

The Effect of Selected Circuit Training Exercises on Sprinters of High School Girls

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Abstract: History shows evidence that, fatlike training and repetition running were used as conditioning factors to improve speed. Now-a-days circuit training was devised to improve strength and endurance used almost in all track and field events and games to improve the strength and endurance of the players. The researcher was interested in conducting a study to find out, if there was significant effect on speed, through selected circuit training exercises. Thirty girls from Govt. 30 girl's students of Govt. Girls High School, Bapatla, Guntur District were selected from random group of 200 students as the subjects for this study. During the pre-test period, the subjects were asked to run 100 metres and their time was recorded as the initial performance. Then the group was administered the programme of circuit training, for a period of six weeks. Selected exercises were regularly given in the evening, three circuits a day and three in a week. At the end of the experimental period of six weeks, again the subjects were asked to run 100 metres and the time was recorded as the final performance.

Keywords: Girls, Exercise, Sprinters, Training.

1. Introduction

The heights which great men gained and kept were not attained by sudden flight; but they while their company slept were toiling upward in the Night. Change and challenge are two words that affect every aspect of human life. Change is taking place all round, because of the change new challenges present themselves. Tends to change in this world including human mind, behaviour, attitude and desire. Human mind always seeks adventures, and a man proves himself to be a hero in the sports arena or in the literary sphere. As athlete takes advantage of training methods and he always changes from one process of training device to another which proves to be more advantageous to him. Physical fitness is an important quality for every athlete to perform his task with vigour and alertness without undue fatigue. Fitness is the ability of the individual to live a full and balanced life. It involves Physical, mental and emotional and spiritual factors and the capacity for their wholesome expression.

The three basic components of the physical fitness are;

1. Muscular strength
2. Muscular endurance
3. Circulatory - respiratory endurance.

The three qualities, strength, speed and endurance are the basic qualities for sprinting. "Sprinting is high powered running and the men who succeed at it are, in the muscular sense, high powered athletes. Sprinting includes 100 Yards or 100 Meters 220 Yards or 200 Meter, 440 Yard or 400 Meter, even though, all these events may not run at top speed, they can be treated as sprints because speed in the predominant factor in each event. "Function makes an organ,". When muscles are used they become stronger, further meter strength is increased". Increased strength may increase the sprinting ability. To increase the basic strength, one may use various training devices. According to o' shea, a combination of the techniques of weight lifting with the principles of 'circuit training' results in a system of

continuous exercise which brings about significant improvement in cardiovascular respiratory efficiency and muscular endurance. Through circuit training the athletes may be increasing their strength and endurance by increasing the repetitions of exercise at each station or by doing the required frequencies of exercises 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. Johnson and Stolberg state the advantages of circuit training as:

1. A large number of persons can be accommodated at the same time.
 2. The individual works at his own rate within his capacity.
 3. The goals are both immediately obtainable and easily evaluated and
 4. 'Target time', the attempt to complete the circuit on a certain maximum time provides strong motivational factor.
- Since the circuit training has the primary objective of improving strength and blood circulation to the working muscles, the researcher was interested on experimenting whether there would be any effect on speed after the experimental period of circuit training.

2. Background Work

A review of related literature shows that this study conducted by various authors shows a remarkable increase in the performance in various fields. Morgan and Adamson performed experiments with progressive loading which led to circuit training. The boys aged (14 to 15) were in two balanced groups which had three physical educational periods per week. The experimental group had an additional overload programmer amounting to 30 Minutes per week for one Month. Gains of the experimental group over the control group indicated that a relatively small amount of intensive overload training using the apparatus normally found in schools produced significant increase in strength, efficiency and fitness increase.

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 AAHPER Youth Fitness Test. Forty two business men from the Vancouver Y.M.C.A. were equated by Taylor into three groups (one underwent a programme of Calisthenics, another a circuit training programme and the third acted as control group). All subjects were given the Larson Muscular Strength Test and the Harvardstep Test at the beginning and at the end of the eight week experimental period. Both experimental groups showed gains in performance that were statistically significant for the cardiovascular 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 the study, were effective methods of improving the Cardiovascular and Muscular status of business men.

The circuit training method of land exercise was used because it includes exercise with and without weights, also because organizations and administration of the method are appropriate to the normal physical education programme. Furthermore, with the apparent acceptance of progressive resistance exercise and with the obvious need for a teaching method by which such exercise can be readily introduced to in school programmes the investigation of circuit training appeared to be timely.

