Unilateral vs. Bilateral Squat Training for Strength, Sprints, and Agility in Academy Rugby Players

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Abstract

Speirs, DE, Bennett, MA, Finn, CV, and Turner, AP. Unilateral vs. bilateral squat training for strength, sprints, and agility in academy rugby players. *J Strength Cond Res* 30(2): 386–392, 2016—The purpose of this study was to investigate the effects of a 5-week lower-limb unilateral or bilateral strength program on measures of strength, sprinting, and change of direction speed. Eighteen academy rugby players (18.1 ± 0.5 years, 97.4 ± 11.3 kg, 183.7 ± 11.3 cm) were randomly assigned to either a unilateral (UNI) or bilateral (BI) group. The UNI group squatted exclusively with the rear elevated split squat (RESS), whereas the BI group trained only with the bilateral back squat (BS). Both groups trained at a relative percentage of the respective 1 repetition maximum (1RM) twice weekly over a 5-week period. Subjects were assessed at baseline and post-intervention for 1RM BS, 1RM RESS, 10-m sprint, 40-m sprint, and pro-agility. There was a significant main effect of time for 1RM BS ($F_{1,16} = 86.5$, $p < 0.001$), ES ($0.84 < \text{Cohen } d < 0.92$), 1RM RESS ($F_{1,16} = 133.0$, $p < 0.001$), ES ($0.89 < \text{Cohen } d < 0.94$), 40-m sprint ($F_{1,16} = 14.4$, $p = 0.002$), ES ($0.47 < \text{Cohen } d < 0.67$) and pro-agility ($F_{1,16} = 55.9$, $p < 0.001$), ES ($0.77 < \text{Cohen } d < 0.89$), but not 10-m sprints ($F_{1,16} = 2.69$, $p = 0.121$), ES ($0.14 < \text{Cohen } d < 0.38$). No significant interactions between group and time were observed for any of the dependent variables. This is the first study to suggest that BI and UNI training interventions may be equally efficacious in improving measures of lower-body strength, 40-m speed, and change of direction in academy level rugby players.

Key Words Single-leg, speed, change of direction, power

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Introduction

In recent years, the use of unilateral (UNI) exercises such as the lunge, step-up, split squat, and rear elevated split squat (RESS) have become popular in strength and conditioning practice (21). UNI exercises are regularly included within strength programs as assistance exercises to bilateral (BI) exercises such as the back squat (BS), typically implemented to increase volume load or provide variation. There are many examples of UNI exercises (31) being used in strength and conditioning programs; yet, there is little evidence of their efficacy with trained individuals.

Improvements in strength and power through the use of BI exercises such as the BS are well established (6,8), and are often selected as the primary exercise for this purpose. For example, 1 study reported significant improvements in 40-m running velocity, countermovement, and squat jump performance in junior level footballers after 8 weeks of twice-weekly BS (6). Similarly, Comfort et al. (8) reported concomitant improvements in BS strength and sprint performance over 5 and 10 m, following 8 weeks of resistance training in professional rugby league players. One study has also suggested that long-term strength training with the BS or front squat may improve change of direction performance in junior footballers (17).

The BS is performed with a 2-leg support, but many athletic skills such as sprinting, jumping, and changing direction are performed either unilaterally, or with weight transferred to 1 leg at a time. It could be speculated that UNI exercises are preferable in improving some aspects of physical performance compared with the BS because of greater specificity, which refers to the degree of similarity between training exercises and athletic performance. Specificity is an important principle in training program design, with both researchers and practitioners attempting to maximize transfer between training and competitive performance (33). It is also considered that greater similarities between training exercises and physical performance variables are more likely to maximize transfer effects (3). This idea is consistent with previous research, for example, 1 study found that 8 weeks of plyometric training including UNI exercises induced significant improvements to 10-m time (24). Furthermore, a 9-week sprint and plyometric program including both UNI and horizontal exercises improve sprint performance over 10 m significantly more than sprinting alone (11).

