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Relationship Between Vertical Jump Parameters And Changes In Agility Performance Following Post-Activation Potentiation In Elite Fencers*

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Abstract

This study aimed to examine the relationship between vertical jump-derived neuromuscular parameters and agility performance changes following post-activation potentiation (PAP) protocols in elite fencers. Seventeen elite male fencers (age: 17.29 ±1.93 years) performed vertical jump assessments—countermovement jump (CMJ), squat jump (SJ), and drop jump (DJ)—using the Opto jump Next system. Reactive strength index (RSI), relative power, and other jump metrics were recorded. PAP was elicited via Smith machine split squat protocols (dominant, non-dominant, bilateral legs), while agility was measured using a 4-2-2-4 test at 1-, 3-, 5-, and 7-minutes post-PAP, timed via photocell gates. A repeated-measures ANOVA was conducted to examine differences in agility performance over time and across conditions. A significant main effect of time was observed on agility performance ($F(4,64) = 11.103$, $p < 0.001$, $\omega^2 = 0.110$), while no significant main effect of condition emerged. A small but significant interaction effect ($F(12,192) = 1.866$, $p = 0.041$, $\omega^2 = 0.017$) suggested time-dependent differences among conditions. However, post hoc tests and simple effects analyses did not yield significant contrasts. Regression models revealed that DJ flight time and DJ height were the most consistent predictors of agility changes, particularly in the bilateral and control groups. CMJ and SJ variables demonstrated moderate predictive relevance. Although PAP protocols led to temporal improvements in agility, no substantial differences were found between conditions. Vertical jump-derived parameters, especially DJ characteristics, may help identify individuals more responsive to PAP. These findings suggest the need for individualized PAP programming in elite fencers.

Keywords: Post-activation potentiation (PAP), Vertical jump, Agility performance, Fencing

Özet

Elit Eskrimcilerde Dikey Sıçrama Parametreleri ile Post Aktivasyon Potansiyasyonu Sonrası Çeviklik Performansındaki Değişim Arasındaki İlişki

Bu çalışma, elit eskrimcilerde dikey sıçrama kaynaklı nöromüsküler parametrelerle post-aktivasyon potansiyasyonu (PAP) sonrası çeviklik performansındaki değişimler arasındaki ilişkiyi incelemeyi amaçladı. On yedi elit erkek eskrimci (yaş: 17,29 ±1,93 yıl), Opto jump Next sistemi kullanılarak karşı hareket sıçraması (CMJ), squat sıçraması (SJ) ve drop jump

(DJ) testlerini gerçekleştirdi. Reaktif kuvvet indeksi (RSI), relatif güç ve diğer sıçrama ölçümleri kaydedildi. PAP, Smith machine split squat protokolleriyle (dominant, nondominant, bilateral bacaklar) uygulandı; çeviklik performansı ise 1., 3., 5. ve 7. dakikalarda 4-2-2-4 çeviklik testiyle ve fotosel sistemiyle ölçüldü. Zaman içinde ve koşullar arasında çeviklik performansındaki farklılıkları incelemek için tekrarlı ölçümlerde ANOVA kullanıldı. Zaman ana etkisi anlamlıydı ($F(4,64) = 11,103$, $p < 0,001$, $\omega^2 = 0,110$), ancak uygulama ana etkisi anlamlı çıkmadı. Küçük ama anlamlı bir etkileşim etkisi ($F(12,192) = 1,866$, $p = 0,041$, $\omega^2 = 0,017$), zamanla gruplar arasında farklılıkların oluştuğunu gösterdi. Ancak post hoc ve basit etkiler analizlerinde anlamlı farklar gözlemlenmedi. Regresyon analizleri, özellikle bilateral ve kontrol gruplarında DJ uçuş süresi ve DJ yüksekliğinin çeviklik değişimlerinin en tutarlı yordayıcıları olduğunu gösterdi. CMJ ve SJ değişkenleri ise orta düzeyde yordayıcı olarak belirlendi. PAP protokolleri çeviklikte zaman içinde iyileşmeler sağlasa da gruplar arasında anlamlı farklılıklar gözlemlenmedi. Bu bulgular, elit eskrimcilerde PAP uygulamalarının bireysel olarak yapılandırılması gerektiğine işaret etmektedir.

