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A Study On How Top-Notch Training Can Significantly Increase Soccer Players' Leg Strength: An Impact Protocol

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Abstract

The present investigation was made to determine how top-notch training can significantly increase soccer player's leg strength. Sixty college level soccer players (n = 60) aged between 18-24 years were randomly selected as the subject of this study. The selected subjects were randomly assigned into three equal groups with twenty subjects each (n = 15). The group I was involved with strength training (STG), group II was given combined strength training with explosive movements (STEG) and group III acted as a control (CG). The experimental groups underwent their respective experimental treatment for eight weeks, 3 days a week and a session on each day. The control group was not exposed to any specific training apart from their regular programme. The Maximum Leg Strength was taken as variable for this investigation, which was measured in kilo grams. The pre and post test were conducted one day before and after the experimental treatment. The collected data were analysed using analysis of covariance (ANCOVA) and Scheffe's test was applied as a post hoc test to determine which of the paired mean difference significantly. The result of the study revealed that both the two training groups such as strength training (STG) and combined with strength and explosive (STEG) training produced significant improvement on maximum leg strength ($p \leq 0.05$) as compared to control group (CG). However there was an insignificant difference ($p \geq 0.05$) between the two training groups. The result of this study is revealed that the strength training with explosive movements is the best way to improve the maximum leg strength of soccer players.

Keywords: Strength training, explosive movements, top-notch trading, maximum leg strength, soccer players, college students.

Introduction

The central goal of strength training in a highly competitive sport is to improve the players' specific and relevant athletic activities inherent in their sport. To achieve this outcome, different strength training modes with distinct movement patterns (traditional resistance exercises, ballistic exercises, plyometric, weight lifting, and sport-specific strength-based actions, different combinations of the temporal organization of strength training loads (e.g., macrocycle and training session variations), distinct loads, a wide range of movement velocities, specific biomechanical characteristics, and different training surfaces have been adopted with the final end point of achieving an improvement in players' performance in relevant motor tasks (Ronnested *et al*., 2011). Certain training methods combine different exercise modes (e.g., weight training, plyometric training, and sport-specific force-based actions) and allow for optimal power development and transfer to athletic activities due to both the neural and morphological adaptations typically associated with advanced training (Ebben & watts, 1998).

A combination of different methods of high-intensity strength training are involving traditional resistance exercises and plyometric (Ronnestad *et al*., 2008). Although some similarities exist between the previous modes of strength and power training, there are important differences. In this review, we found that complex training refers to training protocols that are comprised of the alternation of biomechanically comparable strength exercises and sport-specific drills in the same workout (Willarreal *et al*., 2013). Nevertheless, despite an increase in the body of evidence regarding the applicability of strength training programs to routine soccer training, the short-term duration of interventions (e.g., 4 to 12 weeks) (Bogdanis, 2009).

The adaptation changes and health implications of resistance exercise are very dynamic and variable for each individual. In strength training load refers to the mass or amount of weights utilized for specific exercises. It will help to improve the strength, power and size of muscle (Bloomfield, 1994; Abraham, 2010). The percentage of one repetition maximum (1RM) method was used in this training programme. It is the maximum load that can be lifted successfully one time through the full range of movement (Fielding *et al*., 2002). Physical fitness is one of the most important factors that determine the performance level of an individual. Resistance training is defined as a specialized method of conditioning that involves the progressive use of a wide range of resistive loads and a variety of training modalities (eg, free weights [barbells and dumbbells], weight machines, elastic cords, medicine balls, and body weight) designed to enhance health, fitness, and sports performance. Resistance training is an anaerobic form of exercises (Teng *et al*., 2008). It is caused to enhance the ability of the body to perform at very high force or power outputs for a very short period of time (Baechle, 1994; Ashokan & Abraham, 2015). Progressive resistance training is a muscle training programme in which the amount of resistance is systematically increased as the muscles gain in strength. Marked evidence indicates that regular participation in a resistance training program or a plyometric training program can improve measures of strength and power in adults (Chu, 1998; Fleck and Kraemer, 1997). Thus, both resistance training and plyometric training are typically recommended for adults when gains in motor performance are desired.

