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The Effect of Circuit Training on Cardivascular Endurance of High School Boys

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The Effect of Circuit Training on Cardivascular Endurance of High School Boys

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I. Introduction

The ability to carry out daily tasks with vigor and alertness, with ample energy to enjoy leisure time pursuit and to meet unforeseen emergencies. Physical fitness is the ability to last to bear up and to persons under difficult circumstances where an unfit person would give up. It is self – evident that the fit citizens are a nation's best assets and weak over its liabilities. It is therefore the responsibility of every country to promote physical fitness is the basic requirement for most of the tasks to be undertaken by an individual in his daily life. If it is under developed in his daily life.

Cardiovascular fitness has been defined as the ability of the organism to maintain the various internal equilibrium within the body as closely as possible to the resting state during a sub maximal task and to restore promptly after exercise any equilibrium which have been disturbed "this definition implies that a fit person will adapt more efficiently to the stress imposed by a specific task and will recover much faster following the task. The trained person has a faster recovery following the task as the heart rate returns to its resting value much quicker. If this task were continued, the trained person would be able to perform more work before reaching exhaustion. Information on the construction and function of the heart and circulatory system is presented as necessary back ground information on cardiovascular endurance. In sports training there are many means and methods are available to develop the required components out of all training methods. Investigator has chosen circuit training as a best mean to develop cardiovascular endurance. In all the sports and games endurance plays an important role. Total endurance includes cardio vascular endurance, muscular endurance and capacity of Oxygen debt.

But Cardio – vascular endurance is most important than others. For developing endurance different trainings can be used. They are circuit training, interval training and farther training. Those who have the best endurance can maintain their role throughout the games and sports without fatigue. Among the numerous training the above mentioned are regarded as most valuable training methods for developing endurance. Both training methods are designed to assist the development of the circulatory and respiratory systems of the body. However in athletic events requiring great endurance, the main limitation is the ability of the circulatory system to supply oxygen to the working muscles and to keep the muscle cells free of waste products. This particular process is dependent upon cardio vascular endurance. Endurance or stamina is the term used to cover Cardio – respiratory fitness. It is a measure of an efficient heart and lung system and can only be developed by exercises which involve the heart and lungs and their capacity to supply oxygen to the working areas of the body.

General endurance concerns the whole body and is a measure of this capacity to withstand oxygen debt, where as local endurance concerns fatigue in one particular set of working muscles. Circuit training can be defined as the training programme in which an athlete goes from one exercise station to another in a planned sequence and in the shortest possible time. In planning a circuit training programme, exercises chosen to fit the needs of the individual. Each of these exercises is then numbered and assigned to a certain area called station. Through circuit training, the athletes may increase their strength and endurance by increasing the repetitions of the exercises at each station or by doing the required frequencies of exercises in a shorter length of time. If the work load is to be kept constant, the athletes can develop strength and endurance by gradually decreasing the time taken to go through the circuit. This method of training emphasizes 'time' rather than resistance. This method was originally introduced by Morgan and Adamson about 1957 at the University of Leeds, England.

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- Some advantages of circuit training are

a) A large number of persons can be accommodated at the same time.
b) The individual works at his own rate within his own capacity,
c) The goals are both immediately obtainable and easily evaluated, and
d) 'Target time', the attempt to complete the circuit in a certain maximum time, provides a strong motivational factor.

Since circuit training has the primary objective of improving the blood circulation to the working muscles the investigator was interested to experiment whether there would be any effect on Cardio Vascular endurance after an experimental period of circuit training.

II. Background Work

According to morgon and Adamson, circuit exercises must be selected and arranged in such away as to Coalesce into a period of training which will have a positive effect upon all round strength, endurance and power . According to the English Coaches, who have put to test circuit training, it is no more supplement to the actual training programme of an athlete. It is not only important but a must during the basic conditioning period of the athlete's development.

Circuit respiratory improvement can only be affected by some form of training which makes continuous demands upon the heart and lungs over a prolonged period of time. Circuit training has been adopted throughout the world as a simple but effective method of improving the performance factors. Circuit training is designed to develop cardio vascular respiratory endurance as well as flexibility, strength and muscular endurance in essential muscle groups. It is an efficient training method in terms of gains made in a short time. It can be used by one person or a group and does not require elaborate equipment. Circuit training is designed to stimulate the cardio – respiratory organs and as a result the endurance aspect is stressed.

Brown concluded that a physical education programme for fifth grade girls which included a 10 minute circuit training programme improved Physical fitness as measured by the American Association of health, Physical Education and Recreation youth fitness test .

