# EFFECTS OF HEAVY RESISTED SPRINT TRAINING ON FORCE-VELOCITY-POWER PROFILES IN COLLEGIATE FEMALE VOLLEYBALL PLAYERS

HOFSTRA SCHOOL OF HEALTH SCIENCES
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Jamie Ghigiarelli[1], Keith Ferrara[2], Katie Sell[1], and Adam Gonzalez[1]

[1]Department of Allied Health and Kinesiology, Hofstra University, Hempstead, NY

[2]Department of Athletics, Adelphi University, Garden City, NY

## Peak force was significantly increased after 12 weeks of very heavy RST at 75% $V_{DEC}$ but not greater than 25%-50%-75% $V_{DEC}$

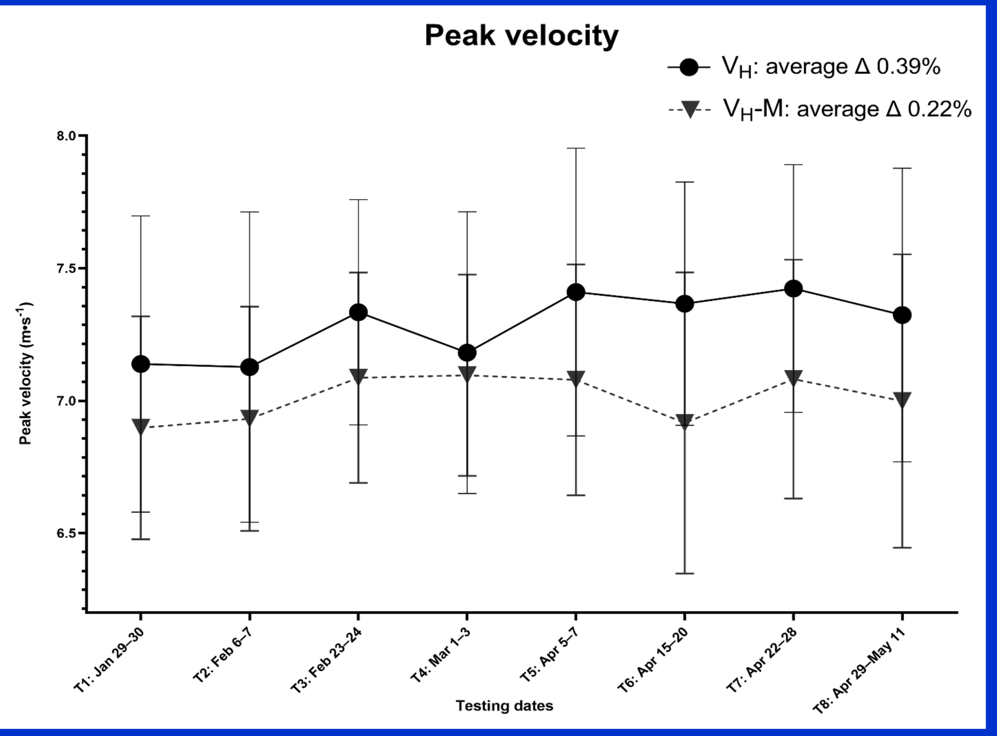
## BACKGROUND

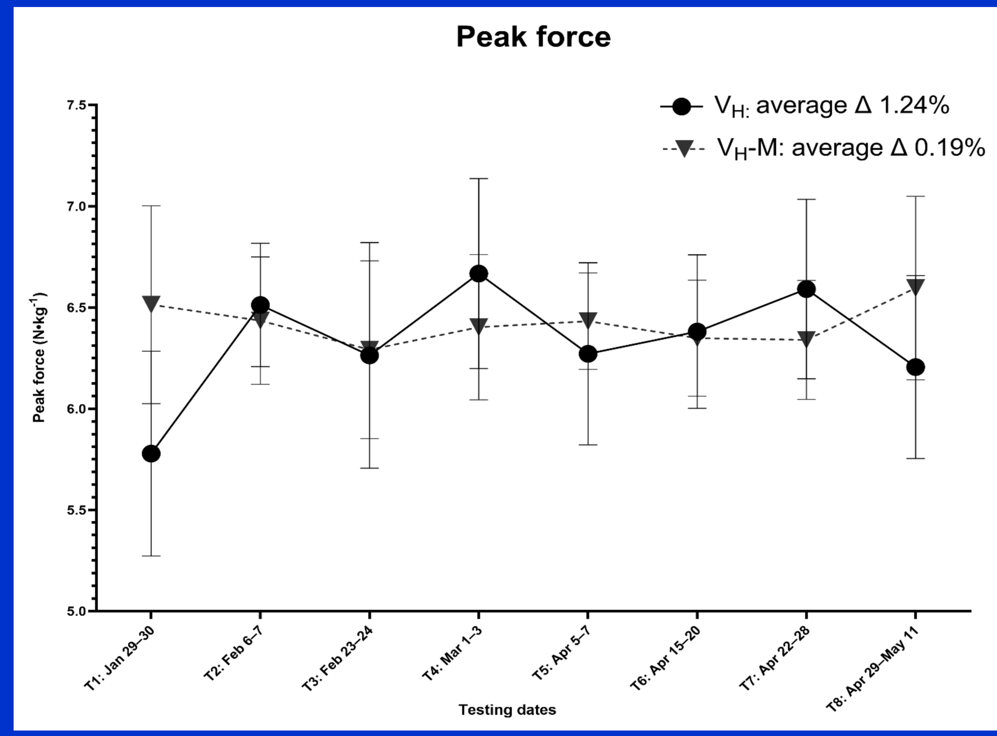
More than 60% of coaches incorporate resisted sprint training (RST) into their program design (1) using a variety of commercially available devices (2). Several systematic reviews and meta-analyses report the limited benefit of RST over unresisted sprinting (UST) for overall sprint performance. Variability in loading, sprint distance, intervention length, and sprint training methodology explains the inconsistencies. The progressive approach to guide RST program design involves the use of the force-velocity (FV) profile (13). Practitioners utilize the FV slope ($S_{FV}$), defined as the athlete's balance between FV capabilities (14) to design programs that address the athlete's weaknesses if they possess force or velocity deficits (15, 16). To date, no studies have focused on female volleyball players, despite volleyball's being classified as a horizontal force-oriented sport (23). Further, the FV variables are strongly correlated to the approach jump, a volleyball sport-specific movement (24).