Practitioners often include UNI exercises as part of a comprehensive strength program based on this rationale; however, such a contention is purely speculative. Research to date investigating UNI training interventions on measures of strength and power demonstrate tenuous external validity, primarily because of the use of untrained individuals (22). For example, 1 study compared the effects of an 8-week RESS and BS protocol on several aspects of strength and power in untrained individuals and reported significant improvements in lower-limb strength with little difference between groups (22). Although it was suggested that UNI and BI training were equally effective in improving lower-body strength, practitioners should be cautious in applying these findings to trained populations. Previous studies investigating the acute responses to UNI exercises in trained individuals suggest comparable muscle activity and hormonal fluctuations between BI and UNI exercises (16), reduced torso angle, and greater activation of the gluteus medius (23) in UNI compared with BI exercises; however, the practical implications of these findings are not clear.

Further theory supporting UNI training may be explained by the bilateral deficit (BLD), which states that simultaneous BI contractions produces lesser force compared with the summed identical UNI contractions (25). The BLD has been observed in jumping activities (4), and the leg extension (9). Authors cite a reduced neural drive as the mechanism. This early research may suggest that performing exercises unilaterally could produce favorable adaptations to UNI strength as more force may be produced unilateral, which may impact UNI activities. A previous study found that training with UNI exercises may be more effective than BI exercises for improving unilateral vertical jumping performance (22); however, this has not yet been investigated in trained athletes.

In order for practitioners to consider UNI exercises as a viable option for developing lower-body strength in trained athletes, more longitudinal data are required to investigate the responses of trained individuals to UNI vs. BI training interventions. Because of the aforementioned limitations in the existing literature, the purpose of this study was to compare the effects of BI and UNI training on lower-body strength, sprinting, and change of direction speed (CODS) in trained rugby union players. It was hypothesized that the effects of UNI and BI training would be similar in improving lower-body strength compared with pretraining. It was also hypothesized that UNI training would be more effective than BI training in improving 10 m, 40 m, and CODS.

Methods

Experimental Approach to the Problem

To test the main hypothesis, that UNI training would significantly increase lower-limb strength as much as BI training, a 2 × 2 mixed design was used. The within-subject factor was time at 2 levels (pre and post) and the between-subject factor was grouped at 2 levels, UNI and BI. The UNI group squatted exclusively with the RESS, whereas the BI group squatted exclusively with the BS twice weekly for a period of 5 weeks. Participants were tested before and after the 5-week intervention period to determine any changes in the dependent variables, including 10-m and 40-m sprint, pro-agility, 1 repetition maximum (1RM) max BS, and 1RM RESS squat.

Subjects

Eighteen healthy academy rugby players (18.1 ± 0.5 years, 97.4 ± 11.3 kg, 183.7 ± 11.3 cm), with at least 1 year of resistance training experience volunteered to participate in this study. All participants were engaged in a structured strength and conditioning program and were familiar with the RESS and BS. Before any data collection, all participants provided written informed consent, which was reviewed by the Edinburgh University Ethics Committee, and participants below the age of 18 were also required to obtain parental consent. Criteria for exclusion consisted of the following: participants with less than 1 year of resistance training experience, evidence of orthopedic or lower-limb injuries, or heart/circulatory conditions. Participants were randomly assigned to an experimental (UNI) or control (BI) group (Table 1). Subjects in the UNI group were not significantly different from the BI group in terms of age, height, weight, relative strength ratio, or training history ($p > 0.05$), and there was 93% training attendance in the UNI group and 92% in the BI group.

