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Gettysburg College

Frank I. Katch

David F. Petrie
Gettysburg College

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

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

Kristin J. Stuempe1, Frank I. Katch2, and David E. Petrie3

1Department of Health and Exercise Sciences, Gettysburg College, Gettysburg, Pennsylvania 17325; 2Department of Exercise Science, University of Massachusetts, Amherst, Massachusetts 01005-9254.

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, pre-shuttle run, vertical jump, 50-yd sholl, and broad jump) in 77 National Collegiate Athletic Association Division III football players. Data were analyzed by position and playing status. Significant differences (p < 0.05) were found between positions for all body composition measurements and all performance tests except the 10- and 40-yd sprints. Trouser ouperformed nose protector in all performance tests except the 10-yd sprint and sprints and reach (p < 0.05). Correlations (r) for percent body fat and performance ranged from 0.52 to 0.70; and common variance with the effects of body mass remained constant at 21% ± 1%. Presence body fat was indepenently correlated with results of commonly administered performance tests in Division III football players.

Key Words: anthropometry, densitometry, performance tests


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, 15).

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, 50) 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, 25, 33) and playing status (stater vs. nonstarter) (5, 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 (22). 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 = 0.62) 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 aim of the present study was to develop baseline body composition and performance test data for Division III football players by position and playing status (stater 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 119-year history of competition in football at this level. Testing was completed within a 2-week period after players reported to pre-season 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 end), n = 13; defensive line (DL, noseguard, tackle, n = 16), offensive backfield (DB, quarterback, running backs, corner, n = 26), defensive backfield (DB, lins- backers, 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 Health- water balance scale accurate to ±0.02 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 manu- facturer's directions using a MedGraphics metabolic cart. Residual lung volume was estimated from vital capacity (FIV50) (residual lung volume = vital capacity * 0.24) according to the report of Wilmore (38), which revealed very close agreement between body compo- sition measurements using measured vs. estimated re- sidual lung volume. Body mass in water was assessed by hydrostatic weighing in the seated position in a 91% - 95% - HSC-20 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 tri- als) produce a "true" underwater weight score (18). For white players, percent error was calculated using the equation of Siri (36), where %fat = (495 - density g/ml) / 450, and for black players, the Schutte equation (30) was applied, where %fat = (474 - density g/ml) / 392.

Performance Tests

Testing was completed in 1 day. The vertical jump, sprints, 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 recorded during testing. The coaches selected the performance tests, which were administered ac- cording 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.
Body Composition Relates Poorly to Performance Tests in NCAA Division III Football Players

Kristin J. Stuemple, Frank I. Katch, and David E. Petrie

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, pre shuttle-run, vertical (cm), sit and reach, and hand/grip) in 77 National Collegiate Athletic Association Division III football players. Data were analyzed by position and playing status. Significant differences (p < 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 < 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 remained marginal (8 to 20%). Present body fat was indepen- dently correlated with results of commonly administered performance tests in Division III football players.

Key Words: anthropometry, densitometry, performance tests

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 muscle 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, 15).

Numerous studies in the last 20 years have report- ed body composition and/or performance test data at the professional (15, 27, 33, 35, 37) and National Col- lege 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, 39) or changes in football players over time (26, 35). Other researchers have assessed body composition and performance test results among players by position (5, 6, 11, 24, 32, 33) and playing status (starter vs. nonstarter) (5, 6, 11, 24, 31).

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The aim of the present study was 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.

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defensive line (DL): noseguard, tackles; n = 16, offen- sive backfield (OB): quarterback, running backs, receiv- ers, kickers; n = 26, defensive backfield (DB): lines- backers, 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 mea- surements, and members of the coaching staff admin- istered the performance tests following guidelines es- tablished during the previous 22 years.

