The Effect of Differing Potentiation Modalities on Acute Performance in Collegiate Athletes

Original Research

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Abstract

Introduction: The purpose of this study was to assess the impact of Reflexive Performance Resets (RPR) compared to a dynamic warm-up and contrast training on acute athletic performance.

Methods: Participants were athletes competing in the National Association of Intercollegiate Athletics (NAIA) collegiate athletes (male: 7, female: 2; average height: 180.64 ± 5.89 cm; average body mass: 76.29 ± 6.57 kg; age: 21.22 ± 1.71years; 1RM trap bar deadlift: 153.95 ± 28.35 kg; deadlift/body mass ratio: 2.02 ± 0.41). Participants in the study completed four different potentiation protocols: control (cycling), contrast training, dynamic warm-up, and RPR. The participants completed each protocol on separate days before performing a countermovement jump, which assessed mean peak displacement, acceleration, velocity, and power on a force plate, and a T-test assessed the change of direction performance.

Results: A repeated measures ANOVA and independent t-tests were used to assess interactions and main effects between the protocols. A significant main effect was found when comparing the dynamic warm-up and RPR protocols in mean peak displacement (Dynamic: 0.42 ± 0.05 m; RPR: 0.36 ± 0.06 m; $p = 0.001$; $d = 1.41$; 95% Cl [-0.66,0.76), velocity (Dynamic: 2.85 ± .17 m/s; RPR: 2.7 ± .19 m/s; $p = 0.003$; $d = 1.41$; 95% Cl [-0.03,0.33], and power (Dynamic: 4258 ± 541.4 w; RPR: 3964 ± 597.91 w; $p = 0.005$; $d = 1.41$; 95% Cl [-275.74,864.20]). There was also a significant main effect when comparing mean peak power between the dynamic warm-up and control protocols (Dynamic: 4258.24 ± 541.4 w; RPR: 4063.56 ± 474.41 w; $p = 0.04$; $d = 0.38$; 95% Cl [-314, 508.7]) There were no significant differences between the dynamic warm-up and RPR protocols in mean peak acceleration (Dynamic: 13.32 ± 2.4 m/s^2; RPR: 13.12 ± 3.28 m/s^2; $p = .310$ or mean peak T-test (Dynamic: 10.31 ± .78 s; RPR 10.1 ± .77 s; $p = .464$.

Conclusions: A dynamic warm-up was shown to be most effective for improving acute countermovement jump performance when compared to RPR, contrast training, and a control protocol

Key Words: Reflexive Performance Resets, Contrast Training, Dynamic Warm-up

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Introduction

The health and performance field is rapidly expanding as more athletes, coaches, and individuals seek the optimal modalities and products to improve their athletic performance and overall health [31]. Many sports, such as track and field, are decided by fractions of seconds, which, while not statistically significant, are the difference between winning and losing competitions. As a result, it is important to consider modalities and methods that could improve acute performance, impacting the outcomes of athletic and sporting events. There are potential training and exercise modalities that can improve acute and chronic performance, such as dynamic warm-ups. Dynamic warm-ups, a warm-up for physical activity that involves moving muscles and joints through complete ranges of motion actively and dynamically [3], may increase acute athletic performance due to activation and excitement of the neuromuscular system as a result of increased muscle and tendon mobility, blow flood to the musculoskeletal system, nerve impulse speeds, and temperature [6,13,19,22,33].

Another frequently used method to improve acute athletic performance is contrast training, where an individual performs a resistance training exercise at a high intensity followed by a similar plyometric exercise [32], such as a heavy back squat followed by a counter-movement jump. The resistance training exercise recruits additional motor units to meet the force demands, and once stimulated, those motor units can potentially lead to an improved force output when performing the vertical jump. Increased stimulation or potentiation could lead to improved performance in training or competition, which could play a significant role in athletic performance [7].