Experimental Procedures

Testing. Before baseline testing, participants were given a 3-week instructional period, consisting of 6 sessions to learn correct technique in the RESS and BS. Participants were encouraged to increase the load on a weekly basis using an autoregulatory progressive pattern (19). Familiarization of 10-m, 40-m, and pro-agility tests were well established, as

Table 1. Participant characteristics.*†

Characteristics	UNI	BI
Age (y)	18.1 (0.5)	18.1 (0.5)
Bodyweight (kg)	96.7 (9.3)	98.1 (13.4)
Resistance training experience (y)	1.62 (0.18)	1.65 (0.18)
Body height (cm)	1.83 (3.4)	1.85 (8.9)
Relative strength ratio	1.60 (0.11)	1.57 (0.20)

*UNI = unilateral; BI = bilateral; RM = repetition maximum.
†Values are presented as mean (*SD*). Relative strength ratio was 1RM squat (kg divided by body mass, kg).

participants undertake these tests as part of routine performance testing at least 4 times per year (Table 2).

Testing Protocol

Upon completion of familiarization, participants were required to attend 2 testing sessions separated by 3 days. During the first session, information on stature (Leicester stadiometer; Invicta Plastics Ltd., Leicester, United Kingdom) and bodyweight was obtained (Avery Berkel 33/448; W & T Ltd., Smethwick, United Kingdom). Participants completed a 10-minute standardized warm-up consisting of dynamic bodyweight exercises, gradually increasing in intensity. Participants then performed two 40-m sprints, where the best 10-m and 40-m split times were obtained (Brower Timing Systems, Draper, UT, USA), which have been reported as reliable and valid measures of speed (28).

To train at a relative percentage of maximum values for RESS, participants completed a 3RM RESS on both legs, with self-selected dominant leg used for statistical analysis (21). RESS were performed within a power rack with safety pins set at hip height to allow participants to fail safely within the rack by dropping the weight on the pins. While performing the RESS, the foot of the nonexercising leg was placed on a 40-cm support box to ensure the exercising leg was independently performing the movement. RESS and BS depth were standardized to an angle of 100° between femur and tibia (26). Previous research has found that the UNI squat can be measured with high reliability (21). Subjects were tested twice, separated by 48 hours to determine 3RM as seen in previous research (21). Intraclass correlation coefficients were recorded. Differences between pre- and posttest measures were determined by the paired-sample *t*-test. The 3RM test was found to be reliable, ICC = 0.98, there was no difference between the first and second trial ($p = 0.17$).

Three days later, participants completed 3 repetitions of the pro-agility test following the standardized warm-up. The pro-agility has shown high test-retest reliability as a measure of CODS in active individuals (32). Markers were placed at 0, 5, and 10 yards with timing gates on the 5-yard line, to indicate where participants start and finish. Participants began in a neutral 3-point position with feet either side of the midline, participants then turned and ran 5 yards to the right side and touched the line with the right hand, and then ran 10 yards to the left, touched the line with their left hand the ran back through the start line to the finish. The trial was then completed in the other direction, with a third trial completed off the preferred foot. The fastest trial was recorded.

Thirty minutes later, a 3RM test on the BS was performed, where depth was standardized to a degree of 100° between femur and tibia in accordance with recommended full squat guidelines outlined in previous studies (26). For both lifts, depth was assessed using a video camera (Sony HDR-AS100VR Action Camera; Pencoed, Wales, United Kingdom) placed side-on to the participant. BS depth was judged retrospectively, and if participants failed to achieve the correct depth, testing was repeated 48 hours later. Before the 3RM testing in both groups, sets of 5–10 repetitions with a self-selected weight on the first set with a 1-minute recovery period was completed, followed by 1 set of 5 repetitions having increased the load by 10–20% as seen in previous studies (22). Three-minute recovery periods were allocated between each successive set. Participants had a limit of 5 trials (including the warm-up sets) to attain the 3RM, as prescribed in previous research (22). The 1RM was then extrapolated using a prediction formula, which is a commonly used method to determine 1RM (5). This testing protocol was subsequently replicated postintervention on the sixth week.

Testing Conditions

The testing environment remained consistent from pre- to posttest, as did the order of testing, warm-up procedures and participant's footwear. Procedures were also completed at the same time of day to avoid circadian fluctuations, and adequate recovery from any previous training and/or competition was allowed. There was a 3-day rest period between initial testing and the intervention and a 3-day rest period between the end of the training intervention and post-testing.

