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Body Composition and Power Output Changes in NCAA Division I American Football Linebackers throughout a Competitive Season

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ABSTRACT

Body composition and power are impactful variables of athletic performance. However, few studies have assessed power and body composition changes from pre-, to mid-, to end-of-season in American Football linebackers. The purpose of this study was to determine how power and body composition respond to a competitive season in Division I Football Championship Series (FCS) American football linebackers. Participants (n=9; Age=19.7 ± 1.5 years; Weight=101.5±11.6 kg; Height=183.3±5.2 cm; [Body Fat percent (BF %) =21.31 ± 6.02%)] performed a Dual-Energy X-ray Absorptiometry (DXA) scan, and power was assessed via three vertical jumps and squat jumps at 40, 60, 80, and 100 kg at three time points: a) 1 week prior to their regular season, b) 2 days after the bye week in the middle of the season, and c) 1 week prior to the completion of the season. An Analysis of Variance (ANOVA) revealed no significant differences ($p \leq 0.05$) in power or body composition. These results support past research, indicating power and body composition can be maintained throughout a competitive season. However, more research is needed to determine the optimal programming methods to maintain or improve athletic performance via optimization of body composition and power during a competitive season.

Keywords: Dual-energy X-ray Absorptiometry; Squat Jump; Athletes; Lean Mass; Fat Mass; Vertical Jump

INTRODUCTION

For over a century, competitive sports have been embraced as a cornerstone in American society. Regardless of the sport, every athlete must endure the physical demands that come with an entire season. Usually by the end of a season, athletes are in a different physiological state compared to the beginning of the season (5, 13, 18). This is to be expected when considering lifestyle factor modifications (i.e., travel, games, food availability, etc.) that contribute to athletic performance (2, 5, 7, 12, 27, 38). Two variables critical to athletic performance are power output (3, 24, 31, 34, 36, 41) and body composition (6, 10, 16, 21, 22, 23). However, research is needed to clearly define the role power output and body composition have on athletic performance.

Power output is a key component in physical performance. A greater power output equates to jumping higher, running faster, and hitting harder. Because of the importance power output plays in athletics, it is worth monitoring throughout a season. Olympic lifting is one method for assessing power output in the weight room (34). However, using Olympic lifts to assess power output can prove challenging due to the complex technique required. In addition to Olympic lifts, a vertical jump is an easy, quick, and accurate method for assessing power output (21, 34, 35, 36). Additionally, squat jumps can be monitored by external equipment to evaluate power output (3, 36). Power output can also be assessed in athletes in a laboratory setting using the Wingate Test, a thirty second cycle ergometer test designed to assess power output (19, 41). Research in this area is inconclusive, with studies showing no change (3, 19, 34, 36), decreases (21, 24, 26), or increases (31, 35) in power output throughout a season. Understanding factors that affect power output will help coaches better prepare athletes for competition throughout an entire season.

Body composition can provide valuable information for coaches and scouts. Depending on the sport, position, and age, body composition can be used as a reliable indicator of athletic potential (10, 12, 28, 31, 34, 36). There are many different methods to assess body composition, each with advantages and disadvantages. Bioelectrical Impedance Analysis (BIA) machines are user friendly and noninvasive (38) but produce a wide range of accuracy (±6.3%) (14). Air displacement plethysmography (e.g., Bod Pod), uses the displacement of air to estimate body fat percent and has an accuracy of ±3.5% (14). With a similar level of accuracy (±3.5%) skinfold calipers are cheap and quick to use, however reliability is lower compared to other methods, such as hydrostatic weighing (14, 32). According to the American College of Sports Medicine (ACSM), hydrostatic weighing is a standard criterion method for estimating body composition but requires special equipment, accurate measurement of residual volume in the lungs, and substantial cooperation and coordination with the subject (14). Dual-Energy X-Ray Absorptiometry (DXA) yields similar body composition values (<1%) to hydrostatic weighing (14, 40), while requiring less time and elimination of user error (1, 39). Since peak performance is affected by body composition (16, 22, 28, 34, 39) these instruments can provide useful insight to better prepare athletes for competition. The current literature has mixed findings on the results of body composition changes throughout a season. There are studies reporting no body composition changes during a season (21, 23, 30, 34, 37) while a larger portion have reported increases in fat mass (25, 29), increases in lean mass (10, 27, 35, 36, 37), decreases in fat mass (10, 27, 31, 35, 37), or decreases in lean mass (6, 25, 29).