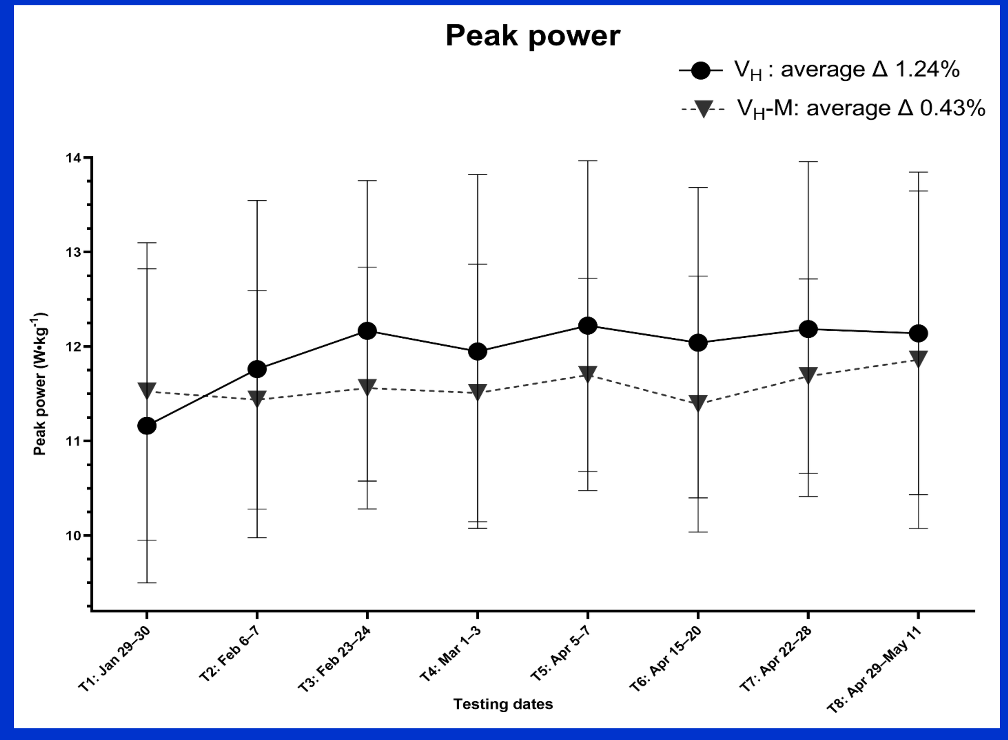
## METHODS

Twenty-four female Division II volleyball players participated in this quasi-experimental study. Data collection occurred during the 2023 and 2024 off-season training sessions. Players were divided into two groups, defined as the $V_H$ group ($S_{FV} < 0.92$, n = 16) and the $V_{H}$-M group ($S_{FV} > 0.92$, n = 8). Unresisted sprint testing: For $V_0$ testing, players performed weekly UST as part of the training sessions and were assessed at eight time points during the off-season. Prior to all sprint testing sessions, players' weights, while wearing full clothing, were recorded by the MuscleLab Windows software. Players performed two RST and UST sessions per week on nonconsecutive days (Monday and Friday) over a 12-week training period, consisting of three 4-week mesocycles (Table 2). The $V_H$ group trained at 75% $V_{DEC}$ for 12 weeks over three 4-week mesocycles. The $V_H$-M group followed a linear descending loading program (75%–50%–25% $V_{DEC}$) across three 4-week mesocycles.

| Week | Day 1 Monday RS (reps x distance) | Day 1 Monday UST sprint (reps x distance) | Day 2 Friday RS (reps x distance) | Day 2 Friday UST sprint (reps x distance) | RS volume | Total volume |
|---|---|---|---|---|---|---|
| **25% $V_{DEC}$ (Moderate)** | | | | | | |
| 1 | 4 x 20 m | 1 x 30 m | 4 x 20 m | 4 x 20m / 1 x 30 m | 160 m | 300 m |
| 2 | 5 x 20 m | 1 x 30 m | 5 x 20 m | 5 x 20m / 1 x 30 m | 200 m | 360 m |
| 3 | 6 x 20 m | 2 x 30 m | 6 x 20 m | 6 x 20m / 2 x 30 m | 240 m | 460 m |
| 4 | 3 x 20 m | 2 x 30 m | 3 x 20 m | 3 x 20m / 2 x 30 m | 120 m | 300 m |
| **50% $V_{DEC}$ (Heavy)** | | | | | | |
| 1 | 4 x 15 m | 1 x 30 m | 4 x 15 m | 4 x 15m / 1 x 30 m | 120 m | 240 m |
| 2 | 5 x 15 m | 1 x 30 m | 5 x 15 m | 5 x 15m / 1 x 30 m | 150 m | 270 m |
