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A Comparison of Selected Physical Fitness and Performance Variables between Division I and Division II Football Players

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A Comparison of Selected Physical Fitness and Performance Variables between Division I and Division II Football Players

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The purpose of this study was to compare select physical fitness and performance variables between Division I and Division II football players and determine if there is a significant difference in the performance variables of the athletes at these levels. The subjects included offensive and defensive starters, excluding kickers and punters, from 26 NCAA Division I teams and 23 NCAA Division II teams. Offensive players were divided into the following positions: quarterbacks, running backs, wide receivers, tight ends, and offensive line. The defensive players were divided into the following positions: defensive line, linebackers, and defensive backs. Division I athletes were superior in 58 of the 117 independent t-tests analyzed in this study ($p \leq .01$). This study found Division II athletes were not superior in any of the t-tests. The greatest similarity between the two divisions was found in height and weight. Of the nine position groups compared for each of these variables, only two showed significant differences.

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Chapter I

Introduction and Justification

Nearly all football players at the collegiate level today participate in extensive weight training and conditioning programs aimed at producing larger, faster, and stronger athletes (Berg, Latin, & Baechle, 1990). Unlike other sports where most off-season training still occurs on the actual court or field and involves sport specific drills of that particular sport, the majority of off-season conditioning for football does not occur on the football field. Although the athletes may do some weight training or off court conditioning, most training for other sports occurs using sport specific skills. Basketball players spend most of their time training by shooting baskets and playing actual games. Likewise, baseball players spend much of their time playing catch and taking batting practice. In these other sports improvement is gauged by sport specific tasks, such as in basketball where a shooters improvement is measured by how many shots he or she makes. How well the athlete throws or hits the ball may determine a baseball player's improvement. In football however, strength, speed, and power may determine each player's improvement. Although the one repetition maximum (1RM) strength tests and related assessments such as sprint and jump tests are not measures of football ability, they are believed to reflect the physical performance characteristics representative of football playing potential (Allerheiligen et al., 1983).

Many researchers have studied the strength and performance levels of Division I football players (Olson & Hunter, 1985, Berg, et al., 1990, Black & Roundy, 1994). A few studies have also been done evaluating these same variables at the Division II level

(Mayhew, McCormick, Levy, & Evans, 1987, Ware, Clemens, Mayhew, & Johnston, 1995). However, very little research has been done comparing the differences between Division I and Division II players. Many times the difference between an athlete having the ability to compete at the Division I or Division II level is minimal. The purpose of this study is to compare select physical fitness and performance variables between Division I and Division II football players and determine if there is a significant difference in the performance variables of the athletes at this level.

Statement of the Problem

The purpose of this study was to compare selected fitness and performance levels for Division I and Division II football players. The results of this study will determine if physical and performance levels are different between Division I and Division II football players. The results of this study may help coaches determine the level at which prospective athlete can compete. The results may also enable coaches to determine how well each of his players compare to other players nationally and which areas need to be improved.

Delimitations

This study surveyed 26 Division I teams and 23 Divisions II teams from the previous season for the following variables; height, weight, 1 repetition maximum (1RM) bench press, 1 RM squat, 1 RM power clean, 40 yd dash, vertical jump, fat free body mass, percent body fat, relative bench press, relative squat, and relative power clean. Results were only requested for the starting player at each offensive and defensive position, excluding punters and kickers (n=22).

Limitations

The data collection tool for this study was a questionnaire, which may be a limitation in itself, because of the return rate. Some schools may not want other schools to have their test results. Another problem that may occur is that teams usually test all of their athletes on a specific date. If a player was injured or sick on the testing day, his performance might have been hindered which will affect the results. Finally, testing procedures and protocols differ at each school, possibly affecting the test scores and how the results should be interpreted.

Hypothesis

It was hypothesized that there would be no significant difference between the Division I and Division II athletes. This hypothesis was tested at the .01 level of significance for each variable.

Definition of Functional Terms

For clarity, the following terms are defined:

Division I- Schools which choose to participate in the highest level of competition in sports sanctioned by the NCAA.

Division II-Schools which choose to participate in the 2nd highest level of competition in sports sanctioned by the NCAA.

National Collegiate Athletic Association (NCAA)-The largest governing body of college athletics. Offer levels of competition at Division I, Division II, and Division III.

One Repetition Maximum (1 RM)- The heaviest weight an athlete can lift one time in a particular exercise.

Power-Ability to perform a movement with maximal level of strength and speed. This is measured as work per unit of time.

Power Clean-A weightlifting exercise designed to measure power. Involves lifting bar

from either the floor or waist level and moving it to the shoulders in one quick movement.

Vertical Jump- this is a test used to compare athlete's anaerobic power. The athlete stands with his side to the wall, reaches as high as he can with his feet flat to the ground, and a measurement is taken. Then the athlete jumps as high as he can off both feet. A measurement is taken where he touches the wall. A score is taken by subtracting the first measurement from the second.

40-yard dash- A 40 yard sprint in which the time is scored to the nearest 0.01 second.

Relative Bench Press (Bench/Weight)-Athletes maximum bench press divided by his body weight, expressed as a percentage.

Relative Squat (Squat/Weight)-Athletes maximum squat divided by his body weight, expressed as a percentage.

Relative Clean (Clean/Weight)-Athletes maximum clean divided by his body weight, expressed as a percentage.

Justification

This study was done to determine if there are statistically significant differences in fitness and performance levels between football players at the NCAA Division I and Division II levels. If there is a significant difference in the results, that would explain one of the distinctions between Division I and Division II players. These variables may assist football coaches with selecting and preparing players for specific positions (Black & Roundy, 1994). This study may also help coaches and players determine their strengths and weaknesses in these tests and allow them to compare themselves against the top teams and players throughout the country.

Chapter II

Review of Literature

Many studies have observed strength and conditioning levels of Division I and II football players. The research topics being reviewed for this study include the following: 1) comparing the differences in strength and speed in Division I football players, 2) norms developed for Division II football players in the bench press, squat, power clean, 40-yd dash, and vertical jump, 3) assessing the relationship of size, speed, strength, power, and body fat in Division I football players, 4) physical performance characteristics of American collegiate football players, 5) determining the accuracy of using relative muscular endurance performance to estimate 1 RM bench press and squat strength in Division II football players, and 6) reviewing football fitness testing and evaluation procedures.

NCAA Division I players between 1974 and 1984

Olson and Hunter (1985) studied the differences in strength and speed in Division I football players between 1974 and 1984 to show how conditioning programs are evolving at the collegiate level. Surveys were sent to 46 Division I universities requesting average maximum efforts from the athletes in 1974 and 1984 for the following tests: 40 yd sprint times, bench press, power clean, and squats. There were six categories used to divide the players into defensive secondary, defensive line, linebackers, offensive line, offensive backs, and receivers.

The study found that players in 1984 were taller and heavier that those in 1974. Using the Ponderal Index it was suggested that the increases in body weight may have

been caused because of the increases in height.

Marked improvement in mean 40-yd time was reported by all positions. The offensive linemen demonstrated the greatest improvement (.19 s) while the receivers showed the least amount of improvement (.11 s) ($p<.05$). However, the receivers still had the fastest times of all the groups in both studies

All of the positions also showed substantial increases in absolute strength in each category. Not surprisingly, the offensive and defensive linemen demonstrated the greatest maximal efforts for each lift both studies.

The most prominent finding of this study was that the increases in strength clearly exceeded the increases in body weight of the athletes over this 10-year period. This would suggest that 1984 players were not only larger, but achieved greater strength performances. This would strongly suggest that focused strength and running programs have a positive impact on explosive strength activities.

Strength norms for NCAA Division II college football players

Mayhew et al. (1987) wanted to develop norms for Division II football players in the bench press, squat, power clean, 40-yd dash, and vertical jump, so that coaches and players at this level have a gauge by which to evaluate their strength levels. Surveys were sent to three NCAA Division II schools. Strength scores from 336 players were compiled. Because of different philosophies among the strength coaches at these schools, not all strength measures were recorded on each player.

When performing the bench press, the athlete was assisted with a lift off, then lowered the bar to the chest, paused for one second, and then pressed the bar to full-arm

length. When performing the squat, the players continued squatting until the hip joint was parallel to the knee. The power clean was performed emphasizing a slow start, an explosive pull phase, rotation of the elbows forward and under until the bar was racked at the front deltoids. When administering the vertical jump, the player stood with his preferred side to the wall and reached as high as possible. From a flat-footed position, the player jumped as high as possible.