One alternative modality that could be implemented to potentially improve acute performance is known as Reflexive Performance Resets (RPR) [21]. Reflexive Performance Resets use breathing and tactile inputs in an attempt to improve neuromuscular function [21]. Other tactile modalities, such as acupuncture or acupressure, have been demonstrated to be effective in improving rectus abdominus strength, balance, jump height, and power [17,18,29]. Acupuncture and acupressure may impact fascia and nerve function, which could improve sympathetic and parasympathetic activity, but the exact mechanisms that lead to changes are debatable at this time [1,14,20]. Proponents of RPR suggest that the modality can improve performance and reduce injury risk due to neuromuscular activation, which may be similar to the modalities and mechanisms described above [21]. Reflexive Performance Resets are self-administered, meaning anyone can be taught how to use them, and they take minimal time and space, so they could be performed anywhere, which would be valuable for many athletes. Despite the claims noted above, research is scarce on RPR. The only published study on RPR at this time was conducted by Graham et al. [8] , and they reported no significant difference between RPR and passive range of motion (PROM) protocols. Reflexive Performance Resets may be an effective modality for improving acute athletic performance, but there is insufficient research at this time regarding its efficacy.

Acute athletic performance differences may ultimately decide what teams or individuals are successful in competition. Contrast training and dynamic warm-ups show potential for improving acute performance, but they require time, space, and equipment to implement [2,13,22]. When considering the limitations of these modalities and the potential ramifications of differences in acute athletic performance on the outcomes of competitions, there is a need for additional research on alternative modalities such as RPR. The purpose of this study was to assess the impact of RPR in comparison to a dynamic warm-up and contrast training on acute athletic performance.

Methods

Participants

The study's participants included nine NAIA student-athletes (male: 7, female: 2; average height: 180.64 ± 5.89 cm; average body mass: 76.29 ± 6.57 kg; age: 21.22 ± 1.71 years; 1RM trap bar deadlift: 153.95 ± 28.35 kg; deadlift/body mass ratio: 2.02 ± 0.41) at a small Midwestern university. A minimum of 1 year of training experience was required because potentiation protocols are likely more effective in trained individuals than in untrained [4,24]. Participants were asked to refrain from strenuous exercise during the study. The university's athletic training staff cleared all participants for full participation. Before the study began, Institutional Review Board (IRB) approval was received from the primary researcher's school of study and the small Midwestern institution where the study occurred. Testing procedures and potential risks were fully explained to participants before obtaining written informed consent.

Protocol

This study examined the impact of four different potentiation protocols on acute performance to determine if the potentiation protocols impacted acute countermovement jump and change of direction performance using a repeated measures design in which all participants completed each experimental protocol due to a small convenience sample of participants. The independent variables were a control, dynamic warm-up, contrast training, and RPR protocol. The dependent variables were acute acceleration-time, velocity-time, displacement-time, contact time, and power-time curves, which were measured by assessing countermovement jump on a Wireless 2-Axis Force Platform by PASCO, Roseville, CA (2023) and change of direction (COD) measured using the T-test through video time recording.

Three individuals conducted this study. The primary researcher was responsible for data analysis, and the two student research assistants were responsible for leading the potentiation protocols, ensuring the proper technique of each modality, and recording data. The study took place at the university's recreation center. Four groups completed each testing protocol at the same time each day to ensure consistency and a minimum 48-hour wash-out period to allow for optimal recovery between the protocols. Participants completed four potentiation protocols: a control (cycling), dynamic warm-up, contrast training, and RPR. After completing each protocol, participants completed three maximum countermovement jumps on the force platform. Three minutes later, they performed the T-test drill three times, separating each attempt by 3 minutes to allow full recovery. After completing three jumps and T-tests, the highest score was used to analyze and compare between protocols.

Initial testing took place at the university field house and consisted of collecting participants' height, body mass, age, and trap bar deadlift 1RM. The participants were randomly assigned to one of four different groups using a balanced Latin square. The balanced Latin square was chosen as it counterbalanced each group by having participants perform the potentiation protocols in a different order to minimize the potential for order effect that might occur as a result of repeated attempts at the counterjump and T-test. After collecting height, body mass, and age, participants were led through a dynamic warm-up by a student research assistant.

