

Changes in Body Composition and Activity Levels of a Division-1 Football Team During COVID-19

Original Research

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Abstract

Introduction: The effect that training cessation due to the COVID-19 pandemic had on a Division-1 football team's activity levels and body composition.

Methods: Dual-energy X-ray absorptiometry (DXA) were taken in February and upon return to campus during the athletic department's normal medical screenings. To measure the athletes' activity during the suspended activity period the validated Modifiable Activity Questionnaire (MAQ) was given to the athletes to confidentially complete. Along with the MAQ were two rating of perceived exertion (RPE) scales that corresponded to cardiovascular work or strength work.

Results: Strength/Weight training was the most frequent activity recorded during this time ($n = 56$) with an average of 16.14 sessions ($SD = 6.92$) per-month. Significant fat mass increased and lean mass losses were seen in both linemen/non-linemen. Frequency of training was a significant predictor of lean mass loss in non-linemen but not linemen.

Conclusions: During the COVID-19 suspension of activities the athletes saw significant decreases in fat free mass with increases in fat mass and body fat percentage. Although, strength/weight training was the most frequently reported activity undertaken during this time it was still not sufficient to maintain the fat free mass of the athletes.

Key Words: Body Composition, Division-1 Football, Self-Reported Activity

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Introduction

On January 21, 2020 the Center for Disease Control (CDC) initiated an agency-wide response to the SARS-CoV-2 (COVID-19) pandemic¹. This set off a chain-reaction of other local schools, businesses, and colleges closing their doors as well. Tison et al. ², showed that within 30-days of the World Health Organization (WHO) declaring COVID-19 a pandemic there was a 27.3% decrease in mean step count measurements obtained from several countries including the United States, United Kingdom and India. A study examining the impact of the self-isolation and social distancing on Italians found that activity levels significantly decreased in all age groups and was correlated with a decrease in mental well-being ³. Italian citizens in self-isolation reported that their sleep habits changed by going to bed and waking later, spending more time in bed and reported lower amounts of sleep quality during the lockdown⁴. Significant increases in perceived screen time, body weight, eating, and decreases in physical activity were also shown in college-aged students (90 students, 88% female)⁵. However, the longitudinal values of weight, body mass index (BMI) or BMI category did not significantly change, thus showing a shift of how college-aged students self-perceptions about their activity level and body image have been impacted by the pandemic ⁵.

Of special interest to the strength and conditioning community is the changes in physical activity of their athletes over the course of the pandemic. When returning to campus, a thorough plan to safely reintroduce the athletes back into activity is vital for the student-athlete. The National Strength and Conditioning Association (NSCA) and Collegiate Strength and Conditioning Coaches Association (CSCCA) released a joint consensus on how to gradually reintroduce activity over the first 2-4 weeks to reduce catastrophic injury in June of 2019, which could serve as a frame work for the Strength and Conditioning coaches ⁶. The need for a gradual reintroduction to training is necessary to avoid similar outcomes following the 2011 NFL lockout. In the first 12 days of Training Camp there were 10 reported Achilles ruptures with 2 more in the first 2-weeks of preseason, compared to 31 total Achilles tendon ruptures in the NFL from 1997 to 2002 seasons ⁷. Additionally, there seems to be an increased risk of sustaining a lateral ankle sprain in athletes with a higher body mass index⁸. The loss of the spring academic semester, which is the time period that Trexler et al. ⁹ have seen significant increases in lean body mass, is an effect that will be felt in the summer and fall academic semesters by collegiate football teams by losing out on months of strength and conditioning work as well as spring football. Binkley et al. ¹⁰ have shown that football athletes on average increased their lean mass by 2.2kg and decreased their fat mass by 1.4kg over the spring academic semester. The cancellation of spring training due to the COVID-19 pandemic will be marked by missed opportunities for gains in strength, conditioning, lean mass and improvements in body comp. With a reduced amount of strength and conditioning training prior to entering into fall camp, not only are the athletes at an increased risk of injury due to a sharp elevation of training load from fall camp ^{11,12} but also theoretically due to the losses of strength and size.

