ACHILLES TENDON IS MECHANOSENSITIVE IN OLD ADULTS: A 1.5 YEAR RESISTANCE TRAINING INTERVENTION

Gaspar Epro1,2,3, Andreas Mierau4,5, Jonas Doerner6, Julian A. Luetsken6, Lukas Scheef6, Guido M. Kukuk7, Henning Boecker6, Constantinos N. Maganaris7, Gert-Peter Brüggemann2,8 and Kiros Karamanidis3

1Institute of Movement and Sport Gerontology, German Sport University Cologne, Cologne, Germany
2Institute of Biomechanics and Orthopaedics, German Sport University Cologne, Cologne, Germany
3Sport and Exercise Science Research Centre, London South Bank University, London, UK
4Institute of Movement and Neurosciences, Medical Faculty, University of Cologne, Cologne, Germany
5Department of Exercise and Sport, International University of Health, Exercise and Sports (LUNEX), Differdange, Luxembourg
6Department of Radiology, University of Bonn, Bonn, Germany
7Research Institute for Sport and Exercise Sciences, Faculty of Science, Liverpool John Moores University, Liverpool, UK
8Cologne Center for Musculoskeletal Biomechanics, Medical Faculty, University of Cologne, Cologne, Germany

e-mail: gasparepro@gmail.com

INTRODUCTION

The aging tendon experiences general degeneration in its structure and function, which is usually described through a diminished ability to adapt to environmental stress as a consequence of deteriorated tissue homeostasis. Tendons of older adults have shown to increase their stiffness after medium-term (12-14 weeks) exercise interventions foremost through an increased Young’s modulus, rather than tendon hypertrophy (Reeves et al., 2003). Nonetheless, there is limited knowledge about the time-adaptive response relationship of tendons experiencing long-term (years) mechanical loading interventions. Therefore, the current study investigated if the older human Achilles tendon (AT) exhibits mechanosensitivity by altering its material and/or morphological properties in response to a long-term mechanical loading exercise intervention.

METHODS

Thirty-four older female adults (age: 65±7 y) voluntarily took part in a medium-term (14 weeks; n=21) strength training intervention using high AT strain cyclic loading (isometric plantarflexion contractions with 90% of MVC for five sets of four repetitions 3 times a week as provided by Arampatzis et al., 2007) or a control group (n=13). A sub-group of the intervention group (n=12) continued the exercise for 1.5 years (long-term intervention). In order to analyse the AT stiffness and Young’s modulus in vivo, ultrasonography and dynamometry were used simultaneously. Tendon cross-sectional area (CSA) was determined along the whole free AT by using custom routines on image sequences obtained through magnetic resonance imaging.

RESULTS

Following 14 weeks of resistance training, the intervention group had a significantly (p<0.05) increased ankle plantarflexor muscle strength (141.5±36.2 vs 116.3±30.8 Nm at baseline), together with a 23% higher AT stiffness (598.2±141.2 Nmm⁻¹ vs 488.4±136.9 Nmm⁻¹ at baseline), 20% greater Young’s modulus (1.63±0.46 GPa vs 1.37±0.39 GPa at baseline) and a homogenous hypertrophy along the entire free AT (approximately 6%). However, despite continuing the strength training intervention for 1.5 years, no further alterations in the muscle strength and tendon properties were found. The control group had no differences neither in muscle or tendon biomechanical properties between measurement time points.

DISCUSSION

The aged AT appears to be able to increase its stiffness in response to medium-term (14 weeks) mechanical loading exercise through changes in both material and morphological properties. Continuing strength training seems rather to maintain, than cause any further adaptive modifications in tendon properties, which indicates that in ageing tendons the time-adaptive response relationship to mechanical loading is non-linear.

CONCLUSION

In conclusion, the current study gives evidence that the human AT preserves its mechanosensitivity in old age and seems to have the capability to increase its stiffness by changing both its material and dimensions and may thereby tolerate higher mechanical loading due to a reduced strain and stress it experiences during tensile loading.

REFERENCES


### ABSTRACT SUBMISSION INFORMATION

<table>
<thead>
<tr>
<th>Corresponding Author Name:</th>
<th>Gaspar Epro</th>
</tr>
</thead>
</table>
| **Affiliation:**          | 1. Institute of Movement and Sport Gerontology, German Sport University Cologne, Cologne, Germany  
2. Institute of Biomechanics and Orthopaedics, German Sport University Cologne, Cologne, Germany  
3. Sport and Exercise Science Research Centre, London South Bank University, London, UK |
| **Status (faculty staff, postgraduate student etc.):** | Research staff and post graduate student |
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