After completing the warm-up, the participants began trap bar deadlifting using self-selected loads and followed the recommendations provided by the National Strength and Conditioning Association (NSCA) [26]. A 1RM was determined when the participants could not complete the lift or technical failure occurred. A student researcher recorded all numbers on a printed Excel sheet and calculated the training load (85% of 1RM) for each individual to use during the contrast training protocol. All testing sessions were separated by a minimum of 48 hours to ensure full recovery [26]. Participants were also asked to abstain from strenuous exercise between testing sessions to minimize fatigue [26].

Once pre-testing was completed, participants were divided into four groups, with each group completing a different experimental protocol each day to minimize the order effect. Each participant arrived at their allotted time and completed the prescribed potentiation protocol, as described below. After completing the potentiation protocols, the participants completed three countermovement jumps on the force platform, which a student research assistant monitored. After resting for 3 minutes, participants completed three T-Tests, each separated by 3 minutes. Additional descriptions of the potentiation protocols and the instructions used can be found below.

Countermovement jump data were recorded using the PASCO, Roseville, CA (2023) Capstone Software and data were exported to Microsoft Excel. All jump data were then stored on a protected cloud storage system. The T-test times were initially recorded on a printed Excel sheet. Paper copies of all data and participant information were stored in a locked file cabinet in the primary researcher's office. The filing cabinet and office require separate keys to open. All paper data were electronically scanned and stored in a protected cloud-based storage device. The only individuals accessing the collected data will be the researchers and the dissertation committee.

Pretesting

On the first day, participants arrived and had their age, height, and body mass recorded on a paper Excel sheet by a student researcher. The participants then began their trap bar 1RM testing. The 1RM assessment protocol selected for this study is recommended by the NSCA [26]. A completed repetition required the participants to have full extension of the hips and knees at the top of the lift. Each participant used a Rackable Hex Trap Bar V3 (Titan Fitness, Memphis, TN, 2023) to ensure consistency of the start position on each attempt. Student researchers monitored the participants' technique and recorded the best attempt on a printed Excel sheet, which was used for statistical analysis.

Participants also went through familiarization sessions on how to perform RPR, countermovement jump, and T-tests to increase the likelihood of correct application. For RPR, the participants were shown a video of the primary researcher explaining and performing the modality according to the RPR Level 1 course. While watching the video, participants also practiced the modality with student research assistants there to answer questions. Afterwards, the research assistants demonstrated and explained how to perform the countermovement jump and T-test before allowing each participant three attempts at both.

Control
The control protocol consisted of 5 minutes of light cycling on an IC7 Indoor Cycle (LifeFitness, Franklin Park, IL, 2023) in the university's fieldhouse. Seat heights were adjusted so that each individual went through a range of motion where the angle of the thigh and hip was less than 90 degrees when the hip was flexed to ensure consistency. The handlebars were also adjusted to a position that helped the individual maintain a neutral spine while cycling. If they were not using the handles, they were instructed to maintain a neutral spine position while sitting up.

Contrast Training
Participants began this protocol with warm-up sets on the trap bar deadlift. Each set was separated by 3 minutes of rest to minimize fatigue. The first warm-up set had five repetitions at 50% of the participants' 1RM. After resting, the participants completed a set of three repetitions at 70% of their 1RM. One final warm-up set of one repetition at 80% was completed before the contrast training protocol began. Participants completed three sets of three repetitions at 85% of their 1RM, with each set being separated by 3 minutes. A load of 85% of 1RM was chosen as previous studies have reported intensities of 40-90% of individuals' 1RM to be beneficial [2,4,5,15,24,32]. The participants were instructed to complete each repetition with maximum intensity and speed.

Dynamic Warm-up
The participants started on the baseline of one of the basketball courts in the university's fieldhouse, where a student research assistant led through the dynamic warm-up. The dynamic warm-up began with lighter aerobic exercises in multiple planes of movement and finished with higher-intensity sprinting and jumping exercises. Participants were instructed to jump and sprint with maximal intensity as the warm-up progressed and reached the higher intensity movements.

