



ANALYSIS OF THE CHANGES ON ARM EXPLOSIVE POWER RESPONSE TO UNILATERAL AND BILATERAL COMPLEX TRAINING AMONG YOUNG ATHLETES

Vidya Sagar Goud* & S. Alagesan**

* Research Scholar, Department of Physical Education, Annamalai University, Chidambaram, Tamil Nadu, India

** Associate Professor, Department of Physical Education, Annamalai University, Chidambaram, Tamil Nadu, India

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Abstract:

The purpose of the present study was to analysis of the changes on arm explosive power response to unilateral and bilateral complex training among young athletes.. To achieve the purpose of the study, forty-five young athletes aged between 15 and 18 years were selected as subjects and randomly divided into three equal groups consisting of fifteen subjects each. Group-I underwent unilateral complex training, Group-II underwent bilateral complex training, and Group-III served as the control group. The training programme was carried out for a period of twelve weeks following a two-week familiarization programme. Arm explosive power was selected as the dependent variable. Pre-test and post-test scores were collected before and after the training programme respectively. The collected data were statistically analyzed using Paired 't' test and Analysis of Covariance (ANCOVA). The results revealed significant improvement in arm explosive power among the experimental groups when compared to the control group. The obtained paired 't' values for unilateral complex training and bilateral complex training groups were 16.240 and 12.656 respectively, which were greater than the required table value of 2.20 at 0.05 level of significance. The ANCOVA results showed that the adjusted post-test 'F' value of 111.542 was significantly higher than the required table value of 2.82 at 0.05 level of confidence, indicating significant differences among the groups. Scheffe's post hoc test further confirmed significant differences between unilateral complex training and control group, and bilateral complex training and control group. However, no significant difference was found between unilateral and bilateral complex training groups on arm explosive power. The percentage of improvement was found to be 22.71% for the unilateral complex training group and 19.83% for the bilateral complex training group. The study concluded that both unilateral and bilateral complex training significantly improved arm explosive power among young athletes.

Key Words: Unilateral Complex Training, Bilateral Complex Training, Arm Explosive Power and Young Athletes.

Introduction:

Athletes' successful performance is usually attributed to the unique combination of talent and physical fitness, technical, tactical, and psychological qualities (Smith, 2003). Among those criteria, physical fitness is considered the most critical quality to determine athletes' competitive ability (Gabbett et al., 2007). Excellent physical fitness is essential for improving the athletes' technical and tactical level and performance and is the basic requirement for competing athletes under high-intensity training (Chunlei, 2016). The loss of an athlete's physical fitness component can jeopardize this ability and lead to sports injuries (Dengguang & Yang, 2007a). A substantial number of publications proved a significant positive correlation between physical fitness components and exercise training intervention.

Importance of Unilateral and Bilateral Resistance Training:

Resistance training is a common place for team sport athletes with the ultimate aim being the transfer of heightened physical capacity to superior sporting performance (McGuigan, Wright & Fleck, 2012). Bilateral resistance exercises such as squats, dead lifts, and weightlifting derivatives have been demonstrated to improve strength and 5-40-meter speed performance and thus incorporated in resistance training programs for elite athletes (Seitz et al., 2014; Comfort, Haigh & Matthews, 2012; Hoffman et al. 2009). However, given that key phases of athletic performance such as sprinting and change of direction (COD) occur in 1 leg, unilateral resistance training is perceived to offer greater movement specificity than bilateral exercises (McCurdy et al., 20-05; Speirs et al., 2015).

Owing to a single base of support, unilateral resistance exercises are considered sport specific (Jones et al., 2012; McCurdy & Conner, 2003). The unstable nature has demonstrated altered neuromuscular activation levels in gluteal, hamstring, and quadricep muscle groups compared with bilateral movements (McCurdy et al., 2010; DeForest, Cantrell & Schilling, 2014). Several lower-limb musculotendinous injuries are attributed to neuromuscular deficits, which may be rectified by targeted unilateral training (Tyler et al., 2006). Coupled with the resemblance of sporting movements, unilateral exercises are recommended for rehabilitation requiring enhanced neuromuscular coordination (Beutler et al., 2002). However, the unstable base may also reduce the magnitude of external load required for strength development and subsequent improvement in sports performance in trained individuals (Behm, Anderson & Curnew, 2002).

Studies investigating the effect of unilateral vs. bilateral resistance training have reported similar strength outcomes, inferring equal benefit using either of the two (McCurdy et al., 2010; Speirs et al., 2015). Investigating bilateral and unilateral

resistance training involves several practical limitations making sound methodological designs challenging and findings difficult to apply. These include the training age of subjects, inadequate familiarization and training period duration, unadjusted differences in pre-training performance, insufficient resistance training stimulus, and supplemental exercise prescription (Speirs et al., 2015; Fisher & Wallin, 2014; Gonzalo-Skok et al., 2016). For example, although improvements in unilateral basketball performance have reported the adolescent age of subjects (average age 17 years), this may have little application to mature athletes (Gonzalo-Skok et al., 2016).

