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Comparison of Olympic vs. Traditional Power Lifting Training Programs in Football Players

Jay R. Hoffman, Joshua Cooper, Michael Wendell, and Jie Kang

Department of Health and Exercise Science, The College of New Jersey, Ewing, New Jersey 08628-0718.

Abstract. Hoffman, J.R., J. Cooper, M. Wendell, and J. Kang. Comparison of olympic versus traditional power lifting training programs in football players. *J. Strength Cond. Res. 18(1):129–135. 2004.*—Twenty members of an National Collegiate Athletic Association Division III collegiate football team were assigned to either an Olympic lifting (OL) group or power lifting (PL) group. Each group was matched by position and trained 4-days·wk^{-1} for 15 weeks. Testing consisted of field tests to evaluate strength (1RM squat and bench press), 40-yard sprint, agility, vertical jump height (VJ), and vertical jump power (VJP). No significant pre- to posttraining differences were observed in 1RM bench press, 40-yard sprint, agility, VJ or in VJP in either group. Significant improvements were seen in 1RM squat in both the OL and PL groups. After log10-transformation, OL were observed to have a significantly greater improvement in ΔVJ than PL. Despite an 18% greater improvement in 1RM squat ($p > 0.05$), and a twofold greater improvement ($p > 0.05$) in 40-yard sprint time by OL, no further significant group differences were seen. Results suggest that OL can provide a significant advantage over PL in vertical jump performance changes.

Key Words. athletic performance, football, resistance training, periodized training

Introduction

The importance of strength, power, speed and agility in the success of the football player is well accepted by both coaches and sport scientists. Several studies have demonstrated the ability of these performance variables to predict success in college football players (2, 3, 7). As one might expect, the primary focus of the off-season conditioning program for these athletes is on developing their physical capabilities. There have been a number of conditioning programs published for the training of football players (5, 13, 14, 16, 20). These training programs have traditionally focused on power lifting exercises that primarily emphasize maximal force production. These exercises, despite an initial explosive movement, are generally performed at a slow velocity of movement. However, many of these training programs have incorporated a number of Olympic weightlifting exercises into the off-season resistance training program. Theoretically, this type of training may be superior to traditional power lifting training because the exercises, while using heavy loads, are performed at a much higher velocity of movement (8, 10). As a result, power outputs are much greater during this latter form of training.

It would appear that a high force, high velocity training program (e.g., Olympic weightlifting) would be advantageous for both strength and power development, while high force, slow velocity training (e.g., power lifting) primarily focuses on strength enhancement. Although most resistance training programs for football appear to use a combination of these 2 styles of training, it is unclear whether either resistance training style provides a greater performance advantage than the other for the football player. It is likely that training experience may be more important in dictating training style than any other factor. Recent research has suggested that most strength gains among college football players are made in the athlete's freshman year of college (25). As the window of adaptation for the athlete becomes smaller for maximal strength development, other components of training (i.e., velocity of movement) may need to be emphasized to further enhance athletic performance (21). It is likely that a different stimulus than what would be achieved from a change in emphasis from a high force, low velocity to high force and high velocity may provide a new stimulus that results in further performance improvement. However, our understanding of the differences between these 2 types of training programs is limited to cross-sectional studies that have compared Olympic lifters to power lifters (10, 22). No studies are known to have prospectively compared these 2 styles of training.

The purpose of this study was to compare an Olympic weightlifting training program to the more traditional power lifting training program during an off-season conditioning program in college football players. It is the hypothesis of this study that high force, high velocity training would provide a greater enhancement in speed performance than the traditional high force, low velocity training program common to many football conditioning programs.

Methods

Experimental Approach to the Problem

Members of an National Collegiate Athletic Association (NCAA) Division III football team who were experienced resistance trained athletes were assigned to either a traditional power lifting training program or an Olympic weightlifting training program. Strength, power, speed, and agility were measured prior to and following a 15-week off-season conditioning program. Both groups performed the same 5-week preparatory phase training program and then progressed to their specific training program. In addition, both groups were required to participate in a team speed and agility program during the final 5-weeks of the off-season training program. Although this low force, high velocity training program may affect the study outcome, such a training paradigm presents a real scenario that provides a more thorough interpretation of the results in light of training strength/power athletes that utilize resistance training as one component of a large conditioning program.