It is Kula's opinion that circuit training has a definite place in the Physical Education programme and our boys have been motivated to expect it. That first twelve minute of each class period are spent on this type training. The circuit is basically, complete for over all development of the over large muscle groups as well for the development of agility and endurance. Weiss adopted a conditioning programme that worked well for the wrestler's centers around the use of exercise stations to set up in a circuit fashion. The objects of the programme are to develop both muscular strength and muscular endurance by having the wrestlers work continuously at each of the six stations for a period of 10 minutes. He found this programme to be quite beneficial in conditioning the wrestlers for the touch scheduled ahead. The programme is flexible enough so that a coach may set up a station to meet his particular needs. It has also had good response from the wrestlers who actually look forward to working on the circuit at the beginning of each wrestling season.

Lemelbaum devised a pre-season circuit programme that will help to develop all areas of conditioning including strength, endurance, speed and agility. The team was divided into three groups and the total practice time should be around two hours of which 45 Minutes should be devoted to the circuit:

1. Strength station.
2. Endurance station and
3. Speed station and agility station.

Each group rotates approximately 12 Minutes. According to Schmidt, speed development exercise and drills are currently being recognized to a greater extent as a means of making fact runners faster, average runners competitive. In the past

few years we have experienced a considerable amount of success in training out some of the faster sprinters in our state while maintaining depth in the sprint crops. We believe that the regularly scheduled sprint drill circuit has contributed to our success.

3. Experimental Design & Methodology

3.1. Testing Methodology

The purpose of this study was to investigate the effect of selected circuit training exercises on hundred meters dash. To fulfil this aim, 30 girl's students of Govt. Girls High School, Bapatla, and Guntur District were selected as subject in random group of 200 students. Subjects were selected purely on the basis of random sampling method. As cited by Aggarwal, random sampling method of selection assures each individual or element in the universe an equal chance of being chosen. First the students who fall between 14 and 17 age group were pooled. The name of each subject was written on a paper and all the places were mixed in a bowl and the required number (30) of students were selected by drawing lots. The initial performance of the students was recorded. The subjects were asked to run 100 metres distance with full speed and their time was recorded. The exercises included in the circuit training programme were originated by Don Schmidt had been slightly modified and were as follows:

- a. High Knee striding : 50 yds
- b. Fast leg : 10 yds
- c. High knee Bounding : 50 yds
- d. Finger tip Push ups : 10 times
- e. Locked Knee striding : 50 yds
- f. Full back leg extension : 10 times
- g. Split Squat Jumps : 10 jumps

A) High Knee Striding:

This is done slowly as the runner moves on his toes and lifting his thigh parallel to the ground. He avoids lifting the thigh any higher than parallel to reduce the risk of injury during the drill. The runner also maintains an upright position and avoids leaning back. He continues this exercise for 50 yards.

B) Fast Leg:

The arms are moved very quickly and the feet are barely moved off the ground-fast. The runner covers about 10 yards rather than running in place to prevent tightening up and the natural tendency to bend at the waist and then lean forward while doing this exercise.

C) High Knee Bounding:

Spring off one foot with the opposite thigh parallel to the ground and glide through the air landing on the other foot and springing off it in a similar manner for 50 yards.

D) Finger Tip Push ups:

Assume the Crouch start position one foot ahead, weight forward on the finger tips. Bend forward and touch the ground for his forehead. 10 repetitions one done.

E) Locked Knee Striding:

Stride 50 yards with the knees locked flexing and extending the ankles.

F) Back Leg Extension:

Take giant strides for 50 Yards driving the lead knee forward and extending and pushing off the rear leg.

G) Split Squat Jumps:

This exercise is performed with the hands behind the head, explosively and with slow cadence. Runners are instructed to stay up in the air as long as possible and perform 10 Jumps in succession. This group was further divided into seven groups. Each group was asked to occupy one station and was given the numbers from one to seven. On whistle, the subjects started doing the exercise allotted to the particular station. After doing the exercise fixed in the station, the subject was asked to move to the next station in the clockwise direction on jogging without wasting time. The circuit was considered as complete when each group had completed exercise in all the seven stations. Three complete circuits were done a day. In between, repetitions no interval was allowed for relaxation. Before the conduct of the experimental study all the exercises were demonstrated to the subjects and they were taught to perform the exercise correctly. A clear cut explanation about the rules regarding the circuit training was given in order to avoid the misbehaviour of the subjects.

3.2 Testers Competency

The investigator selected three testers including him and conducted the tests in 100 Meters run for the subjects. The other two testers were carefully oriented regarding the testing procedures and timing. The testers reliability had been established by test re-test method.

