Body Composition Changes in Female Collegiate Soccer Athletes From Preseason to Postseason

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Abstract

Previous studies have suggested that percent body fat (%BF) and lean mass do not change from pre- to postseason in female collegiate soccer athletes even though changes may be seen in athletes competing in other sports. ***PURPOSE***: To document changes from preseason to postseason in body mass, %BF, fat distribution, and lean mass in female collegiate soccer athletes using readily available skinfold measures. ***METHODS:*** Twenty-four healthy, female collegiate soccer athletes (age 19.6 yrs ±1.2, ht 166.44 cm ± 6.28 cm, mass 62.05 kg ± 4.66) participated. Participants were screened in the preseason and directly after (postseason) using standard anthropometric measurements that included: height, mass, and skinfold measure of the triceps, suprailiac, and thigh areas. These measurements were conducted by an exercise physiologist with 25 years of experience and the skinfold technique was selected for collection convenience. The measurements allowed for calculation of the BMI, lean body mass, lean body mass index (LBMI), and %BF which were compared from preseason to postseason. Individual skinfold sites were also compared from pre- to postseason. ***RESULTS:*** No differences were noted between preseason and postseason measurements, respectively, for: body mass (62.05 & 62.13 kg, t(23)=-.229, $P > 0.05$), BMI (22.07 & 22.35; t(23)=-1.96, $P > 0.05$), lean body mass (46.84 & 46.47 kg; t(23)=1.65, $P > 0.05$), LBMI (16.75 & 16.62; t(23)=1.44, $P > 0.05$), and %BF (24.38 & 25.25; t(23)=-1.79, $P > 0.05$). There were differences in skinfold thickness at the triceps (19.5 & 20.5 mm; t(23)=-2.102, P< 0.05) and suprailiac (15.98 & 17.70 mm; t(23)=-2.57, $P < 0.05$) assessment sites. The covariate of field position was not a significant factor in the changes noted in triceps [F(1,22) = 0.55, $P = 0.47$] and suprailiac [F(1,22) = 0.55, $P = 0.47$] thickness. ***CONCLUSION:*** These results suggest that female collegiate soccer athletes did not experience changes in %BF or lean mass from pre- to postseason. However, there may be small increases in fat accumulation at specific sites. Monitoring of individual athletes for these types of changes might also be important for training considerations during the season.

Introduction

Body composition (BC) is an effective indicator of the physical fitness and health of athletes (3). Excess body fat is detrimental and fat-free mass (FFM) is beneficial for athletic performance. For example, it has also been shown that lower percent body fat (%BF) is related to better sprint performance (8), and fat free mass contributes to the production of power during high-intensity activities and provides greater absolute strength (3). Excess %BF serves as dead weight in activities such as running and jumping, during which the body mass must be repeatedly lifted against gravity.

The typical collegiate soccer athlete spends multiple hours per week conditioning, strength training, practicing, and competing in games throughout the competitive season (6). It is common for elite female soccer players to complete several training sessions per week, covering distances of 6–7 km per session (5). In one study of elite female soccer players (5), energy expenditure was reported to be in excess of energy intake. This would increase the risk of low energy availability and subsequent metabolic, reproductive, and bone-related changes. A negative energy balance could lead to a decrease in lean mass.

Several have examined preseason to postseason BC changes in female soccer athletes (1,6,10). Most pre- to postseason investigations have shown %BF and FFM to not change in this population from preseason to postseason (1,10), even though BC changes are seen in other women's sports. However, some studies have reported the loss of lean mass during the competitive soccer season (6). This could be indicative of a negative energy balance.

The purpose of this study was to document changes from pre- to postseason in body mass, %BF, fat distribution, and lean mass in female collegiate soccer athletes using readily available skinfold measures.

