International Journal of Yoga, Physiotherapy and Physical Education
Online ISSN: 2456-5067; Impact Factor: RJIF 5.24
www.sportsjournal.in
Volume 2; Issue 4; July 2017; Page No. 99-101

Effect of low volume circuit training on lower body muscular endurance in collegiate women

[*1] Dr. B Arun, [2] Mahadevi Bharathi

[1] Professor, K.G. College of Physiotherapy, Coimbatore, Tamil Nadu, India
[2] Lecturer, MAHSA University, Kuala Lumpur, Malaysia

Abstract
Resistance training improves the muscular strength, power, endurance and speed. Muscle endurance is one of the important components to the person which prevent from early fatigue. Although there are different form of exercises to improve the endurance there is no strong evidences exists. Studies have shown that women are having poor muscle endurance. The aim of the study was to find out the effect of low volume resistance training on lower limb muscle endurance in collegiate women. 62 women were selected for the study, which fits in the inclusion criteria. They all divided into control group who receive general exercises and experimental group who receives low volume resistant training. Study was conducted for 8 weeks and the leg muscle endurance was used as outcome measure. The results were computed using SPSS 21.0 version. The study results show that there was significant difference in the leg muscle endurance between the experimental group and the control group. The low volume resistance training group produces better results than the general exercises group.

Keywords: low volume circuit training, general exercises, lower body muscle endurance, leg press, collegiate women

Introduction
Resistance training is a variety of physical activity that is intended to improve the muscular fitness. It has been extensively used to improve the fitness and sports performances. It also demonstrated that to augment maximum strength, power and jumping ability in individuals [1, 2]. Resistance training has become one of the important components in women fitness.
Reduction of lower and upper body isometric and dynamic muscle strength is a consequence of ageing process [3]. There is a loss of muscle mass which results from decrease in number of muscle fibers and atrophy of muscle fibers [4, 5]. Decline of muscle quality of the lower body has been proposed as another consequence of the aging process [6].
Well-designed resistance training is an efficient method of mitigating several impairments related to the aging process via increase in muscular strength, muscle mass, maximal voluntary activation of the muscles [7, 8]. Resistance work can also improve tendon and ligament strength and increase bone density, effects which should help to lower injury rates.
Low volume circuit training is a combination of high intensity aerobics and resistance training designed to be easy to follow. It involves formation of a single set per exercises using relatively moderate to long repetition duration. [9, 10]. Low volume circuit resistance training provides an overload cardio respiratory system, taxes muscular system by forcing it to work against increased resistance, forces the key joints involved in moving body to go through a wider range of motion leading to more powerful performance.
Several studies have compared effect of low volume with high volume and have contradictory results [11]. Some studies has identified that there was no difference between the two and other has show differences [12, 13]. However the effect of low volume resistance training was not extensively evaluated and the studies showing only with the low volume are very less. Thus the aim of the study was to identify the effect of low volume resistance training on lower limb muscle endurance in collegiate women.

Methodology
Study is a quasi-experimental study with 62 participants was selected using convenience sampling method with the age group range from 22-32 years. The participants with BMI of 20—25 kg/m2 with no history of resistance training and they don't have any cardiovascular, neurological or musculoskeletal problems. A detailed description about the study was given to all the individuals and informed consent was obtained from the participants. This study was approved by institutional ethical committee. All the participants were divided randomly into two equal groups 31 in each group using lottery method. Control group receives general exercises for 30 minutes which include walking for 10 min's in a same pace, general body stretching, and gentle exercises. Experimental group receives low volume circuit resistance training which includes leg curl, seated rowing, standing calf raise, curl sit-up, military press, leg curl lateral raise, seated calf raise, knee extension, and hip abduction and adduction. All these exercises should be done for 30 min's in a circuit manner. All the exercise sessions started with general exercises which include slow running and stretching and ended with a 5-minute cool-down which includes the same as stretching and slow running. Overall the whole session will cover 60 min's. The exercises were done in alternative days. All the participants were advised to consume lot of water to prevent dehydration, since the study was done in summer. Leg muscle endurance was evaluated using leg press repetitions. Pretest scores of their lower limb endurance were measured using leg press exercises at the beginning of the test and following 8 weeks of programmer post test of leg press was measured. Data were described using descriptive statistics and the result of the study were analyzed using T-test

for dependent samples and it was used to compare changes in the leg muscle endurance within groups before and after the training period, and t-test for independent samples was used to compare differences between groups at the 0.05 significance level.

