The impact of cone drill training on reaction time and 60-meter sprint performance in youth sprinters

El impacto del entrenamiento con ejercicios de cono en el tiempo de reacción y el rendimiento en el sprint de 60 metros en velocistas jóvenes

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Abstract

Introduction: Reaction speed and maximum sprinting velocity are two essential determinants that influence the overall performance of athletes in athletics, particularly in the 100-meter event. Despite their importance, comprehensive and empirically validated training models designed specifically to enhance reaction speed and top-end sprint velocity remain insufficiently explored in current sports science literature. Therefore, identifying and examining structured training methods that effectively target these components is crucial for optimizing competitive sprint performance.
Objective**:** This study aims to investigate and verify the impact of Cone Drill training on reaction speed and maximum sprint velocity in youth athletes specializing in the 100-meter sprint, with a particular focus on performance improvements measured through the 60-meter sprint test.
Methodology**:** The study involved 16 youth sprinters aged 15–17 years who participated in a structured 6-week Cone Drill training intervention. Performance data were obtained through the 60-meter sprint test to assess maximum sprinting velocity, while reaction speed was measured using a whole-body auditory and visual reaction assessment conducted both before and after the training period. A parametric paired-sample t-test was used to evaluate within-group differences, and an independent-sample t-test was employed to examine between-group differences, with the level of significance set at 5%.
Results: Findings revealed significant improvements in 60-meter sprint performance and reaction speed after six weeks of training ($p \le 0.001$). Additionally, comparative analysis between groups indicated meaningful increases in both reaction speed and 60-meter sprint outcomes in the experimental group compared with the control group ($p \le 0.05$).
Conclusions: The results demonstrate that Cone Drill training produces a substantial positive influence on enhancing reaction speed and 60-meter sprint performance in youth sprinters. These outcomes suggest that Cone Drill–based agility training should be considered a viable and effective component within the preparation and implementation phases of training programs for developing 100-meter sprint athletes.

Keywords

Athletics; 60-meter sprint test; physical performance components; reaction speed; agility-based training model.

Resumen

Introducción: La velocidad de reacción y la velocidad máxima se consideran factores determinantes del rendimiento deportivo, particularmente en las pruebas de velocidad como los 100 metros planos. No obstante, los programas de entrenamiento orientados al desarrollo simultáneo de ambos componentes aún presentan limitaciones dentro de la literatura científica, lo que pone de manifiesto la necesidad de realizar investigaciones que permitan identificar estrategias de preparación más eficaces para la optimización del rendimiento atlético..
Objetivo: El presente estudio tuvo como propósito analizar la influencia del entrenamiento basado en el *Five Cone Drill* sobre la velocidad de reacción y la velocidad máxima en atletas juveniles especializados en pruebas de velocidad, empleando la prueba de sprint de 60 metros como principal indicador de evaluación del rendimiento.
Metodología: Participaron 16 atletas jóvenes velocistas de entre 15 y 17 años, quienes realizaron un programa de entrenamiento con el taladro de 5 conos *I of Pain* durante 6 semanas. La velocidad máxima se midió mediante una prueba de sprint de 60 metros, mientras que la velocidad de reacción se evaluó mediante pruebas auditivas y visuales de cuerpo completo antes y después de la intervención. Para el análisis estadístico se aplicaron la prueba t de muestras pareadas y la prueba t de muestras independientes, con un nivel de significancia del 5%.
Resultados: Los análisis realizados evidenciaron mejoras estadísticamente significativas en la velocidad de reacción y en el rendimiento del sprint de 60 metros tras el periodo de intervención ($p \le 0{,}001$). Asimismo, el grupo experimental presentó incrementos superiores en comparación con el grupo control ($p \le 0{,}05$), lo que confirma el efecto positivo del programa de entrenamiento aplicado.
Conclusiones: Los resultados indican que el entrenamiento *I of Pain 5 Cone Drill* tiene un impacto favorable en el aumento de la velocidad de reacción y del rendimiento en el sprint de 60 metros, consolidándose como un método eficaz que puede incorporarse a los programas de preparación de atletas juveniles de 100 metros lisos.

