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Effects of Circuit Training Combined with Different Neuromuscular Activities on Muscular Endurance and Body Composition of School Girls

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Abstract

Background: Due to the lack of physical activity now a day's many youngsters are having health issues to do their regular activities. Muscular endurance and proper body composition are important to enable the person to carry out different type of day to day activities and sport activities all over the life time. The sport training is the way to develop one's health and physical fitness to live a healthy.

Purpose: To identify the 12 weeks training effects of circuit training combined with different neuromuscular activities on muscular endurance and body composition of school girls.

Method: This is an intervention study carried out to compare effects of 4 groups. Group 1 (n=15), who trained circuit training (CT), group 2(n=15), who trained circuit training combined with resistance band (CT-RB), group 3(n=15), who trained circuit training combined with skipping rope (CT-SR) and group-4(n=15) control group (CG). The pre and post test data was collected for the muscular enduranceand body composition.

Results: The difference between pre and post test was significant ($p< 0.05$) in the intervention groups and insignificant ($p>0.01$) in control group.

Conclusion: The circuit training combined with resistance band and skipping rope produced greater improvement on muscular endurance and reduced percentage of body composition

Keywords: *Circuit training, Resistance band, Skipping Rope, Muscular endurance, Intervention.*

Introduction

Dramatic physiological and psychological changes occur in childhood and adolescence period. This is a critical period of life. The lifestyle, healthy and unhealthy behaviors are develops in this stage. These may influence health behaviors in adult stage. The detailed reviews have conversed about the associations between physical activities and its consequences on health in childhood and adolescence .[1-6]

Now a day's fitness is considered as most important health indicators in childhood.[7] The concept of physical fitness has since evolved to include morphological and metabolic components.[8] Thus, in the previous decades a number of countries have been promoting physical fitness development among young people in different mode.[9] In many situation, schools have been measured the best setting in which children with small fitness levels can be recognized and a healthy lifestyle can be carry out.[7] It is acknowledged that preparation of long-term fitness programme is one of the most excellent ways to improve fitness components.[10] However in the Physical Education setting these programme cannot lost the entire course or a large part of it since many curricular contents should be developed in a school year.[11] Therefore, in the physical education setting we require to find short-term programme that could be also helpful for the growth of physical fitness. An excellent methodology that meets these criteria could be the circuit training.[12-14] This training efficiently reduces the

time devoted to training while allowing and sufficient training volume to be achieved.[15] Furthermore, it allows a higher motor engagement time.[16] Adding together, this methodology has multilevel effects on fitness, particularly in beginners.[15, 12, 17]

Circuit training is often erroneously portrayed as an intensive and stressful form of exercise, with a drill sergeant type in the middle of a circuit bellowing orders at weary recruits. Circuit training is a very versatile and adaptable mode of training that requires the performance of a series of carefully selected exercises. The use of resistance bands and cords as a form of exercise is becoming increasingly popular.[18] In this study, the resistance band and skipping rope training have chosen as a neuromuscular activity.

Resistance band and cords are an effective complement or alternative to any strength and power training workout. Like other strength training exercises, these bands and cords can provide strength gains in both muscle and bones by providing resistance.[19] Rope jumping is one of only a few inexpensive, highly portable and easily learned fitness and sports training exercises that require the precise coordination of several muscle groups. [20]

Method

Participants: Sixty healthy school girls children, 12-14 years old (13.10+0.38 years; body mass 45.29+10.45 kg; body height 1.40+0.03 m; body mass index 18.35+2.90 kg/m^2) from ADW Higher Secondary School participated in this study. Children and their legal guardians were fully informed about all the features of the study and were required to sign an informed consent form. The Departmental Research Committee of the Department of Physical Education, Alagappa University approved the study protocol.

Study Design: The sixty school girls were divided into three experimental and one control group. The experimental group 1, 2 and 3 were performed circuit training, circuit training combined with resistance band and circuit training combined with skipping rope respectively. The subjects performed their training interventions for the period of 12 weeks. The control group did not entertain any specific type of activity.

Data Collection: The muscular endurance was tested by sit ups test; this is a standardized test for assessing the muscular endurance. The body composition was tested by BMI calculation. The data on muscular endurance and body composition was collected from the participants before and after the training interventions.

Statistics: The analysis of variance was used to analyze the pre and post test development in the groups. The analysis of covariance was used to find the adjusted post test mean differences among the groups. The pair wise comparisons were made by Scheffe's Post Hoc test.

Results

Muscular Endurance:

Table 1: Showing the analysis of co-variance on the parameter of muscular endurance (Measures in Counts)

	CT	CT-RB	CT-SR	CG	F	p value
Pre test (M±SD)	11.26+0.79	11.0+0.92	11.2+0.94	11.13+0.91	0.24	0.87
Post test (M±SD)	12.73+0.59	14.66+0.72	14.86+0.74	10.53+0.51	144.6*	0.00
Adjusted post test Mean	12.71	14.69	14.85	10.53	155.5*	0.00

CT-Circuit training, CT-RB- Circuit training combined with resistance band, CT-SR- Circuit training combined with skipping rope, CG-Control group, M= Mean, SD=Standard Deviation; *=Significant, p=Significance level from one way analysis of covariance, Significant at $p< 0.01$, Insignificant at $p>0.05$

The table-1 shows the statistical end results of pre, post and adjusted post test on muscular endurance of different groups. The results proved that, the pre test mean values show the insignificant ($F=0.24$, $p>0.05$) effect on muscular endurance among the groups. Further, the results show that post and adjusted post test show significant differences (Post test $F=144.6$, $p< 0.05$ and Adjusted Post test $F=155.5$, $p< 0.05$) on muscular endurance among the groups. Finally, the analysis shows that there was a significant positive improvement on muscular endurance of difference groups.