Past research on in-season athletes has observed power output using explosive movements such as sprints (24, 31, 36), jumps (21, 34, 35, 36) and squat jumps (3,36). Body composition of athletes has been assessed using a variety of methods: skinfolds (SKF) (20,21, 31, 34), BIA (11, 41), Bod Pod (22, 23), and DXA (6, 10, 16, 25, 27, 29, 30, 35, 36, 37). Assessing power output or body composition of athletes has provided extensive insight on changes from the beginning to the end of a season. However, current literature has not clearly defined body composition and power output from pre-, mid-, to end-of-season, while utilizing DXA as the criterion assessment method for body composition. Due to this lack of research, the aim of this study was to assess power output and body composition from pre-, to mid-, to end-of-season in Collegiate Football Championship Subdivision (FCS) American football linebackers. Additionally, linebackers were used because they were the only group that was able to fit the scheduling of the study during the academic semester. It was hypothesized that power output, lean mass, and fat mass would change from pre-, to mid-, to end-of-season.

METHODS

Experimental Approach to the Problem

The study observed body composition and power output at three different time points (pre-, mid-, and end-of-season) throughout a Division 1 American Football season. DXA was used to assess body composition due to its low level of error in estimations. Linear transducers were used to measure power output during barbell squat jumps. Additionally, vertical jump height was recorded.

Subjects

DI FCS American football linebackers (n=9; age=19±1.5 yr=1.8±.3; height=183.3±5.2 cm) from a regional university voluntarily consented to participate. Approval to conduct the study was obtained by the Health and Human Services Human Subjects Review Committee.

Procedures

During the Fall academic term, participants had vertical and squat jumps assessed one week prior to the first game of the competitive season, two days after the bye week in the middle of the season, and one week prior to the final game of the season. For each data collection time point, body weight was measured with a Health o Meter® Mechanical Beam Scale. The scale was calibrated the day before every weigh in. A warm-up led by the certified strength and conditioning football coach was conducted prior to the participants performing jumps. The warm-up consisted of 2 minutes of foam rolling the lower body muscle groups and active warm-ups including dynamic movements. After the warm-up, vertical jump was then assessed via Just Jump System® jump pads. Participants performed three maximal vertical jump trials, with a 30 second rest between trials. The highest recorded value was used as the vertical jump score. It was believed that 30 seconds was enough time between sets for the participants to fully recover. The Sayers Equation was used to calculate power from the highest recorded vertical jump height of the three attempts (Watts =60.7 X jump height (cm) + 45.3 X body weight (kg) -2055) (15). After a rest period of 90 seconds, participants performed three maximal barbell squat jumps, resetting feet between each jump. This was done with 40, 60, 80 and 100 kg. A rest period of 90 seconds was allotted between each weight increase. It was believed that 90 seconds of rest was enough time between each set for the participants to be fully recovered. Each squat jump repetition was assessed for peak power, mean power, peak velocity, and mean velocity by a PowerTracker Lite® system. Participants were encouraged to perform barbell squat jumps to achieve maximal height. Participants performed DXA scans the day after jump testing. Participants performed all jump and DXA scans at similar times of the day at the pre-, mid-, and end-of-season timepoints. Immediately after body weight was recorded, using the same scale used the day prior, participants completed a DXA total body scan. Body weight was reported as the average between the two days of measurements. Vertical jumps, squat jumps, and DXA scans were conducted before practice/training each day. No guidance was provided to the participants in regard to nutrition, hydration, or supplementation prior to power data collection sessions or DXA data collection sessions. No playing time of the participants was assessed. Nutritional status was not assessed by the athletes due to the low availability of registered dietitians. Sleep and wellness were not monitored prior to the sessions either.

Participants performed a low volume, high intensity resistance training program designed by the university strength and conditioning department. The program conducted three days of resistance training a week throughout an 11-game competitive season. The focus of the program during the season was on maintenance of power and strength. The three primary exercises in the training program were Squats, Bench Press, and Hang Cleans with sport specific accessory lifts. The number of working sets for the main exercises varied between 4 and 6 on average throughout the season.

