INDICATORS OF METABOLIC SYNDROME OF FIRST YEAR DIVISION III FOOTBALL PLAYERS.

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Abstract

INTRODUCTION: Football teams are comprised of a variety of body types dependent on position. For instance, for blocking purposes, linemen tend to be heavier. Other positions such as running backs are more agile and require speed (skilled position). Some football players such as linemen may be overweight or obese and are at elevated risk of metabolic syndrome (METs). The metabolic health of college football players is important to consider for the purpose of tailoring their training regimen and eating habits to maintain healthy lifestyles, rather than just to perform well in their sport. PURPOSE: The purpose of this study was to examine the relationships between the offensive line, defensive line, and skilled positions and metabolic health status in Division III first year players. Effective methods for assessing risk of metabolic syndrome were also investigated. METHODS: The following data was collected: Body Mass Index (BMI), percent body fat, cholesterol levels, fasting glucose, blood pressures, and umbilical and suprailiac circumferences. Subjects were coded into three categories by the position they played (offensive line, defensive line, skilled). Metabolic data was evaluated in terms of position and relationships were examined via correlation. RESULTS: The study included 33 male first-year football players. There were three offensive linemen, five defensive linemen, and 25 skilled players. Four players met the criteria for METs (12%, 3 linemen, 1 skilled). The mean weight for the offensive line was higher than the defensive line and skilled positions (122.55 kg, 107.19 kg, and 84.50 kg respectively, [$F_{2,33}$= 18.1, $p < 0.05$]). There were also significant differences between groups for BMI, suprailiac and umbilical circumferences ($F_{2,32}$ = 11.0, $F_{2,32}$ = 18.9, $F_{2,32}$ = 7.2, $p < 0.05$, respectively). On Post-Hoc analysis, BMI and suprailiac circumference differences were found between all three groups ($p < 0.05$). For umbilical circumferences, differences were only found between the offensive line and skilled players ($p < 0.05$). Suprailiac circumference was positively correlated ($p < 0.05$) with BMI (r =.91), % body fat (r = 0.69), triglycerides (r = 0.43) and systolic blood pressure (r = 0.53) and negatively correlated with high-density lipoprotein cholesterol (r = -0.44). CONCLUSION: The study suggests that first year football players are at risk for METs, with linemen having the highest risk. The suprailiac circumference is related to the highest number of METs indicators. Division III football teams should consider using the suprailiac circumference as a measurement for pre-season health evaluations to identify high risk players.

Introduction

Metabolic syndrome (METS) is diagnosed by meeting three of the five following criteria: high waist circumference, hypertension, elevated fasting blood glucose, high triglyceride values and low high-density lipoprotein (HDL) cholesterol (see table 1). Metabolic syndrome puts the individual at a higher risk of type II Diabetes Mellitus and cardiovascular disease which are associated with higher mortality. Athletes are often assumed to have a decreased risk of METS and cardiovascular disease due to their increased rate of physical activity. American football players develop a training and dietary regimen based on the goals of their position. Skilled players tend to focus on agility and speed while linemen tend to focus on being larger and more powerful than their opponent for blocking purposes. Ideally, increased weight for linemen is composed of higher muscle mass. Instead there is a trend of higher adipose tissue and particularly abdominal fat with offensive and defensive linemen, particularly at the division III level. These players face an increased risk of METS, diabetes and cardiovascular disease after their football careers have ended. The increased risk may be caused by the lack of emphasis on cardiovascular training for linemen and a common misconception of the primary goal to be weight gain rather than strength and power through increased muscle mass. The metabolic health of Division III football players can potentially be affected by their awareness of their increased risk, and as a result early screening for METS indicators may decrease their likelihood of developing diabetes and cardiovascular disease.

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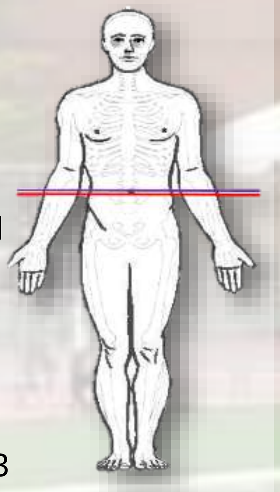
Purpose

The purpose of this study was to examine the relationships between the offensive line, defensive line, and skilled positions and metabolic health status in Division III first year players. Effective methods for assessing risk of metabolic syndrome were also investigated.

