

Preseason and Postseason Body Composition Does Not Change Relative to Playing Time in Division I Female Basketball Players

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ABSTRACT

International Journal of Exercise Science 6(3) : 208-216, 2013. The purpose of the study was to determine if preseason and postseason body fat percentages (BF%) change relative to playing time in Division I women's basketball players. Subjects for the study included 11 National Collegiate Athletic Association (NCAA) Division I female collegiate basketball athletes over the age of 18 from a Midwest public university. Demographic data of each subject (age 20.09 \pm 1.81 yrs., weight 71.13 \pm 10.85 kg., height 176.48 \pm 8.33 cm.) was taken before the initial body fat assessment. The subjects underwent preseason and postseason BOD POD® testing to get an accurate measure of body fat percentages. Data analyses looked for changes between preseason and postseason body fat percentage. A Pearson's Correlation was performed to determine if changes in preseason and postseason BF% changed relative to playing time. Body fat percentage varied across preseason and postseason (average decrease in BF%: -1.83%) but such a difference was not significant ($t_{1,10} = 1.89$, $p = .088$). A negative relationship was found between preseason BF% and playing time ($r = -.707$) and postseason BF% and playing time ($r = -.728$). No relationship was found between change in BF% and playing time.

KEY WORDS: Body composition, fat-free mass, plethysmography

INTRODUCTION

Body composition's application to health and fitness has gained a considerable amount of attention among coaches, parents, exercise scientists, sports medicine specialists, and athletes (13). Terms such as, body fat percentage (BF%) and lean body mass (LBM) are of growing interest, as both coaches and athletes are becoming more aware of such terms application in sport (10, 13). The level of physical activity often found in athletics can prevent gaining unwanted fat mass (FM) (body fat) and can

result in weight loss; engaging in physical activity results in burning calories. High intensity activities can assist with decreasing body fat by promoting caloric expenditure (19). The intensity and duration of certain sports could impact the amount of calories burned; literature recognizes that sports of higher physical activity can influence body composition (3, 9, 10, 12-15, 20, 25).

Basketball has been identified as one such example of a higher intensity sport, where the physical skills and metabolic demands

are especially high (12). The intense nature of physical activity along with the yearlong training commitment involved in basketball at the college level leads to changes in body composition (26); this is verified through the vast amount of research available that has investigated changes in body composition across the basketball season of collegiate female athletes (4, 10, 12, 14, 21, 22, 27). However, research has not yielded consistent findings. Research has also failed to investigate changes in BF% relative to playing time.

To develop a proper off-season, preseason, and in-season training routine, coaches need to be familiar with the particular demands basketball puts on the athlete's body (26). Assessing and monitoring body composition across the collegiate basketball season can help coaches and strength and conditioning specialists recognize the demands and effects of the intense nature of basketball can have on the body. Body composition should be considered one of the top components of physical fitness in basketball, as well as other higher intensity sports.

Multiple studies (1, 2, 4, 5, 8, 12, 14, 16, 17, 20, 21, 26) have investigated changes in body composition as a result of college sport involvement, but only one study has assessed the changes in body composition relative to playing time (game exposure); Carling and Orhant (5) investigated variations in body composition in 30 professional male soccer players along with the effects of exposure time and player position. The lack of additional research emphasizes the need for further studies to better clarify the possible influence of playing time (game exposure) on body composition. The following research

question has been established: does BF% change relative to playing time from preseason and postseason in Division I college female basketball players?

Due to the intense nature of basketball, along with its high physical skill requirements and metabolic demands (12) preseason and postseason changes in body composition are hypothesized to change relative to each athlete's amount of playing time.

METHODS

Participants

Eleven (n=11) National Collegiate Athletic Association (NCAA) Division I female collegiate basketball athletes over the age of 18 from a Midwest Public University participated in this study. Approval was obtained from the host university's Institutional Review Board. Any athletes that encountered various factors that then resulted in 1 or more game absences from their 2011-12 regular seasons (injuries, illness, etc.) were excluded from the study.

Protocol

An electronically calibrated BOD POD® (Life Measurement Inc., Concord, CA) scale was used to measure weight of each subject. The BOD POD® Gold Standard Model number BOD POD® 2007A was used to assess body composition. Height was recorded using a standard stadiometer.

