Effect of Plyometric Training Strength Training and Combination of Plyometric Strength and Mobility Training on Leg Strength and Explosive Strength

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Abstract-The purpose of the present study was to find the effect of plyometric training, strength training and combination of plyometric, strength and mobility training on leg strength and explosive strength. For this purpose, sixty male kho-kho players from various colleges around Namakkal District, Tamilnadu, in the age group of 17 – 25 years were selected. They were divided into four equal groups (n = 15), each group consisted of fifteen subjects, in which group – I underwent plyometric training, group – II underwent strength training, group – III underwent combination of plyometric, strength and mobility training and group – IV acted as control group who did not participate in any special training. The training period for this study was three days in a week for twelve weeks. Prior to and after the training period the subjects were tested for leg strength and explosive strength. Leg strength was assessed by using leg lift with dynamometer and explosive strength was assessed by administering standing broad jump. The analysis of covariance (ANCOVA) was used to find out the significant difference if any, among the experimental groups and control group on selected criterion variables separately. Since there were four groups involved in this study the Scheffé *S* test was used as pos-hoc test. It was concluded from the result of the study that the plyometric training group, strength training group and combination of plyometric training, strength training and mobility training group has positively altered the criterion variables, such as, leg strength and explosive strength. The result of the study also shown that there was an insignificant difference occurred between the experimental groups, such as, plyometric training group, strength training group and combination of plyometric, strength and mobility training group only on leg strength but in explosive strength, the plyometric training group has better improvement than other experimental groups. The combined training group has also improved explosive strength than the strength training group and control group.

Key Words: ***plyometric training, strength training, mobility training, leg strength, explosive strength.***

INTRODUCTION

Humans have always strived to move more quickly, jump higher, and exhibit more strength, endurance, and skill. We are perfectionists in our pursuit of excellence because we are competitive by nature. Old conditioning techniques, while fascinating and historically significant, have been replaced with new ones that are based on wisdom and information gleaned from real-world experience, outside observation, and academic study. Improvements in conditioning techniques have been modest for a while, but in recent years, significant developments have led to some amazing performance gains.[1]

Athletic performance has improved dramatically in recent years. Performance levels that were previously unthinkable are becoming more prevalent, and the number of athletes capable of extraordinary feats is increasing. One factor is that athletics is a demanding activity, and high desire has resulted in long and exhausting practise sessions. Furthermore, coaching has become more sophisticated as a result of technology improvements [2].

Any physical activity causes anatomical, physiological, metabolic, and psychological changes. The duration, distance, and repetitions of a physical activity, as well as the load and velocity of the activity, and the frequency with which it is conducted, all factor towards its efficiency. While structuring the dynamics of training based on the functional and psychological elements of a competition, consider these features, referred to as training factors. During the training phases leading up to a competition, determine which component to

emphasise and achieve the desired performance goal [3].

Plyometric exercises are a type of training that incorporates these movements and is used to increase power. In these sorts of activities, stretch-shortening cycles are prevalent [4,5]. It may be used to strengthen both the upper and lower body. Plyometric training, which includes various types of jumps such as countermovement jumps, the drop jump, and squat jump, hopping, alternate-leg bounding, and the stretch-shortening cycle]6], is a method to improve vertical jump ability and leg muscle power [4], which is included in various types of jumps such as countermovement jumps, the drop jump, and squat jump

Plyometric trainings have also been shown to improve kicking speed in football game[7,8], as well as strength, muscular power [7], coordination, agility [7,9], speed, and acceleration time [10,11,12] however, there have also been reports of neutral or negative effects [13,14].

When plyometric exercises and weight training were coupled, vertical leaping performance was improved [15,16,17] or remained unchanged [18]. This combination may provide a more effective training stimulus for vertical leaping than either weight or plyometric training alone. Clutch *et al*. (1983)[35] did not reach the same conclusion as Ioannis *et al*. (2000) [36], who stated that combining plyometric and weight training increased muscular strength.

Strength training, often known as ballistic training, is used to increase jumping ability and performance. [19] Strength training has also been shown to be an effective technique or tool for increasing strength, running economy, agility [22-23], and sprint capacity [24-25]. Strength refers to the pursuit for enhanced power production and is derived from two Greek words: plio, which means more, and metric, which means to measure. [25] Strength workouts make muscle fibres and connective tissue more elastic, allowing the muscle to store and release energy during deceleration and acceleration [26-29].

Leg strength is extremely important in human daily activities. It is a requirement for practically all games and sports to have it. An athlete will only go as far as his legs will take him, according to an old adage [30,31]. Leg strength is critical for athletes and other sportspeople. The cross-sectional area, or girth, of a muscle is proportional to its strength. The stronger a muscle is, the larger it is. It is feasible to establish whether extra strength is required by comparing strength to performance. The ability of the neuromuscular system to overcome obstacles by speeding up contractions [32].

METHODS

This study under investigation involves the experimentation of plyometric training, strength training and combination of plyometric training, strength training and mobility training on leg strength and explosive strength. Sixty Male kho-kho players those were studying in various colleges around Namakkal Town, Tamilnadu, in the age group of 17 – 25 years were selected. They were divided into four equal groups (n = 15), each group consisted of fifteen subjects, in which group – I underwent plyometric training, group – II underwent strength training, group – III underwent combination of plyometric training, strength training and mobility training and group – IV acted as control group who did not participate in any special training. The training programme was carried out for three days (Monday, Wednesday and Friday) per week during morning session only (6 am to 8 am) for twelve weeks. Leg strength was assessed by administering leg lift dynamometer and explosive strength was assessed by using standing broad jump test.

