REVIEW OF RESEARCH
IMPACT FACTOR : 5.7631(UIF) UGC APPROVED JOURNAL NO. 48514 ISSN: 2249-894X
VOLUME - 8 | ISSUE - 7 | APRIL - 2019

EFFECT OF LOW AND HIGH INTENSITY CIRCUIT TRAINING ON MUSCULAR ENDURANCE AND CARDIO-RESPIRATORY ENDURANCE OF JUNIOR BASKETBALL PLAYERS

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ABSTRACT :

The purpose of the study was to investigate the effect of low and high intensity circuit training on muscular and cardio-respiratory endurance of junior basketball players. One hundred and five junior Basketball players (13-15 years) were selected on a random purposive sampling from Vimla Public School Thodupuzha, Kerala, India. The study was formulated as a factoral design and the subjects (n=105) were equated into three groups (n= 35). Group I served as control, group II was exposed to low intensity circuit training programme, at a sub-maximal load for a period of twelve weeks for three days per week. Group III was subjected to high intensity circuit training programme, for a period of twelve weeks at a sub-maximal load for five days in a week. The effect of low and high intensity circuit training on the junior basketball players were tested before and after the experimental treatment and data was collected on the criterion measures (push-ups, sit-ups, half squat jump and twelve minutes run and walk test). The analysis of co-variance was applied to the data. The initial mean among the group were adjusted with the final means to determine the significant 'F'ratio between the paired mean. The level of confidence was fixed at the 0.05 level of significance. The 'F' ratio was tested for mean significant difference at the 0.05 level of confidence. The Post hoc – test of Scheffi's correction was applied to determine the confidence between the paired mean groups. Our results showed that the circuit training program was effective to increase and maintain both muscular and cardiovascular endurance among basketball players. Further high intensity circuit training program significantly enhanced the endurance of players. Therefore, such study will help physical education teachers design programs that impart physical fitness among basketball players.

KEYWORDS : *Sit-ups,Push-ups,Half squat jump and12 minutes run/walk.*

INTRODUCTION

Sports are integral part of modern society as it makes substantial contribution to the well being of the people. Sports performance is the result and outcome of the overall fitness of the individual(Baby and Moorthy, 2019). Enhanced level of sports performance depends on four areas namely physical power, social adjustment, psychological development and physiological efficiency.

The present day concept of sports has been changed drastically. Recent advances in sports science have tremendously contributed towards human sporting performance at the highest level (Charles et al., 1987; Meyers, 2006) . Circuit training is an exercise program designed to develop overall fitness of an individual (Davis et al., 2011; Giannaki et al., 2016; Mayorga-Vega et al., 2013). It consists of series of training which will improve muscular strength, endurance, cardiovascular fitness and

flexibility(Schmidt et al., 2016). Circuit training program can be completely structured and customized according to the demand and specific outcome of the sport. Incorporation of low and high intensity circuit program offers substantial benefit in improving physical fitness as well as overall health of the individual (Paoli et al., 2013). It enhances the cardiovascular endurance and muscular strength. To our knowledge, no data are available on the role of circuit training on the physical fitness of basketball players. Therefore, the aim of the present study is to understand the effect of low and high intensity circuit training on muscular and cardio-respiratory endurance of junior basketball players.

METHODOLOGY

Sources and selection of subjects

One hundred and five junior Basketball players were selected on a random purposive sampling from Vimla Public School Thodupuzha, Kerela State. The player's age ranged from 13 years to 15 years as per their school records. The selected subjects had the opportunity to represent their school in their inter school Basketball tournament, inter- district matches and tournaments and in a number of open-tournaments in and around Kerala State.

