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Original Research Article

Effect of Circuit Training Combined with Speed Agility Quickness Drills and Jump Rope Drills on Upperbody Muscular Endurance

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Abstract

The purpose of study was to find out the effect of two modes of circuit training on muscular endurance in term of upper body of school boys. To achieve the purpose of the study, thirty school boys from different schools from of Alagappa Sports Foundation at Karaikudi, were selected as subject at random. Their age group range between 11 to 14 years. The study was formulated as pre and post test random group design, in which thirty subject were divided into three equal groups. The experimental group-1 (n=10, CT-SAD) underwent circuit training combined with speed agility quickness drills, the experimental group-2 (n=10, CT-JRD) underwent through circuit training combined with Jump Rope Drills and group 3 served as a control group (n=10, CG) did not undergo any specific training. In this study, two training programme were adopted as independent variable, i.e., circuit training combined with speed agility quickens and circuit training combined with jump rope drills. The physical fitness variable muscular endurance in term of upper body was selected as dependent variable. It was measured by push-up measured in counts. The selected two treatment groups namely circuit training combined with speed agility quickens drills and circuit training combined with jump rope drills were performed five days in a week for the period of six weeks, as per the stipulated training program. The muscular endurance in term of upper body was collected before and after the training period. The collected pre and post test data was critically analyzed with apt statistical tool of analysis of co-variance, for observed the significant adjusted post-test mean difference of three groups. The Scheffe's post hoc test was used to find out pair-wise comparisons between groups. To test the hypothesis 0.05 level of significant was fixed. The performance of the muscular endurance in term of upper body is similar in circuit training combined with the jump rope drills and the circuit training combined with speed agility and quickness drills.

Keywords: 1.Circuit Training (CT) 2.Speed Agility Quickness (SAQ) 3.Jump Rope Drills (JRD) 4. Muscular endurance in term of upper body.

INTRODUCTION

Although toddler and young children nearly always seem to be rushing about, it does not take long for them to develop the habit of slumping in front of the television as soon as they get home from school. In addition, many schools are now devoting less time to sports due to lack of staff with proper physical education training, especially in primary schools. In some schools, there has been a tendency to concentrate on the minority who are good at sport, while neglecting the rest (Maniazhagu and Malar 2021). In other schools, there have been moves to reduce the amount of competitive sport; because some educationalists believe that children who constantly lose may suffer long term psychological harm. The increased levels of violence in society have also led to many children not being allowed to play unsupervised in urban areas. The combined effect of all these various factors is that today's youngsters are involved in less day-to-day physical activity than previous generations (Maniazhagu, Soniya James and Malar 2017). The in active life style of many of today's children is likely may suffer as a result. All children should take regular exercise because of it reduces their risk of developing

heart disease in later life. Activity produces many other benefits too. Fit children have strong muscles, which are very important for good posture and stable joints; they have better balance, coordination, flexibility, and excel in skill related fitness components; and they are less likely to fracture bones, as exercise increases bone density. Apart from the obvious physical benefits, regular exercise produces many more subtle skills. Children who take part in physical activities learn how to interact and cooperate with other children. They also develop their own self –esteem by creating a strong sense of purpose and self – fulfillment. Their initial circuit training routine consisted of several stations arranged in a circle so as to work muscle groups alternately from station to station.

As circuit training grew in popularity, other authors began to provide additional information (Maniazhagu, and Sudha, 2020). Hence the researcher made an attempt to find out the effect of circuit training combined with speed agility quickness drills and jump rope drills on upper body muscular endurance of school boys.

METHODOLOGY

The study was formulated as pre and post test random group design, in which thirty subject were divided into three equal groups. The experimental group-1 (n=10, CT-SAD) underwent circuit training combined with speed agility and quickness drills, the experimental group-2 (n=10, CT-JRD) underwent through circuit training combined with Jump Rope Drills and group 3 served as a control group (n=10, CG) did not undergo any specific training. The selected two treatment groups were performed five days in a week for the period of six weeks, as per the stipulated training program.