Subjects

Twenty members of an NCAA Division III football team were assigned to either an Olympic weightlifting (OL: $n = 10$; 19.3 ± 1.2 y; 174.0 ± 5.8 cm; 90.3 ± 13.3 kg) or a power lifting group (PL: $n = 10$; 18.9 ± 1.4 y; 178.8 ± 8.6 cm; 91.3 ± 11.8 kg). Each group was matched for football position. Thus, each group had 5 linemen (consisting of offensive linemen, defensive linemen, or linebackers) and 5 backs (consisting of either running backs, defensive backs, or receivers). Subjects were assigned to the Olympic weightlifting group based upon their competency in the techniques of this style of lifting (e.g., primarily the power clean exercise) demonstrated in previous training programs performed at the college. Both training programs were performed 4d·wk^{-1} for 15 weeks. This training program was part of the off-season training program for the football team. The subjects gave their informed consent as part of their sport requirements consistent with the institution's policies of our Institutional Review Board for use of human subjects in research.

Resistance Training Programs

The resistance training program (RTP) for OL and PL can be seen in Tables 1 and 2, respectively. The phase I training program lasted for 5 weeks and was similar for both groups. At phase II (week 6) each group began their group specific training program. For the next 2 phases, each lasting 5 weeks, the subjects performed their group specific training program. The only similarity between the training programs was the bench press and squat exercises, which were maintained at similar training volume and intensities since both of those exercises were part of the athletes' testing program. Subjects were provided a range of repetitions to perform at a recommended intensity of their 1 repetition maximum (1RM) for each exercise. For instance, if a subject was required to perform between 6 to 8 repetitions for the bench press exercise, they needed to select a resistance that they could perform for at least 6 repetitions, but not more than 8. Each workout was supervised by one of the investigators.

In addition to the resistance training program, all subjects participated in a 2d·wk^{-1} sprint and agility training program. This program was performed during phase III of the training program and was required of all members of the football team, including those participating in the study groups. An example of the sprint and agility training program can be seen in Table 3.

Table 1. Olympic weight lifting program.

Phase I (5 weeks)	
Days 1 and 3	Days 2 and 4
Bench press 4 × 8–10RM*	Squats 4 × 8–10RM
Incline bench press 3 × 8–10RM	Dead lift 4 × 8–10RM
Incline flys 2 × 8–10RM	Leg extensions 3 × 8–10RM
Seated shoulder press 4 × 8–10RM	Leg curls 3 × 8–10RM
Upright rows 3 × 8–10RM	Standing calf raises 3 × 8–10RM
Lateral raises 3 × 8–10RM	Lat pulldowns 4 × 8–10RM
Triceps pushdowns 3 × 8–10RM	RM seated row 4 × 8–10RM
Triceps extension 3 × 8–10RM	Biceps curls 4 × 8–10RM
Sit-ups	Sit-ups
Phase II (5 weeks)	
Day 1	Day 3
Snatch pulls (above knee) 5 × 5RM	Snatch pulls (floor) 5 × 5RM
Snatch pulls (floor) 5 × 5RM	Snatch pulls (waist) 5 × 5RM
Bench press 4 × 6–8RM	Push jerk 5 × 5RM
Dumbell pulls (floor) 5 × 5RM	Bench press 4 × 6–8RM
Push press 5 × 5RM	Front squat 5 × 6–8RM
Day 2	Day 4
Clean (floor) 5 × 5RM	Clean pulls (above knee) 5 × 5RM
Clean pulls (above knee) 5 × 5RM	Dumbell push press 5 × 5RM
Push jerks 5 × 5RM	Squats 4 × 6–8RM
Squats 4 × 6–8RM	Power shrugs 5 × 5RM
Lunges 4 × 6–8RM	Overhead squats 4 × 6–8RM
Phase III (5 weeks)	
Day 1	Day 3
Snatch pulls (floor) 5 × 3RM	Clean pulls (above knee) 5 × 3RM
Push jerks 5 × 3RM	Squats 5 × 4–6RM
Squats 5 × 4–6RM	Jump squats (30% 1RM) 4 × 5RM
Box jumps 3 × 8	Dumbell push press 4 × 3RM
Lunges 3 × 6–8RM	Snatch pulls (waist) 3 × 3RM
Day 2	Day 4
Overhead squats 4 × 6–8RM	Clean pulls (waist) 3 × 3RM
Snatch pulls (floor) 5 × 3RM	Front squats 3 × 5RM
Clean pulls (above knee) 3 × 5RM	Box jumps with dumbell 3 × 5
Bench press 5 × 4–6RM	Bench press 5 × 4–6RM
Push press 5 × 3RM	Power shrugs 5 × 5RM

