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PHYSICAL EDUCATION

IMPACT OF UNILATERAL AND BILATERAL RESISTANCE AND PLYOMETRIC TRAINING ON ANAEROBIC POWER AMONG SOCCER PLAYERS

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ABSTRACT

The purpose of the study is to find out the impact of unilateral and bilateral resistance and plyometric training on anaerobic power among Soccer players. The study was delimited to the soccer players of age between eighteen and twenty one years and they were selected from the Mohammed Sathak AJ Engineering College, Siruseri, Chennai and Hindustan College of Arts and Science, Padur, Chennai. Participants were randomly assigned to four different training groups (15 in each group). Group-I performed Unilateral Resistance Training [URT], Group-II performed Unilateral polymeric training [UPT], group-III performed Bilateral Resistance and plyometric Training [BRPT] and group-IV acted as control [CG]. The experimental groups trained at the same time of day in the morning session, three days a week for 12 weeks, throughout the study. The chosen fitness element anaerobic power was assessed by RAST. The data collected from the experimental groups on selected dependent variables was statistically analyzed by paired 't' test and analysis of covariance (ANCOVA). Since four groups were involved, whenever the obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied. Further, percentage of changes was calculated to find out the chances in selected dependent variables due to the impact of experimental treatment. In all the cases the level of confidence was fixed at 0.05 level for significance. Due to URT, UPT as well as bilateral training, the soccer player's anaerobic power was greatly improved. Though, UPT was much better than URT and bilateral training. Further, URT was much better than bilateral training.

Keywords: Unilateral and bilateral resistance and Plyometric training, Anaerobic power, Soccer players.

Introduction

Research has demonstrated that an increase in maximal strength is usually connected with an improvement in relative strength and therefore, with improvement of power abilities (Hoff & Helgrud, 2004). More specifically, by increasing force in appropriate muscles or muscles groups, acceleration and speed may improve in skills that are directly relevant to soccer such as turning, sprinting, and changing pace (Chelly et al., 2009). Players must be faster and more powerful than the opponent to score goals or to stop goals from being scored (Chelly et al., 2009). All of these movements previously mentioned require muscular strength and power, which is why those physical attributes are so valued and so commonly assessed in soccer players (Rampinini et al., 2007).

Based on the previous research, this study assessed four 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 soccer field. In summary, the main objective was to evaluate the effects of unilateral resistance and plyometric training on soccer 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 resistance and plyometric program and their effects on fitness elements and striking variables.

Even though soccer includes a lot of high intensity movements such as short distance and short duration sprints

(speed) and change of direction (agility), it is considered an endurance sport by most coaches, players, and fans. In a professional setting, cardiovascular endurance training would be emphasized as a key part of practice, an offseason training program, or on an individual basis. Due to this emphasis on cardiovascular endurance, the off the field training such as lifting weights, plyometrics, and power training would receive less attention compared to other sports by most soccer coaches, programs, and organizations. Even though most attention is paid to endurance, multiple studies have demonstrated that strength and plyometric training can improve jump height and speed with no negative affect on cardiovascular endurance (Gorostiaga et al., 2004; Siegler, Gaskill & Ruby, 2003).

Aside from this lack of results agreement, the relative effects of unilateral and bilateral resistance and plyometric exercises are not clear. Some have hypothesized that unilateral and bilateral resistance and plyometric drills may offer higher benefits (Brown, Palmieri-Smith & McLean, 2014); however, to the best of the authors' knowledge, no studies have established the relative effect of unilateral and bilateral resistance and plyometric exercises among Soccer players. Thus, the objective was to determine the effect of unilateral and bilateral resistance and plyometric training on anaerobic power among Soccer players.