ANALYSIS OF DATA

The data collected prior to and after the experimental periods on leg strength and explosive strength of plyometric training group, strength training group, combination of plyometric training, strength training and mobility training group and control group were analysed and presented in the following table - I.

Table – I Analysis of Covariance and 'F' ratio for Leg strength and Explosive strength for Plyometric training Group, Strength training Group, Combination of Plyometric training, Strength Training and Mobility training Group and Control Group

Variable Name	Group Name / Mean Values	Plyometric Training Group	Strength Training Group	Combined Training Group	Control Group	'F' Ratio
Leg strength (in Kg)	Pre-test Mean ± S.D	72.00 ± 1.51	72.40 ± 1.68	71.33 ± 1.70	72.33 ± 1.05	1.58
	Post-test Mean ± S.D.	78.00 ± 1.70	78.53 ± 2.23	77.47 ± 1.81	72.47 ± 1.69	33.76*
	Adj. Post-test Mean	78.012	78.251	77.971	72.233	55.10*
Explosive strength (Meters)	Pre-test Mean ± S.D	1.54 ± 0.09	1.51 ± 0.08	1.49 ± 0.07	1.50 ± 0.12	1.053
	Post-test Mean ± S.D.	1.74± 0.09	1.61 ± 0.07	1.67 ± 0.09	1.496 ± 0.11	19.07*
	Adj. Post-test Mean	1.716	1.611	1.691	1.503	40.85*

* Significant at .05 level of confidence. (The table value required for significant at .05 level with df 2 and 42 and 2 and 41 are 3.22 and 3.23 correspondingly).

Table – I displays the 'f' - ratio values of pre-test means of leg strength for plyometric training and strength training group and combination of plyometric training, strength training and mobility training group and control group was 1.58, which was less significant. The 'f' - ratio of post- and adjusted post-test means were 33.76 and 55.10 were superior to the requisite table value of 3.22 and 3.23 for significance with df 2 and 42 and 2 and 41 at .05 level of confidence. The result of this study showed that there was a significant dissimilarity among plyometric training and strength training group and combination of plyometric training, strength training and mobility training group and control group on muscular endurance.

The above table shows the 'f' - ratio values of pre-test mean of explosive strength for plyometric training and strength training group and combination of plyometric training, strength training and mobility training group and control group was 1.053, which was not significant at 0.05 level of confidence. The 'f' ratio of post and adjusted post-test means was 19.07 and 40.85 was superior to the requisite table value of 3.22 and 3.23 for significance with df 2 and 42 and 2 and 41 at .05 level of confidence. The result of this study showed that there was a significant dissimilarity among plyometric training and strength training group and combination of plyometric training, strength training and mobility training group and control group on explosive strength.

Further to determine which of the paired means has a significant difference, Scheffẽ *S* test was applied as post-hoc test. The result of the follow-up test is presented in Table - II.

Table – II-Scheffẽ S Test for the Difference Between the Adjusted Post-Test Means of Leg strength and Explosive strength

Plyometric Training Group	Strength Training Group	Combined Training Group	Control Group	Mean Difference	CI
Adjusted Post-test Mean Difference on Leg Strength					
78.102	78.251			0.149	1.59
78.102		77.971		0.131	1.59
78.102			72.233	5.869*	1.59
	78.251	77.971		0.28	1.59
	78.251		72.233	6.108*	1.59
		77.971	72.233	5.738*	1.59
Adjusted Post-test Mean Difference on Explosive Strength					
1.716	1.611			0.105*	0.0609
1.716		1.692		0.024	0. 0609
1.716			1.506	0.21*	0. 0609
	1.611	1.692		0.081*	0. 0609
	1.611		1.506	0.105*	0. 0609
		1.692	1.506	0.186*	0. 0609

* Significant at 0.05 level of confidence.

RESULTS

After applying the analysis of covariance, the result of this study showed that there was a significant difference among training groups and control group on the changes in leg strength and explosive strength after twelve weeks of training. In explosive strength, the plyometric training group has better improvement than strength training group and combined training group have better improvement than the strength training group. The strength training group has significantly differ than the control group in explosive strength. The criterion variables such as, leg strength and explosive strength was improved for the plyometric training group, strength training group and combination of plyometric training, strength training and mobility training group.

CONCLUSIONS

The plyometric training, strength training, and combination of plyometric training, strength training, and mobility training groups all shown a significant increase in leg strength when compared to the control group. According to Blakeyl and Southard, (1987) [33] weight training and plyometric exercises significantly increased the leg strength of female students. Rahimi and Behpur (2005) [34] discovered that a weight-training and plyometric routine significantly increased leg strength. But there was no significant difference between the training groups on leg strength. The study's conclusions show that all training groups considerably improved their explosive power in terms of horizontal distance. Plyometric training greatly increased explosive power in terms of horizontal distance, as revealed by Rahimi and Behpur (2005) [34] and Ganie, Sheikh, and Hayyat (2019) [35]. Additionally, it was shown that there was a substantial difference in explosive power between the groups who had plyometric training, strength training and combination training.

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