Palabras clave

Atletismo; prueba de 60 metros; componentes físicos del rendimiento; velocidad de reacción; modelo de entrenamiento basado en agilidad.

Introduction

Action speed and maximum sprint velocity are two fundamental components that strongly influence athletic performance, particularly in sprint events such as the 100-meter discipline (Haugen et al., 2019). Sprinting is commonly defined as a running activity in which athletes perform at near-maximal velocity throughout the race distance (Bushnell et al., 2007). During sprint locomotion, both feet frequently enter a flight phase, meaning that the athlete's center of mass is momentarily suspended without ground contact (McDermott et al., 2017). The 100-meter sprint not only assesses how rapidly an athlete can run, but also evaluates their ability to respond efficiently to an initial external stimulus—most commonly the starting gun—as well as their capacity to generate rapid acceleration, sustain maximal velocity, and effectively manage the inevitable phase of deceleration within a relatively short time frame (Tønnessen et al., 2013). Broadly, this sprint event consists of three primary phases: block start and acceleration, maximum-speed maintenance, and deceleration prior to the finish line (Healy et al., 2022). During the acceleration phase, athletes must rapidly transition from a stationary position to high velocity. In the maximum-speed phase, the objective is to maintain peak velocity for as long as possible, whereas in the deceleration phase, athletes must efficiently control the gradual reduction in speed. The ability to effectively manage these phases is widely recognized as a decisive determinant of overall sprint performance (Nagahara et al., 2014).

Reaction speed refers to the time required for an athlete to respond to an external cue, such as an auditory starting signal, and represents a performance factor of critical importance in all sprint events (Tønnessen et al., 2013). Even minimal delays, often measured in milliseconds, can substantially influence competitive outcomes, particularly at elite levels of performance. A delayed reaction negatively affects the acceleration phase and is often extremely difficult to compensate for during the subsequent stages of the race. In contrast, maximum sprint speed reflects an athlete's ability to attain and maintain high running velocities, which depends on an optimal interaction of muscular power, neuromuscular coordination, biomechanical efficiency, and technical execution (Tam & Yao, 2024). Both reaction speed and maximal velocity are considered highly adaptable physical qualities that can be enhanced through appropriately structured training programs, which continue to evolve alongside advances in sports science and performance technology (Neviantoko et al., 2020). As emphasized by Maksum and Indahwati (2023), athletic achievement results from the integration of multiple interacting components, among which the design and application of effective training methods play a central role. Contemporary sprint-training approaches therefore extend beyond traditional strength or endurance development and increasingly incorporate agility, coordination, and neuromotor-focused drills to improve overall performance capacity (Neviantoko et al., 2020).

Among agility-based training methods receiving increasing attention is the Five Cone Drill (5CD), an exercise specifically designed to enhance acceleration, deceleration, directional speed, and rapid changes of movement (Diputra et al., 2015). Although its direct application within sprint-specific training has not been extensively documented, the drill involves repetitive changes of direction around five strategically positioned cones, demanding high levels of agility, spatial awareness, coordination, and rapid neuromuscular responses. Existing evidence suggests that agility-oriented training may contribute to improvements in reaction speed and maximum running velocity through underlying neuromuscular adaptations. Previous research has indicated that agility-based training can enhance neuromuscular responsiveness, coordination, and sensorimotor integration, which may be particularly relevant for developing sprint performance in youth athletes.

The Five Cone Drill (5CD) may exert its effects through several neuromuscular mechanisms, including enhanced motor-cortex engagement and improved synchronization of muscle activation during complex movement tasks (Yeom et al., 2020). Furthermore, agility-based training may promote greater recruitment of type II muscle fibers, which are essential for explosive sprint actions, and enhance the efficiency of actin–myosin interactions that underlie high-velocity muscle contractions (Plotkin et al., 2021). Improvements in proprioceptive control may allow athletes to respond more effectively to rapid directional changes, while metabolic adaptations—such as increased glycolytic activity—may support greater short-duration power output during sprint performance (Yılmaz et al., 2024). Although these physiological adaptations are indirectly associated with reaction speed, further empirical research is required to establish direct effects on stimulus–response performance under both auditory and visual conditions.