Linemen were significantly taller and heavier ($p<.05$) than the backs. The linemen also had greater absolute strength than did the backs on all three measures. However, when the strength scores were considered relative to body weight, the backs were significantly stronger.

Percentile norms for each group were constructed for each test. The correlation between bench press and squat did not exceed $r = .58$ for either group, thus accounting for no more than 33.6 percent of the common variance. This indicates that these tests measure independent aspects of strength since the bench press and squat are the most popular exercises for evaluating strength. Body weight and power clean were significant factors in predictions of speed and jumping ability. The values in this study averaged 13.7 percent lower than Division I players. Division I players were also 3.8 percent taller, 9.7 percent heavier, and 5.0 percent faster. Body weight was significantly related to bench press ($r =.32$), squat ($r =.25$), and power clean ($r =.35$) (Olson & Hunter, 1985).

These strength measures were the first normative values on Division II football players. Future work might use body composition values to help evaluate the interaction of muscle mass with strength performance.

Physical and performance characteristics of NCAA Division I football players

Berg et al. (1990) assessed the relationship of size, strength, speed, power, and body fat in Division I football players to team success. This study described 40 teams with respect to height, weight, bench press and squat strength, 40-yd dash speed, vertical jump, vertical jump power and body fat. Analysis were also made between: ranked versus unranked teams, offensive and defensive players, positions, major football conferences, and the relationship between selected variables and final rank.

Surveys were sent to the strength and conditioning coaches of 65 Division I football teams, including all teams ranked in the final top 20 poll for 1987. Information was requested for only the starting player at each offensive and defensive position, excluding kickers. Data were collected between the spring of 1987 and the start of the fall season.

The validity of these measurements were limited by the fact that different testing procedures may have been used, since there was no pre-established methodology. From the data, strength was divided by body weight to express bench press and squat relative to weight. Vertical jump was expressed in cm and was converted to power using the Lewis nomogram (Berg et al. 1990).

Positions were grouped into the following categories: quarterbacks, offensive backs, tight ends, wide receivers, offensive linemen, defensive linemen, linebackers, and defensive backs. Data analysis included calculation of descriptive statistics, multiple regression to predict final rank using fitness and performance variables, analysis of variance to make comparisons, omega squared to provide the percent variance explained

by the variables, and Spearman rank order correlations to examine selected relationships. An alpha level of .01 was used.

Because of the large number of comparisons used and the large number of subjects, many statistically significant differences occurred. However, many of these differences were very small. In all of the comparisons made, except for positions, Omega squared ranged from 0% to 21%.

Significant differences were observed when comparing the mean scores of each team in every category except height and weight. Using the Omega squared analysis, the least amount of variability was 2%, while the greatest amount was 21%. The comparison done between ranked and unranked teams showed significant differences ($p<.01$) in three of the 10 variables: vertical jump, vertical jump power, and bench press/weight. These variables all favored ranked teams. This supports research showing power may distinguish level of playing ability among football players. There was also a difference between offensive and defensive players in seven of the ten categories. The differences favored the defense in four of these seven categories. Overall, defensive players were leaner and better at moving the body rapidly.

The following conclusions were made at the completion of this study: 1) the teams were similar across selected variables, 2) differences between offensive and defensive players were small, 3) there were meaningful differences in comparing positions, 4) teams in major conferences appear to be similar on most variables. The only variable significantly related to final rank was power, and final rank could not be accurately predicted through these variables.

Physical performance characteristics of American collegiate football players

Fry and Kraemer (1991) studied the physical performance characteristics of American collegiate football players. The purpose of this study was to compare the performance tests (1 RM bench press, 1 RM back squat, 1 RM power clean, vertical jump, and 40 yd dash) of collegiate football players by position, playing ability (starters versus nonstarters) and caliber of play (NCAA Division I, II, and III).

Thirty collegiate strength and conditioning coaches were contacted for a survey. This included 10 coaches each from NCAA Divisions I, II, and III. Results from the 1987 preseason were requested. Because not all programs use all five tests, only the results that were used by the institution were reported. Nineteen surveys were returned (Division I n=6, Division II n=7, Division III n=6). The sample ranges for each individual test ranged from n=776 for the bench press to n=297 for the back squat.

Data were collected for first, second, and third strings of 14 positions: quarterback, running back, fullback, center, offensive guard, offensive tackle, tight end, receiver, middle guard, defensive tackle, defensive end, linebacker, cornerback, and safety.

One way ANOVA (1 x 3) were used to compare test performance by caliber of play (division) as well as player position (1 x 14). Two way ANOVA (2 x 3) were used to compare player ability (starter vs. nonstarter) with caliber of play. Tukey post-hoc multiple comparisons were used to determine significant differences. A significant level of $p<.05$ was used for all analysis. Eta coefficients were used to determine relationships between test scores and division of play, while point-biserial correlations determined

relationships between test scores and playing ability (starters vs. nonstarters).

In all cases Division I athletes were superior to Division III. Low to moderate, ($p<.05$) significant differences were observed between caliber of play and test scores. Significant differences were observed between each of the 14 positions. In general, linemen and linebackers exhibited the greatest absolute strength and total body power.

When comparing starters against nonstarters, there was no significant difference in the 40-yd dash, regardless of division. There was a significant difference however in the bench press, squat and power clean.

Significant differences in offensive linemen were only observed in the bench press and vertical jump between starters and nonstarters. There were no significant differences found between divisions in the back squat or 40-yd dash.

Data found for the receivers showed that starters performed significantly better in every test except for the back squat. Division III receivers were significantly better in the bench press then Division II receivers. This was the only difference among divisions for any of the variables.

Starting defensive linemen performed significantly better than nonstarters in all tests except for the back squat. Division I and II athletes were stronger than Division III in the bench press and Division I defensive linemen were stronger than Division III in the back squat.

Tests showed that starting linebackers were superior to nonstarters in all tests except the back squat. Division I linebackers were significantly better than Division III players in the bench press and vertical jump. The Division I linebackers also had greater

power clean performances than did the other two groups.

The defensive backs showed significant differences between starters and nonstarters for the power clean, 40-yd dash, and vertical jump. When comparing divisions, the only significant difference was observed in the bench press, with Division III defensive backs being stronger than Division II.

This study concluded that bench press, power clean, and vertical jump displayed the biggest differences between divisions of play and playing ability on a specific team. The 40 yd dash displayed significant differences only for playing ability and not between divisions. The back squat differentiated poorly between playing ability and divisions of play.

Comparisons of NCAA Division I football players

Black and Roundy (1994) compared the size, strength, speed, and power for starters and nonstarters in NCAA Division I football players. The purpose of this study was to assist coaches in making decisions on player positions and status and in developing training programs for specific positions.

Surveys were sent to 44 strength and conditioning coaches at the NCAA Division I level. The information requested included: body weight, 1-RM bench press and back squat, vertical jump, and 40 yard dash. Data were collected for each of the starters and nonstarters for each of 16 positions: nose tackle, defensive tackle, defensive end, inside linebacker, outside linebacker, cornerback, free safety, strong safety, offensive center, offensive guard, offensive tackle, tight end, wide receiver, quarterback, running back, and fullback. Starters were designated by the individual who started at least half of the

games.

A two-way (2 x 16) ANOVA was used to test statistical significance ($p<.05$). The independent variables were status (starter vs. nonstarter) and position. An analysis was made for each of the five variables: weight, bench press, squat, vertical jump, and 40 yard dash.

Significant differences were observed for 10 of the 16 positions in the bench press between starters and nonstarters. These included all of the offensive line positions, quarterback, fullback, defensive tackle, inside linebacker, cornerback, and free safety.

Seven positions showed significant differences in the 40-yard dash. These were defensive tackles, outside linebacker, cornerback, offensive center, offensive guard, wide receiver, and quarterback.

There were six positions that showed significant differences in squat strength: outside linebacker, cornerback, offensive guard, tight end, wide receiver, and running back. Starters were superior to the nonstarters for vertical jump at outside linebacker, cornerback, and wide receiver. Differences were also found significant for body weight in defensive tackles, outside linebackers, inside linebackers, strong safety, and tight ends.

This was the first study done comparing starters versus nonstarters, only a few comparisons can be made. The effectiveness of these test items for determining playing ability is controversial. There are many examples of players with superior testing results that seldom play. Likewise, there are situations when a great player has lower test performance. This study shows that, in general, players who score higher in strength, power, and speed were selected as starters.