Thus, the main aim of this study was to assess the lean mass, fat mass, body fat percentage and total mass changes in Division I Football athletes over the course of the COVID-19 pandemic through a retrospective study design. The secondary aim of the study was to measure the activity of the Division I Football athletes during the COVID-19 pandemic.

Methods

Participants

This study was a retrospective analysis conducted on the returning athletes from a Division-1 football team. The football team ($n = 83$) was divided into two position groups [linemen ($n = 24$) and non-linemen ($n = 59$)] to analyze the changes in body composition and the activity level of the groups when they returned from the COVID-19 break. During the usual winter training activities all athletes' body composition was analyzed via DEXA in February 2020. Upon returning from the COVID-19 break, body composition was measured again, and an activity questionnaire was provided to the student-athletes to confidentially complete. During the suspended activity period the student-athletes were given resistance training bands to conduct their daily training due to government ordered closures of gyms.

Protocol

Body composition analysis was conducted using a Dual Energy X-ray absorptiometry (DEXA) scan during normal activities in February 2020 and again upon return in June 2020. Body composition, (lean and fat mass) was estimated using the GE Lunar iDXA (Encore 2014 version 16). All measurements were performed by two individuals trained on this equipment to ensure accuracy of measurements.

To measure the athletes' activity during the suspended activity period (March – June) the validated Modifiable Activity Questionnaire (MAQ)¹³ was given to the athletes to confidentially complete. The MAQ gives a bank of activities to choose from and allows the participant to detail which activities were completed during the individual months, and average duration and average times the activity was performed. The student-athletes would fill in the dialog boxes using current memory of activities they participated in during the suspended activity period. Along with the MAQ were two rating of perceived exertion (RPE) scales (OMNI perceived exertion scale for resistance exercise¹⁴ and the OMNI scale of perceived exertion for walking/running exercises¹⁵) that corresponded to cardiovascular or strength work. The student-athletes would match their RPE with the visual scale and record it with the corresponding activity.

Statistical Analysis

Paired t-tests were used to compare body composition measurements obtained in February and March and then again in June. Simple linear regression was used to determine the change in lean mass and fat mass over the course of the training cessation. Statistical significance was set at $p < 0.05$.

Results

Body Composition

The team on average gained 1.37kg ($SD = 2.21$) of fat mass and lost 2.10kg ($SD = 2.80$) of lean mass. There were significant gains in fat mass in both groups as well as lean mass in both groups. The total mass change was found to be significant for the non-linemen position group ($M = -0.87 \pm 3.18$, $p = 0.041$) while not significant for the linemen ($M = -0.40 \pm 4.06$, $p = 0.633$).

Self-Reported Activity

Strength/weight training was the most reported activity ($N = 56$) with an average of 16.14 times per month ($SD = 9.92$), lasting 78.08 ± 33.38 minutes, with an average intensity of 7.30 ± 1.67 . This correlates well with the strength training protocols that athletic departments participate in, with a 4-day a week strength and conditioning split. The least popular activities included skating, horseback riding, dancing, scuba diving, tennis, and volleyball. The longest activity average recorded was golf (184.80 minutes \pm 111.15) while the shortest was Jump Rope (20.78 minutes \pm 22.47). The most intense activity was recorded to be strength/weight training (7.30 ± 1.67), while hunting was the least intense (1.50 ± 1.00).

Table 1. Self-Reported activity over the course of March until return to campus in June. (Mean \pm Standard Deviation). Activities with less than 20 responses are not shown.

Activity	N	Times Per Month	Duration (min)	Intensity (RPE)
Strength/Weight Training	56	16.14 \pm 9.92	78.08 \pm 33.38	7.30 \pm 1.67
Jogging	53	10.94 \pm 6.22	35.19 \pm 25.63	6.43 \pm 3.88
Jump Rope	43	10.84 \pm 6.50	20.78 \pm 22.47	5.95 \pm 1.80
Plyometrics	35	11.63 \pm 5.83	27.69 \pm 26.27	6.37 \pm 2.12
Basketball	25	8.20 \pm 6.40	72.04 \pm 43.97	6.04 \pm 2.15
Recovery Techniques	24	10.63 \pm 7.25	29.17 \pm 17.49	2.73 \pm 2.59
Fishing	22	7.77 \pm 6.55	96.18 \pm 43.43	1.68 \pm 2.25
Swimming	22	6.91 \pm 5.04	52.96 \pm 35.78	3.77 \pm 1.51