Results

Baseline characteristic of the 62 participants were detailed in the Table 1

Table 1: baseline characteristic of the participants

Age Group	No of participants	Percentage	Mean value
22-24	13	21%	27.59±2.89
25-27	17	27%	
28-30	21	34%	
31-32	11	18%	

The analysis of the lower limb muscle endurance was evaluated using leg press repetitions. The analysis is shown in Table 2 the pretest and posttest value with the t values.

Table 2: Mean, S.D and the Paired 't' value for the control and experimental group

Groups	Pre	Post	t value	P value
Experimental Group	31.2±1.19	56.4±2.78	43.9	0.0001
Control Group	31.4±1.17	39.9±1.12	32.7	0.0001

The result of the study shows that there was a significant difference obtained between the pretest and the post test in the groups. Both the group was improved following training.

The analysis of the lower limb muscle endurance is shown in Table 3 the posttest value with the t values.

Table 3: Mean, and the unpaired 't' value for the control and experimental group

Groups	Post	t value	P value
Experimental Group	56.4±2.78	30.9	0.0001
Control Group	39.9±1.12		

The result of the study shows that there was a significant difference obtained between the groups. The experimental group produces significant changes in the lower extremity muscle endurance when compared with the control group. This study confirms that the experimental group improves significantly and the low volume circuit training produces a significant improvement in the lower limb muscle strength when compared with the general exercised group.

Discussion

The aim of the study was to find out the effect of low volume circuit training on lower body muscular endurance in collegiate women. Resistance training plays an integral part in health and fitness concern. Exercise training is accompanied by metabolic adaptation that occurs in skeletal muscle tissue and facilitates oxidation of fatty acids during exercise. Exercise increase flex of fatty acids through smaller pools of adipose energy [14].

Muscle strengthening is improved by various hormonal changes. Testosterone is a well known potent androgenic anabolic hormone in both men and women. Resistance training has shown physiologic adaptation to hormone and cause changes in neuromuscular system [15]. Strengthening cause increase of force production which is related to various mechanisms like supraspinal adaptations, changes in the maximal motor unit discharge rate and changes ate the whole muscle and single fiber levels [16, 17].

Improvements in muscle performances appear to occur for one of the following reasons a) neural adaptation which cause increase in the activation of synergistic muscles, b) motor unit recruitment and discharge rate c) decreased activation of antagonist muscles [18] d) alterations in muscle architecture. Low volume circuit resistance training is a combination of high- intensity aerobics and resistance training designed to be easy to follow concentration on fat loss, muscle building and heart fitness, which influence the athletes body composition, muscular performance and health status of the individual. This well suits for improving aerobic endurance or fat burning and increase body strength with stamina [19].

In this present study low volume circuit training has shown marked differences in the pretest and posttest values which are well supported by the studies done by various other authors also. Another study done by McBride *et al*., [20] evaluated the effect of low volume with high volume training on EMG activity. Following 12 weeks of exercises there are significant changes in the EMG findings and the data suggests that there were significant neural adaptations obtained following low volume exercises [21]. The study was limited with few restriction which includes other functional abilities can be assessed in future studies. The gender differences can be compared in the future study.

Conclusion

The study concludes that the low volume circuit resistance training will produce a significant improvement in the lower limb muscle endurance in collegiate women. This training can be imparted without any specific equipments which improves the ability of the muscle to work for longer time.

Acknowledgement

Thanks to all the participants and the faculties for their support and guidance.