3.3 Test Administration

All the necessary markings for hundred meters were properly done with chunnam powder. The international amateur Athletic Federation rules and regulations were followed. In order to have a good view, the testers were placed give meters from and line with the finish. A well conditioned working whistle, a good stop watch and a finish tape were used. To avoid muscle pull and muscle cramps, the runners were given five minutes warming up exercises. The runners were lined up behind the starting line. After getting the approval of the Officials (testers) at the finishing line, the start was given by the starter to one runner at a time, by using the approved command 'on your marks', 'get set', and with the order of 'go' and at the same time the starter used the hand kerchief by bringing it down vigorously as a signal to the official at the finish about the start. The time keeper starts the watch as soon as he saw the signal of the start. He stopped the watch as the runner's torso touched the finish tape. The time taken by each subject was recorded carefully. After the experimental period of six weeks, the subjects were oriented and their final performance in the 100 meters dash was taken by using the above test administration.

The following statistical measures were used for the successful interpretation of the obtained data:

A) To compute mean, the formula used was that of Clarke.

$$M = \frac{\sum X}{N}$$

N

$\sum X$ -Summation of Scores

N -The number of scores

B) For computing standard deviation.

$$\sigma = \sqrt{\frac{\sum x^2}{N}}$$

C) The standard error for the mean:

$$\sigma_M = \frac{\sigma}{\sqrt{N}}$$

σ_M -Standard error of the mean

σ -Standard deviation

N -Total number of scores

D) The statistical treatment of the difference between correlated means differs from the treatment for uncorrelated means in the formula used to compute the standard error. The formula for correlated mean is

$$DM = \sqrt{\sigma M_1^2 + \sigma M_2^2 - 2r_{12}\sigma M_1\sigma M_2}$$

Where,

M_1 -Standard error of the mean₁

M_2 - Standard error of the mean₂

r_{12} -Coefficient of correlation between the two variables.

E) The formula for M_{xy} as used by Mathews, was

$$M_{xy} = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

Where,

M_{xy} - Correlation of X on Y

$\sum xy$ - Summation of cross – products

$\sum x^2$ - Sum of squares for X

$\sum y^2$ - Sum of squares for y

E) 't' ratio, can be computed by applying the formula

$$t = \frac{DM}{\sigma DM}$$

Where,

DM - Difference between the two means

σDM - Standard error of the difference between the two means.

3.4 Equipments Used

A) Steel Tape:

A standard steel tape of 30 meters was used to measure the length of the 100 meters track.

B) Stop Watch:

A standard, good conditioned stop watch from CACIO Company was used to record the time.

4. Data Analysis & Results

Since the purpose of this study was to find out the effect of circuit training on 100 metres dash, the obtained data were statistically analysed to assess the significance of the obtained difference. A t-ratio was computed and tested for significance at 0.01 levels the table for the level of significance. A t-ratio of 2.76 was needed for significance at the 0.01 level of confidence. Since it was a single group design, the degree of freedom chosen was N-1. The readings of pre-test and post-test scores were presented graphically for clarity of interpretation. The mean of the pre-test score was 16.3 and standard deviation was 1.264. The mean and the standard deviation of the post-test score was 15.4 and 0.97 respectively. The null hypothesis was put to test by subjecting the difference between the pre-test and post-test to statistical analysis of t-ratio, as recommended by Clarke and Clarke.

The summary of the calculations for the pre-test and post-test data such as pre-test and post-test means, standard deviations, standard error of the two means, co-efficient of correlation, standard error of the difference between the means and t-ratio is given in Table. Since the obtained t(6.555) was much higher that required for significance at 0.01 level of confidence (2.76), the null hypothesis was rejected at 0.01 level of confidence and the hypothesis that there will be significant improvement on the sprinting ability of the students through circuit training exercise was proved:

Table I: Computation of Mean, Standard Deviation and Standard Error of Pre-Test Performance of 100 Metres Dash

