Recent Research in Science and Technology 2011, 3(3): 107-110
ISSN: 2076-5061
www.recent-science.com

PHYSICAL EDUCATION AND SPORTS SCIENCES

PROGRESSIVE, FLUCTUATED AND REGRESSIVE RESISTANCE TRAINING AND ITS IMPACT ON LOWER EXTREMITY STRENGTH

P.S. Sankaranarayanan[1*], George Abraham[2] and Gobind Singh[3]

[1]*Associate Professor, Department of Physical Education, S.N.M Training College, Mahatma Gandhi University, Kerala– 683 516, India*
[2]*Assistant Professor, Department of Physical Education and Sports Sciences, Annamalai University, Tamil Nadu – 608 002, India*
[3]*Associate Professor, Department of Physical Education, Guru Nanak College, Moga, Punjab-142 001, India*

Abstract

The purpose of the study was to analyze the progressive, fluctuated and regressive resistance training and its impact on lower extremity strength. Eighty physically active and interested high school students (N=80) were randomly selected as subjects and their age ranged between 14 and 18 years. The selected subjects were randomly assigned into four equal groups with twenty subjects each (N=20). Group I was involved with progressive resistance training (PRG), group II was given fluctuated resistance training (FRG), group III was given regressive resistance training (RRG) and group IV acted as control (CG). 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 curriculum. Leg strength was taken as variable for this investigation. The pre and post test were conducted one day before and after the experimental treatment. Analysis of covariance (ANCOVA) was used to analyze the collected data. Scheffe's test was used as a post hoe test to determine which of the paired mean difference significantly. The results revealed that progressive and fluctuated resistance training (PRG and FRG) produced significant difference ($P \leq 0.05$) on leg strength as compared to control group (CG). However regressive resistance training (RRG) produced insignificant difference ($P \geq 0.05$) on leg strength as compared to control group (CG).

Keywords: Progressive resistance, Fluctuated resistance, Regressive resistance, Leg strength

Introduction

Resistance training programme has gained popularity in recent years. It act as an integral part of a total strength and conditioning programme for the enhancement of athletic programme and also prescribed by major health organizations, recreational and clinical communities for improving health, fitness and also in rehabilitation. (Pearson *et al*., 2000 & ACSM, 2002). Resistance training programme for adolescent age group, are generally similar (Fleck & Kraemer, 2004). The latest research indicates that the adolescents can increase muscular strength as a consequence of strength training. 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). Reports indicated that resistance training may improve motor performance; strength of the muscles, ligaments and bones in youth (Faigebaum, 2001).Some studies have reported that loads of 60 – 80% of 1 repetition maximum (IRM) 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 (Sale *et al*., 1990, Stone & Coulter, 1994 & Weiss *et al*., 1999).

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 (Henwood & Taafee). In this study the leg dynamometer is the instrument used to measure the leg strength. The capacity of 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).

Methods

The purpose of the study was to analyze the progressive, fluctuated and regressive resistance training and its impact on lower extremity strength. Eighty(N=80) physically active and interested high school students of Syrian Christian Seminary Higher Secondary School, Tiruvalla, Kerala were selected as subjects and the age of students were between 14 and 18 years. The selected subjects were randomly divided into four equal groups of twenty subjects each (N=20). The groups were three experimental and one control. During the training period, the experimental groups

* Corresponding Author, *Email*: profgeorgeabraham@gmail.com

underwent their respective training programmes apart from their curriculum. Group I have given progressive resistance training (PRG), group II underwent fluctuated resistance training (FRG), group III was engaged with regressive resistance training (RRG) for three days per week for eight weeks. The duration of training section in all days was approximately two hours. Group IV acted as control (CG), who did not participate in any specific training. Leg strength was selected as independent variable for this study. It was assessed by using leg dynamometer. All the subjects of the training groups initially performed thorough warming up exercises. Before the commencement of the experimentation, the investigation recorded 1RM for all the three experimental groups taking each subject separately. The experimental groups I, II and III performed the resistance training at different velocity. The volume and load was calculated through the number of sets, repetition and intensity used for each exercise and it was measured in kilograms. The intensity ranged from 65 to 100 percentages. In this study 5% of intensity was increased for every week for progressive resistance training group (RRG), in fluctuated resistance training (FRG) the intensity was increased and decreased of 5% in every alternative week and for the regressive resistance training (RRG) 5% of intensity was gradually decreased in every week over the training period. The percentage of volume and velocity for progressive, fluctuated and regressive resistance training groups presented in table I.

