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Abstract

We assessed body composition (height, body mass, body mass index, body fat by densitometry, fat mass, fat-free mass, and lean/fat ratio) and performance (10- and 40-yd sprints, pro shuttle run, vertical jump, sit and reach, and bench press) in 77 National Collegiate Athletic Association Division III football players. Data were analyzed by position and playing status. Significant differences (*p* less than or equal to 0.05) were found between positions for all body composition measurements and all performance tests except the sit and reach. Starters outperformed nonstarters in all performance tests except the 10-yd sprint and sit and reach (*p* less than or equal to 0.05). Correlations (*r*) for percent body fat and performance tests ranged from 0.52 to 0.70, and common variance with the effects of body mass removed ranged from 8 to 23%. Percent body fat is not closely correlated with results of commonly administered performance tests in Division III football players.

Keywords

anthropometry, densitometry, performance tests

Disciplines

Other Medicine and Health Sciences | Sports Sciences

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Body Composition Relates Poorly to Performance Tests in NCAA Division III Football Players

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ABSTRACT

We assessed body composition (height, body mass, body mass index, body fat by densitometry, fat mass, fat-free mass, and lean/fat ratio) and performance (10- and 40-yd sprints, pro shuttle run, vertical jump, sit and reach, and bench press) in 77 National Collegiate Athletic Association Division III football players. Data were analyzed by position and playing status. Significant differences ($p \leq 0.05$) were found between positions for all body composition measurements and all performance tests except the sit and reach. Starters outperformed nonstarters in all performance tests except the 10-yd sprint and sit and reach ($p \leq 0.05$). Correlations (r) for percent body fat and performance tests ranged from 0.52 to 0.70, and common variance with the effects of body mass removed ranged from 8 to 23%. Percent body fat is not closely correlated with results of commonly administered performance tests in Division III football players.

Key Words: anthropometry, densitometry, performance tests

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Introduction

Strength and conditioning programs are an integral component of most football programs. The programs are designed to improve factors believed important to success on the football field, including muscular strength and endurance, cardiovascular endurance, flexibility, leg explosiveness, quickness, agility, speed, and a good fat:muscle ratio (1). Testing often is included in the program to assess players' strengths and weaknesses and to improve player motivation (1, 9, 13).

Numerous studies in the last 20 years have reported body composition and/or performance test data at the professional (15, 27, 33, 35, 37) and National Collegiate Athletic Association (NCAA) Division I (3, 4, 6, 11, 17, 23, 24, 26, 31, 32) level. Several of these studies have focused on comparing methods of assessing body composition (17, 35) or changes in football players over time (26, 35). Other researchers have assessed body composition and performance test results among players by position (3, 6, 11, 24, 32, 33) and playing status (starter vs. nonstarter) (3, 6, 11, 24, 31).

A relationship between body composition and performance test results has commonly been assumed. Intuitively, it makes sense that an increase in body fat would negatively influence athletic performance (12). Results of previous studies (7, 20, 25, 28) have suggested that an increase in body fat decreases performance on general physical fitness tests. Relatively few investigators have examined this relationship in football players (2, 8, 23). Weak ($r = 0.12$) to moderate ($r = 0.72$) positive correlations have been found between body fat and the 10-yd sprint (23), 40-yd sprint (8, 23), and bench press (2, 8, 23).

The aims of the present study were to develop baseline body composition and performance test data for Division III football players by position and playing status (starter vs. nonstarter) and to investigate the influence of body fat on commonly used tests of performance that measure speed, agility, power, flexibility, and strength.

Methods

Experimental Approach to the Problem

Anthropometric characteristics and performance tests were assessed in 77 football players from Gettysburg College (Gettysburg, PA), an NCAA Division III school with a 110-year history of competition in football at this level. Testing was completed within a 2-week period after players reported to preseason camp in mid-August 2000. The team was not ranked in NCAA Division III rankings during the 2000 season. The college institutional review board approved this study, and subjects were fully informed of the purpose and nature of the study and provided informed consent.

Subjects

Players were grouped by position and status: offensive line (OL; center, guards, tackles, tight ends; $n = 13$), defensive line (DL; noseguard, tackles; $n = 16$), offensive backfield (OB; quarterback, running backs, receivers, kickers; $n = 26$), defensive backfield (DB; linebackers, corners, safeties; $n = 22$), starters (S; $n = 32$), nonstarters (NS; $n = 45$). Starters were players who started in at least half of the games; nonstarters were the remaining players on the team.