* RM = Repetition maximum.

Athletic Performance Testing

Prestudy (PRE) strength (1RM squat and bench press), vertical jump, and vertical jump power measurements occurred within 1 week prior to the off-season training program. However, for PRE speed (40-yard sprint) and agility (T drill) measures, the subjects' preseason training camp results were used. Considering the differences in weather between the start and conclusion of the training program (January vs. May), and the likely detrained sprinting condition of the athletes during the start of the off-season training program, it was thought that use of the preseason training camp results would provide the most accurate measure of their PRE sprinting and agility ability. All post-testing occurred within last week of the training program. Strength and vertical jump testing was performed at least 30 minutes following the speed and agility testing.

One RM bench press and squat exercise tests were performed to measure upper and lower body strength. The 1RM tests were conducted as described by Hoffman (15). Subjects warmed up with a light resistance and then achieved a 1RM effort within 3 to 5 attempts. No bouncing was permitted, as this would have artificially boosted strength results. Bench press testing was performed in the standard supine position: the subject lowered an

TABLE 2. Power lifting program.*

Phase I (5 weeks)	
Days 1 and 3	Days 2 and 4
Bench press 4 × 8–10RM	Squats 4 × 8–10RM
Incline bench press 3 × 8–10RM	Dead lift 4 × 8–10RM
Incline flys 3 × 8–10RM	Leg extensions 3 × 8–10RM
Seated shoulder press 4 × 8–10RM	Leg curls 3 × 8–10RM
Upright rows 3 × 8–10RM	Standing calf raises 3 × 8–10RM
Lateral raises 3 × 8–10RM	Lat pulldowns 4 × 8–10RM
Triceps pushdowns 3 × 8–10RM	RM seated row 4 × 8–10RM
Triceps extension 3 × 8–10RM	Biceps curls 4 × 8–10RM
Sit-ups	Sit-ups
Phase II (5 weeks)	
Days 1 and 3	Days 2 and 4
Squats 4 × 6–8RM	Bench press 4 × 6–8RM
Dead lift 3 × 6–8RM†	Incline Dbl BP 4 × 6–8RM‡
Stiff leg dead lift 3 × 6–8RM§	Incline BP close grip 4 × 6–8RM‖
Leg curl 3 × 6–8RM	Incline flys (flat) 3 × 6–8RM
Standing calf raise 3 × 6–8RM	Seated Dbl SP 4 × 6–8RM
Lat pulldown 3 × 6–8RM	Upright Row 3 × 6–8RM
Seated row 4 × 6–8RM	Front Raise 3 × 6–8RM‡
Biceps curls 4 × 6–8RM	Lateral Raise 3 × 6–8RM‖
Sit-ups	Triceps Extension 4 × 6–8RM‡
	Triceps Pushdown 4 × 6–8RM‖
	Sit-ups
Phase III (5 weeks)	
Day 1 and 3	Days 2 and 4
Squats 5 × 4–6RM	Bench press 5 × 4–6RM
Dead lift 4 × 4–6RM†	Incline Dbl BP 5 × 4–6RM‡
Romanian dead lift 4 × 4–6RM§	Incline BP close grip 5 × 4–6RM‖
Leg curl 3 × 4–6RM	Seated Dbl SP 5 × 4–6RM
Standing calf raise 3 × 4–6RM	Upright row 4 × 4–6RM
Lat pulldown 5 × 4–6RM	Triceps extension 4 × 4–6RM‡
Seated row 5 × 4–6RM	Triceps pushdown 4 × 4–6RM‖
Biceps curl 4 × 4–6RM	Sit-ups
Sit-ups	

* RM = repetition maximum; BP = bench press; Dbl = dumbbell; SP = shoulder press.
† On day one only.
‡ On day two only.
§ On day three only.
‖ On day four only.

