CHANGES IN PHYSICAL PARAMETERS PERFORMANCE IN STARTING SIX AND SUBSTITUTES OF UNIVERSITY VOLLEYBALL PLAYERS: A SHORT REPORT.

Dr. Amar Kumar, Asst. Prof., L.N.U.P.E., Gwalior (M.P.)
Dr. S. Mukherjee, Professor, L.N.U.P.E., Gwalior (M.P.)
Dr. Keshav Singh Gurjar, Jiwaji University, Gwalior (M.P.)

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Abstract

The aim of this study was to investigate the changes in physical parameters produced during an in-season resistance training (RT) program on 12 intervarsity volleyball players. Moreover, differences in the adaptive responses between players who played most of the times (starters: S) and players that were mainly used as substitutes (non starters: NS) were analyzed. The RT program consisted of 2 sessions per week over 12 weeks (Tables 2a and 2b). The main RT exercises were, respectively, the bench press (BP) and parallel squat (PS), plus jumping and throwing. Subjects performed 3 sets of 3-6 reps with a load of 50-80% 4RM-BP; and 3 sets of 3-6 reps with a load of 30-75% of 4RM-PS. On completion, all athletes then performed three explosive strength exercises: (i) vertical jumps into a box; (ii) vertical jumps with additional weights (3 sets of 5 reps); (iii) throwing medicine ball (3 sets of 10 reps. with a 3kg medicine ball). Rests of 2 minutes were permitted between sets and between categories. Of greatest interest was the lack of any interactions for group (S or NS) by time effects for any of the tests ($p>0.05$), except for the bench press in the final test ($p=0.025$). This indicates that both groups responded similarly to the training program. There were, however, several main effects for time, showing significant improvements for the entire group of population. In fact, for all physical parameters both Starting six and Non Starting six improved significantly ($p<0.001$). Finally, no relationship was found between any physical parameters and the changes in performance for all groups.

Keywords: Volleyball, Throwing, Sets and Repetitions.

Introduction

Team Volleyball, as several other ball games, requires not only technical and tactical skills, but also a great deal of physical fitness (Marques, González-Badillo, & Kluka, 2006; Marques, van den Tillaar, Vescovi, & GonzálezBadillo, 2008). Usually, the potentially greater the competitive responsibilities placed on actual starters in a sport (Kraemer et al., 2004), and the differential physiological and performance effects related to starters (S) or non starters (NS) status, have not been clarified in prior Team Volleyball research. In fact, little information has so far been produced relative to the adaptive responses in strength and power over the course of competitive ball game sports to examine possible differences between Starting six and Non Starting six of the same team. The aim of this study was to investigate the changes in physical parameters produced during an in-season resistance training (RT) program of 12 intervarsity volleyball players. Moreover, differences in the adaptive responses between players who played most of the time S (Starting six) and players that were mainly used as substitutes NS (Non Starting Six) were analyzed.

Experimental Design and Approach to the Problem

This research was completed in competition in-seasons. All players competed in 2-3 matches per week, combined with volleyball practice sessions as well as the strength and conditioning regimen. The athletes were familiar with all of the testing and training exercises, as they had completed a pre-season training routine prior to the initiation of the current in-season study. The RT program consisted of 2 sessions per week over 12 weeks (Tables 1a and 1b). The main RT exercises were, respectively, the bench press (BP) and parallel squat (PS), plus jumping and throwing. Subjects performed 3 sets of 3-6 reps with a load of 50-80% 4RM-BP; and 3 sets of 3-6 reps with a load of 30-75% of 4RM-PS. On completion, all athletes then performed three explosive strength exercises: (i) vertical jumps into a box; (ii) vertical jumps with additional weights (3 sets of 5 reps: loads varied between 10kg and 40kg); (iii) throwing medicine ball (3 sets of 10 reps. with a 3kg medicine

ball). Rests of 2 minutes were permitted between sets and between categories.

Subjects

A group of 12 male intervarsity volleyball player (mean ± SD age: 19.5 ± 3.1 years) participated in the study. Additionally, participant subjects were divided in 2 groups: starting six (S; n = 6), and non starting six (NS; n = 6) based on the amount of game time each played during the season. Starting six (S) and Non Starting six (NS) participated, respectively, in 81.7% and 18.3% of total game time. The physical characteristics (mean ± SD) of the S and NS, respectively, were: height, 182 ± 0.7 and 179 ± 0.69 cm; body mass, 93.4 ± 8.3 and 89.6 ± 6.6 kg. Seventy percent of the subjects were state team players who played on Inter district , All India Inter University and Senior National. All players represented the same team, No players had taken exogenous anabolic–androgenic steroids or other drugs or substances expected to affect physical performance or hormonal balance during this study. All of the subjects gave their informed consent and volunteered to participate.

