values for Achilles tendon elasticity moduli in healthy adult women and men using shear wave elastography.

Materials and Methods: The study included 300 participants aged 18-60 years and was conducted at the REHApunkt Clinic in Warsaw. The Mindray Resona I9 device was used as the research tool. Statistical analysis included Pearson's chi-square test (χ^2), the Mann-Whitney U test, Student's t-test, and Spearman's rank correlation. The reliability of the assessed moduli was evaluated using the intraclass correlation coefficient (ICC). Categories of longitudinal elasticity, transverse elasticity, and Achilles tendon stiffness were defined assuming that $\bar{x} \pm SD$ represents the average range of variability of the parameter.

Results: ICC values between examinations I and II ranged from 0.84 to 0.87 for examiner I and from 0.83 to 0.87 for examiner II, while inter-rater ICC values ranged from 0.64 to 0.78. In women, normative Young's modulus values for the right lower limb ranged from 62.02 to 83.16 kPa and for the left from 60.10 to 80.88 kPa. In men, the corresponding ranges were 62.53-84.37 kPa for the right lower limb and 62.72-82.46 kPa for the left. Normative Kirchhoff's modulus (G) values in women ranged from 20.68 to 27.72 kPa for the right lower limb and from 20.03 to 26.97 kPa for the left. In men, these values ranged from 20.84 to 28.12 kPa for the right and from 20.91 to 27.49 kPa for the left. Reference values of shear wave velocity (Vs) in the tissue ranged from 4.48 to 5.20 m/s for the right lower limb and from 4.40 to 5.12 m/s for the left in women. In men, Vs values ranged from 4.50 to 5.24 m/s for the right lower limb and from 4.51 to 5.19 m/s for the left.

Conclusions: Good repeatability of measurements obtained using the Mindray Resona I9 device confirms the reliability of monitoring changes in the biomechanical properties of the Achilles tendon and supports the usefulness of this method in clinical diagnostics, therapy outcome assessment, and scientific research. The obtained normative ranges may serve as a reference for evaluating normal Achilles tendon elasticity in healthy adults.

Key words: Young's modulus, Kirchhoff's modulus, shear wave velocity, women, men.