TABLE 3. Agility and sprint training program.

Training program
Warm-up and flexibility 10 minutes
Sprint technique 20 minutes
Agility drills 20 minutes
Conditioning 10 minutes
Sprint technique drills used
Arm swings
Marching in place
Marching
Wall slide
High knees
Pull-through
Partner wall drill
Resisted march partner
Fall away partner
Starts 4 steps
Starts 8 steps
2 Sprints 30 yards
Agility drills
T-drill
Side-shuffle drill
L drill
Zigzag with cones drill
Reaction drill
Quick feet drill
Ladder
Conditioning
Combination of 40–100-m sprints and line drills

Olympic weightlifting bar to midchest, then pressed the weight until his arms were fully extended. The squat exercise required the player to rest an Olympic weightlifting bar across the trapezius at a self-chosen location. The squat was performed to the parallel position, which was achieved when the greater trochanter of the femur was lowered to the same level as the knee. The subject then lifted the weight until his knees were extended. Previous studies have demonstrated good test-retest reliabilities ($r > 0.90$) for these strength measures (16, 17).

Speed was determined by a timed 40-yard (37-meter) sprint. Sprint times were determined using hand-held stopwatches. Timing began on the subject's movement out of a 3-point stance. The best of 3 attempts was recorded as the subject's best time. Agility was determined by a T-test that required the subject to sprint in a straight line from a 3-point stance to a cone 9 meters away. At that point the subject sideshuffled to the left, without crossing his feet, to another cone 4.5 meters away. As he touched the cone, he sideshuffled to the right to a third cone 9 meters away. The subject then side-shuffled back to the middle cone and backpedaled to the starting position. Each subject performed 3 maximal attempts, and the fastest time was recorded.

Vertical jump height was measured by a maximum vertical jump with a countermovement (CMJ). During the CMJ, the subject began by standing erect on the floor with his hands on his hips. On a verbal signal, the subject then lowered himself to a self-selected depth and immediately performed a maximal vertical jump landing back on the floor. For all jumps, subject displacement was recorded for subsequent calculation of jump height, velocity, force, and power data.

For the CMJ test, a position transducer (Celesco model PT 9510, Canoga Park, CA) was attached to the subject's waist to measure displacement of the center of mass. The computer recorded force and displacement data and a software package (Ballistic Measurement System, Innervations, Muncie, IN) was used to calculate jump height, force, power, and velocity data. Samples were collected at 500 Hz for 4 seconds. The system was calibrated before each testing session. Displacement-time data was filtered using a Butterworth fourth order digital filter and a cutoff frequency of 20Hz prior to differentiation by the finite difference technique to calculate veloc-

TABLE 4. Athletic performance results.†

Variable	Group	Pretraining	Posttraining
Body mass (kg)	OL	90.3 ± 13.3	91.0 ± 11.9
	PL	91.3 ± 11.8	91.6 ± 12.4
1RM bench press (kg)	OL	128.7 ± 14.6	134.4 ± 14.6
	PL	120.7 ± 17.0	132.3 ± 17.3
1RM squat (kg)	OL	175.0 ± 21.0	197.5 ± 31.5*
	PL	148.0 ± 25.9	166.9 ± 33.1*
40-yard sprint (s)	OL	4.95 ± 0.17	4.88 ± 0.22
	PL	4.94 ± 0.16	4.90 ± 0.19
T drill (s)	OL	9.36 ± 0.44	9.21 ± 0.54
	PL	9.42 ± 0.38	9.23 ± 0.41
Vertical jump height (cm)	OL	44.2 ± 2.14	6.8 ± 6.1
	PL	40.8 ± 8.94	0.5 ± 6.8
Vertical jump power (w)	OL	4310 ± 402	4665 ± 874
	PL	4366 ± 937	5076 ± 905

† RM = repetition maximum; OL = Olympic weight lifting group; PL = power lifting group.
* $p < 0.05$ between pre and post measures.

ity-time data. High test-retest reliabilities ($r > 0.97$) have been previously reported with this testing apparatus (26). Anthropometric assessments included height and body mass. Body mass was measured to the nearest 0.1 kg.

