EFFECTS OF RESISTANCE TRAINING AND PLYOMETRIC TRAINING ON MAXIMUM STRENGTH AMONG COLLEGE MALE STUDENTS

K. Asaithambi[1], Dr. Venkatesan[2] and Dr. George Abraham[2]
[1]PhD.Scholar, Dept. of Physical Education and Sports Sciences, Annamalai University, Tamil Nadu
[2]Assit. Prof, Dept. of Physical Education and Sports Sciences, Annamalai University, Tamil Nadu

ABSTRACT

The purpose of this study was to determine the effects of resistance training and plyometric training on maximum strength among college male students. Forty five male college students (n=45) were randomly selected as subjects and their age ranged between 18 and 22 years. The selected subjects were randomly assigned into three equal groups such as resistance training group (RTG), plyometric training group (PTG) and control group (CG) with fifteen subjects each (n=15). The experimental groups underwent their respective experimental treatment for eight weeks 3 days per week and a session on each day. Control group was not exposed to any specific training apart from their regular activities. Maximum strength was taken as variable for this investigation. The pre and post test were conducted one day before and after the experimental treatment. The collected data was analyzed by using analysis of covariance (ANCOVA) and Scheffe's post hoc test. The results revealed that the resistance training group (RTG) produced significant improvement ($p \leq 0.05$) due to resistance training programme when compare to control group on maximum strength and there was insignificant difference between plyometric training group and control group.

Key Words: Resistance training, plyometric training, maximum strength, leg strength

INTRODUCTION

Resistance training is a form of strength training in which each effort is performed against a specific opposing force generated by resistance. Physical fitness is one of the most important factors that determine the performance level of an individual. Resistance training means working with weights, either free weight, the weight on a gymnasium machine or own body weight. It is an anaerobic activity (Sale *et al*., 1990). This increase in strength is largely related to the intensity and volume of loading and appears to be the result of an increased neuromuscular activation rather than muscle hypertrophy (Guy & Mischeli, 2001). One repetition maximum (IRM) with 60 – 80% of load in adults, young men and women, has lead to an increase in dynamic muscular strength following 6- 12

weeks of resistance training at a rate of 3 days per week (Stone & Coulter, 1994 & Weiss *et al*., 1999).

Plyometric training is a form of exercise training designed to increase muscular power. It is a high intensity work out and only well conditioned athletes should use them as training tool and it is used to enhance the ability of muscles to generate power (Chu, 1998). Plyometric training exaggerates the stretch- shorten cycle (SSC), using activities such as jumping, hopping, and bounding. This suggests that plyometric training improves the ability of muscles to return elastic energy during the SSC. 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 movements (concentric phase), which enables muscles to work together in doing the particular motion (Goran, 2007).

Maximum strength is the ability to act against resistance. It is, in fact, a product of voluntary muscle contractions caused by the neuro-muscular system (Singh, 1991). Strength is one of the most important components of physical fitness, which affects performance in almost all games and sports in some form or the other. The primary objective of strength in training is not to learn to lift as much weight as possible but to increase strength for application to the relevant sport (Uppal, 1984). Leg strength is the capacity of the lower limb to exert muscular force (Baugartner & Jackson, 1987). The strength of a muscle related to its sectional area or girth.). In this study the leg dynamometer is the instrument used to measure the leg strength.

MATERIALS AND METHOD

The aim of the study was to determine the effects of resistance training and plyometric training on maximum strength among college male students. Forty five male (n=45) students studying under graduation from Department of Education, Annamalai university, Tamil Nadu were selected as subjects and the age of students were between 18 and 22 years. The selected subjects were randomly divided into three equal groups of fifteen subjects each (n=15). The groups were resistance training group (RTG), plyometric training group (PTG) and one control (CG). During the training period, the experimental groups underwent their respective training programme for eight weeks 3 days per week and a session on each day apart from their regular activities. Control group (CG) was not participating in any specific training. Moderate intensity (60-70%) of resistance was used in this experimentation. Leg strength was selected as dependent variable for this study. It was measured by using leg lift with dynamometer. These are the exercise used as a resistance 1.bench press 2. half squat 3.push press 4. heel raises 5.arm curl 6.leg curl 7.leg press 8. military press 9.sit ups. These plyometric exercises are used to perform this study for strengthening the lower body 1. drop jump; 2. tuck jump; 3. split jump; 4. bounding; 5. single leg hop; 6. hurdling; 7. medicine-ball

exercises. The pre and post test were conducted one day before and after the experimental treatment

Data Analysis

Mean and standard deviation were calculated for maximum strength for 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 post hoc test to determine the significant difference between the paired mean. Statistical significance was fixed at 0.05 levels.

