Both vertical and horizontal plyometric training influence sprint force-velocity profile in young elite soccer players.

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During a soccer match, sprint horizontal acceleration ability is determinant for performance. Development of sprint force and velocity qualities has been reported after plyometric training (Barrera-Dominguez et al. 2023).

However, the orientation of plyometric training exercises can influence functional performances (Dello Iacono et al. 2017). The force-velocity profile (FVP) can be of great interest to assess the plyometric training-induced effects on the changes in performance and athletes' behavior during a linear sprint (Watkins et al. 2021). Nevertheless, a comparison between horizontal and vertical plyometric training on sprint FVP has yet to be conducted.

The purpose of the present study was to evaluate and compare the effects of 8-week horizontal and vertical plyometric training on explosiveness performance and sprint force-velocity profile in young soccer players.

### Methods

#### Population

Twenty-eight soccer players (age: 30 ± 6 y, height: 169 ± 9 cm, mass: 65 ± 12 kg) divided in a vertical (n = 14) and a horizontal (n = 14) group.

#### Training protocol

2000 contacts (16 session (2 sessions/wk) (Table 1)

#### Jump performances

Vertical and horizontal jumps including: squat jump (SJ), counter-movement jump (CMJ) and drop jump 30 cm (DJ) | OfoJump and MyJump app.

#### Sprint FVP: Linear 30 m sprint – Times at 5, 10, 15 and 30 m | MySpring app.

From the F-V relationship modeling the 30 m sprint: maximal force (F0), maximal velocity (V0), maximal power (Pmax), maximal ratio of force (RFmax) and the decrease rate in RF with increasing speed (DRF) (Samozino et al., 2022).

#### Statistical analysis

2-way ANOVA (time [PRE – POST] * group [VG – HG]) for all the variables (Tukey HSD post-hoc test in case of interaction) | Student t-test for the time effect in each group.

### Results

**Table 1: Plyometric training in vertical and horizontal groups. Data are expressed as number of contacts (sprints + jumps) and intensity are displayed between parentheses (jump height for [vertical group]) or length (for [horizontal group] in centimeters). Unilateral jumps were made on a single leg (and repeated on the other).**, 

**Figure 5: Significant main relative changes between pre- and post-test for the vertical group (VG) and the horizontal group (HG) in horizontal jump performances (equal jump [SJ], counter-movement jump [CMJ] and drop jump [DJ]), sprint performances (sprint time at 5m, 10m, 15m and 30m) and force-velocity profile parameters [including the maximal force (F0), the maximal power (Pmax), the maximal force ratio (RFmax) and the decrease rate in RF with increasing speed (DRF)].**, 

### Discussion

Both horizontal and vertical plyometric training can be either used in young soccer players to improve vertical and horizontal performances in jump and sprint as previously reported (Ramírez-Campillo et al., 2015). However, horizontal plyometric training may give a larger gain in horizontal ballistic actions while developing vertical jump qualities in young soccer players.

Further studies are necessary to more deeply compare motor coordination and muscular synergies involved in vertical and horizontal actions and potential specific effects on musculoskeletal structural adaptations. Additionally, the comparison of directions (i.e., lateral and anterior) of horizontal plyometric exercises needs to be further investigated.

### References