Methods

The following measurements were completed on the same day in the Exercise Physiology Lab at Linfield College. Participants were asked to refrain from eating for eight hours prior to testing.

- Height and weight - standard physicians scale and stadiometer.
- Resting blood pressure – auscultation: confirmed three times
- Waist circumference – umbilical and suprailiac - Gulick tape measure
- Body composition: Ultrasound (IntelaMetrix)- 3 sites: Tricep, Abdomen & Thigh
- Fasting cholesterol: TC (total cholesterol), TG (triglycerides), LDL and HDL cholesterol
- Fasting blood glucose (FBG) and blood glucose: Capillary sample (Cholestech)
- Statistics:
  - Students T-Test was used to compare skilled vs. lineman.
  - ANOVA was used to compare across position.
  - Pearson Correlations was used to evaluate
  - Relationships between METS criteria. Statistics were completed using SPSS v23
- This study was approved by the Linfield College Institutional Review Board



Results

Table 1: Demographics and Clinical Results

	All (N=33)	Linemen (n=8)	Skilled (n=25)
Age	18.65 ± 0.61 (18 - 20)	19 ± 0.76 (18 - 20)	18.52 ± 0.51 (18 - 19)
Height (m)	1.80 ± 0.06 (1.7 – 1.9)	1.85 ± 0.04 (1.8 – 1.9)	1.78 ± 0.06 (1.7 – 1.9)
Weight (kg)	91.40 ± 17.47 (58.1 – 137.7)	112.95 ± 16.12 (92.3 – 137.7)	84.51 ± 11.29 (58.1 – 109.8)
BMI	28.04 ± 4.38 (20.9 – 40.4)	32.91 ± 4.82 (27.2 – 40.42)	26.48 ± 2.90 (20.9 – 31.9)
% Body Fat	18.02 ± 4.38 (9.8 – 27.4)	20.4± 5.40 (9.8 – 27.1)	17.25 ± 3.82 (11.0 – 27.4)
Waist (cm) Umbilical	88.12 ± 7.97 (75.3 – 112.3)	95.44 ± 9.21 (82.3 – 112.3)	85.78 ± 6.03 (75.3 – 98.3)
Waist (cm) Suprailiac	89.62 ± 11.58 (74.5 – 123.3)	103.19 ± 12.90 (88.0 – 123.3)	85.28 ± 7.02 (74.5 – 102.8)

	All (N=33)	Linemen (n=8)	Skilled (n=25)
TC (mg/dl)	139.70 ± 37.88 (42.0 – 190.6)	146.53 ± 29.40 (101.2 – 179.2)	137.52 ± 40.50 (42.0 – 190.6)
HDL (mg/dl)	44.64 ± 8.20 (33.0 – 69.0)	39.38 ± 4.63 (34.0 – 48.0)	46.32 ± 8.45 (33.0 – 69.0)
LDL (mg/dl)	84.70 ± 19.93 (41.0 ± 131.0)	84.13 ± 23.41 (41.0 – 107.0)	84.91 ± 19.12 (55.0 – 131.0)
FBG (mg/dl)	92.21 ± 9.90 (53.0 – 105.0)	93.88 ± 9.36 (77.0 – 104.0)	91.68 ± 10.19 (53.0 – 105.0)
Tg (mg/dl)	99.37 ± 47.07 (46.0 - 214.0)	115.13 ± 50.08 (49.0 - 204)	93.64 ± 45.76 (46.0 – 214.0)
Systolic (mmHg)	118.04 ± 14.64 (92.33 – 142.67)	120.46 ± 15.50 (92.3 – 136.0)	117.23 ± 14.60 (95.0 – 142.67)
Diastolic (mmHg)	68.51 ± 10.35 (51.0 – 88.0)	62.25 ± 11.34 (51.0 – 88.0)	69.55 ± 10.03 (52.7 – 88.0)

Values are mean and standard deviation: TC: Total Cholesterol, HDL: High Density Lipoprotein, LDL: Low Denisity Lipoprotein, FBG: Fasting Blood Glucose and Tg: Triglycerides