Preseason and postseason body composition was recorded using the BOD POD® to assess BF%. All preseason testing was performed two weeks before the start of official practices. Postseason testing was performed two weeks after the conclusion of the collegiate basketball season. Each test was performed by the same

Table 1. Descriptive Statistics (n=11)

Dependent Variable	Mean	Std. Deviation	Range
Age (years)	20.09	1.81	18.00 – 23.00
Height (cm)	176.48	8.33	164.59 – 189.23
Pre Weight (kg)	71.13	10.85	56.81 – 92.43
Post Weight (kg)	70.98	11.72	54.88 – 94.73
Pre BF%	22.30	5.50	14.10 - 32.30
Post BF%	20.46	5.77	12.40 - 32.30
Change Pre-Post%	-1.84	3.22	-5.20 - 3.80
Playing Time (min)	451.73	384.51	65.00 - 964.00

investigator certified to operate the BOD POD®. Before beginning any testing, all the instruments were calibrated according to manufacturer's guidelines (7). Weight measurements were recorded to the nearest thousandth of a pound, and height measurement were taken from the closest 1/4 inch (.64 cm).

Various readings: temperature, barometric pressure, and relative humidity, were retained within the identified ranges for accurate operation of the BOD POD®: 70.5 – 71 degrees F, 75.69 – 75.95 centimeters, and 51.0 – 51.2%, respectively.

Subjects were required to wear a Lycra swim cap and instructed to wear compression shorts and a sports bra or a two-piece bathing suit. Subjects were also instructed not to eat or exercise 3-4 hours prior to testing. On screen testing techniques were followed in agreement to the BOD POD® software:

Basic subject information was entered into the control system (height, age, and ethnicity). The BOD POD® was then calibrated. The subjects mass was measured using the integrated digital scale (accuracy is assured by scale calibrations at regular intervals utilizing provided calibration weights). The subject's body volume was measured while sitting inside the BOD POD®. Participants were then instructed to relax, breathe normal, and remain as motionless as possible during the actual testing. Each subject's thoracic gas volume was estimated. Since subjects included Caucasian and African American females, the Siri (24) equation was used to assess body fat percentage: $\%BF = (4.95/Db - 4.50) \times 100$. Each subjects test results were displayed and printed.

Playing time for each player's total minutes in the 2011-2012 regular season was gathered from the athletic website of the participants. The university website was updated daily with regards to general information by the Sports Information Director and their staff. The authors

gathered the data weekly during the season from the website. Players' minutes were listed as "average minutes per game" on the site.

Statistical Analysis

The outcomes are described as means and standard deviation (mean \pm SD). All calculations were performed using SPSS version 19.0 software. A paired *t* test was performed to look at changes in mean preseason and postseason BF% among the collegiate female basketball players across their 2011-2012 basketball season. A Pearson's correlation was used to determine the magnitude of the relationship between playing time and BF%. An alpha level of $p < 0.05$ was used for significance. Statistical power and effect size calculations were measured according to Cohen (6).

RESULTS

The study consisted of 11 female collegiate basketball players from a team of 13; two subjects did not meet the study's requirements and were excluded. Descriptive statistics from the female collegiate basketball subjects are summarized in Table 1. The majority of the subjects were Caucasian; 10 Caucasian participants and 1 African American. All subjects were present, healthy and eligible for all regular season games. As described earlier, the Siri equation was used for the female basketball subjects, even though one subject was African-American. Usually, the Ortiz equation is highly recommended to determine accurate body fat percentage of African-American females. Post-hoc Pearson Correlations using the Ortiz equation for the lone subject determined to be minor (-0.012) and were still considered

significant as originally stated in Table 2. Under the advice of the COSMED technicians, the authors kept all original measurement methods consistent even though the following recommendations are listed via the Bod Pod Operator's Manual (see below):

Siri1 % fat = $(4.95/DB - 4.50) \times 100$ General Population

Schutte2 % fat = $(4.374/DB - 3.928) \times 100$ African American and Black Males

Ortiz3 % fat = $(4.83/DB - 4.37) \times 100$ African American and Black Females

Brozek4 % fat = $(4.57/DB - 4.142) \times 100$ Lean and obese individuals

Table 2. Pearson Product Moment Correlation.

