Influence of Plyometric Training and Combination of Plyometric and Strength Training on Leg and Back Strength

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Abstract- The purpose of the study was to find out the effect of plyometric training, and combination of plyometric and strength training on selected leg strength and back strength. Forty-five male kabaddi players aged between 18 and 25 years were selected for the study. They were divided into three equal groups, each group consisting of fifteen subjects in which three experimental groups and one control group, in which the group I (n=15) underwent plyometric training, group II (n = 15) underwent combination of plyometric and strength training for three days (alternative days) per week for twelve weeks and group III, acted as control, which did not participate in any training. The subjects were tested on selected criterion variables such as leg strength and back strength at prior to and immediately after the training period. For testing the leg strength and back strength the dynamometer was used. The analysis of covariance (ANCOVA) was used to find out the significant difference if any, between the experimental groups and control group on selected criterion variables separately. Since there were three groups involved in the present study, the Scheffé *S* test was used as post-hoc test. The selected criterion variables such as leg strength and back strength were improved significantly for all the training groups when compared with the control group.

Key Words: Plyometric training, combination of plyometric and strength training, leg strength, and back strength.

INTRODUCTION

Mechanistic aims are the main emphasis of physical training. After the physical exercise, the general muscles and certain specialised skills will grow over a set period of time. The physical training program will most likely increase physical fitness.[1] Dale S. Beach[2] defines Training is defined as "the systematic process through which individuals acquire information and/or skills for a specific goal." Training is the practise of imparting a certain talent to a person, whether a human or an animal, with the intention of raising that person's ability, performance, or output.[3] The most crucial component to an athlete's high level of performance is physical training. Its goals are to raise an athlete's physiological capacity and biomotor skills to the maximum levels possible.[4] Athletes should get physical training based on scientific principles that helps them achieve exceptional and record-breaking performances via the methodical development of mental and physical efficiency, capability, and motivation.[5]

Periodization is the term for a structured training program that takes place over a certain amount of time and incorporates an increasing number of training cycles to improve an individual's performance.[6] The contestant receives the best adaptability during periodization before a significant event. The athlete alters his or her routine with regular times or intervals to work harder with enough recovery rather than repeating the same routine workouts month after month. [7] A research done at Ball State University's Human Performance Laboratory indicated a substantial difference favouring periodized plyometric training programs over non-periodized programs.[8]

Track & field competitors have been trained using plyometrics in Russia and Eastern Europe for decades. [9,10,11,12,13,14]. Verkhoshanski (1973) [15], a renowned Soviet track and field coach, who invented what is now known as "jump training" or "shock training." Sports performance outcomes, such as throwing, serving velocity, jump height, or sprint speed, are frequently quantified in testing or competition. [16,17,18].

Resistance training is associated with an increase in bone mineral density and/or bone breadth in athletes when compared to a non-athletic control group.

[19,20,21]. Resistance training may be an effective preventive measure since it is inversely associated to better bone health and a reduction in ageing. [22].

According to studies [23,24], plyometric activities are either less effective than weight training or more effective than other workouts in increasing vertical jumping ability. A combination of plyometric exercises and weight training enhanced or did not affect vertical jumping performance. Adams et al. (1992) [23] suggested that this combination may offer a more effective training stimulus for vertical jumping performance than either weight training or plyometric training alone. Loannis et al., (2000) [24] asserted that combining plyometric and weight training increased muscular strength, contrary to Clutch et al., (1983) [25], who did not reach the same conclusion.

The national field game of India features kabaddi heavily, and as more scientific methods are employed, it is becoming more and more well-liked. All participants get a great exercise at the same time, and no further equipment is needed. [26].

METHODS

The goal of this study was to determine how plyometric exercise, as well as a combination of plyometric and strength training, affected back and leg strength. 45 male kabaddi players who were enrolled at St. Peter's University in Chennai, Tamil Nadu for the academic year 2020–2021 were chosen as subjects to fulfil the goal. They were divided into three equal groups of fifteen each and further divided as two experimental groups and one control group, in which the group I (n=15) underwent plyometric training (PT), group II (n = 15) underwent combination of plyometric and strength training (CPST) for three days (alternative days) per week for twelve weeks, and group III (n=15) acted as control which did not participate in any special training apart from the regular curricular activities.

There will be changes to the body's numerous structures and systems with every training regimen. After consulting with the specialists, the researchers decided to use the following variables as criteria: 1. Leg strength, and 2. Back strength.

