**INTRODUCTION**

The term “priming exercise” has recently been introduced to describe a bout of low-volume exercise stimuli prescribed to improve performance for a subsequent activity (e.g., training or competition) within 1-48 hours of that stimulus. Studies have found improvements in different forms of strength expression (e.g., heavy maximal [Cook et al., 2013; Ekstrand et al., 2013; Fry et al., 1995] and fast [Gonzalez-Garcia et al., 2022, 2020; Harrison et al., 2021; Mason et al., 2016; Nishioka & Okada, 2023, 2022; Tsoukos et al., 2017] dynamic strength) and maximal running ability (Cook et al., 2013; Nutt et al., 2022; Russell et al., 2016) within this time frame following various exercise stimuli. Among other methods (resistance exercise [Fry et al., 1995; Gonzalez-Garcia et al., 2020; Tsoukos et al., 2017], plyometrics [de Villarreal et al., 2007], and task-specific activities [McGowan et al., 2017; Nutt et al., 2022]), sprinting tasks have been shown to improve some performance outcomes subsequently. However, most investigations involving these activities have used repeated-sprint exercise stimuli (Cook et al., 2013; Girard et al., 2011; Nutt et al., 2022; Russell et al., 2016), potentially inducing substantial residual fatigue (Bishop et al., 2004; Jimenez-Reyes et al., 2019; Keane et al., 2015), which may be less than optimal for a priming response to occur. Less researched are maximal sprint stimuli involving bouts of unpaced running over a short duration (≤ 10 sec), where speed can be maintained until the end of the effort, separated by sufficient time, allowing for full recovery (Girard et al., 2011; Kotula et al., 2023; Ross et al., 2001). Recent findings suggest that these stimuli are currently applied pre-competition in elite sporting environments (Harrison et al., 2020; Holmberg et al., 2023). An improved understanding of the effects of sprint priming may be particularly beneficial for practitioners to determine whether these strategies can elicit a performance-enhancing effect.

Activities involving high forces and rapid angular velocities through large ranges of motion have generally been shown to result in muscle damage (Chapman et al., 2006; Nosaka et al., 2001; Soares et al., 2015). As such, there is a heightened possibility of impaired muscle function following sprint priming stimuli (particularly with higher total session volumes [Ross & Leveritt, 2001; Ross et al., 2001]). However, the muscle damage response generally peaks and is resolved between 24-48 hours and ~4 days, respectively, following intensive training (Damas et al., 2016). Thus, it may not affect the same-day priming response subsequent to sprint stimuli. However, the inflammatory response to muscle damage, not the muscle damage per se, may ultimately affect performance outcomes (Dousset et al., 2007; Johnston et al., 2015). As the inflammatory response is generally initiated between 2-6 hours post-exercise (Armstrong, 1990) and studies have reported increases in related markers (e.g., creatine kinase) within 2 and 24 hours following maximal sprint training (Johnston et al., 2015, 2016; Liakou et al., 2023), there is the potential for performance decreases within this time frame. Accordingly, studies have suggested a biphasic pattern of recovery following a maximal sprinting session (210-300 m), where performance outcomes are immediately depressed post-training, subsequently restored within 2 hours, and again diminished at 24 hours (Johnston et al., 2015, 2016; Liakou et al., 2023). However, no studies have investigated performance responses past 2 hours and within the same day following a bout of maximal sprinting with lower total session volumes. Thus, it is unclear whether sprint stimuli involving methods emphasising the expression of top speed (Francis, 2008; Ross et al., 2001) may result in the heightened possibility of fatigue that could mask or delay any same-day priming response. As priming exercise is generally prescribed in the 8-hour pre-competition period (Harrison et al., 2020), this information may help practitioners appropriately apply these strategies.