Given the essential role of reaction speed and maximal sprint velocity in determining sprint performance, the identification of effective training strategies remains a priority in athletic development. The Five Cone Drill (5CD), as a training modality designed to optimize movement quality through combined neuromuscular and biomechanical adaptations, may offer substantial performance benefits. Although the drill does not explicitly target auditory or visual reaction stimuli, its emphasis on rapid directional changes, acceleration control, and sensorimotor integration suggests potential improvements in reaction-related performance. Complex agility exercises are known to stimulate rapid activation of the central nervous system and enhance neural transmission efficiency (Yeom et al., 2020). Previous studies have demonstrated that agility training can improve decision-making speed and proprioceptive responsiveness, both of which contribute to effective sprint starts (Lichtenstein et al., 2023).

Despite these theoretical advantages, empirical evidence examining the direct effects of agility-based drills, such as the Five Cone Drill, on reaction time and sprint performance remains limited, particularly in youth athletes who are still undergoing neuromuscular development. Therefore, the present study aims to investigate the effects of Five Cone Drill training on reaction time and 60-meter sprint performance in youth sprinters. It is hypothesized that this agility-based intervention will lead to significant improvements in both reaction speed and sprint performance compared with conventional sprint training methods. The findings are expected to contribute to the existing body of literature by providing empirical insight into the practical applications of agility-based training for enhancing sprint-specific performance in young athletes.

Method

Study design and participants

This study was conducted using a true-experimental research design with a pretest–posttest control group structure. A total of sixteen youth sprinter athletes voluntarily participated in the investigation. The inclusion criteria required participants to be between 15 and 17 years of age; to have a body mass index (BMI) ranging from 20 to 22 kg/m^2; to present normal systolic and diastolic blood pressure values (120–110/90–80 mmHg); a resting heart rate between 60 and 80 bpm; oxygen saturation levels between 96% and 100%; and a body temperature ranging from 36.1 to 37.0 °C. All participants were screened to ensure the absence of smoking habits, alcohol consumption, hypertension, diabetes, or any diagnosed medical conditions that could influence physiological or neuromuscular performance. In addition, none of the athletes were undergoing medication or therapeutic interventions that could affect performance outcomes.

Following the eligibility assessment, participants were randomly allocated into two groups using a simple randomization procedure generated by a computerized random sequence. The experimental group (n = 8) completed a structured Five Cone Drill (5CD) training intervention, while the control group (n = 8) continued with their standard sprint training program. Randomization and group allocation were performed by an independent research assistant who was not involved in subsequent data collection or statistical analysis, in order to minimize allocation bias.

All athletes completed a six-week training program, with training sessions conducted three times per week under the direct supervision of certified athletic coaches.

Protocol of Cone Drill training

The Cone Drill training protocol followed a clearly defined sequence of forward and backward movements combined with repeated changes of direction. Athletes started from the first cone and initially moved backward to the second cone positioned 5 meters away. They then sprinted forward to return to the first cone. Subsequently, athletes moved backward to the third cone located 10 meters from the starting point and sprinted forward again to the first cone. This forward–backward movement pattern continued with a forward sprint to the fourth cone placed 15 meters away, followed by a backward movement to the fifth cone positioned at a distance of 20 meters. The drill concluded with a maximal forward sprint back to the first cone.

