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Leg muscle activation under full and partial towing assistance in sprint running

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INTRODUCTION:
Research on sprint adaptation has focused on optimizing performance through various training methods (Van Den Tillaar & Gamble, 2017). Among these, assisted sprinting has been studied for its potential to enhance speed via neuromuscular adaptations (Cecilia-Gallego et al., 2022). However, there is concern that muscle activation during supra-maximal sprinting may not be optimal due to passive contributions from external towing forces.
The present study compared fully assisted sprinting with partially assisted sprinting, where assistance was applied until approximately 0.5 m/s below the athletes supra-maximal speed, after which the impact of the towing force diminishes to zero, allowing the athlete to continue unassisted. This technique may require greater voluntary effort. It was hypothesized that partially assisted sprinting would increase propulsive muscles activation.

METHODS:
Fourteen male students from different sports (age: 21.3 ± 1.3 years, body mass: 81.5 ± 8.3 kg, height: 1.86 ± 0.06 m) performed full-assisted, partial-assisted, and unassisted (free-run, control condition) 30-m sprints in a randomized order within a single session. A motorized device provided precise assistance load. Sprint times and EMG activity of the Rectus Femoris (RF), Vastus Lateralis (VL), Semitendinosus (ST), Biceps Femoris (BF), and Gluteus Maximus (GM) were compared across conditions. Additionally, stride length, stride frequency, contact time, and flight time were recorded for each condition using Optojump.
RESULTS:
Running speed over the 30-m sprint was higher in both assisted conditions compared to the unassisted condition (unassisted vs. partly assisted: $p < 0.01$; unassisted vs. fully assisted: $p < 0.001$). This increase in speed resulted mainly from a significantly greater stride length in both assisted conditions compared to the unassisted condition ($p < 0.001$ for both comparisons).
In both partially and fully assisted condition, ST ($p < 0.01$) and BF ($p < 0.001$) showed greater activation before initial contact (late swing phase) compared to the unassisted condition. Additionally, VL activation was significantly higher in the fully assisted condition during early stance (knee flexion) compared to the unassisted condition ($p < 0.05$). However, no significant differences were found between the partly and fully assisted conditions.

CONCLUSION:
The absence of significant muscle activation differences between the partly and fully assisted conditions suggests both techniques provide similar neural drive, sufficient to enhance sprinting performance, as evidenced by higher sprint speed and greater stride length compared to the unassisted condition. These findings highlight how assistance levels influence neuromuscular demands and can be applied in training.

REFERENCES:
1) Cecilia-Gallego et al., J. Sports Sci., 2022
2) Van Den Tillaar and Gamble, ISBS Proceedings Archive, 2017

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