Dependent Variable	Change PrePost	Playing Time	Pre_BF%
PlayingTime	-.097	--	--
Pre_BF%	-.208	-.707*	--
Post_BF%	.361	-.728*	.837**

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

Body fat percentage differed across preseason and postseason (average decrease in BF%: -1.84%) but such a difference was not significant at the set alpha level ($t_{1,10} = 1.89$, $p = .088$). The results of the applied correlations are summarized in Table 2. A large relationship as defined by Cohen (6) (small = .10, medium = .30, large = .50) was found between preseason BF% and playing time ($r = -.707$) and postseason BF% and playing time ($r = -.728$). A minimal relationship was found between change in BF% and playing time ($r = -.097$). The study yielded an effect size of $d = .57$, and power was estimated to be .389.

There was no significant change in preseason and postseason body composition at the determined alpha level ($\alpha = .05$). In the present study, the mean preseason BF% was 22.30 ± 5.50 , and the mean postseason BF% was 20.46 ± 5.77 .

DISCUSSION

It was anticipated that participation in the high intensity sport of basketball at the college level would result in changes in preseason BF% and postseason BF%, and such changes would be related to playing time. Although the results of this study did not support the primary hypothesis, the results did identify other important relationships between BF% and playing time.

There was a large relationship (6) between those with low BF% at the start of the season and low BF% at the end of the season. Accordingly, the results indicated that preseason and postseason BF% were not significantly different. However, such findings should not be dismissed. A mean BF% change of 1.84% was still observed; indicating an average loss in BF by each subject from preseason to postseason.

The gathered mean BF%s are comparable to those of previous studies that have investigated BF% among female collegiate basketball populations; ranging from 18.30–23.30% (4, 10, 12, 14, 21, 22, 27). However, inconsistencies exist among various studies that have looked at changes in preseason and postseason BF% across female collegiate basketball players (4, 14, 21, 23). Carbuhn et al. (4) and Siders et al. (21) noted significant changes between preseason and postseason body

composition in female collegiate basketball players; they found an average decrease in body fat from preseason to postseason. Sinning (22) and Johnson et al. (14) also observed decreases in average BF%. However, like this study, neither Sinning nor Johnson et al. found the decreases in BF% to be significant. It is important to recognize the varying sample sizes among the studies; it was in the studies with notably larger sample sizes that a significant decrease was found between preseason and postseason BF% (4, 21). The current study ($n=11$), as well as, studies conducted by Sinning ($n=25$) and Johnson ($n=8$), all had smaller sample sizes by comparison. The smaller and limited samples could explain the lack of significance in the results.

In addition, differences across studies may also be explained by the varying methods used to assess BF%. Furthermore, how researchers defined preseason and postseason, and hence when they took measurements of BF%, also differed. Johnson et al. (14) took all preseason measurements one week prior to first week of each practice, and all postseason measurements were taken just before final tournament competition. Sinning (22) took preseason measurements before the first game (more than one team tested), and postseason measurements within one week of the last game. Siders et al. (21) took initial measurements (preseason) during the week before the first practice of the season and postseason measurements were made the week before the last regular season scheduled game. Carbuhn et al. (4) defined preseason as just before the beginning of the competitive season, and postseason as just after the competitive season. The present study gathered data

two weeks before official practices and two weeks after completion of the basketball season. The authors selected this time frame to ensure all subjects were injury-free and well-hydrated. All female basketball players were measured during the same time period (early afternoon) pre and post assessments using the Bod Pod. All players were constantly reminded to hydrate themselves before the assessments by the PI and the athletic training staff. Hydration variability within subjects was another reason why the authors used a period of 2 weeks prior to the season and 2 weeks after for assessment purposes compared to past literature.

The major explanation for the obtained results may have been the limited data analyses. More statistics could have been done to see if those with higher BF% at the start of the season significantly changed as there could have been a plateau effect for those with lower BF% at the start of the season. Female basketball players should not lose too much BF% or the results could have negative ramifications upon their overall health status.

The hypothesized inverse relationship between change in BF% and playing time was not supported by this study. Correlation analyses conveyed virtually no relationship between playing time and changes in preseason and postseason BF%. To the author's best knowledge, this study was the first to investigate a relationship between changes in body composition and playing time among female collegiate basketball players. Therefore, limited studies exist for comparison.