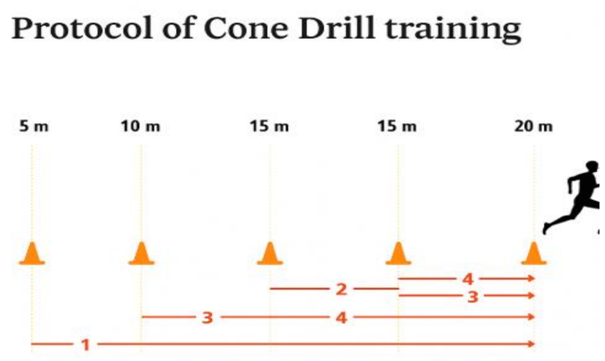
This protocol required athletes to repeatedly accelerate, decelerate, and change direction in a linear forward–backward manner ("go-and-return" pattern), thereby emphasizing neuromuscular control, coordination, and sprint-specific movement efficiency. Such directional changes were intentionally incorporated to simulate the acceleration–deceleration demands commonly observed during sprint performance.

The drill was performed for three sets of six repetitions per training session, with three-minute rest intervals between repetitions and an additional three-minute recovery period between sets. Training sessions were conducted three times per week over a six-week intervention period.

Training intensity was prescribed at a high level corresponding to near-maximal effort. Although maximal aerobic speed (MAS) was used as a general reference for controlling exercise intensity, the drill primarily targeted anaerobic sprint performance, emphasizing maximal acceleration and sprint velocity relevant to the 60-meter sprint test. Heart rate and rate of perceived exertion (RPE) were monitored throughout each session to ensure that athletes consistently performed the drill at the intended high-intensity level.

All athletes completed the same training protocol under direct supervision of certified coaches. Training adherence was recorded, and compliance of at least 90% of the prescribed sessions was required. A schematic representation of the Cone Drill training protocol, including cone placement and movement directions, is presented in Figure 1.

Figure 1. Protocol of the Five Cone Drill training.



The arrows indicate the movement sequence performed in a forward–backward ("go-and-return" or "yo-yo") pattern. Athletes sprint forward and retreat backward between cones positioned at increasing distances (5 m, 10 m, 15 m, and 20 m), emphasizing repeated acceleration, deceleration, and directional changes.

Control Group Activities

The control group continued with their routine sprint training program, which consisted of warm-up activities, fundamental technical sprint drills, and general conditioning exercises such as bodyweight strength training. This group did not receive any additional agility-based or cone-oriented training throughout the study duration. The purpose of this approach was to isolate and highlight the specific effects of the Five Cone Drill intervention by ensuring that only the experimental group received agility-focused stimulus during the training period.

Data collection

Data collection was carried out by assessing reaction speed through a whole-body reaction test, following the procedures described by Gavkare et al. (2013). The whole-body auditory and visual reaction test required the preparation of standardized equipment, including visual stimulus devices (such as LED lights or digital display screens) and auditory stimulus systems (such as loudspeakers or calibrated headphones), along with a digital stopwatch to record precise reaction times. Participants were thoroughly instructed to respond to each stimulus—either visual (light-based) or auditory (sound-based)—

as quickly as possible using full-body movement initiation. Reaction time was recorded from the exact moment the external stimulus was delivered until the participant initiated visible movement.

Meanwhile, maximum sprinting speed was evaluated using a 60-meter sprint test, which served as the primary performance indicator for maximal velocity in this study (adapted from Ferro et al., 2014; Putera et al., 2023). The 60-meter measurement was selected to provide a more comprehensive reflection of maximum sprint speed, as it allows athletes sufficient distance to reach and maintain near-peak velocity. This test was administered both before and after the six-week intervention.

Additionally, several anthropometric and physiological variables—including age, body mass, height, body mass index, systolic and diastolic blood pressure, resting heart rate, oxygen saturation, and body temperature—were measured prior to the intervention to ensure that all participants met the health and safety criteria for high-intensity sprint training.