Training Intervention

Participants completed a 5-week strength training intervention, consisting of 2 fully supervised training sessions per week, with BS and RESS depth standardized to the testing

Table 2. Outline of the 3-week familiarization resistance training protocol.*

Set	Protocol
1	Warm-up
2	10 reps at 50% of 6RM
3	6 reps at 75% 6RM
4	Reps to failure at previous session 6RM
5	Reps to failure with adjusted 6RM

*Reps = repetitions; RM = repetition maximum.

Table 3. Outline of 5-week UNI and BI training intervention.*

Week	Reps	Sets	Percentage of 1RM
Week 1	6	4	75
Week 2	6	4	80
Week 3	5	4	85
Week 4	4	4	90
Week 5	3	4	92

*UNI = unilateral; BI = bilateral; Reps = repetitions; RM = repetition maximum.

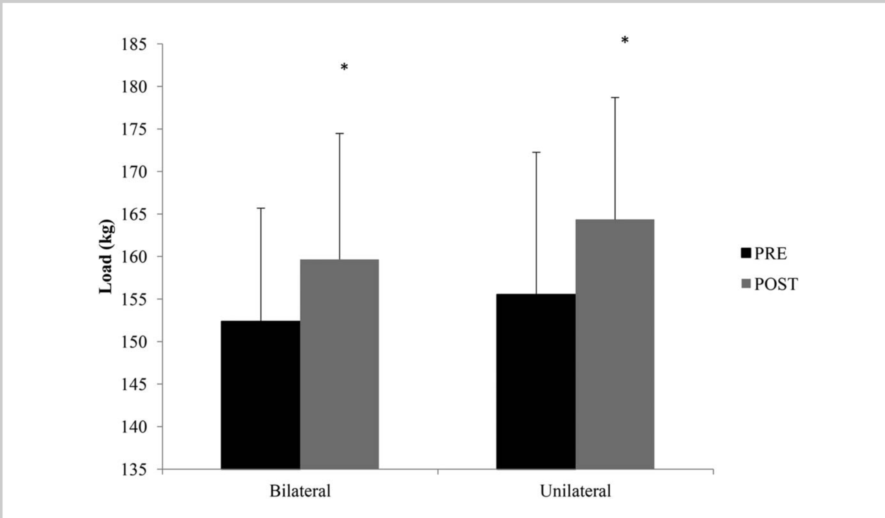

Figure 1. Squat 1 repetition maximum (1RM) (pre and post). Mean (*SD*) back squat 1RM before and after a 5-week BI or UNI training intervention. *Significant difference pre-post within groups ($p \le 0.05$).

conditions. In the UNI group, researchers observed the lead leg and the barbell for correct technique. If posterior displacement of the barbell occurred on descent with no anterior movement of the knee joint, the lift was deemed unsuccessful because of weight distribution in the nonexercising leg (21). Subjects repeated the missed repetition but were only given 1 additional attempt to complete repetition correctly. Intensity was standardized across groups using the same relative intensity at a percentage of 1RM in each exercise (22) and the UNI group trained both legs at a percentage of 1RM. Participants followed the same prescribed loading pattern over the 5-week period. The highest prescribed volume and lowest intensity occurred during week 1, whereas the lowest prescribed volume and highest intensity occurred during week 5 (Table 3). Tempo was also standardized across groups by encouraging the use of a 2-0-1, whereby the concentric and eccentric phases are completed in 1 and 2 seconds, respectively, with no pause between phases (26). This tempo rather than a fast concentric phase was chosen to reduce shear and compressive related forces (26) Three minutes of rest was allocated between each set, and training days were separated by 72 hours to ensure sufficient recovery between sessions. No additional lower-limb strength exercises were performed during the intervention period. Both the control and experimental group participated in 2 skills sessions, 2 rugby sessions, and 1 game per week.