Anahtar kelimeler: Post-aktivasyon potansiyasyonu (PAP), Dikey sıçrama, Çeviklik performansı, Eskrim

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INTRODUCTION

Vertical jump performance is widely recognized as a reliable indicator of lower-body neuromuscular capabilities, especially in sports requiring rapid force production such as fencing (10, 11). Fencing is a high-intensity, intermittent combat sport characterized by explosive actions including lunges, directional changes, and sudden accelerations (1, 16). These movements demand a high level of lower-body power and reactive strength to ensure quick responses and maintain tactical advantage during bouts.

Countermovement Jump (CMJ) and Squat Jump (SJ) tests are commonly used to assess different components of explosive strength. While the SJ evaluates concentric strength in isolation, the CMJ leverages the stretch-shortening cycle (SSC), which reflects an athlete's ability to use stored elastic energy and reflexive neural mechanisms for greater force production (2). The difference between CMJ and SJ outcomes—often referred to as "elastic strength"—offers further insights into the efficiency of neuromuscular coordination and SSC utilization (3).

Drop Jump (DJ) assessments, on the other hand, incorporate both eccentric and concentric components, providing valuable information on reactive strength via the Reactive Strength Index (RSI). RSI is defined as the ratio of jump height to ground contact time and has been shown to strongly correlate with explosive sports performance (7, 6). In fencing, where rapid deceleration and re-acceleration are critical, a high RSI may be particularly advantageous.

Post-Activation Potentiation (PAP) is a physiological phenomenon whereby prior high-intensity muscular contractions temporarily enhance subsequent performance, particularly in explosive tasks (10). PAP is believed to result from mechanisms such as increased phosphorylation of myosin regulatory light chains, heightened motor neuron excitability, and improved synchronization of motor units (15). The practical application of PAP in athletic settings often involves the use of heavy-resistance or ballistic exercises prior to performance tasks like sprinting or jumping (13, 8).

While the physiological mechanisms underlying PAP are well-established, recent literature has extensively explored the optimal strategies and modulating factors for its practical application. For instance, a meta-analysis by Seitz et al. (13) demonstrated that PAP effects, though generally small to moderate across various explosive tasks, are significantly influenced by an individual's strength level, training experience, and specific conditioning activity parameters like type, intensity, and rest intervals. Similarly, Garbisu-Hualde et al. (8), in their review, emphasized the critical role of conditioning activity intensity (suggesting 85-90% 1RM for higher effects) and sufficient rest periods (7-8 minutes for experienced athletes) in maximizing potentiation, further highlighting the nuanced approach required for effective PAP implementation.

Although the term PAP is frequently used in the literature, it is important to distinguish it from "Post-Activation Performance Enhancement" (PAPE), as suggested by Cuenca-Fernández et al. (5) and Boullosa (3). PAP refers to the transient increase in muscle force following a conditioning activity, typically measured during electrically evoked twitch contractions. In contrast, PAPE describes voluntary performance improvements in tasks such as jumping or sprinting following a high-intensity activation exercise. Given that most sport-specific studies—including the present research—assess voluntary athletic tasks rather than involuntary twitch responses, the term PAPE is more appropriate to describe the observed phenomena. PAPE involves distinct physiological mechanisms such as increased muscle temperature, intracellular fluid shifts, and fiber-type-specific rate of force development improvements, which go beyond the neural potentiation mechanisms associated with PAP. While the current study retains the PAP terminology for consistency with common usage, it aligns more closely with the characteristics of PAPE.

Although PAP has been shown to acutely improve performance in sprinting and jumping activities (17), individual responses to PAP protocols vary widely. This variation may stem from intrinsic neuromuscular characteristics, such as strength levels, fiber-type composition, and previous training experience (14). Given the movement characteristics of fencing, it is plausible that vertical jump parameters—particularly those reflecting SSC and reactive strength—could serve as predictors of PAP responsiveness in agility tasks. To date, no study has specifically examined whether vertical jump-derived metrics such as RSI or elastic strength predict agility responses following PAP in elite fencers.

Therefore, the aim of this study is to investigate the relationship between vertical jump-derived neuromuscular parameters (CMJ, SJ, DJ, RSI) and changes in agility performance following a standardized PAP protocol in elite fencers. Using repeated measures ANOVA to detect condition and time effects, and regression to determine predictive parameters.

METHOD

Seventeen elite male fencers (age: 17.29 ±1.93 years), each with a minimum of three years of competitive experience, voluntarily participated in this study. Initially, twenty-two athletes were recruited; however, five were excluded from the final analysis due to injuries or scheduling conflicts with competitions. All procedures were approved by the Institutional Ethics Committee, and written informed consent was obtained from each participant prior to data collection.