Data analysis

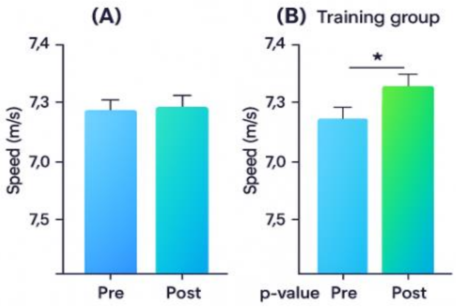
Effect size was calculated using Cohen's d, with interpretative criteria of small (0.2), medium (0.5), large (0.8), and very large (1.3), as described by Sullivan et al. (2012). Furthermore, an a priori power analysis was conducted using G*Power version 3.1 to ensure that the sample size provided adequate statistical power. The analysis assumed an independent-sample t-test design with two groups (n = 8 per group), targeting a large effect size (d = 0.80), a significance level of $\alpha = 0.05$, and a minimum statistical power of ≥ 0.80, confirming that the sample size was sufficient to detect meaningful differences. All statistical procedures adhered to a 5% significance level, and the results were expressed as mean ± standard deviation (SD).

Results

Data distribution was verified for normality using the Shapiro–Wilk test and for homogeneity using Levene's test. The results demonstrated statistically significant increases in maximum sprint speed and reaction speed following the six-week intervention ($p \leq 0.001$) (Figures 2–4). Specifically, the experimental group exhibited significant improvements in 60-meter sprint performance, indicating an enhanced ability to accelerate and maintain near-maximal velocity throughout the testing distance. Improvements in both auditory and visual reaction speed were also observed after the intervention, reflecting enhanced neuromuscular responsiveness and stimulus-processing efficiency.

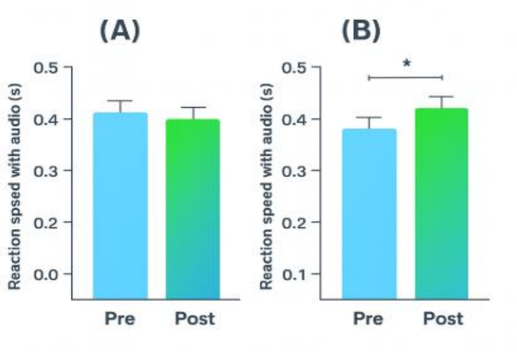
Additionally, statistically significant between-group differences were identified for both maximum sprint speed (60 m) and reaction speed ($p \leq 0.05$), with the experimental group outperforming the control group across all measured variables. These findings indicate that the Five Cone Drill intervention produced meaningful performance enhancements beyond those achieved through standard sprint training alone. Detailed results, including descriptive statistics, effect sizes, and corresponding p-values for each analyzed variable, are presented in Table 1.

Figure 2. The difference in speed between pre and post in each group



Description: (A) control group. (B) training group. p-value was obtained by paired sample t-test analysis. (*) Significant at pre ($p \leq 0.001$).

Figure 3. The difference in reaction speed with audio between pre and post in each group



Description: (A) control group. (B) training group. p-value was obtained by paired sample t-test analysis. (*) Significant at pre (p ≤ 0.001).

Table 1. Group (n = 8)

Variable	CG (Mean ± SD)	TG (Mean ± SD)	P value	Effect size
Pre-speed 60 m	7.18 ± 0.22	7.14 ± 0.19	0.431	0.355
Post-speed 60 m	7.17 ± 0.25	7.48 ± 0.20*	0.007*	1.082
Δ-speed 60 m	-0.01 ± 0.06	0.34 ± 0.06*	0.001*	4.891
Pre-reaction (audio)	0.326 ± 0.02	0.332 ± 0.01	0.772	0.601
Post-reaction (audio)	0.325 ± 0.02	0.310 ± 0.01	0.091	0.399
Δ-reaction (audio)	-0.001 ± 0.01	-0.022 ± 0.01*	0.001*	5.244
Pre-reaction (visual)	0.323 ± 0.02	0.315 ± 0.01	0.854	0.588
Post-reaction (visual)	0.322 ± 0.03	0.304 ± 0.01	0.402	0.471
Δ-reaction (visual)	0.000 ± 0.00	-0.011 ± 0.01*	0.002*	1.987

Notes:
- Effect size calculated using Cohen's d.
- P-value obtained by independent sample t-test.
- Data are presented as mean ± SD.
- (*) Significant improvement in the training group (TG) (p ≤ 0.001).