The table 2 shows the pair wise comparisons of Scheffe's Post Hoc test.

Table 2: Pair wise comparisons muscular endurance

Groups	Mean Differences	Scheffe's (p value)
CT and CT-RB	1.98*	0.000
CT and CT-SR	2.14*	0.000
CT and CG	2.17*	0.000
CT-RB and CT-SR	0.15	1.000
CT-RB and CG	4.61*	0.000
CT-SR and CG	4.31*	0.000

The table 2 shows the pair wise comparisons on muscular endurance of different groups.

- The results proved that there was a significant differences were found in CT and CT-RB, CT and CT-SR, CT and CG, CT-RB and CG, CT-SR and CG.
- Insignificant difference was found between CT-RB and CT-SR.

Body Composition:

Table 3: Showing the analysis of co-variance on the parameter of body composition (Measures in Percentage)

	CT	CT-RB	CT-SR	CG	F	p value
Pre test (M±SD)	24.05±0.49	24.03±0.45	24.03±0.49	24.02±0.45	0.006	0.99
Post test (M±SD)	23.81±0.43	23.50±0.17	23.13±0.07	24.2±0.44	29.47*	0.00
Adjusted post test Mean	23.81	23.51	23.13	24.2	42.22*	0.00

CT-Circuit training, CT-RB- Circuit training combined with resistance band, CT-SR- Circuit training combined with skipping rope, CG-Control group, M= Mean, SD=Standard Deviation; *=Significant, p=Significance level from one way analysis of covariance, Significant at $p< 0.01$, Insignificant at $p>0.05$

The table-3 shows the statistical end results of pre, post and adjusted post test on body composition of different groups. The results proved that, the pre test mean values show the insignificant ($F=0.006$, $p>0.05$) effect on body composition among the groups. Further, the results show that post and adjusted post test show significant differences (Post test $F=29.47$, $p< 0.05$ and Adjusted Post test $F=42.22$, $p< 0.05$) on body composition among the groups. Finally, the analysis shows that there was a significant positive alteration on body composition of difference groups.

The table-4 shows the pair wise comparisons of Scheffe's Post Hoc test.

Table 4: Pair wise comparisons body composition

Groups	Mean Differences	Scheffe's (p value)
CT and CT-RB	0.3*	0.019
CT and CT-SR	0.68*	0.000
CT and CG	0.38*	0.001
CT-RB and CT-SR	0.37*	0.002
CT-RB and CG	0.69*	0.000
CT-SR and CG	1.1*	0.000

The table-4 shows the pair wise comparisons on body composition of different groups.

The results proved that there was a significant differences were found in CT and CT-RB, CT and CT-SR, CT and CG, CT-RB and CT-SR, CT-RB and CG, CT-SR and CG.

Discussions

In this study, circuit training combined with different neuromuscular activities for 12 weeks have significantly improved the capacity of muscular endurance and decreased the percentage of body composition. The training produced relative effect between the study groups. The muscular endurance was better improved in circuit training combined with resistance band and circuit training with skipping rope training than the other training group. The body composition was better altered in the circuit training with skipping rope training than the other training groups.

We confirmed that, twelve weeks of circuit training combined with different neuromuscular activities (i.e.,

resistance band and skipping rope) significantly improved the muscular endurance compared to the control group. The percentage of improvement on muscular endurance for circuit training was 10.03%, circuit training combined with resistance band was 33.27% and circuit training combined with skipping rope training was 32.67%. From the results CT-RB and CT-SR produced more or less same effect on muscular endurance than CT. Both the trainings are suitable for the improvement of muscular endurance. The earlier studies on muscular strength and endurance reveals that 12 weeks of combined exercise or 8 weeks of high intensity circuit training improve the muscular endurance, grip and back strength in obese women.[21] Abdominal muscular endurance and cardio vascular endurance in school children were developed due to the circuit training program.[22] The circuit training alone develops the muscular strength and power better than combined training of resistance and endurance training.[23] We think that the improvement is due to the different type of circuit exercises and neuromuscular activities applied with the time, duration, intensity and recovery. Findings of this study indicate that the circuit training with neuromuscular activities for the period of 12 weeks improves the muscular endurance. The circuit training with different neuromuscular activities is useful for the development of muscular endurance in school going students.

We established that, twelve weeks of circuit training combined with different neuromuscular activities (i.e., resistance band and skipping rope) significantly decreased the body composition compared to the control group. The percentage of improvement on body composition for circuit training was 1.0%, circuit training combined with resistance band was 2.2% and circuit training combined with skipping rope training was 3.7%. From the results CT-SR greatly decreased the body composition than the CT-RB and CT. The previous study findings are in line with the findings of the present study. The positive effects of circuit strength training on body composition parameters were observed.[24] The moderate intensity of circuit resistance training increases lean body mass, bone mineral density and reduces body fat percentage.[25] The circuit weight training and aerobic exercise for the period of 12 weeks resulted in positive effects on body composition.[26] In the present study, the alteration of body composition was due to the gradual increase of intensity of exercise, frequency, repetition and rest of circuit exercises and neuromuscular activities.

Conclusion

In this study, results showed that the circuit training with the combinations of neuromuscular activities conveyed positive effects on the improvement of muscular endurance and reduction of body composition. It improves the health fitness components and helped in the prevention of lifestyle diseases in school students.

The present training protocols very much beneficial for school going children for the anatomical adaptation. Once children well developed in the anatomical adaptations, it leads to the better improvement of health and skill related components of physical fitness. Future studies may be attempted in this area with other training parameters.

Conflict of Interest: Nil

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Ethical Clearance: The Departmental Research Committee of the Department of Physical Education, Alagappa University approved the study protocol.

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