The authors took all of the anthropometric measurements, and members of the coaching staff administered the performance tests following guidelines established during the previous 22 years.

Height, Body Mass, and Body Mass Index

Height was measured with a meter stick to 1 decimal place, and body mass was measured on a Healthometer balance beam scale accurate to ± 0.25 lb. Body mass index was calculated as body mass (kg) divided by height (m).

Densitometry

Prior to underwater weighing, 3 trials of seated vital capacity (ATPS) were determined according to manufacturer's directions using a Medgraphics metabolic cart. Residual lung volume was estimated from vital capacity (BTPS) (residual lung volume = vital capacity $\times$ 0.24) according to the report of Wilmore (38), which revealed very close agreement between body composition measurements using measured vs. estimated residual lung volume. Body mass in water was assessed by hydrostatic weighing in the seated position in a 91- $\times$ 91- $\times$ 183-cm aluminum tank. Subjects performed 10 successive trials of underwater weighing, with an approximately 1-minute rest interval between trials following procedures described previously (19). Ten repeated weighings (using an average of the last 3 trials) produces a "true" underwater weight score (18). For white players, percent body fat was calculated using the equation of Siri (34), where %fat = (495 $\div$ density $g \cdot ml^{-1}$) $-$ 450, and for black players, the Schutte equation (30) was applied, where %fat = (437.4 $\div$ density $g \cdot ml^{-1}$) $-$ 392.8.

Performance Tests

Testing was completed in 1 day. The vertical jump, sit and reach, and 1 repetition maximum (1RM) bench press were administered in the morning, and the 10- and 40-yd sprints and pro shuttle were completed in the afternoon. The 10- and 40-yd sprints and the pro shuttle were run on an outdoor all-weather track. The vertical jump was performed in a gym with a wooden floor, and the 1RM bench press and sit-and-reach tests were carried out in a weight room. Athletes wore t-shirts, gym shorts, and running shoes, and scores were not revealed during testing. The coaches selected the performance tests, which were administered according to procedures established over the past 22 years. All the tests except the 10-yd sprint and pro shuttle run had previously established high reliability: $r = 0.970$ for 40-yd sprint (10); $r = 0.93$ for vertical jump (16); $r = 0.98$ for sit and reach (22); and $r = 0.97$ for 1RM bench press (5).

Vertical Jump. The athlete warmed up by stretching, jogging, and doing 2 or 3 vertical jumps at approximately ½ to ¾ effort. Using a flat measuring scale attached to the wall, standing reach at the tip of the tallest chalked finger was measured to the nearest inch, with the athlete standing with the feet together and the dominant side against the wall. Jumping reach was measured following a 2-ft takeoff with 1 approach step. The score was calculated as the difference between standing reach and vertical jump reach. Three trials were given with approximately 10 seconds of rest between trials, and the highest score was used to represent vertical jump ability.

Sit and Reach. Within 5 minutes of submaximal jogging and light stretching, the shoeless athlete sat with legs extended and feet placed against a box with a mounted flat measuring scale. With legs extended, the athlete bent at the hips and reached forward as far as possible, with distance recorded to the nearest 0.5 in. Zero intersects the point where the feet press against the box. Positive values represent the distance the athlete reached beyond his toes, and negative values represent the distance the athlete fell short of reaching his toes. The highest score of 3 trials, with approximately 5 seconds of rest between trials, served as the measure of flexibility.

1RM Bench Press. Prior to testing, the athlete performed 10 repetitions at 60% of estimated 1RM, 5 repetitions at 80% of estimated 1RM, and 1 repetition at 90% of estimated 1RM. Following this warm-up, the athlete lay supine on the bench with scapula and hips on the bench and feet flat on the floor. A spotter placed the bar in the athlete's pronated, chalked, ungloved hands spaced slightly wider than shoulder width, with the arms extended in a position directly above the chest. The athlete lowered the bar to the chest and then pushed upward, returning the bar to the starting position. The athlete selected the starting weight for the test (estimated 1RM). If the athlete could not lift the weight using correct form after 3 attempts, then he selected a lower weight and repeated the test. In contrast, if he could lift the weight once with proper form, he selected a higher weight, and the test was repeated. A 5- to 10-minute rest interval was allowed between attempts. This process was repeated until the athlete achieved 1RM.