Although same-day performance improvements have been found following priming exercise stimuli, studies have also reported considerable variation in responses after these activities (Ekstrand et al., 2013; Fry et al., 1995; Gonzalez-Garcia et al., 2022, 2020, 2023; Gonzalez-Badillo et al., 2016; Harrison et al., 2021, 2023a, 2023b; Rud et al., 2021). Evidence suggests that differences in strength levels may partly explain the conflicting results (Gonzalez-Garcia et al., 2022, 2023; Holmberg et al., 2022). However, studies investigating the association between strength expression and priming responses have generally included this inquiry tangentially, supplementing research aims primarily concerned with the effects of resistance exercise stimuli on the ability to express strength in a single action (e.g., countermovement jump [CMJ]) (Gonzalez-Garcia et al., 2022, 2023). Accordingly, no studies have investigated the influence of strength qualities on performance outcomes following sprint stimuli completed on the same day. Recent findings have highlighted practitioners’ perceptions about the importance of athletes achieving high strength levels before priming exercise is prescribed (Holmberg et al., 2023). Additionally, practitioners have previously suggested that the methods generally utilised in priming investigations do not align with sporting actions and that the measures used to assess priming responses are generally believed to have limited transfer to competition-specific performance indicators, diminishing the applicability of research findings to applied settings (Holmberg et al., 2023). Considering previous studies indicating that priming responses are improved in a movement-specific manner (Cook et al., 2013; de Villarreal et al., 2007; Nishioka & Okada, 2022; Nutt et al., 2022; Tsoukos et al., 2017) and given that sprinting speed is a critical success factor for most athletes (Haugen et al., 2014; Simperingham et al., 2016), research examining the effects of maximal sprinting stimuli on top speed, whilst investigating the influence of strength qualities on this performance outcome, may allow practitioners to make more informed decisions about whether sprint priming activities should be included in athletes’ training plans.

Depending on the relative amount of work performed, it is possible that potentiation and fatigue coexist for some time after a low-volume exercise session (Chiu et al., 2003; Rassier & MacIntosh, 2000) and that stronger individuals may be able to tolerate fatiguing exercise by eliciting a same-day priming response (Chiu et al., 2004; Holmberg et al., 2022). This hypothesis is supported by previous research indicating that stronger individuals demonstrate greater fatigue resistance as an adaptation to strength training (Deyhle et al., 2016; Gordon et al., 2012; Peake et al., 2017; Suchomel et al., 2016) and related findings showing that in participants with a more extensive history of strength training, performance measures were recovered to a greater degree 4-6 hours after a bout of dynamic resistance exercise (Chiu et al., 2004). The oxidative potential of MHC IIa muscle fibres may be important in restoring adenosine triphosphate within the same day following a priming session (Chiu et al., 2004; Green, 1986). As a higher percentage of these fibres strongly correlates with greater relative MHC IIa area, an indicator of the strength training history (Fry et al., 2003a, 2003b, 2003c; Tesch & Karlsson, 1985), the magnitude of potentiation or fatigue following priming exercise stimuli may be influenced by strength levels (Chiu & Barnes, 2003; Chiu et al., 2004; Holmberg et al., 2022). Accordingly, studies that have reported same-day performance improvements after a priming session included participants whose relative 1RM back squat was approximately double body weight (Cook et al., 2013; de Villarreal et al., 2007; Ekstrand et al., 2013; Fry et al., 1995). In contrast, weaker individuals (1RM back squat ≤ 1.60 x body mass [BM]) have generally demonstrated small changes in performance within 8 hours of a priming session (Gonzalez-Garcia et al., 2023; Gonzalez-Badillo et al., 2016; Harrison et al., 2021; Rud et al., 2021). Although studies investigating short-term responses following a bout of maximal sprinting have involved competitive athletes, these studies generally did not report participants’ strength levels (Johnston et al., 2015, 2016; Kotula et al., 2023; Liakou et al., 2023). Studies examining the mediating effects of strength qualities on same-day priming outcomes have also been limited to heavy maximal dynamic strength (i.e., 1RM back squat) (Gonzalez-Garcia et al., 2022, 2023). Yet, research has revealed that specific strength qualities exist (James et al., 2023; Young, 1999) and that performance in particular tasks is associated with different forms of strength expression (Comfort et al., 2019). Given that studies have found improvements in various strength qualities, allowing for the heightened expression of sporting actions in response to training (Aagaard et al., 2001, 2000, 2002; Andersen et al., 2006; Comfort et al., 2019) and considering the lack of investigations examining the degree to which strength levels influence sprint priming outcomes, subsequent findings may guide practitioners in identifying the athletes for whom these strategies may be most beneficial.