Methodology

The study was delimited to the soccer players of age between eighteen and twenty one years and they were selected from the Mohammed Sathak AJ Engineering College, Siruseri, Chennai and Hindustan College of Arts and Science, Padur, Chennai. Participants were randomly assigned to four different training groups (15 in each group). Group-I performed Unilateral Resistance Training [URT], Group-II performed Unilateral plyometric training[UPT], group-III performed Bilateral Resistance and plyometric Training [BRT] and group-IV [CG] acted as control. The selected subjects were medically examined by a qualified physician and certified that they were medically and physically fit enough to undergo the training programme. The chosen fitness element anaerobic power was assessed by RAST.

TRAINING PROGRAMME

Adequate warm up was given to the subjects prior to the unilateral and bilateral resistance and plyometric training. The experimental groups trained at the same time of day in the morning session, three days a week for 12 weeks, throughout the study. The experimental group-I performed unilateral resistance training (URT), group-II performed unilateral plyometric training (UPT), group-III performed bilateral resistance and plyometric training (BRPT) and group-IV was control (CG). The unilateral and bilateral resistance and plyometric training groups participated in a 12-week training program performing a variety of exercises designed for the upper and lower extremity.

Unilateral and Bilateral Resistance Training Exercises

After familiarization and baseline testing, the players participated in a 12-week unilateral and bilateral resistance training program with three training sessions per week. The resistance training program was a total body workout consisting of 3 sets of 4-12 repetitions on 6 exercises that trained all the major muscle groups. The load was fixed for the experimental groups based on one repetition maximum (1 RM) of each participant in all the selected resistance exercises. Training volume for the unilateral resistance (URT) and bilateral resistance (BRT) groups was equalized, with the BRT performing all exercises with support on both legs, while the URT group performed 50% of the exercises on each leg separately. The intensity of exercise performed for each exercise was progressively increased once in two weeks. The rest interval of 1:1 between exercises and 1:3 minutes between sets was given.

Unilateral and Bilateral Plyometric Training Intervention

The participants in all groups 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 increasing number of foot-contacts. During

all training sessions, a standardized warm-up was performed (3 min of easy running, dynamic stretching & soccer drills). Training volume for the unilateral plyometric (UPT) and bilateral plyometric (BPT) groups was equalized, with the BPT performing all jumps with support on both legs, while the UPT group performed 50% of the jumps on each leg separately. Each plyometric training session performed with maximum effort. Training volume ranged from 90 foot contacts to 140 foot contacts per session. Ample recovery was given based on work rest ratio between exercises (1:1), sets (1:3) and sessions (one day).

Statistical Technique

The data collected from the experimental groups on selected dependent variable 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 selected dependent variable due to the impact of experimental treatment. In order to nullify the initial mean differences the data collected from the four groups prior to and post experimentation on selected dependent variable were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). The pre test means of the selected dependent variable was used as a covariate. Since four groups were involved, whenever the obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases the level of confidence was fixed at 0.05 level for significance.

Result

The assessed pre and post test anaerobic power (AP) scores of URT, UPT, BT & Control group's are analyzed as in table-I

Table – I: Paird't' Test and % of Changes on Soccer Player's Anaerobic Power (AP) of URT, UPT, BT & Control groups

Group	Test	N	Mean	SD	DM	't' - ratio	%
Unilateral Resistance Training	Pre	15	227.46	9.48	16.06	5.25*	7.06
	Post	15	243.53	6.06			
Unilateral Plyometric Training	Pre	15	229.26	4.28	27.80	21.04*	12.12
	Post	15	257.06	4.09			
Bilateral Training	Pre	15	229.00	4.84	8.46	9.96*	3.69
	Post	15	237.46	4.25			
Control	Pre	15	226.60	3.58	0.06	0.04	0.04
	Post	15	226.66	4.71			

*Table value for df 14 is 2.15(*significant)*

The assessed pre and post test anaerobic power (AP) values of three training (URT, UPT & BT) groups differ noticeably since the 't' values of URT (5.25), UPT (21.04) as well as bilateral training (BT=9.96) groups were greater than the table value (df14=2.15). Following 12 weeks of URT, UPT and BT treatment, soccer player's anaerobic power performance (URT=7.06%, UPT=12.12% and BT=3.69%), enhanced greatly.