Plyometric training has been established as a training method that improves the muscle-tendon unit's ability to tolerate stretch loads and the efficiency of the stretch-shorten cycle (SSC) (Allerheiligen, 1994 & Chu, 1998). It is a type of exercise training designed to produce fast, powerful movements and improve the functions of the nervous system, generally for the purpose of improving performance in sports – plyometric movements, in which a muscle is loaded and then contracted in rapid sequence, use the strength, elasticity and innervations of muscles and surrounding tissue to jump higher and run faster, depending on the desired training goal (Brooks, 1996). This training involves and uses, practicing plyometric movements to toughen tissues and train nerve cells to stimulate a specific pattern of muscle contraction, so the muscles generate as strong a contraction as possible in the shortest amount of time (Chu, 1998; Abraham, 2011)). A plyometric contraction involves first a rapid muscle lengthening movement (eccentric phase), followed by a short resting phase (amortization phase), then an explosive muscle shortening movement (concentric phase), which enables the muscles to work together in doing the particular motion (Andrew, 2010).

Strength, or the ability to express force, is a basic physical characteristic that determines the performance efficiency in sports. Furthermore, how to improve the muscular strength is the problem which athletes and coaches often concerned about. Leg strength is very essential for sports persons, especially athletes. The strength of a muscle related to its sectional area or girth. The larger the muscle, the stronger it is (Taafee *et al*., 1996; Abraham, 2014). In this study the leg dynamometer is the instrument used to measure the leg strength. The capacity of the lower limb to extent muscular force, the leg strength is measured by the limits of lifting resistance in lowering to and arising from sitting position (Johnson & Nelson, 1982).

Therefore, the purpose of the present investigation was how top notch training can significantly increase soccer players' leg strength. Even though initial gains in strength and power due to training are mediated by neural factors, we used a eight week training program since previous investigations reported favorable changes in performance in youth (Martel *et al*, 2005; Myer *et al*, 2006) and adults (Adams *et al*., 1992 & Vossen *et al*, 2000) following eight weeks of resistance and plyometric training. We hypothesized that the combinatorial effects of plyometric and resistance training would result in significantly greater improvements in strength output.

Materials and method

To achieve this, sixty (n = 60) soccer players from different colleges of Mahatma Gandhi University, Kerala were randomly selected as subjects and their age ranged between 18 to 24 years. The selected subjects were randomly assigned into three equal groups with fifteen subjects each (n = 20). The group I was involved with strength training (STG), group II was underwent strength training with explosive training (STEG) for alternate days and group III acted as a control (CG). The exercise groups trained thrice per week on nonconsecutive days (Monday, Wednesday and Friday) for eight weeks and a session on each day under carefully monitored and controlled conditions. The control group was not exposed to any specific training apart from their regular programme. Maximum Leg strength was taken as variable for this investigation. The maximum leg strength was measured by using leg dynamometer. Before the

commencement of the experimentation, the investigator recorded 1RM for all the two groups taking each subject separately. The following strenth exercises were used to resistance training group and performed with progressive method, half squat, bench press, leg press, overhead press, standing calf raise, biceps curl, front squat, incline press, upright row, and triceps extension exercises. The intensity ranged from 60% to 90% of 1RM. The components of this program included preparatory movement training and explosive strength training.

The following explosive exercises were used, box jump (depth or drop jump), tuck jump, split jump, bounding, steps, single leg hop (alternate leg) and hurdle jump, These exercises were performed for 60 minutes in a day after proper warming up. The pre and post test data were collected one day before and after the experimental treatment. Group II performed combined strength and explosive strength training for alternate days. Following every strength training session, subjects in both groups performed two sets of 12 to 25 repetitions of abdominal (e.g., abdominal curl), lower back (e.g., kneeling trunk extension) and rotator cuff (e.g., external rotation) strengthening exercises. Subjects were taught how to record their data on workout logs and did so throughout the training period. The instructors reviewed the workout logs daily and made appropriate adjustments in training weight and repetitions throughout the study period. Mean and standard deviation were calculated for maximum leg strength of each training group. And the data were analyzed by using analysis of covariance (ANCOVA). If the *'F'* value was found to be significant for adjusted post-test mean, Scheffe's test was used as a post hoc test to determine the significant difference between the paired mean. The statistical significance was set to priority at $p < 0.05$.