TRAINING APPROACHES FOR EXPERIMENTAL GROUP 1-(CT-SAQ)

Nature of training variables	1-2 weeks	3-4 weeks	5-6 weeks
Total number of station	8 stations	8 stations	8 stations
Duration of each station	15 seconds	15 seconds	25 seconds
Exercise order	Clock wise	Clock wise	Clock wise
Rest in between station	15 seconds	20 seconds	25 seconds
Total number of circuit	3 circuit	3 circuit	3 circuit
Rest in between circuit	5 minutes	5 minutes	5 minutes
Duration of one circuit	2 minutes	2 min &40 sec	3 min 20 sec
Volume of the week	30 minutes	36 minutes	50 minutes

SAQ DRILLS

Activity 1-2 weeks	Repetition	Sets	Rec- in between repetition	Rec- in between sets
Standing stationary arm swing	Each 30 sec	3	1 min	3 min
Running Balance				
Ladder Speed Run				
Run Through				
Crossover Skipping				
T-Drill				
Figure Eights				
Icky Shuffle				
Reaction Arm Sprints				
One –Handed Tap Drills With Partner				
Medicine Ball Bull in a Ring				
Wheelbarrow Drills				
Activity 3-4 weeks	**Repetition**	**Sets**	**Rec- in between repetition**	**Rec- in between sets**
Standing stationary arm swing	Each 45 sec	3	1 min	3 min
Running Balance				
Ladder Speed Run				
Run Through				
Crossover Skipping				
T-Drill				
Figure Eights				
Icky Shuffle				
Reaction Arm Sprints				
One –Handed Tap Drills With Partner				
Medicine Ball Bull in a Ring				
Wheelbarrow Drills				

Activity 5-6 weeks	Repetition	Sets	Rec- in between repetition	Rec- in between sets
Standing stationary arm swing	Each60 sec	3	1 min	3 min
Running Balance				
Ladder Speed Run				
Run Through				
Crossover Skipping				
T-Drill				
Figure Eights				
Icky Shuffle				
Reaction Arm Sprints				
One –Handed Tap Drills With Partner				
Medicine Ball Bull in a Ring				
Wheelbarrow Drills				

TRAINING APPROACHES FOR EXPERIMENTAL GROUP – II (CT-JRD)

Nature of training variables	1-2 weeks	3-4 weeks	5-6 weeks
Total number of station	8 stations	8 stations	8 stations
Duration of each station	15 seconds	15 seconds	25 seconds
Exercise order	Clock wise	Clock wise	Clock wise
Rest in between station	15 seconds	20 seconds	25 seconds
Total number of circuit	3 circuit	3 circuit	3 circuit
Rest in between circuit	5 minutes	5 minutes	5 minutes
Duration of one circuit	2 minutes	2 min &40 sec	3 min 20 sec
Volume of the week	30 minutes	36 minutes	50 minutes

JUMP ROPE DRILLS

Activity (1-2 weeks)	Repetition	Sets	Rec- in between repetition	Rec- in between sets
High step	Each 60 sec	3	1 min	3 min
Alternate –foot step				
Forward straddle				
The bounce step				
Bell jump				
Forward shuffle				
Back ward shuffle				
Half twist				
Full twist				
X foot cross				
Arm side swing				
Arm crossover				
Activity (3-4 weeks)	**Repetition**	**Sets**	**Rec- in between repetition**	**Rec- in between sets**
High step	Each 75 sec	3	1 min	3 min
Alternate –foot step				
Forward straddle				
The bounce step				
Bell jump				
Forward shuffle				
Back ward shuffle				
Half twist				
Full twist				
X foot cross				
Arm side swing				
Arm crossover				
Activity (5-6 weeks)	**Repetition**	**Sets**	**Rec- in between repetition**	**Rec- in between sets**
High step	Each 90 sec	3	1 min	3 min
Alternate –foot step				
Forward straddle				
The bounce step				

Bell jump				
Forward shuffle				
Back ward shuffle				
Half twist				
Full twist				
X foot cross				
Arm side swing				
Arm crossover				

Table I: The Results of Analysis of Covariance on Muscular Endurance in the Term of Upper Body of Different Groups (Scores in counts)

Test Conditions		Group 1 CT-SAQ	Group 2 CT-JRD	Group 3 CG	SV	SS	Df	MS	'F' Ratio
Pre test	Mean	12.90	12.80	12.70	B	0.20	2	0.10	0.80
	S.D.	1.64	0.60	0.64	W	34.60	27	1.28	
Post test	Mean	15.10	14.90	13.00	B	26.87	2	13.43	9.59*
	S.D.	0.94	1.04	1.34	W	37.80	27	1.40	
Adjusted post test	Mean	15.05	14.90	13.05	B	24.86	2	12.43	10.62*
					W	30.49	26	1.17	

* Significant at .05 level of confidence. The required tables value for test the significance was 3.35 and 3.37with the df of 2 and 27, 2 and 26.