Muscular endurance repetitions predicting bench press and squat strength

Ware et al. (1995) did a study to determine the accuracy of using relative muscular endurance performance to estimate 1 RM bench press and squat strength in Division II college football players. They determined that the bench press and squat are two of the most often used core exercises in resistance training programs for college football players.

Forty-five Division II football players were selected as subjects. The subjects lifted on a 4-day-a-week split routine, working the upper body twice a week and the lower body twice a week. During the first three weeks the athletes used 4 sets of 10 repetitions in the core exercises. During the second three weeks they performed 5 sets of 8 repetitions. During the third three weeks they performed 5 sets of 5 repetitions. During the final 3-week cycle the players did 3 sets of 3 repetitions followed by 3 sets of 2 repetitions. During the final week before the testing, each athlete performed repetitions to failure in the core exercises using seventy percent of his probable 1 RM.

The 1 RM bench press and squat values were 7.5 and 1.5%, respectively, below the mean scores for Division II players. Different 1 RM equations were used for comparisons, but most of them greatly overestimated the 1 RM, by as much as 14.2 kg for the bench press and 48.5 kg for the squats.

This study concluded that using repetitions to failure to predict 1 RM might be limited when using highly trained athletes. The most accurate way for determining 1 RM is to use fewer repetitions (<10) with heavier loads (>80%).

Football fitness testing and evaluation

Ebben (1998) reviewed football fitness testing and evaluation procedures. The purpose of this study was to examine many studies that have been done involving fitness testing in football and compile it together. A number of sources offer general guidelines for physical testing.

Frequency of testing is considered one of the major issues. Although there is variation, the most frequent times that testing occurs is during the pre-season, post-season, prior to winter conditioning, and prior to spring practice. It is also very popular to test different fitness variables at different times of the year. One opinion that is shared by many programs is that testing must be frequent and consistent or the athletes will lose motivation and the information will become meaningless.

Selection of testing items is also very important. Conditioning programs should employ the mechanical and movement speed requirements of the sport. It is also important to prioritize and test the parameters of fitness needed to meet the unique needs of a specific team. It may also be beneficial to incorporate different test items for different positions.

There is a lot of disagreement about testing muscular strength. The most frequent tests used are the bench press and squat to assess upper body and lower body strength respectively. Other tests used less frequently are the incline press, hip sled, Nautilus 4-way neck, incline dumbbell press, military press, front squat, incline machine, and deadlift.

There is some controversy between 1-RM strength tests and multiple repetition

tests. Sometimes test load is determined by a percentage of body weight or a fixed weight for maximum repetitions. It appears that strength is best evaluated through tests of approximately 1- to 6-RM.

Speed/strength exercises assess movements with high power output. A number of sources incorporate Olympic-style exercises to assess speed/strength. The power clean is the most frequently used test for speed/strength. Other tests include the hang clean, jerk, dumbbell clean and press, push press, and snatch.

Muscular power is the ability to exert force at relatively high speeds. This is another area that is frequently tested. The most common test for lower body power is the vertical jump. Other tests used are the standing long jump, the Margaria/Kalamen test, 3-step vertical jump and three response standing jumps.

Anaerobic capacity is the rate and quantity of work performed using primarily the anaerobic energy systems. Football relies primarily on the anaerobic systems. Football conditioning and testing should include continuous sequence movements lasting between 15 seconds and 2 minutes. The most commonly used test is the 300-yd shuttle for two trials with five minutes rest in between.

Speed is the rapidity of movement and is commonly tested with running. Speed is an important physical ability of football. It has been tested with the 10-yd dash, 20-yd dash, 40-yd dash, and 100-yd dash. The most commonly used method is the 40-yd dash. Acceleration has been tested by timing the intervals between 10, 20, and 40 yards during the 40-yd dash.

Body composition refers to the relative percentage of fat versus fat-free body

tissue. Assessment of body fat is a common practice in many athletic programs since there is evidence that excess body fat typically impairs performance. Skinfold measurements are the most reliable and valid means of assessment commonly available to strength and conditioning professionals. Hydrostatic weighing and the Sloan form are also used.

In the opinion of many coaches and athletes, the bench press repetition maximum and 40-yd dash time remain the standard of football fitness. There are many reasons for testing and evaluating athletes. These include assessing ability, determining postion placement, ranking athletes, identifying strengths and weaknesses, potential health risks, individualizing programs, motivation, program adherence, and evaluating the strength and conditioning program itself. Although a comprehensive test is best, administering a minimal program is better than no test..

Summary

These studies have all examined how different performance variables carry over to success on the football field. Most of the research has concluded that the best variables for comparing players are height, weight, strength, speed, and anaerobic power. There is often a minimal difference between a Division I and Division II athlete. Comparing these variables will give coaches a better idea of determining the talent level of their players.

Chapter III

Methodology

Preliminary Procedures

Informed Consent

The Institutional Review Board at the University of Nebraska approved this study before it was started. Implied Informed consent was obtained from each team. Consent was assumed if a questionnaire was returned from the participating institution.

Subjects

The subjects for this study were the starting players at each offensive and defensive position, excluding punters and kickers (n = 22), at the conclusion of the previous season, from 26 Division I teams and 23 Division II teams. The player who started the majority of games at each position was to be used.

Operational Procedures

A questionnaire was sent to the strength and conditioning coach of each school that participates in football at the NCAA Division I (n=112) and Division II (n=152) levels. The questionnaire requested height (cm) and weight (kg), 1 RM bench press (kg), 1 RM squat (kg), 1 RM power clean (kg), vertical jump (in), 40-yd dash time (s), and body fat percentage for each starter. From these results other performance scores were computed; fat free mass (kg), relative bench press, relative squat, and relative power clean. The results from the testing done nearest to the start of the playing season in the fall were used. If the questionnaire was not returned within two weeks, a follow up phone call was made. If the questionnaire was not returned in one week after the call, a

second questionnaire was sent.

The vertical jump was used to measure anaerobic power. The vertical jump height was calculated by subtracting the jump and reach score from the standing reach score. Vertical jump scores were then converted to power (kgm/sec) using the Lewis nomogram (Mayhew et al., 1987).

Players were divided by position in the following categories; quarterbacks, running backs, wide receivers, tight ends, offensive linemen, interior defensive linemen, defensive ends, linebackers, and defensive backs.

Data Analysis

The data analysis included the calculation of descriptive statistics (mean, standard deviation, and range), and independent t tests to make comparisons. Because of a large number of analysis, an alpha level of .01 was selected to reduce the chance of a type I error being made.

Chapter IV

Results and Discussion

Results

Table 1 displays all schools that participated in the study by division. Questionnaires were sent to all 112 schools which play football in NCAA Division I and to all 152 schools playing NCAA Division II Football. Twenty-six (23.2%) Division I schools returned questionnaires and 23 (15.1%) Division II schools participated.

Descriptive data for each division regardless of position appears in Table 2. Significant differences were observed favoring Division I athletes for each test item except height and weight. Table 3 contains test performances for the defensive linemen. Again, Division I players tested significantly better for all variables except height and weight.

Test results for linebackers are shown in Table 4. Division I athletes were significantly better in each test except height, weight, and relative power clean. Table 5 describes the data for the defensive back groups. The Division I group was significantly superior in all tests except height, weight, body fat percentage, and fat free mass.

Testing results for quarterbacks are illustrated in Table 6. Significant differences favoring Division I players were observed in the bench press, vertical jump, 40-yard dash, and relative bench.

Table 7 shows testing results for the running back groups. The Division I group was significantly superior in height, bench press, vertical jump, 40 yard dash, and vertical jump power.

Table 8 shows test results for wide receivers. Significant differences favoring the Division I group were observed in the bench press, squat, power clean, vertical jump, 40 yard dash, vertical jump power, and relative squat.

Test performances for the offensive linemen are illustrated in Table 9. Division I players were significantly better in all tests except relative power clean. Data description for the tight end groups is displayed in Table 10. The Division I group tested significantly better in weight, bench press, squat, power clean, vertical jump, fat free mass, and vertical jump power.