Methodology:

Selection of the Subjects:

To achieve the purpose of the present study, forty-five young athletes in the age group of 15 to 18 years were selected as subjects. The selected subjects were randomly divided into three equal groups, each consisting of fifteen subjects. Group-I underwent unilateral complex training, Group-II underwent bilateral complex training, and Group-III served as the control group. Prior to the commencement of the twelve-week training programme, all subjects participated in a two-week familiarization programme consisting of resistance and plyometric training sessions. The purpose of the familiarization sessions was to acquaint the subjects with the exercises and training procedures used in the study.

Selection of Variables:

Independent Variables:

- Unilateral complex training (Resistance & Plyometric exercises).
- Bilateral complex training (Resistance & Plyometric exercises).

Dependent Variables:

- Arm Explosive Power

Research Design:

The purpose of the present investigation was to analysis of the changes on arm explosive power response to unilateral and bilateral complex training among young athletes.. To achieve the purpose of the study, forty-five young athletes in the age group of 15 to 18 years were selected as subjects.

The selected subjects were randomly divided into three groups, each consisting of fifteen subjects. Group-I underwent unilateral complex training, Group-II underwent bilateral complex training, and Group-III served as the control group, which did not participate in any specific training programme apart from their regular activities.

Prior to the commencement of the twelve-week training programme, all subjects participated in a two-week familiarization training programme. During this period, the subjects performed four resistance and plyometric training sessions in every two weeks, including two bilateral and two unilateral exercise sessions. The purpose of the familiarization programme was to acquaint the subjects with the exercises and training procedures used in the intervention programme.

Pre-test measurements on explosive power were recorded before the administration of the training programme, and post-test measurements were taken after the completion of the twelve-week intervention period. The collected data were statistically analyzed by applying the paired ‘t’ Test and Analysis of Covariance (ANCOVA) to determine the significant differences among the groups.

Analysis of Arm Explosive Power:

The descriptive analysis of the data showing the mean and standard deviation, range, mean differences, ‘t’ ratio and percentage of improvement on arm explosive power of experimental groups are presented in table 1.

Table 1: Descriptive Analysis of the Pre and Post Test Data and ‘t’ Ratio on Arm Explosive Power of Experimental Groups

Group	Test	Mean	Standard Deviation	Std. Error Mean	Mean Differences	‘t’ Ratio	Percentage of Changes
Unilateral Complex Training	Pre Test	3.1740	.33753	.08715	0.456	16.240*	22.71%
	Posttest	3.6300	.36733	.09484			
Bilateral Complex Training	Pre Test	3.1033	.39482	.10194	0.102	12.656*	19.83 %
	Posttest	3.2053	.37548	.09695			
Control	Pre Test	3.1107	.35935	.09278	0.025	0.891*	0.97 %
	Post Test	3.0860	.38204	.09864			

Table t-ratio at 0.05 level of confidence for 19(df) =2.20

*Significant

Table 1 shows that the mean, standard deviation, range and mean difference values of the pre and post test data collected from the experimental groups on arm explosive power. Further, the collected data was statistically analyzed by paired ‘t’ test to find out the significant differences if any between the pre and post data on arm explosive power. The obtained ‘t’ values of and control groups are 16.240, 12.656 at 0.05 level for 14 degrees of freedom. It revealed that significant differences existed between the pre and post test means of experimental groups on arm explosive power. The result of the study also produced 22.71% of improvement due to unilateral complex training, 19.83% of improvement due to bilateral complex training.

The pre and post test data collected from the experimental and control groups on arm explosive power is statistically analyzed by using analysis of covariance and the results are presented in table 2.

Table 2: Analysis of Covariance on Arm Explosive Power of Experimental and Control Groups

	Unilateral Complex Training Group	Bilateral Complex Training Group	Control Group	SoV	Sum of Squares	df	Mean squares	‘F’ ratio
Pre Test Mean	3.67	3.92	3.83	B	18.56	2	6.19	0.47
SD	3.14	4.23	3.81	W	581.92	57	13.23	
Post Test Mean	4.08	3.25	3.50	B	546.56	2	182.19	13.37*
SD	3.50	3.60	3.83	W	588.42	57	13.37	

Adjusted Post Test Mean	3.585	3.231	3.105	B	1.850	2	.925	111.542
				W	.340	41	.008	

Table F-ratio at 0.05 level of confidence for 2 and 57 (df) = 2.82, 2 and 56 (df) = 2.82

*Significant

Table 2 shows that the pre-test means and standard deviation on arm explosive power of unilateral complex Training and bilateral complex training and control groups are 32.67 + 3.14, 31.92 + 4.23, and 32.83 + 3.81 respectively. The obtained 'F' value 0.47 of arm explosive power is lesser than the required table value of 2.82 at 2, 57 df at 0.05 level of confidence, which proved that the random assignment of the subjects were successful and their scores on arm explosive power before the training were equal and there was no significant differences.

