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A study of effects of circuit training on selected physical fitness variables of sports persons

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Abstract

The purpose of the study was to explore the effects of Circuit Training on selected physical fitness variables of sportspersons. State level healthy male players of Athletics, Football, Cricket and Hockey were selected for experimentation. Total subjects were 28, ranging 15-19 years of age. All the subjects were divided into two equal groups i.e. Experimental group (n=14) and Control group (n=14). Experimental group was given Circuit training program while Control group was not given any specific training programme. 6 weeks training programme was designed and the subjects were required to attend five days training programme in a week. AAHPER youth fitness test (Revised edition: 1976) was used to collect pre and post test data on selected physical fitness variables. Paired t-test was used to check if any significant difference exists or not between pre and post-test scores of Circuit training group and pre and post test scores of Control group. Independent t-test was employed to check significant difference between pre scores of Circuit training and Control group and post-test scores of Circuit training and Control group and mean, S.D and t-ratio were tested. It was concluded on the basis of results that Circuit training have significant effect on all selected physical fitness variables.

Keywords: Physical Fitness, Circuit training and Sports training

Introduction

Physical fitness is a current issue for physical educationists and researchers to deal with. Level of physical fitness is deteriorating due to advancement in technology and lack of activity and interest towards sports. Physical fitness is equally important for a common man as well as sports person. For a common man physical fitness is the capacity to carry out daily routine activities without undue fatigue and for a sportsperson physical fitness is the ability to bear load of training, strenuous exercises and to meet the demands of competition without undue fatigue. However physical fitness depends upon several factors i.e. genetic makeup, nutrition, sleep, sports training etc. Importance of sports training can't be ignored as "Sports training is a scientifically based and pedagogically organized process which though a planned and systematic method, affects on performance" In fact physical fitness is the balanced development of muscular strength, speed, muscular endurance, muscular co-ordination, flexibility and agility which is outcome of planned training. In modern world sports have become more competitive in nature and new records are being established and old ones are broken. So, proper training is needed to develop the components of physical fitness and to develop foundation of Sports (Indira Gandhi Message (1982) [2].

Physical fitness is a set of attributes related to health or skill that people have or have achieved which is measured with specific tests (C.J. Caspersen, K.E. Powell and G. M. Christensen, 1985) [3]. Circuit training is an organized way of exercising which improves muscular strength, cardio-respiratory endurance, flexibility, body composition and co-ordination etc. Circuit training was devised by R.E. Morgan and G.T. Adamson in 1953 in the university of Leeds (R.E. Morgan and G.T. Adamson, 1961) [1], England in which 9-12 stations were recommended to perform exercises with moderate intensity (40% to 60% of 1RM value) for specified numbers of repetitions or amount of time. In this specialized training students would move to next station with little rest or no rest between exercises (Kravitz L., 1996) [4], Researchers explored that how the increasing intensity of this type of training is beneficial for increasing strength-endurance and heart efficiency.

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Methods and procedures

28 state level healthy male subjects were recruited randomly from Shah Satnam ji Boys School, Sirsa Haryana of 15-19 years of age. The subjects were selected from Athletics, Football, Cricket and Hockey games. Subjects were equally distributed into two group i.e Experimental group/ Circuit training group (n=14) and Control group (n=14). After pre-test Circuit training group was offered selected training programme for 6 week, 5 days a week in the morning session from 6 to 7 am (including warm up, Circuit training and cool down). Every Thursday and Sunday were rest day of every week. A Circuit consisting 8 exercises was designed for Circuit training group which includes on the spot run, alternate toe touch, shoulder press, step up, triceps extension, shuttle run, calf raise with weight and push up. All the subjects were instructed to perform each exercise for 30 seconds and to move on next station without any rest to perform next exercise. 3 sets of Circuit with 50% intensity for first two weeks, 4 sets of Circuit with 60% intensity for 3rd week, 5 sets of Circuit with 60% intensity for 4th week, 3 sets of Circuit with 70% intensity for 5th week and 5 sets of

Circuit with 70% intensity for 6th week were prescribed at 4:1 ratio for training purpose.