Table 1. Schools Responding to Survey

Division I	Division II
Air Force	Albany
Clemson	American International
Colorado State	Augustana
Eastern Michigan	Central Oklahoma
Indiana	Chadron
Kansas State	Concordia-St. Paul
Nevada-Reno	Eastern New Mexico
New Mexico State	Mars Hill
North Carolina	Minnesota-Duluth
Northwestern	Minnesota-Morris
Temple	Missouri-Rolla
United States Military Academy	Morris Brown
Utah State	Northwest Missouri State
UTEP	Savannah State
Virginia Tech	Shepherd
Washington	Southwest State
*	Stony Brook
*	Texas A&M-Commerce
*	Valdosta State
*	Washburn
*	West Chester
*	*
*	*
*	
*	
*	

*** Indicates teams requesting to remain anonymous**

Table 2. Descriptive and Comparative Statistics for All Data

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	510	185.9	2.6	155.0-203.0	473	185.0	2.4	168.0-202.0	0.9	2.23
Weight, kg	532	108.0	19.6	72.7-154.6	496	105.3	22.0	70.0-164.3	2.7	2.11
Bench press, kg	531	165.0	26.9	90.9-263.6	470	145.8	25.9	81.8-218.2	19.2	11.50*
Squat, kg	479	231.6	40.8	125.0-320.5	459	203.9	41.2	108.0-322.0	27.7	10.38*
Power clean, kg	486	138.6	18.6	85.0-245.5	386	126.2	21.1	68.2-206.8	12.4	9.03*
Vertical Jump, cm	549	80.1	10.2	49.5-110.4	385	70.1	12.1	30.5-105.4	10.0	13.25*
40 yd, s	447	4.74	0.3	4.13-5.86	464	4.88	0.3	4.25-5.90	0.14	-6.65*
Body fat, %	357	11.9	5.5	3.3-26.0	281	13.9	6.3	3.2-30.0	2.0	-4.34*
Fat free mass, kg	357	94.8	12.9	66.2-124.5	281	89.6	11.7	64.8-130.2	5.2	5.37*
VJ power, kgm/s	527	211.9	31.3	135.8-279.9	384	193.5	37.8	115.4-286.8	18.4	7.78*
Bench/Weight, %	509	153.8	22.6	103.4-254.2	467	140.5	21.8	96.5-230.3	13.3	9.36*
Squat/Weight, %	457	217.0	40.9	130.6-324.3	457	197.1	39.3	125.0-347.5	19.9	7.57*
Clean/Weight, %	464	130.5	23.2	77.8-290.3	386	123.2	24.7	82.3-216.7	7.3	4.42*

* $p \leq .01$

Table 3. Descriptive and Comparative Statistics for Defensive Line

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	94	188.0	2.7	158.8-196.0	84	187.3	1.8	178.0-197.0	0.7	0.82
Weight, kg	98	120.7	8.8	94.6-136.4	89	116.9	11.6	88.6-145.5	3.8	2.51
Bench press, kg	98	180.1	24.0	129.6-238.6	83	161.7	20.7	109.1-211.4	18.4	5.56*
Squat, kg	89	246.5	34.8	152.3-318.2	80	219.3	36.4	136.4-295.5	27.2	4.95*
Power clean, kg	90	146.8	17.4	111.4-209.1	69	132.7	22.0	88.6-195.5	14.1	4.36*
Vertical Jump, cm	101	77.9	8.2	55.8-97.8	70	66.9	11.3	30.5-99.1	11.0	7.02*
40 yd, s	82	4.85	0.2	4.4-5.3	84	5.03	0.3	4.57-5.8	0.1	-5.61*
Body fat, %	66	14.1	3.8	6.0-23.2	51	16.9	4.8	4.5-26.1	2.8	-3.39*
Fat free mass, kg	66	104.8	6.3	83.2-118.0	51	96.3	8.0	76.1-116.0	8.5	6.25*
VJ power, kgm/s	97	234.8	18.1	179.7-278.1	70	210.4	23.6	146.0-258.4	24.4	7.24*
Bench/Weight, %	94	151.3	19.3	114.6-202.1	83	138.8	17.2	96.5-197.3	12.5	4.55*
Squat/Weight, %	85	202.9	27.9	139.6-298.2	80	187.6	28.3	125.0-250.0	15.3	3.50*
Clean/Weight, %	86	121.6	15.0	96.1-176.9	69	114.0	19.8	88.64-183.0	7.6	2.63*

* $p \leq .01$

Table 4. Descriptive and Comparative Statistics for Linebackers

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	69	185.1	1.4	178.0-197.0	64	184.2	1.7	170.2-193.0	0.9	1.27
Weight, kg	72	103.8	5.2	88.64-113.6	67	104.0	29.4	84.1-109.8	0.2	-0.03
Bench press, kg	71	159.5	23.7	111.4-231.8	64	146.2	21.7	100.0-206.8	13.3	3.43*
Squat, kg	69	240.5	36.5	143.2-318.2	63	209.0	37.7	131.8-360.0	31.5	4.87*
Power clean, kg	66	144.3	16.4	113.6-195.5	55	131.6	22.8	97.7-206.8	12.7	3.39*
Vertical Jump, cm	75	83.2	7.8	63.5-105.4	53	72.4	10.8	45.72-102.9	10.8	6.24*
40 yd, s	62	4.64	0.2	4.35-4.99	62	4.76	0.2	4.44-5.29	0.12	-4.06*
Body fat, %	48	9.5	3.0	4.0-16.5	38	12.2	3.7	4.0-22.1	2.7	-3.60*
Fat free mass, kg	48	94.3	4.7	83.8-101.9	38	88.7	4.9	80.14-98.8	5.6	5.38*
VJ power, kgm/s	72	209.0	13.8	164.4-236.6	52	188.5	16.4	149.7-236.3	20.5	7.32*
Bench/Weight, %	68	163.5	17.2	123.2-209.3	63	145.7	24.0	115.2-230.3	17.8	4.84*
Squat/Weight, %	66	231.4	35.2	130.6-324.3	62	206.1	39.5	64.19-292.9	25.3	3.81*
Clean/Weight, %	63	139.1	14.8	107.8-187.8	53	130.6	27.5	95.6-216.7	8.5	2.04

* $p \leq .01$

Table 5. Descriptive and Comparative Statistics for Defensive Backs

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	92	180.1	1.9	155.0-189.0	84	180.3	1.7	173.0-191.0	0.2	-0.54
Weight, kg	96	85.1	5.8	73.4-100.8	88	83.2	6.4	69.3-103.5	1.9	2.12
Bench press, kg	96	142.4	16.6	90.0-180.0	84	126.0	18.2	81.0-180.0	16.4	6.26*
Squat, kg	93	207.8	39.6	128.3-272.2	82	176.6	37.9	112.5-276.8	31.2	5.32*
Power clean, kg	86	127.1	19.6	84.2-243.0	71	116.1	19.4	67.5-168.8	11.0	3.49*
Vertical jump, cm	99	87.8	7.8	71.1-110.5	70	78.0	10.3	48.3-104.1	9.8	6.69*
40 yd, s	81	4.52	0.2	4.21-5.0	84	4.61	0.1	4.25-5.0	0.9	-3.81*
Body fat, %	63	6.9	2.1	3.4-12.0	50	8.0	2.6	3.2-14.4	1.1	-2.47
Fat free mass, kg	63	79.2	5.7	69.1-94.7	50	76.4	6.0	64.1-98.3	2.8	2.48
VJ power, kgm/s	95	175.9	14.2	151.4-206.3	69	163.4	18.9	114.2-233.8	12.5	4.60*
Bench/Weight, %	92	166.9	18.1	116.6-204.4	83	152.0	19.9	105.6-192.1	14.9	5.15*
Squat/Weight, %	89	243.4	44.6	137.7-305.6	82	212.7	43.8	138.9-286.0	30.7	4.54*
Clean/Weight, %	82	149.4	23.7	103.6-290.3	71	139.2	20.7	90.9-211.9	10.2	2.86*

* $p \leq .01$

Table 6. Descriptive and Comparative Statistics for Quarterbacks

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	24	185.8	2.0	178.0-196.0	22	186.1	1.9	178.0-196.0	0.3	-0.22
Weight, kg	25	92.7	6.3	80.45-104.6	23	93.4	7.9	81.82-110.5	0.7	-0.32
Bench press, kg	25	162.9	21.7	118.2-204.6	21	128.9	23.3	90.9-193.2	33.0	5.09*
Squat, kg	23	200.2	45.0	125.0-272.7	21	179.0	40.3	109.1-279.6	21.2	1.64
Power clean, kg	23	124.6	18.7	95.0-170.5	18	120.0	19.2	97.7-179.6	4.6	0.76
Vertical Jump, cm	26	80.7	6.4	67.31-92.71	18	70.3	9.3	50.8-83.82	10.4	4.12*
40 yd, s	20	4.70	0.1	4.47-4.9	22	4.81	0.1	4.6-5.06	0.11	-2.77*
Body fat, %	17	9.2	2.2	3.7-14.0	13	12.3	4.9	8.0-26.0	3.1	-2.13
Fat free mass, kg	17	84.4	5.1	77.36-95.14	13	83.2	7.5	71.67-93.07	2.2	0.49
VJ power, kgm/s	25	184.0	15.4	151.6-213.6	18	174.9	16.4	147.7-202.7	9.1	1.85
Bench/Weight, %	24	166.5	18.9	137.9-210.9	21	138.0	21.0	104.2-186.2	28.5	4.77*
Squat/Weight, %	22	213.3	45.9	130.6-272.7	21	192.2	47.6	125.0-336.1	21.1	1.48
Clean/Weight, %	22	133.4	15.3	114.6-178.2	18	129.2	20.8	100.0-183.7	4.2	0.71