RPR
Participants followed a pre-recorded video leading them through the RPR protocol provided in the Level 1 course. In the video, the primary researcher led the participants through the RPR drills, which consisted of diaphragmatic breathing pressing on different RPR reset locations across the body. According to the RPR website [21], anyone can perform RPR, and individuals can use the modality without understanding of anatomy. Based on this description, the participants were able to perform the modality on themselves with instruction. The student research assistants were present to answer any questions that participants might have had.

Countermovement Jump Assessment
After completing the prescribed potentiation protocol and resting for a self-selected time of 3 minutes, the participants completed three countermovement jumps. All testing was performed on a force plate (Wireless 2-Axis Force Platform, PASCO, Roseville, CA, 2023). Data were collected using the PASCO Capstone Software (Roseville, CA, 2023) on a Macbook desktop. The force plate used Bluetooth to transmit data from the force plate to the computer. Custom programs designed using Microsoft Excel were used for data analysis. The participants were instructed to stand in the middle of the force plate with their feet shoulder-width apart and hands on their hips. They were then told to jump as high as possible while keeping their ankles, legs, and hips extended in the air before landing back on the force plate. Foot placement measurements were recorded to ensure similarity in jump technique between attempts for each participant. The force plate recorded data on maximal force-time, velocity-time, displacement-time, contact-time, and power-time curves on each countermovement jump. Intraclass coefficients were used to assess the reliability of the attempts.

T-test
Participants rested for 3 minutes between the countermovement jump and the T-test assessment. The T-test was based on the protocol by Semenick, D [25]. An iPad was placed on the side of the cones to record each attempt with the Slowmo application. Participants were instructed to begin the test on command. They then sprinted to cone B and touched it with their hand, shuffled 5 yards to the left, and touched cone C with their left hand. They then shuffled 10 yards to the right and touched cone D with their right hand before shuffling left to cone B and touching it with their left hand. The participants then backpedaled to cone A and the final time was recorded based on when they passed the cone. The athletes completed three attempts, each separated by 3 minutes, and the fastest attempt was recorded.

Statistical Analysis
Data were analyzed using SPSS 29.0.0.0, IBM, Armonk, NY. Descriptive statistics consisted of analyzing measures of central tendency (mean, median, mode) and variability (variance, standard deviation, range). A repeated measures

analysis of variance (ANOVA) and independent t-tests were used for inferential statistics to assess differences in acute velocity-time, displacement-time, acceleration-time, power-time curves, and COD between the potentiation protocols. The alpha value was set at 0.05 and the confidence interval was at 95%. Cohen's *d* was used to analyze effect size.

Results

Dynamic Warm-up and RPR

When comparing a dynamic warm-up to RPR, there were significant differences in mean peak displacement, power, and velocity (Tables 1 and 3). There were no significant differences in mean peak acceleration (Tables 1 and 3).

Dynamic Warm-up and Contrast Training

There were also significant differences between the dynamic warm-up and contrast training protocol in mean peak displacement, power, and velocity (Tables 1 and 3). There were no differences in mean peak acceleration and T-test times (Tables 1 and 3).

Dynamic Warm-up and Control

There was also a significant difference between mean peak power between the dynamic and control protocol. There were no significant differences between mean peak acceleration, velocity, displacement, or T-test times between the dynamic warm-up and control protocols (Tables 1 and 3).

Control and RPR

The control protocol led to significant differences in mean peak displacement and velocity when compared to the RPR protocol (Tables 1 and 2). There were no significant differences in mean peak power), acceleration, or T-test times (Tables 1 and 2).

Table 1. Dynamic warm-up comparisons.