The post-test means and standard deviation on arm explosive power of unilateral complex Training and bilateral complex training and control groups are 40.08 + 3.50, 38.25 + 3.60, and 33.50 + 3.83 respectively. The obtained 'F' value of 13.37 on arm explosive power is greater than the required table value of 2.82 at 2, 57 df at 0.05 level of confidence. It implied that significant differences exist between the three groups during the post test on arm explosive power.

The adjusted post-test means on arm explosive power of unilateral complex Training and bilateral complex training and control groups are 40.17, 38.99, and 33.45 respectively. The obtained 'F' value of 45.61 on arm explosive power is greater than the required table value of 2.82 of 2, 56 df at 0.05 level of confidence. Hence, it is concluded that significant differences exist between the adjusted post test means of unilateral complex Training and bilateral complex training and control groups on arm explosive power.

Since, the obtained 'F' value in the adjusted post test means is found to be significant, the Scheffe's test is applied as post hoc test to find out the paired mean difference, and it is presented in table 3.

Table 3: Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental and Control Groups on Arm Explosive Power

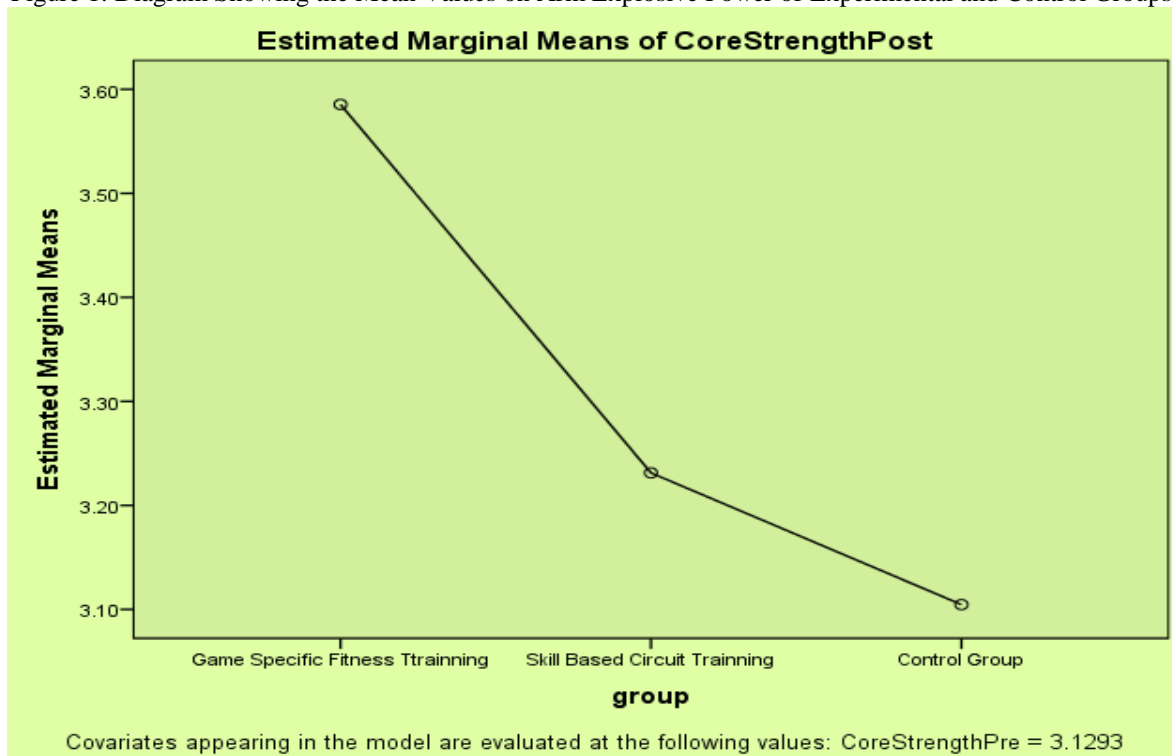
Unilateral Complex Training Group	Bilateral Complex Training Group	Control Group	Mean Difference	Confidence Interval
3.585	3.231		0.354*	0.24
3.585		3.105	0.481*	0.24
	3.231	3.105	0.127*	0.24

*Significant at .05 level

As shown in table 3 the Scheffe's post hoc analysis proved that significant mean differences existed between unilateral complex training and control groups, bilateral complex training and control groups, on arm explosive power since, the mean differences 0.354, 0.481, 0.127 are higher than the confident interval value of 0.24 at 0.05 level of significance. However, there was no significant difference between unilateral complex and bilateral complex training groups, since, the mean difference 1.18 is lesser than the confident interval value of 0.24 at 0.05 level of significance.

Hence, it is concluded that due to the effect of unilateral complex training and bilateral complex training the arm explosive power of the subjects is significantly improved. However, there is no significant differences found between unilateral complex and bilateral complex training groups.

Figure 1: Diagram Showing the Mean Values on Arm Explosive Power of Experimental and Control Groups



Conclusion:

Due to the effect of unilateral complex Training and bilateral complex training the arm explosive power of the subjects is significantly improved. It is also concluded that no significant differences found between the experimental groups. The result of

the study also produced 21.97% of improvement due to unilateral complex Training, 24.51% of improvement due to bilateral complex training.

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