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Prior to underwater weighing, 3 trials of seated vital capacity (ATPs) were determined according to man- ufacturer’s directions using a MedGraphics metabolic cart. Residual lung volume was estimated from vital capacity (FIRS) (residual volume = vital capacity × 0.24) according to the report of Wilmore (48), which revealed very close agreement between body composi- tion measurements using measured vs. estimated se- tidual lung volume. Body mass was measured by hydrostatic weighing in the seated position at 95% ± 15% of the seated height. Subjects performed 10 successive trials of underwater weighing, with an approximately 1-minute rest interval between trials. Following procedures described previously (19). Ten reported weightings (using an average of the last 3 tri- als) produce a “true” underwater weight score (18). For white players, percent body fat was calculated by ing the equation of Siri (56), where = (9155) − (450), and for black players, the Schaufelberger equation (58) was applied, where = (0.0434 − dense- gnty of g) − 392.

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 ac- cording to procedures established over the past 22 years. All tests except the 10-yd sprint and pro shuttle were run previously established high reliability.
Table 1. Anthropometric characteristics by position. Values expressed as mean ± SD (range).  

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tm</th>
<th>CL</th>
<th>DL</th>
<th>OL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>21.7 ± 1.3</td>
<td>19.0 ± 1.3</td>
<td>18.5 ± 1.2</td>
<td>16.9 ± 1.4</td>
</tr>
<tr>
<td>HT (cm)</td>
<td>186.0 ± 8.1</td>
<td>184.6 ± 7.2</td>
<td>181.3 ± 5.8</td>
<td>179.0 ± 6.2</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.1 ± 1.9</td>
<td>23.8 ± 1.7</td>
<td>24.4 ± 2.3</td>
<td>25.1 ± 2.6</td>
</tr>
<tr>
<td>Fat %</td>
<td>11.4 ± 1.5</td>
<td>11.9 ± 1.6</td>
<td>12.1 ± 1.5</td>
<td>12.3 ± 1.4</td>
</tr>
<tr>
<td>Fat mass (kg)</td>
<td>111.0 ± 9.0</td>
<td>118.0 ± 18.0</td>
<td>122.0 ± 15.0</td>
<td>120.2 ± 13.0</td>
</tr>
</tbody>
</table>

* OL = offensive line; DL = defensive line; CB = offensive backfield; DB = defensive backfield.  
† Age at first professional contract.  
‡ Fat mass = fat mass index * body mass index.  
§ L:D ratio = lean : fat ratio.  
|| Significantly different from OL value.  
|| Significantly different from DB value.

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tm</th>
<th>CL</th>
<th>DL</th>
<th>OL</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Y-o (s)</td>
<td>2.1 ± 0.1</td>
<td>2.1 ± 0.1</td>
<td>2.1 ± 0.1</td>
<td>2.1 ± 0.1</td>
</tr>
<tr>
<td>40 Y-o (s)</td>
<td>6.9 ± 0.3</td>
<td>6.8 ± 0.2</td>
<td>6.8 ± 0.2</td>
<td>6.8 ± 0.2</td>
</tr>
<tr>
<td>30 Y-o (s)</td>
<td>11.0 ± 2.8</td>
<td>11.0 ± 2.1</td>
<td>10.9 ± 2.3</td>
<td>10.8 ± 2.2</td>
</tr>
<tr>
<td>Fat mass (kg)</td>
<td>111.0 ± 9.0</td>
<td>118.0 ± 18.0</td>
<td>122.0 ± 15.0</td>
<td>120.2 ± 13.0</td>
</tr>
</tbody>
</table>

* CB = center; OL = offensive line; DL = defensive line.  
† Age at first professional contract.  
‡ Fat mass = fat mass index * body mass index.  
§ L:D ratio = lean : fat ratio.  
|| Significantly different from CB value.  
|| Significantly different from DB value.