Methods

Subjects: Twenty-four healthy, female athletes (age 19.6 yrs ±1.2, ht 166.44 cm ± 6.28 cm, mass 62.05 kg ± 4.66) from a very competitive NCAA Division I women's soccer program volunteered for this study. This group went on to win the conference regular season and conference tournament championships, and advance to the second round of the NCAA national tournament. All athletes consented to releasing their medical documents, de-identified, to the researchers for this study. This study was approved by Institutional Review Board at Florida Gulf Coast University.

Methods cont.

Design: A repeated measures, non-randomized experimental design was used to study changes in anthropometric measurements over the course of a single season. The single independent variable was time with two levels: preseason and postseason. The dependent variables were: body mass, %BF, fat distribution, and lean mass.

Figure 1. Tricep Skinfold Measurement

Procedures: Participants were screened at the beginning of their organized conditioning season in August (preseason) and again in December after the end of their competitive season (postseason). The following anthropometric measures were obtained: height, mass, and skinfold thickness taken at the pectoral, abdominal, and anterior thigh sites. The sum of the skinfolds was used to estimate percent body fat and lean body mass (LBM) using equations specific for gender and age (2). Body mass was measured to the nearest 0.1 kg with participants clothed in shorts and tee-shirts using digital scales (Healthometer, Neosho,MO, USA). Height was measured to the nearest 0.1 cm with participants barefoot using a wall-mounted stadiometer (Heightronics, QuickMedical, Issaquah, WA, USA). Body mass index (BMI, kg/m^2) and lean body mass index (LBMI, kg/m^2) were then calculated from the individual measurements. Comparisons from pre- to postseason were made for the all of the anthropometric variables. An exercise physiologist with 25 years of experience conducted all of the measurements, and the skinfold technique was selected for collection convenience. The training and competition schedule used for these athletes during the season included two-hour practices four to six times per week depending on the competition schedule, one-hour strength training sessions twice per week, and games twice per week. This schedule is similar others reported in the literature (5,6).

A paired samples t-test was used to assess changes in all anthropometric variables from preseason to postseason. The level of significance was accepted at $P \leq 0.05$.

Results

Descriptive statistics for each anthropometric variable by time is presented in table 1. No differences were found between preseason and postseason measurements, respectively, for body mass (62.05 & 62.13 kg; t(23)=-2.29, $P > 0.05$), BMI (22.07 & 22.35; t(23)=-1.96, $P > 0.05$), lean body mass (46.94 & 46.57 kg; t(23)=1.65, $P > 0.05$), LBMI (16.75 & 16.62; t(23)=1.44, $P > 0.05$), and %BF (24.38 & 25.25; t(23)=-1.79, $P > 0.05$, table 2). There were differences in skinfold thickness at the triceps (19.5 & 20.5 mm; t(23)=-2.102, $P < 0.05$) and suprailiac (15.98 & 17.70 mm; t(23)=-2.57, $P < 0.05$, table 2) assessment sites. The covariates of field position was not significant factors in the changes noted in triceps [F(1,22) = 0.55, $P = 0.47$] and suprailiac [F(1,22) = 0.55, $P = 0.47$] thickness (table 2).

Table 1: Means, Standard Errors, and 95% CIs for All Anthropometric Variables from Preseason to Post Season

				95% Confidence Interval	
Group	Time	Mean	Std. Error	Lower Bound	Upper Bound
Tricep Skinfold	Pre-	19.50	.7542	17.94	21.06
	Post-	20.48	.8951	18.63	22.33
Suprailum Skinfold	Pre-	15.98	.9006	14.12	17.84
	Post-	17.70	1.077	15.48	19.93
Thigh Skinfold	Pre-	26.79	.9858	24.75	28.83
	Post-	26.96	.9771	24.94	28.98
Body Mass	Pre-	62.05	2.097	60.08	64.01
	Post-	62.13	1.939	60.31	63.95
Body Fat %	Pre-	24.38	.5640	23.22	25.55
	Post-	25.25	.5766	24.06	26.44
BMI	Pre-	22.07	.2983	21.45	22.68
	Post-	22.35	.3292	21.67	23.03
Lean Mass	Pre-	46.84	1.316	45.61	48.08
	Post-	46.47	1.347	45.21	47.73
LBM	Pre-	16.75	.2043	16.32	17.17
	Post-	16.62	.2456	16.11	17.13