Table 2: Metabolic Syndrome criteria & frequency for all and by position

Criteria	Measurement	All (N = 33)	Skilled (n= 25)	Lineman (n = 8)
Dyslipidemia	TG ≥ 150 mg/dl or diagnosis or Rx	5 (15%)	3 (12%)	2 (25%)
Dyslipidemia	HDL < 40 mg/dl or diagnosis or Rx	10 (30%)	5 (20%)	5 (63%)
Hyperglycemia	Fasting glucose ≥ 100 mg/dl or Rx	5 (15%)	2 (8%)	3 (38%)
Hypertension	Systolic > 130 mmHg or diastolic > 85 mmHg or Rx	10 (30%)	7 (28%)	3 (38%)
Obesity	Waist circumference > 102 cm (M) and > 88 cm (F)	5 (15%)	1 (4%)	4 (50%)

TG: Triglycerides, HDL: High Density Lipoprotein Cholesterol, Rx: diagnosis, M: Male and F: Female.

Table 3: Relationship of Waist Measurement and Risk Factors

Waist (cm)	Umbilical	Suprailiac
Body Mass Index	0.621**	0.910**
% Body Fat	0.402*	0.688**
HDL Cholesterol	-0.157	-0.437*
Blood Glucose	0.226	0.175
Triglycerides	0.494*	0.492*
Systolic BP	0.295	0.534**
Diastolic	0.145	0.251