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tm</th>
<th>Players Remaining</th>
<th>Nonforecasters</th>
<th>Tm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>21.8 ± 1.5</td>
<td>21.9 ± 1.5</td>
<td>21.9 ± 1.5</td>
<td>21.9 ± 1.5</td>
</tr>
<tr>
<td>HT (cm)</td>
<td>186.0 ± 8.1</td>
<td>184.6 ± 7.2</td>
<td>181.3 ± 5.8</td>
<td>179.0 ± 6.2</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.1 ± 1.9</td>
<td>23.8 ± 1.7</td>
<td>24.4 ± 2.3</td>
<td>25.1 ± 2.6</td>
</tr>
<tr>
<td>Fat %</td>
<td>11.4 ± 1.5</td>
<td>11.9 ± 1.6</td>
<td>12.1 ± 1.5</td>
<td>12.3 ± 1.4</td>
</tr>
<tr>
<td>Fat mass (kg)</td>
<td>111.0 ± 9.0</td>
<td>118.0 ± 18.0</td>
<td>122.0 ± 15.0</td>
<td>120.2 ± 13.0</td>
</tr>
</tbody>
</table>

| Correlation between percent fat and vertical jump (r = -0.59 vs. r = 0.48).  
| Correlation between percent fat and the 10- and 40-yard sprint (r = 0.59-0.74 vs. r = 0.36).  
| Correlation between percent fat and the 40-yard sprint (r = 0.59 vs. r = 0.48).  

Discussion

The present study provides both comparative data by position and status for body composition and performance tests in Division III football players and addresses the crucial time-honored concern 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 (0.8) and commonly administered “football” tests of speed, agility, power, flexibility, and muscular strength with previously established high reliability (0.9, 10, 16, 22).

The results of this study suggest that neither body mass nor percent fat can be used to predict performance with any degree of confidence. The highest significant correlation with body mass was found for the 40-yard sprint (r = 0.46), which accounted for only 46% of the common variance. This result was not entirely surprising because heavy athletes do not necessarily do poorly on running tests. Heavy athletes who are also overly fat might perform poorly in running tests, whereas heavy athletes with high lean mass might perform well.
Table 1. Anthropometric characteristics by position. *Values expressed as mean ± SD (range).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Team</th>
<th>CL</th>
<th>DL</th>
<th>LB</th>
<th>DB</th>
<th>(n = 19)</th>
<th>(n = 12)</th>
<th>(n = 5)</th>
<th>(n = 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>19±0.3</td>
<td>15±0.2</td>
<td>25±1.2</td>
<td>19±0.4</td>
<td>19±0.2</td>
<td>(7.6-22.8)</td>
<td>(18.2-23.9)</td>
<td>(18.0-20.5)</td>
<td>(18.9-21.8)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.0±1.0</td>
<td>25.4±0.1</td>
<td>25.5±1.0</td>
<td>25.3±0.1</td>
<td>25.2±0.1</td>
<td>(24.5-26.5)</td>
<td>(24.2-26.8)</td>
<td>(24.1-26.5)</td>
<td>(24.2-26.5)</td>
</tr>
<tr>
<td>Vmax (m·s⁻¹)</td>
<td>10.0±0.5</td>
<td>10.5±0.5</td>
<td>10.5±0.5</td>
<td>10.5±0.5</td>
<td>10.5±0.5</td>
<td>(9.0-11.0)</td>
<td>(9.0-11.0)</td>
<td>(9.0-11.0)</td>
<td>(9.0-11.0)</td>
</tr>
<tr>
<td>L/F ratio</td>
<td>0.7±0.1</td>
<td>0.7±0.1</td>
<td>0.7±0.1</td>
<td>0.7±0.1</td>
<td>0.7±0.1</td>
<td>(0.6-0.8)</td>
<td>(0.6-0.8)</td>
<td>(0.6-0.8)</td>
<td>(0.6-0.8)</td>
</tr>
</tbody>
</table>

*CL = offensive line; DL = defensive line; LB = linebacker; DB = defensive backfield. †1YD = height; BM = body mass; BMI = body mass index; FM = fat mass; FFM = fat-free mass; L/F ratio = leg:fat ratio. ‡Significantly different from DB value. §Significantly different from LB value. ||Significantly different from CL value.