Table 4. Pre- and post-changes for 10-m sprint, 40-m sprint, pro-agility, and 1RM RESS.*†

Variable	Pre	Post
10 m (s)		
UNI	1.73 (0.09)	1.70 (0.05)
40 m (s)		
UNI	5.35 (0.15)	5.26 (0.16)‡
BI	5.40 (0.26)	5.34 (0.23)‡
Pro-agility (s)		
UNI	4.61 (0.11)	4.53 (0.07)‡
BI	4.71 (0.15)	4.64 (0.14)‡
1RM RESS (kg)		
UNI	76 (6.1)	83 (5.1)‡
BI	75 (4.5)	81 (4.3)‡

*RM = repetition maximum; RESS = rear elevated split squat; UNI = unilateral; BI = bilateral.
†Data are presented as mean (*SD*).
‡Significant difference from prevalues.

Statistical Analyses

Data are presented as mean (M) ± *SD* and were screened for normality and homogeneity of variance using the Wilks-Shapiro and Levene's test, respectively. Two-way analysis of variance with mixed design were used to examine any differences in each performance variables, within and between groups, before and after the training period. Significant effects for time and interaction effects (condition × time) were measured using the Wilks-Lambda test. Significance was accepted at $p \le 0.05$, and effect sizes were assessed using partial eta squared (partial η^2) values, which were square-rooted to give correlation coefficients that were compared with the effect sizes given by Hopkins: 0.1–0.3 as small, 0.3–0.5 as moderate, 0.5–0.7 as large, and 0.7–0.9 as very large (7).

Results

There was a significant main effect of time for 1RM BS ($F_{1,16} = 86.5, p < 0.001$), ES ($0.84 <$ Cohen $d < 0.92$). 1RM RESS ($F_{1,16} = 133.0, p < 0.001$), ES ($0.89 <$ Cohen $d < 0.94$); 40-m sprint ($F_{1,16} = 14.4, p = 0.002$), ES ($0.47 <$ Cohen $d < 0.67$); and pro-agility ($F_{1,16} = 55.9, p < 0.001$), ES ($0.77 <$ Cohen $d < 0.89$), but not 10-m sprints ($F_{1,16} = 2.69, p = 0.121$), ES ($0.14 <$ Cohen $d < 0.38$). Differences in 1RM BS pre- to postintervention are shown in Figure 1 and differences in 10-m, 40-m, pro-agility, and 1RM RESS squat (pre-post) are shown in Table 4. No significant interactions were observed between any of the dependent variables.

Discussion

The primary finding of the current study was that UNI and BI training were equally effective in improving lower-body strength. There was a large effect size reported for back squat ES (0.84 < Cohen d < 0.92). Similar improvements were also observed in 40 m between groups ES (0.47 < Cohen d < 0.68) and pro-agility ES (0.78 < Cohen d < 0.88). This is in contrast to the hypothesis that UNI training would be more effective in enhancing 10 m, 40 m, and CODS.

The data in the current study suggest that BI and UNI training exert reciprocal benefits to UNI and BI strength, with increases of 5.7 ± 3.8% and 5.0 ± 3.7% in BS 1RM in the UNI and BI groups, respectively. RESS 1RM strength also improved by 9.2 ± 2.1% and 10.5 ± 3.2% in the UNI and BI groups. These findings are in agreement with our hypothesis that UNI and BI training would be equally effective for improving lower-body strength, and somewhat in agreement with previous literature (22). McCurdy et al. (2005) reported similar improvements in BI and UNI strength, in untrained individuals. The present study suggests this may also be the case in academy level rugby players, indicating some degree of external validity in applying these results to athletic groups.