Table I Percentage of Intensity, Repetition and Sets of Strength Training

Groups	Components	Weeks							
		I	II	III	IV	V	VI	VII	VIII
Strength Training	Intensity	60	60	70	70	80	80	90	90
	Repetitions	8 to 10	8 to 10	6 to 8	6 to 8	4 to 6	4to 6	2 to 4	2 to 4
	Sets	2	2	2	2	3	3	3	3

Table II Percentage of Intensity, Repetition and Sets of Explosive Strength Training

Groups	Components	Weeks							
		I	II	III	IV	V	VI	VII	VIII
Explosive Strength Training	Intensity	60	60	70	70	80	80	90	90
	Repetitions	10 to 12	10 to 12	8 to 10	8 to 10	6 to 8	6 to 8	4 to 6	4 to 6
	Sets	2	2	2	2	3	3	3	3

Results

Table III. Analysis of covariance of Maximum Leg Strength of experimental groups and control group

Test	STG	STEG	CG	SOV	SS	df	MS	*F*
Pre-test Mean S.D (±)	88.37 8.27	85.29 7.37	86.82 7.89	B W	7.27 1987.32	2 57	2.72 35.29	1.45
Post-test Mean S.D (±)	98.35 7.88	102.35 7.66	88.56 8.01	B W	997.25 1326.7	2 57	361.72 24.86	13.56*
Adjusted Post-test Mean	98.75	102.82	88.76	B W	982.38 938.27	2 56	337.02 14.92	16.39*

*Significant F = (df 2, 57) (0.05) = 3.16; (P ≤ 0.05) F = (df 2, 56) (0.05) = 3.165; (P ≤ 0.05).

Table shows that pre and post test mean and standard deviation of experimental and control groups on maximum leg strength. The obtained *'F'* value for pre test mean on leg strength was 1.45, which was lesser than table value of 3.16 for degree of freedom 2 and 57 at 0.05 level of confidence; hence there was no significant difference in pre test data of experimental and control groups. The analysis of the post and adjusted post test mean data reveals that obtained '*F'*

value of 13.56 and 16.39 respectively, which were higher than table 'F', hence there exists a significant difference in leg strength among the experimental and control groups. Since, three groups were compared, whenever obtained 'F' value for adjusted post test was found to be significant, Scheffe's test was used to find out the paired mean difference and it was presented in Table IV.

Table IV. Scheffe's post hoc test for the difference between paired mean on Maximum Leg Strength

STG	STEG	CG	MD	CI
98.75	102.82		4.07	4.15
98.75		88.76	9.99*	
	102.82	88.76	14.06*	

* Significant, ($p \leq 0.05$)

Table IV showed that the adjusted post test mean difference in maximum leg strength between strength training group and control group and strength with explosive training group and control group, 9.99 and 14.06 respectively. These values are higher than the required confidence interval value of 4.15, which shows significant difference at the 0.05 level of confidence. It also showed that there was no significant difference between two experimental groups. The pre, post and adjust post test mean values of experimental groups and control group on maximum leg strength was graphically represented in the figure 1 & 2.

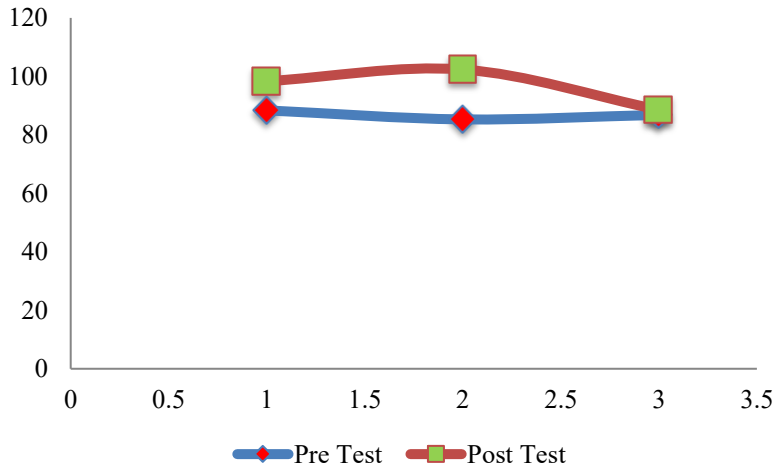

Figure 1: The pre and posttest mean values of experimental groups and control group on maximum Leg Strength