Muscular strength (dynamic) and muscular endurance of arms and shoulders, speed and agility, muscular strength and endurance of trunk, explosive strength of legs, speed of lower extremities and cardio-vascular endurance were selected as criterion variables. Subjects were evaluated before and after training programme using modified AAHPER youth fitness test (1976) which contains pull up, 10x4 yards shuttle run, bent knee sit ups, standing broad jump, 50 yards dash, 12 minutes run/walk to test selected criterion variables. After collecting the data Paired t-test was employed to check if any significant difference exists or not between pre and post-test scores of Circuit training group and pre and post test scores of Control group. Independent t-test was used to check significant difference between pre scores of Circuit training and Control group and post-test scores of Circuit training and Control group.

Results and analysis

Table 1: Significance of difference between pre and post test scores of physical fitness of Circuit training group

Sr. no	Test items	Scores	N	Mean	S.D	t-value	Significance
1.	Pull ups	Pre	14	10.43	1.16	-16.13	.001
		Post	14	13.29	0.99		
2.	Bent knee sit ups	Pre	14	32.86	1.79	-24.31	.001
		Post	14	40.00	2.04		
3.	Shuttle run	Pre	14	10.81	0.17	37.86	.001
		Post	14	10.51	0.15		
4.	Standing broad jump	Pre	14	1.96	0.09	34.86	.001
		Post	14	2.04	0.08		
5.	50 yard dash	Pre	14	6.93	0.29	28.31	.001
		Post	14	6.63	0.26		
6.	12 minutes run/walk	Pre	14	2.75	152.29	-29.00	.001
		Post	14	3.00	143.92		

*Significant level =0.05, Table value (df=13) =2.160

The above table clearly evident that the pre and post-test mean scores of pull up ($10.43 \pm 1.16 < 13.29 \pm 0.99$), pre and post mean scores of bent knee sit ups ($32.86 \pm 1.79 < 40.00 \pm 2.04$), pre and post mean scores of shuttle run ($10.81 \pm 0.17 > 10.51 \pm 0.15$), pre and post mean scores of standing broad jump ($1.96 \pm 0.09 < 2.04 \pm 0.08$), pre and post-test mean scores of 50 yard dash ($6.93 \pm 0.29 > 6.63 \pm 0.26$) and pre and post-test mean scores of 12 minutes run/ walk ($2.75 \pm 152.29 < 3.00 \pm 143.92$) which are significant at 0.05 level. It means that there is significant difference between pre and post scores of all the tested items and performance was

significantly increases after Circuit training. It is indicated that $t_{14} = -16.13$ (pull ups), -24.31 (bent knee sit up), 37.86 (Shuttle run), 34.86 (Standing broad jump), 23.31 (50 yard dash) and -29.00 (12 minute run/walk) are significant at 0.05 (i.e $p=0.001$, of all tested items).

It was hypothesized that there will be no significant difference in pre and post test scores of physical fitness of variables of Circuit training group but result shows that significant difference exists in pre and post scores of all tested items. Hence, the null hypothesis was rejected.

Table 2: Significance of difference between pre and post test scores of physical fitness of control group

Sr. no	Test items	Scores	N	Mean	S.D	t-value	Significance
1.	Pull ups	Pre	14	9.79	1.19	-1.794	0.096
		Post	14	10.14	0.95		
2.	Bent knee sit ups	Pre	14	32.14	1.88	-1.794	0.096
		Post	14	32.50	1.61		
3.	Shuttle run	Pre	14	10.83	0.17	1.881	0.082
		Post	14	10.83	0.17		
4.	Standing broad jump	Pre	14	1.97	0.69	-1.793	0.096
		Post	14	1.97	0.68		
5.	50 yard dash	Pre	14	7.01	0.25	0.898	0.385
		Post	14	7.01	0.25		
6.	12 minutes run/walk	Pre	14	2.73	154.35	-2.034	0.063
		Post	14	2.73	154.25		