The chosen soccer player's anaerobic power (AP) performance of URT, UPT and BT groups were analyzed through ANCOVA statistics, and put on view in table–II.

Table – II: ANCOVA Statistics Output on Soccer Player's Anaerobic Power (AP) of URT, UPT, BT & Control groups

	Unilateral Resistance Training	Unilateral Plyometric Training	Bilateral Training	Control	SoV	SS	df	MS	'F' ratio
Adjusted Mean	243.60	256.92	237.36	226.84	B	6981.37	3	2327.12	99.35*
					W	1288.21	55	23.42	

*(Table value for df 3 &55 is 2.77)*Significant (.05 level)*

The ANCOVA statistics result established that the adjusted final means (URT=243.60, UPT=256.92, BT=237.36 & CG=226.84) on soccer player's anaerobic power of all (URT, UPT, BT & Control**)** chosen groups differs from one another, because the derived adjusted final mean's 'F' value (99.35) is superior to requisite value (*df 3 & 55* =2.77).

As the URT, UPT, BT & Control group's adjusted final means 'F' value (F= 93.35) is significant, further statistics **Scheffe's Test** was calculated as in table-III.

Table – III: Scheffe's Test Outcome on Soccer Player's Anaerobic Power (AP) of URT, UPT, BT & Control Groups

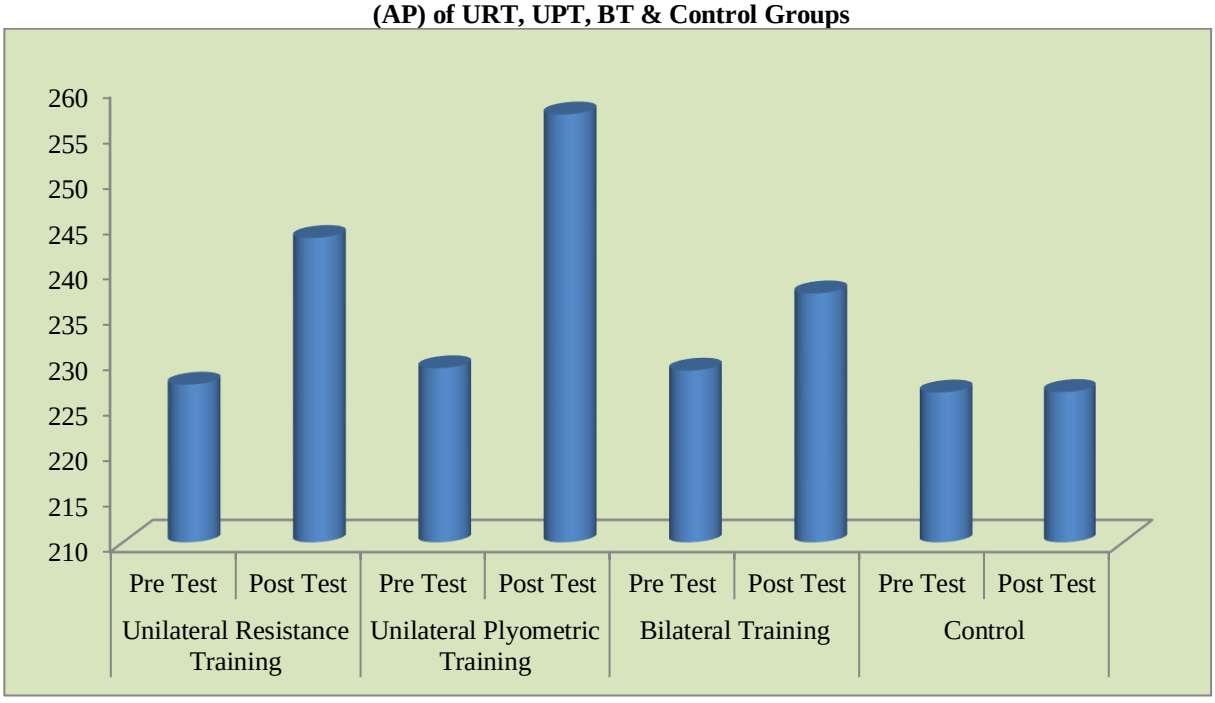
Variable	**Unilateral Resistance Training**	**Unilateral Plyometric Training**	**Bilateral Training**	**Control**	**MD**	**CI**
Anaerobic Power (AP)	243.60	256.92			13.32*	6.23
	243.60		237.36		6.24*	6.23
	243.60			226.84	16.24*	6.23
		256.92	237.36		19.56*	6.23
		256.92		226.84	30.08*	6.23
			237.36	226.84	10.52*	6.23