Statistical Analyses

Data obtained from DXA scans, vertical jump height, and barbell squat jumps were first assessed for normality using the Kolmogorov-Smirnov test. Most variables were normally distributed, those that were not were log transformed and normality was then found. Next, data were analyzed using a repeated measures analysis of variance (ANOVA). Mauchly's Test of Sphericity was first read to determine if the variances and covariances of the study's variables were not significant. If Mauchly's test was significant, then the Hyunh-Feldt was used. If Mauchly's was not significant, then Sphericity Assumed was used to determine significance. Any statistically significant ANOVA effects ($p<0.05$) were further analyzed by a paired samples t test, significance set at $p<0.025$. All analyses were performed using SPSS statistical software (SPSS Inc., Chicago, IL).

RESULTS

Participants

Due to injury, two junior and two freshman participants were unable to complete the mid- and/or end of season data collection time points due to injury or inability to be at data collection time points. Descriptive characteristics for completers are listed in Table 1.

Power Output Data

A repeated measures ANOVA reported no significant difference in power output levels at any given time point during the season for vertical (Table 1) or squat jump (Table 2). No significant difference in power was observed between the subgroups (i.e., freshman, sophomore, and junior).

Table 1. Vertical Jump Data

Variable	Pre-Season	Mid-Season	End-of-Season	ANOVA Statistical Sign.
1st Jump	79.40±11.40	77.72±8.05	76.43±8.18	p=.505
2nd Jump	79.02±10.77	79.65±10.97	79.83±7.90	p=.953
3rd Jump	81.99±10.97	80.98±8.74	79.40±7.92	p=.604
Best Jump	82.37±10.52	82.09±9.07	81.25±7.37	p=.804
Sayers (Watts)	7,576.17±730.18	7,614.55±650.49	7,530.53±507.85	p=.506

Values are mean ± SD

Vertical Jump Height is reported in centimeters

Table 2. Squat Jump Data

Variable	Pre-Season	Mid-Season	End of Season	ANOVA Statistical Sign.
40 kg PP	1066.3±115.2	1074.3±92.9	1094.3±134.3	p=.861
40 kg MP	594.9±33.5	586.7±24.2	610.1±74.7	p=.438
40 kg PV	2.7±.3	2.6±.2	2.8±.3	p=.748
40 kg MV	1.5±.1	1.5±.1	1.4±.1	p=.469
60 kg PP	1419.0±171.2	1437.8±188.7	1372.8±137.2	p=.526
60 kg MP	813.8±54.9	807.0±39.3	787.6±52.8	p=.384
60 kg PV	2.4±.3	2.4±.3	2.3±.3	p=.598
60 kg MV	1.4±.1	1.4±.1	1.3±.1	p=.177
80 kg PP	1656.4±186.4	1622.9±120.1	1575.9±119.4	p=.315
80 kg MP	972.1±73.5	966.6±54.4	940.8±45.8	p=.170
80 kg PV	2.1±.2	2.1±.2	2.1±.2	p=.598
80 kg MV	1.2±.1	1.2±.1	1.2±.1	p=.741
100 kg PP	1874.7±168.5	1816.3±215.4	1735.3±177.6	p=.196
100 kg MP	1110.0±105.7	1113.4±85.8	1067.0±67.3	p=.208
100 kg PV	1.9±.2	1.9±.2	1.8±.1	p=.301
100 kg MV	1.1±.1	1.1±.1	1.1±.1	p=.156

PP = Peak Power PV = Peak Velocity
MP = Mean Power MV = Mean Velocity
Peak Power and Mean Power are reported in Watts

Peak Velocity and Mean Velocity are reported in meters per second

Table 3. Body Composition Data

Variable	Pre-Season	Mid-Season	End of Season	ANOVA Statistical Sign.
Body Weight	103.12±2.72	102.74±4.48	101.88±4.56	p=.459
Body Fat %	21.31±6.02	21.02±5.98	20.79±5.78	p=.562
Lean Mass	76.79±7.97	78.33±7.84	80.68±7.29	p=.225
Fat Mass	20.76±5.86	20.71±5.72	20.37±5.48	p=.711
Fat Free Mass	81.43±8.23	83.18±8.00	82.71±7.47	p=.197

Values are mean ± SD
Body Weight, Lean Mass, Fat Mass, and Fat Free Mass are all reported in kilograms.

Body Composition Data

The repeated measures ANOVA indicated no significant relationship between body composition variables and the time of season (Table 3). No significant differences in body composition were seen between the subgroups.

DISCUSSION

The purpose of the present study was to investigate power output and body composition in linebackers over the course of a DI FCS American football season. To our knowledge, this is the first study to observe power and body composition changes simultaneously in DI FCS American football linebackers over the course of a competitive season.