Experimental design

The study was formulated as a factoral design. Based on the bio-variable test such as push-ups test, sit-ups test, half squat jumps test and twelve-minutes run or walk test, the subjects (n=105) were equated into three groups. Group I (n=35) served as a control group, group II was exposed to the effect of low intensity circuit training programme, at a sub-maximal load for a period of twelve weeks for three days per week. Group III was subjected to a high intensity circuit training programme, for a period of twelve weeks at a sub-maximal load for five days in a week. The effect of experimental training programme (i.e., low and high intensity circuit training) on the junior basketball players were tested before and after the experimental treatment on the following selected criterion measures.

(a) Sit-ups.
(b) Push-ups.
(c) Half – squat jump.
(d) 12 minutes run or walk.

Group I was not allowed to participate in the experimental training programmes as they were assigned as the control group.

Group II was termed as an experimental group. These subjects were exposed to a low intensity circuit training schedule for three days in a week. The training was administrated in the evening session for duration of one hour.

Group III was subjected to a high intensity circuit training schedule for five days in a week. The training programme was conducted from Monday to Friday in the evening session for an hour. However both low and high intensity circuit training programmes were scheduled for a period of twelve weeks.

RESULT

Analysis of covariance pre-test (x) and post test(x) on sit-up test

In order to measure the muscular endurance of the abdominal musculature, Sit-Up test was performed. The significant mean difference between adjusted initial means and final means among the control and Low intensity experimental group I and High intensity experimental group II were analysed using ANACOVA and the result was tabulated in table I.

Table 1: Mean difference of the criterion measures for the control and experimental groups

Source of variance	Df	SSx	SSy	SSx.y	SSy.x	MSy.x	**'F' Value**
Between sets	**2**	**11.20**	**370.30**	**59.71**	**269.93**	**134.97**	25.29*
Within sets	**101**	**1875.60**	**2067.54**	**1700.49**	**525.82**	**5.21**	
Total	**103**	**1886.80**	**2437.85**	**1760.20**	**795.75**		

Table values for degrees of freedom 2 and 101 at 0.05 level was 3.09.

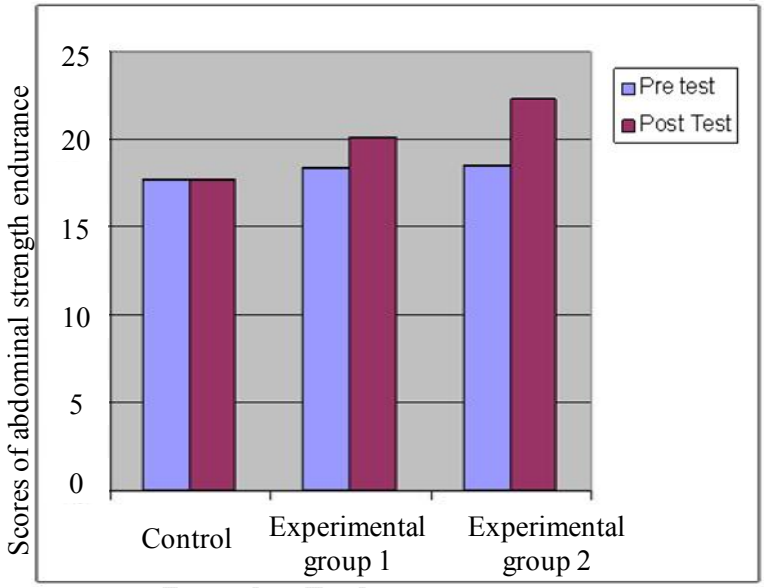

Figure 1: Mean Differences among Control Group, Low Intensity Experimental Group 1 and High Intensity Experimental Group II on Sit-ups.

Results of analysis of covariance are presented in Table I pretest (X) and post test (Y) scores of abdominal strength endurance. The obtained 'F' value was 25.29 which were much greater than the required F value of 3.09 at 0.05 level of confidence. The obtained F was significant at 0.05 level indicating that the 'X' means differ significantly and that the random assignment of the subjects to the groups was not successful. The significant differences may be due to the fact that there was no difference in initial means.

