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Muscle fiber conduction velocity and selected biomotor abilities in soccer players

Kurz, E., Pröger, S., Gizzi, L., Schwesig, R., Delank, K.S., Bartels, T.

Martin-Luther-University Halle-Wittenberg

INTRODUCTION:

Higher muscle fiber conduction velocities (CV) were related to the training status. Within trained participants, sprinters showed higher CV than endurance runners. Based on the muscle fiber CV, the cross-section of the muscle fibers can be estimated. Muscle fibers with a larger cross-sectional area would suggest a higher distribution of type II (fast-twitch) fibers. The aim of this study was to examine the selective influences of muscle fiber CV on strength, speed, and endurance test results in soccer players.

METHODS:

Sixteen professional male soccer players (age: 17-29 years, BMI: 20-25 kg/m²) participated in this cross-sectional study. Muscle fiber CV of the vastus lateralis muscle was recorded in monopolar mode (EMG-USB2+, OT Bioelettronica, sampling rate: 2048/s) using a linear electrode array (ELSCH004, Spes Medica) concurrently with the isometric force (SM-2000N, Forza, gain: 200). Linear sprinting time was measured indoors with photoelectric timing gates at 10 meters (best of two trials). Endurance performance was determined via an incremental test on a treadmill (Saturn, h/p/cosmos) using a gas analyzer (Metalyzer 3B, Cortex). All tests were performed at the beginning of the pre-season period. The maximum voluntary torque (MVT) of the knee extensors and the maximum oxygen uptake (VO₂max) were normalized to athletes' body mass. Athletes were divided into "slower" and "faster" groups according to their vastus lateralis muscle fiber CV outcome using the median split method. Differences between groups were estimated using Student's unpaired t tests and effect sizes (d), respectively.

RESULTS:

The lower CV group revealed on average similar MVT (4.0 Nm/kg) as compared to the higher CV group (4.1 Nm/kg, $t(14) = -0.29$, $d = -0.15$). Likewise, the groups did not differ in their sprinting times (either: 1.8 s, $t(14) = -0.08$, $d = -0.04$). There was a moderate effect of the muscle fiber CV ($t(14) = -1.16$, $d = -0.58$), with the higher CV group demonstrating higher VO₂max (55.6 ml/min/kg) compared to the lower CV group (53.1 ml/min/kg).

CONCLUSION:

Soccer players with lower muscle fiber CV at the vastus lateralis muscle are equally able to generate maximum knee extensor torque and linear sprint over 10 m as their counterparts with higher muscle fiber CV. However, they appear to show a higher endurance capacity. In turn, these findings confirm that in soccer players with higher muscle fiber CV and thus a larger fast-twitch fiber proportion the endurance capacity is not adversely affected.

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