A within-subject repeated-measures design was employed to examine the relationship between vertical jump-derived neuromuscular parameters and PAP effects on agility performance. Each participant completed vertical jump testing and PAP-based agility assessments on separate days to prevent fatigue-induced confounding.

Vertical jump assessments included CMJ, SJ and DJ, performed in a standardized warm-up and testing protocol. Each jump type was performed three times with 1 minutes rest time provided, and the best trial was used for analysis. Testing was conducted using the Optojump Next system (Microgate, Bolzano, Italy), a validated optical measurement device for vertical jump analysis.

Measured variables included: CMJ height (cm), SJ height (cm), Elastic Strength (CMJ − SJ height difference), Relative Power in CMJ and SJ (W/kg), DJ variables: box height (cm), ground contact time (s), flight time (s), jump height (cm), reactive strength index (RSI; m/s), and relative power (W/kg).

For the DJ test, athletes began from a box height of 30 cm. The height was progressively increased in 10 cm increments until the RSI showed a consistent decrease, indicating reduced efficiency in reactive force output. Some participants reached up to 70 cm. Sufficient rest (~60 seconds) was allowed between trials to prevent fatigue accumulation.

The PAP intervention consisted of split squat exercises performed on a Smith machine at 80% of the participant's previously established one-repetition maximum (1RM). Each condition—dominant leg, non-dominant leg, and bilateral—was applied in randomized order, with participants completing 3 sets of 4 repetitions per condition. A control condition involving no PAP stimulus was also included. The split squat exercise was selected due to its sport-specificity to fencing stance and its ability to isolate unilateral force production, which is critical in fencing actions.

Following each PAP condition, participants performed a standardized 4-2-2-4 agility test at 1, 3, 5, and 7 minutes post-exercise. Baseline (pre-PAP) performance was also recorded. The agility test was timed using a wireless photocell timing system (Witty Timing System, Microgate, Bolzano, Italy), ensuring high temporal precision. To ensure accurate capture of the potentiation time course, only one attempt was performed at each time point, immediately upon the start of the minute.

All statistical analyses were conducted using JASP software Version 0.19.2 Intel. Descriptive statistics (mean ±SD) were calculated for all measured variables. The assumption of normality was assessed using the Shapiro–Wilk test, and potential outliers were identified using z-scores and boxplots. Variables not meeting normality assumptions were visually inspected and verified for robustness before inclusion in parametric analyses.

To assess the acute effect of PAP on agility performance, a 2-way repeated-measures ANOVA was conducted with time (Pre, 1st, 3rd, 5th, and 7th minutes) and condition (dominant leg, non-dominant leg, bilateral, control) as within-subject factors. Where no significant interaction was found, main effects were reported. Additionally, to explore group differences at each individual time point, simple main effects analyses were performed across the four conditions.

To quantify the performance changes, delta scores were computed by subtracting the pre-test agility score from the best post-PAP agility score for each condition. These delta values were used as dependent variables in multiple linear regression analyses, with vertical jump parameters (e.g., CMJ height, SJ height, RSI, relative power outputs) as predictors. Fencing experience (years) and general sports background were included as covariates to control for inter-individual differences in training history.

Furthermore, Pearson's correlation coefficients were calculated to examine the relationships between vertical jump variables and agility improvements. These results were visualized in a correlation heatmap, providing insight into the associations between neuromuscular characteristics and PAP-induced agility responses.

All statistical significance levels were set at $p < 0,05$. Where appropriate, effect sizes (e.g., partial eta-squared for ANOVA, standardized beta for regression) and 95% confidence intervals were reported in accordance with current standards for transparent and meaningful statistical reporting in sports science research (9).

Ethical approval and institutional permission

All procedures were approved by the Çanakkale Onsekiz Mart University Scientific Research and Publication Ethics Committee (Approval No: 03/46, dated 29.02.2024, Project Code: 2024-YÖNP-0115), and written informed consent was obtained from each participant prior to data collection.