$p \leq .01$

Table 7. Descriptive and Comparative Statistics for Running Backs

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	46	181.3	1.5	173.0-188.0	44	178.2	2.0	168.0-188.0	3.1	3.25*
Weight, kg	48	97.3	8.9	75.0-116.8	46	95.4	9.3	76.82-113.6	1.8	0.98
Bench press, kg	48	174.9	23.7	127.3-263.6	43	146.9	19.7	109.1-186.4	28.0	6.15*
Squat, kg	44	233.3	32.6	172.7-311.1	41	214.8	40.1	136.4-311.4	18.5	2.03
Power clean, kg	44	138.3	14.9	113.6-171.8	36	127.3	21.9	90.9-181.8	11.0	2.57
Vertical Jump, cm	50	85.9	7.7	69.85-106.7	35	74.2	11.0	55.9-105.4	11.7	5.44*
40 yd, s	43	4.53	0.2	4.13-4.79	42	4.69	0.2	4.4-5.24	0.16	-4.00*
Body fat, %	33	8.8	2.9	4.0-15.0	26	11.16	4.3	4.0-19.3	2.36	-2.40
Fat free mass, kg	33	89.9	8.3	70.65-102.6	26	85.6	7.0	70.55-97.02	4.3	2.16
VJ power, kgm/s	48	199.1	18.9	154.3-242.1	35	181.8	16.0	142.3-216.5	17.3	4.52*
Bench/Weight, %	46	165.1	25.7	120.4-254.2	43	152.4	21.7	106.7-205.0	12.7	2.52
Squat/Weight, %	42	233.3	32.6	172.7-311.1	41	226.4	39.3	135.6-311.4	10.7	1.22
Clean/Weight, %	42	142.0	17.4	107.8-197.7	36	134.5	24.8	90.0-200.0	7.5	1.51

* $p \leq .01$

Table 8. Descriptive and Comparative Statistics for Wide Receivers

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	46	183.0	2.32	168.0-196.0	43	184.0	2.3	173.0-196.0	1.0	-0.85
Weight, kg	48	85.6	7.0	72.73-100.0	45	83.4	5.5	75.0-96.8	2.20	1.70
Bench press, kg	50	151.2	26.5	104.6-218.2	43	122.6	20.4	81.82-175.0	28.6	5.88*
Squat, kg	46	205.6	40.4	136.4-272.7	42	173.8	35.3	113.6-272.7	31.8	3.94*
Power clean, kg	44	127.5	15.2	100.0-159.1	34	112.7	16.9	81.8-150.0	14.8	3.99*
Vertical Jump, cm	48	87.4	7.0	71.1-101.6	34	77.8	12.1	43.2-103.6	9.6	4.14*
40 yd, s	42	4.48	0.1	4.25-4.81	44	4.59	0.2	4.29-5.11	0.11	-3.79*
Body fat, %	33	6.6	2.2	3.3-12.0	25	8.3	2.7	5.0-14.0	1.7	-2.44
Fat free mass, kg	33	79.6	6.6	66.2-94.9	25	77.7	5.8	66.5-90.9	1.9	1.14
VJ power, kgm/s	46	177.0	17.9	135.8-222.6	34	162.4	17.1	120.4-195.5	14.6	3.71*
Bench/Weight, %	48	146.0	19.4	109.7-190.9	43	141.1	23.5	98.9-230.3	4.9	1.08
Squat/Weight, %	44	239.7	48.8	171.4-324.3	42	207.4	38.9	150.0-297.0	32.3	3.39*
Clean/Weight, %	42	147.6	17.4	118.4-184.2	34	135.7	21.1	100.0-182.9	11.9	2.63

* $p \leq .01$

Table 9. Descriptive and Comparative Statistics for Offensive Line

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	115	191.3	1.9	168.0-203.0	110	189.0	2.0	175.0-200.0	1.7	3.50*
Weight, kg	120	133.2	8.1	108.2-154.6	115	128.4	11.9	100.9-165.9	4.8	3.62*
Bench press, kg	118	174.0	27.6	102.3-250.0	110	160.0	25.0	160.0-158.0	14.0	4.01*
Squat, kg	110	251.3	33.8	184.1-320.5	108	221.6	35.8	143.2-322.7	29.7	6.29*
Power clean, kg	110	143.4	16.0	110.5-204.6	87	132.0	17.4	93.18-188.6	11.4	4.73*
Vertical Jump, cm	124	68.8	6.2	49.5-86.4	88	60.4	8.6	44.5-87.1	8.4	7.80*
40 yd, s	96	5.12	0.2	4.6-5.86	104	5.25	0.2	4.87-5.90	0.13	-4.06*
Body fat, %	80	19.2	2.8	13.9-26.0	65	21.1	4.4	8.50-30.0	1.9	-2.96*
Fat free mass, kg	80	108.1	6.7	91.2-124.5	65	101.7	8.9	84.68-130.2	0.64	4.79*
VJ power, kgm/s	119	244.2	16.9	168.6-279.9	88	220.6	23.3	172.3-286.8	23.6	8.06*
Bench/Weight, %	113	141.9	20.3	103.4-216.2	110	127.2	17.1	96.9-174.3	14.7	5.84*
Squat/Weight, %	105	187.7	23.8	143.2-320.5	108	173.6	27.3	112.5-276.3	14.1	4.03*
Clean/Weight, %	105	107.2	14.0	77.8-155.8	87	103.2	14.0	82.4-151.8	4.0	1.98

* $p \leq .01$

Table 10. Descriptive and Comparative Statistics for Tight Ends

	Division I				Division II					
Variable	n	M	SD	Range	n	M	SD	Range	Diff	t
Height, cm	24	190.3	1.1	185.0-196.0	22	190.0	1.9	183.0-202.0	0.3	0.61
Weight, kg	25	113.7	6.4	102.3-127.3	23	104.5	8.8	88.6-115.9	9.2	4.13*
Bench press, kg	24	172.4	16.5	143.2-213.7	22	144.3	16.2	113.6-168.2	28.1	5.84*
Squat, kg	23	232.4	37.3	165.9-318.9	22	202.5	29.0	131.8-265.9	29.9	3.00*
Power clean, kg	23	140.9	14.3	110.5-165.9	18	122.6	18.7	97.7-165.9	18.3	3.43*
Vertical Jump, cm	26	79.6	7.2	27.0-39.0	17	70.1	8.7	50.8-82.0	9.5	3.71*
40 yd, s	21	4.78	0.2	4.40-5.0	22	4.84	0.1	4.56-5.06	0.06	-1.50
Body fat, %	17	12.6	2.9	8.0-19.0	13	12.6	3.6	7.2-19.3	0.0	-0.01
Fat free mass, kg	17	99.9	5.3	91.6-110.4	13	90.1	7.6	79.8-107.1	9.8	3.97*
VJ power, kgm/s	25	224.4	15.3	193.4-258.0	17	194.0	18.6	168.4-230.5	30.4	5.57*
Bench/Weight, %	23	127.5	11.6	107.9-151.6	22	132.2	16.0	101.6-160.5	4.7	-1.13
Squat/Weight, %	22	202.1	28.8	149.2-269.2	22	194.3	24.3	139.4-230.3	7.8	0.98
Clean/Weight, %	22	123.7	12.5	94.2-145.8	18	117.8	18.5	88.2-144.8	5.9	1.17

* $p \leq .01$

Discussion

There were 117 individual t-tests done with the data collected for this study. t-tests comparing Division I players against their Division II counterparts were done by position for the following variables; height, weight, bench press, squat, power clean, vertical jump, 40 yard dash, body fat percentage, fat free mass, vertical jump power, relative bench press, relative squat, and relative power clean. Data were organized into the following groups; all players, defensive linemen, linebackers, defensive backs, quarterbacks, wide receivers, running backs, offensive linemen, and tight ends.

