Impact of Isolated and Combined Strength Plyometric and Mobility Training on Leg Strength and Anxiety

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Abstract- The purpose of the study was to find out the effect of isolated and combined strength, plyometric and mobility training on leg strength and anxiety. Seventy five male students studying in various arts and science colleges in and around Villupuram District, Tamilnadu were divided into five equal groups (n = 15), in which group - I underwent strength training, group - II underwent plyometric training, group - III underwent mobility training and group – IV underwent combined training for 3 days per week for 12 weeks, and group V acted as control which did not participate any special training. The subjects were tested on selected criterion variables such as leg strength and anxiety at prior to and immediately after the training. For testing the leg strength, the dynamometer was used, and for anxiety the Taylor Manifest Anxiety Scale was used. The analysis of covariance (ANCOVA) was used as statistical tool and since five groups were involved in the present study, the Scheffé S test used as post-hoc test. The selected criterion variables such as leg strength was improved and anxiety was decreased significantly for all the training groups when compared with the control group and the leg strength was improved significantly for strength training group and plyometric training group.

Key Words: Strength training, plyometric training, mobility training, combined training, leg strength and anxiety.

INTRODUCTION

Old ways of conditioning, albeit intriguing and rich in heritage, have been jettisoned in favour of new approaches based on insight and knowledge as a consequence of practical experience, observation, and scientific investigation. For ages, progress toward improved conditioning methods was sluggish, but in recent years, major advances have resulted in some incredible gains in performance [1].

The term 'training' refers to the development of an individual's resource and means that instruction and guidance are used to raise a certain aptitude to the highest level. Training is a specific cycle of repeated exercise and activity that includes learning and acclimatization [2]. Training is a method of conveying and receiving knowledge that is linked to critical thinking [3]. The long-term athlete development is a planned, structured and progressive development of youth's athleticism to achieve elite sport success and to engage in lifelong, health-enhancing physical activity [4]. Physical training can be classified as jobs, conditioning, sports, or other daily activities. It should be organised, repeated, and structured with the goal of improving or maintaining physical fitness as a final or intermediate goal [5]. Exercise is a type of physical activity that is designed to promote physical fitness by being planned, repeated, organised, and purposeful [6]. Within physical care, the term 'exercise' is used more broadly, and it will be referred to as physical fitness training[7].

Strength training appears to be an appropriate and effective technique of improving muscle fitness and sport-specific performance in both trained and untrained athletes [8,9]. Strength training is regarded as the best intervention for preventing and treating the negative effects of sarcopenia [10,11]. Strength training enhances muscular strength, power, and body composition (total and regional) according to several research [12,13,14,15,16]. Numerous studies have shown that strength training can increase physical function [17,18,19], but the particular physical qualities that cause this improvement have seldom been explored.

Plyometric training is a type of strength training used to improve sport-specific performance in both team and individual sports [20,21]. Plyometric workouts have been proven to improve a variety of physical characteristics, including strength and jump height[22], running economy[23], agility [24]. sprint speed and endurance [25]. Explosive muscular extension and contraction are characteristics of plyometric training exercises.

Mobility exercises are those that enhance the range of motion and the stability, or control, of the muscles that surround each joint. Although they are similar, mobility is not the same as flexibility. Mobility is a combination of flexibility and strength that allows people to squat deeper, push harder, and leap higher [26].

One of the most contentious study areas in exercise science and physiology for a long time was the impact of resistance and plyometric training on young people and its possible advantages and disadvantages. Due to the immaturity of the skeletal system, researchers and scientific societies hypothesised in the 1970s and 1980s that resistance training carried a higher risk of injuries [27,28]. Additionally, it was claimed that young resistance training is inefficient since there aren't enough anabolic hormones in the blood [29].

Physical fitness refers to a condition of health and wellbeing and, more particularly, the capacity to engage in certain activities related to sports, jobs, and daily living. Physical fitness is often attained by healthy eating, moderate to strenuous activity, adequate rest, and a systematic recovery plan [30]. A number of groups value maintaining high levels of muscular strength and hypertrophy. These characteristics benefit the general population in performing daily tasks [31] and have broad implications for health and wellbeing, including evidence of a definite inverse link between muscular fitness and mortality[32]. Multiple sets of each exercise were used in the majority of studies that showed increased flexibility when just resistance training was performed. When three sets of each exercise were performed in a training session, untrained young women [33,34,35], middle-aged women [36[and elderly women [37] all demonstrated increased flexibility. Adult men and women completing three sets [38] and four sets [39] of each exercise and adult males performing three sets [40,41,42] of each exercise in a training session both showed increased flexibility.