*Significant level = 0.05, Table value (df=13) =2.160

The above table clearly explains that the pre and post-test mean scores of pull up ($9.79 \pm 1.19 < 10.14 \pm 0.95$), pre and post mean scores of bent knee sit ups ($32.14 \pm 1.88 < 32.50 \pm 1.61$), pre and post mean scores of shuttle run ($10.83 \pm 0.17 > 10.83 \pm 0.17$), pre and post mean scores of standing broad jump ($1.97 \pm 0.69 = 1.97 \pm 0.68$), pre and post-test mean scores of 50 yard dash ($7.01 \pm 0.25 = 7.01 \pm 0.25$) and pre and post-test mean scores of 12 minutes run/walk ($2.73 \pm 154.35 < 2.73 \pm 154.25$) which are not significant at 0.05 level. It means that there is no significant difference between

pre and post scores of all the tested items. It is indicated that $t_{14} = -1.794$ (pull ups), -1.794 (bent knee sit up), 1.881 (Shuttle run), -1.793 (Standing broad jump), 0.898 (50 yard dash) and -2.034 (12 minute run/walk) are not significant at 0.05 because t-value is less than Table value. It was hypothesized that there will be no significant difference in pre and post test scores of physical fitness of variables of control group and result shows that no significant difference was found between pre and post scores of all tested items. Hence, the null hypothesis was accepted.

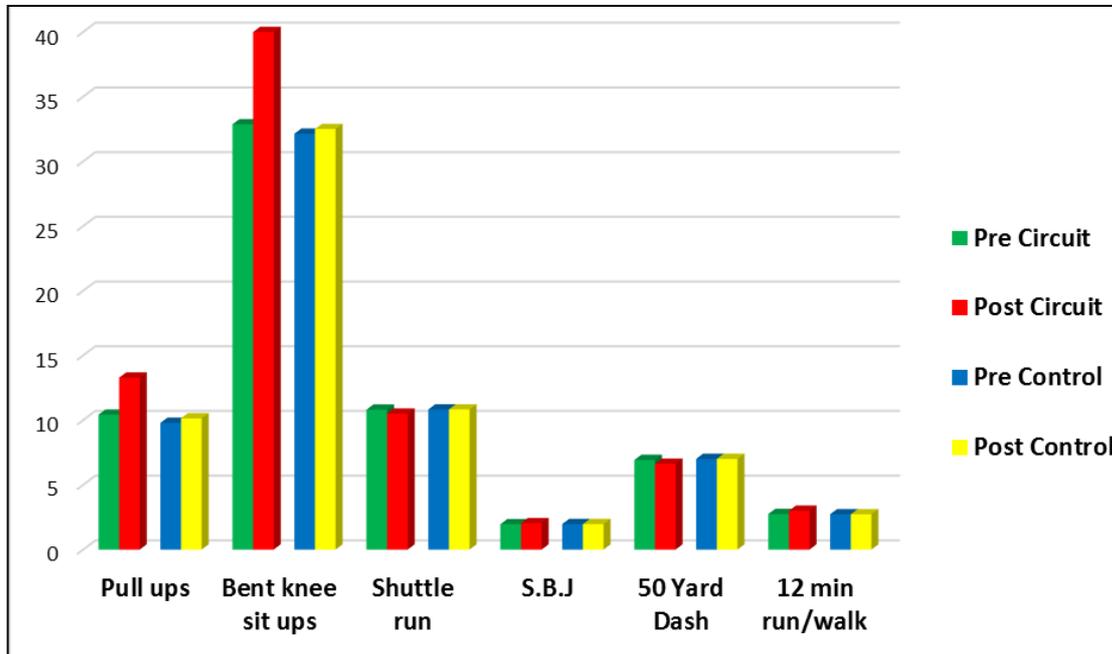


Fig: Comparison of pre and post score of circuit group and Control Group

Table 3: Comparison of significance of difference between circuit training group and control group pre-test scores of physical fitness

