Body Composition and Bone Mineral Density of Division 1 Collegiate Football Players: A Consortium of College Athlete Research Study

Tyler A Bosch, Aaron Carbuhn, Philip R. Stanforth, Jonathan M. Oliver, Kathryn A. Keller, Donald R Dengel
Journal of Strength and Conditioning Research Publish Ahead of Print DOI: 10.1519/JSC.0000000000001888
Summary written by Donald R Dengel, School of Kinesiology, University of Minnesota, Minneapolis, Minnesota

Introduction

College football is a unique sport in that it has identifiable positions that have specific physical demands that often require different body types to be successful. Generally speaking, individuals at these specific positions are trying to maximize their total mass-lean mass ratio (i.e., percent body fat [%BF]), but the optimal total mass for each position is highly variable[2,4].

The purpose of this study was to use dual X-ray absorptiometry (DXA) derived total and regional body composition measures to define position specific characteristics in a large cohort of National Collegiate Athletic Association (NCAA) Division 1 football athletes (n=467)[1]. We hypothesized that the data from this study would provide distinction between the type and distribution of mass for each position group and that positions which mirror each other would have similar body composition characteristics.

Methods

Collegiate football players from four different National Collegiate Athletic Association (NCAA) Division 1 football programs were scanned on GE Healthcare Lunar systems (Lunar iDXA/ Prodigy; GE Healthcare, Madison, WI, USA). All raw DXA scan files were collected from each university and analyzed at the University of Minnesota using enCore software version 16.2 (GE Healthcare, Madison, WI, USA). Visceral adipose tissue mass was estimated using CoreScan (GE Healthcare), as described previously[2,3]. Participants were grouped into positions as follows: defensive backs (DB), wide receivers (WR), tight ends (TE), linebackers (LBs), running backs (RB), offensive linemen (OL), defensive linemen (DL), quarterbacks (QB), and special teams (ST).

Results and Discussion

The Table compares the characteristics (i.e., age, height, weight, BMI, and body composition) of the cohort by position. Positions that share a letter within each row were not significantly different from one another. The player's age was similar across positions. LB and DL would be classified as Class I obese (30.0-34.9 kg/m^2), OL as Class II obese (35.0-39.9 kg/m^2) and all other positions as overweight (25.0-29.9 kg/m^2) based on standard BMI categories[6]. OL had a greater %BF than all other position groups and using %BF classifications, OL would be classified as obese and DL as overweight[5]. With the exception of OL and DL, there were no significant differences on any measures of body composition between offensive and defensive positions that mirror each other, but these values (i.e., fat mass, lean mass, etc.) were different than other position groups. Total fat mass for DL was significantly lower than OL, but there were no differences between DL and OL for lean mass. OL had significantly higher VAT mass ($p<0.05$) compared to all positions, except DL. Total bone mineral densities were similar among positions that mirror each other; however, there were fewer positional differences. DL had the highest average density and ST athletes had the lowest bone mineral density.