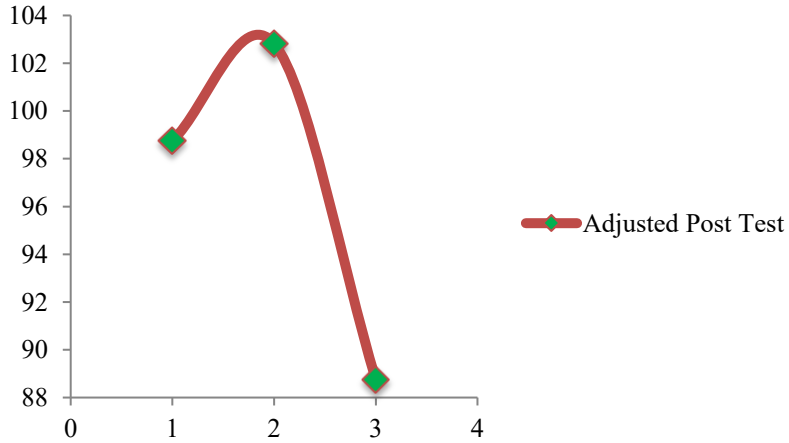

Figure 2: The improvement of the mean values of experimental groups on maximum Leg Strength

Discussion

The purpose of the study was to investigate how top notch training can significantly increase soccer players' leg strength. The main findings from this study were a significant improve in maximum leg strength ($p \leq 0.05$) following an 8 week resistance training and resistance training with plyometric training. Resistance training alone as well as the combination of both resistance and explosive training, as evidenced by this study has a significant effect on increasing leg strength. Strength and power variables are considered as the main determinants of athletic performance. Many research studies suggest that resistance training may be valuable for determining the physical variables such as leg strength (Lesnegard *et al*., 2010; Badillo *et al*., 2006 and Sankaranayanan & George, 2011). Teixeira *et al*. (2001) pointed out that resistance training three times per week is an effective as five times per week.

Strength training has become an integral component of the physical preparation for the enhancement of sports performance (Young, 2006). While strength is defined as the integrated result of several force-producing muscles performing maximally, either isometrically or dynamically during a single voluntary effort of a defined task, power is the product of force and the inverse of time, i.e., the ability to produce as much force as possible in the shortest possible time (Hoff & Helgerad, 2004). The development of leg strength as a result is supported by the findings of Robert *et al.* (2002), Hunder *et al*. (2001) and George & Thomas (2011).

The various training components (E.g. sets, repetitions, rest, intervals) could be manipulated the training loads used for the most important factor that determine the training stimuli and the consequent training adaptations (Myer *et al*., 2006 & Jones *et al*., 2001). Results from several investigations involving adults suggest that combining plyometric training with resistance training may be useful for enhancing muscular performance (Adams *et al*., 1992; Fatouros *et al*., 2000). Similar findings were recently reported by Myer and colleagues (2005) and Panackal & Abraham (2015) who observed that a six week, multi-component training program which included resistance training and plyometric training significantly enhanced strength, jumping ability in female adolescent athletes as compared to a non-exercising control group. Thus the effects of plyometric training and resistance training may actually be synergistic, with their combined effects being greater than each program performed alone. Bogdanis *et al*. (2011) and Asaithambi *et al*., (2012) also find out the squat training is very useful to increase the maximum strength of the lower body of the soccer players.

Studies also suggest that changes in motor performance skills resulting from the performance of combined resistance training and plyometric training are greater than with either type of training alone (Adams *et al*., 1992; Fatouros *et al*., 2000 and Panackal *et al*., 2012). From the results of the present study and literature, it is concluded that the dependent variable such as leg strength was significantly improved due to the influence of resistance training, and the combination of both resistance with explosive strength training.

Conclusion

It is evident from a number of the adaptations that occur with resistance training and plyometric training that there are several physical fitness related benefits. Any practical application requires careful implementation and individual experimentation. The results of the study showed that there was a significant improvement in leg strength between resistance training group and control group, and combined resistance and plyometric training group and control group.

The results also revealed that there was a significant difference in maximum leg strength in between two training groups such as plyometric training group and combined resistance and plyometric training group. Moreover, we have demonstrated that the combined resistance and plyometric training programme were more effective than resistance training alone in improving leg strength at maximum level of college male students. Leg strength is very essential for soccer players to perform maximum level, so resistance training with explosive strength training is very useful to improve it. Moreover, the resistance training with explosive movements is one of the best methods to advisable to all the coaches and sports scientists to improve their trainees' lower extremity strength.

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Informed Consent Statement
Informed consent was obtained from all parents of subjects involved in the study

Data Availability Statement
Data are available upon request from the corresponding author.

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Conflicts of Interest
The authors declare no conflicts of interest.

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