Sr. no	Test items	Scores of post test	N	Mean	S.D	S.E.M	t-value	Sig.
1.	Pull Ups	Circuit training group	14	10.43	1.16	0.309	1.450	1.59
		Control group	14	9.78	1.19	0.318		
2.	Bent knee sit ups	Circuit training group	14	32.86	1.79	0.479	1.031	0.312
		Control group	14	32.14	1.88	0.501		
3.	Shuttle run	Circuit training group	14	10.81	0.17	0.046	-0.368	0.716
		Control group	14	10.83	0.17	0.045		
4.	Standing broad jump	Circuit training group	14	1.96	0.09	0.023	0.729	0.774
		Control group	14	1.97	0.07	0.019		
5.	50 yard dash	Circuit training group	14	6.93	0.29	0.078	-0.848	0.404
		Control group	14	7.02	0.25	0.067		
6.	12 minutes run/walk	Circuit training group	14	2.75	152.29	40.70	0.275	0.786
		Control group	14	2.73	154.35	41.25		

*Significant level = 0.05
Table value (df=26) = 2.056

Findings of the study indicates that pull up mean score of Circuit training group (10.43 ± 1.16) is higher than mean scores (9.78 ± 1.19) of Control group. However t value is 1.450 which is not significant (i.e. $p > 0.05$: because $p = 1.59$). Bent knee sit ups mean score of Circuit training group (32.86 ± 1.79) is higher than mean scores (32.14 ± 1.88) of Control group. However t value is 1.031 which is not significant (i.e. $p > 0.05$: because $p = 0.312$). Shuttle run mean score of Circuit training group (10.81 ± 0.17) is less than mean scores (10.83 ± 0.17) of Control group which shows decrease in timings. However t value is -0.368 which is not significant (i.e. $p > 0.05$: because $p = 0.716$). Standing broad jump mean score of Circuit training group (1.96 ± 0.09) is less than mean scores (1.97 ± 0.07) of Control group. However t value is 0.729

which is not significant (i.e. $p > 0.05$: because $p = 0.774$). 50 yard dash mean score of Circuit training group (6.93 ± 0.29) is less than mean scores (7.02 ± 0.25) of Control group. However t value is -0.848 which is not significant (i.e. $p > 0.05$: because $p = 0.404$). 12 minutes run/ walk mean score of Circuit training group (2.75 ± 152.29) is higher than mean scores (2.73 ± 154.35) of Control group. However t value is 0.275 which is not significant (i.e. $p > 0.05$: because $p = 0.786$). It was hypothesized that there will be no significant difference between pre-test scores of selected physical fitness variables of Circuit training and Control group and result shows that no significant difference exists between pre-test scores of all tested items. Hence, the null hypothesis was accepted.

Table 4: Comparison of significance of difference between Circuit training group and control group post test scores of physical fitness

Sr. no	Test items	Scores of post test	N	Mean	S.D	S.E.M	t-value	Sig.
1.	Pull ups	Circuit training group	14	13.29	0.99	0.266	8.554	0.001
		Control group	14	10.14	0.95	0.254		
2.	Bent knee sit ups	Circuit training group	14	40.00	2.04	0.545	10.817	0.001
		Control group	14	32.50	1.61	0.429		
3.	Shuttle run	Circuit training group	14	10.52	0.15	0.040	-5.207	0.001
		Control group	14	10.83	0.17	0.044		
4.	Standing broad jump	Circuit training group	14	2.04	0.08	0.021	2.424	0.001
		Control group	14	1.97	0.07	0.018		
5.	50 yard dash	Circuit training group	14	6.63	0.26	0.068	-4.105	0.001
		Control group	14	7.02	0.25	0.067		
6.	12 minutes run/walk	Circuit training group	14	3.00	143.92	38.465	4.766	0.001
		Control group	14	2.73	155.25	41.493		

