

INFLUENCE OF CIRCUIT TRAINING ON STRENGTH ENDURANCE AMONG HIGH SCHOOL BASKETBALL PLAYERS

Siju P. John¹ & Dr. George Abraham²

¹Ph. D Research Scholar, Tamil Nadu Physical Education and Sports University, Chennai,
Tamil Nadu, INDIA

²Research Supervisor and Principal, YMCA College of Physical Education, Chennai – 35,
Tamil Nadu, INDIA

Abstract

The purpose of this study was to find out the influence of circuit training on strength endurance among high school basketball players. Thirty male students ($n = 30$) were randomly selected as subjects and their age ranged between 14 and 17 years. They were randomly divided into two equal groups such as experimental group (*EG*) and control group (*CG*) with fifteen subjects each ($n = 15$). The experimental group underwent circuit training for eight weeks three days per week and a session on each day. Control group was not exposed to any specific training apart from their curriculum. Strength endurance was selected as criterion variable for this study and it was measured by using bent knee sit ups. Analysis of covariance (*ANCOVA*) was applied as statistical tool. In all cases 0.05 level of confidence was fixed to test the significance, which was considered as an appropriate. It was concluded from the result of the study that there was a significant improvement ($p \leq 0.05$) due to circuit training on strength endurance as compared to control group.

Keywords: Circuit training, strength endurance, high school students, basketball players.

Introduction

Physical fitness is nowadays considered as one of the most important health markers in childhood (Ortega et al., 2008). Consequently, in the last decades several countries have been promoting physical fitness improvement among young people in different ways (Department of Health and Human Services, 1990). In many circumstances, schools have been considered the best setting in which children with low fitness levels can be identified and a healthy lifestyle can be promoted (Ortega et al., 2008). Therefore, one of the main strategies of the government was focused on modifying school health a more important role in the Educational System. Schools are mainly attempting to increase the pupils' health level by using measures

such as the improvement of their physical fitness through physical education (PE) (Ciencia, 2006).

It is known that planning long-term fitness programs is the best way to improve these components (Donnelly et al., 2009). Circuit training is an everlasting and evolving training exercise program that was developed by R.E. Morgan and G.T. Anderson in 1953 at the University of Leeds in England (Kravitz, 1996). The term circuit refers to a number of carefully selected exercises arranged consecutively. In the original format, 9 to 12 stations comprised the circuit. This number may vary according to the design of the circuit. Each participant moves from one station to the next with little (15 to 30 seconds) or no rest, performing a 15- to 45-second work-out of 8 to 20 repetitions at each station (using a resistance of about 40% to 60% of 1RM). The program may be performed with exercise machines, hand-held weights, elastic resistance, calisthenics or any combination. The circuit training effectively reduces the time devoted to training while allowing an adequate training volume to be achieved (Ramón et al., 2008). Moreover, it permits a greater motor engagement time (Lozano et al., 2009), which is a very important requirement for the success of a PE program.

The term circuit training describes the way a workout is structured rather than the type of exercise performed. It typically consists of a series of exercises or stations completed in succession with minimal rest in between. Circuit routines allow the athlete or coach to create an endless number of workouts and add variety to routine training programs. Through circuit training the athletes may increase their strength and endurance by increasing the repetitions of exercise at each station or by doing the required frequencies of exercise in a shorter length of form. If the work load is kept constant, the athletes can develop strength and endurance by gradually decreasing the time taken to go through the circuit. Circuit training is a program in which an athlete moves from one exercise station to another planned sequence and in the shortest possible form. In planning a circuit training programme exercises are chosen to fit the needs of the individuals each of these exercises is numbered and assigned to a certain area called station.

Strength endurance is the specific form of strength displayed in activities which require a relatively long duration of muscle tension with minimal decrease in efficiency" (Stiff, 2000).

Sports that involve strength endurance are numerous from the rower to the swimmer to the wrestler on the mat. Even these examples are differentiated by the abilities expressed, dynamic or static, general or local strength endurance.

Materials and Methods

The purpose of this study was to investigate the eight weeks of circuit training and its influence on strength endurance of high school basketball players. Thirty ($n = 30$) male basketball players from St. Francis higher secondary school Mattom, Thrissur, Kerala, were selected as subjects and the age of students were between 14 and 17 years. The selected subjects were randomly divided into two equal groups of fifteen subjects each ($n = 15$). The groups were one experimental group (*EG*) and one control (*CG*). During the training period, the experimental groups underwent their respective training programme for eight weeks 3 days per week. Control group (*CG*), who did not participate in any specific training. Strength endurance was selected as dependent variable for this study. It was measured by bent knee sit-ups. These are the exercises used as a circuit 1. Jumping jacks, 2. Burpees, 3. Crunches, 4. High knee, 5. Half squat, 6. Triceps dips, 7. Butt kicks, 8. Superman, 9. Push-ups, 10. Lunges. The collected data were statistically examined by analysis of covariance (ANCOVA). The confidence level was fixed at 0.05 levels, which is appropriate to the present study.