Power Output

No change in power output levels were observed in the group of linebackers from pre-, to mid-, to end-of-season. Our hypothesis predicting that power output will change from pre-, to mid-, to end-of-season was rejected..

Past research has observed that athletes do not experience changes in power output levels from the beginning to the end of the season (3, 19, 34, 36). Baker (2001) found no changes in power output, assessed by squat jumps, in collegiate rugby players (n=29) from pre- to post-season. Similarly, Silvestre et al. (2006) found no difference in pre- vs. postseason power output, using vertical jump and nine- and 36-meter sprints, in collegiate soccer players (n=25). Additionally, Hoffman et al. (2005) found no changes in power output, using the Wingate cycle ergometer test, over the course of a competitive season in collegiate American football players (n=10). Additionally, Schmidt et al. (2005) used power cleans and vertical jumps to assess power outputs in collegiate wrestlers (n=10) and found no changes from pre- to postseason. Schmidt et al. (2005) also utilized the Sayers equation to predict power output and found no significant difference from pre-, to mid-, to postseason. These studies suggest a competitive season will not cause significant changes in power output, which supports the findings of the current study. Overall, these findings support the goal of most strength and conditioning programs, that is to increase power in the off-season in hopes of maintaining power output levels throughout the competitive season.

While these studies found no power output changes throughout a competitive season, there are contradictory research findings (21, 24, 26, 31, 35). Ostojic (2003) reported increased power output via faster sprint times and decreased fat mass throughout a competitive season for professional soccer players (n=30). With less body fat encumbering the athletes, faster sprint times would be expected. Silva et al. (2012) reported an increase in vertical jump height in junior level basketball players (n=17) from pre- to postseason. Kraemer et al. (2004) found a decrease in power with slower sprint times and lower vertical jump heights in collegiate soccer players (n=25). Similarly, Laurent and Fullencamp (2014) also found slower sprint times in collegiate hockey players (n=20), implying a decrease in power output levels by the end of the season. However, McLean et al. (2012) found a decrease in power output in collegiate soccer players (n=19). The current study's findings do support changes in power output in the collegiate linebackers throughout the competitive season. This was evidenced by consistent vertical jump heights and barbell jump squats.

The available research on power output changes from pre- to end-of-season is inconclusive. These findings may be, at least partially, due to the numerous methodologies implemented to monitor and improve athletic performance with resistance training (3, 6, 36). Athletes in the current study followed a high-intensity low-volume strength and conditioning program throughout the season. As supported by past research, the athletes in our study were able to maintain power output by performing resistance training throughout the season (6, 36, 39). Additionally, nutrition will impact the recovery of an athlete. Adequate calories will allow for athletic performance to be maintained. There are multiple factors (stress, travel, inadequate caloric intake) that will most likely lead to fatigue, causing a negative effect on power output. However, there are no studies to our knowledge that have assessed all these factors, individually or combined impact power output. Nutrition was not assessed in the current study or in the referenced studies. Future studies should consider utilizing a full dietary analysis to obtain valuable information on the physiological condition of a given sample.

To summarize, the findings of this study support the notion that athletes are able to maintain levels of power output throughout the season, but more research is needed to fully understand and predict the changes, or lack of changes, seen in power output in athletes throughout a competitive season.

Body Composition

There were no changes in body composition from pre-, to mid-, to end-of-season. Our hypothesis stating that lean mass would change from pre-, to mid-, to end- of-season was rejected. Additionally, the hypothesis predicting fat mass would change from pre-, to mid-, to end-of-season was also rejected.

Currently, there are conflicting findings on body composition changes that athletes experience throughout a competitive season. There is research that reports no body composition changes occur throughout a competitive season (21, 23, 30, 34, 37). Schmidt et al. (2005) used a 6-site skinfold test and Kramer et al. (2004) used a 7-site skinfold test, both reported no significant changes in body composition in collegiate wrestlers (n=10) and collegiate soccer players (n=25) throughout a season. Similarly, Ladwig et al. (2013) found no significant changes in body composition, using a Bod Pod, throughout a season in collegiate basketball players (n=11). Nepocatych (2017) found no changes in lean or fat mass, via DXA, in collegiate basketball players (n=10). Additionally, Stanforth et al. (2014) found no seasonal changes in lean or fat mass with DXA scans on 47 collegiate soccer players. These studies show similar findings to our study by reporting no significant changes in lean mass, fat mass, or body fat percent throughout a season.