Accumulated fatigue resulting from increased workloads can diminish the expression of strength (Busso et al., 1994). As priming strategies are generally prescribed to improve competition performance and considering its apparent relationship with priming outcomes (Gonzalez-Garcia et al., 2022, 2023; Holmberg et al., 2022; Nishioka & Okada, 2023, 2022), attenuated strength expression due to condensed practice and game schedules (Miloski et al., 2016; Silva et al., 2011, 2014; Sporis et al., 2011; Walker et al., 2020, 2019), may be less than optimal for a beneficial response to occur. Notably, most investigations examining same-day responses following a bout of sprinting involving competitive athletes have occurred during the pre-season or in the middle of the regular season (Cook et al., 2013; Johnston et al., 2015, 2016; Liakou et al., 2023; Russell et al., 2016). As such, the summation of fatigue responses following substantial increases in training volume and intensity with reduced recovery periods during these time frames (Miloski et al., 2016; Silva et al., 2011, 2014; Walker et al., 2020, 2019) may have attenuated priming effects in these studies. However, no studies have examined whether changes in strength qualities associated with altered training parameters may influence subsequent priming responses. Per recent findings (Holmberg et al., 2023), information of this nature may be useful to practitioners when weighing the potential benefits of a sprint priming session against the possibility of heightened cumulative fatigue effects that may diminish sporting performance subsequently.

This study aimed to (a) compare changes in performance responses 6 hours following a bout of sprint priming during and after 9 weeks of periodised training involving resistance exercise and maximal sprinting activities and (b) to determine whether changes in strength qualities during and following the training intervention demonstrate an influence over same-day performance responses after a sprint priming session. As previous findings have suggested that greater strength levels are associated with heightened priming effects (Cook et al., 2013; de Villarreal et al., 2007; Ekstrand et al., 2013; Fry et al., 1995; Gonzalez-Garcia et al., 2023; Gonzalez-Badillo et al., 2016; Harrison et al., 2021; Rud et al., 2021), the researchers hypothesise that changes in strength qualities following the different training phases would influence performance responses subsequent to a sprint priming session completed on the same day.

**METHODS**

*Experimental Approach to the Problem*

A repeated measures design was used to compare changes in performance outcomes following a bout of sprint priming during and after 9 weeks of periodised training. After familiarisation, anthropometric, and two baseline testing sessions separated by 7 days, participants completed a sprint priming session with subsequent performance testing at 6 hours. Priming sessions and performance testing was completed at the same time of the day (± 1 hour) to account for diurnal variation (Drust et al., 2005). The training plan was periodised into four phases with three weekly sessions involving resistance exercise and maximal sprinting activities. Following the fifth and ninth week of training, strength qualities and same-day priming responses were re-assessed. During this time, there was no prescribed training activities. Testing sessions occurred 5-7 days post-training (Figure 1). Ethical approval was granted by an Institutional Research Ethics Committee, Approval number 6399.

**Figure 1**

*Training Activities*



*Participants*

Statistical software (G\*Power, Dusseldorf, Germany) was used to calculate the sample size based on the partial eta-squared reported by Russell et al. (2016) (η2 = 0.120). A priori power calculation for repeated measures analysis of variance (effect size = 0.36, *p* = 0.05, power = 0.80) resulted in a sample size of 16 participants. Twenty-one male competitive athletes (age: 20.48 [± 1.84] years, height: 177.09 [±7.87] cm, BM: 73.80 [± 8.20] kg, 1RM back squat strength: 106.19 [± 15.95] kg, 1.43 [± 0.21] kg BM-1, 1RM bench press strength: 77.38 [± 16.81] kg, 1.04 [± 0.20] kg BM-1, 20 m sprint time: 3.12 [± 0.13] seconds) provided written consent before participation. Inclusion criteria were individuals aged 18-24 years, elite or highly-trained athlete (i.e., professional and national- and international-level or collegiate [McKay et al., 2022]), currently performing ≥ 2 lower-body training sessions involving resistance exercise and maximal sprinting activities per week, and injury-free.