Table I. Percentage of volume and intensity of training for experimental groups

Groups	Components	Weeks							
		I	II	III	IV	V	VI	VII	VIII
Progressive resistance	Intensity	65	70	75	80	85	90	95	100
	Repetitions	12 to 14	10 to 12	8 to 10	6 to 8	4 to 6	2 to 4	1 to 2	1
	Sets	2	2	2	2	3	3	3	3
Fluctuated resistance	Intensity	70	65	80	75	90	85	100	95
	Repetitions	10 to 12	12 to 14	6 to 8	8 to 10	2 to 4	4 to 6	1	1 to 2
	Sets	2	2	2	2	3	3	3	3
Regressive resistance	Intensity	100	95	90	85	80	75	70	65
	Repetitions	1	1 to 2	2 to 4	4 to 6	6 to 8	8 to 10	10 to 12	12 to 14
	Sets	2	2	2	2	3	3	3	3

Data analysis

Mean and standard deviation were calculated for leg 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. All analysis was carried out using SPSS version (Field, 2000) and statistical significance was set to priority at $p<0.05$.

Results

Table II. Analysis of covariance for leg strength of experimental groups and control group

ADJUSTED POST TEST MEAN				SOV	SS	df	MS	'F'
PRG	FRG	RRG	CG					
102.3	103.09	98.14	92.37	BG	1444.18	3	481.39	6.66*
				WG	5421.56	75	72.29	

*Significant F = (df 3, 75) (0.05) = 2.74, ($p \leq 0.05$)

From the table II, the adjusted post test mean values of leg strength for progressive, fluctuated and regressive resistance training groups and control group are 102.30, 103.09, 98.14 and 92.37 respectively. The obtained 'F' value of 6.66 for adjusted post test mean is higher than the table value of 2.74 for df 3 and 75 required for significance at 0.05 level of confidence. Hence there exist significant difference in leg strength among the experimental groups and control group. Since, four groups were compared, whenever obtained 'F 'value for adjust post test was found to be significant, Scheff's test was used to fount out the paired mean difference and it was present in table III.

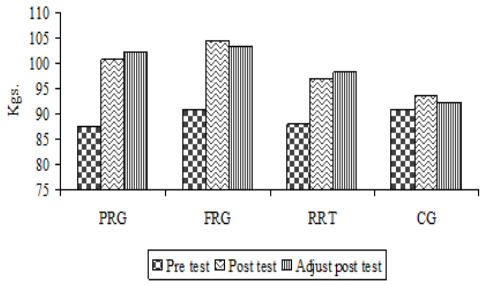
Table III. Scheffe's post hoc test for the difference between paired mean on leg strength

ADJUSTED POST TEST MEAN				MD	CI
PRG	FRG	RRG	CG		
102.3	103.09	-	-	0.79	7.71
102.3	-	98.14	-	4.16	
102.3	-	-	92.37	9.93*	
-	103.09	98.14	-	4.95	
-	103.09	-	92.37	10.72*	
-	-	98.14	92.37	5.77	

* Significant, ($p \leq 0.05$)

Table III showed that the adjusted post test mean difference on leg strength between progressive resistance training group and control group, fluctuated resistance training group and control group are 9.93 and 10.72 respectively. These values are higher than the required confidence interval value of 7.71, which shows significant difference at 0.05 level of confidence. However there was no significant difference between regressive resistance training group and control group. It also showed that there was no significant difference between three experimental groups. The pre, post and adjust post test mean values of experimental groups and control group on leg strength were graphically represented in the figure 1.

Fig. 1: The pre, post and adjusted post test mean values of experimental groups and control group on Leg Strength



Discussion

Strength variables are considered as one of the main determinants of athletic performance. The improvement of muscle power and successful performance in emergencies need a high level of fitness of respiratory system, cardio-vascular system and physiological components. 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, Kraemer & Ratemess, 2004 and Sewall & Micheli, 1996). Ramsay *et al.* (1990) and Macaluso & Vito (2004) conducted a study on the effect of varying resistance training loads on intermediate and high velocity specific adaptations and concluded that heavier training loads increases 1RM strength in the lower bodies of resistance trained athletes. 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) & Hunder *et al*. (2001). 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 of the present study and literature, it is concluded that the dependent variables such as leg strength was significantly improved due to the influence of progressive and fluctuated resistance training.

Conclusion

Any practical application requires careful implementation and individual experimentation. In summary the leg strength, there was significant difference occurred between progressive and fluctuated resistance training groups and control group. However there was no significant difference between regressive resistance training group and control group. There was insignificant difference between experimental groups on leg strength, in which the fluctuated resistance training is the top followed by progressive resistance training group, regressive resistance training group and control group. It is concluded that the FRT is best for leg strength as compared to control group.