Performance Markers	Dynamic	RPR	Significance	Cohen's *d*
Peak Acceleration (m/s^2)	13.32 ± 2.4	13.12 ± 3.28	p = .310	0.07
Peak Displacement (m)	0.42 ± .05	0.36 ± .06	p = .001	1.08
Peak Power (w)	4258.2 ± 541.4	3964.0 ± 597.9	p = .005	0.52
Peak Velocity (m/s)	2.85 ± .17	2.7 ± .19	p = .003	0.83
Peak T-test (s)	10.31 ± .78	10.31 ± .77	p = .464	0.1
Performance Markers	**Dynamic**	**Contrast**	**Significance**	**Cohen's *d***
Peak Acceleration (m/s^2)	13.32 ± 2.4	12.99 ± .15	p = .150	0.24
Peak Displacement (m)	0.42 ± .05	0.39 ± .05	p = .040	0.6
Peak Power (w)	4258.2 ± 541.4	3977.8 ± 419.3	p = .007	0.58
Peak Velocity (m/s)	2.85 ± .17	2.74 ± .22	p = .050	0.56
Peak T-test (s)	10.31 ± .78	10.25 ± .73	p = .320	0.08
Performance Markers	**Dynamic**	**Control**	**Significance**	**Cohen's *d***
Peak Acceleration (m/s^2)	13.32 ± 2.4	12.98 ± 2.8	p = .170	0.13
Peak Displacement (m)	0.42 ± .05	0.401 ± .045	p = .070	0.4
Peak Power (w)	4258.2 ± 541.4	4063.6 ± 474.4	p = .040	0.38
Peak Velocity (m/s)	2.85 ± .17	2.80 ± .15	p = .070	0.25
Peak T-test (s)	10.31 ± .78	10.37 ± .63	p = .310	0.08

Data are means ± SD

Table 2. Reflexive performance resets (RPR) comparisons.

Performance Markers	Control	RPR	Significance	Cohen's *d*
Peak Acceleration (m/s²)	12.98 ± 2.8	13.12 ± 3.28	p = .786	0.05
Peak Displacement (m)	0.401 ± .045	0.36 ± .06	p = .008	-0.77
Peak Power (w)	4063.6 ± 474.4	3964 ± 597.9	p = .100	-0.18
Peak Velocity (m/s)	2.80 ± .15	2.70 ± .19	p = .013	-0.58
Peak T-Test (s)	10.37 ± .63	10.31 ± .77	p = .284	-0.07
Performance Markers	**Contrast**	**RPR**	**Significance**	**Cohen's *d***
Peak Acceleration (m/s²)	12.99 ± .15	13.12 ± 3.28	p = .310	-0.04
Peak Displacement (m)	0.39 ± .05	0.36 ± .06	p = .120	0.5
Peak Power (w)	3977.8 ± 419.3	3964 ± 597.9	p = .390	0.07
Peak Velocity (m/s)	2.74 ± .22	2.68 ± .195	p = .250	0.19
Peak T-test (s)	10.25 ± .73	10.31 ± .77	p = .344	-0.16
Performance Markers	**Dynamic**	**RPR**	**Significance**	**Cohen's *d***
Peak Acceleration (m/s²)	13.32 ± 2.4	13.12 ± 3.28	p = .310	0.07
Peak Displacement (m)	0.42 ± .05	0.36 ± .06	p = .001	1.08
Peak Power (w)	4258.24 ± 541.4	3964 ± 597.91	p = .005	0.52
Peak Velocity (m/s)	2.85 ± .17	2.7 ± .19	p = .003	0.83
Peak T-test (s)	10.31 ± .78	10.31 ± .77	p = .464	0.1

Data are means ± SD

Table 3. Effect size comparisons.

Magnitude	Effect Size (*d*)	Variable	Effect Size (*d*)
Trivial	0-0.2	Dynamic/RPR Mean Peak Displacement	1.08
		Dynamic/RPR Mean Peak Velocity	0.83
Small	0.2-0.6	Dynamic/RPR Mean Peak Power	0.52
		Dynamic/Control Mean Peak Power	0.38
Moderate	0.6-1.2	Dynamic/Contrast Mean Peak Power	0.58
		Dynamic/Contrast Mean Peak Velocity	0.56
Large	1.2-2.0	Dynamic/Contrast Mean Peak Displacement	0.6

Note. Effect size based on Hopkins Scale for Effect Size Magnitude (Flanagan, 2013).