Sl.No.	X	X-Mx	X ²
1	18	1.2	1.4
2	17	0.7	0.5
3	16	-0.1	0
4	16	-0.1	0
5	16	-0.6	0.6
6	17	0.5	0.3
7	17	0.7	0.5
8	15	-0.9	0.8
9	16	-0.3	0.1
10	18	1.7	2.9
11	16	0.1	0
12	19	2.2	4.8
13	17	0.5	0.3
14	14	-2	4
15	16	-0.4	0.2
16	15	-0.9	0.8
17	16	-0.6	0.4
18	18	1.2	1.4
19	19	3	9
20	16	-0.3	0.7
21	18	1.2	1.4
22	16	-0.3	0.1
23	17	-0.9	0.8
24	14	-2.1	4.4
25	16	-0.8	0.6
26	17	0.2	0.6
27	16	-0.5	0.3
28	15	-1.3	1.7
29	15	-0.9	0.8
30	15	-1.4	2

$$\text{Mean} = \frac{\sum x}{N}$$

$$= \frac{489.6}{30}$$

$$= 16.32$$

$$M_1 = 16.3$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum x^2}{N}}$$

$$= \sqrt{\frac{47.94}{30}}$$

$$= \sqrt{1.597}$$

$$= 1.264$$

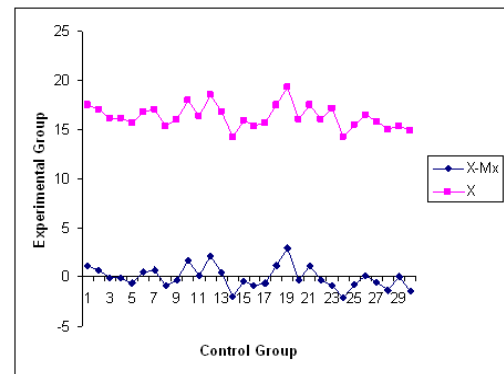
$$\text{Standard Error of the Mean} \sum M_1 = \frac{\sigma}{\sqrt{N}}$$

$$= \frac{1.264}{\sqrt{30}}$$

$$= \frac{1.264}{5.477}$$

$$= 0.2308$$

Results for Table – I Were presented in Graph and Line Diagram as described below.



Finally, we conclude that exercises used in the circuit training for experimental group increased the performance of the subjects.

Table II: Computation of Mean Standard Deviation and Standard Error of Post Test Performance of 100 Metres Dash

S. No.	X	X-Mx	X ²
1	17	1.6	2.6
2	16	0.6	0.4
3	15	-0.3	0.1
4	15	-0.4	0.2
5	15	-0.6	0.4
6	16	0.7	0.5
7	16	0.8	0.6
8	14	-1.4	2
9	16	0.1	0
10	17	1.8	3.2
11	14	-1.4	2
12	16	1	1
13	16	0.6	0.4
14	14	-1.4	2
15	15	-0.5	0.3
16	15	-0.7	0.5
17	15	-0.4	0.2
18	16	1	1
19	17	1.6	2.6
20	16	0.3	0.1
21	17	1.4	2
22	15	-0.5	0.3
23	16	0.6	0.4
24	13	-2	4
25	15	-0.4	0.2
26	15	-0.4	0.2
27	15	-0.2	0
28	15	-0.9	0.8
29	14	-1.3	1.7
30	15	-0.3	0.1

$$\text{Mean} = \frac{\sum x}{N} = \frac{461}{30} = 15.36$$

$$M_2 = 15.4$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum x^2}{N}}$$

$$= \sqrt{\frac{28.22}{30}}$$

$$= \sqrt{0.9407}$$

$$= 0.97$$

$$\text{Standard Error of the Mean } M_2 = \frac{\sigma}{\sqrt{N}}$$

$$= \frac{0.97}{\sqrt{30}}$$

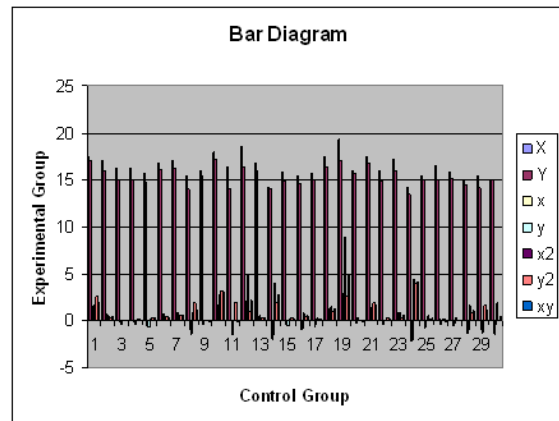
$$= \frac{0.97}{5.477}$$

$$= 0.177$$

Table-III: Error of the Difference between Means of the Pre Test and Post Test Performances of 100 Meters Dash