Out of the 117 individual t-tests, Division I athletes were significantly better in 58. Division II players were not significantly superior in any of the tests. The biggest similarities between the two divisions were in height and weight, where there were only two positions out of nine with significant differences for each of these variables.

Fry and Kraemer (1991) conducted a similiar study to the present one, comparing performance levels among NCAA Division I, II, and III football players. Their study investigated five of the same variables as this study: bench press, squat, power clean, 36.6 meter sprint, and vertical jump. Direct comparisons for some positions could not be made since position grouping was slightly different between the two studies. When analyzing this study compared to the Fry and Kraemer (F&K) study, the only thing compared were the actual results found, with no tests of significance being done. Therefore the statistical significance of the differences was not established.

Performance levels were higher in the present study for all variables in both divisions when comparing all subjects. Division I athletes in the present study had a

mean bench press of 165.0 kg compared to 144.5 kg F&K study and Division II athletes had a mean bench press of 145.8 kg versus 135.2 kg in the F&K study. In the squat, Division I players averaged 232.6 kg and Division II players averaged 203.9 kg in the present study as compared to 192.8 kg and 182.5 kg, respectively. In the present study, Division I players cleaned 138.6 kg and Division II players 126.2 kg on average. In the F&K study Division I players cleaned an average 123.0 kg and Division II players lifted 116.5 kg. For the present study Division I players ran a 4.74 s 40-yard dash on average while Division II athletes had a mean of 4.88 s. Fry and Kraemer's study found Division I players had a mean 40-yard dash of 4.88 s, compared to 4.92 seconds for their Division II counterparts. Division I players had an average vertical jump of 80.1 cm and Division II players averaged 70.1 cm for the present study, while their Division I counterparts had a mean vertical jump of 72.8 cm and the Division II group averaged 69.3 cm.

When comparing data collected on Division I offensive linemen, players bench pressed more in the present study, with a mean of 174.0 kg compared to 165.0 kg. The players in the current study also squated more on average, 251.3 kg compared to 212.2 kg (F&K). The group in the current study also cleaned more weight with a mean of 143.4 kg compared to 133.5 kg. The offensive linemen were slightly faster in the F&K study with a mean of 5.09 s in the 40-yard dash compared to 5.12 s. The F&K group also had a better vertical jump averaging 69.5 cm compared to 68.8 cm.

When analyzing the data of the Division II offensive linemen, the F&K group had a better bench press with an average of 163.2 kg compared to 160 kg. The players in the present study had a better squat with a mean of 221.6 kg versus 205.6 kg. The athletes in

the present study also cleaned more averaging 132 kg compared to 127.1 kg. The athletes in the F&K study were just slightly faster running 5.23 s in the 40-yard dash compared to 5.25 s. The F&K group also had a better vertical jump with a mean of 64.0 cm compared to 60.4 cm.

When analyzing data for Division I defensive linemen, athletes in the present study outperformed the F&K group in each category. The players in the present study had a mean bench press of 180.1 kg compared to 172.5 kg. The present athletes had an average squat of 246.5 kg compared to 231.5 kg. The current group had an average clean of 146.8 kg versus 135.4 kg. The defensive linemen in the present study were faster with a mean 40-yard dash of 4.85 s compared to 4.88 s. The average vertical jump of the present group was 77.9 cm compared to 72.3 cm.

Data for Division II defensive linemen were more similar between the two studies. The F&K group had a higher bench press with a mean of 163.0 kg compared to 161.7 kg, while the athletes in the present study were stronger in the squat with a mean of 219.3 kg compared to 207.3 kg. The players in the F&K group had a slightly better average clean, 133.3 kg compared to 132.7 kg. The athletes were also faster and jumped higher in the F&K study with a mean of 4.94 s in the 40-yard dash compared to 5.03 s, and an average vertical jump of 71.9 cm compared to 66.9 cm in the present study.

When comparing the data collected for linebackers between the two studies, Division I players were superior in the present study for all variables. The athletes in the present study averaged 159.5 kg compared to 157.1 kg in the bench press, 240.5 kg compared to 215 kg in squats, 144.3 kg compared to 138.6 kg in power cleans. The

present group of athletes also ran an average of 4.64 s in the forty yard dash compared to 4.74 s, and had a mean vertical jump of 83.2 cm compared to 74.5 cm.

Division II linebackers were also better for all variables in this study except in the bench press. The athletes in the F&K group had a mean of 152.0 kg compared to 146.2 kg in the bench press. The players in the current study had an average of 209.0 kg versus 188.4 kg in squats. The present group of athletes had a power clean of 131.6 kg compared to 124.2 kg. The mean 40-yard dash for the current group was 4.76 s compared to 4.81 s, and the average vertical jump for the current group was slightly better, 72.4 cm compared to 71.7 cm.

Division I defensive backs also performed better in all five variables in the present study. The athletes in the present study averaged 142.4 kg compared to 134.7 kg in the bench press, 207.8 kg in squats compared to 185.0 kg, 127.1 kg compared to 122.1 kg for cleans. The athletes in the present study averaged 4.52 seconds in the 40-yard dash versus 4.61 s, and 87.8 cm compared to 82.5 in the vertical jump.

Division II athletes bench pressed more and had a better vertical jump on average in the F&K study, with an average of 128.4 kg compared to 126.0 kg in the bench press, and 79.5 cm compared to 78.0 cm for the vertical jump. The Division II group in the present study performed better in the squats with a 176.6 kg mean compared to 168.7 kg. Interestingly, both groups were equivalent in the clean with a 116.1 kg average, and in the 40-yard dash with a time of 4.61 s.

The Division I wide receivers in the present study also outperformed the group in the F&K study in each variable. The players in the current study averaged 151.2 kg

compared to 130.2 kg in the bench press, 205.6 kg compared to 163.2 kg for squats, 127.5 kg compared to 117.9 kg in cleans, 4.48 s in the 40-yard dash versus 4.64 s, and 87.4 cm compared to 77.1 cm in the vertical jump.

Once again, the data were much closer between the two groups when comparing the Division II wide receivers. The F&K group had a slightly better bench press with an average of 123.5 kg compared to 122.6 kg. They also had better cleans with a mean of 116.0 kg compared to 112.7. The players in the current study were slightly stronger in squats with a mean of 173.8 kg compared to 173.0 kg. The current group of players were also faster with an average of 4.59 s compared to 4.65 s in the 40-yard dash. The players in this study also had better vertical jumps on average, 77.8 cm compared to 75.0 cm.

It should be noted again that the comparisons made between these two studies only analyzed the reported values. No tests of significance were performed, therefore the athletes in this study outperformed those in the Fry and Kraemer study for most of the variables in each division. This could be attributed to a number of reasons: Knowledge of performance training has improved over the years, training facilities and equipment have improved, information on nutrition has improved, supplements have improved and have become more available to athletes today, and more schools are hiring full time strength and conditioning coaches.

Berg, Latin, and Baechle (1990) conducted a study looking at the physical and performance characteristics of NCAA Division I football players. Many of the findings in the Division I groups from the present study can be compared to the Berg et al.

findings, since the Berg et al. study used the same variables with the exception of clean and relative clean and also used the same groupings.

When comparing descriptive data for all subjects, the athletes analyzed for the present study outperformed the players in the Berg et al. study in every category except for height, where the Berg et al. group averaged 187.1 cm compared to 185.9 cm in the present study. The players in the present study weighed 108.0 kg compared to 104.1 kg. The body fat percentage in the current study was 11.9 compared to 12.3. The present athletes had a mean of 4.74 s in the 40-yard dash, while the athletes in Berg et al. ran 4.81 s. The players in this study had an average vertical jump of 80.14 cm compared to 73.6 cm. The athletes in the present study had a vertical jump power of 211.9 kgm/s versus 195.5 kgm/s. The average bench press was 165 kg for the current players compared to 157.6 kg in the Berg et al. study. The mean relative bench press was 153.8 percent in the present study compared to 152.5 percent. The average squat was 231.6 kg in the present study, while the Berg et al. group averaged 215.0 kg. The relative squat mean for the present athletes was 217.1 percent versus 208.2 percent.

When comparing the offensive linemen from the two studies, many of the results were very similar. The offensive linemen in the present study outperformed their counterparts in weight with an average of 133.2 kg compared to 123.4 kg. The present group ran a slightly better 40-yard dash with a mean of 5.12 s versus 5.13 s for the Berg et al. athletes. The current group outperformed the Berg et al. offensive linemen in the vertical jump with a mean score of 68.8 cm versus 66.2 cm. The present offensive linemen also did better in vertical jump power with an average of 244.3 kgm/s compared

to 220.7 kgm/s. The players in the present study squatted more with a mean of 251.3 kg compared to 241.3 kg. The offensive linemen in the Berg et al. study were slightly taller with an average of 191.7 cm compared to 191.3 cm. The players in the Berg et al. study also had a slightly better relative bench press with a mean of 142.0% compared to 141.9%.