10- and 40-Yd Sprints. The sprint tests were conducted simultaneously following an approximately 10-minute team warm-up that consisted of stretching and four 20-yd sprints at ½, ¾, ¾, and ¾ speeds. Athletes started from a 3-point stance, and timers started their stopwatches when the athlete made the first movement to sprint. One timer recorded when the athlete crossed the 10-yd line. Two other timers recorded when the

Table 1. Anthropometric characteristics by position.* Values expressed as mean ± *SD* (range).

Variable†	Team (*n* = 77)	OL (*n* = 13)	DL (*n* = 16)	OB (*n* = 26)	DB (*n* = 22)
Age (y)	19.6 ± 1.3 (17.8–22.8)	19.0 ± 1.1 (18.2–21.9)	19.5 ± 1.2 (18.2–22.8)	19.9 ± 1.4 (17.8–22.0)	19.8 ± 1.2 (18.1–21.8)
HT (cm)	180.0 ± 6.1 (165.5–193.3)	184.0 ± 5.2§ (174.4–190.1)	181.0 ± 5.8 (168.2–193.3)	179.0 ± 6.5 (165.5–190.5)	177.0 ± 5.1 (166.0–186.0)
BM (kg)	88.6 ± 10.9 (65.5–114.7)	101.0 ± 9.2‡§ (85.7–114.7)	96.6 ± 7.9‡§ (81.4–108.9)	79.6 ± 6.0§ (65.5–92.6)	85.7 ± 6.5 (73.1–96.0)
BMI	27.4 ± 2.9 (21.6–35.5)	29.9 ± 2.3‡§ (25.2–33.3)	29.5 ± 2.8‡§ (25.5–35.5)	25.0 ± 1.9 (21.6–28.6)	27.3 ± 2.0‡ (23.3–30.4)
%Fat	17.2 ± 5.4 (7.4–29.9)	21.9 ± 4.5‡§ (14.3–29.4)	21.5 ± 4.3‡§ (14.8–29.9)	13.8 ± 3.3 (7.4–18.8)	15.2 ± 4.6 (7.7–25.1)
FM (kg)	15.6 ± 6.5 (5.8–33.7)	22.4 ± 6.3‡§ (12.2–33.7)	20.9 ± 5.3‡§ (13.4–32.5)	11.0 ± 2.8 (5.8–16.0)	13.2 ± 4.6 (6.5–23.4)
FFM (kg)	73.0 ± 6.6 (56.7–88.7)	78.8 ± 5.3‡§ (70.9–88.7)	75.7 ± 5.7‡ (62.5–83.8)	68.8–5.9 (56.7–79.0)	72.5 ± 5.4 (58.6–80.4)
L:F ratio	5.5 ± 2.3 (2.4–12.6)	3.8 ± 1.0‡§ (2.4–6.0)	3.8 ± 0.9‡§ (2.4–5.8)	6.7 ± 2.2 (4.3–12.6)	6.2 ± 2.2 (3.0–12.0)

* OL = offensive line; DL = defensive line; OB = offensive backfield; DB = defensive backfield.
† HT = height; BM = body mass; BMI = body mass index; FM = fat mass; FFM = fat-free mass; L:F ratio = lean:fat ratio.
‡ Significantly different from OB value.
§ Significantly different from DB value.

athlete crossed the 40-yd line, and the mean of the 40-yd times was calculated. Three trials were performed, with an approximately 10-minute rest between trials. The fastest 10- and 40-yd trials were designated as the criterion speed scores.

Pro Shuttle. Three cones were placed in a straight line 5 yd apart, with taped lines at the cones. The athlete started at the center cone, sprinted 5 yd to the left cone, touched the line with 1 foot, turned and sprinted 10 yd to the right cone, touched the line with 1 foot, and turned and sprinted 5 yd back to the middle starting cone and line. Approximately 10 minutes of rest was allowed between trials. The fastest of 3 trials represented the pro shuttle speed.

Statistical Analyses

A 4 × 2 analysis of variance compared all body composition and performance variables by position (OL, DL, OB, DB) and playing status (S, NS); a Tukey-Kramer post hoc test was used to determine the location of specific pairwise differences. Pearson product moment correlations were used to evaluate relationships between body composition and performance variables. Partial correlations (36) were used to evaluate the relationships between %fat, fat mass, fat-free mass, and performance tests, with the effects of body mass removed from the zero-order correlations. Statistical significance was established at $p \leq 0.05$ for all analyses.

Results

Table 1 shows significant differences ranging from 4 to 51% between positions for all anthropometric characteristics. Apart from the sit and reach, players in each position category differed significantly (4–17%) on all performance tests (Table 2).

