Intra-Individual Responses From Additional Sprint or Nordic Hamstring Exercise Training on the Modifiable Risk Factors of Hamstring Strain Injury

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INTRODUCTION

Sprint training (SPT) has been defined as a potential vaccine for hamstring strain injuries (HSI). However, eccentric load placed on the hamstrings during the gait cycle is influenced by running velocity, which could impact the adaptive response. The nordic hamstring exercise (NHE) is also frequently implemented, however, its effectiveness could be impacted by initial eccentric hamstring strength (EHS), being unable to move through muscle action types.

Therefore, **the purpose of this study was to determine intra-individual variation based on initial sprint and EHS ability on modifiable risk factors of HSIs.**

METHODS

28 Collegiate athletes were randomly assigned to either NHE (*n* = 15, 21.4±2.6 years, 1.70±0.04 m, 76.9±14.2 kg) or SPT (*n* = 13, 22.2±2.5 years, 1.71±0.05 m, 70.6±7.8 kg) groups. Both groups performed identical resistance training programs twice per week for seven weeks (Table 1), with either additional NHE with incremental loading or SPT. Pre- and post-intervention testing of Bicep femoris fascicle length (BFL) ultrasound images were taken at the hamstring muscle belly. EHS was assessed by participants performing three NHE repetitions on the Nordbord. BFL analyzed using ImageJ software and the following equation OFL+(h÷SIN(PA)), where OFL is the observed fascicle, h is the perpendicular distance between aponeurosis and BF end point and PA is the pennation angle. Peak EHS was analyzed using custom designed Excel spreadsheets.

20m sprint performance and EHS was used to determine between "fast" and "slow" and "strong" and "weak" based on the median values. Two-way AVOVAS with Bonferroni post-hoc analysis and Hedge's *g* effect sizes were used to determine the significance and magnitude of differences. An *a priori* alpha level was set at *p*≤*0.05*. Hedge's *g* effect sizes were interpreted as trivial (≤0.19), small (0.20–0.59), moderate (0.60–1.19) and large (>1.20).

Table 1. Resistance training intervention (sets x reps and estimated percentage 1RM), in addition to the supplemental NHE or ST.

Day 1							
Weeks	1	2	3	4	5	6	7
Power clean	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3
	80%	85%	90%	75%	80%	85%	90%
Back Squat	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3
	80%	82.5%	85%	75%	80%	82.5%	85%
Reverse lunge	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6
	70%	72.5%	75%	70%	72.5%	75%	77.5%
Day 2							
Weeks	1	2	3	4	5	6	7
Mid-thigh pulls	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3	3 x 3
	80%	85%	90%	75%	80%	85%	90%
Romanian deadlift	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6
	70%	72.5%	75%	70%	72.5%	75%	77.5%
Reverse lunge	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6	3 x 6
	70%	72.5%	75%	70%	72.5%	75%	77.5%
NHE (Twice per week)	2x4	2x4	2x4	2x4	2x4	2x4	2x4
Sprinting (Twice per week)	4x25m	5x25m	6x25m	7x25m	7x25m	7x25m	7 x 25m