Forty two businessmen from the Vancouver young Men's Christian Association were equated by Taylor into three groups (one underwent a programme and the third acted as a control group). All subjects were given the lenson Muscular strength. Test and the Harward step test at the beginning and the end of the eight week experimental period. Both experimental groups showed gains in performance that were statistically significant for the Cardio Vascular and Muscular strength tests. There were no statistically significant differences between the two experimental groups. It was concluded that both the calisthenics and the circuit training programme as used in this study, were effective methods of improving the cardio Vascular and muscular status of business men. In a study by watt, one group of 21 subjects was subjected to a developmental course of exercises at the University of Oregon. A second group of 17 subjects went through a developmental course in which circuit training was used. The subjects were tested in pull-ups, push-ups, leg, 300 yard shuttle run and 60 second sit-up test before and at the end of the course watt found that significant gains in the physical fitness level of low fitness students can be achieved by their participation in either in the performance of the cardio vascular test (300 yard run) can be increased significantly by the regular developmental exercises or by the circuit training.The general purpose of circuit training is to develop muscular strength, muscular endurance, and Cardio vascular endurance. The arrangement of a circuit permits a large number of heterogeneous individuals to train together. The arrangement and selection of exercises determine. The degree and type of physiological changes occurring in the individual.

Circuit training can be used for general fitness purposes or can be adopted as a conditioning medium for various grounds sports. For sports conditioning, for example, it has been utilized by many professional soccer and by teams in England and by foot ball and competitive seiling teams in Australia. According to the originators, circuit training enables large number of performers to train together by employing a circuit of consecutive exercises around which each performer progresses, performing an individually derived dosage of exercise and timing his progress. Circuit training enables large numbers of performer, to train at the same time by employing a circuit of consecutively numbered exercises around which each performer progresses doing a prescribed allocation of work at each exercise, and checking his progress against the clock. In the circuit training study by wakefidd, Harkins and Cooper, the girls moved as rapidly as possible from one station to another, performing the prescribed exercised at each station before moving on to the next one. The requirement at a specific station was to run a specific weight prescribed number of times. Orchin herself a pre-determined number of times. New requirements and new goals were established as desired when using this method. Participation in this circuit training programme should have caused the girls to improve progressively. As performance was improved and girls were motivated to try to complete three circuits. Circuit training became an important device in conditioning girls for participation in track and field activities as well as in other sports activities.

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According to Boyer, The trained heart works at lower rate and affects a larger stroke volume than the untrained man. This increase in stroke volume is thought to require. For a given work load, a lesser amount of myocardial oxygen than an untrained heart. Letounov of Soviet Socialist Republic States. As a result of training, the action of the Cardio-vascular system becomes more economical, as revealed by a drop in the pulse rate, lengthening of ventricular contraction and relaxation phases, lengthening of the diastole and lowering of the systolic and diastolic blood pressures, decrease in the velocity of the blood flow and a better utilization of oxygen.

III. Experemental Designing

It Related group design was used in this study. During the pre-test the pulse rate after three minutes modified Harvard step Test, was recorded for every subject. On the basis of their pulse rate, they were formed into two equivalent groups of 48 each. The scholar used 125 boys, though only 96 students were needed in order to secure matching scores in computing the equivalent groups out of 125, 96 students were selected and they were classified into two equivalent groups by matching process. Thus the experimental design chosen was a related group design.

The exercises in included in the circuit training programme were,

a) Rope skipping

Three metre ropes were used for the purpose. The duration of the exercise was minute and there was no restriction about the number of skips ; but the subject had to do it continuously till the end of the stipulation time of one minute. The subjects had to keep the ends of the rope each in one hand and on whistle they would start skipping on both the legs.

b) Four count jumping jog

For this dynamic exercise, the duration was also fixed as one minute. No restriction was imposed on the number of jumping jogs to be done within one minute, but the subjects were instructed to do it without break till the end. The exercise had to be done in four counts. The subjects had to be in standing position. On whistle they had to jump astride and the bring the hands sideward (No.1) hands over the head clap, (No.2) hands sideward (No.3) & then return to the starting position. This exercise had to be done continuously and rhythmically on the spot.

c) Squat thrust

The subjects had to be in standing position, feet together. On the first count they had to bend the knees to a full squat position, placing hands on floor and between the knees. On count two, they had to thrust both the legs backward to a front leaning rest.

d) Sit-Ups

The subjects were asked to lie in supine position, legs extended and feet about twelve inches apart. The subject had to interlock the hands and place them behind the neck. The subject and to sit-up and touch with the left elbow, the right knee without raising the knee and return to the lying position. The same was to be repeated with the right elbow touching the left knee. This was to be done continuously till the end of the one minute period, but no restriction was imposed on the number of sit-ups to be done.