Age differed significantly between starters (+1.3 years, 6%) and nonstarters (Table 3). When performance tests were compared by playing status (Table 4), starters ran significantly faster in the 40-yd sprint (−0.2 seconds; 4%) and pro shuttle run (−0.2 seconds; 4%) and achieved greater vertical jump (+3.9 cm; 6%) and 1RM bench press (+15.3 kg; 13%) scores than did nonstarters.

The only significant interaction between position and playing status occurred in the vertical jump. Starting offensive (+9.7 cm) and defensive (+5.8 cm) linemen and defensive backs (+8.2 cm) achieved higher scores than did nonstarters. However, starting offensive backs jumped 5.6 cm less than did nonstarters.

Correlations ranged from 0.40 to 0.64 (r^2 = 16–41%) between body mass and the 10- and 40-yd sprints, pro shuttle run, and 1RM bench press (Table 5). The correlation was −0.41 (r^2 = 17%) between body mass and the vertical jump. Positive correlations (r = 0.52–0.70; r^2 = 27–49%) were found between percent body fat and the 10- and 40-yd sprints and pro shuttle run, and a negative correlation ($r = -0.59$; r^2 = 35%) was found between percent body fat and the vertical jump. When body mass was statistically removed from the zero-order correlations using the partial correlation technique ($r_{12.3}$), the positive correlations between percent body fat and the running tests diminished from r = 0.52–0.70 to $r_{12.3}$ = 0.28–0.47, as did the negative

Table 2. Performance tests by position.* Values expressed as mean ± *SD* (range).

Variable†	Team (n = 77)	OL (n = 13)	DL (n = 16)	OB (n = 26)	DB (n = 22)
10 Y (s)	1.6 ± 0.1 (1.4–1.9)	1.7 ± 0.1‡§ (1.6–1.9)	1.7 ± 0.1‡ (1.5–1.9)	1.6 ± 0.1 (1.4–1.8)	1.6 ± 0.1 (1.5–1.9)
40 Y (s)	4.9 ± 0.3 (4.5–5.9)	5.2 ± 0.3‡§ (4.7–5.9)	5.1 ± 0.3‡§ (4.7–5.5)	4.8 ± 0.2 (4.5–5.1)	4.8 ± 0.3 (4.5–5.5)
PS (s)	4.6 ± 0.2 (4.1–5.1)	4.8 ±0.2‡§ (4.4–5.1)	4.8 ± 0.2‡§ (4.4–5.1)	4.5 ± 0.2 (4.1–5.0)	4.6 ± 0.2 (4.3–5.0)
VJ (cm)	59.1 ± 9.0 (40.6–78.7)	53.9 ± 10.5‡ (43.2–78.7)	55.4 ± 8.2‡ (45.7–71.1)	63.3 ± 6.9 (50.8–76.2)	60.0 ± 8.9 (40.6–73.7)
S/R (cm)	12.1 ± 5.9 (−7.6–26.7)	10.7 ± 3.9 (3.8–16.5)	14.3 ± 6.1 (5.1–26.7)	11.4 ± 6.4 (−7.6–21.6)	12.1 ± 5.9 (2.5–24.1)
BP (kg)	111.0 ± 19.0 (70.5–152.3)	118.0 ± 4.3‡ (88.6–138.6)	112.0 ± 15.0 (93.2–147.7)	102.0 ± 18.5§ (70.5–145.5)	116.0 ± 21.3 (70.5–152.3)

* OL = offensive line; DL = defensive line; OB = offensive backfield; DB = defensive backfield.
† 10 Y = 10-yd sprint; 40 Y = 40-yd sprint; PS = pro shuttle run; VJ = vertical jump; S/R = sit and reach; BP = 1RM bench press.
‡ Significantly different from OB value.
§ Significantly different from DB value.

Table 3. Anthropometric characteristics by playing status. Values expressed as mean ± *SD* (range).