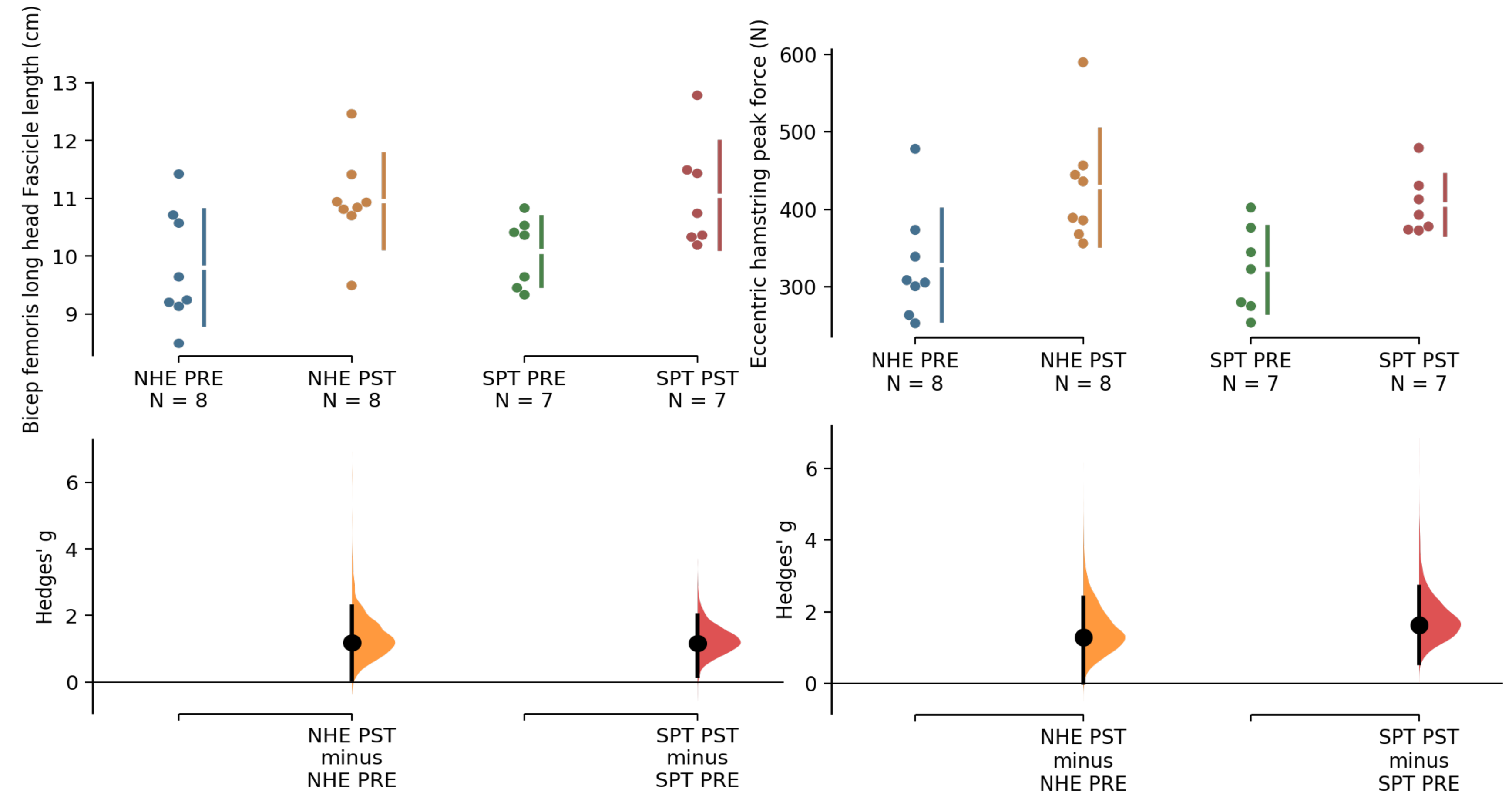

Figure 1. Cumming estimation plots illustrating the magnitude of the difference for FAST participants.

