

# RELATIONSHIP BETWEEN BODY COMPOSITION AND PERFORMANCE MEASURES IN DIVISION III AMERICAN FOOTBALL PLAYERS

Brian A. Thompson    Springfield College    USA

Glenn J. Cain                      Kansas University    USA

## Abstract

The purpose of this study is 1.) To examine mean percent body fat (BF, %) and Body Mass Index (BMI) values across three American football position groupings, skill (SK), big skill (BSK) and down linemen (LN). 2.) To examine the relationship between BF and BMI and the following performance measures: vertical jump (VJ, in.), 1-RM power clean (PC, lbs.), 1-RM back squat (BS, lbs.), 1-RM bench press (BP, lbs.), 20m sprint (20S, sec.), and pro-agility (PRO, sec.). Body composition data, (BF and BMI) were measured on 54 Division III varsity football players with a minimum of one year of participation in a collegiate strength and conditioning program. Performance measures (VJ, PC, BS, BP, 20S, PRO) were collected on 38 of the 54 athletes over three separate testing sessions within a one week period. There was a significant interaction ( $p < 0.001$ ) across groups for the body composition data ( $n=54$ ). A Tukey post-hoc analysis revealed the following results for BF and BMI, respectively: The LN group was significantly higher than the BSK ( $p = .021$ ;  $p = .006$ ) and SK ( $p < 0.001$ ;  $p < 0.001$ ) groups. The BSK group was significantly higher than the SK ( $p = .040$ ;  $p = .001$ ) group. Examination of the performance measures showed significant correlations between BF and BP ( $r = .494$ ;  $p = .002$ ), 20S ( $r = .728$ ;  $p < 0.001$ ), PRO ( $r = .724$ ;  $p < 0.001$ ) and VJ ( $r = -.630$ ;  $p < 0.001$ ). Significant correlations were found between BMI and BS ( $r = .393$ ;  $p = .015$ ), BP ( $r = .549$ ;  $p < 0.001$ ), 20S ( $r = .713$ ;  $p < 0.001$ ), PRO ( $r = .735$ ;  $p < 0.001$ ) and VJ ( $r = -.713$ ;  $p < 0.001$ ). Additionally, there was not a significant relationship seen between VJ and PC ( $r = .133$ ,  $p = .427$ ).

**Keywords :** BODY COMPOSITION, PERFORMANCE MEASURES, DIVISION III, AMERICAN FOOTBALL.

## ملخص:

تهدف هذه الدراسة الى التعرف على طبيعة العلاقة بين تركيبة الجسم وقياسات الأداء لدى فئة لاعبي كرة القدم الأمريكية في الدرجة الثالثة، وقد تمت القياسات على 54 لاعب في دوري الدرجة الثالثة.

الكلمات المفتاحية: تركيبة الجسم، قياسات الأداء، كرة القدم الأمريكية.

**Introduction:**

Literature, as well as the media, has documented the increase in the body weight of football players over the past two decades (4). However, there have been few studies examining how this weight gain is reflected in percent body fat (BF) and body mass index (BMI) and how these variables are related to tests that strength and conditioning professionals commonly use to assess strength, power and speed. Studies have indicated that American football players have a decreasing amount of body fat as you ascend in level from Collegiate Division III (DIII) to Division I (DI) to the National Football League (NFL) (9,10,11,12,13), which seems to indicate there must be some correlation between body fat and performance on the football field. More research is needed to understand the correlations between BF and BMI with strength, power and speed measures.

The purposes of this study were

- 1.) To examine mean BF and BMI values across three American football position groupings;
- 2.) To examine the relationship between BF and BMI and various performance measures.

**Methods:**

Body composition data, (BF and BMI) were measured on 54 Division III varsity football players with a minimum of one year of participation in a collegiate strength and conditioning program. Subjects were assigned to one of three American football position groupings. 1.) Skill (SK) which included quarter backs, running backs, wide receivers, defensive backs and specialists. 2.) big skill (BSK) which included full backs, tight ends and line backers. 3.) down linemen (LN) which included offensive and defensive linemen. Performance measures (VJ, PC, BS, BP, 20S, PRO) were collected on 38 of the 54 athletes over three separate testing sessions within a one week period. Body composition values were measured using a Tanita BC-418 Segmental Body Composition Analyzer. All performance testing was conducted by NSCA CSCS individuals.