Variable*	Team (n = 77)	Starters (n = 32)	Nonstarters (n = 45)
Age (y)	19.6 ± 1.3 (17.8–22.8)	20.4 ± 1.3† (18.2–22.8)	19.1 ± 0.9 (178.8–21.9)
HT (cm)	180.0 ± 6.1 (165.5–193.3)	179.0 ± 6.2 (165.5–190.5)	180.3 ± 6.0 (166.0 ± 193.3)
BM (kg)	88.6 ± 10.9 (65.5–114.7)	87.9 ± 11.5 (65.5–114.7)	89.1 ± 10.6 (73.1–114.0)
BMI	27.4 ± 2.9 (21.6–35.5)	27.4 ± 2.9 (21.6–35.5)	27.4 ± 3.0 (22.3–34.9)
%Fat	17.2 ± 5.4 (7.4–29.9)	15.5 ± 5.4 (7.7–29.9)	18.3 ± 5.1 (7.4–28.9)
FM (kg)	15.6 ± 6.5 (5.8–33.7)	14.1 ± 6.7 (6.5–33.7)	16.7 ± 6.2 (5.8–33.0)
FFM (kg)	73.0 ± 6.6 (56.7–88.7)	73.8 ± 7.0 (56.7–86.5)	72.4–6.3 (58.6–88.7)
L:F ratio	5.5 ± 2.3 (2.4–12.6)	6.2 ± 2.4 (2.4–12.0)	5.0 ± 2.0 (2.5–12.6)

* HT = height; BM = body mass; BMI = body mass index; FM = fat mass; FFM = fat-free mass; L:F ratio = lean:fat ratio.
† Significantly different from nonstarters.

correlation between percent body fat and the vertical jump (r = −0.59 vs. $r_{12.3}$ = −0.48). The correlations ranged from r = 0.55–0.74 (r^2 = 30–55%) between fat mass and 10- and 40-yd sprints and pro shuttle run and r = −0.58 between fat mass and vertical jump (r^2 = 34%). Partialing out body mass diminished the positive correlations between fat mass and the running tests (r = 0.55–0.74 reduced to $r_{12.3}$ = 0.29–0.49) and the negative correlation between fat mass and vertical jump (r = −0.58 vs. $r_{12.3}$ = −0.47). Positive correlations (r = 0.28–0.56; r^2 = 8–31%) were found between fat-free mass and the 10- and 40-yd sprints, pro shuttle run, and 1RM bench press. Partialing out body mass reversed the positive correlations between fat-free mass and the running tests to negative partial correlations ($r_{12.3}$ = −0.29 to −0.49) and diminished the positive correlation between fat-free mass and 1RM bench press (r = 0.56 vs. $r_{12.3}$ = 0.45).

Discussion

The present study provides both comparative data by position and playing status for body composition and performance tests in Division III football players and addresses the crucial time-honored conviction that body composition is related to performance deemed important at all levels in football. We assessed body composition by hydrodensitometry, a criterion (valid) method with high reliability (21), and commonly administered "football" tests of speed, agility, power, flexibility, and muscular strength with previously established high reliability (5, 10, 16, 22).

The results of this study suggest that neither body mass nor percent body fat can be used to predict performance with any degree of confidence. The highest significant correlation with body mass was found for the 40-yd sprint (r = 0.64), which still accounted for only 41% of the common variance. This result was not entirely surprising because heavy athletes do not necessarily do poorly on running tests. Heavy athletes that are also overly fat might perform poorly in running tests, whereas heavy athletes with high lean mass might perform well.

Table 4. Performance tests by playing status. Values expressed as mean ± *SD* (range).

Variable*	Team (n = 77)	Starters (n = 32)	Nonstarters (n = 45)
10 Y (s)	1.6 ± 0.1 (1.4–1.9)	1.6 ± 0.1 (1.4–1.8)	1.6 ± 0.1 (1.4–1.9)
40 Y (s)	4.9 ± 0.3 (4.5–5.9)	4.8 ± 0.3† (4.5–5.3)	5.0 ± 0.3 (4.5–5.9)
PS (s)	4.6 ± 0.2 (4.1–5.1)	4.5 ± 0.2† (4.1–5.0)	4.7 ± 0.2 (4.3–5.1)
VJ (cm)	59.1 ± 9.0 (40.6–78.7)	61.4 ± 8.2† (43.2–78.7)	57.5 ± 9.4 (40.6–76.2)
S/R (cm)	12.1 ± 5.9 (−7.6–26.7)	12.9 ± 5.1 (0.0–24.1)	11.5 ± 6.3 (−7.6–26.7)
BP (kg)	111.0 ± 19.0 (70.5–152.3)	119.8 ± 18.2† (84.1–152.3)	104.5 ± 17.1 (70.5–138.6)

* 10 Y = 10-yd sprint; 40 Y = 40-yd sprint; PS = pro shuttle run; VJ = vertical jump; S/R = sit and reach; BP = 1RM bench press.
† Significantly different from nonstarters.

