ASSESSMENT OF MUSCULAR STRENGTH ENDURANCE ALTERATIONS SUBSEQUENT TO UNILATERAL AND BILATERAL COMPLEX TRAINING AMONG SUB-ELITE AND RECREATIONAL CRICKET PLAYERS

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ABSTRACT

The aim of this study was to assess the muscular strength endurance alteration subsequent to unilateral and bilateral complex training among sub-elite and recreational cricket players. To achieve the purpose of the study, the investigator selected sixty sub-elite and recreational cricket players (men) as subjects in the age group of 15 to 18 years. Of the selected subjects (N=60) thirty subjects were sub-elite cricket players and the remaining thirty subjects were recreational cricket players. Of the selected thirty sub-elite cricket players, fifteen performed unilateral complex training and the remaining fifteen performed bilateral complex training. Likewise of the selected thirty recreational cricket players, fifteen performed unilateral complex training and the remaining fifteen performed bilateral complex training. The duration of the training period is restricted to twelve weeks and the number of sessions per week is confined to three days. The data collected from the training groups on muscular strength endurance was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post test. Further, percentage of changes was calculated to find out the chances in muscular strength endurance due to the impact of experimental treatment. Further, three-way analysis of variance (2 × 2 × 2) was used to find out the influence of each factor independently and also their combined influence. The level of confidence was fixed at 0.05 level for significance. Subsequent to 12 weeks of unilateral complex training (UCT) and bilateral complex training (BCT) 12.21% and 9.29% of changes muscular strength endurance was observed among sub-elite cricket players. Similarly, after 12 weeks of unilateral complex training (UCT) and bilateral complex training (BCT) 16.63% and 16.36% of changes in muscular strength endurance was observed among recreational cricket players.

Key Words: *Unilateral and Bilateral Complex Training, Muscular strength endurance, Sub-Elite and Recreational Cricket Players.*

INTRODUCTION

Cricket has a great and long tradition. It is a game with a proud history, but also a game without a training culture. It has often been said that to get fit for Cricket one should play Cricket. This has always been enough in the past for Cricketers at all levels and is perhaps a sound base on which to develop a player's level of fitness. However, in recent years modern Cricket has woken up to the benefits of well trained and conditioned athletes. Even more recently, the advent

of Cricket-specific strength training is producing stronger, faster and more agile players than ever before.

Many sports require athletes to possess both strength and power for optimal performance. However, because of time constraints, it is often difficult for athletes to dedicate the time needed for both the training and recovery to promote the development of strength and power. Complex training (CT) is a method used to enhance both strength and power in the same session, thus providing an efficient training method.

Complex training combines strength exercises and power exercises to improve both muscle force production (strength) and the rate of force production (power). A complex training set involves performing two exercises back to back, with a brief rest period in between. The first exercise is a strength exercise using a heavy weight for four to six repetitions (ideally fatiguing by the final rep). The second exercise is a power exercise focusing on explosive movement for five to eight repetitions. There should be a 30- to 45-second rest interval between the strength and power exercises and a 90- to 120-second minute rest interval after both exercises.

Based on the previous research, this study assessed two separate training programs, with the assumption that strength is the foundation of all other athletic movements and performance. After each of the training programs, it was hypothesized that there would be an increase in physical performance measures which should translate to increased performance on the cricketr field. In summary, the main objective was to evaluate the effects of unilateral complex training on cricket players' fitness elements, in comparison with bilateral-dominant program, which has been traditionally and still commonly practiced. To the researcher's knowledge, no studies have been directed towards specifically looking at comparing a unilateral and a bilateral complex training program and their effects on performance determinants of sub-elite and recreational cricket players.

Cricket managers, coaches and players are always trying to find ways of increasing game performances. It would appear that very few studies have investigated this. Elite cricket players have access to physical trainers and resources, and their time is dedicated to performance enhancement. However, at a recreational level player this is probably not the case. It is important to identify what training strategies recreational level players can utilize to improve their performance, as this has not been previously reported in the literature. Furthermore, in order to optimize training for recreational level players, coaches finding a complex training programme

that can be used during practice sessions would be ideal. Hence, the purpose of this study was to assess the muscular strength endurance alteration subsequent to unilateral and bilateral complex training among sub-elite and recreational cricket players.