FINDINGS

Descriptive statistics for the participants (N = 17) are presented in Table 1. The mean age of the fencers was 17.29 years (SD = 1.93), with a mean sport experience of 11.18 years (SD = 1.33) and fencing-specific experience of 10.29 years (SD = 1.65). The average body mass was 72.64 kg (SD = 10.16), with a mean height of 178.24 cm (SD = 6.47). The mean body fat (%) was 20.48% (SD = 5.91), while the average fat mass and lean mass were 14.92 kg (SD = 5.31) and 57.72 kg (SD = 8.81), respectively. Muscle mass was recorded with a mean of 54.83 kg (SD = 8.40). Strength levels, as measured by one-repetition maximum (1RM) for the lower limbs, revealed a mean of 107.19 kg (SD = 23.06) for the right leg and 96.14 kg (SD = 22.25) for the left leg. The Shapiro-Wilk test indicated that all variables, except fat mass ($p = .040$), were normally distributed ($p > 0.05$).

Table 1. Descriptive Statistics

	N	Mean	SD	SW	P-value of SW	Min-Max
Age (year)	17	17.294	1.929	897	0.61	15-21
Sport Age (year)	17	11.176	1.334	0,918	0.138	8-13
Fencing Age (year)	17	10.294	1.649	0,938	0.294	7-13
Body Mass (kg)	17	72.641	10.162	0,937	0.288	56.2-88
Height (cm)	17	178.235	6.467	0,960	0.635	165.5-190
Body Fat (%)	17	20.482	5.914	0,910	0.100	11.9-35.3
Fat Mass (kg)	17	14.918	5.310	0,821	0.4	9.6-30.6
Lean Mass (kg)	17	57.724	8.806	977	0.925	40.1-73.1
Muscle Mass (kg)	17	54.835	8.395	0,977	0.923	38.1-69.5
Dom Leg 1RM (kg)	17	107.193	23.056	0,933	0.244	58.953-138.683
Non dom Leg 1RM (kg)	17	96.138	22.250	0,946	0.400	47.563-127.293

Note. N = Number of participants; 1RM = One-repetition maximum; Dom = dominant; nondom = nondominant SD = Standard deviation; SW = Shapiro Wilk; p < 0.05 indicates statistical significance.

Pearson correlation reveals several significant relationships between agility, power, strength, and anthropometric variables (Figure 1). Notably, bilateral agility performance at the 1st trial was negatively correlated with height ($r = -0.660$, $p = 0.004$) and positively correlated with body fat (%) ($r = 0.616$, $p = 0.008$), suggesting that taller athletes and those with higher body fat tend to have slower agility times. Furthermore, agility at various time points (particularly on the non-dominant side and in bilateral trials) was negatively associated with lean and muscle mass, indicating that increased muscularity may not directly enhance agility performance. Conversely, jump-related power variables (e.g., DJ Power Max, RSI Max) showed strong positive correlations with right and left leg 1RM values, as well as with CMJ and SJ heights, underscoring the close relationship between lower-limb strength and explosive power performance (e.g., DJFT Max–Left Leg 1RM: $r = 0.750$, $p < 0.001$). These findings emphasize the multifactorial nature of agility and power performance in elite athletes and highlight the importance of tailoring training programs to address both body composition and neuromuscular capacity.

Figure 1. Correlation Heatmap relationships between agility, power, strength, and anthropometric variables

Note. Only statistically significant ($p < 0.05$) relationships are color-emphasized.

Backward linear regression analyses were performed to identify significant neuromuscular predictors of best agility performance in each group. The final models retained different sets of predictors across the four experimental conditions (Table 2.).

In the Dominant Leg Group, significant predictors were drop jump height (β = 9,85; t = 2,29; p = 0,045) and left leg 1RM strength (β = -3,12; t = -2,75; p = 0,020). Additionally, squat jump power (p = 0,056), right leg 1RM (p = 0,063), and DJ flight time (p = 0,059) were included in the model but did not reach statistical significance.

In the Non-dominant Leg Group, DJ flight time (β = 12,98; p = 0,041) emerged as a significant predictor. Other variables such as DJ height, DJ power, and RSI were retained in the model but showed marginal p-values.

In the Bilateral Group, both DJ height (β = -11,87; p = 0,011) and DJ flight time (β = 11,96; p = 0,011) significantly predicted agility performance.

For the Control Group, significant predictors included DJ flight time (β = 15,84; p = 0,007), DJ height (β = -12,49; p = 0,017), DJ power (β = -21,48; p = 0,011), and RSI (β = 18,55; p = 0,013). Only the final stepwise regression results are reported. CMJ and SJ variables were included in initial models but did not meet inclusion criteria based on p < 0.10 threshold.

