EFFECT OF THE OFFSEASON ON BODY COMPOSITION AND STRENGTH IN DIVISION I COLLEGIATE BASEBALL PLAYERS

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INTRODUCTION

Before the 1970s, the predominant thought about body composition and resistance training in the sport of baseball was that a player could play and condition themselves into shape and weight training would cause an athlete to become muscle bound and not able to perform well on the field (9).

In the 1980s, change began to occur because players like Nolan Ryan was weight training to prepare himself for competition and strength coaches like Dr. Gene Coleman was writing about the impact of body composition on baseball performance (2,3,4,9). In the 1990s, some Major League Baseball (MLB) teams were assessing body composition and resistance training to enhance performance. By the 2000s all MLB teams had full-time strength coaches that assessed body composition and utilized year-round training (9).

Over the last 50 years, baseball research has evolved. It has been reported that significant relationships existed between body composition, strength, power, and baseball performance of high school, college, and professional baseball players (2-10).

There are multiple methods for assessing body composition, including skinfold, Bod Pod, underwater weighing, DXA, and bioelectrical impedance analysis (BIA). The InBody 770 is a BIA device that provides such information as body mass, fat mass, percent body fat, lean body mass, skeletal muscle mass, and dry lean mass. Antonio et al. (1) reported that the InBody 770 is an acceptable method for body composition analysis.

Despite the use of assessing body composition and periodized resistance training to enhance baseball performance (7), little has been reported about seasonal variations in collegiate baseball players. Variables that may influence body composition or performance-related variables include differences in training variables, such as frequency, intensity, and volume.

Improving body composition and strength are two primary objectives of the off-season. Improvements in body composition and strength may enhance baseball performance. Therefore, the purpose of this study was to investigate the effect of the offseason on body composition and lower and upper body strength in collegiate baseball players.

METHODS

Forty-two (21 pitchers and 21 position players) Division I baseball players (age = 20.4 ± 1.6 years, height = 182.6 ± 7.1 cm) participated in this study. They performed the same resistance training program, but conditioned differently over the offseason. Body composition was determined by bioelectrical impedance analysis (InBody 770) according to the manufacturer specifications at two time points: beginning of the offseason (September) and end of the offseason (December). Body mass (BM), fat mass (FM), percent body fat (%BF), lean body mass (LBM), skeletal muscle mass (SMM), and dry lean mass (DLM) were recorded. All participants performed a standardized warm-up before each strength testing sessions. Lower and upper body strength variables, one repetition maximum (1RM) back squat, bench press, and 1-arm row, were measured two times: beginning of the offseason and end of the offseason. All attempts were separated by at least 3-minutes of rest. Eight 2x2 (position x time) repeated measures ANOVAs were used to analyze changes in body composition and strength variables. Changes in body composition and strength variables between times points were calculated and relationships between these variables were analyzed with Pearson product-moment correlations.

METHODS

Correlation values were classified by significance using Pearson's product-moment critical *r* value for alpha levels $\alpha = 0.05$ (r (19) = 0.433, $p < 0.05$) and $\alpha = 0.01$ (r (19) = 0.549, $p < 0.01$) and color-coded by strength of correlation: moderate (green: 0.433 - 0.599), moderately high (orange: 0.600 – 0.799), and high (yellow: 0.800 – 1.0).

RESULTS

Table 1. Mean and ±SD offseason bioelectrical impedance analysis body composition values.

	Offseason - Body Composition Values											
	September						December					
Position Players (n = 21)	BM (kg)	FM (kg)	%BF	LBM (kg)	SMM (kg)	DLM (kg)	BM (kg)	FM (kg)	%BF	LBM (kg)	SMM (kg)	DLM (kg)
Mean	86.0	11.9	13.5	74.2	42.9	44.0	85.9	11.5	13.2	74.2	43.0	20.1
SD	6.5	3.6	3.6	4.9	2.9	1.4	6.5	3.4	3.4	4.7	2.8	1.4
	Offseason - Body Composition Values											
	September						December					
Pitchers (n = 21)	BM (kg)	FM (kg)	%BF	LBM (kg)	SMM (kg)	DLM (kg)	BM (kg)	FM (kg)	%BF	LBM (kg)	SMM (kg)	DLM (kg)
Mean	95.9	17.1	17.7	78.7	45.3	21.2	95.6	15.7**	16.3**	79.9*	46.0**	21.6**
SD	11.5	5.1	3.4	8.0	4.6	2.2	11.5	4.9	3.4	8.4	4.9	2.3