At this stage we cannot draw any conclusions regarding the physiological mechanism that would explain the findings in the present study. Previous research has found that muscle activity is comparable between the RESS and BS when relative intensities are matched (16), specifically in the lower back, hamstring, gluteals, and quadriceps, which may indicate that the amount of neuromuscular activity required for both exercises is the same and therefore strength adaptations are similar. However, research by Mccurdy et al. (23) reported increased electromygraphic (EMG) activity in gluteus medius and hamstring during the RESS, but increased quadriceps activity in the BS. The authors attributed these findings to the relative instability of the RESS in comparison with the BS; however, the subjects were female so results may differ with male athletes, the subjects in this study also had less experience using the RESS and the discrepancies in muscle activity may be due to the novelty of the exercise. Antagonist activity is known to increase when new tasks are introduced (12) to improve stability and safeguard against excessive forces (34). In the present study, this was addressed with a longer familiarization period; however, EMG recording was not available during this study, therefore we may only speculate based on findings from previous research. Furthermore, as BI training improved UNI strength, this explanation seems unlikely, whereas the compatibility in muscle involvement may be responsible for the similarities in strength development between groups.

Previous research has also found that both the UNI and BS produce similar postexercise testosterone (16), which is a significant finding as an elevation in testosterone can have a positive effect on muscular strength development by increasing protein synthesis, lean body mass, and aiding in exercise recovery (35); however, it is unlikely that 5 weeks would have been a long enough time period for hypertrophy to occur.

No significant main effect for time in 10-m speed was observed; however, there was a small effect size ES (0.14 < Cohen d < 0.38). This was surprising, as a previous study have demonstrated increases in maximal squat strength are associated with improvements in 10-m sprint time (8). Furthermore, a recent meta-analysis, which included 510 subjects, 85 effect sizes, and 15 studies investigated the relationship between increases in lower-body strength and transfer to sprint performance, and reported a significant correlation in lower-body strength and sprint performance over short distances (<20 m) (27). It is well established that peak ground reaction forces and impulse are strong determinants of sprint performance (15), and based on this it was expected that an increase in force production would contribute to improved 10-m sprint times.

The lack of a main effect may be explained by the short study period. Five weeks is a short duration to expect any substantial changes in sprinting performance. Practitioners maintain that athletes require a certain amount of time to be able to "use" new levels of strength and express them in a specific context (33). It is also possible that the lack of effect may be due to lag time. Lag time refers to the period of time in which a specific adaptation manifests itself, or the duration in which an athlete learns how to optimally express force (1). It is possible that different training methods can produce lag times varying in duration, sometimes extending over months at a time (33). Furthermore, central to the concept of transfer of training is specificity, which states that the adaptations are specific to the nature of the training (37), therefore a concurrent sprint training program may have elicited further changes in 10-m time. A speed program was not provided during this time because of the stage of the season players were in and to isolate the effects of the resistance training program on the performance variables. However, this is in contrast to 40-m data below. Finally, it is possible that statistical power was insufficient to show this difference, resulting in a type II statistical error.

Moderate effect size was found for 40-m time ES (0.47 < Cohen d < 0.68), with no significant interaction between groups. This is in contrast to the hypothesis that UNI would be more effective in improving 40-m sprinting time compared with BI training. Data from this study are consistent with previous research, suggesting that improvements in lower-limb strength transfers to enhanced sprinting performance (8,27).

The current data also provide new information for practitioners regarding the effectiveness of UNI training and its transference to improved sprint performance. Based on the concept of specificity, it was hypothesized that training with the RESS would result in more pronounced improvements in sprinting performance compared with the BS. However, specificity is a complex concept that is determined by overload in specific criteria (33).

Siff and Verkoshansy (1998) suggest that the magnitude of training transfer depends on dynamic correspondence, whereby basic mechanics rather than outward appearances of training movements must replicate athletic skills. Additionally, for exercises to transfer successfully to athletic performance, exercises must overload specific parameters including the type of muscular action, force magnitude and direction, dynamics of effort, and rate of force development (RFD) (30,33,37). Sprinting is a complex athletic activity, requiring high levels of force, the ability to produce force during quick contact times, and exert force in the appropriate direction (10,18,36). As improvements were observed in UNI and BI strength in both groups, it is likely that participants were able to exert greater peak ground reaction force, impulse and RFD as a result of both training methods; however, these parameters were not measured in this study.