Results and Discussion

Table - I
Analysis of Covariance on Strength endurance of Training Group and the Control Group

Test		Training Group	Control Group	SOV	SS	df	MS	F
Pretest	Mean	18.40	17.66	B	4.03	1	4.03	.423
	SD	3.52	2.58	W	266.93	28	9.53	
Post test	Mean	26.00	18.13	B	464.13	1	464.13	69.22*
	SD	2.20	2.92	W	187.73	28	6.705	
Adjusted Post test	Mean	22.067	18.13	B	412.79	1	412.79	99.97*
				W	111.48	27	4.12	

$F = (df 1, 28) (0.05) = 4.20; (P \leq 0.05), F = (df 1, 27) (0.05) = 4.21; (P \leq 0.05)$

Mean, Standard deviation analysis of covariance (ANCOVA) were used for the analysis of data, and statistical significance was fixed at 0.05 levels. The analysis of covariance on strength endurance among experimental and control group were described in Table 1. The pre test mean values of strength endurance of training and control groups were 18.40 and 17.66. The obtained 'F' value of 0.423 was lesser than the table value of 4.20, there was insignificant among the groups in pre test result of strength endurance. The post test means of the groups were 26 and 18.13 respectively, and the obtained 'F' value of 69.22 was greater than the table value, and there was a significant difference in strength endurance between the training and control groups among the male high school level basketball players. The obtained adjusted post test F value also greater the table value of 4.21 for df 1 and 27 required for significant at 0.05 level.

The pre, post and adjusted post test mean values of training group and the control group of strength endurance was graphically represented in Figure 1.

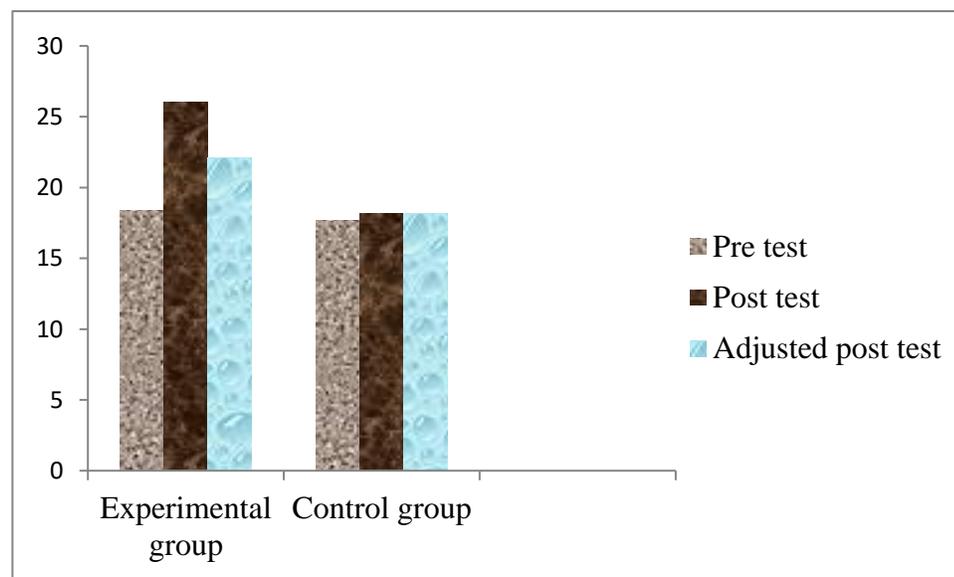


Figure 1: The pre, post and adjusted post test mean values of training group and the control group on strength endurance

The results of this study revealed that there was a significant difference in strength endurance due to eight weeks of circuit training. From the results of the present study and literature, it is

concluded that dependent variable such as strength endurance was significantly improved due to the circuit training.

Circuit training group was improved in abdominal strength endurance. Strength endurance is considered as one of the determinants of sports 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. Pollack *et al.* (1993) and Collin & Snow (1993) pointed out that circuit resistance training is the best method to improve strength endurance. 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) Teixeira *et al.* (2001) pointed out that resistance training three times per week is an effective as five times per week. Waller *et al.* (2011) and Tanaka & Swensen (1998) concluded that the improvement of strength endurance depends on the modalities of resistance training and circuit weight training is helps to improve strength endurance. Resistance exercises are one of the best methods for improving upper body strength endurance, many studies supported to this statement (Hickson *et al.*, 1980, Chtara *et al.*, 2008 & Faigenbaum *et al.*, 1999). 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 variable such as abdominal strength endurance was significantly improved due to the influence circuit resistance training.

Conclusion

The result of the study revealed that the training group has significant improvement in strength endurance among school level basketball players after the circuit training protocol. It was also concluded that the circuit training is one of the best training methods for improving the strength endurance.

The results of the present study show that it is possible to develop strength endurance by means of an eight week circuit training program. With the circuits method the pupils can easily reach the minimum motor engagement time (Lozano et al., 2009) at the same time they execute many types of exercises. This is the best way to make the most of the time at a PE

teacher's disposal, especially when classes are few and short-lasting and there are many contents to develop (Ciencia, 2006). Thus, the present results indicate that the design proposed in this research could be effective for PE classes. Hence the researcher found a statistically significant improvement for strength endurance when the circuit training was complemented with endurance training. In conclusion, the present study suggests that it is possible to develop and maintain strength endurance through a short-term program in the PE setting.

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