The quarterbacks in the present study outperformed the Berg et al. quarterbacks in every category, however, there were a few similarities. The athletes in the present study had a mean height of 185.8 cm compared to 185.6 cm. The present players had a body fat percentage of 9.21 compared to 9.9. The mean 40-yard dash of present quarterbacks of 4.70 s versus 4.79 s in the Berg et al. group.

The running backs in the current study outperformed their counterparts in height, weight, vertical jump, vertical jump power, bench press, squat, and relative squat. The current group of running backs had a mean height of 181.3 cm, which was just slightly better than 181.0 cm for the Berg et al. group. The present group outweighed their counterparts with a mean of 97.3 kg versus 91.9 kg. The mean vertical jump for the current backs was 85.9 cm compared to 79.9 cm. The vertical jump power average for the current group was 199.1 kgm/s versus 181.1 kgm/s. The running backs in the present study had a better bench press with a mean of 174.9 kg compared to 152.1 kg. The current players had a better squat with a mean of 231.7 kg, while the Berg et al. group had a mean of 214.1 kg. The current players also had a better relative squat with a mean of 237.1 percent versus 233.2 percent. The players in the two studies were equivalent for body fat percentage with a mean of 8.8 percent.

The tight ends in the present study outperformed the tight ends in the Berg et al. study in each category except height, body fat percentage, 40-yard dash, and relative bench press. The athletes in the current study outweighed the Berg et al. group with a mean of 113.7 kg versus 106.2 kg. The mean vertical jump of the current players was 79.6 compared to 75.4. The current tight ends also had better vertical jump power with a mean of 224.4 kgm/s compared to 203 kgm/s. The tight ends in the present study had a mean bench press of 172.4 kg compared to 142.7 kg in the Berg et al. group. The players in the present study had a better mean squat with an average of 232.4 kg compared to 211.1 kg. The mean relative squat for the current study was 202.1 percent versus 198.1 percent.

The wide receivers in the current study had better mean performances for each variable except height, weight, and relative bench press. The athletes in the Berg et al. study were slightly taller and heavier. The Berg et al. wide receivers had a mean height of 183.5 cm compared to 183 cm. The Berg et al. group had a mean weight of 85.9 kg compared to 85.6 kg for the receivers in the present study. The wide receivers in this study were leaner, having mean body fat of 6.6 percent compared to 8 percent. The current group of wide receivers were faster with an average 40-yard dash time of 4.47 s compared to 4.57 s. The mean vertical jump of the current group was 87.4 cm compared to 78.7 cm. The current group also had better vertical jump power with an average of 177 kgm/s versus 167.7 kgm/s. The current group of wide receivers had a mean bench press of 151.2 kg compared to 127.3 kg for the Berg et al. group. The receivers in the current study had a better mean squat than their counterparts with an average of 205.6 kg

compared to 177.1 kg. The present group also had a better relative squat with a mean of 239.7 percent compared to 209.1 percent.

Once again, the differences being reported between the two studies were not tested for statistical significance. Conceivably many of the same reasons the athletes in the present study outperformed those in Berg et al. are the same as in the Fry and Kraemer research.

Some test performances from Division I players in the present study can be compared to those reported by Black and Roundy (1994). The Black and Roundy study assessed data collected on Division I football players comparing starters vs. nonstarters. Data can be compared between the present study and the data found by Black and Roundy in five similar variables. These variables are bench press, squat, weight, vertical jump, and 40- yard/36.6 meter dash. Because Black and Roundy broke their data into 16 specialized positions, comparisons can only be made for quarterbacks, wide receivers, and tight ends.

For the quarterback groups, athletes in the present study outperformed the Black and Roundy group in each test except the 40-yard dash. The athletes in the current study averaged 162.9 kg compared to 123.0 kg in the bench press, 200.2 kg compared to 168.8 kg for squats, 92.7 kg compared to 87.4 kg in weight, and averaged 80.7 cm compared to 73.9 cm in the vertical jump. The Black and Roundy group was faster with a mean of 4.78 s compared to 4.79 s in the 40-yard dash.

The data collected for wide receivers showed identical results as the quarterback groups, with the group from the current study outperforming their counterparts in each

variable except the 40-yard dash. The current players had an average bench press of 151.2 kg compared to 122.8 kg, squated 205.6 kg compared to 178.1 kg, had an average weight of 85.6 kg compared to 80.7 kg, and had a mean vertical jump of 87.4 kg compared to 78.7 kg. The Black and Roundy group averaged 4.46 s in the 40-yard dash compared to 4.48 s for the current players.

When comparing the data collected on Division I tight ends, the athletes in the present study outperformed the Black and Roundy group in every variable. The current group of players had a mean bench press of 172.4 kg compared to 154.1, an average squat of 232.4 kg compared to 202 kg, an average weight of 113.7 kg compared to 106.9 kg, a mean vertical jump of 79.6 cm compared to 73.4 cm, and an average of 4.78 seconds in the 40-yard dash compared to 4.79 seconds.

Olson and Hunter (1985) conducted a study to determine the differences in the size, strength, and speed of Division I football players between 1974 and 1984. They divided their positions into defensive secondary, defensive line, linebackers, offensive line, offensive backs, and receivers. The variables Olson and Hunter used were height, weight, 40-yard dash, bench press, squat, and clean.

Between 1974 and 1984, defensive linemen improved in each variable analyzed by Olson and Hunter. This trend continued to the current study with the exception of height. In 1974 defensive linemen were 73.3 cm tall compared to 75.1 cm in 1984. Defensive linemen in the current study were only 74.0 cm tall however. In 1974 the mean weight of defensive linemen was 97.1 kg, 113.5 kg in 1984, and 120.7 kg in the current study. Forty-yard dash times have improved from 5.15 s in 1974, to 4.98 s in

1984, to 4.84 s in the present study. Average bench press has increased from 136.4 kg in 1974, to 160.0 kg in 1984, to 180.1 kg presently. According to Olson and Hunter the average squat in 1974 was 169.4 kg and 208.0 kg in 1984. The average squat was 246.5 kg in the present study. Cleans have improved from 111.7 kg in 1974, to 127.6 kg in 1984, and are 146.8 kg in the present study.

Division I linebackers have also increased in most of the variables analyzed in these to studies. The mean height in 1974 was 73.4 cm and 74.8 cm in 1984. However, that average fell in the present study to 72.9 cm. Weight has continually increased amongst linebackers in the two studies from 101.0 kg in 1974 to 103.0 kg, to 103.8 in the current study. In 1974 linebackers had an average 40-yard dash of 4.93 s according to Olson and Hunter. This time increased however to 4.98 s in 1984. The athletes in the current study had a lower time of 4.64 s. Bench press has increased throughout the years according to the two studies from 130.3 kg in 1974 to 152.4 kg in 1984, to 159.5 kg in the present study. Mean squats for linebackers has also increased from 167.3 kg in 1974, to 198.0 kg in 1984, to 240.5 kg in the current study. Average weights for cleans has also improved throughout the two studies. The average in 1974 was 107.5 kg, 123.0 kg in 1984, and 144.3 kg in the present study.

Performances have increased for defensive secondary players between the two studies for each variable with the exception of height and weight. The average height in 1974 was 73.12 cm. This increased to 74.1 cm in 1984, but has decreased to 70.9 cm in the present study. Average weight has gone from 84.7 kg in 1974 to 85.3 kg in 1984, to 85.1 kg in the current study. 40-yard dash times have improved according to these two

studies from 4.79 s in 1974 to 4.64 s in 1984, to 4.52 s in the current study. The average bench press has increased from 107.9 kg in 1974 to 132.5 kg in 1984, to 142.4 kg in the present study. Squats have improved from 148.0 kg in 1974, to 174.7 kg in 1984, to 207.8 kg in the current study. Cleans have also improved throughout from 96.5 kg in 1974 to 113.4 kg in 1984, to 127.1 kg presently.

