

Inter-limb mechanical properties of the triceps surae muscle-tendon unit in master sprinters

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INTRODUCTION:

Human muscle-tendon units (MTUs) adapt to both ageing and mechanical (un)loading. However, a different time course of adaptation and unequal loading patterns of muscle and tendon may affect MTU's inter-limb uniformity (1), possibly increasing injury risk in older athletes. We examined the triceps surae MTU mechanical properties of healthy young elite sprinters, master sprinters and recreationally active young adults to detect potential changes in the uniformity of adaptation within the triceps surae MTU due to ageing and mechanical loading.

METHODS:

Ankle plantarflexion moments and Achilles tendon stiffness of both legs were assessed for three different groups using simultaneous dynamometry and ultrasonography: 10 young elite sprinters (mean age and SD: 22 ± 3 yrs) and 12 master sprinters (66 ± 7 yrs) competing on national and international level as well as 12 recreationally active young adults (24 ± 2 yrs), acting as controls. Tendon elongation during the loading phase was assessed by manually digitising the myotendinous junction of the gastrocnemius medialis muscle. Tendon stiffness was determined subsequently in the linear region of the force-length relationship of the tendon. In order to analyse the inter-limb uniformity of triceps surae MTU, symmetry index for muscle strength and tendon stiffness was formed between the preferred and non-preferred leg (2).

RESULTS:

Master sprinters demonstrated lower triceps surae muscle strength (mean of both legs and SD: 2.59 ± 0.78 vs. 4.25 ± 0.88 Nm/kg) and tendon stiffness (582 ± 129 vs. 805 ± 158 N/mm) compared to young elite sprinters ($P < 0.05$) and lower muscle strength compared to young controls (3.51 ± 0.41 Nm/kg; $P < 0.05$). However, no group differences could be observed for the symmetry indexes of triceps surae muscle strength (master: -1.2 ± 21.7 %, elite: 0.9 ± 11.5 % and control: 5.0 ± 12.8 %) and tendon stiffness (-6.9 ± 21.6 %, 0.6 ± 15.4 % and 3.1 ± 13.6 % respectively).

CONCLUSION:

Considering the reported degeneration in leg extensor muscle strength and tendon stiffness with increasing age (3), our results reveal that aged tendons still appear to be mechanosensitive and hence sustain their integrity to higher functional demands. However, although we found no clear sign for a disturbance in the uniformity within the triceps surae MTU through intense athletics training in young age, the twofold stimulus of ageing and training, in contrast, may lead to non-uniform adaptive changes within the triceps surae MTU independent of the analysed leg, making master sprinters perhaps more vulnerable to injury.

REFERENCES:

- 1) Mersmann et al., J Appl Physiol, 2016.
- 2) Epro et al., Front Physiol, 2019
- 3) McCrum et al., Front Physiol, 2018