Statistical Analyses

Statistical evaluation of the data was accomplished by an analysis of variance (2 groups by 2 time points). When appropriate, Tukey's posthoc tests were used for pairwise comparisons. After log10-transformation, Δ strength comparisons between groups were analyzed with unpaired student's *t*-tests. Pearson product-moment correlations were used to examine selected bivariate correlations. Based upon previous studies that have examined changes in strength in off-season resistance training programs (16, 17), a sample size of 20 subjects would provide at least 80% statistical power at an α level of 0.05 (2-tailed). All data are reported as mean ± *SD*.

RESULTS

Injuries during the sprint and agility program resulted in 2 subjects (1 from each group) to be removed from the study due to less than 80% compliance to the training program. In addition, another subject from OL was hurt during performance of the snatch exercise and was unable to continue with this exercise; that subject was removed from the data analysis as well. The remainder of the subjects had 100% compliance with all training sessions. Comparisons between OL and PL in strength, power, speed, agility, and anthropometric measures can be seen in Table 4. No significant pre- to post-training changes were seen in the 1RM bench press, 40-yard sprint time, T drill, vertical jump height, vertical jump power, and body mass in either group. A significant pre- to posttraining improvement was seen in 1RM squat strength in both OL and PL. However, no significant group differences were seen in any of the performance variables.

Comparisons between OL and PL in Δ strength, speed and agility, and vertical jump measures can be seen in Figures 1–3, respectively. No significant differences between the groups were seen following the raw data analysis; however, after log10 transformation it was observed that OL had a significantly greater improvement in vertical jump height than PL. No other significant differences were noted. Interestingly, improvements in 40-yard sprint times were 175% greater in subjects training with OL compared to the subjects training with PL (0.07 ± 0.14 s compared to 0.04 ± 0.11 s, respectively).

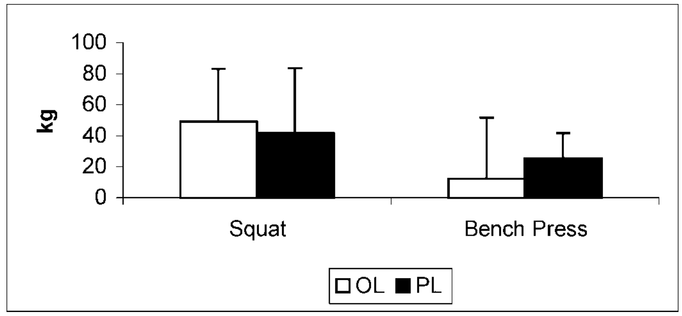

FIGURE 1. Comparisons between OL and PL in Δ strength measures. OL = Olympic weight lifters; PL = power lifters.

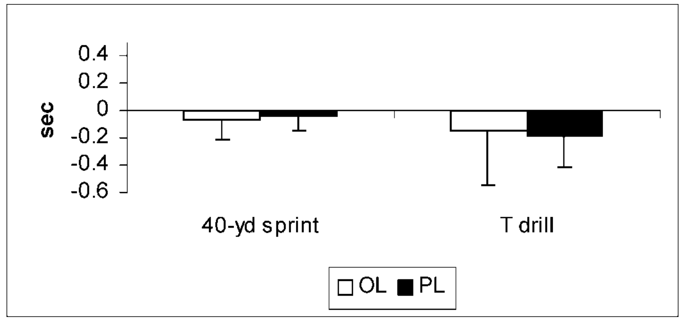

FIGURE 2. Comparisons between OL and PL in Δ sprint speed and agility measures. OL = Olympic weight lifters; PL = power lifters.