Participants were instructed not to perform any lower-body exercise in the 72 hours before each testing session and abstain from lower-body resistance exercise and maximal sprint training for the duration of the study. All permitted exercises was recorded in an activity diary and standardised across testing sessions. Participants also completed a 3-day nutritional intake diary before the initial testing session and were instructed to replicate their nutritional intake and timing for the remaining testing sessions.

*Strength Testing*

One-repetition maximum back squat and bench press tests were used to assess heavy maximal dynamic strength following previously described methods (Jimenez-Alonso et al., 2022; Suchomel et al., 2016). Participants performed 5, 5, 3, and 1 warm-up repetition(s) at 30%, 50%, 70%, and 90% of their self-determined 1RM, respectively. Two- and 4-minute rest periods separated the lighter (30% and 50% 1RM) and heavier (70% and 90% 1RM) warm-up sets, respectively. Participants then completed maximal attempts (separated by 5 minutes) with a ≥ 2.5 kg increase in weight until a failed repetition occurred. The primary investigator determined the loads. Up to four maximal attempts were allowed to establish participants’ 1RM. A depth in which participants’ hip crease was in line with the top of the knee musculature was required for a successful back squat repetition. Squatting depth was confirmed with 2-dimensional motion capture filmed 1 m to the right of participants at the height of 40 cm (Hudl Technique; Ubersense Inc, Chicago, IL). For the bench press, participants initiated the test by holding the barbell with a self-selected grip width and their elbows fully extended. From this position, they lowered the barbell in a controlled manner until touching the chest at the level of the sternum. The barbell was subsequently lifted until the elbows reached full extension. Participants were not allowed to bounce the barbell off their chests or raise the trunk off the bench. If these conditions were not met, the test was repeated following a 5-minute rest period.

*Experimental Activities*

Sprint performance was assessed by maximal 20 m straight-line sprint with 10 m split times. Infrared timing gates with 0.01-second accuracy (Brower Timing Systems, Utah, USA) were positioned at approximately hip height 90 cm above ground at 10 and 20 m. Participants assumed a split-stance crouch position (Cronin et al., 2007) 0.3 m behind tape affixed to the turf denoting the “starting line”. Upon taking their preferred starting stance (recorded during the familiarisation session), the motion start sensor was placed on a stable surface ~5 cm above ground and manually positioned ~18 cm from the lateral malleolus of the participant’s rear leg. After confirmation that the motion start sensor was in position, participants were instructed to begin each maximal trial at their ready. Timing of maximal sprints was initiated upon the movement of the rear foot and concluded upon completion of the specified distance. The accuracy of the motion start sensor was confirmed using 2-dimensional motion capture filmed 2.5 cm to the left or right of participants (depending on their starting leg) at a height of 40 cm (Hudl Technique; Ubersense Inc, Chicago, IL). Participants were instructed to sprint maximally through cones positioned at 22 m representing the “finish line”. Verbal encouragement was provided throughout each maximal sprint. The best trial (based on sprint time) was used to assess sprint performance (Moir et al., 2004). Acceptable test-retest reliability for maximal 20 m straight-line sprint with 10 m split times (CV = 4.18-4.58%, ICC = 0.90-0.97) obtained in our laboratory has previously been observed.

Before physical activity, each participant’s height and body mass was recorded. A standardised ~20 min warm-up involving jogging (5 minutes), static and dynamic stretching, and submaximal 20 m sprints (70%, 80%, 90% of maximal effort) was then performed. Participants completed sprint priming activities involving 3 x 20 m maximal sprints. As recommended, a 5-minute rest period separated all maximal sprint efforts (Francis, 2008). All sprinting activities were performed on outdoor field turf.