The pre test mean and standard deviation on muscular endurance in the term of upper body scores G1, G2, and G3 were 12.90+1.64, 12.80+0.60 and 12.70+0.64 respectively. The obtained pre test F value of 0.08 was lesser than the required table F value 3.35. Hence the pre test means value of circuit training combined with speed agility quickness and circuit training combined with jump rope drills on muscular endurance in the term of upper body before start of the respective treatments were found to be insignificant at 0.05 level of confidence for the degrees of freedom 2 and 27. Thus this analysis confirmed that the random assignment of subjects into three groups were successful. The post test mean and standard deviation on muscular endurance in the term of upper body of G1, G2 and G3 were15.10+0.94, 14.90+1.04 and 13.00+1.34 respectively. The obtained post test F value of 9.59 was higher than the required table F value of 3.35. Hence the post test means value of circuit training combined with speed agility quickness and circuit training combined with jump rope drills on muscular endurance in the term of upper body were found to be significant at 0.05 level of confidence for the degrees of freedom 2 and 27. The results proved that the selected two training interventions namely circuit training combined with speed agility quickness and circuit training combined with jump rope drills on muscular endurance in the term of upper body were produced significant improve rather than the control group of the sample populations. The adjusted post test means on muscular endurance in the term of upper body scores of G1, G2 and G3 were 15.05, 14.90 and 13.05 respectively. The obtained adjusted post test F value of 10.62 was higher than the required table F value of 3.37. Hence the adjusted post test means value of circuit training combined with speed agility quickness and circuit training combined with jump rope drills on muscular endurance were found to be significant at 0.05 level of confidence for the degrees of freedom 2 and 26. The results confirm that the selected two training interventions namely circuit training combined with speed agility quickness and circuit training combined with jump rope drills on muscular endurance were produced significant difference among the groups. In order to find out the superiority effects among the treatment and control groups the Seheffe's post hoc test were administered. The outcomes of the same are presented in the Table II.

Table II: The Results of Scheffe's Post HOC Test Mean Differences on Mascular Endurance in Term of Upper Body among Three Groups (Scores in counts)

Group 1 CT-SAQ	Group 2 CT-JRD	Group 3 C G	Mean Differences	Confidence Interval Value
15.05	14.90		0.15	0.28
15.05		13.05	2.01*	0.28
	14.90	13.05	1.85*	0.28

* Significant at .05 level of confidence.

Result of Scheffe's post hoc test on muscular endurance in term of upper body:

Table II, shows the paired mean differences of circuit training combined with speed agility quickness and circuit training combined with jump rope drills and control group on muscular endurance in term of upper body. First comparison: Group 1 and Group 2: The pair wise mean difference of group 1 and group 2 values 0.15 was lesser than the confidential value of 0.28. Hence the first comparison was not significant. The results of this comparison clearly proved that both training have produced similar effect on muscular endurance in the term of upper body. Second comparison: Group 1 and Group 3: The pair wise mean difference of group 1 and group 3 values 2.01was higher than the confidential value of 0.28. Hence the second comparison was significant. The results of this comparison clearly proved that circuit training combined with speed agility quickness have produced greater improvements on muscular endurance in the term of upper body than the control group. Third comparison: Group 2 and Group 3: The pair wise mean difference of group 2 and group 3 values 1.85 was higher than the confidential value of 0.28. Hence the third comparison was significant. The results of this comparison clearly proved that circuit training combined with jump rope drills have produced greater improvements on muscular endurance in the term of upper body than the control group.

Discussion of muscular endurance (Upperbody)

After analyzing the statistical end results the researcher found that the selected training groups have significantly improved the quality of muscular endurance in the term of upper body from the base line to post intervention.