One similar study by Carling and Orhant (5) drew similar conclusion in a different

athletic population. They evaluated a relationship between changes in BF% and exposure time among elite soccer players, and they too found no significant association ($r=.12$). However, they also had a small and limited population ($n=9$). In addition to investigating such a relationship, the researchers examined changes in body composition relative to player position. They found significant intra-season differences in body composition across player positions; defenders and midfielders had significant differences in FFM and BF% while goalkeepers and forwards did not. This coincides with the findings of Gibson et al. (12); that optimal body weight and BF% differed not only among athletes, and sports, but positions as well. For this study, monitoring player positions when assessing body composition may have allowed for more thorough investigation and better interpretation of results; however, the low sample size per position limited this analysis. It is also important to recognize the minimal time spent in game competition with comparison to practice time. Record of practice time in addition to each player's playing time may better verify the current study's findings. At the same time, the fact that most individuals spend more time in practice, regardless of their playing time, than in games may justify why there was not a significant difference between playing time and body composition. This could possibly explain the high SD (384.51 min.) in Table 1 among the subjects. Further research, incorporating such variables as (e.g. practice time and player position) need to be conducted.

Although not the initial intention, it is interesting to recognize that the current

study found large (6) relationships between playing time and both preseason BF% and postseason BF%. An inverse relationship existed between playing time and BF%. The findings suggest that one is more likely to have more playing time if they have a lower BF%. It may be that those athletes with a lower BF% are more physically prepared and fit for competition; allowing them to play for longer bouts at their optimal level. Gibson et al. (12) and Fox et al. (11) support such a conclusion; due to the physically demanding sport of basketball, where a vast amount of running and jumping is required, a moderately low BF% is desired.

Body composition is a vital tool when trying to assess an athlete's health and physical fitness (11, 16, 18, 28). The results suggest a possible significance in monitoring collegiate female basketball players' body composition in accordance with their playing time. Due to the absence of similar studies, additional research and investigation is recommended for better interpretation and verification of such a relationship.

Athletes, coaches, and medical professionals may find such information valuable when designing and assessing weight and nutrition plans. An ideal competition weight and BF% should be unique to each athlete. Recognizing what type of weight athletes are gaining / losing can assist them in designing individualized nutrition and diet plans.

A negligible relationship was found between these changes in BF% and playing time. A large inverse relationship was, however, recognized between both preseason BF% and postseason BF% and

playing time, suggesting that athletes with a low BF% are likely to see more playing time. Assessment and monitoring of such a relationship may help athletes better find and maintain a low and healthy BF% unique to them; perhaps serving as a mark of their physical fitness and preparation for competition.

Further studies are necessary to confirm and better understand such findings and relationships. The power of the study, due to the small sample size and limited population evaluated was not very large. A larger sample may have yielded stronger findings, having greater power and a larger effect size.

The following are recommendations for future research: 1.) A replicated study with a larger sample size. The present study's population was small ($n=11$). A larger sample may have given significant results. Although the study yielded a medium effect size ($d=.57$); medium = .5 (Cohen, 1988). The power was estimated to be only .389. A sample size exceeding 30 participants would increase power to a more desirable level (.80). 2.) Further studies should try and include a more diverse subject pool. The following study included only basketball athletes from one Midwest public University, with majority being Caucasian. Findings from a range of regions of the country, with a variety of races, may provide different results. 3.) Closer monitoring of other external variables is also recommended: training routines, amount of physical activity completed outside of practice, diet, energy requirements, and player position (guard, forward, center, etc.). A longitudinal study from freshmen to final college season may allow for additional and more conclusive

results. 4.) Additional body composition evaluations in addition to preseason and postseason (i.e. off-season, and in-season) may better display the results of a competitive collegiate basketball season on BF%. 5.) Investigation of other sports and levels in addition to collegiate may bring about further findings.

The results of this study suggest that involvement in a collegiate basketball season does not result in significant changes in body composition among female players. However, the results do indicate a large relationship between having a low BF% and playing time. This finding further supports and recognizes the importance of a low but healthy BF% among female basketball athletes at the collegiate level. However, being the only known study to find such a relationship in a sample of female collegiate basketball players, and given the small and limited sample, further studies are needed to better interpret the weight of such findings. Regular monitoring of collegiate female basketball players' body composition is recommended to identify an ideal training regimen, nutrition plan, and body composition unique to each athlete.

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