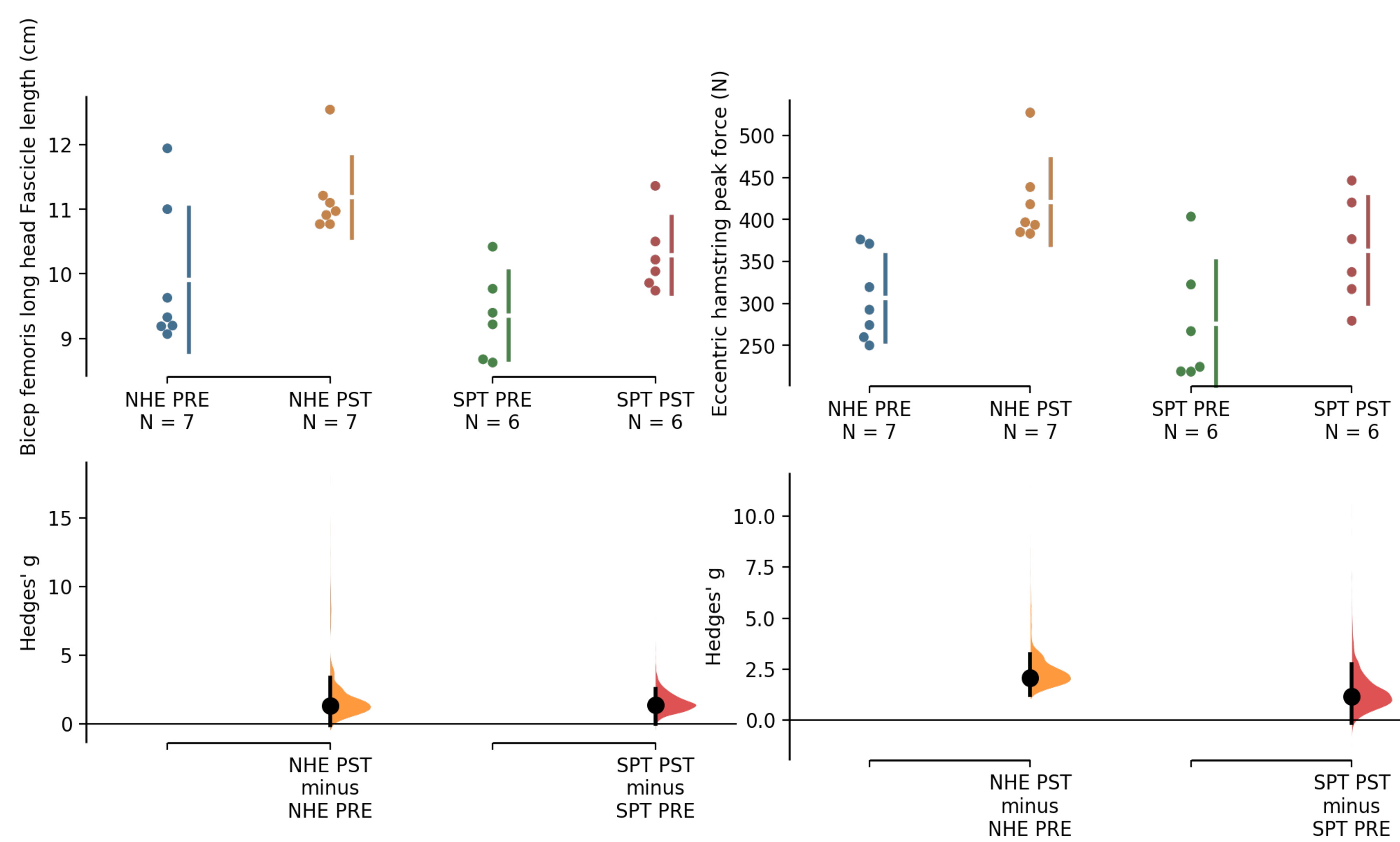

Figure 2. Cumming estimation plots illustrating the magnitude of the difference for SLOW participants.

