

Effect of elite sprinters' toe flexor strength on sprint performance

Jan-Peter Goldmann^{1,2}, Marvin Zedler^{1,2}

INTRODUCTION

There is some evidence that intrinsic foot muscles propel the body forward during running (1). Nearly 80% of intrinsic foot muscles consists of toe flexor muscles (TFM) (2), whose strength capacity create a good prerequisite for enhanced performances in horizontal movement directions (3). For being able to run fast, we hypothesized that i) elite sprinters have stronger TFM than a group of sport students, and ii) there is a correlation between elite sprinters' personal best and their TFM strength.

METHODS

18 male sprinters (21 ± 4 y, 77 ± 5 kg, 1.82 ± 0.04 m) of the German national team with an average 100 m personal best of 10.42 ± 0.21 s and a control group of sport students ($n = 28$, 25 ± 3 y, 77 ± 8 kg, 1.83 ± 0.06 m) performed three maximum voluntary isometric contractions of TFM for each foot. TFM strength was determined by measuring the moment about the transverse axis of a custom-made dynamometer in 25 degrees toe dorsiflexion. The external moments of force about the axis represented the moments of force produced by the TFM (3). The best of three trials was used for further analysis. Maximum moments were determined as the mean value of a 2 s time window of the plateau region. Statistics: Kolmogorov-Smirnov, unpaired t-test, Pearson correlation.

RESULTS

TFM strength significantly differed ($p < 0.05$) between sprinters (left: 0.29 ± 0.08 Nm kg⁻¹, right: 0.29 ± 0.09 Nm kg⁻¹) and non-sprinters (left: 0.22 ± 0.05 Nm kg⁻¹, $p = 0.001$, right: 0.25 ± 0.06 Nm kg⁻¹, $p = 0.03$). Sprinters' TFM strength did not correlate with 100 m personal best ($r = 0.25$, $p = 0.31$).

DISCUSSION & CONCLUSION

Elite sprinters showed 16% to 31% stronger TFM than non-sprinters, but TFM strength was not associated with sprint performance within this homogenous group of elite sprinters. This is in accordance with the findings that foot muscles are more developed in sprinters than in non-sprinters, but muscle sizes may not contribute to achieve superior sprint performance (4). Since a heavy resistance strength-trained group demonstrated values of 0.38 ± 0.07 Nm kg⁻¹ and 0.40 ± 0.08 Nm kg⁻¹ for the left and right foot (3), respectively, with the same dynamometer, sprinters have the potential to increase TFM strength by 38%.

REFERENCES

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- 3) Goldmann et al., J Sport Sci, 2013
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