* = $p < 0.05$, ** = $p < 0.01$

SD = standard deviation, BM = body mass, FM = fat mass, %BF = percent body fat, LBM = lean body mass, SMM = skeletal muscle mass, DLM = dry lean mass

Table 2. Strength values (mean and ±SD) from September to December and percent (%) change.

	September	December		September	December		September	December	
Position Players (n = 21)	1RM Squat (kg)	1RM Squat (kg)	% Change	1RM BP (kg)	1RM BP (kg)	% Change	1RM Row (kg)	1RM Row (kg)	% Change
Mean	174.1	180.0	**3.30***	109.4	115.4	**5.30***	56.9	64.7	**12.00***
SD	20.0	19.1	**2.5**	13.6	12.7	**4.1**	8.5	8.5	**7.1**
	September	December		September	December		September	December	
Pitchers (n = 21)	1RM Squat (kg)	1RM Squat (kg)	% Change	1RM BP (kg)	1RM BP (kg)	% Change	1RM Row (kg)	1RM Row (kg)	% Change
Mean	181.5	194.0	**6.60*^**	112.9	118.6	**5.00***	58.2	64.6	**9.90***
SD	23.8	22.5	**3.2**	16.0	14.7	**3.6**	7.6	7.2	**6.4**

* Significant difference within groups from September and December ($p < 0.01$), ^ = significant difference in % change between pitchers and position players ($p < 0.01$).

SD = standard deviation, 1RM = one repetition maximum, BP = bench press, Row = 1-arm landmine row.

Table 3. Percent changes (mean and ±SD) for strength and body composition from September to December.

	Strength Changes			Body Composition Changes					
Position Players (n = 21)	PBSC	PBPC	PRowC	PPBMC	PPFMC	PP%BFC	PPLBMC	PPSMMC	PPDLMC
Mean	3.30	5.26	11.99	-0.43	-4.08	-3.77	0.08	0.28	0.63
SD	2.5	4.1	7.1	2.1	11.9	10.8	2.0	2.1	2.1
	Strength Changes			Body Composition Changes					
Pitchers (n = 21)	PBSC	PBPC	PRowC	PBMC	PFMC	P%BFC	PLBMC	PSMMC	PDLMC
Mean	6.60	5.00	9.90	-0.33	-9.87	-9.24	1.38	1.64	1.69
SD	3.20	3.60	6.40	2.50	11.60	9.80	2.20	2.20	2.10

SD = standard deviation, P = pitcher, PP = position player, BSC = back squat change, BPC = bench press change, RowC = 1-arm landmine row change, BMC = body mass change, FMC = fat mass change, %BFC = percent body fat change, LBM C = lean body mass change, SMMC = skeletal muscle mass change, DLMC = dry lean mass change.

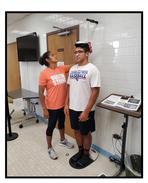

Figure 1. Height.

Figure 2. InBody 770 BIA.

Figure 3. 1RM Back squat.

Figure 4. 1RM Barbell bench press

Figure 5. 1RM 1-Arm landmine row.

Table 4. Correlations between position player's changes in strength and changes in body composition.

Variables	PPBSC	PPBPC	PPRowC	PPBMC	PPFMC	PP%BFC	PPLBMC	PPSMMC
PPBPC	**0.613****							
PPRowC	-0.305	0.140						
PPBMC	0.238	0.360	-0.114					
PPFMC	0.237	0.340	-0.084	**0.596****				
PP%BFC	0.212	0.304	-0.056	**0.454***	**0.984****			
PPLBMC	0.072	0.115	-0.084	**0.671****	-0.180	-0.335		
PPSMMC	0.056	0.060	-0.129	**0.589****	-0.273	-0.424	**0.982****	
PPDLMC	0.025	0.024	-0.177	**0.605****	-0.210	-0.350	**0.954****	**0.960****

Table 5. Correlations between pitcher's changes in strength and changes in body composition.