Discussion

The purpose of this study was to assess the impact of RPR compared to a dynamic warm-up and contrast training on acute athletic performance. Based on the results of this study, there were significant acute differences in countermovement jump performance between the dynamic warm-up and RPR and contrast training protocols, with the dynamic warm-up significantly improving mean peak displacement, power, and velocity. The dynamic warm-up protocol also significantly increased mean peak power compared to the control group and mean peak displacement and velocity were trending towards a significant improvement. Dynamic warm-ups are effective in improving acute performance, especially when the warm-up is specific to the activity being tested [6,12,13,16]. Exercise and movement specificity appear important when using a dynamic warm-up to increase acute performance [6,26] and this study's warm-up incorporated high-intensity skipping and sprinting, which may explain the increase in mean peak displacement, power, and velocity. Acute performance might have been increased more if the warm-up included more specific exercises, such as box jumps or depth jumps. As described above, movement and task specificity appear to impact acute performance improvements, so choosing additional jumping exercises might lead to further improvements.

The dynamic warm-up protocol also led to improvements in countermovement jump performance compared to the control protocol, although mean peak power was the only significantly different variable. However, there was no significant difference in T-test times between any of the protocols, which could be explained in several ways. The warm-up did include sprinting and lateral movement, which is specific to the T-test. However, there was a significant amount of time between the dynamic warm-up protocol and the T-test due to participants having allocated rest times and performing countermovement jumps. Had the T-test been done first, perhaps the results might have been different. The principle of specificity might apply to the T-test as well. There were some lateral movements in the dynamic warm-up, but maybe not enough to potentiate performance.

Contrast training may improve acute athletic performance, but some authors have found otherwise [23,30]. Weber et al. [32] found increased acute vertical jump performance when using back squats at 85% of 1RM, while Bauer et al. [2] found that loads of 60-90% were also effective in improving countermovement jump performance. Smilos et al. [28] suggested that loads as low as 30% could increase countermovement jump performance, which is consistent with results reported in a meta-analysis by Cormier et al. [4]. Ideal rest times appear to be between 3-7 minutes for acute performance increases [5]. There are several possible explanations for why contrast training did not significantly improve acute performance in this study. Contrast training utilizes a PAP effect by increasing motor unit activation and recruitment, which may increase synchronization and force output [7]. However, if the volume and intensity are too high or the rest times too short, the participant may become fatigued, reducing the PAP effect. Acute performance improvements appear dependent upon balancing potentiation and fatigue as too much intensity or volume may cause fatigue and, therefore, a decrease in performance [4,5,32]. In this study, participants completed three sets of three repetitions at 85% of their 1RM, which is similar to other studies [2,4,5,15,24,32]. This study used 3 minutes of rest between the contrast training protocol and countermovement jump, but some individuals may do better with shorter or longer rest intervals. Many of the athletes who participated in the study were out of season, so perhaps their fitness levels needed to be higher to use such heavy loads without causing fatigue. A lower percentage of 1RM, fewer sets, or longer rest intervals might have been better for these individuals as it may have reduced the effect of fatigue on performance.

Regarding the T-test, contrast training had no significant impact. However, participants performed 0.15 seconds faster than the control and 0.06 seconds faster than the dynamic warm-up and control protocols, which is around a 1% difference. As discussed above, slight differences in performance can impact the outcomes of competitions, which is important to consider. The rest intervals could again explain a lack of significant improvement. After jumping, participants rested for 3 additional minutes before their first T-test attempt, followed by 3 minutes of rest between each attempt. Based on the recommendations of 3-7 minutes of rest presented by Dobbs et al. [5] for maximizing potentiation, the potentiation effect from contrast training may have dissipated by the time participants completed the T-test. However, there was still no significant effect on countermovement jump performance. In conjunction with this study, these findings stress the importance of finding the appropriate balance between potentiation and fatigue. This is likely based on the individual and context, aligning with general contrast training recommendations of using 30-90% of 1RM and 3-7 minutes of rest. Based on multiple factors, individuals likely need a different amount of intensity, volume, and rest to see improvements in acute performance.