Conflict of interest: NIL

References

1. Danneels LA, Vanderstraeten GG, Combier DC, Witvrouw EE, Bourgois J, Dankaerts W, *et al.* Cuyper HJ. Effects of three different modalities on the cross sectional area of the lumbar multifidus muscle in patients with chronic low back pain. British Journal of Sports Medicine. 2001, 35: 186-191.
2. Tricoli V, Lamas L, Carnevale R, Uprinowitsch C. Short term effects of lower body function power development: Weightlifting vs. vertical jump training program. Journal of Strength and Conditioning Research. 2005, 19: 433-437.
3. Klein CS, Rice CL, Marsh GD. Normalized force, activation, and co-activation in the arm muscles of young and old men. J. Appl. Physiol. 200191, 1341-1349.
4. Aagaard P, Suetta C, Caserotti P, Magnusson SP, Kjaer M. Role of the nervous system in sarcopenia and muscle atrophy with aging: strength training as a countermeasure. Scand. J. Med. Sci. Sports 2010; 20, 49–64.

5. Andersen JL. Muscle fiber type adaptation in the elderly human muscle. Scand. J. Med. Sci. Sports 2003; 13:40-47.
6. Arts IM, Pillen S, Schelhaas HJ, Overeem S, Zwarts MJ. Normal values for quantitative muscle ultrasonography in adults. Muscle Nerve 2010; 41:32-41.
7. Ivey FM, Roth SM, Ferrell RE, Tracy BL, Lemmer JT, Hurlbut DE, *et al.* Martel GF, Siegel EL, Fozard JL, Jeffrey Metter, E., Fleg, J.L., Hurley, B.F.,. Effects of age, gender, and myostatin genotype on the hypertrophic response to heavy resistance strength training. J. Gerontol. A Biol. Sci. Med. Sci. 2000; 55:M641-M648
8. Tracy BL, Ivey FM, Hurlbut D, Martel GF, Lemmer JT, Siegel EL, *et al.* Metter EJ, Fozard JL, Fleg JL, Hurley BF. Muscle quality. II. Effects of strength training in 65- to 75-yr-old men and women. J. Appl. Physiol, 1999; 86:195-201.
9. Darden E. The New High Intensity Training. Rodale; 2004.
10. Bryzcki M. A Practical Approach to Strength Training. Blue River Press; 2012.
11. Kemmler WK, Lauber D, Engelke K, Weineck J. Effects of single- vs. multipleset resistance training on maximum strength and body composition in trained postmenopausal women. J. Strength Cond. Res. 2004; 18, 689-694
12. Bottaro M, Veloso J, Wagner D, Gentil P. Resistance training for strength and muscle thickness: effect of number of sets and muscle group trained. Sci. Sports 2011; 26, 259-264.
13. Cannon J, Marino FE. Early-phase neuromuscular adaptations to high- and low volume resistance training in untrained young and older women. J. Sports Sci. 2010; 28, 1505-1514.
14. Askew FW. Role of fat metabolism in exercise. Clin Spors Med 1984; 3(3)605-21.
15. Vingren JL, Kraemer WJ, Ratamess NA, Anderson JM, Volek JS, Maresh CM. *et al.* Testosterone Physiology in Resistance Exercise and Training The Up-Stream Regulatory Elements. Sports Med 2010; 40(12):1037-1053
16. Falvo MJ, Sirevaag EJ, Rohrbaugh JW, Earhart GM. Resistance training induces supraspinal adaptations: evidence from movement-related cortical potentials. Eur. J. Appl. Physiol. 2010; 109:923-933.
17. Kamen G, Knight CA. Training-related adaptations in motor unit discharge rate in young and older adults. J. Gerontol. A Biol. Sci. Med. Sci. 2004; 59:1334-1338.
18. Aagaard P. Training-induced changes in neural function. Exerc. Sport Sci. Rev. 2003; 31:61-67.
19. Bezern. The Performance of Female Athletes Physical Education Essay Internet. Accessed 12 Aug 17; Available from: https://www.bezern.com/read-power-161188.htm. 2013
20. McBride JM, Blaak JB, Triplett-McBride T. Effect of resistance exercise volume and complexity on EMG, strength, and regional body composition. Eur. J. Appl. Physiol. 2003; 90:626-632.
21. Cannon J, Marino FE. Early-phase neuromuscular adaptations to high- and low volume resistance training in untrained young and older women. J. Sports Sci. 2010; 28:1505-1514.