e) Two count jumping jog

For this dynamic exercise, the duration was also fixed as one minute. No restriction was imposed on the number of jumping jogs to be done within one minute, but the subjects were instructed to do it without break till the end. The exercise had to be done in two counts. The subjects had to be in standing position. On whistle they had to jump astride and bring the hands sideward upward over the return to the starting position. The exercise had to be done continuously and rhythmically on the spot.

f) Running on the spot

The duration of time fixed for this exercise was also one minute. On whistle, the subjects had to start running on the spot with high knee action. These was no restriction regarding the speed, the subjects were not to stop, till the end of the stipulated time. The experimental group was further divided into six groups of eight each. Each group was asked to occupy one station and was given the numbers from one to six. On whistle, the subjects started doing the exercise allotted to the particular station. After every minute, the whistle was blown the subjects had to proceed to the next station in the anticlock wise direction without wasting any time. The circuit was treated as complete when each group had completed exercises in all the six stations. In between repetitions, no interval was allowed for regulation. Prior to the start of the experimental study, demonstration of all exercises was made and the subjects were taught to perform the exercises correctly. At the end of six weeks. The modified Harvard step test, pulse rate was again administered for both the groups and the pulse rate was again recorded. The pre-test and post-test scores of both control and experimental groups have been presented in the appendices.

The obtained data were statistically analysed test administration.

To test whether there was any significant difference between the means of the experimental and control groups, in the post-test data, the't' ratio was used. The't' ratio is the ratio of the difference between means and the standard error of the difference between means. Since related groups were used in this study, the degree of freedom chosen was N-1, as suggested

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by Clarke and Clarks. The formula used for the calculations were the following.

$$M = AM + \left[\frac{\Sigma fd}{N} \right] \times C$$

Where M = Mean
AM= Assumed Mean
∑fd= Sum of the products of the frequencies
N = Total number of subjects.
C = Size of the class interval.

$$\text{Standard Deviation} = \sqrt{\frac{\sum fd^2}{N} - \left[\frac{\sum fd}{N}\right]^2}$$

where
σ = standard deviation.
∑fd = sum of the products of the frequencies and deviation from the assumed mean.
N = Total number of subjects.
C = size of the class interval.

Standard Error of the Mean

$$\underline{\sigma} M = \frac{\sigma}{N}$$

Where,
$\underline{\sigma}$ = standard deviation.
N = Total number of subjects.

Co-efficient of correlation

For finding out the co-efficient of correlation between the control and experimental groups, the formula recommended by Clarke and Clarke for product moment correlation was used.
Where
r = Co-efficient of correlation.
Ex1y1 =sum of deviations of x and y
N = Variables respectively
∑x = E fdx
N
∑y = E fdy
N
σ x1 = correction of standard, deviation of x variable.
y1 = correction of standard deviation of y variable.

t-Ratio

The 't' ratio was calculated to test whether there was any significant post-test difference between the means of the control and experimental groups. The t-ratio was calculated as under.
t = DM
σDM

where,
t = 't' ratio.
DM = Difference between the means.
σ DM = standard error of the difference between means.

Where,
My = Mean of the experimental group.
Mx = Mean of the control group.

Correlated Group Standard error of the difference between means
My = Mean of the experimental group.
Mx = Mean of the control group.

$$DM = \sqrt{\sigma Mx^2 + \sigma My^2 - 2\sigma MX^1 \sigma My^1}$$

Where
σMx = Standard error of mean x(control group)
σMy = Standard error of mean y(experimental group)
Un correlated group Standard error of the difference between means
σDM =
σMx = Standard error of mean x (control group)
σMy = Standard error of mean y (experimental group)
r = Co-efficient of correlation between the control and experimental groups.

IV. Observations & Analysis

The The null hypothesis was put to test by subjecting the difference in the performances of control and experimental groups before and after the experimental treatment for statistical significance by calculating 't' ratio using the following formula recommended by Clark and Clarks.

Where
t ='t' ratio.
DM = Difference between means.
σDM = Standard error of difference between means.

Table I (a) : Computation of Mean standard Deviation and Standard error of the mean of pulse rate of the pre-test of the control group

Step Intervals	F	d	fd	fd^2
68-70	3	4	12	48
65-67	2	3	6	18
62-64	4	2	8	16
59-61	8	1	8	8
56-58	**10**	**0**	**0/+3/4**	**0**
53-55	10	-1	-10	10
50-52	6	-2	-12	24
47-49	4	-3	-12	36
44-46	1	-4	-4/-38	16
	48		∑fd=-4	$\sum fd^2$=176

Table I (b) : Computation of Mean standard deviation and Standard error of the mean of pulse rate of the pre-test of Experimental group