Discussion

The present study demonstrates that Five Cone Drill training contributed to significant improvements in both reaction speed and maximum sprint speed among youth sprinters. These findings indicate that agility-based training, which incorporates rapid changes of direction combined with repeated acceleration and deceleration phases, can positively influence sprint-specific performance outcomes. In particular, the observed improvements in 60-meter sprint performance suggest enhanced acceleration capacity and an improved ability to sustain near-maximal running velocity across short sprint distances, which are critical determinants of success in sprint events.

The improvements observed in auditory and visual reaction speed following the intervention further highlight the potential benefits of agility-based training on stimulus-processing efficiency and neuromuscular responsiveness. Reaction speed represents a key performance factor in sprinting, as even minimal delays in response to an external stimulus—such as the starting signal—can substantially affect overall race performance. Although reaction speed was directly measured in the present study, the neuromuscular and functional mechanisms underlying these improvements were not directly assessed. Therefore, explanations related to enhanced neural activation, improved motor-unit recruitment, and more efficient sensorimotor integration should be interpreted as theoretically grounded mechanisms supported by previous literature rather than as directly measured outcomes of the current investigation.

Previous studies have emphasized that repeated exposure to agility-based drills can enhance motor control, coordination, and movement efficiency, all of which play an essential role in sprint acceleration and velocity maintenance. During sprinting, athletes are required to generate high levels of force within extremely short ground-contact times, making neuromuscular coordination and rapid force production particularly important. Agility drills that emphasize rapid directional changes may improve an athlete's ability to rapidly reorganize motor patterns, contributing to more effective regulation of stride frequency and stride length during high-speed running. This interpretation aligns with earlier research suggesting that agility-oriented training enhances neuromuscular responsiveness and movement efficiency in both athletic and non-athletic populations.

The quantitative results of the present study further support these interpretations. The experimental group exhibited substantially greater improvements in both reaction speed and 60-meter sprint performance compared with the control group, which demonstrated only marginal changes over the same training period. These between-group differences indicate that the Five Cone Drill intervention produced meaningful performance enhancements beyond those achieved through conventional sprint training alone. Such findings suggest that agility-based training may serve as a valuable complementary strategy within sprint-training programs, particularly during developmental stages in youth athletes.

From a biomechanical perspective, improved acceleration and sprint performance may be attributed to more effective force application during ground contact and improved coordination among the lower-limb joints. Agility drills that involve frequent changes of direction and rapid deceleration–acceleration cycles may enhance an athlete's ability to control center-of-mass displacement and optimize force transmission throughout the sprinting action. Although these biomechanical factors were not directly measured in the present study, existing evidence indicates that improvements in movement efficiency and coordination are closely associated with enhanced sprint performance.

Despite these promising findings, several limitations should be acknowledged. First, the relatively small sample size and the inclusion of athletes from a single training center may limit the generalizability of the results. Second, neuromuscular and biomechanical variables—such as electromyographic activity, ground reaction forces, or joint kinematics—were not directly measured, restricting the ability to confirm the specific mechanisms underlying the observed performance improvements. Additionally, the six-week duration of the intervention may not fully capture long-term adaptations associated with agility-based training, and longer intervention periods could result in different or more pronounced effects.

Future research should therefore aim to include larger and more diverse samples, extend the duration of training interventions, and incorporate direct measures of neuromuscular and biomechanical function to better elucidate the mechanisms underlying performance adaptations. Comparative studies examining Five Cone Drill training alongside other agility-based or sprint-specific training modalities may also help clarify its relative effectiveness. Moreover, future investigations could explore the impact of agility-based training across different age groups and competitive levels to better understand its role in long-term athletic development.

In conclusion, the findings of the present study provide preliminary evidence supporting the effectiveness of Five Cone Drill training as a complementary approach for enhancing reaction speed and sprint performance in youth athletes. By targeting movement quality, coordination, and neuromuscular efficiency, agility-based training may offer practical benefits for sprint preparation and performance optimization, particularly during early stages of athletic development.