References

American college of sports medicine (2002). Progression models in resistance training for healthy adults. *Med. Sci. Sports Exercises*; 364-380.

Andera Macaluso & Giuepp De Vito. (2004). Muscle strength, power and adaptation to resistance training in older people, *European Journal of Applied Physiology*, 91, pp.450-472.

Faigenbaum, A. D. (2001). Strength training and children's health. *JOPERD*;70(3):24

Field, A. (2000). *Discovering Statistics Using SPSS for Windows,* London: Sage Publications

Fleck, S. J., & W. J. Kraemer (2004). Designing resistance training programme (3rd Ed), Champaign, IL: Human Kinetics.

Gonzalez Badillo, J.J., Izquierdo, M., & Gorostiaga, E.M. (2006). "Moderate Volume of High Relative Training Intensity Produces Greater Strength Gains Compared with Low and High Volumes in Comparative Weightlifters". *Journal of Strength and Conditioning Research,* 20(1), 73-81.

Gray, R. Hunder., Carla, J. Wetzstein., Charles, L. Mclafferty., Paul, A. Zukerman., Kathlene, A. Landers., & Marcas, M. Bamman. (2001). Higher resistance versus variable resistance in older adults, *Medical Science Sports Exercise*, Vol. 33(10), pp.1759-1764.

Gregory, D. Myer., & Eric, J. Wall. (2006). Resistance training in the young athletes. *Journal of Operative Technique in Sports Medicine,* Vol. 14(3), pp. 218-230.

Guy, J.A & L. J Micheli. (2001). Strength training for children and adolescents. *Jounal of American Academic Orthopaedic Surgen*, 9(1): 29- 36.

Johnson Barry L., & Jack, K. Nelson. (1982). *Practical Measurement of Evaluation in Physical Education.* Delhi: Surjeet Publications.

Jones, K., Bishop, P., Hunter, G., & Fleising, G. (2001). "The Effects of Varying Resistance Training Loads on Intermediate and High Velocity Specific Adaptations". *The Journal of Strength and Conditioning Research,* 15: 3.

Kraemer, W.J., & Ratamess, N.A. (2004). *Fundamentals of Resistance Training: Progression and Exercises Prescription,* Medicine and Science in Sports and Exercise.

Losnegard, T., K, Mikklsen., B. R. Ronnested., J. Hallen., B. Rud., & T. Raastad. (2010). The effect of heavy resistance training on muscle mass and physical performance in elite cross country skiers, *Scandinavian Journal of Medicine & Science in Sports.*

Marios Christou. (2006). Effects of resistance training on the physical capacities of adolescent soccer players, *The Journal of Strength and Conditioning Research,* Vol. 20(4), pp. 281-288.

Newton Robert, U., Hakkinen Keijo., Hakkinen Arja., Mccormick Matt., Volek Jeff & Kraemer William, J. (2002). Mixed methods resistance training increases power of strength of young and older men, *Medicine and Science in Sports & Exercis*e Vol. 34(8), pp.1367-1375.

Pearson, D., A. Faigenbaun., M. Conley., & W. J. Kraemer (2000). The Nationalstrength and conditioning association's basic guidelines for the resistance training of athletes. *Journal of Strength and Conditioning*, 22(4): 14-27.

Ramsay, J., Blimkie, C., Smith,K., Garner, s., & MacDougall.J. (1990). Strength training effects in prepubescent boys. *Medicine & Science in Sports & Exercise*, 22, 605-614.

Sale, D. G., I Jacobs., J.D. MacDougall,. & S. Garner.(1990). Comparison of two regimens of non current strength and endurance training. *Med. Sci. Sports Exercises*; 22(3): 348-356.

Sewall, L., & Micheli. (1986). Strength training for children. *Journal of Pediatric Orthopedics*, 6, 143-1456.

Stone, W. j., & S.P. Coulter. (1994). Strength/ endurance effects from three resistance training protocols with women. *Journal of Strength and Conditioning Research*, 8: 231-234.

Teixeira, M.S., Silva, E.B., Santos, C.B., & Gomez, P.S. (2001). "Effect of Resistance Training with Different Sets and Weekly Frequencies on Upper Body Muscular Strength in Military Males 18 Years of Age". *Medicine and Science in Sports and Exercises,* 33: 5.

Tim, R. Henwood., & Dennis, R. Taafee. (2006). Short term resistance training and the older adults: the effect of varied programme for the enhancement of muscle strength and functional programme, *Clinical Physiology and Functional Imaging*, 26, pp.305-313.

Weiss, L. W., H. D. Coney., & F. C, Clark. (1999). Differential functional adaptations to short term low moderate and high repetition weight training. *Journal of strength and conditioning Research*; 13: 236-241.