**Results:**

The following mean values were found for each body composition variable overall and within each group (Overall:  $n=54$ ; SK:  $n=23$ ; BSK:  $n=13$ ; LN:  $n=18$ ):

- BF: Overall ( $17.6\% \pm 5.6$ ), SK ( $14.1 \pm 3.6$ ), BSK ( $17.9 \pm 3.8$ ), LN ( $22.4 \pm 5.7$ )
- BMI: Overall ( $28.8 \pm 3.9$ ), SK ( $25.9 \pm 1.8$ ), BSK ( $29.4 \pm 2.2$ ), LN ( $32.5 \pm 3.8$ )
- Mean values for each group are shown in Figures 1 and 2

There was a significant interaction ( $p < 0.001$ ) across groups for the body composition data ( $n=54$ ). A Tukey post-hoc analysis revealed the following results for BF and BMI, respectively:

- The LN group was significantly higher than the BSK ( $p = .021$ ;  $p = .006$ ) and SK ( $p < 0.001$ ;  $p < 0.001$ ) groups.
- The BSK group was significantly higher than the SK ( $p = .040$ ;  $p = .001$ ) group.

Examination of the performance measures showed significant correlations between BF and BMI and the following values for the group as a whole ( $n=38$ ):

- BF: BP ( $r = .494$ ;  $p = .002$ ), 20S ( $r = .728$ ;  $p < 0.001$ ), PRO ( $r = .724$ ;  $p < 0.001$ ) and VJ ( $r = -.630$ ;  $p < 0.001$ )
- BMI: BS ( $r = .393$ ;  $p = .015$ ), BP ( $r = .549$ ;  $p < 0.001$ ), 20S ( $r = .713$ ;  $p < 0.001$ ), PRO ( $r = .735$ ;  $p < 0.001$ ) and VJ ( $r = -.713$ ;  $p < 0.001$ )
- Mean values and standard deviations for all measures are shown in Table 1.

Additionally, there was not a significant relationship seen between VJ and PC ( $r = .133$ ,  $p = .427$ ).

**Conclusions:**

The mean values found on the performance tests in this study are similar to values reported by other researchers examining DIII football players (5,13). The BMI and percent body fat values found in this study were very similar to results of other researchers examining Division III football players (12,13). However, BMI in this study was lower and percent body fat higher than has been previously reported in studies examining Division I football players (9). Body fat percentages found in this study were also much higher than reported for National Football League Players (10,11). Literature has documented the increase in the weight of football players over the past two decades (4). According to the results found in this study BF and BMI do significantly correlate with strength measures, but do not correlate positively with power, speed or agility variables.

Another question that could be addressed is the role of nutrition in these findings. The importance of proper nutrition for athletic performance has been well documented, but studies have indicated over the years that male college athletes receive most of their nutritional information from athletic trainers or magazines (6,7). Other studies have indicated that athletes have similar diets to non-athletes and have misconceptions about the use and effectiveness of supplements (2,3,8).

This study as well as the research which has been mentioned within regarding the relationship between body fat and performance as well as nutritional knowledge adds support to the belief that it is of critical importance that strength and conditioning professionals have the ability to properly educate athletes about proper nutrition at all levels from high school to the NFL.

Also, according to this study PC was not significantly related to VJ which contradicts results previously reported with competitive Olympic weightlifters (1). Previous research examining the relationship between hang-clean (HC) and VJ in male lacrosse players also found no relationship (14). This relationship needs to be examined across many sports to determine if the Olympic movements are a good measure of assessing performance in athletes that are not competitive weightlifters.

## Practical Applications

- 1.) Due to the need for explosive power, agility, and speed in football optimal body composition can be critical. This study has shown that body composition can have a negative impact on performance variables possibly giving evidence to the importance of nutrition at all levels.
- 2.) The finding that significant relationships exist between body structure (BF, BMI) and maximal strength (BP, BS) but not power (PC) indicates alternative methods may be better for assessing power in larger athletes.