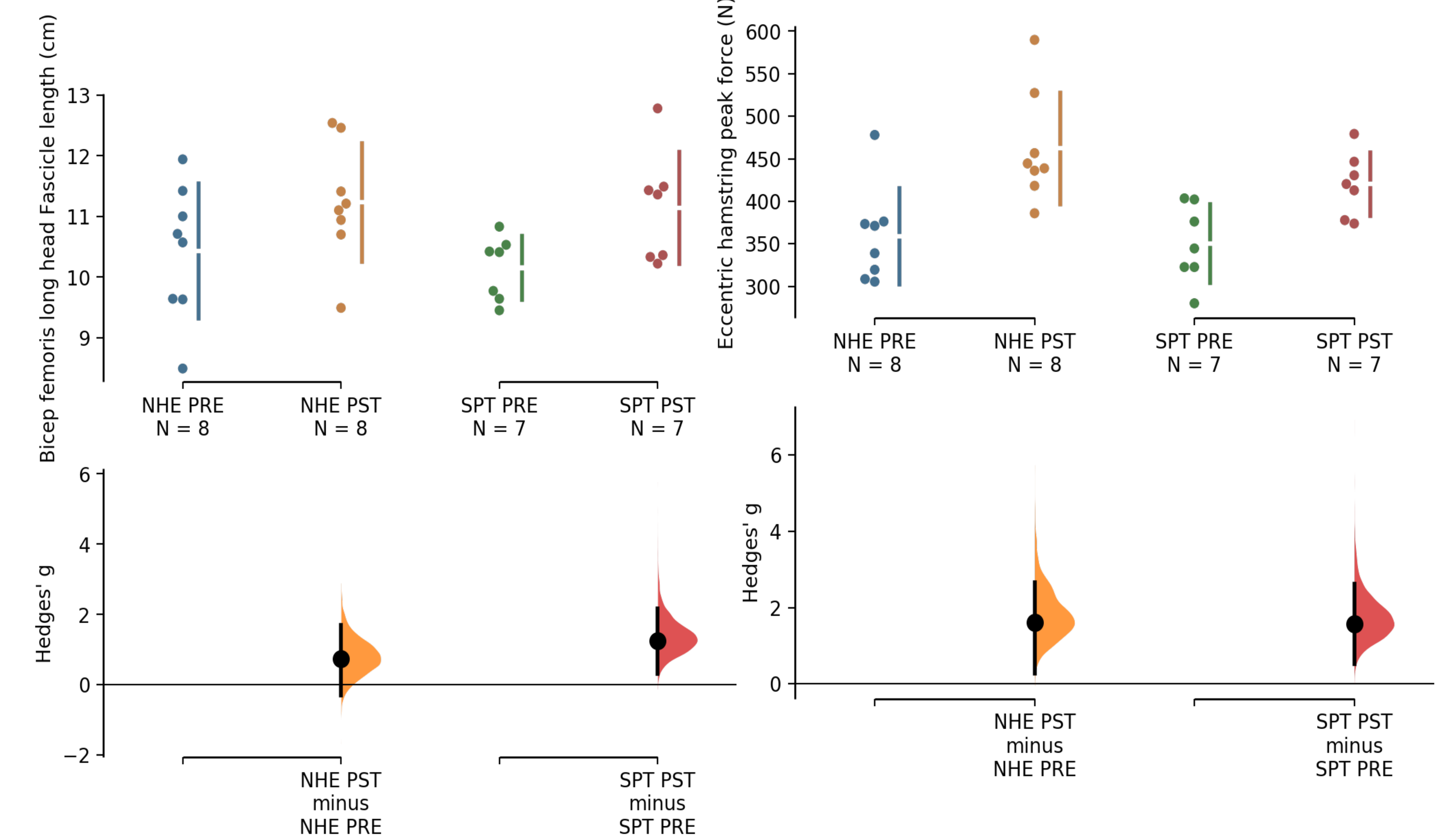

Figure 3. Cumming estimation plots illustrating the magnitude of the difference for STRONG participants.