Analysis of covariance pre-test (x) and post test(x) on push-ups test

Next the muscle and endurance of the upper body was assessed by push-up test. The obtained result was tabulated in table 2 and a graph was plotted between scores of push-ups and the different experimental groups.

Table 2: Mean difference of the criterion measures for the control and experimental groups.

Source of variance	Df	SSx	SSy	SSx.y	SSy.x	MSy.x	'F' Value
Between sets	**2**	**8.97**	**207.94**	**-14.66**	**238.82**	**119.41**	77.30*
Within sets	**101**	**732.23**	**689.26**	**624.86**	**156.03**	**1.54**	
Total	**103**	**741.20**	**897.20**	**610.20**	**394.85**		

Table value for degrees of freedom 2 and 101 at 0.05 levels was 3.09.

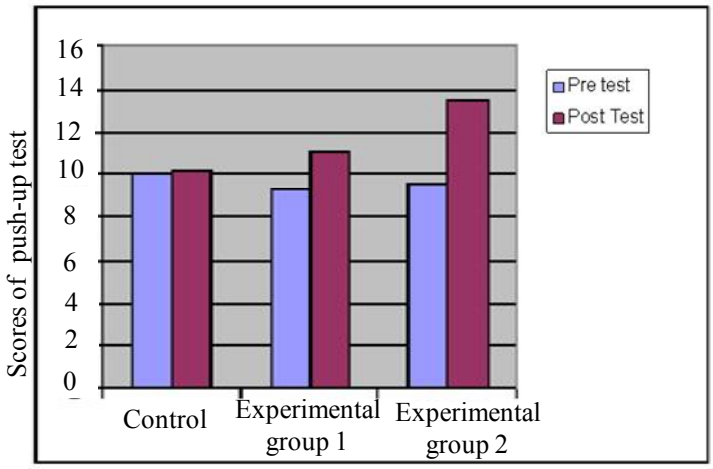

Figure 2: Mean differences among Control Group, Low Intensity Experimental Group 1 and High Intensity Experimental Group II on Push-ups.

Results of analysis of covariance are presented in Table 2 pre-test (X) and post-test (Y) scores of push-ups test. The obtained 'F' value was 77.30 among the control group, low intensity group and high intensity group found to be significant at 0.05 levels. Thus the significant 'F' value in this case indicated that there were no differences in initial means.

Analysis of covariance pre-test(x) and post test(y) on half – squat jump test

Further half squat jump test was employed to assess the lower body power. The obtained result was tabulated in table 3 and a graph was plotted between scores of half-squat jump test and the different experimental groups.

Table 3: Mean difference of the criterion measures for the control and experimental groups.

Source of variance	Df	SSx	SSy	SSx.y	SSy.x	MSy.x	'F' Value
Between sets	**2**	**0.17**	**108.88**	**-3.31**	**115.25**	**57.63**	31.10*
Within sets	**101**	**954.34**	**1032.17**	**898.03**	**187.13**	**1.85**	
Total	**103**	**954.51**	**1141.05**	**894.71**	**302.39**		

Table value for degrees of freedom 2 and 101 at 0.05 levels was 3.09.

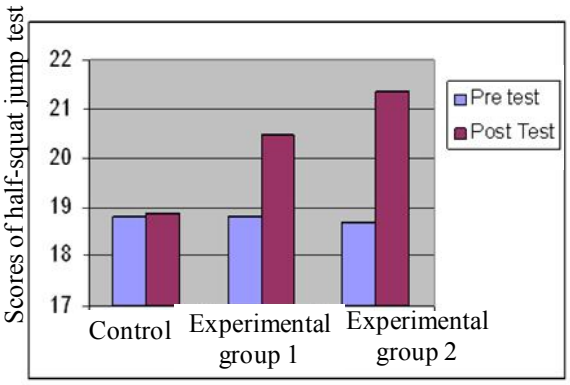

Figure 3: Mean Differences of Control Group, Low Intensity Experimental Group 1 and High Intensity Experimental Group II on Half – squat jump

Results of analysis of covariance are presented in Table 3 pre test (X) and post test (Y) scores of half-squat jump to find out the leg strength endurance. From the table it can be seen that 'F' value of 31.10 for the post test among the control group, low intensity group and high intensity group was found to be significant at 0.05 level thus the significant 'F' value in the case indicated that initial means differed significantly and that the random assignment of the subjects to the group was not successful. There was no real difference in the initial means.