Intuition tells us that excessive body fat should negatively affect performance; however, this assumption was not supported by the data. Correlations between percent body fat and performance tests ranged from 0.52 to 0.70, accounting for only 27–49% of the common variance. These findings are similar to those of others (2, 8, 23). The correlation between 2 variables (e.g., percent body fat and 10-yd sprint) can be misleading because this correlation may be influenced by their common dependence on a third variable (e.g., body mass). To avoid this complication, partial correlations were calculated between percent body fat and performance tests, with body mass held statistically constant. This approach permits the net relationship between percent body fat and performance to emerge without the confounding influence of body mass. All partial correlations between percent body fat and performance were diminished, ranging from 8 to 23% of the common variance compared with 27–49% of the common variance for zero-order correlations on the same variables. This analysis further reveals the specificity among the variables, providing confirming evidence that test performance in the area assessed is poorly related to percent body fat.

To our knowledge, this is only the third study of NCAA Division III football players and is the first to measure body composition with the criterion method of densitometry. The extensive survey of 19 schools, including 6 Division III schools, by Fry and Kraemer (14) in 1991 produced the first published performance test data for Division III football players. Subsequently, Schmidt (29) in 1999 reported preseason testing results for a Division III football team. Athletes in the present study were shorter (1%) and lighter (7%) than athletes

Table 5. Correlations among measures of body composition* and performance tests.†

	10 Y			40 Y			PS			VJ			S/R			BP		
	r	r^2	$r_{12.3}$	r	r^2	$r_{12.3}$	r	r^2	$r_{12.3}$	r	r^2	$r_{12.3}$	r	r^2	$r_{12.3}$	r	r^2	$r_{12.3}$
BM	0.59‡	0.35		0.64‡	0.41		0.50‡	0.25		−0.41‡	0.17		0.07	0.0049		0.40‡	0.160	
% Fat	0.57‡	0.32	0.28	0.70‡	0.49	0.47	0.52‡	0.27	0.30	−0.59‡	0.35	−0.48	−0.04	0.0016	−0.12	−0.03	0.001	−0.44
FM	0.63‡	0.40	0.31	0.74‡	0.55	0.49	0.55‡	0.30	0.29	−0.58‡	0.34	−0.47	−0.02	0.0004	−0.14	0.10	0.010	−0.45
FFM	0.35‡	0.12	−0.31	0.32‡	0.10	−0.49	0.28‡	0.08	−0.29	−0.10	0.01	0.47	0.13	0.0169	0.13	0.56‡	0.310	0.45

* BM = body mass; FM = fat mass; FFM = fat-free mass.
† 10 Y = 10-yd sprint; 40 Y = 40-yd sprint; PS = pro shuttle run; VJ = vertical jump; S/R = sit and reach; BP = 1RM bench press; r = Pearson product moment correlation coefficient; r^2 = coefficient of determination; $r_{12.3}$ = single-order partial correlation.
‡ Significant correlations ($p \leq 0.05$).

in Schmidt's study (29). When comparing performance test results, the athletes in this study were slightly slower (1%) in the 40-yd sprint than athletes in the Fry and Kraemer study (14). Vertical jump scores were virtually identical to jump scores in the Schmidt study (29) but were 14% lower than those in the Fry and Kraemer survey (14). Flexibility finding were essentially identical to those of Schmidt (29). In this study, 1RM bench press scores were lower than those reported by Fry and Kraemer (−16%) (14) and Schmidt (−19%) (29).

When data were analyzed by position, the results confirmed the findings of others (3, 6, 11, 14, 24, 29, 32, 33) that significant differences occur among positions for body composition and performance test scores. Analysis of performance test data by playing status confirmed previous reports (3, 6, 11, 14, 24, 29, 31) that test results can distinguish starters from nonstarters.

Practical Applications

This study provides the first body composition data for Division III football players using the criterion method of densitometry and provides results for common performance tests that measure speed, agility, power, flexibility, and strength. However, it also provides evidence that percent body fat is not correlated with performance in these general tests. Because such tests assess characteristics believed important to football ability, does it follow that performance on the football field is unrelated to percent body fat? A certain amount of fat may be valuable for football players, particularly linemen, because the fat acts as a cushion to help protect the body from the constant violent contact of the sport. However, the effect of an increased percent body fat on the health of the athlete is certainly a different story.

Note: Frank Katch is retired and currently living in Santa Barbara, CA.

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