## References

1. Carlock, J.M., Smith, S.L., Hartman, M.J., Morris, R.T., Ciroslan, D.A., Pierce, K.C., Newton, R.U., Harman, E.A., Sands, W.A. & Stone, M.H. The relationship between vertical jump power estimates and weightlifting ability: a field test approach. *Journal of Strength and Conditioning Research*, 18(3): 534- 539, 2004.
2. Cole, C.R., Salvaterra, G.F., Davis, J.E., Borja, M.E., Powell, L.M., Dubbs, E.C. & Bordi, P.L. Evaluation of dietary practices of national collegiate athletic association division I football players. *Journal of Strength and Conditioning Research*, 19(3): 490-494, 2005.
3. Duellman, M.C., Lukaszuk, J.M., Prawitz, A.D. & Brandenburg, J.P. Protein supplement users among high school athletes have misconceptions about effectiveness. *Journal of Strength and Conditioning Research*, 22(4): 1124-1129, 2008.
4. Harp J.B. & Hecht, L. Obesity in the national football league. *Journal of the American Medical Association*, 293(9): 1061, 2005.
5. Hoffman, J.R., Ratamess, N.A., Klatt, M., Faigenbaum, A.D., Ross, R.E., Tranchina, N.M., McCurley, R.C. Kang, J. & Kraemer, W.J. Comparisons between different off-season resistance training programs in division III american college football players. *Journal of Strength and Conditioning Research*, 23(1):11-19, 2009.
6. Jacobson, B.H. & Gemmell, H.A. Nutrition information sources of college varsity athletes. *Journal of Applied Sport Science Research*, 5(4): 204-207, 1991.
7. Jacobson, B.H., Sobonya, C. & Ransone, J. Nutrition practices and knowledge of college varsity athletes: a follow-up. *Journal of Strength and Conditioning Research*, 15(1): 63-68, 2001.
8. Jonnalagadda, S.S., Rosenbloom, C.A. & Skinner, R. Dietary practices, attitudes, and physiological status of collegiate freshman football players. *Journal of Strength and Conditioning Research*, 15(4): 507- 513, 2001.
9. Kaiser, G.E., Womack, J.W., Green, J.S., Pollard, B., Miller, G.S. & Crouse, S.F. Morphological profiles for first-year national collegiate athletic association division I football players. *Journal of Strength and Conditioning Research*, 22(1): 243-249, 2008.

10. Kraemer, W.J., Torine, J.C., Silvestre, R.S., French, D.N., Ratamess, N.A., Spiering, B.A., Hatfield, D.L., Vingren, J.L. & Volek, J.S. Body size and composition of national football league players. *Journal of Strength and Conditioning Research*, 19(3): 485-489, 2005.
11. Snow, T.K., Stafford, M.M. & Rosskopf, L.B. Body composition profile of NFL football players. *Journal of Strength and Conditioning Research*, 12(3): 146-149, 1998.
12. Stuempfle, K.J., Drury, D.G., Petrie, D.F. & Katch, F.I. Ponderalsomatograms assess changes in anthropometric measurements over an academic year in division III collegiate football players. *Journal of Strength and Conditioning Research*, 21(3): 689-696, 2007.
13. Stuempfle, K.J., Katch, F.I. & Petrie, D.F. Body composition relates poorly to performance tests in NCAA division III football players. *Journal of Strength and Conditioning Research*, 17(2): 238-244, 2003.
14. Thompson, B.A., Wood, R.J., Wall, C. & Jones, M.T. Effects of a periodized 12-week resistance training program on trained male division III lacrosse players. Abstract 2008 NSCA National Conference.

**Table 1: Body Composition and Performance Mean Values (n=38)**

Measure	Mean	Standard Deviation
Power Clean (lbs)	229.9	31.95
Back Squat (lbs)	345.8	56.51
Bench Press (lbs)	260.7	42.42
Vertical Jump (in)	25.4	3.70
20 yard dash (sec)	2.90	0.18
Pro Agility (sec)	4.82	0.31
Percent Body Fat (%)	17.87	5.97
BMI (kg/m <sup>2</sup> )	29.08	4.33