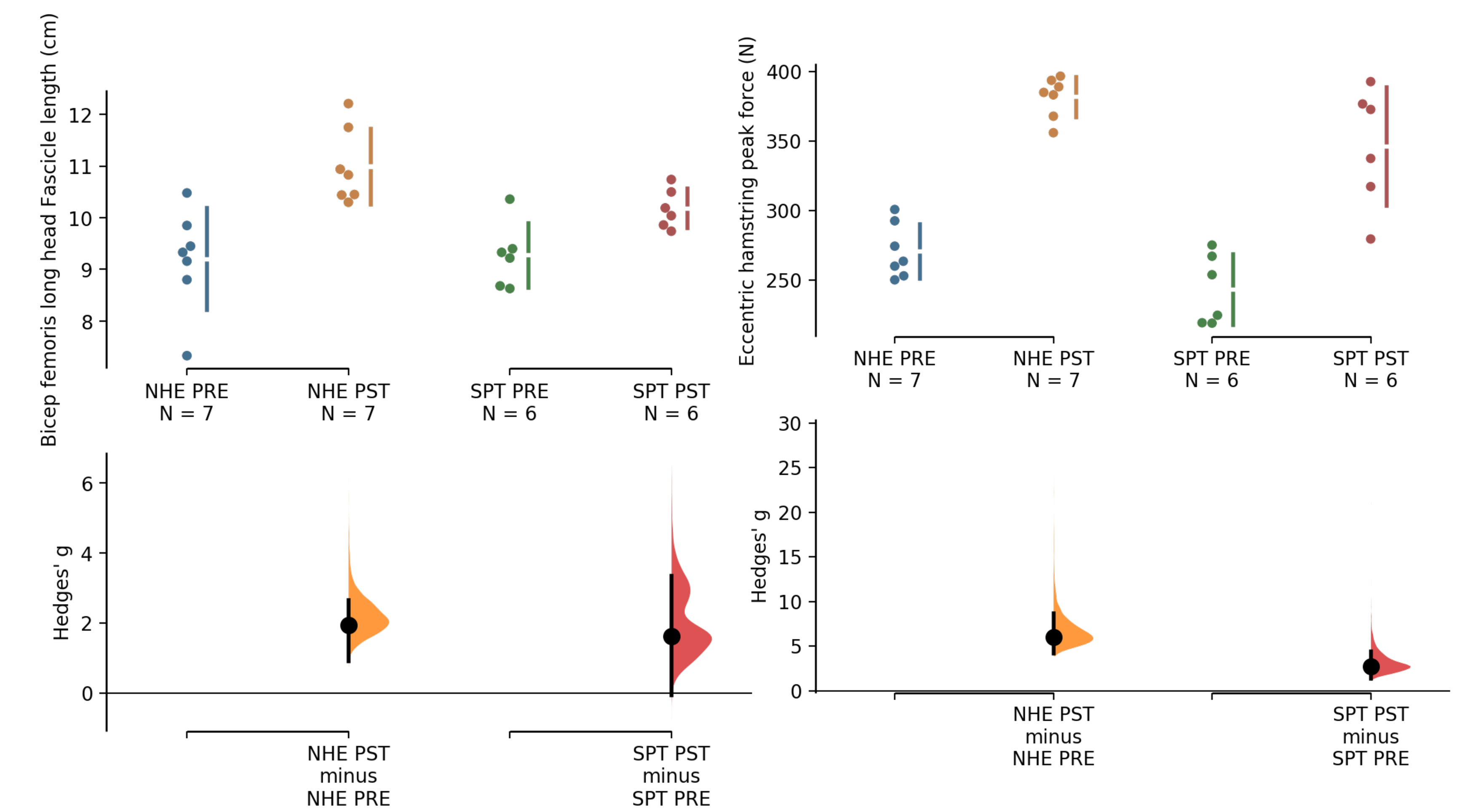

Figure 4. Cumming estimation plots illustrating the magnitude of the difference for WEAK participants.

RESULTS

Significant increases in BF FL and EHS were observed for both training groups (*p*<0.001). The median values for EHS and 20m sprint performance was 303.15 N and 3.39 seconds, respectively. Weak participants had the greatest increase in BFL and EHS with the NHE (*p<0.001, g* = 1.94-4.57, figure 4). Strong participants had similar increases in EHS for both the NHE and SPT (*p<0.001, g* = 1.57-1.60, figure 3), with SPT having the greatest increase in BFL (*p<0.001, g* = 1.24) in comparison to the NHE (*p<0.001, g* = 0.73). Fast participants had the greatest increase in BF FL and EHS via SPT (*p<0.001, g* = 1.63-1.61), in contrast to NHE (*p<0.001, g* = 1.19-1.29) (figure 1). Slow participants had the greatest increase in BF FL and EHS via NHE (*p<0.001, g* = 1.72-2.09), in contrast to SPT (*p<0.001, g* = 1.16-1.35) (figure 2).

CONCLUSIONS

Weaker individuals had greater adaptations from the NHE, while **strong participants had similar increases in EHS for both training modalities,** while SPT had a greater effect on BFL. **Fast participants had greater increases in BFL and EHS using sprint training**, whereas **slow participants had the greatest adaptations through NHE**. Demonstrating initial EHS and sprint performance impacts the potential adaptations that can be realised.

PRACTICAL APPLICATION

The prescription of training with the goal of decreasing HSI incidence should consider initial training status, including strength and speed performance as they can both impact the magnitude of adaptations independently. Although training should not rely on a single modality, especially when weak.