Testing Procedures

A detailed description of the muscular power testing procedures can be found elsewhere (Marques et al., 2008). These were tests that could be rapidly administered and were highly specific to Team Volleyball.

Countermovement Jump

Countermovement jump (CMJ) height was measured using a Subjects began from a standing position, performed a crouching action followed immediately by a jump for maximal height. Each subject completed three attempts with two minutes of rest allowed between trials. The hands were on the hips throughout the entire jump. The average of the two best trials was used for analysis. The unloaded CMJ had an intra class correlation coefficient (ICC) of 0.98.

Medicine Ball Throw

An overhead medicine ball throw was used to evaluate the upper body muscular power. While standing, subjects held a 3kg medicine ball in both hands in front of the body with arms relaxed. The athletes were instructed to throw the ball over their heads as far as possible. A backward countermovement was allowed during the action. Five trials were performed with a one-minute rest between each trial. An average of the best four throws was subsequently used for analysis. The distance of the throw was recorded to the nearest 1cm. The ball throwing distance showed an intra class correlation coefficient of 0.93.

Maximal Dynamic Strength

Upper and lower body maximal strength tests were carried out using a 4-repetition maximum bench press (4RM-BP) and a 4RM parallel squat (4RM-PS). The 4RM-BP test was conducted on a standard bench and required the subject to perform an eccentric-concentric action. Beginning with the arms fully extended, the athletes lowered the bar towards the chest reaching 90º abduction of the shoulder joint and 90º flexion of the elbow before returning to the start position. Repetitions performed incorrectly were not included in the count. The protocol began with 50kg and increased 10, 5, and 2.5kg during subsequent sets until four complete repetitions could not be performed. All subjects performed 5-6 reps for each warm-up set. The rest time between sets was 3 minutes. In the 4RM-PS, the bar was placed across the trapezium at a self-chosen location and the starting position knee angle was set at 180° (full leg extension). The squat was performed to the parallel position, i.e. when the greater trochanter of the femur was lowered to the same level as the knee. Two researchers monitored the correct position. The subject then lifted the weight until his knees were fully extended. Each player started with identical weights of 90kg, performing on command a series of 4 complete parallel squats. Subsequently, the weight was increased by 10kg increments until the subject was unable to reach full leg extension. The last bearable load was determined as being 4RM. Five-minute rest intervals separated the 4RM-BP and 4RM-PS tests. The 4RM-BP showed an ICC of 0.96 and the 4RM-PS reported an ICC of 0.92.

Table – 1

Strength Training Programs for Six Weeks

Exercises	**Session 1**	**Session 2**	**Session 3**	**Session 4**	**Session 5**	**Session 6**
Squat 1	30: 3x6	30: 3x6	40:3 x6	40: 3x6	45: 3x6	45: 3x6
CMJ with additional load	3x5:10kg	3x5:10kg	3x5:10kg	3x5:10kg	3x5:20kg	3x5:20kg
CMJ into box	5x6	5x6	5x6	5x6	5x6	5x6
Bench press 2	50: 3x6	50: 3x6	50: 3x6	50: 3x6	60: 3x6	60: 3x6
Ball Throwing	3x10:3kg	3x10:3kg	3x10:3kg	3x10:3kg	3x10:3kg	3x10:3kg
Exercises	**Session 7**	**Session 8**	**Session 9**	**Session 10**	**Session 11**	**Session 12**
Squat 1	50: 3 x 6	50: 3 x 6	55: 3 x 6	55: 3 x 6	55: 3 x 6	60: 3 x 6
CMJ with additional load	3x5:30kg	3x5:30kg	3x5:30kg	3x5:30kg	3x5:30kg	3x5:30kg
CMJ into box	5 x 6	5 x 6	5 x 6	5 x 6	5 x 6	5 x 6
Bench press 2	60: 3 x6	70: 3 x6	70: 3 x6	70: 3 x6	75: 3 x4	75: 3 x4
Ball Throwing	3x10:3kg	3x10:3kg	3x10:3kg	3x10:3kg	3x10:3kg	3x10:3kg

Table - 2

Strength Training Programs between week 7 and week 12.