Values expressed as mean \pm SD. Abbreviations: RPE, Rating of Perceived exertion

Factors affecting Lean and Fat Mass Change

A simple linear regression was calculated to predict lean mass change based on the frequency of strength training for the separate lineman and non-linemen groups. A significant regression equation was found ($F(1,36) = 18.25$, $p < 0.000$) with an R^2 of 0.34 for the non-linemen group. Participants predicted lean mass loss was equal to $-13.41 + 0.577$ (Times per month of strength training) when lean mass change is measured in kilograms. However, a non-significant regression equation was found ($F(1,15) = 1.16$, $p = 0.299$) with an R^2 of 0.07. When a simple linear regression was calculated to predict fat mass change, average times per month, average duration in minutes and average intensity (RPE) did not produce a significant regression equation.

Discussion

The self-reported strength training frequency (16.14 ± 9.92 days per month) was found to be double the previously reported activity of non-athlete college students (2.2 ± 2.1 days per week) while aerobic exercise was about equal, (10.94 ± 6.22 days per month for the athletes in this study, 2.8 ± 2.1 days per week for non-athletes)¹⁶. The frequency of strength training was found to be the only significant predictor of the change in lean mass for the non-linemen group. Thus, when student-athletes are away from campus it would be suggested that the non-linemen athletes are instructed to maintain or increase the frequency of their strength training. It has been shown that more frequent training produces greater gains in one-repetition max (1RM)¹⁷. The training performed during the McLester et al. study¹⁷ was conducted with resistance training however the majority of the participants involved in the current study only had access

to resistance bands due to the closure of gyms during the pandemic. The average self-reported intensity of the strength training sessions was 7.30 ± 1.67 , which may have not been enough to induce the training adaptations necessary. A meta-analysis performed by Wernborn et al.¹⁸, showed that the ideal percent of 1RM to induce conventional hypertrophy was 70-85% with 8-10 repetitions for 2-3 sessions per week¹⁸. These loads would have been hard to achieve with the limited amount of equipment that was used as the majority of the student-athletes only had access to the resistance band set given to them by the university's athletic department. Previous studies have shown that a 90% 1RM equated to an RPE of 6.9¹⁹, and the student-athlete reported average RPE for strength training with the resistance bands was 7.30. Thus, with an average of about 4-days per week of strength training and an RPE that correlates with an intensity of 90% 1RM, there was, theoretically enough of a stimulus to induce positive strength training adaptations. When assessing the linemen group the regression equation calculated with average times per month of strength training it was no longer significant, compared to the non-linemen group. One study reported that the average squat 1RM for a college offensive lineman was reported $208.97 \pm 35.26\text{kg}$ ²⁰. During the quarantine period the majority of the team had access to at least resistance bands, which can explain why the frequency of training was not a significant predictor of lean mass change as the intensity was not high enough for the strength adaptations to occur. Our findings indicate that alternative methods of training in addition to resistance bands would be more beneficial for linemen to achieve lean mass goals.

As stated previously Division-1 football athletes add on average 2.20kg of lean mass and decrease their fat mass by 1.4 kg, with the senior linemen not adding a significant amount during the spring academic semester¹⁰. During the activity suspension the student-athletes included in the study saw almost the exact opposite effect, on average gaining more fat mass and losing lean mass. Thus, not only is there concern about the strength of the athletes with the decrease in lean mass but there is also concern about the conditioning of the athlete due to the increase in fat mass. Trexler et al.⁹, theorized that the intensified pre-season training is used to optimize body composition prior to the need to reduce training due to increased sport practice. With the team average lean mass loss during this time of 2.10kg, during a time where it's been reported that they can gain 2.20kg, the athletes are potentially down 4.30kg from where they would be during a typical season. To the authors' knowledge increased injury risk due to the losses in size and strength have not been examined in Division-1 football athletes, which allows for further analysis of this past season to investigate further.

Media-Friendly Summary

Frequency of training is a significant predictor of lean mass loss in Division-1 non-linemen football athletes.

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