Variables	PBSC	PBPC	PRowC	PBMC	PFMC	P%BFC	PLBMC	PSMMC
PBPC	0.369							
PRowC	**0.455***	0.267						
PBMC	0.074	0.140	0.143					
PFMC	0.317	0.236	0.360	**0.643****				
P%BFC	0.344	0.245	0.374	**0.486***	**0.981****			
PLBMC	-0.129	0.046	-0.084	**0.710****	-0.057	-0.242		
PSMMC	-0.180	0.073	-0.083	**0.698****	-0.056	-0.241	**0.980****	
PDLMC	-0.067	0.137	-0.063	**0.688****	-0.033	-0.209	**0.962****	**0.967****

P = pitcher, PP = position player, BSC = back squat change, BPC = bench press change, RowC = 1-arm row change, BMC = body mass change, FMC = fat mass change, %BFC = percent body fat change, LBMC = lean body mass change, SMMC = skeletal muscle mass change, DLMC = dry lean mass change.

CONCLUSIONS

Pitchers experienced a decrease in FM and %BF and an increase in LBM, SMM, and DLM over the offseason. Body composition of position players did not change over the course of the offseason. Lower and upper body strength increased for both pitchers and position players. Pitchers had a significantly greater improvement in 1RM back squat than position players. Upper body strength improvements were similar for pitchers and position players.

PRACTICAL APPLICATIONS

Offseason strength and conditioning, practices, and intrasquad games can impact body composition and strength. It is important for college players to attempt to improve strength and maintain or gain LBM, SMM, and DLM over the offseason as it is challenging to maintain body composition and lower and upper body strength over a 3–4-month college baseball season.

REFERENCES

1. Antonio, J, Kenyon, M, Ellerbroek, A, Carson, C, Tyler-Palmer, D, Burgess, V, Angeli, G, Silver, T, Jiannine, L, and Peacock, C. Body composition assessment: A comparison of the Bod Pod, InBody 770, and DXA. *Journal of Exercise and Nutrition*. 2(2): 11, 2019.
2. Coleman, AE. Skinfold estimates of body fat in major league baseball players. *Physician and Sportsmedicine*. 9(10): 77-82, 1981.
3. Coleman, AE. Physiological characteristics of major league baseball players. *Physician and Sportsmedicine*. 10(5): 51-57, 1982.
4. Coleman, AE and Lasky, LM. Assessing running speed and body composition in professional baseball players. *Journal of Applied Sport Science Research*. 6(4): 207-213, 1992.
5. Crotin, RL, Forsythe, CM, Karakolis, T and Bhan, S. Physical size associations to offensive performance among major league leaders. *Journal of Strength and Conditioning Research*. 28(9): 2391-2396, 2014.
6. Czeck, MA, Raymond-Pope, CJ, Bosch, TA, Bach, CW, Oliver, JM, Carbuhn, A, Stanforth, PR, and Dengel, DR. Total and regional body composition of NCAA Division I collegiate baseball athletes. *International Journal of Sports Medicine*. 40(7): 447-452, 2019.
7. Matthens, JR, Sanchez Porush, SR, Sharpless, SA, Oates, MK, Schaffner, AA, Sikalidis, AK, and Reaves, SK. The effects of a baseball season on various body composition measurements in NCAA Division I baseball players. *Journal of Exercise and Nutrition*. 4(1): 3, 2021.
8. Szymanski, DJ. Effects of various resistance training methods on overhand throwing power athletes: A brief review. *Strength and Conditioning Journal*. 34(6): 61-74, 2012.
9. Szymanski, DJ. Introduction. In: *Strength Training for Baseball*. Human Kinetics, Champaign, IL. viii-x. 2022.
10. Szymanski, DJ, DeRenne, C, and Spaniol, FJ. Contributing factors for increased bat swing velocity. *Journal of Strength and Conditioning Research*. 23(4): 1338-1352, 2009.