Finally, RPR did not appear to affect acute athletic performance significantly. When compared to the other protocols, athletes in the RPR protocol performed significantly worse in some variables (mean peak displacement, velocity, and power) while showing no effect in the other. Acupuncture and acupressure can improve acute performance markers such as balance, jump height, speed, strength, and power [17,18,27,29]. These studies often required trained professionals to perform the modality used, which is why RPR was chosen for this study, as only some individuals have access to a trained acupuncture or acupressure specialist. Reflexive Performance Resets have grown in popularity and usage and can be done by anyone, not just a trained practitioner. These results are similar to the study done by Graham et al. [8], showing that RPR did not significantly impact acute back squat and bench press performance compared to a passive range of motion protocol in collegiate hockey players.

One potential explanation for why RPR did not improve acute performance in this study would be that the participants did it incorrectly. Each individual went through a familiarization session and was led through the modality in a prerecorded video, but perhaps more sessions were needed to ensure each individual understood the modality. For this study, it was not possible to do additional familiarization sessions due to how many sessions were already required of participants and to remove potential participant bias, but future studies should consider doing multiple sessions.

While this is one explanation, proponents of RPR [21] claim that exact accuracy in the application of the modality is unnecessary to see a positive impact on performance. If the modality was effective, it could be argued that participants should have seen improved performance in relation to the control. However, this study found that RPR negatively impacted performance compared to the control in some measurements.

Another explanation might be that RPR may not provide enough stimulus to see changes in acute performance metrics like speed and power. As discussed above, acute performance changes appear to be caused by balancing fatigue and potentiation. While contrast training and the dynamic warm-up may have caused too much fatigue, perhaps RPR did not generate enough stimulus. As discussed earlier, motor unit activation depends on the amount of force required [11]. As force requirements increase, more motor units are recruited [9]. Based on these principles, RPR may not provide enough stimulus to recruit enough motor units to impact acute performance variables like speed or power. However, this argument conflicts with the idea that RPR improves neuromuscular function. If neuromuscular function improved, then one could assume that performance would also improve.

There are several limitations in this study, one of which is the small sample size due to difficulty with recruiting. Multiple attempts were made to recruit additional participants, but the researchers had difficulty finding individuals willing to participate. While this sample is small, the results are consistent with previous research done by Graham et al. [8] that also found RPR did not seem to impact acute performance. This study also continues to add to the discussion on the modality, and future researchers should examine the impact of these modalities using larger samples as it may impact the results. Another limitation, which was mentioned above, was that the participants were in their off-season. Being too unconditioned for contrast training and the dynamic warm-up protocols may have made the protocols fatiguing rather than potentiating. Additional research should be done with athletes during different training and competition phases.

Another limitation was the lack of control over external factors such as sleep and nutrition. Participants may have been fatigued from work or lack of sleep the day before, which could impact their acute performance. Nutrition habits could significantly alter performance, which should be considered, particularly since some participants completed their protocols early in the morning. The athletes may not have followed the request to refrain from additional training, which could also impact acute performance.

Based on the results of this study, it appears that a dynamic warm-up can increase acute athletic performance, while RPR appears to have no beneficial effect. Coaches and athletes looking to improve acute performance should experiment with different dynamic warm-up exercises, durations, and intensities, as each individual will likely require slight variations based on training experience and fitness. Practitioners should also consider using contrast training, but again, each individual will likely respond differently to different exercises, volumes, and intensities. Based on previous studies, both dynamic warm-up and contrast training can be effective for improving acute performance metrics, but it is essential to try different volumes, durations, and intensities outside of competition as acute performance can be potentiated or decreased as a result of fatigue.

Conclusions

Based on the results of this study, it appears that dynamic warm-ups are effective for improving acute performance, as the dynamic warm-up outperformed the other protocols. A dynamic warm-up can be done with minimal time, space, and equipment. It is an option that individuals and athletes looking to improve acute performance could use as long as they manage intensity and volume. The results of this study also suggest that RPR may not be an effective modality for improving acute athletic performance. Scholars should continue to examine if there are acute changes in performance variables like speed and power or other factors such as range of motion. Additional research should also be done to assess if there are chronic changes using RPR.

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