ANALYSIS OF THE DATA

The differences, if any, between the corrected post test means on several criteria variables were examined independently using analysis of covariance. The Scheffé S test was used as a post-hoc test if the adjusted post test mean's "F" ratio was shown to be significant. To evaluate the "F" ratio discovered using analysis of covariance, the level of significance was set at.05 level of confidence.

Table – I Analysis of Covariance and 'F' ratio for Leg Strength and Back Strength of Plyometric training Group (PTG), Combination of plyometric and strength training Group (CPSTG) and Control Group(CG)

Variable Name	Group Name	PTG	CPSTG	CG	'F' Ratio
Leg Strength (in Kg.)	Pre-test Mean ± S.D.	71.67 ± 4.70	71.87 ± 4.24	72.40 ± 3.40	0.125
	Post-test Mean ± S.D.	74.87 ± 4.72	75.87 ± 4.93	71.93 ± 2.87	4.02*
	Adj. Post-test Mean	74.149	75.967	71.551	54.75*
Back strength (in Kg.)	Pre-test Mean ± S.D.	62.87 ± 4.22	62.40 ± 4.62	63.47 ± 3.07	0.27
	Post-test Mean ± S.D.	65.53 ± 4.36	66.60 ± 4.62	62.00 ± 3.09	5.22*
	Adj. Post-test Mean	65.578	67.115	61.441	190.64*

* Significant at .05 level of confidence. (The table value required for significance at .05 level of confidence with df 2 and 42 and 2 and 41 were 3.21 and 3.23 respectively).

Table – I shows that the leg strength pre-test "F" ratio value of 0.125 was less than the necessary table value of 3.21 for significant with df 2 and 42 at 0.05 level of confidence. For the post-test mean and adjusted post-test mean 'F' ratio value of 4.023 and 13.685 for the adjusted post-test scores was greater than the necessary table value of 3.24 for significant.

According to Table - I, the pre-test averages of back strength "F" ratio value of 0.27 was less than the necessary table value of 3.21 for significant with df 2 and 42 at 0.05 level of confidence. For post-test and adjusted post-test mean "F" ratio values of back strength were 6.48 and 190.64 was greater than the necessary table value of 3.24 for significant.

Table – II Scheffẽ S Test for the Difference Between the Adjusted Post-Test Mean of Leg Strength and Back Strength

PTG	CPSTG	CG	Mean Difference	Confidence Interval at 0.05 level
Adjusted Post-test Mean for Leg Strength				
74.149		71.551	2.598*	1.14
74.149	75.967		1.818*	1.14
	75.967	71.551	4.416*	1.14
Adjusted Post-test Mean for Back Strength				
65.578		61.441	4.137*	0.76
65.578	67.115		1.537*	0.76
	67.115	61.441	5.674*	0.76

* Significant at 0.05 level of confidence.

RESULTS

The adjusted post-test mean difference in leg strength between PTG and CG, PTG and CPSTG, and CPSTG and CG was 2.598, 1.818, and 4.416, respectively, and these differences were significant at the.05 level of confidence, according to Table IV. Based on the study's findings, it can be said that PTG and CPSTG considerably boost leg strength. Additionally, the study's findings indicate that there was a substantial difference between the training groups in favour of CPSTG.

The adjusted post-test mean difference in back strength between PTG and CG, PTG and CPSTG, and CPSTG and CG was 4.1637, 1.537, and 5.674, respectively, and these differences were significant at the.05 level of confidence, according to Table - VI. Based on the study's findings, it can be said that PTG and CPSTG considerably boost leg strength. Additionally, the study's findings indicate that there was a substantial difference between the training groups in favour of CPSTG.

CONCLUSION

The research's findings revealed that PTG and CPSTG greatly boosted leg strength. According to *Mohamed Abd El-Mawgoud Elsayed's* (2012) [27] research, leg strength significantly increased following the PT programme. Additionally, *Rahman Rahimi and Nasir Behpur* (2005) [28] discovered that following the CPST regimen, leg strength significantly increased. Additionally, the outcome demonstrates that a substantial difference between the training groups was discovered in favour of CPSTG.

After the PT and CPST treatment, it was discovered that back strength had significantly improved. *Mohamed Abd El-Mawgoud Elsayed* (2012) [27] discovered that following the PT programme, there was a noticeable improvement in back strength. The study's findings also showed a significant difference in back strength across the training groups, favouring CPSTG.

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