METHODOLOGY

Subjects & Variable

To achieve the purpose of the study, the investigator selected sixty sub-elite and recreational cricket players (men) as subjects in the age group of 15 to 18 years. Of the selected subjects (N=60) thirty subjects were sub-elite cricket players and the remaining thirty subjects were recreational cricket players. Of the selected thirty sub-elite cricket players, fifteen performed unilateral complex training and the remaining fifteen performed bilateral complex training. Likewise of the selected thirty recreational cricket players, fifteen performed unilateral complex training and the remaining fifteen performed bilateral complex training. The muscular strength endurance was selected as determinant variables and was assessed by conducting bent-knee sit-ups test.

Training Programme

After familiarization and baseline testing, the players participated in a 12-week unilateral and bilateral complex training program with three training sessions per week. The experimental group-I performed unilateral complex training (unilateral resistance & unilateral plyometric training sessions) exercises. They performed 50% of the repetition on their right leg and 50% of the repetition on their left leg. The experimental group-II performed bilateral complex training (bilateral resistance & bilateral plyometric training sessions) exercises. The resistance training program was a total body workout consisting of 2 sets of 4-12 repetitions on 6 exercises that trained all the major muscle groups. The participants in plyometric training trained for 12 consecutive weeks with three training sessions per week. During this 12-week program, the type of plyometric drills increased progressively, in terms of number of foot conducts, as well as the level of difficulty. In addition, the volume of the plyometric training sessions increased progressively by 10 foot-contacts per week over two weeks.

Statistical Technique

The data collected from the chosen groups on muscular strength endurance was statistically analyzed by paired ‘t’ test to find out the significant differences if any between the pre and post test. Further, percentage of changes was calculated to find out the chances in

muscular strength endurance due to the impact of experimental treatment. Further, three-way analysis of variance (2 × 2 × 2) was used to find out the influence of each factor independently and also their combined influence. The level of significance was fixed at 0.05 level.

RESULT

The pre and post test mean and standard deviation values on muscular strength endurance of sub-elite and recreational cricket players performed unilateral and bilateral complex training (resistance & plyometric exercises) are given in table-1.

Table-1: Descriptive Analysis of the Data on Muscular Strength Endurance of Unilateral and Bilateral Complex Training among Sub-Elite and Recreational Cricket Players

Group	Training	Test	Mean	Std. Deviation	N
Sub-elite	Unilateral Complex Training	Pre Test	31.1333	5.12510	15
		Post Test	34.9333	4.18273	15
		Total	33.0333	4.98607	30
	Bilateral Complex Training	Pre Test	30.8667	5.20805	15
		Post Test	33.7333	4.49550	15
		Total	32.3000	4.99759	30
Recreational	Unilateral Complex Training	Pre Test	29.2667	3.41147	15
		Post Test	34.1333	3.96172	15
		Total	31.7000	4.39553	30
	Bilateral Complex Training	Pre Test	28.9333	3.78845	15
		Post Test	33.6667	3.79222	15
		Total	31.3000	4.43458	30

The pre and post test mean(M) and standard deviation(SD) values on muscular strength endurance of unilateral complex training group (31.1333± 5.12510& 34.9333 ± 4.18273) as well as bilateral complex training group (30.8667± 5.20805& 33.7333 ± 4.49550) of sub-elite cricket players and the pre and post test mean(M) and standard deviation(SD) values on muscular strength endurance of unilateral complex training group (30.8667± 3.41147& 34.1333 ± 3.96172) as well as bilateral complex training group (28.9333± 3.78845& 33.6667± 3.79222) of recreational cricket players are presented in this table (Table-4.19).

The ‘t’ test result and also percentage improvement in on muscular strength endurance of the chosen groups are mentioned in table-2.