RESULTS

Table - I

Analysis of Covariance on Maximum Strength of Experimental Groups and the Control Group

Test	RTG	PTG	CG	SOV	SS	df	MS	F
Pre-test								
Mean	82.8	83.2	83.53	B G	4.04	2	2.02	0.05
S.D (±)	5.49	8.06	6.21	W G	1870.53	42	44.54	
Post-test								
Mean	99.47	89.8	84.87	B.G	1654.71	2	827.36	15.8*
S.D (±)	8.93	6.69	5.72	W G	2199.87	42	52.38	
Adjusted Post-test								
Mean	99.57	89.79	84.77	B G	1693.7	2	846.85	16.75*
				W G	2072.52	41	50.55	

*****Significant, F = (df 2, 42) (0.05) = 3.22; ($P \leq 0.05$), F = (df 2, 41) (0.05) = 3.225; ($P \leq 0.05$)

Table I shows that the pre test mean of experimental and control groups are 82.8, 83.2 and 83.53 respectively. The obtained F ratio of 0.05 for pre test mean is lower than the table value 3.22 for df 2 and 42 required for significance at 0.05 level. The post tests mean of experimental and control groups are 99.47, 89.8 and 84.87 respectively. The obtained F ratio of 15.8 for post test mean is higher than the table value 3.22 for df 2 and 42 required for significance at 0.05 level. The adjusted post test mean of experimental and control groups are 99.57, 89.79 and 84.77 respectively. The obtained F ratio of 16.75 for adjusted post test mean is higher than the required table value 3.225 for df 1 and 41 required for significant at 0.05 level. The result of the study indicated that there was a significant difference between the adjusted post tests mean of resistance training group, plyometric training group and control group on maximum strength at 0.05 levels. Since, three groups were compared, whenever they obtained 'F' ratio for adjusted post test was

found to be significant, the Scheffe's test was used to found out the paired mean difference and it was presented in Table II.

Table II

Scheffe's post hoc test for the difference between paired mean on maximum strength

RTG	PTG	CG	MD	CI
99.57	89.79		9.78*	
99.57		84.77	14.8*	6.59
	89.79	84.77	5.02	

*Significance at 0.05 level of confidence ($p \leq 0.05$).

Table II showed that the adjusted post test mean difference on maximum strength between resistance training group and plyometric training group and resistance training group and control group are 9.78 and 14.8 respectively. These values are higher than the required confidence interval value of 6.59, which shows significant difference at 0.05 level of confidence. The results of the study showed that there was a significant difference between resistance training group and control group and between two experimental groups. However there was insignificant difference between plyometric training group and control group. The pre, post and adjusted post test mean values of experimental groups and control group on maximum strength were graphically represented in the figure 1.

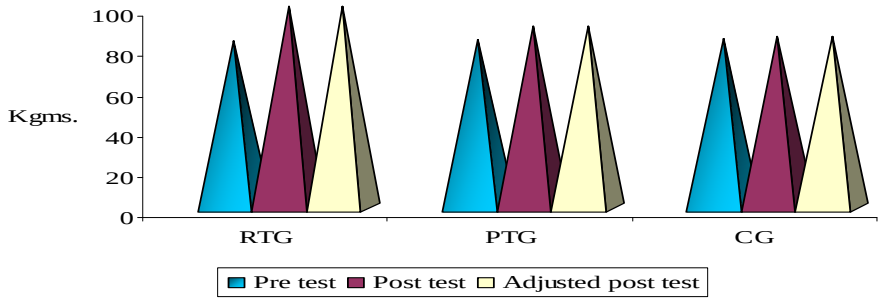

Figure 1: The pre, post and adjusted post test mean values of experimental groups and control group on maximum strength

DISCUSSION

The resistance training group demonstrated greater increases in maximum strength compared with the control group. Plyometric training is not enough to help to improve maximum strength at significant level. Many research studies revealed that the use of different training loads elicits different training adaptations and further it indicate that it

also includes the volume specific adaptations in strength variable (Christou, 2006, and Sewall & Micheli, 1996). 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). Teixeira *et al*. (2001) pointed out that resistance training three times per week is an effective as five times per week. The development of leg strength as a result is supported by the findings of Robert *et al.* (2002), Sandor *et al*., (2009) and Sankaranarayanan *et al*., (2011). The various training components (E.g. sets, repetitions, rest, intervals) could be manipulated the training loads used from the most important factor that determine the training stimuli and the consequent training adaptations(Myer *et al*., 2006 & Jones *et al*.,2001). From the results, it is concluded that the dependent variables such as maximum strength was significantly improved due to the moderate intensity resistance training.

CONCLUSION

The result of this study suggests that resistance training modality targets the maximum strength. Any practical application requires careful implementation and individual experimentation. In summary, the leg strength can be improved during the age between 18 and 22 years of male students and favour the prescription of moderate intensity resistance training programme during the initial adaptation period. There was also a significant difference between resistance training group and plyometric training group. From this study we can concluded that resistance training is the best method to improve maximum strength and plyometric training is not a suitable training for improving maximum strength at significant level.

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