Pearson r: * p < 0.05 ** P < 0.001

Figure 1: Number of players with risk factors for METS

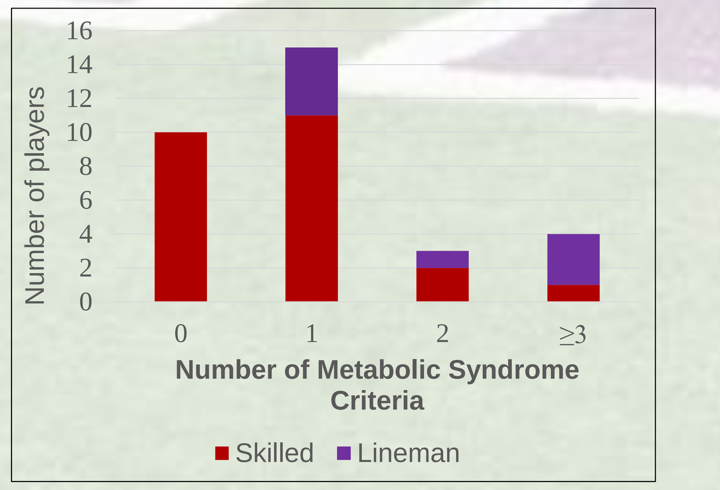
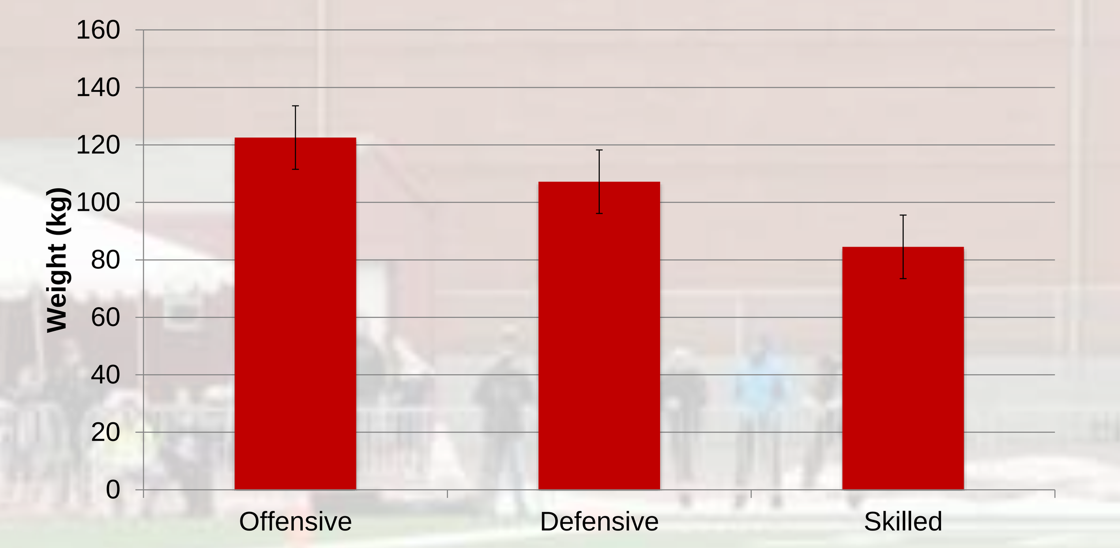
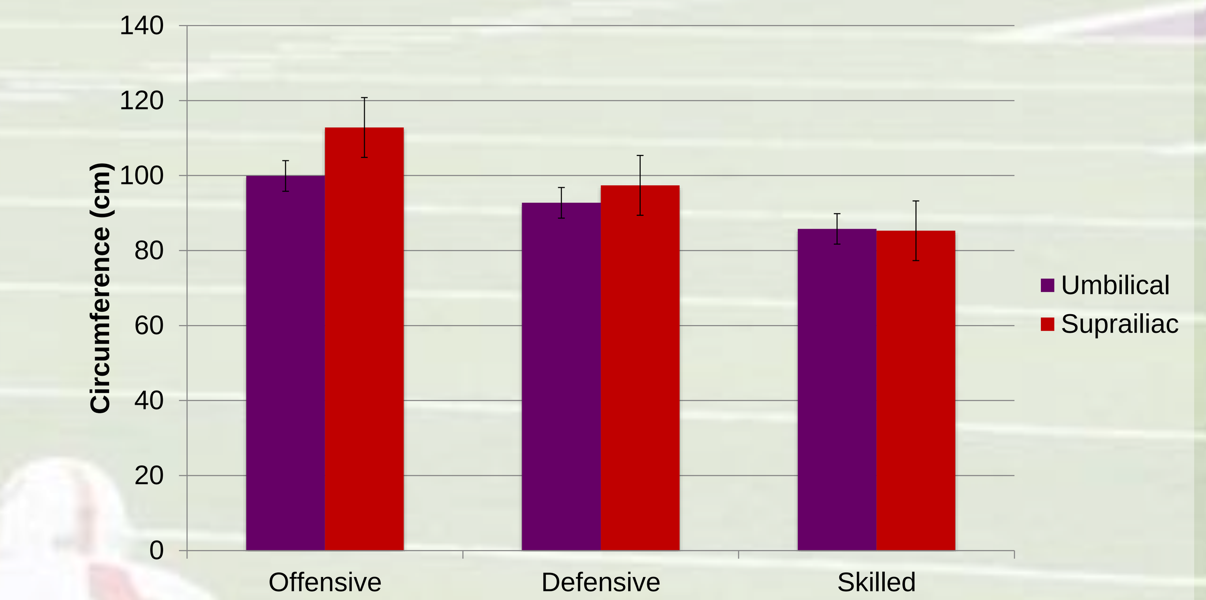


Figure 2: Body Weight by Position



The mean weight for the offensive line was higher than the defensive line and skilled positions (122.55 kg, 107.19 kg, and 84.50 kg respectively, [$F_{2,33}$= 18.1, $p < 0.05$]).

Figure 3: Waist Circumference by Position and Measurement Location



Discussion

Previous research has shown that professional football players and Division I players are at risk of METs (Borchers et al., 2009). The results of this study suggest that Division III players are also at risk for METs, with linemen having the highest risk. Possibilities for further research include collecting data on high school players to determine if METs indicators have an earlier onset. Another prospect is to extrapolate this study into a longitudinal evaluation risk progression or changes over time. Coaches can increase awareness of this risk and foster healthy training and eating habits that allow players to perform well without significant metabolic health detriments. The suprailiac circumference is related to the highest number of METs indicators. Division III football teams should consider using the suprailiac circumference as a measurement for pre-season health evaluations to identify high risk players.

Study Limitations

This study consists of cross-sectional data. Repeated measurements of the metabolic indicators in the same 33 subjects could provide more information on their long term metabolic health. The small sample size of the lineman is an additional limitation.

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