Table-2: Paired 'T' Test Result on Muscular Strength Endurance of Unilateral and Bilateral Complex Training among Sub-Elite and Recreational Cricket Players

Groups	Training	Mean Difference	'T'-Test	Percentage (%)
sub-elite Cricket Players	Unilateral Complex Training (UCT)	3.800	10.333	12.21%
	Bilateral Complex Training (BCT)	2. 867	7.888	9.29%
Recreational Cricket Players	Unilateral Complex Training (UCT)	4.867	12.007	16.63%
	Bilateral Complex Training (BCT)	4.733	11.953	16.36%

** Table value: [df 14=1.761 (0.05 level)]*

The pre and post test mean difference on muscular strength endurance of unilateral complex training group (MD=3.800) as well as bilateral complex training group (MD=2.867) of sub-elite cricket players varies considerably because the dependent 't' test results of UCT (10.333) and BCT (7.888) groups were better than the necessary table value *[df 14=1.761 (0.05 level)]*.

Similarly, the pre and post test mean difference on muscular strength endurance of unilateral complex training group (MD=4.867) as well as bilateral complex training group (MD=4.733) of recreational cricket players varies considerably because the dependent't' test results of UCT (12.007) and BCT (6.98) groups were better than the essential table value *[df 14=1.761 (0.05 level)]*.

Subsequent to 12 weeks of unilateral complex training (UCT) and bilateral complex training (BCT) 12.21% and 9.29% of changes muscular strength endurance was observed among sub-elite cricket players. Similarly, after 12 weeks of unilateral complex training (UCT) and bilateral complex training (BCT) 16.63% and 16.36% of changes in muscular strength endurance was observed among recreational cricket players.

The muscular strength endurance data gathered from the two different training groups (UCT & BCT) of sub-elite and recreational cricket players have been analyzed by three way factorial ANOVA (2x2x2) as in table -3.

Table -3:Three Way ANOVA Outcomes on Muscular Strength Endurance of Unilateral and Bilateral Complex Training among Sub-Elite and Recreational Cricket Players

Source of Variance	Sum of Squares	df	Mean Squares	Obtained "F" ratio
Groups (Sub-elite & Recreational)	40.833	1	40.833	2.220
Training (UCT & BCT)	9.633	1	9.633	0.524
Test (pre & post)	496.133	1	496.133	26.971*
Groups &Training	0.833	1	0.833	0.045
Groups &Tests	16.133	1	16.133	0.877
Training & Tests	2.133	1	2.133	0.116
Groups, Training &Tests	1.200	1	1.200	0.065
Error	2060.267	112	18.395	

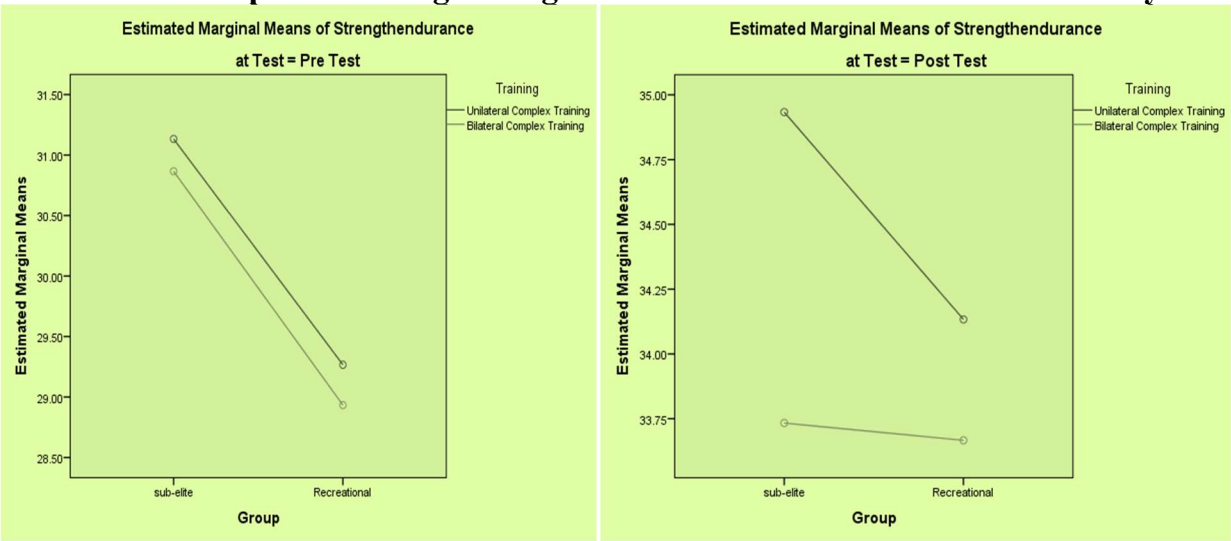
**Significant(.05 level)*
(Table values for df 1&112=3.927)