This is the first study to compare the effects of UNI and BI training on measures of CODS. In the pro-agility test, there was a large main effect size (0.78 < Cohen d < 0.88). Participants improved by 1.74 ± 1.0% and 1.9 ± 0.8% in the UNI and BI groups, respectively.

These results demonstrate that strength training is an appropriate means to improve CODS in a 5-week period in trained rugby players. There is currently some disparity in the literature with regard to the effects of strength training on measures of CODS, partly as a result of different test designs and different strength-speed parameters. For example, a previous study reported significant improvements in sprint times and change of direction in the T test following 8 weeks of squat jump training with 30 and 80% of 1RM (20). It has also been reported that strength training with either the front squat or BS over a period of 2 years significantly improves CODS performance of CODS in junior footballer players (17).

However, it should be noted that although the pro-agility has reported high test-retest reliability (32), direct transfer into improved athletic performance cannot be assumed, as research has demonstrated that agility is a product of both physical and cognitive factors, including perceptual skills, decision-making skills, and pattern recognition (29). The ability of team sport athletes to "read and react" to game-specific stimuli is an important variable associated with improved agility (29). This study used a preplanned change of direction test, creating some difficulty in deducing what the performance implications may be, but collectively, research suggests that aspects of improved strength and power may positively influence the physical factors associated with CODS.

In attempt to evenly match the total work, each group trained at a relative percentage of their respective 1RM, following the same sets and repetition scheme. A limitation of standardizing the groups using intensity was that workload was difficult to evenly match between groups, as it would be assumed that load would be equally distributed between legs during the BS. It would also be assumed that 100% of the total load during the RESS is placed on the front foot. Through the use of EMG, UNI training may incur a higher relative workload compared with BI training; with previous data suggesting 85.1% of the total load is placed on the front foot during the RESS (23). Inequalities in net joint torques between the right and left sides during the BS have also been demonstrated (13). It was therefore difficult to accurately match total work because of biomechanical differences between the exercises.

The intervention may have also been limited by the concurrent nature of training necessary for the participants involved, which included lower-body and upper-body resistance training. Participants were required to gain weight during this time, and reported average increases in bodyweight of 2.21 ± 0.49 kg and 2.35 ± 0.80 kg in the UNI and BI groups, respectively. This may have confounded the results by negatively affecting 10-m speed, as acceleration is a product of force divided by mass (18). Furthermore, the participants in this study were engaged in at least 3 rugby training sessions per week. Current evidence suggests that this approach may attenuate gains in muscle strength and power (14), but the randomized design in the current study should have controlled for this as both groups participated in equal number of rugby sessions.

Furthermore, improvements over a 5-week period may be indicative of early strength improvements, which are primarily a result of neural adaptations associated with skill learning, rather than changes in muscle cross-sectional area (25), although we did observe some increases in body mass also. Five weeks was the maximum study length that was permitted due to the player's involvement in international competitions.

A longer study length is required to clarify any chronic adaptations and longer-term benefits associated with UNI training. Future studies should attempt to investigate any chronic adaptations or long-term benefits associated with UNI training, such as transferability to athletic skills, as well as the implications in preventing and/or managing injury. EMG and hormonal data would also provide valuable information on the physiological responses to each exercise modality. Further research could explore exercises other than the squat.

UNI and BI training modalities appear equally effective in improving lower-body strength, sprint, and CODS following 5 weeks of strength training with the RESS or BS in trained academy level rugby players who have initial strength levels comparable with other professional rugby union teams (2).

Practical Applications

This study was the first to compare the effects of UNI and BI training modalities on aspects of strength and power in academy rugby players. From a practical perspective, these findings provide strength and conditioning practitioners with evidence that UNI squatting may be considered an effective alternative to BI methods during the initial stages of training. It could also offer additional benefits for non-assessed variables, including injury prevention, given the prevalence of UNI movements during sport. Future work should explore the mechanisms and other UNI and BI exercises beyond squats.

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