MATERIALS AND METHODS

In this study it was aimed to find out the effect of isolated and combined strength training, plyometric training, mobility training and their combination on leg strength and anxiety. To achieve the purpose, seventy five male students studying in various arts and science colleges in and around Villupuram District, Tamilnadu were selected as subjects at random. They were divided into five equal groups of fifteen each and further divided as four experimental groups and one control group, in which the group - I underwent strength training, group - II underwent plyometric training, group - III underwent mobility training, group – IV underwent the combination of strength, plyometric and mobility training for three days (alternative days) per week for twelve weeks, and group - V acted as control which did not participate in any special training apart from the regular sports activities.

The subjects those who are under medical treatment for various injuries were excluded from the present study after using a self-answered questionnaire. This study was approved by the doctors of Government Hospital, Villupuram in which it was performed and compiled with the ethical committee. All participants provided their written informed consent to participate in this study prior to enrollment. The physical and anthropometric characteristics in Table – 1.

Table – 1 MEAN VALUES OF GENERAL CHARACTERS OF THE PARTICIPANTS

	Experimental Group - I	Experimental Group – II	Experimental Group – III	Experimental Group - IV	Control Group (n=15)
Age (year)	21.3±0.3	21.5±0.5	21.4±0.6	20.8±0.7	20.9±0.3
Height (cm)	152.8±1.60	152.7±1.20	151.9±1.50	152.7±1.40	151.9±1.60
Weight (kg)	55.8 ±1.80	56.3±1.20	54.8±1.50	55.5±1.56	54.9±1.50
Systolic (mmHg)	123.26±10.20	123.45±9.40	124.30±10.5	124.30±10.5	122.15±9.3
Diastolic (mmHg)	81.8±1.60	82.50±1.50	81.3±1.90	81.3±1.90	82.20±2.05

For every training programme there would be a change in various structure and systems in human body. So, the researchers consulted with the experts and then selected the following variables as criterion variables: 1. Leg strength, and 2. Anxiety. The leg strength was assessed by BID – 2000 dynamometer, and anxiety was assessed by using Taylor's Manifest Anxiety Scale.

ANALYSIS OF THE DATA

Analysis of covariance was used to determine the differences, if any, among the adjusted post test means on selected criterion variables separately.

Whenever the 'F' ratio for adjusted post test mean was found to be significant, the Scheffé *S* test was applied as post-hoc test. The level of significance was fixed at .05 level of confidence to test the 'F' ratio obtained by analysis of covariance.

Table – 2 Analysis of Covariance and 'F' ratio for Leg strength and Anxiety of Isolated and Combined Strength training Group, Plyometric Training Group, Mobility Training Group, Combined Training Group and Control Group

	Strength Training Group	Plyometric Training Group	Mobility Training Group	Strength Plyometric and Mobility Training Group	Control Group	'F' ratio
Leg Strength						
Pre- test Mean ± S.D	78.00 ± 1.51	77.40 ± 1.69	77.33 ± 2.41	77.07 ± 1.58	78.20 ± 1.21	1.15
Post-test Mean± S.D	84.00 ± 1.69	83.60 ± 1.68	79.40 ± 2.59	83.27 ± 1.16	77.93 ± 1.39	36.92*
Adjusted Post-test Mean	83.650	83.775	79.633	83.734	77.408	149.8*
Anxiety						
Pre- test Mean ± S.D	22.07 ± 1.28	22.33 ± 1.11	22.20 ± 0.78	22.13 ± 0.74	22.27 ± 0.96	0.168
Post-test Mean± S.D	19.27 ± 1.34	19.40 ± 1.40	19.67 ± 1.18	19.27 ± 1.03	23.00 ± 1.00	27.28*
Adjusted Post-test Mean	19.394	19.273	19.667	19.33	22.936	68.80*

* Significant at 0.05 level of assurance. (The table value required for significance at 0.05 level of assurance with df 4 and 70 and 4 and 69 were 2.50 and 2.51 respectively).

Table – 2 show that pre and post test means 'f' ratio of strength training group, plyometric training group, mobility training group, combined training group and control group on leg strength shown 1.15, which was insignificant at 0.05 level of confidence. The post and adjusted post test mean 'f' ratio value of experimental groups and control group were 36.92 and 149.8 which was significant at 0.05 level of confidence. The pre test means 'f' ratio of strength training group, plyometric training group, mobility training group, combined training group and control group on anxiety shown as 0.168, which is insignificant at 0.05 level of confidence. The post and adjusted post test mean 'f' ratio value of experimental groups and control group was 27.28 and 68.80, which was significant at 0.05 level of confidence. The overall study shows that there was a significant increase in leg strength and a significant decrease in anxiety. Further, to find out which of the paired mean significantly differ, the Scheffĕ *S* test was applied and presented below:

Table - 3

Scheffĕ S Test for the Difference Between the Adjusted Post-Test Mean of Back strength Muscular endurance and Cardio-respiratory endurance

Adjusted Post-test Mean on Leg Strength						
Strength Training Group	Plyometric Training Group	Mobility Training Group	Strength, Plyometric and Mobility Training Group	Control Group	Mean Difference	Confidence Interval at 0.05 level
83.650	83.775				0.125	1.073
83.650		79.633			4.017*	1.073
83.650			83.734		0.084	1.073
83.650				77.408	6.242*	1.073
	83.775	79.633			4.142*	1.073
	83.775		83.734		0.41	1.073
	83.775			77.408	6.367*	1.073
		79.633	83.734		4.101*	1.073
		79.633		77.408	2.225*	1.073
			83.734	77.408	6.326*	1.073

Adjusted Post-test Mean on Anxiety						
19.394	19.273				0.121	0.856
19.394		19.667			0.273	0.856
19.394			19.33		0.064	0.856
19.394				22.936	3.542*	0.856
	19.273	19.667			0.394	0.856
	19.273		19.33		0.057	0.856
	19.273			22.936	3.663*	0.856
		19.667	19.33		0.337	0.856
		19.667		22.936	3.269*	0.856
			19.33	22.936	3.606*	0.856

*Significant at 0.05 level of assurance.

Table – 3 shows that the Scheffĕ *S* Test for the difference between adjusted post-test mean of strength training group and mobility training group (4.017), strength training group and control group (6.242), plyometric training group and mobility training group (4.142), plyometric training group and control group (6.367), mobility training group and control group (2.225), combined training group and mobility training group (4.101) and combined training group and control group (6.326), which were significant at 0.05 level of confidence. But there was no significant difference between strength training group and plyometric training groups (0.125), strength training group and combined training group (0.084) and plyometric training group and combined training group (0.41) on back strength after the training programme.

Table – 3 also shows that the Scheffĕ *S* Test for the difference between adjusted post-test mean difference in anxiety between strength training group and the control group (3.542), the plyometric group and the control group (3.663), the mobility training group and the control group (3.269), and the combined training group and the control group (3.606). But there was no significant difference between strength training and the plyometric training (0.121), strength training and the mobility training (0.273), the strength training and the combined training (0.064), the plyometric training and the mobility training (0.394, mobility training and the plyometric training (0.057), and mobility training and combination training (0.337).

DISCUSSIONS

The maximum noticeable health benefits of strength training is improving the muscle size, strength, metabolic efficiency, body composition and bone density [43,44,45,46,47,48]. Moreover, it also increases the physiological, psychological and social health sphere and also positively correlate to regular strength training of male [49,50,51,52]. Moreover, high levels of muscular strength and endurance are key stimulant of success in many sporting events [53,54]. The concept of specificity in training [55,56], the strength training increases the strength of the muscle and aerobic training enhances the cardiovascular endurance. The strength training and plyometric training are interact with one another [57] and it creates some less gain in muscular strength with strength training [58]. A meta-analysis study shown that plyometric training combined with strength training has improved a small amount of muscular strength, muscular hypertrophy and muscle power [59].

CONCLUSIONS

According to the study's findings, leg strength significantly improved across all training groups. The strength training and plyometric training groups, the strength training and combined training groups, and the plyometric training and combination training groups, however, did not differ significantly from one another. Leg strength significantly increased in the resistance training, plyometric training, and combined resistance and plyometric training groups, according to Shafeeq *et al*. (2013) [60] and Alexander and Raja (2020) [61]. Resistance training and plyometric training both increased leg strength, however Rahimi and Behpur (2005) [62] showed that combination training increased leg strength more than the other two training groups. After the plyometric, weight, and combination training periods, leg strength greatly improved, according to Jothi, Vinu, and Eleckuvan (2010) [63], however the combination training group notably differed from the other training groups. Arumugam (2016) [64] discovered that soccer players' leg and core strength have increased thanks to mobility training.

The result of the study revealed that there was a significant reduction in anxiety after the respected training programmes. But the study also revealed that the level of anxiety between the groups receiving the strength training and the mobility training, strength training and the plyometric training, the strength training and the combined training, the plyometric training and the mobility training, mobility training and the combined training, and plyometric training and combination training were not significant. Gordon, *et al*., (2017)[65] found that there was a significant reduction after the resistance training. Saroja and Vijayalakshmi, (2020) [66] and Saro and Nageswaran, (2015)[67] also found that there was a significant decrease in anxiety after the plyometric training among women basketball players. Muthukumar and Sokkanathan (2014)[68] found that there was a significant decrease in anxiety after the plyometric and combination of plyometric and weight training among male football players.

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