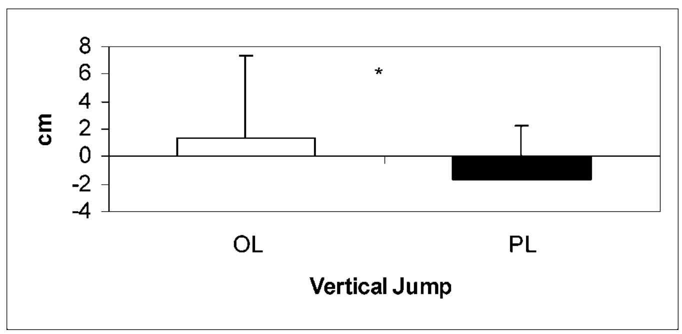

FIGURE 3. Comparisons between OL and PL in Δ vertical jump measures. OL = Olympic weight lifters; PL = power lifters; * $p < 0.05$.

The Pearson product-moment correlations between Δ performance scores for each group can be seen in Table 5. Moderate correlations were observed between Δ vertical jump power and Δ 40-yard sprint and Δ squat scores. In addition, moderate correlations were also observed between Δ bench press and Δ body weight and Δ vertical jump scores. These moderate correlations were observed for OL only. No significant correlations between any of the Δ performance measures were seen for PL.

DISCUSSION

A power lifting training program incorporates exercises that utilize high force and low velocity movements, and

TABLE 5. Pearson product-moment correlations between Δ performance scores for OL and PL.†

	ΔBW	ΔBP	ΔSquat	Δ40	ΔT test	ΔVJ	ΔVJP
OL							
ΔBW	—						
ΔBP	−.79*	—					
ΔSquat	.33	.52	—				
Δ40	−.07	−.06	−.58	—			
ΔT test	−.56	−.26	−.26	.73*	—		
ΔVJ	−.64	.77*	.50	−.16	.17	—	
ΔVJP	−.49	.38	.78*	−.70*	−.08	.56	—
PL							
ΔBW	—						
ΔBP	.40	—					
ΔSquat	.57	.47	—				
Δ40	.22	−.24	.38	—			
ΔT test	−.23	−.15	.17	.42	—		
ΔVJ	.36	.49	.35	.30	−.56	—	
ΔVJP	.22	.35	.61	.43	−.06	.55	—

† OL = Olympic lifting group; PL = power lifting group; BW = body weight; BP = bench press; 40 = 40-yd sprint; VJ = vertical jump; VJP = vertical jump power.
* $p < 0.05$.

is thought to be most beneficial in developing muscle strength. In contrast, Olympic weight training uses exercises that combine high force and high velocity movements and is likely better suited for developing strength, power, and speed. These potential training differences have been supported by previous research that have compared power lifters to Olympic lifters and showed similar strength performance between these athletes, but significantly higher power output and velocity of movement in the Olympic lifters (10, 22). As a result of these investigations and empirical evidence gathered by strength and conditioning professionals, many athletic training programs have begun to incorporate the Olympic exercises into the training routines of strength/power athletes. However, a prospective examination that has compared these 2 styles of training on strength/power athletes has not been previously performed. In addition, studies that have reported on these 2 different styles of training have primarily used either Olympic or power lifting athletes. Generally, the training programs of those athletes are quite specific to the needs of their sport and rarely are other modes of training (i.e., sprint or agility) utilized.

This study provided a unique opportunity to compare these two styles of training in athletes whose primary training goal was to improve athletic performance (e.g., strength, power, speed, and agility) for the sport of football. In addition, these athletes maintained other facets of their overall conditioning program (i.e., speed and agility training). The results of this study indicate that a 10-week Olympic weightlifting program provides a significant advantage for vertical jump improvement in college football players compared to traditional power lifting. However, no other significant differences in performance measures were seen between the groups.

The resistance training programs used in this study were specific to the mode of training for each group. The exception being that both groups performed the bench press and squat exercise using similar sets and repetitions for each phase of training. Although the squat exercise would be considered a core exercise in either training program, the bench press would not be considered to be a core lift for Olympic weightlifting. Since these subjects were football players who were required to test for upper body strength, it was necessary to provide a similar training paradigm for both groups in regard to this exercise. Nevertheless, neither group realized any significant strength improvement in the bench press exercise. This is most likely a result of the subjects' resistance training experience. Subjects of both groups had an average resistance training experience of 3.1 ± 1.2 years, with no significant difference between the groups in training experience observed. Previous research on intercollegiate athletes (both football and basketball) has demonstrated that the greatest strength gains are generally made in the athletes' freshman year of participation (18, 25, 27). However, it does appear that a greater window of adaptation exists for the lower body than for the upper body in these subjects, regardless of the training program used.