While there is evidence for no change in body composition throughout competitive season, there is more evidence suggesting body composition changes occur (6, 10, 11, 16, 25, 27, 29, 31, 35, 36, 37). Ostojic (2003) reported significantly lower body fat percentages using 7-site skinfold assessments in professional soccer players (n=30) at the end of the season. Similarly, Bunc et al. (2015) found professional soccer players (n=45) experienced an increase in lean mass and decrease in fat mass, assessed by BIA, by the end of the season. Moreover, DXA results from Silvestre et al. (2006) showed lean mass of collegiate soccer players (n=25) increased throughout a season with no change in fat mass. Conversely, DXA scans from Harley and Hind (2011) reported a significant second half of the season increase in BF% and fat mass in professional rugby players (n=20) while lean mass decreased. Binkley et al. (2015) reported similar decreases in lean mass with DXA scans by the end of the season for collegiate American football players (n=53). Stanforth et al. (2014) found body composition changes, assessed via DXA, throughout the season in swimmers (n=52) and track athletes (n=49) (decreased fat mass and increased lean mass), basketball Players (n=38) (decreased fat mass), and volleyball players (n=26) (increased lean mass). Lees et al. (2017) and Minett et al. (2017) reported decreases in lean mass and increases in fat mass with DXA scans on professional rugby players (n=35) and collegiate soccer players (n=24). Milanese et al. (2015) and Silva et al. (2012) both found increases in lean mass and decreases in fat mass with DXA scans for professional soccer players (n=31) and junior basketball players (n=17). Carling and Orhant (2010) found a decrease in fat and increase in lean mass via 4-site skinfold tests for professional soccer players (n=26). These studies all report different findings on body composition changes (both increases and decreases in both lean and fat mass). These variant results could be due to studying different levels of athletes, sports played, and body composition assessment methodologies and their respective reliabilities (DXA vs Skinfolds vs BIA vs Bod Pod). However, these studies support the notion that body composition will change from the beginning to end of a season. Training programming may also play a part in body composition changes. Binkley et al. (2015) and Trexler et al. (2017) note high-intensity low-volume training programs could lead to no change in lean mass. Both studies utilized ground based, multi joint exercises and trained two days a week (6) or three days a week (39) during the competitive season.

Current research throughout a season present mixed findings, with the majority indicating body composition will change. However, there are differing results even within the same sport. The different methodologies utilized to assess body composition is thought to, at least partially, contribute to the mixed findings. Additionally, little research on body composition and power output changes have been done on collegiate American football players. To summarize the research, Table 4 details research related to body composition and power output. Nutrition is a very impactful factor regarding body composition. If the athlete is expending more calories than consumed, fat and lean mass are likely to decrease. The opposite will be seen if the athlete consumes more calories than expended. However, a large portion of past research did not assess nutrient intake for potential impact on body composition with athletes due to the low availability of dietitians working with collegiate teams and the amount of time needed to collect the quantity of data. It is believed that high-intensity low-volume training programs could aid in the retention of lean mass, explaining how the linebackers in the current study did not lose lean mass throughout the season. The training program in our study was like the program implemented in Trexler et al. 2017. Participants performed three low volume, high intensity resistance training sessions a week. The lifts prioritized in both studies were the Back Squat, Bench Press, and Hang Clean. The current study did not attempt to analyze dietary intake because it was not the focus of the study. Additionally, the time requirement for nutrition focused data collection would have been too great. However, an analysis of athletes' nutrition would provide information on how to fully optimize body composition throughout a competitive season.

Table 4. Literature Summary

Source	Participants	Mode	Timing	Lean Mass	Fat Mass	Power
Baker (2001)	29 Col/Prof Rugby	SJ Bench	Pre Mid Post	NA	NA	↔ ↑
Hoffman et al. (2005)	10 Col FB	Wingate	Pre Pre Pre Mid Post	NA	NA	↔
Laurent and Fullencamp (2014)	20 Col Hockey	Sprint	Pre Post	NA	NA	↓
McLean et al. (2012)	19 Col Soc	Cycle Test	(9 Times) Pre Every two weeks	NA	NA	↓
Schmidt et al. (2005)	10 Col Wrestlers	Cleans Vert Skinfold	Pre Mid Post	↔	↔	↔
Binkley et al. (2015)	53 Col FB	DXA	Pre Mid Post	↓	↔	NA
Bunc et al. (2015)	45 Prof Soc	BIA	Pre Mid Post	↑ ↑	↓ ↓	NA
Harley et al. (2013)	20 Prof Rugby	DXA	Pre Mid Post	↓	↑	NA
Ladwig et al. (2013)	11 Col Basket	Bod Pod	Pre Post	↔	↔	NA
Nepocatych et al. (2017)	10 Col Basket 10 Col SB	DXA	Pre Post	↔	↔	NA