*Jump Testing*

Jump testing was performed on a portable, wireless, dual force plate system by Hawkin Dynamics (Hawkin Dynamics Inc., Westbrook, Maine, United States) that sampled at 1,000 Hz. Testing involved 3 x CMJ and 2 x maximal 10 rebound jump (10-5RJT) completed in a block randomised order to assess fast maximal dynamic and reactive strength, respectively. The CMJ and 10-5RJT were separated by a 1-minute rest period and 30 seconds and 1 minute separated the CMJ and 10-5RJT trials, respectively. Participants performed jumps with hands akimbo to negate arm swing. Before the participant stepped onto the platform, the force plates were zeroed. Participants were instructed to stand tall and as still as possible with their feet hip-width apart and equal distribution on both force cells. Once body weight was accurately determined, the force-time curve was visually inspected to make certain limited movement occurred during the weighing phase. For the CMJ trials, participants dropped to a self-selected depth before beginning the upward phase of the jump. Following a “*3-2-1-jump*” countdown, participants were instructed to “*jump as high and as fast as possible*”; verbal encouragement was provided to promote a maximal effort on each attempt. Initiation of the jump was identified as 30 ms before the instant when vertical force was reduced by a threshold equal to 5 times the standard deviation of body weight (calculated in the weighing phase) (Owen et al., 2014). A threshold of force equal to 5 times the standard deviation of flight force over a 300 ms portion of the flight phase was used to identify take-off and touchdown (McMahon et al., 2018). Time to take-off was calculated as the time between the onset of movement and take-off (Badby et al., 2022). The CMJ phases (i.e., unweighing, braking, and propulsive) were identified and defined as previously described (Merrigan et al., 2022). Hawkins Dynamics software (Hawkin Dynamics Inc., Westbrook, Maine, United States) was used to analyse and generate the CMJ variables (i.e., jump height [impulse-momentum], mean braking force, propulsion mean force, countermovement depth [onset of movement to the end of the braking phase], braking phase time, propulsion phase time).

Participants subsequently completed the 10-5RJT trials involving previously described methods (Comyns et al., 2019). To initiate each trial, participants performed a CMJ followed by 10 maximal rebound jumps. Participants were instructed to maximise jump height and minimise ground contact time (i.e., “*imagine the ground is a hot surface, jump as high as possible*” and “*imagine their leg is like a stiff spring rebounding off the ground*”) (Flanagan & Comyns, 2008; Lloyd et al., 2009). Reactive strength index (RSI) was calculated for each of the maximal rebound jumps by dividing the time taken to complete the flight phase by the total time taken from the initial contact to the instant of take-off (i.e., time to take-off). The average of the five best RSI scores with GCT less than 0.25 sec determined an overall RSI value for each trial (Harper et al., 2011). Hawkins Dynamics software (Hawkin Dynamics Inc., Westbrook, Maine, United States) generated RSI values. The trial with the best RSI score was used for statistical analysis.

*Isometric Squat Testing*

After a 20-minute break, participants completed an isometric squat (ISQ) test to assess maximal and explosive strength qualities. Participants performed the ISQ over the force platform and against a fixed standard barbell in a squat rack at mean hip and knee joint angles of 143.8±3.4° and 124.6±3.8° (measured with a handheld goniometer), respectively. Foot width was measured (recorded during the familiarisation session) and remained consistent between trials and testing sessions. Following a specific warm-up involving 3- and 5-second submaximal efforts at 50% and 75% of their perceived maximal effort, respectively, participants completed two 5-second maximal efforts separated by a 2-minute rest period. While standing on the dual force plate system, participants were prompted to prepare for each trial by applying “*steady tension against the bar*” to reduce slack in the body and minimise any countermovement. Pretension determined to be > 50 N above the participant’s system mass (body weight + bar mass) before initiation of the trial was not permitted (Comfort et al., 2019). Once a consistent force trace was observed, a countdown of “*3-2-1-push*” was provided with loud verbal encouragement. Participants were previously instructed to “*push their feet into the ground as fast and hard as possible*” for the duration of each trial. Additional trials were performed if maximal force during the trials was not within 250 N of each other (Comfort et al., 2019). The average of the trials (based on peak force) was used for statistical analysis. Hawkins Dynamics software (Hawkin Dynamics Inc., Westbrook, Maine, United States) was used to analyse and generate ISQ variables (i.e., peak force, net peak force, relative peak force, and force at 100, 150, and 200 ms).