Although improvements in both upper and lower body strength measures were not significantly different between OL and PL, there did appear to be specific strength adaptations that were related to the subjects' specific training program. Subjects of PL experienced a twofold greater improvement in upper body strength ($p > 0.05$), while the subjects in OL experienced an 18% greater improvement in lower body strength ($p > 0.05$). These differences in strength improvement are likely a result of the inclusion of specific assistance exercises that were part of the subjects' training programs. Previous research by Hoffman and colleagues (16) has demonstrated the importance of assistance exercises for eliciting strength improvements in the training program of college football players. In this study, subjects of PL incorporated 2 assistance exercises (incline bench press and incline flys) in addition to the core lift (bench press) for upper body strength training, while the subjects of OL did not have any specific upper body assistance exercises in their training program. Although the subjects of PL had several lower body assistance exercises incorporated into their training program (see Table 2), the multi-joint structural exercises utilizing the lower body musculature comprising the training program of OL (see Table 1) may have had a greater impact on lower body strength development.

The high number of pulling exercises (i.e., cleans, snatches, and pulls) seen in the training program of OL likely impacted the significantly greater vertical jump improvement seen in this group compared to PL. These exercises are mechanically similar to the vertical jump and the motor unit firing patterns that are improved during training of these exercises would likely enhance the firing pattern of these motor units during the vertical jump as well (29). In addition, the moderate correlations seen between Δ vertical jump power and Δ 1RM squat and Δ 40-yard sprint in OL, but not PL, also provide further evidence suggestive of training specific adaptations. Interestingly, no significant improvements for either group were seen in vertical jump power. For OL this was a bit surprising considering the improvement in vertical jump performance. However, it should be noted that although the subjects in OL may have trained with a lighter load for many of their exercises, it was still at a high percentage of their maximum (>80% 1RM). High velocity training studies and training programs designed to maximize power development generally require exercising at a much lower percentage of the subject's 1RM (12, 19, 23).

Training programs that involve high velocity movements, such as that seen with Olympic training, are thought to be superior for eliciting gains in power output and speed (10–12). This is based primarily on the high rates of force development and improved contractile speed associated with high force, high velocity resistance training (6, 11). This would appear to be of greatest benefit for sports that primarily rely upon explosive dynamic movements for success. Although differences in 40-yard sprint times and the T drill between the groups did not reach statistical significance, there did appear to be a tendency for a greater improvement in 40-yard sprint time in OL compared to PL. The sprint and agility training program that was incorporated into the training program of both groups likely had a significant impact on speed and agility improvement in both OL and PL. Sprint and agility training is a form of low force, high velocity training that has previously been shown to be quite effective in eliciting high power outputs and peak velocity (10, 22, 24). The combination of high force, low velocity training and low force, high velocity training by PL appeared to help those subjects compensate for the lack of explosive high force, high velocity exercises in their resistance training program. Other studies have reported that combination training may be more effective than training programs that focus primarily on either high force or high power only (1, 12, 30). Training programs of high force only appear to improve force at the high end of the force-velocity curve, while the inclusion of high power or high velocity exercises appears to emphasize greater improvements of force at the high velocity end (9, 28). A combination of high force and high power training would appear to result in adaptation occurring at a greater part of the force-velocity curve and have a greater impact on athletic performance (10). It appears that the inclusion of a speed and agility training program for the subjects of PL provided a training stimulus at the high velocity spectrum of the force-velocity curve. In addition, by providing subjects with the ability to practice a specific task, the ability to transfer strength improvements to that specific task appears to be supported by previous research (4).

PRACTICAL APPLICATIONS

The results of this study suggest that Olympic weight lifting provides a greater advantage in improving vertical jump performance than traditional power lifting in Division III college football players. In addition, several trends seen in speed and lower body strength improvements suggest that the sprint and agility training program may have confounded some of the results of this study and that further research may be warranted in this area.

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Address correspondence to Dr. Jay R. Hoffman, hoffmanj@tcnj.edu.