Stanforth et al. (2014)	47 Col Soc 52 Col Swim 49 Col Track 38 Col Bas-ket 26 Col VB	DXA	Pre Post	↔ ↑	↔ ↓	NA
Lees et al. (2017)	35 Prof Rug-by	DXA	Pre Post	↓	↑	NA
Milanese et al. (2015)	31 Prof Soc	DXA	Pre Mid Post	↑	↓	NA
Minett et al. (2017)	24 Col Soc	DXA	Pre Post	↓	↑	NA
Kraemer et al. (2004)	25 Col Soc	Vert Skinfold	Post Pre Pre Pre Mid Post	↔ ↔ ↔ ↔ ↔	↔ ↔ ↔ ↔ ↔	↓ ↓ ↓ ↓ ↓
Ostojic (2003)	30 Prof Soc	Sprint Skinfold	Pre Pre Pre Mid Post Pre Pre	↔ ↔ ↔ ↔	↓ ↓ ↓ ↑	↑ ↑ ↑ ↑
Silva et al. (2012)	17 Jun Bas-ket	DXA Vert	Pre Post	↑	↓	↑
Silvestre et al. (2006)	25 Col Soc	Sprint Vert SJ DXA	Pre Post	↑	↔	↔

↑ = Significant increase from prior assessment NA=Not Assessed
↓ = Significant decrease from prior assessment
↔ = No significant difference from prior assessment

Pre Pre=before preseason Pre=preseason
Mid=middle point in season Post=after the conclusion of season

SJ=Squat Jump Vert=Vertical Jump
Cleans=Power Cleans

Soc=Soccer Players SB=Softball Players
Basket=Basketball Players Swim=Swimmers
FB=American Football Players VB=Volleyball Players

Prof=Professional Col=Collegiate
Jun=Junior

SUMMARY

The findings of this study suggest there are no significant power output or body composition changes throughout a competitive season in this population of athletes. Since American football is such a demanding and rigorous contact sport, maintaining both power output and body composition throughout a competitive season can be difficult.

It is believed that resistance training during the season is a contributing factor in maintaining power output and body composition levels. The athletes in our study followed a high-intensity low-volume training program throughout the season, which may have helped to preserve lean mass. Maintaining power output levels throughout a season is optimal for athletic performance, but it places a greater emphasis on having athletes start the season in the best possible physiological condition. Few articles indicate that power output will improve as the season progresses while most research claims that power output will either decrease or not change. Including more detailed descriptions of the training programs that athletes undertake during competitive seasons would contribute significantly to the present body of research. It should be noted that the sample size was small compared to past studies, however prior studies have utilized similar sample sizes. The tests used in this study were selected based on the energy systems utilized by the participants as American football players. Specifically, repeated squat jumps and vertical jumps are typical movements, both in the muscle recruitment and timing (i.e., quick and explosive) conducted by American football linebackers. In addition to the power tests, DXA is one of the most accurate assessments for body composition. This optimizes the reliability of our body composition data. Additionally, a full dietary analysis of the athletes would help improve the understanding of body composition over the course of the season.

In conclusion, this study found that it is possible for DI FCS American football linebackers to maintain levels of power output and body composition throughout a competitive season. However, more research is needed to better predict the effects a competitive season will have on the power output and body composition of athletes. To our knowledge, this study was the first to observe power and body composition changes simultaneously in DI FCS American Football Linebackers over the course of a competitive season.

PRACTICAL APPLICATIONS

These results show that it is possible to maintain body composition (i.e., lean and fat mass) and power output throughout a season. A strength and conditioning coach can utilize this information to monitor the athletic potential of athletes. If body composition starts to show decreases in lean mass or power output begins to drop as the season progresses, a strength coach can make necessary adjustments to training programs to better prepare athletes to be more competition ready (more explosive with less body fat and more lean mass). If power output and lean mass are decreasing, a strength coach may determine that the athletes are overly fatigued or under stimulated by resistance training, or not consuming enough calories to maintain lean mass.

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