Conclusions

This study demonstrates that the Five Cone Drill training method leads to significant improvements in reaction speed and 60-meter sprint performance among youth sprinter athletes. These performance enhancements appear to be associated with movement patterns that involve rapid directional changes combined with acceleration and deceleration control. The findings suggest that agility-based training may offer additional benefits beyond conventional linear sprint training, particularly in terms of neuromuscular responsiveness, early-phase acceleration, and the ability to sustain high running velocity over short sprint distances.

From a practical perspective, the Five Cone Drill may be considered a valuable complementary component within sprint training programs aimed at improving reaction speed, initial explosiveness, and overall acceleration mechanics in developing sprinters. Nevertheless, future studies are encouraged to include larger and more diverse samples, extend the duration of training interventions, and incorporate psychological and environmental factors in order to gain a more comprehensive understanding of long-term training adaptations.

References

Bushnell, T., & Hunter, I. (2007). Differences in technique between sprinters and distance runners at equal and maximal speeds. *Sports Biomechanics, 6*(3), 261–268. https://doi.org/10.1080/14763140701489728

Diputra, R. (2015). The effect of three cone drill, four cone drill, and five cone drill exercises on agility and speed. *SPORTIF Journal: Journal of Learning Research, 1*(1), 41. https://doi.org/10.29407/js_unpgri.v1i1.574

Ferro, A., Villacieros, J., Floría, P., & Graupera, J. L. (2014). Analysis of speed performance in soccer by playing position and sport level using a laser system. *Journal of Human Kinetics, 44*, 143–153. https://doi.org/10.2478/hukin-2014-0120

Gavkare, A. M., Surdi, A. D., & Nanaware, N. (2013). Auditory reaction time, visual reaction time, and whole body reaction time in athletes. *Indian Medical Gazette, 147*(6), 214–219.

Haugen, T., Seiler, S., Sandbakk, Ø., & Tønnessen, E. (2019). The training and development of elite sprint performance: An integration of scientific and best practice literature. *Sports Medicine – Open, 5*(1), 44. https://doi.org/10.1186/s40798-019-0221-0

Healy, R., Kenny, I. C., & Harrison, A. J. (2022). Profiling elite male 100-m sprint performance: The role of maximum velocity and relative acceleration. *Journal of Sport and Health Science, 11*(1), 75–84. https://doi.org/10.1016/j.jshs.2019.10.002

Lee, Y. S., Lee, D., & Ahn, N. Y. (2024). SAQ training on sprint, change-of-direction speed, and agility in U-20 female football players. *PLOS ONE, 19*(3), e0299204. https://doi.org/10.1371/journal.pone.0299204

Lichtenstein, E., Held, S., Rappelt, L., Zacher, J., Eibl, A., Ludyga, S., Faude, O., & Donath, L. (2023). Agility training to integratively promote neuromuscular, cardiorespiratory, and cognitive function in healthy older adults: A one-year randomized controlled trial. *European Review of Aging and Physical Activity, 20*(1), 21. https://doi.org/10.1186/s11556-023-00331-6

Maksum, A., & Indahwati, N. (2023). Personality traits, environment, and career stages of top athletes: Evidence from outstanding badminton players of Indonesia. *Heliyon, 9*(3), e13779. https://doi.org/10.1016/j.heliyon.2023.e13779

Mongold, S. J., Georgiev, C., Legrand, T., & Bourguignon, M. (2024). Afferents to action: Cortical proprioceptive processing assessed with corticokinematic coherence specifically relates to gross motor skills. *eNeuro, 11*(1), ENEURO.0384-23.2023. https://doi.org/10.1523/ENEURO.0384-23.2023