Tablo 2. Summary of Final Backward Linear Regression Models Predicting Best Agility Performance in Four Experimental Groups

Predictors	β (Dom)	t	p	β (Non Dom)	t	p	β (Bilat)	t	p	β (Cont)	t	p
Dom Leg 1RM	2.642	2.088	0.063	—	—	—	—	—	—	—	—	—
Non Dom Leg 1RM	-3.115	-2.753	0.020	—	—	—	—	—	—	—	—	—
SJ Height	1.214	2.109	0.061	—	—	—	—	—	—	—	—	—
SJ Power	-1.478	-2.164	0.056	—	—	—	—	—	—	—	—	—
DJ Fligth	-9.166	-2.127	0.059	12.980	2.287	0.041	11.959	2.927	0.011	15.844	3.281	0.007
DJ Height	9.851	2.285	0.045	-10.828	-2.050	0.063	-11.874	-2.906	0.011	-12.489	-2.279	0.017
DJ Power	—	—	—	-15.561	-1.841	0.091	—	—	—	-21.476	-2.986	0.011
RSI	—	—	—	13.462	1.790	0.099	—	—	—	18.545	2.898	0.013

Note. Only significant predictors retained in the final models are presented. β = standardized regression coefficient. Dom = Dominant leg split squat (SS). NonDom = nondominant SS. Bilat = bilateral SS. Cont = control group. 1RM = 1 repetition maximum. SJ = squat jump. DJ = drop jump. FT = flight time. RSI = reactive strength index.

A mixed-design ANOVA was conducted to examine the effects of time and condition on the best agility performance. The main effect of time was statistically significant, F (4, 64) = 11.103, p = 0.0001 ω^2 = 0.110, indicating that agility performance changed significantly across different time points (Table 3.).

The main effect of condition was not significant, F(3, 48) = 0.517, p = 0.673, ω^2 = 0.000, suggesting no overall difference in agility performance between the different experimental protocols.

However, the interaction effect between condition and time was statistically significant, F (12, 192) = 1.866, p = 0.041, ω^2 = 0.017. This indicates that the pattern of change in agility performance over time varied depending on the condition applied.

Table 3. One-Way ANOVA Results for Best Agility Scores Across Experimental Groups.

Cases	Sum of Squares	df	Mean Square	F	p	ω²
Condition	0.353	3	0.118	0.517	0.673	0.000
Residuals	10.939	48	0.228			
Time	1.993	4	0.498	11.103	0.0001	0.110
Residuals	2.873	64	0.045			
Condition ✻ Time	0.627	12	0.052	1.866	0.041	0.017
Residuals	5.381	192	0.028			

Note, Type III Sum of Squares. [a] Mauchly's test of sphericity indicates that the assumption of sphericity is violated (p < .05)

While the mixed ANOVA indicated a statistically significant condition × time interaction (p = 0.041), subsequent post hoc comparisons did not yield significant differences between specific time points within or between conditions. This suggests that although the interaction effect was present, the pairwise contrasts lacked sufficient power or effect size to reach significance. Descriptive trends may nonetheless point to condition-specific temporal patterns that warrant further investigation.

To further examine the significant interaction effect between time and condition, a series of simple effects analyses were conducted. One-way ANOVAs were performed at each time point to assess the effect of condition. The results revealed that the effect of condition was not statistically significant at any specific time point (all p > 0.05). However, the comparison at the 1st minute approached statistical significance (F (3, 48) = 2.341, p = 0.085), suggesting a possible trend that may warrant further investigation in future studies (Table 4). Although the overall condition × time interaction was significant (p = 0.041), Bonferroni-adjusted post hoc comparisons did not reveal statistically significant differences between specific conditions at each time point (all p > 0.05). The effect size (ω^2 = 0.017) indicates a small effect according to conventional bench marks (9).

These findings indicate that although the interaction effect was statistically significant, the between-condition differences at individual time points did not reach significance, potentially due to limited power or subtle variations.

Table 4. Simple Main Effects -Condition

Level of Time	Sum of Squares	df	Mean Square	F	p
Pre (1)	0.218	3	0.073	0.820	0.489
1st	0.462	3	0.154	2.341	0.085
3rd	0.101	3	0.034	0.603	0.616
5th	0.064	3	0.021	0.287	0.835
7th	0.137	3	0.046	0.823	0.488

Note, Type III Sum of Squares

DISCUSSION AND CONCLUSION

The present study aimed to investigate the relationship between vertical jump performance and changes in agility following PAP protocols in elite fencers. The findings indicate a significant main effect of time on agility performance, although the interaction effect between condition and time, while statistically significant, yielded only a small effect size. Notably, post hoc comparisons did not reveal significant pairwise differences between the PAP conditions, suggesting that while temporal changes occurred, these changes were not condition-specific.