*Training Program*

The training plan included three weekly ~1.5 h sessions over 9 weeks (Tables 1 and 2). Training bouts were ≥ 48 hours apart and included resistance training and maximal sprinting activities. All sessions were supervised by the primary investigator, who is a certified strength and conditioning specialist with the National Strength and Conditioning Association. The resistance training program involved four concentrated loading periods. The concentrated loads were sequenced to take advantage of residual training effects, stimulating adaptive responses in subsequent phases of training (Painter et al., 2012). The concentrated load shifted across training phases with an initial emphasis on strength-endurance followed by maximal and absolute strength and speed-strength subsequently (Minetti, 2002; Zamparo et al., 2002). Exercise prescription followed a long-term athletic development model involving procedural memory development strategies (i.e., chunking), promoting technical proficiency over the training phases (e.g., bent knee shrug 🡪 mid-thigh pull 🡪 power clean [mid-thigh] 🡪 power clean [high hang]) (DeWeese et al., 2016; Gerrig, 2014; Suchomel et al., 2015; Wagle et al., 2016). Exercises were selected related to the set/repetition structure to achieve the aims of each phase (Hornsby et al., 2013). Alterations in loading parameters were included in the weekly training plan to demonstrate heavy and light training days (Carroll et al., 2017). Although concentrated loads are indicated, a variety of loads were programmed to maximise force-generating capacity (Table 3) (Toji & Kaneko, 2004; Tricoli et al., 2005). Loading was assigned as a percentage of 1RM back squat (reverse lunge to reach through, Romanian deadlift, weightlifting derivatives) or bench press (bent over row, pull up) achieved during 1RM testing. Participants were instructed and encouraged to perform the exercises (including warm-up sets) with ballistic intent (i.e., a maximal effort to accelerate the load [Gruber et al., 2007]) (unless otherwise specified). A ≥ 3 min rest period separated resistance exercise sets. A standardised dynamic warm-up was completed at the start of each resistance training session.

Sprinting activities were programmed to support phase-specific aims following previously described strategies (DeWeese et al., 2016). Similar to the resistance training program, concentrated loads were sequenced to stimulate subsequent adaptive responses (DeWeese, Hornsby, et al., 2015). The first training phase emphasised acceleration ability before transitioning to maximal speed development (Table 4). Initial increases in the rate and length of the acceleration phase have been suggested to improve maximal running speed during later training phases (DeWeese, Sams, et al., 2015). Participants were instructed and encouraged to perform sprint repetitions with the intention to run maximally (unless otherwise specified). A ≥ 5 min rest period separated sprint efforts (Francis, 2008). A standardised static and dynamic warm-up (~20 minutes) was completed at the start of each sprint training session.

Statistical Analysis

Statistical analysis plays a very vital role in understanding the impact of training interventions and assessing differences in performance outcomes over time in different tests. Data was processed using R scripts. The distribution of each variable was identified using the Shapiro-Wilk normality test, and visual representations of the histogram were created. The countermovement jump, isometric force, training intervention, time points, and isometric squat tests were assessed to understand their relationship to pyloric exercises. The statistical analysis reveals the effect of the training interventions on performance, compared performance tests, and a correlation of the performance measures to understand whether the exercises and interventions affect the performance of an individual.

The descriptive statistics of the variables in the dataset are represented in the table below. The mean of age, weight, and weight is 20.14, 177. 09, and 74.04, with their standard deviation as 1.84,7088, and 8.14, respectively. The mean for isometric forces, isometric net peak force, isometric peak force, and isometric relative peak force is 2027.07, 3380.25, 45.89, with standard deviations as 528.42, 578.72, and 6.82, respectively. The countermovement jump height mean is 0.40 with a standard deviation of .08. The man for Concentric phase mean force and concentric phase time is 1642.45 and 0.23 with a standard deviation of 200.96 and 0.03, respectively. The mean braking force, braking phase time, and cm displacement are 1493.61, .14, and .29, with standard deviations of 235.09, .03, and .07, respectively. The relative strength index mean is 2.89 with a standard deviation of .37. The sprint time mean is 2.08 with a standard deviation of .77. The mean of isometric force is 2050.13 with a standard deviation of 370.85.