Morat, M., Faude, O., Hanssen, H., Ludyga, S., Zacher, J., Eibl, A., Albracht, K., & Donath, L. (2020). Agility training to integratively promote neuromuscular, cognitive, cardiovascular, and psychosocial function in healthy older adults: A study protocol of a one-year randomized controlled trial. *International Journal of Environmental Research and Public Health, 17*(6), 1853. https://doi.org/10.3390/ijerph17061853

Morin, J.-B., Slawinski, J., Dorel, S., de Villarreal, E. S., Couturier, A., Samozino, P., Brughelli, M., & Rabita, G. (2015). Acceleration capability in elite sprinters and ground impulse: Push more, brake less. *Journal of Biomechanics, 48*(12), 3149–3154. https://doi.org/10.1016/j.jbiomech.2015.07.009

Nagahara, R., Matsubayashi, T., Matsuo, A., & Zushi, K. (2014). Kinematics of transition during human accelerated sprinting. *Biology Open, 3*(8), 689–699. https://doi.org/10.1242/bio.20148284

Neviantoko, G. Y., Mintarto, E., & Wiriawan, O. (2020). The effect of five cone snake drill, V-drill, and lateral two in the hole in-out shuffle exercises on agility and speed. *Multilateral Journal of Physical Education and Sports, 19*(2), 154. https://doi.org/10.20527/multilateral.v19i2.9039

Plotkin, D. L., Roberts, M. D., Haun, C. T., & Schoenfeld, B. J. (2021). Muscle fiber type transitions with exercise training: Shifting perspectives. *Sports, 9*(9), 127. https://doi.org/10.3390/sports9090127

Putera, S. H. P., Setijono, H., Wiriawan, O., Nurhasan, Muhammad, H. N., Hariyanto, A., Sholikhah, A. M., & Pranoto, A. (2023). Positive effects of plyometric training on increasing speed, strength, and limb muscle power in adolescent males. *Physical Education Theory and Methodology, 23*(1), 42–48. https://doi.org/10.17309/tmfv.2023.1.06

Skelly, L. E., Gillen, J. B., Frankish, B. P., MacInnis, M. J., Godkin, F. E., Tarnopolsky, M. A., Murphy, R. M., & Gibala, M. J. (2021). Human skeletal muscle fiber type-specific responses to sprint interval and moderate-intensity continuous exercise: Acute and training-induced changes. *Journal of Applied Physiology, 130*(4), 1001–1014. https://doi.org/10.1152/japplphysiol.00862.2020

Sullivan, G. M., & Feinn, R. (2012). Using effect size—or why the p value is not enough. *Journal of Graduate Medical Education, 4*(3), 279–282. https://doi.org/10.4300/JGME-D-12-00156.1

Suyoko, A., Triardhana, Y. A., Wahyu, T., Seputra, A., & Susilo, E. A. (2022). Monitoring the physical condition of Shorinji Kempo athletes. *Bravo's Jurnal Program Studi Pendidikan Jasmani dan Kesehatan, 10*(4), 333. https://doi.org/10.32682/bravos.v10i4/2820

Tam, C. K., & Yao, Z. F. (2024). Advancing 100 m sprint performance prediction: A machine learning approach to velocity curve modeling and performance correlation. *PLOS ONE, 19*(5), e0303366. https://doi.org/10.1371/journal.pone.0303366

Tønnessen, E., Haugen, T., & Shalfawi, S. A. (2013). Reaction time aspects of elite sprinters in athletic world championships. *Journal of Strength and Conditioning Research, 27*(4), 885–892. https://doi.org/10.1519/JSC.0b013e31826520c3

Yeom, H. G., Kim, J. S., & Chung, C. K. (2020). Brain mechanisms in motor control during reaching movements: Transition of functional connectivity according to movement states. *Scientific Reports, 10*(1), 567. https://doi.org/10.1038/s41598-020-57489-7

Yılmaz, O., Soylu, Y., Erkmen, N., Kaplan, T., & Batalik, L. (2024). Effects of proprioceptive training on sports performance: A systematic review. *BMC Sports Science, Medicine & Rehabilitation, 6*(1), 149. https://doi.org/10.1186/s13102-024-00936-z.

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