S.No.	X	Y	x	y	x ²	y ²	xy
1	17.5	17	1.2	1.6	1.44	2.56	1.92
2	17	16	0.7	0.6	0.49	0.36	0.42
3	16.2	15.1	-0	-0.3	0.01	0.09	0.03
4	16.2	15	-0	-0.4	0.01	0.16	0.04
5	15.7	14.8	-1	-0.6	0.36	0.36	0.36
6	16.8	16.1	0.5	0.7	0.25	0.49	0.35
7	17	16.2	0.7	0.8	0.49	0.64	0.56
8	15.4	14	-1	-1.4	0.81	1.96	1.26
9	16	15.5	-0	0.1	0.09	0.01	-0.03
10	18	17.2	1.7	1.8	2.89	3.24	3.06
11	16.4	14	0.1	-1.4	0.01	1.96	-0.14
12	18.5	16.4	2.2	1	4.84	1	2.2
13	16.8	16	0.5	0.6	0.25	0.36	0.3
14	14.3	14	-2	-1.4	4	1.96	2.8
15	15.9	14.9	-0	-0.5	0.16	0.25	0.2
16	15.4	14.7	-1	-0.7	0.81	0.49	0.63
17	15.7	15	-1	-0.4	0.36	0.16	0.24
18	17.5	16.4	1.2	1	1.44	1	1.2
19	19.3	17	3	1.6	9	2.56	4.8
20	16	15.7	-0	0.3	0.09	0.09	-0.09
21	17.5	16.8	1.2	1.4	1.44	1.96	1.68
22	16	14.9	-0	0.1	0.09	0.25	0.15
23	17.2	16	0.9	0.6	0.81	0.36	0.54
24	14.2	13.4	-2	-2.1	4.41	4	4.2
25	15.5	15	-1	0	0.64	0.16	0.32
26	16.5	15	0.2	-0.4	0.04	0.16	-0.08
27	15.8	15.2	-1	-0.2	0.25	0.04	0.1
28	15	14.5	-1	-0.9	1.69	0.81	1.17
29	15.4	14.1	-1	-1.3	0.81	1.69	1.17
30	14.9	15.1	-1	-0.3	1.96	0.09	0.42
	$\sum x$ 480.6	$\sum y$ 461.0			47.9	29.2	30.1

Results for Table – III Were presented in Graph and Line Diagram as described below



Finally, we conclude that exercises used in the circuit training for experimental group increased the performance of the subjects.

Mean of X = 16.3 sec. Mean of Y = 15.4 sec.

Co-efficient of Correlation

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

$$= \frac{30.12}{\sqrt{47.94 \times 29.22}}$$

$$= \frac{30.12}{\sqrt{1401.0}}$$

$$= \frac{30.12}{37.43}$$

$$r = 0.8047$$

Standard error after difference between Means

$$\sigma_{DM} = \sqrt{\sigma M_1^2 + \sigma M_2^2 - 2r \sigma M_1 \sigma M_2}$$

$$= \sqrt{0.2308^2 + 0.177^2 - 2 \times 0.8047 \times 0.2308 \times 0.177}$$

$$= \sqrt{0.084598 - 0.065747}$$

$$= \sqrt{0.018851}$$

$$\sigma_{DM} = 0.1373$$

$$t = \frac{DM}{\sigma_{DM}}$$

$$DM = M_1 - M_2$$

$$= 16.3 - 15.4$$

$$= 0.90$$

$$\sigma_{DM} = 0.1373$$

$$t = \frac{0.9}{0.1373}$$

$$t = 6.555$$

Table V: T-Ratio of the Mean Gains (Pre Test And Post Test) Performance

Groups	Pre-Term Mean	Post Term Mean	Mean Gain	t-ratio
X	16.3	15.4	0.9	6.555

5. Conclusion

Thirty girls from Govt. Girls High School, Bapatla, Guntur District were selected from random group of 200 students as the subjects for this study. During the pre-test period, the subjects were asked to run 100 metres and their time was recorded as the initial performance. Then the group was administered the programme of circuit training, for a period of six weeks. Selected exercises were regularly given in the evening, there circuits a day and three in a week. At the end of the experimental period of six weeks, again the subjects were asked to run 100 metres and the time was recorded as the final performance. The significance of the difference between the means of score of the pre-test and post-test were analysed by t-ratio. The level of significance chosen was 0.01 level and the obtained t-ratio or 6.555 was significant well beyond 0.01 level of confidence. Thus the null hypothesis was rejected at 0.01 level of confidence. It was observed that there was a significant improvement in the sprinting ability of the subjects through the circuit training programme. It was also found that circuit training exercises had more effect on the beginners, that is, in high school girls.

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