When comparing the data for offensive linemen between the two studies, the current athletes have improved in weight, bench, squat, and cleans, but are not as tall or as fast. The average height in 1974 was 75.1 cm. This increased to 76.3 cm in 1984, but fell to 75.3 in the current study. The average weight has steadily improved throughout the two studies from 109.0 kg in 1974 to 118.5 kg in 1984, to 133.2 kg for the present group. The average 40-yard dash time in 1974 was 5.27 s compared to 5.08 s in 1984. This time dropped to 5.12 s in the present study. Mean bench press has increased from 134.9 kg in 1974 to 162.5 kg in 1984, to 174.0 in the present study. Averages in squats have increased from 173.5 kg in 1974 to 217.3 kg in 1984, to 251.3 kg in the current study. Offensive linemen have also increased their cleans throughout the two studies from 109.8 kg in 1974 to 127.9 kg in 1984, to 143.4 kg in the current study.

The results of the present study found improvements in most of the variables tested compared to Olson and Hunter. Once again, differences were not tested for statistical significance. Comparing the present study to the Olson and Hunter study demonstrates the improvements made over time by Division I football players.

Ware, Clemens, Mayhew, and Johnston (1995) conducted a study to find if 1 repetition maximum (RM) could be accurately calculated from muscular endurance

repetitions in bench press and squats for NCAA Division II football players. They found that using exponential relative muscular endurance equations can be used to estimate 1-RM bench press strength, however it was not accurate for squats. Ware et al. did find average height and weight for the athletes tested, so these can be compared to the present study along with bench press. They did not divide their athletes into positions, so only data for the entire groups can be compared.

The athletes in the present study outperformed the players in Ware et al. in each category. The average height for the players in the current study was 185.0 cm compared to 183.3 cm. Athletes in the current study had an average weight of 105.3 kg compared to 97.1 kg. The mean bench press for the current players was 145.8 kg compared to 124.3 kg in Ware et al.

Selected physical and performance levels have been compared between Division I and Division II football players. Division I athletes proved to be superior to their Division II counterparts for these many of the variables tested in this study ($p<.01$). As stated before, Division I players were significantly better in 58 individual t-tests out of a possible 117. The findings of this study support those of Fry and Kraemer (1991).

When comparing the Division I and Division II athletes in this study there was very little difference in height and weight. In each of these two variables, only two out of nine possible groups had significant differences. However, there seems to be a much finer line between Division I and Division II football players in performance levels according to the results.

It can be speculated that the differences in the performance levels between the two divisions can probably be attributed to several factors. The biggest difference is probably the athletes that are attracted to these schools. Although every program is trying to recruit the best athlete possible, Division I programs have more scholarship money. The limit for scholarships in Division I football is 85 compared to 36 in Division II. Since athletes are usually looking for the highest level of competition to play at most of the time, Division I programs have the advantage of recruiting better players.

Division I programs almost always have a full time strength coach, and these coaches usually have a staff to work with. These staffs are often composed of other full time coaches, graduate assistants, and student assistants. Some Division II schools are employing full time strength and conditioning coaches today, however, many schools still have someone who coaches another sport or has other duties besides strength and conditioning. This often means someone not as trained or knowledgable in strength and conditioning and someone whose time is divided between other sports. These factors take away from the knowledge that can be given to the athletes and the amount of time that can be spent working with the athletes. Full time strength coaches who have no other responsibilities also have more time to research and learn about the trends in strength and conditioning.

Another factor involved is facilities and equipment. Division I programs usually have better equipment, and more of it. Strength and conditioning equipment is being improved all the time. With more money and improved facilities, Division I programs can certainly keep up with the new trends better. Division I athletes also have an

advantage with nutrition. Many Division I programs employ a nutritionist to implement a training table where the athletes are receiving an optimal diet for top-level performance.

Chapter V

Summary, Conclusions, Recommendations

Summary

The purpose of this study was to compare select physical fitness and performance variables between Division I and Division II football players to determine if there is a significant difference in the physical and performance variables of the athletes at this level. This study was conducted by sending out questionnaires to every college football program in the United States that participates in the NCAA Division I or Division II level. The questionnaire asked for testing data for all offensive and defensive starters, excluding punters and kickers for the following variables: height, weight, bench press, squat, power clean, 40-yard dash, vertical jump, and body fat percentage. Once this information was received from the schools, the data was also converted into other variables for comparisons: fat free mass, vertical jump power, bench press/weight, squat/weight, and power clean/weight. Offensive starters were divided into the following groups for comparisons: quarterbacks, running backs, wide receivers, tight ends, and offensive line. Defensive starters were grouped the following way: defensive line, linebackers, and defensive backs.

There were 117 independent t-tests done for this study. This study found that Division I athletes were significantly superior in 58 of these t-tests, and Division II athletes were not significantly superior in any of the comparisons. The greatest similarity between the two divisions was in height and weight. Out of nine position groups compared, only two had significant differences in each of these variables.

Conclusions

The return rate of the surveys was low for this study which means there are many Division I and Division II football players whose data could not be examined. Some schools were missing data if they did not test for one of the variables on the survey or if a player was injured. Strength and conditioning coaches use different testing procedures and protocols, which can affect how the data is interpreted. Based on the findings and limitations of this study, it was concluded that Division I athletes are stronger, faster, leaner, and have more power than their Division II counterparts.

Recommendations

There are probably many factors that contribute to the Division I athletes being superior to Division II athletes. Better athletes are usually attracted to Division I programs which naturally results in better performance in these tests. Division I programs usually have larger and more qualified strength and conditioning staffs, and better equipment facilities. It is recommended to look at these factors and find how much difference there is between the two divisions in each of these areas.

The optimal situation for performing this study again would be for the researcher to travel to each school participating in the study and conduct the tests. This would ensure data for each school and that each test was being conducted the same way each time. Because of money and time factors this is probably not conceivable.

Appendix I

IRB Approval

University of Nebraska

Institutional Review Board (IRB)
Office of Regulatory Affairs (ORA)
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February 15, 1999

Marcus Garstecki
HPER
UNO

IRB#: 053-99-EX

TITLE OF PROTOCOL: A Comparison of Selected Physical Fitness and Performance Variables Between Division 1-A and Division II Football Players

The IRB has reviewed your Exemption Form for the above-titled research project. According to the information provided, this project is exempt under 45 CFR 46:101b, category 4. You are therefore authorized to begin the research.

It is understood this project will be conducted in full accordance with all applicable sections of the IRB Guidelines. It is also understood that the IRB will be immediately notified of any proposed changes that may affect the exempt status of your research project.

Please be advised that the IRB has a maximum protocol approval period of five years from the original date of approval and release. If this study continues beyond the five year approval period, the project must be resubmitted in order to maintain an active approval status.

Sincerely,

E. Prentice/jlg

Ernest D. Prentice, PhD
Vice Chair, IRB

EDP:jlg

Appendix II

Cover Letter

June 18, 1998

David Noonan
Head Strength and Conditioning Coach
University of Nebraska at Omaha
60th and Dodge Streets
Omaha, NE 68182

Dear Coach Noonan:

I am currently conducting a study comparing the differences in fitness and performance levels between Division I and Division II football players. I am doing this study to assist both strength and conditioning coaches and football coaches by setting a standard to compare their athletes to.

I know as a strength and conditioning coach this is a very busy time for you. However, I hope you will take the time to fill out the enclosed form. I think this study will do a great deal to expand the knowledge in our field. I hope you will find this study to be as important as I do.

Please follow the instructions on the form. When determining the starter at each position, please use the player who started the most games at that position. Anonymity will be used if you would prefer. Please return the questionnaire as soon as possible. Thank you again for your time and good luck on your upcoming season.

Sincerely,

Marcus Garstecki
University of Nebraska at Omaha

Appendix III

Questionnaire

Questionnaire

Name of institution:_____

May we use your school name in a research article: Yes or No

Please circle one of the following:

Level of competition: NCAA Division I or Division II

40-yd dash: Handheld or Electronic timer

Method of testing vertical jump:

Method of Body Composition Testing:

1-Step Approach

2-Step Approach

Other, Please explain:

Method of Body Composition Testing:

Skinfold

Hydrostatic weighing

Other, Please explain:

Appendix IV

Data Collection Form

Position	Bench (kg)	Squat (kg)	Clean (kg)	Vertical Jump (cm)	40 yd (s)	Height (cm)	Weight (kg)	Body Fat (%)
DE								
DT								
DT								
DE								
LB								
LB								
LB								
CB								
S								
S								
CB								

Position	Bench (kg)	Squat (kg)	Clean (kg)	Vertical Jump (cm)	40 yd (s)	Height (cm)	Weight (kg)	Body Fat (%)
WR								
TE								
OT								
OG								
C								
OG								
OT								
WR								
QB								
RB								
RB								

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