Exercises	**Session 13**	**Session 14**	**Session 15**	**Session 16**	**Session 17**	**Session 18**
Squat 1	65: 3x6	65:3x6	65:3x6	70:3x5	70:3x5	70:3x5
CMJ with additional load	3x5:35	3x5:35	3x4:40	3x4:40	3x4:40	3x4:40
CMJ into box	5 x 6	5 x 6	5 x 6	5 x 6	5 x 6	5 x 6
Bench press 2	75: 3 x 6	75: 3 x 6	75: 3 x 6	75: 3 x 6	80: 3 x 3	80: 3 x 3
Ball Throwing	3 x 10:3kg	3 x 10:3kg	3 x 10:3kg	3 x 10:3kg	3 x 10:3kg	3 x 10:3kg
Exercises	**Session 19**	**Session 20**	**Session 21**	**Session 22**	**Session 23**	**Session 24**
Squat 1	70:3x5	70:3x5	75:3x4	75:3x4	60:3x6	Testing
CMJ with additional load	3x4:40	3x4:40	3x4:40	3x4:40	3x5:35	
CMJ into box	5x6	5x6	5x6	5x6	5x6	
Bench press 2	80:3x3	80:3x4	80:3x4	80:3x4	70:3x6	
Ball Throwing	3x10:3kg	3x10:3kg	3x10:3kg	3x10:3kg	3x10:3kg	

Statistical Analysis

Mean and standard deviations were calculated for all variables. All data were checked for distribution normality A paired sample and independent student t tests were also applied to measures performance changes and to compare active game time in order to determine S and NS, which proved to be significantly different (i.e., again, S and NS participated in 81.8% and 18.2% of total game time, respectively). The Pearson correlation coefficient was calculated and the level accepted for statistical significance was $p \leq 0.05$.

Table -3

Differences Between Starting Six and Non Starting Six in Physical Performance Tests During the Course of a 12-Week Competitive Team Volleyball Training Program.

Test	**Status**	**Mean**	**SD**
1 RM Bench Press (Pre)	Starters Non Starters	64.58 62.91	3.16 2.34
1 RM Bench Press (Post)	Starters Non Starters	78.71 72.22	1.39 2.32
1 RM Parallel Squat (Pre)	Starters Non Starters	133.8 132.54	2.56 2.67
1 RM Parallel Squat (Post)	Starters Non Starters	161 157.83	7.37 4.72
Medicine Ball Throw (Pre)	Starters Non Starters	10.85 10.65	0.39 0.21
Medicine Ball Throw (Post)	Starters Non Starters	12.19 11.90	0.34 0.21
Counter Movement Jump (Pre)	Starters Non Starters	37.22 35.46	0.99 0.85
Counter Movement Jump (Post)	Starters Non Starters	41.3 38.16	0.75 1.12

Table- 4

Changes in physical performance during the course of a 12-week competitive Team Volleyball training program in starters and non starters

Status	Test	t- ratio
Starters	1RM Bench Press (Pre) 1RM Bench Press (Post)	13.956*
Non Starters	1RM Bench Press (Pre) 1RM Bench Press (Post)	9.34*
Starters	1RMParallel Squat (Pre) 1RM Parallel Squat(Post)	12.81*
Non Starters	1RMParallel Squat (Pre) 1RM Parallel Squat(Post)	18.30*
Starters	Medicine Ball Throw(Pre) Medicine Ball Throw(Post)	8.134*
Non Starters	Medicine Ball Throw(Pre) Medicine Ball Throw(Post	19.36*
Starters	Counter Movement Jump(Pre) Counter Movement Jump(Post)	10.818*
Non Starters	Counter Movement Jump(Pre) Counter Movement Jump(Post)	11.54*

*Significant at 0.05 tab t (5) =2.571

Of greatest interest was the lack of any interactions for group (S or NS) by time effects for any of the tests ($p>0.05$), except for bench press in the final test ($p=0.025$). This indicated that both groups responded similarly to the training program (Table 2). There were, however, several main effects for time, showing significant improvements for the entire group of population (Table 3). In fact, for all physical parameters both S and NS improved significantly ($p<0.001$). Finally, no relationship was found between all physical parameters and the changes in performance for all groups.

Discussion

The primary aim of this study was to examine the changes in strength and power performance during a competitive season experienced group of intervarsity male volleyball players. Results revealed that improvements in upper and lower body strength as well as jumping and throwing are possible during the competitive phase of the training cycle by using a combination of resistance exercises with moderate loads and explosive drills. The potentially greater competitive stress placed on the Starting six, and the differential physiological and performance effects related to Starters or Non Starting six status have not been clarified in prior sport research, especially with regard to volleyball players.

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