Mean (+Standard Deviation) Positional Body Composition Characteristics

	OL (n=83)	DL (n=53)	TE (n=30)	LB (n=58)	RB (n=36)	DB (n=78)	WR (n=75)	QB (n=23)	ST (n=31)
Age (yrs)	19.6[a] (1.5)	19.6[a] (1.4)	19.7[a] (1.5)	19.6[a] (1.5)	19.7[a] (1.5)	19.5[a] (1.5)	19.4[a] (1.4)	19.2[a] (1.4)	19.7[a] (1.4)
Weight (kg)	135.5[a] (11.8)	120.4[b] (14.2)	107.4[c] (9.6)	102.0[c] (6.6)	95.1[d] (9.6)	87.8[e] (6.5)	87.2[e] (8.8)	93.9[de] (8.2)	92.0[de] (9.2)
Height (cm)	192.9[a] (4.9)	189.1[b] (3.7)	190.5[ab] (5.5)	184.2[c] (3.1)	179.4[d] (3.9)	181.1[d] (4.1)	183.9[c] (6.5)	186.9[bc] (4.9)	184.8[c] (6.4)
BMI (kg/m2)	36.4[a] (3.1)	33.7[b] (4.5)	29.5[c] (2.1)	30.0[c] (2.0)	29.4[c] (2.2)	26.5[d] (2.0)	25.7[d] (1.7)	26.8[d] (1.9)	26.9[d] (2.1)
Percent Fat (%)	30.8[a] (4.2)	23.5[b] (7.0)	19.8[c] (3.9)	18.8[c] (4.9)	15.3[de] (3.9)	13.3[e] (3.2)	14.1[de] (3.6)	17.2[cd] (4.2)	19.9[c] (5.5)
Total Lean Mass (kg)	89.5[a] (6.5)	87.6[a] (6.8)	82.2[b] (6.5)	79.5[bc] (5.2)	77.3[cd] (6.8)	72.4[e] (5.2)	71.6[e] (6.5)	74.4[de] (6.3)	70.4[e] (6.0)
Total Fat Mass (kg)	40.1[a] (7.9)	27.8[b] (10.8)	20.5[c] (5.3)	18.5[c] (5.4)	14.1[de] (4.6)	11.2[e] (3.0)	11.9[e] (3.7)	15.5[cde] (4.4)	17.7[cd] (5.8)
Total BMD (g/cm2)	1.63[ab] (0.12)	1.65[a] (0.11)	1.59[abc] (0.11)	1.61[ab] (0.10)	1.56[bcd] (0.12)	1.54[cd] (0.11)	1.51[cd] (0.10)	1.56[bcd] (0.13)	1.47[d] (0.10)
VAT (g)	811[a] (499)	645[ab] (481)	228[c] (142)	241[c] (184)	181[c] (129)	204[c] (144)	223[c] (116)	248[bc] (123)	331[bc] (94)

For each row, if a position does not share a letter it is significantly different at an adjusted ($p<0.05$). OL = offensive Line, DL = defensive line, TE = tight end, LB = linebacker, RB = running back, DB = defensive back, WR = wide receiver, QB = Quarterback, ST = special teams. BMI = body mass index, BMD = bone mineral density, VAT = visceral adipose tissue.

Conclusion

While other studies have reported body composition in collegiate football players, this study provides the largest cohort of collegiate football players with total and regional body composition measured by DXA, the *"gold standard"* in body composition. This study builds on previous studies by reporting positional bone mineral density and VAT mass differences in collegiate football players. These data provide new insight into positional body composition characteristics of collegiate football players that can be used to guide nutrition and training plans as well as monitor player health and wellness.

References: **1.** Bosch, TA, Carbuhn, A, Stanforth, PR, Oliver, JM, Keller, KA, and Dengel DR. Body composition and bone mineral density of division 1 collegiate football players: a consortium of college athlete research study. *Journal of Strength and Conditioning Research* 33(5):1339-1346, 2019. **2.** Bosch, TA, Steinberger, J, Sinaiko, AR, Moran, A, Jacobs, DR, Kelly, AS, and Dengel, DR. Identification of sex-specific thresholds for accumulation of visceral adipose tissue in adults. *Obesity* 23: 375–382, 2015. **3.** Bosch, TA, Burruss, TP, Weir, NL, Fielding, KA, Engel, BE, Weston,TD, and Dengel, DR. Abdominal body composition differences in NFL football players. *Journal of Strength and Conditioning Research* 28: 3313–3319, 2014. **4.** Dengel, DR, Bosch, TA, Burruss, TP, Fielding, KA, Engel, BE, Weir, NL, and Weston, TD. Body composition and bone mineral density of national football league players. *Journal of Strength and Conditioning Research* 28: 1–6, 2014. **5.** Jeukendrup A, Gleeson M. Sport Nutrition. 3rd ed. Champaign, IL: *Human Kinetic*; 2019. **6.** Weir CB, Jan A. BMI Classification Percentile And Cut Off Points. [Updated 2021 Jun 29]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK541070/

For more information and additional education resources, visit www.hologiced.com

HOLOGIC®
The Science of Sure