**Table 1**

*Descriptive statistics*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | Std. Deviation | Skewness | Range | Percentiles | | |
|  |  |  |  |  | 25 | 50 | 75 |
| age | 20.14 | 1.84 | 0.39 | 6.00 | 19.00 | 19.00 | 22.00 |
| height | 177.09 | 7.88 | 0.97 | 33.10 | 170.50 | 176.70 | 181.20 |
| weight | 74.04 | 8.14 | 0.46 | 33.86 | 68.27 | 74.16 | 79.63 |
| isonetpeakforce | 2027.07 | 528.42 | 0.58 | 2621.13 | 1705.84 | 1987.63 | 2329.91 |
| Isopeakforce | 3380.25 | 578.72 | 0.67 | 2756.00 | 2993.00 | 3307.50 | 3638.25 |
| isorelativepeakforce | 45.89 | 6.82 | 0.26 | 31.46 | 41.76 | 45.16 | 50.59 |
| CMJht | 0.40 | 0.08 | 1.22 | 0.36 | 0.34 | 0.38 | 0.42 |
| CONmeanforce | 1642.45 | 200.96 | -0.08 | 927.63 | 1506.71 | 1631.01 | 1809.42 |
| CONphasetime | 0.23 | 0.03 | -0.02 | 0.14 | 0.20 | 0.23 | 0.25 |
| meanbrakingforce | 1493.61 | 235.09 | 0.14 | 1128.51 | 1322.99 | 1489.61 | 1646.91 |
| brakingphasetime | 0.14 | 0.03 | 0.06 | 0.13 | 0.12 | 0.13 | 0.15 |
| CMdisplacement | -0.29 | 0.07 | -0.26 | 0.31 | -0.33 | -0.29 | -0.23 |
| RSI | 2.89 | 0.37 | -0.50 | 2.00 | 2.72 | 2.93 | 3.14 |
| sprint\_time | 2.08 | 0.77 | 0.46 | 2.34 | 1.30 | 1.84 | 3.05 |
| isoforce | 2050.13 | 370.85 | 0.47 | 2136.00 | 1795.75 | 2013.00 | 2264.00 |

Age =age, Ht=height, Wt = weight, Isonetpeakforce= isometric net peak force, Isopeakforce= isometric peak force, Isorelativepeakforce = isometric relative peak force, CMJht = countermovemnt jump heght, CONmeanforce = concentric phase mean force, CONphasetime = concentric phase time, Meanbrakingforce = mean braking force, Brakingphasetime = braking phase time, CMdisplacement = countermovement displacement, RSI = relative strength index, sprint\_time = sprint time, isoforce= isometric force

**Table 2**

*Effect of Training Intervention on Performance*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Factor | Source | SS | df | MS | F | p-value |
| Between-subjects (COND) | COND | 1,764,076 | 1 | 1,764,076 | 10.57 | 0.001 |
| Within-subjects (prevspost) | prevspost | 52,361 | 1 | 52,361 | 0.055 | 0.815 |
| Interaction (COND:prevspost) | COND:prevspost | 2,121 | 1 | 2,121 | 0.001 | 0.975 |
| Residuals | Within-subjects | 3,122,540,315 | 1470 | 2,123,497 |  |  |

COND= Training intervention, prevspost= time points

The repeated measures analysis of variance (ANOVA) was conducted to investigate the effect of plyometric training intervention on performance outcomes in the post-test, mid-test, and pre-test assessments. The main effects of the training intervention are time points and interaction effects. The main effect of the training intervention was significant, F(1,1470)=10.570, p=.001. The main effect of time points was insignificant, F(1,1470)=.055, p = .815. The interaction between time points and training intervention was also not significant, F(1, 1470) = .001, p = .975. Post hoc tests show significant performance outcome differences between the control and plyometric training groups.