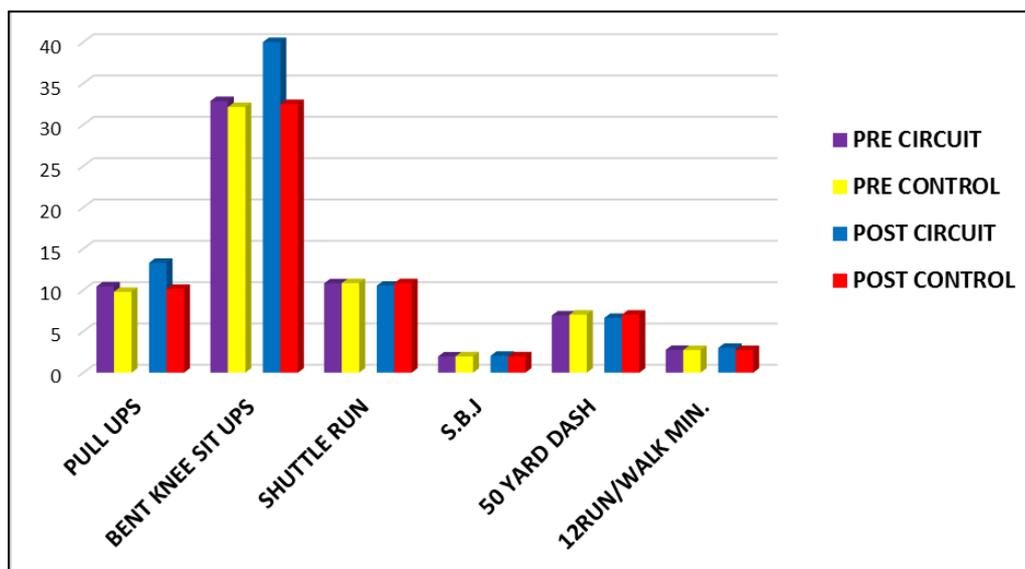
*Significant level = 0.05

Table value (df=26) =2.056

Findings of the study indicates that pull up mean score of Circuit training group (13.29 ± 0.99) is higher than mean scores (10.14 ± 0.95) of Control group. However t value is 8.554 which is significant (i.e. $p < 0.05$: because $p = 0.001$). Bent knee sit ups mean score of Circuit training group (40.00 ± 2.04) is higher than mean scores (32.50 ± 1.61) of Control group. However t value is 10.817 which is significant (i.e. $p < 0.05$: because $p = 0.001$). Shuttle run mean score of Circuit training group (10.52 ± 0.15) is less than mean scores (10.83 ± 0.17) of Control group which shows decrease in timings. However t value is -5.207 which is significant (i.e. $p < 0.05$: because $p = 0.001$). Standing broad jump mean score of Circuit training group (2.04 ± 0.08) is higher than mean scores (1.97 ± 0.07) of Control group. However t value is 2.424 which is significant (i.e. $p < 0.05$: because $p = 0.001$). 50 yard

dash mean score of Circuit training group (6.63 ± 0.26) is less than mean scores (7.02 ± 0.25) of Control group. However t value is -4.105 which is significant (i.e. $p < 0.05$: because $p = 0.001$). 12 minutes run/ walk mean score of Circuit training group (3.00 ± 143.92) is higher than mean scores (2.73 ± 155.25) of Control group. However t value is 4.766 which is significant (i.e. $p < 0.05$: because $p = 0.001$).

It was hypothesized that there will be no significant difference between post test scores of of selected physical fitness variables of Circuit training and Control group but result shows that significant difference exists between post test scores of all tested items of Circuit training and Control group. Hence, the null hypothesis was rejected and there was significant improvement in performance after Circuit training.

**Fig:** Comparison of pre circuit and pre control scores and circuit and post control Group Scores

Results

1. Significant difference exists between pre and post test scores of Circuit training group.
2. Significant difference don't exists between pre and post test scores of Control group.
3. Significant difference don't exists between pre-test scores of Circuit training group and Control.
4. Significant difference exists between post test scores of Circuit training group Control group.

Conclusion

On the basis of the results it is concluded that Circuit training

is effective in improving muscular strength and endurance of arms and shoulders, speed and agility, muscular strength and endurance of trunk, explosive strength of legs, speed of lower extremities and cardio-vascular endurance.

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