| 3 | 6 x 15 m | 2 x 30 m | 6 x 15 m | 6 x 15m / 2 x 30 m | 180 m | 390 m |
| 4 | 3 x 15 m | 2 x 30 m | 3 x 15 m | 3 x 15m / 2 x 30 m | 90 m | 255 m |
| **75% $V_{DEC}$ (Very Heavy)** | | | | | | |
| 1 | 5 x 10 m | 1 x 30 m | 5 x 10 m | 5 x 10m / 1 x 30 m | 100 m | 210 m |
| 2 | 6 x 10 m | 1 x 30 m | 6 x 10 m | 6 x 10m / 1 x 30 m | 120 m | 240 m |
| 3 | 7 x 10 m | 2 x 30 m | 7 x 10 m | 7 x 10m / 2 x 30 m | 140 m | 330 m |
| 4 | 4 x 10 m | 2 x 30 m | 4 x 10 m | 4 x 10m / 2 x 30 m | 80 m | 240 m |


## RESULTS

At baseline, there was a significant group difference for $F_0$ and $S_{FV}$, with the $V_H$-M group producing higher $F_0$ outputs and $S_{FV}$ in comparison to the $V_H$ group. No baseline differences were reported for $V_0$ and $P_{MAX}$. After adjusting for baseline values, a significant main effect for time was observed for $F_0$ ($p = 0.001$. $\eta^2 = 0.228$), although no overall group ($p = 0.167$, $\eta^2 = 0.153$) or group x time interaction effect ($p = 0.440$) was observed (Figure 1). No statistical differences were observed in $V_0$, for group ($p = 0.447$, $\eta^2 = 0.054$), time ($p = 0.740$), or group x time interaction ($p = 0.290$) (Figure 2). For $P_{MAX}$, a significant main effect for group ($p = 0.025$, $\eta^2 = 0.291$) was observed, as the $V_H$ group had higher values compared to the $V_H$-M group (12.37 ± 0.15 vs. 11.72 ± 0.21 W·kg$^{-1}$; mean difference = 0.65 ± 0.26 W·kg$^{-1}$, $\eta^2 = 0.29$). There was no significant main effect for time ($p = 0.310$) or group x time interaction ($p = 0.107$) (Figure 3).

## CONCLUSIONS

In collegiate volleyball players with force-deficit profiles, heavy RST concurrent with UST over a 12-week period may be an effective stimulus for improving horizontal $F_0$ sprint performance, but it does not increase $P_{MAX}$ or $V_0$.

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