**Significant (.05)*

It (**Scheffe's Test**) proved that due to URT (16.24), UPT (30.08) as well as bilateral training (10.52) the soccer player's anaerobic power was greatly improved. Though, UPT was much better than URT (MD=13.32) and bilateral training (MD=19.56). Further, URT was much better than bilateral training (MD=6.24). The mean differences (13.32, 6.24, 16.24, 19.56, 30.08 & 10.52) are higher than CI value (6.23).

Chosen URT, UPT, BT & Control group's anaerobic power scores are graphically displayed in diagram-

Figure – I: Figure Showing Soccer Player's Anaerobic Power (AP) of URT, UPT, BT & Control Groups



Discussion

The results of the study showed significant

improvement on anaerobic power due to unilateral and bilateral resistance and plyometric training. Many studies have examined the possible interference of unilateral and bilateral resistance and plyometric training on anaerobic power improvements. Recently, it has been reported a significantly higher performance change in power and jumping ability after 6 weeks of unilateral PT but not after bilateral PT (Makaruk et al., 2011). Similarly, unilateral PT induced a higher increase in jumping performance vs. bilateral PT. On the other side, compared with bilateral training, unilateral exercises were equally effective to induce improvement of unilateral and bilateral leg strength and power (McCurdy et al., 2005) or even induce significantly larger contact times, lower vertical ground reaction forces, and rate of force development (Cappa & Behm, 2011). All these previous results may suggest that bilateral exercises can be a more specific power training drill for many reported sprint and jump actions that occur during soccer games.

Previous findings demonstrated that both bilateral and unilateral exercises demonstrate improvements in their trained movement and proved to be equally effective in increasing strength (Appleby, 2019; McCurdy, 2005; Spiers, 2016). Improvements in both strength and power using bilateral exercises, such as the back squat, have been established and are commonly used as a primary exercise for this reason (Spiers, 2016). Double leg jumps (sarjent jump) were similarly improved in both UPT and BPT groups. This is also in accordance with previous studies in adults (Bogdanis et al., 2019a) and children (Johnson et al., 2011; Michailidis et al., 2013; Bogdanis et al., 2019b; Tottori and Fujita, 2019). The main argument for the use of unilateral exercises is their greater specificity and potential transfer to sport-specific movements like running, bounding, jumping, and changing directions which are entirely or predominately unilateral. Specificity is a key principle in program design to maximize the transfer between training and competitive performance.

Conclusion

Due to URT (16.24), UPT (30.08) as well as bilateral training (10.52) the soccer player's anaerobic power was greatly improved. Though, UPT was much better than URT (MD=13.32) and bilateral training (MD=19.56). Further, URT was much better than bilateral training (MD=6.24). Following 12 weeks of URT, UPT and BT treatment, soccer player's anaerobic power performance (URT=7.06%, UPT=12.12% and BT=3.69%), enhanced greatly. Therefore, to most effectively improve performance, it is argued that unilateral resistance and plyometric exercises must closely resemble the forces and mechanics required for the specific sport.

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