The improvement observed in agility performance over time may reflect a general neuromuscular facilitation process rather than a condition-dependent PAP response. This finding is partially consistent with the work of Sale (12) and Tillin & Bishop (15), who highlighted that PAP responses are highly individual and influenced by numerous factors including training status, strength level, and muscle fiber type composition. The small effect size in the condition × time interaction supports this notion, aligning with Seitz et al. (13), who noted that not all conditioning activities yield measurable performance enhancements in all athletes.

The absence of significant PAP effects may relate to insufficient loading intensity, lack of individual optimization, or interference from fatigue, as noted by Seitz et al. (13).

Although none of the post hoc comparisons were statistically significant, the effect size and direction of change suggest a possible trend in agility enhancement following the protocol. As shown by Markovic et al. (10) and Bobbert & van Ingen Schenau (2), the efficiency and coordination in vertical force production are important predictors of explosive athletic performance, including agility. However, it appears that in this study, the PAP protocols employed (e.g., various Smith Split Squat variations) may not have elicited sufficient neuromuscular stimulation to generate significant acute agility improvements, as also discussed by Seitz & Haff (14).

Additionally, the relationship between countermovement jump (CMJ) parameters and agility performance showed moderate correlations, suggesting a shared neuromuscular foundation. Previous research by Cormie et al. (4) and Meylan et al. (11) supports this relationship, indicating that the neuromechanical qualities underlying vertical jump also contribute to change-of-direction capabilities. However, due to the specificity of fencing movements and the unique nature of agility in this sport, transfer from vertical jump-based potentiation to fencing-specific agility may be limited.

Our findings regarding the relationships between vertical jump parameters and agility performance align with and extend existing literature, highlighting the complex interplay of various physical qualities in athletic movements. Cormie et al. (4)'s investigation into the countermovement jump (CMJ) demonstrated that training status not only influences peak performance variables but also significantly impacts the entire force-, power-, and velocity-time curves of the jump. Their work underscores that adaptations to training are multifaceted, affecting various phases of explosive movements. In our study, observed correlations between jump variables (e.g., SJ Power, DJ Height Max) and agility parameters suggest that similar underlying force and power production capacities, which are adaptable through training as shown by Cormie et al. (4), contribute to effective agility performance. Furthermore, the findings of Meylan et al. (11), who examined the reliability and interrelationships of unilateral jumps and their ability to predict sprint and change-of-direction (COD) performance, provide valuable context . Their study indicated that various single-leg jump assessments are relatively independent and represent distinct strength/power qualities, with limited predictive ability for sprint and COD. While our study examined bilateral and control agility, Meylan et al.'s (11) observations regarding the specificity of jump types and their modest predictive power for COD reinforce the notion that agility is a complex, multi-component ability. Our correlation analyses, therefore, offer insights into specific interdependencies between vertical jump metrics and agility, complementing prior research by shedding light on these relationships within an elite fencing population.

In terms of methodology, this study applied the 4-2-2-4 agility test, which evaluates directional change and acceleration-deceleration ability—qualities central to fencing performance, as highlighted by Turner et al. (16). Despite the high relevance of the chosen test, the lack of significant contrasts between PAP conditions may reflect the need for more individualized or sport-specific PAP interventions.

Practical applications

The findings of this study suggest that while PAP protocols may induce slight improvements in agility performance over time, these effects are not uniformly significant across all athletes or conditioning modalities. Therefore, strength and conditioning coaches working with elite fencers should apply PAP strategies selectively and monitor individual responses closely.

Given the absence of robust differences between PAP conditions, coaches may consider integrating jump-based assessments, such as CMJ metrics, into training diagnostics to better understand an athlete's readiness and responsiveness to potentiation stimuli. Additionally, the timing and intensity of PAP protocols should be carefully calibrated, possibly through pre-testing or athlete profiling, to ensure that the potentiation effect aligns with competition demands. Practitioners may consider unilateral split squat protocols at 80% 1RM with 3–7 minutes rest before agility drills to explore possible potentiation effects.

Finally, practitioners are encouraged to focus on long-term development of power and reactive strength—qualities known to underpin both vertical jumping and agility—rather than relying solely on acute potentiation effects for performance enhancement.

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