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Team</th>
<th>CL</th>
<th>DL</th>
<th>LB</th>
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<th>(n = 12)</th>
<th>(n = 5)</th>
<th>(n = 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Y (y)</td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
<td>(1.4-1.9)</td>
<td>(1.4-1.9)</td>
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</tr>
<tr>
<td>40 Y (m)</td>
<td>4.9±1.3</td>
<td>5.2±1.3</td>
<td>5.1±1.3</td>
<td>4.8±1.2</td>
<td>4.8±1.2</td>
<td>(4.5-5.5)</td>
<td>(4.5-5.5)</td>
<td>(4.5-5.5)</td>
<td>(4.5-5.5)</td>
</tr>
<tr>
<td>PS (m)</td>
<td>4.6±0.5</td>
<td>4.4±0.5</td>
<td>4.5±0.5</td>
<td>4.6±0.5</td>
<td>4.6±0.5</td>
<td>(4.3-4.8)</td>
<td>(4.3-4.8)</td>
<td>(4.3-4.8)</td>
<td>(4.3-4.8)</td>
</tr>
<tr>
<td>Vl (m·s⁻¹)</td>
<td>61±10</td>
<td>57±10</td>
<td>57±10</td>
<td>54±10</td>
<td>54±10</td>
<td>(50-80)</td>
<td>(50-80)</td>
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<tr>
<td>5x10 (m)</td>
<td>46±10</td>
<td>46±10</td>
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<td>46±10</td>
<td>(44-48)</td>
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<td>1.6±0.1</td>
<td>(1.4-1.9)</td>
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<td>54±10</td>
<td>54±10</td>
<td>(50-80)</td>
<td>(50-80)</td>
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</tr>
<tr>
<td>5x10 (m)</td>
<td>46±10</td>
<td>46±10</td>
<td>46±10</td>
<td>46±10</td>
<td>46±10</td>
<td>(44-48)</td>
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<tbody>
<tr>
<td>10 Y (y)</td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
<td>(1.4-1.9)</td>
<td>(1.4-1.9)</td>
<td>(1.4-1.9)</td>
<td>(1.4-1.9)</td>
</tr>
<tr>
<td>40 Y (m)</td>
<td>4.9±1.3</td>
<td>5.2±1.3</td>
<td>5.1±1.3</td>
<td>4.8±1.2</td>
<td>4.8±1.2</td>
<td>(4.5-5.5)</td>
<td>(4.5-5.5)</td>
<td>(4.5-5.5)</td>
<td>(4.5-5.5)</td>
</tr>
<tr>
<td>PS (m)</td>
<td>4.6±0.5</td>
<td>4.4±0.5</td>
<td>4.5±0.5</td>
<td>4.6±0.5</td>
<td>4.6±0.5</td>
<td>(4.3-4.8)</td>
<td>(4.3-4.8)</td>
<td>(4.3-4.8)</td>
<td>(4.3-4.8)</td>
</tr>
<tr>
<td>Vl (m·s⁻¹)</td>
<td>61±10</td>
<td>57±10</td>
<td>57±10</td>
<td>54±10</td>
<td>54±10</td>
<td>(50-80)</td>
<td>(50-80)</td>
<td>(50-80)</td>
<td>(50-80)</td>
</tr>
<tr>
<td>5x10 (m)</td>
<td>46±10</td>
<td>46±10</td>
<td>46±10</td>
<td>46±10</td>
<td>46±10</td>
<td>(44-48)</td>
<td>(44-48)</td>
<td>(44-48)</td>
<td>(44-48)</td>
</tr>
</tbody>
</table>

*CL = offensive line; DL = defensive line; LB = linebacker; DB = defensive backfield. †10 Y = 10-yard sprint; 40 Y = 40-yard sprint; PS = pro shuttle test; Vl = vertical jump; 5X10 = shuttle; SM = shuttle; MP = 40-yard dash press.

Discussion

The present study provides both comparative data by position and status for football players and performance tests in Division III football players and addresses the crucial time/honed conditions that body composition is related to performance demand important at all levels in football. We assessed body composition by hydrodensitometry, a criterion (valid) method with high reliability (0.61), and commonly administered "football" tests of speed, agility, power, flexibility, and muscular strength with previously established high reliability (r = 0.61, 0.62).