The obtained 'F' ratio value on muscular strength endurance for test (pre & post =26.971), is greater than the table value [df 1&112=3.927 (0.05 level)]. It proved that pre test values differ from the post test value irrespective of groups and training. However, the obtained 'F' ratio value on muscular strength endurance for groups (sub-elite & recreational cricket players=2.220) and Training (UCT & BCT=0.524) are lesser than the table value [df 1&112=3.927 (0.05 level)]. It proved that sub-elite and recreational cricket players didn't differ from one another irrespective of training and testing conditions and also unilateral complex training (UCT) and bilateral complex training (BCT) groups didn't differ from one another irrespective of groups and tests.

However, the interaction between groups and training (F=0.045), groups and test (F=0.877), training and test (F=0.116) did not differ from one another because these 'F' values are lesser than table value [df 1&112=3.927 (0.05 level)].

The obtained 'F' ratio value for interaction of groups, training and test (0.065) is also lesser than the table value[df 1&112=3.927 (0.05 level)].

Figure-I&II: Pre & Post Test Muscular Strength Endurance of Unilateral and Bilateral Complex Training among Sub-Elite and Recreational Cricket Players



DISCUSSION

The findings of this study imply that the muscular strength endurance of both sub-elite and recreational cricket players are positively impacted by twelve weeks of unilateral and bilateral complex training. Recently, UNI (UNI) exercises such as lunge squats, rear foot elevation split-leg squats, single-leg drop jumps, *etc.*, have become increasingly popular in physical training programs. As an auxiliary exercise to bilateral (BI) training, UNI training is usually implemented to increase the overall load or to provide training variations (Stone et al., 2007). Specialized characteristics and adaptive migration to the body are important considerations in designing UNI training programs to improve sport performance (Zatsiorsky and Kraemer, 2006). Many studies have shown that the main training method for migrating strength qualities to physical performance is BI training (e.g., squat, deadlift, bench press, *etc.*) (Hoffman et al., 2004; Harris et al., 2008; Comfort et al., 2012).

Numerous studies in the literature have confirmed that unilateral complex training is effective in improving athletic performance in athletes (Boyle, 2010; Yinlin, 2010; Stern et al., 2020; Fahui, 2021). Unilateral training can promote strength growth in small and deep muscle groups, and this growth is precisely through nerve stimulation of the muscles, indicating that unilateral training helps to improve the nervous system's ability to control the muscles and coordinate the strength of the upper and lower limbs during running. Therefore, unilateral training can effectively promote the athletes' sprinting ability.

Complex training is a combination of resistance training and plyometric training, which provides a more comprehensive adaptation compared to single resistance training and plyometric training (Fatouros et al., 2000; Lee et al., 2014; Fathi et al., 2019; Zghal et al., 2019). Resistance training in complex training provides effective stimulation and activation of the nervous and muscular systems, allowing the individual to produce greater explosive power in the subsequent plyometric training (Ebben and Watts, 1998). In terms of exercise physiology, complex training increases motor unit excitability, which causes an increase in motor unit recruitment levels.

CONCLUSION

Subsequent to 12 weeks of unilateral complex training (UCT) and bilateral complex training (BCT) 12.21% and 9.29% of changes muscular strength endurance was observed among sub-elite cricket players. Similarly, after 12 weeks of unilateral complex training (UCT) and bilateral complex training (BCT) 16.63% and 16.36% of changes in muscular strength endurance was observed among recreational cricket players. It proved that pre test values differ from the post test value irrespective of groups and training. However, the sub-elite and recreational cricket players didn't differ from one another irrespective of training and testing conditions and also unilateral complex training (UCT) and bilateral complex training (BCT) groups didn't differ from one another irrespective of groups and tests. Complex training is equally effective on training-induced game specific fitness components, and more efficient than resistance training only, in cricket players. This should be taken into consideration in order to optimize game specific fitness components of various games and sports.

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