The pre to post intervention was present as follows. Circuit training combined with speed agility drills group from pre (12.90+ 1.64),to post(15.10+0.94) and circuit training combined with jump rope drills group from pre (12.80+0.60) to post (14.96+1.04) have significantly changed the pre to post results. The present study demonstrates an increase in speed performance of 0.022% and 0.021% for circuit training combined with speed agility quickens and circuit training combined with jump rope drills respectively. Schmidt W, Anderson K, Graff M, Strutz V. (2015), they found that the high intensity circuit training may improve muscle endurance in moderately fit populations. Slight improvements that are gender specific may also be observed in muscle strength as well as aerobic fitness. Atul Meethal* and Dr. A. M. Najeeb (2013) their study proved that the mud circuit training group had improved the speed, agility, leg explosive power, pulse rate, blood pressure, and aerobic capacity to a greater degree than concrete circuit training group. Taşkin, Halil (2009) conducted a study on effect of circuit training on the sprint-agility and anaerobic endurance. Their study shows that the circuit training, which is designed to be performed 3 days a week during 10 weeks of training, improves sprint-agility and anaerobic endurance. The major findings of earlier studies were given briefly here for comparison with the present findings. Moran, Blagrove, Drury, Fernandes, Paxton, Chaabene, Ramirez-Campillo (2019) investigated a study on effects of small-sided games vs. conventional endurance training on endurance performance in male youth soccer players: a meta-Analytical Comparison. Small-sided games are as effective as conventional endurance training for increasing aerobic endurance performance in male youth soccer players. Buchheit M, *et al*. (2008) investigated a study on cardio respiratory responses during running and sport-specific exercises in handball players. They found that cardio respiratory responses during small handball games are inversely related to fitness level, coaches are invited to add specific rules to increase the activity of the fittest players. (Hemambara Reddy, D Maniazhagu, 2015) D. Maniazhagu (2019) found that the low and moderate intensities of aquatic plyometric training combined with yogic practices have improved the anaerobic capacity of junior athletes. James Zachariah, D Maniazhagu (2014) conducted a study on comparative effects of different sprint training on anaerobic power. They found that the acceleration sprinting influenced to a great extent on anaerobic power performance. Sridhar, Maniazhagu and Revathi, (2011) found that agility is the key components of the performance of sprint, middle and long distance performance. Study findings from effects of asana practices and stretching exercises combined with neuromuscular drills on cardio respiratory endurance of school girls revealed that the capacity of cardio respiratory endurance was better in asana practices combined with neuromuscular drills. (Maniazhagu, Soniya James, Malar, 2018) Susana *et al*., (2018) examined a study on Short-Term Recreational Team Handball-Based Programme on Physical Fitness and Cardiovascular and Metabolic Health of 33-55-Year-Old Men. They found that Recreational team handball practice shows positive physical fitness and health-related adaptations, with high attendance, which may contribute to the reduction of the risk of developing lifestyle diseases. In another research findings individual and combined interventions of Tai Chi pilates and yogic practices on cardio respiratory endurance of B.Ed trainees showed that the above training produced significant improvement on cardio respiratory endurance. (S Leo Stanly, Maniazhagu Dharuman, 2020).In another study findings shows that handball coaching program had significant improvement than control group in selected Physical Fitness and Skills performance variables (T. Madhankumar and Mebaratu, 2016) A study findings showed that the circuit resistance training have imporved motor fitness variables in men foot ball players. (V Senthil Kumar and D Maniazhagu, 2014) Study results of effects of integrative neuromuscular training on fitness performance in children indicate that

integrative neuromuscular training is an effective and time-efficient addition to PE as evidenced by improvements in health- and skill-related fitness measures in children. Schmidt W, Anderson K, Graff M, Strutz V. (2015), they found that the high intensity circuit training may improve muscle endurance in moderately fit populations. Slight improvements that are gender specific may also be observed in muscle strength as well as aerobic fitness. Atul Meethal* and Dr. A. M. Najeeb (2013) their study proved that the mud circuit training group had improved the speed, agility, leg explosive power, pulse rate, blood pressure, and aerobic capacity to a greater degree than concrete circuit training group. Taşkin, Halil (2009) conducted a study on effect of circuit training on the sprint-agility and anaerobic endurance. Their study shows that the circuit training, which is designed to be performed 3 days a week during 10 weeks of training, improves sprint-agility and anaerobic endurance. Physical activities are systematic, planed rhythmic bodily movements aimed to improve physical fitness. (S. Malar, D. Maniazhagu, 2019) Plyometric exercises consist of speedy prevailing movements that involve counter movements or pre stretch. It also called stretch shortening cycle.

CONCLUSION

The results of this study indicate the performance of the muscular endurance in the term of upper body significantly improved over six weeks training period for circuit training combined with speed agility quickens drills and circuit training combined with the jump rope drills. The selected two training intervention namely circuit training combined with speed agility quickens drills and circuit training combined with the jump rope drills produce similar effect on muscular endurance in the term of upper body.

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