Table 2: Results of Paired Samples t-test for Anthropometric Variables from Preseason to Post Season

	Mean Difference	t value	df	Sig. (2-tailed)
Pair 1: Tricep Skinfold Pretest to Posttest	-.9792	-2.102	23	.047
Pair 2: Suprailum Skinfold Pretest to Posttest	-1.725	-2.572	23	.017
Pair 3: Thigh Skinfold Pretest to Posttest	-.1667	-.296	23	.770
Pair 4: Body Mass Pretest to Posttest	-.1917	-.229	23	.821
Pair 5: Body Fat % Pretest to Posttest	-.8688	-1.790	23	.087
Pair 6: BMI Pretest to Posttest	-.2833	-1.958	23	.062
Pair 7: Lean Mass Pretest to Posttest	-.8263	1.65	23	.112
Pair 8: LBMI Pretest to Posttest	-.125	1.436	23	.1675

Discussion

The preseason body composition characteristics of this group were similar to those reported by other authors (1,6,10).The results suggest that female collegiate soccer athletes do not experience significant changes in body mass, %BF, or lean mass from pre- to postseason. When the researchers controlled the analysis for age and field position, the results were not influenced. In general, females demonstrate an increase in fat mass and %BF in their 20s (4). The female soccer athletes in this study and others had a lower %BF than the average college female. The athletes were most likely already physically active before beginning college and showed no significant change in %BF during the competitive season.

Discussion Cont.

The non-significant changes in body composition seen in this study were similar to the reported non-significant average change in most other studies (1,10). One study involving female collegiate soccer athletes did report a loss of lean mass over the competitive season (6). The authors speculated that the loss might be attributed to the change in the strength program once the competitive season began. The soccer players in that study participated in three days per week of required strength training prior to the start of the competitive season, but only one day per week of strength training during the competitive season (6). The athletes in the current study completed two strength-training sessions per week and did not lose lean mass during the competitive season. It is also possible the athletes in the previous study had a negative energy balance, while those in the current study did not. The monitoring of energy status is important for female athletes as it may help to prevent unfavorable health outcomes (9). The athletes in this study had preseason healthy body mass index (BMI) values that were maintained at postseason. However, the different relationship between BMI and %BF in collegiate female athletes compared to non-athletes has been shown previously (7), and even a high BMI does not necessarily represent over fatness in athletic populations. There were regional increases in fat accumulation at the triceps and suprailliac skinfold sites. The importance or cause of these small but significant changes is not known. The skinfold technique was utilized in this study due to the dual convenience of portability of equipment and limited time requirement for the athletes. Assessments were completed in the athletic complex where athletes regularly report for various functions. All skinfold measurements were completed by the same tester, an exercise physiologist with 25 years of experience in the skinfold technique.

Conclusion

The results of this and similar studies must be interpreted with caution. There are differences across studies in the methods used to assess BC variables. Different measurement techniques can yield different results (6, 10). Many studies with collegiate female athletes have used hydrostatic weighing, but studies that are more recent have used DXA. The negatives of these techniques include the required equipment and increased difficultly of collecting repeated measures of individual athletes across time. Monitoring individual and team body composition at various points during the year is useful for athletes, coaches, and athletic trainers. The current study supports the idea that body composition for female collegiate soccer athletes should be in the normal healthy range with a lower %BF than the student population at preseason. %BF should not change significantly throughout the competitive season. Lean mass should be maintained throughout the competitive season, however this might require two strength-training sessions per week. Those who regress significantly should be identified as this could suggest an energy imbalance.

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