Step Intervals	f	d	fd	Efd^2
69-71	2	4	8	32
66-68	2	3	6	18

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63-65	1	2	2	4
60-62	11	1	11/ +27	11
57-59	**5**	**6**	**0**	**0**
54-56	11	-1	-11	11
51-53	8	-2	-16	32
48-50	7	-3	-21	63
45-47		-4	-4/-52	16
	48		$\sum fd=-25$	$\sum fd^2=187$

Table II (A) : computation of mean standard deviation and standard error of the mean of pulse rate of the post-test of the control group

Step Intervals	f	D	fd	Efd^2
67-69	2	4	8	32
64-66	2	3	6	18
61-63	6	2	12	24
58-60	8	1	8/ 34	8
55-57	**7**	**0**	**0**	**0**
52-54	10	-1	-10	10
49-51	9	-2	-18	36
46-48	3	-3	-9	27
43-45	1	-4	-4/-41	16
	48		$\sum fd=-7$	$\sum fd^2=171$

Table II (B) : computation of mean standard deviation and standard error of the mean of pulse rate of the post-test of the experimental group

Step Intervals	f	D	Fd	Efd^2
59-61	2	4	8	32
56-58	1	3	3	9
53-55	2	2	4	8
50-52	14	1	14/ +29	14
47-49	**7**	**0**	**0**	**0**
44-46	2	-1	-5	5
41-43	8	-2	-16	32
38-40	9	-3	-27/-48	81
	48		$\sum fd=-19$	$\sum fd^2=181$

Table III : mean standard deviation and standard errors of means of the initial scores of control and experimental groups

Groups	Mean	Standard deviation	Standard and error of the mean
Control group	56.75	5.739	.82
Experimental group	56.44	5.712	.82

Table IV : mean standard deviation and standard errors of mean of the final scores of control and experimental groups

Groups	Mean	Standard Deviation	Standard and error of the mean
Control group	55.56	5.649	.82
Experimental group	46.31	5.703	.82

Table V : the mean gains of control and experimental groups

Groups	Mean	Standard Deviation	Standard and error of the mean
Control (48)	56.75	55.56	1.19
Experimental (48)	56.44	46.81	9.63

Table VI : 'T' ratio of the difference between initial means of control and experimental groups

Groups	Mean of initial puls rate	Difference between mean	t-ratio
Control group	56.75	0.31	0.27
Experimental group	56.44		

Table VII : 'T' ratio of the difference between initial means of control and experimental groups

Groups	Mean of final pulse Rate	Difference between mean	t-ratio
Control group	55.56	8.75	4.57
Experimental group	46.81		

Table VIII : 'T' ratio of the difference between initial means of control and experimental groups

Experimental group	Mean of pulse Rate	Difference between mean	t-ratio
Initial reading	56.44	9.63	7.295
Final reading	46.81		

The graph clearly indicated that the experimental group was much better than the control group, as far as the experimental factors were concerned. It also revealed the fact that the circuit training exercise given to the experimental group has caused better development of cardio vascular endurance of the experimental group. The selected circuit training exercise has contributed to the development of cardio vascular endurance as shown by the graph on pulse rates.

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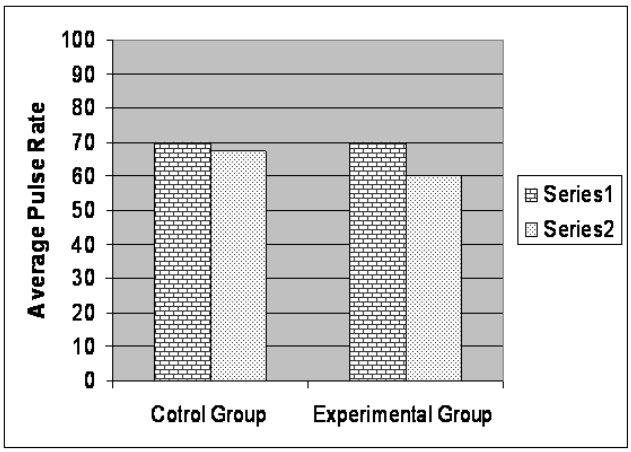


Fig.1 : bar diagrams showing the pulse rate of the control and experimental group

V. Conclusion

It was observed that there was a significant improvement in the cardio-vascular endurance of the experimental group through the circuit training programme. It was also found the there was no significant improvement in cardio-vascular endurance of the control group which did not have the circuit training programme. Within the limitations of the study and from the findings of the analysis of the data, Circuit training may be considered as a vital part of the physical education programme in all schools, to improve the Cardio vascular efficiency of the students. Circuit training exercises to suit the need of the athletes may be framed for all athletic events. Circuit training may be used more often as a conditioning device. This study may be conducted in a more elaborate and extensive manner to cover different age groups. This training method may be compared with other training methods. Circuit training needs specialized research studies relating to its contribution to speed, co-ordination agility, flexibility etceteras..

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