**Table 3**

*Comparison of Performance Tests*

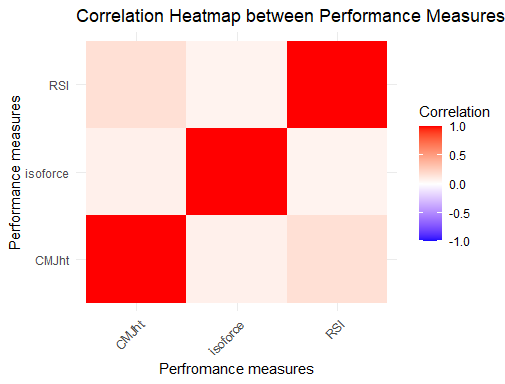
|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Effect | DFn | DFd | SSn | SSd | F | p | ges |
| Lower Body Power | Intercept | 1 | 20 | 6.609 | 0.248 | 533.547 | 0.000 | 0.964 |
|  | prevspost | 1 | 20 | 0.001 | 0.001 | 20.292 | 0.000 | 0.003 |
| Muscular Strength | Intercept | 1 | 20 | 176527400.710 | 1992845.600 | 1771.611 | 0.000 | 0.987 |
|  | prevspost | 1 | 20 | 17459.690 | 318254.700 | 1.097 | 0.307 | 0.007 |
| Sprint Performance | Intercept | 1 | 20 | 351.494 | 4.208 | 1670.723 | 0.000 | 0.988 |
|  | prevspost | 1 | 20 | 0.012 | 0.113 | 2.073 | 0.165 | 0.003 |

DFn = degree of freedom for the numerator, DFd= degrees of freedom for the numerator, SSn = sum of squares for the effects, SSd = sum of squares for the error, F = F value, p = P value, ges = generalized eta squared, prevspost= time points

The repeated measures analysis of variance (ANOVA) results show the results of performance outcomes for the lower body power like counter movement jump test, muscular strength like isometric squat test, and sprint performance measure at different time points. The lower body power indicates a statistically significant effect of time points on performance outcomes, F(1,20)= 20.292, p <.001. There are statistically significant differences in the performance outcomes across various time points. Muscular strength and Sprint performance results were not statistically significant in indicating performance outcomes across time points.

**Figure 1**

*Correlation between Performance Measures*



CMJht= countermovement jump height, isoforce= isometric force, RSI= relative strength index

The correlation matrix shows associations between countermovement jump height, isometric force, and relative strength index. Countermovement jump height shows a positive correlation, indicating a linear relationship between relative strength index and isometric force. Isometric force shows a weak positive correlation between countermovement jump height and relative strength index, thus indicating a weak linear relationship. In addition, the countermovement jump height shows a weak relationship with isometric force. This correlation heatmap shows a positive linear relationship between performance measures.

**Discussion**

The study investigated the effects of sprinting priming sessions on performance outcomes and influence changes in strength qualities during a periodized training intervention on the same day performance responses. The training intervention has a significant effect on the outcome of the training in relation to the performance. This is supported by other scholars who have proven improvements in strengths and running ability following exposure to different stimuli or treatments. The presence of the stimuli causes a positive change to the outcome of the strength, thus proving the need for organized stimuli to cause a positive performance. The correlation analysis showed associations between countermovement jump height, isometric, and relative index. Countermovement jump height shows a positive correlation, indicating a linear relationship between relative strength index and isometric force. Isometric force shows a weak positive correlation between countermovement jump height and relative strength index, thus indicating a weak linear relationship. In addition, the countermovement jump height shows a weak relationship with isometric force. This correlation heatmap shows a positive linear relationship between performance measures.

These findings are consistent with other research in understanding the effect of sprint priming exercises on same-day performance responses, highlighting the importance of strength levels in training. According to the findings, the strength qualities may influence the effectiveness of sprint priming sessions. Stronger individuals demonstrate great fatigue resistance and benefit more from the sessions. Some of the individuals who had priming exercises showed significant differences in their daily performance. Therefore, there is a need for the coaches to use priming exercises to improve the performance of the players.

The study's findings have implications to the coaches and general exercise practices involved in athletes' training and preparations. Trainers can have training sessions to optimize the athletes' performance by understanding how different training interventions have an effect on performance. In addition, the study emphasizes monitoring performance outcomes across various training interventions. This study provides valuable insights into the effects of sprint priming exercises on same-day performance responses and emphasizes the role of strength qualities in affecting the outcomes.

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