Analysis of covariance pre-test(x) and post test (y) on 12 minutes run and walk test

A 12minutes run and walk test was performed to measure the cardio- respiratory endurance of the players. The obtained result was tabulated in table 4 and a graph was plotted between scores of 12minutes walk and run test and the different experimental groups.

Table 4: Mean difference of the criterion measures for the control and experimental groups.

Source of variance	Df	SSx	SSy	SSx.y	SSy.x	MSy.x	'F' Value
Between sets	**2**	**57940.5**	**1069411.4**	**236264.3**	**658590.5**	**329295.2**	61.04
Within sets	**101**	**6012942.9**	**6256390**	**5860285.7**	**544885.8**	**5394.91**	
Total	**103**	**6070883.3**	**7325801.4**	**6096550**	**1203476.25**		

Table value for degrees of freedom 2+101 at 0.05 levels was 3.09.

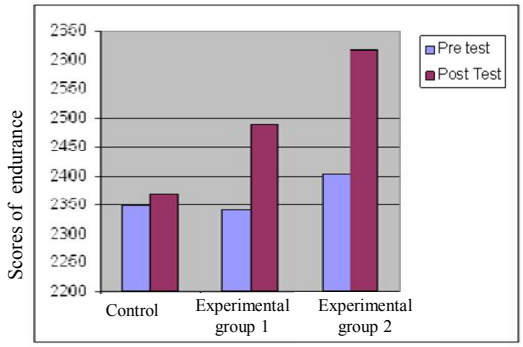

Figure 4: Mean Differences of Control Group, Low Intensity Experimental Group I and High Intensity Experimental Group II on 12 Minutes Run and Walk Test

Results of analysis of covariance are presented in Table 4 pre test (X) and post test (Y) scores of 12 minutes run and walk to find out the cardio- respiratory endurance. From the table it can be seen that 'F' value was 61.04 for the post test among the control group, low intensity group and high intensity group, this was found to be significant at 0.05 level. The significant 'F' value in the case that the test applied to the samples indicated that there were no real differences in the initial means.

DISCUSSION

Circuit training has become an integral part of fitness regime and is considered to play key role in the development of physical fitness in diverse groups of players (Meyers, 2006; Sonchan et al., 2017).

All the subjects of the experimental groups involved in this study had undergone regular low and high intensity circuit training which was assigned to them. From the results it is evident that in case of selected physical fitness variables such as push-ups, sit-ups, half – squat jump, 12 minutes run and walk tests, significant changes were noticed after 12 weeks of low and high intensity circuit training in comparison to control group. The predominant changes on selected physical fitness variables were observed in the experimental groups which had undergone five days low and high intensity training in each week. The experimental groups which were trained for five days of low and high intensity training programme in a week showed significant progress in the physical fitness variables compared to the experimental group which had given three days of low and high intensity training in a week. The experimental group II (five days in a week) has undergone high intensity circuit training programme for five days is a week with sufficient rest period of two days in a week. But the experimental group I have undergone low intensity circuit training three days in a week. This group had taken more rest than the high intensity training group that is why their improvement was lesser after experimental period. The experimental group II had improved all selected physical fitness variables because of the continuity of high intensity training for five days in a week for 12 weeks of duration. All these significant changes were attributed to the fact that as the subjects had undergone the low and high intensity circuit training exercises, the work load improved the selected physical fitness such as push-ups, sit-ups, half – squat jump and 12 minutes run and walk tests performances improved their efficiency. Thus this study helps in understanding the significance of circuit training for gaining endurance among junior basket ball players.

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