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-yard sprint (r = 0.64), which still accounted for only 64% of the common variance. This result was not entirely surprising because heavy athletes do not necessarily do poorly on running tests. Heavy athletes who are also overly fat might perform poorly in running tests, whereas heavy athletes with high lean mass might perform well.
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 Kramer study (14). Vertical jump scores were visually identical to jump scores in the Schmidt study (29) but were 14% lower than those in the Fry and Kramer survey (14). Flexibility findings were essen-
tially identical to those of Schmidt (29). In this study, 3RM bench press scores were lower than those re-
ported by Fry and Kramer (160-216) and Schmidt (190-250).
When data were analyzed by position, the results confirmed the findings of others (3, 5, 11, 14, 24, 25, 32, 33), that significant differences occur among posi-
tions for body composition and performance test scores. Analysis of performance test data by playing status confirmed similar confidence reports (3, 5, 11, 14, 24, 25) that test results can distinguish starters from non-
starters.

Practical Applications
This study provides the first body composition data for Division II football players using the criterion method of densitometry and provides results for com-
mon performance tests that measure speed, agility, power, flexibility, and strength. However, it also pro-
vides evidence that percent body fat is not correlated with performance in these general tests. Because such test assess characteristics believed important to foot-
ball ability, does it follow that performance on the foot-
ball field is unrelated to percent body fat? A certain amount of fat may be valuable for football players, par-
ticularly 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 pre-
cent body fat on the well-being of the athlete is a different story.

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

References
Table 1: Performance tests by playing status. Values expressed as mean ± SD (range).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Team Green (n = 224)</th>
<th>Nonstarters (n = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:0 (s)</td>
<td>1.6 ± 0.2 (1.3-1.9)</td>
<td>1.6 ± 0.2 (1.3-1.9)</td>
</tr>
<tr>
<td>40:0 (s)</td>
<td>31.4 ± 1.3 (30.0-32.8)</td>
<td>32.8 ± 1.3 (31.0-34.0)</td>
</tr>
<tr>
<td>PS (s)</td>
<td>3.1 ± 0.2 (2.9-3.2)</td>
<td>3.2 ± 0.2 (3.0-3.3)</td>
</tr>
<tr>
<td>V (m/s)</td>
<td>11.0 ± 0.3 (10.5-11.5)</td>
<td>10.5 ± 0.3 (10.0-11.0)</td>
</tr>
<tr>
<td>S/R (m)</td>
<td>12.3 ± 1.1 (11.9-12.7)</td>
<td>12.7 ± 1.1 (12.0-13.3)</td>
</tr>
<tr>
<td>BF (kg)</td>
<td>116.0 ± 15.0 (109.0-123.0)</td>
<td>123.0 ± 15.0 (115.0-130.0)</td>
</tr>
</tbody>
</table>

* 10:0 = 10-yd sprint; 40:0 = 40-yd sprint; PS = peak shuttle run; V = vertical jump; S/R = sit and reach; BF = 18.5 bench press.
* Significantly different from nonstarters.

Intuitively 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 scores was moderately significant (r = 0.52 to 0.57) for only 27% to 49% of the common variance. These findings are similar to those of others (2, 3, 23). The correlation between these 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 scores were diminished, ranging from 0 to 2% 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 I 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 I schools, by Fry and Kraemer (14) in 1991, published 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 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 very similar to jump scores in the Schmidt study (29) but were 14% lower than those in the Fry and Kraemer study (14). Flexibility testing was essentially identical to those of Schmidt (29). In this study, 18.5 bench press scores were lower than those reported by Fry and Kraemer (14) and Schmidt (19%).

When data were analyzed by position, the results confirmed the findings of others (3, 6, 11, 14, 24, 25, 32) that significant differences occur among positions for body composition and performance test scores. Analysis of performance test data by playing status confirmed stable status reports previous findings (3, 6, 11, 14, 24, 25) 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 a different story.

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

References


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Address correspondence to Kristin J. Stuemple, kstuemple@gettysburg.edu.