28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Semitendinosus hypertrophy is linked to improvement in sprint performance after one year of sprint-based training: An observational study

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INTRODUCTION:
It is still questionable as to which muscles are most important for achieving fast sprint running velocity in sports and academic fields. Researchers have demonstrated that sprinters with large sizes of the rectus femoris (1), semitendinosus (2), gluteus maximus (3), and psoas major (4) showed high sprint performance in cross-sectional studies. However, little is known about the impacts of hypertrophy of these muscles on intra-individual changes in sprint performance. This study aimed to examine the impacts of the hypertrophy of each trunk and thigh muscle on the intra-individual changes in sprint performances during one year of sprint-based training.
METHODS:
Twenty-three male sprinters (the personal best record for the 100-m race: 11.36 s ± 0.44 s) at a university's athletics club participated in this study. They continued their sprint-based training for one year without our intervention. Before and after the one-year observation period, the participants performed two 100-m sprints with their maximal effort on a synthetic track. Mean sprint velocities at 0–100 m and 50–60 m intervals and spatiotemporal variables (e.g., step frequency and step length) at 50–60 m interval were measured with timing gates and a high-speed camera, respectively. The volumes of 14 trunk and thigh muscles were also measured by magnetic resonance imaging. Muscle volumes were normalized to their body mass at each time point.
RESULTS:
Sprint velocities at 0–100 m ($p < 0.001$) and 50–60 m ($p = 0.018$) intervals, stance time ($p = 0.015$), and flight distance ($p = 0.013$) at 50–60 m interval were significantly increased after the observation period. Additionally, the absolute and relative volumes of the tensor fasciae latae, sartorius, biceps femoris long head, biceps femoris short head, semitendinosus, and iliacus were significantly increased (all $p < 0.05$). Among the above six muscles, the changes in the absolute and relative volumes of the semitendinosus were positively correlated with the change in sprint velocity at 50–60 m interval ($p = 0.013$ to 0.015), but not with the changes in any spatiotemporal variables ($p = 0.119$ to 0.898).
CONCLUSION:
The present result is in line with that in the previous cross-sectional study showing a positive correlation between the semitendinosus volume and the sprint velocity at 50–60 m (2). The semitendinosus was reported to be highly activated at the late swing phase during high-speed running (5). Thus, the semitendinosus hypertrophy may increase the angular velocity of the hip extension, and thereby might contribute to the increase in sprint velocity. The present finding suggests that semitendinosus hypertrophy has an important role to enhance sprint performance within individuals.

1. Ema et al. (2018) Med Sci Sports Exerc
2. Takahashi et al. (2021) Plos One
3. Miller et al. (2021) Med Sci Sports Exerc
4. Sugisaki et al. (2018) Int J Sports Physiol Perform
5. Higashihara et al. (2010) J Sports Sci

Topic: Training and Testing

Presentation Oral