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Shri Patel Vijaybhai Devalbhai
Research Scholar, Dept. of
Physical Education,
Hemchandracharya North
Gujarat University, Patan,
Gujarat, India

Dr. Milan P Patel
Physical Instructor, College of
Agriculture, Navsari
Agricultural University, Waghai,
The Dangs, Gujarat, India

Effect of plyometric and circuit training on selected physiological variables on school children

Shri Patel Vijaybhai Devalbhai and Dr. Milan P. Patel

Abstract

The purpose of the study was to see the effect of Plyometric and Circuit Training on Selected Physiological Variables on school children. In order to draw an adequate representative sample, 150 boys from the 03 Schools Vasnda, Dist. Navsari were selected with age ranging between 14 to 16 years. Further they were divided into 3 groups of 50 each. The pretest of aspects of physical fitness was conducted on each group. Then, Group A was provided plyometric training and group-B, circuit training for 12 weeks. Group – C was accepted as the control group. Finally, the posttest was executed on all three groups. To test the effect of training on physiological variables following test were included for the present study Pulse Rate, Vital Capacity, Systolic Blood Pressure and Diastolic Blood Pressure. Results showed significant improvement in Pulse Rate and Vital Capacity of the subjects who participated in Plyometric and Circuit training compared to Control group, where as no significant improvement was seen in Systolic Blood Pressure and Diastolic Blood Pressure in the subject of Plyometric, Circuit and Control groups.

Keywords: Plyometric, circuit, training, physiological

Introduction

All the training in sports and games aims at the improvement of performance. The purpose of training programme is to produce metabolic, physiological and psychological adaptations that allow sport persons to perform better. It is formulated in such a way that the sportsman is able to win or at least successfully participate in a competition. Physiological variables such as anaerobic power, vital capacity, resting heart rate, resting respiratory rate, lean body weight, body fat percentage and breath holding capacity receive special consideration and it is an important pre-requisite for outstanding performance in sports. With training and conditioning the heart becomes more efficient and is able to circulate more blood while beating less frequently.

Plyometric training is a form of training that develops speed and power through replicating the pace and movement patterns of the chosen sport. Plyometric is the term now applied to exercise, that have their roots in "Europe" where they were first known simply as "jumping training". Interest in this jump training increased during the early 1970's as east European athletes emerged as powers on the world sports scene. As the eastern bloc countries began to produce superior athletes in such sports as track and field, gymnastics, and weight lifting, the mystique of their success began to Centre on the training methods.

Circuit training is a form of body conditioning or resistance training using high-intensity aerobics. It targets strength building and muscular endurance. An exercise "circuit" is one completion of all prescribed exercises in the program. Circuit training is the most and effectual way to enhance cardiovascular fitness and muscle endurance. Circuit training is a method of physical conditioning or resistance training using high intensity training. It aims to build the strength and muscular endurance. An exercise circuits one accomplishment of all suggested exercises in the training. When one circuit is completed, again the first exercise for the next circuit will be started. By tradition, in circuit training, the time between exercises is very short, with the rapid movement to the next exercise.

Corresponding Author:

Dr. Milan P Patel
Physical Instructor, College of
Agriculture, Navsari
Agricultural University, Waghai,
The Dangs, Gujarat, India

What research says?

Chaudhari had selected 30 characters for his study and divided them into yogasan group and control group. The objective of the present study was to examine effect of Yogasana and Physical Fitness Programme on selected physiological parameters. Training had been given to selected characters for 10 weeks. The variables such as percentage of body fat, heart beats at time of rest, vital power etc were selected in the present study. Analysis of covariance was applied to find out mean difference between scores on pretest and posttest. Significance was tested at 0.05 levels. The results indicated that, the group, which was trained by Physical Fitness Programme, was found superior in respect to heart beats at time of rest. The group, which was trained by Yogasana, was found superior in respect to vital ability than others.

Anitha, Dr & Kumaravelu, Dr & Lakshmanan, Dr & Karuppasamy, Govindasamy studied the effect of plyometric training and circuit training on selected physical and physiological variables among male volleyball players. Twenty four male volleyball players aged between 18 to 25 years were selected randomly. They were divided into two groups (two experimental and one control group) the experimental group I was given plyometric training and experimental group II was given circuit training for six weeks and control group was not allowed to participate in any training programme. Pretest was conducted dependent variables such as speed, muscular endurance, flexibility, agility, explosive strength, vital capacity and anaerobic capacity at the beginning before the experimental treatment and posttest was taken after the experimental treatment. The data were analyzed by applying dependent ‘t’ test and ANCOVA. The results revealed that the plyometric training and circuit training had significantly improved the speed, muscular endurance, flexibility, agility, explosive strength, vital capacity and anaerobic capacity.

Purpose of the study

The purpose of the study was to see the effect of Plyometric and Circuit Training on Selected Physiological Variables on school children.

Tools

No.	Variable	Test	Measurement
1	Pulse Rates	Near wrist at resting time	Number
2	Vital Capacity	Peak Flow Meter	ml
3	Systolic Blood Pressure	Sphygmomanometer at resting time	mmHg
4	Diastolic Blood Pressure		

Statistical analysis of the data

For the present study, Analysis of Covariance was applied to know the effects on plyometric training and circuit training.

Hypotheses

- Significant effect will be found in Pulse Rate of school children by Plyometric and Circuit Training.
- Significant effect will be found in Vital Capacity of school children by Plyometric and Circuit Training.
- Significant effect will be found in Systolic Blood Pressure of school children by Plyometric and Circuit Training.
- Significant effect will be found in Diastolic Blood Pressure of school children by Plyometric and Circuit Training.

Methodology

Selection of Subjects

The purpose of the study was to see the effect of Plyometric and Circuit Training on Selected Physical Variables on school children. In order to draw an adequate representative sample, 150 boys from the 03 Schools namely Shri Sadguru High School, Bhinar, Ta. Vasnda, Dist. Navsari, Gnan Sarita Madhyamik Shala, Vangan, Ta. Vasnda, Dist. Navsari and Pragna Saurabh Madhyamik Shala, Manpur, Ta. Vasnda, Dist. Navsari were selected as subjects with age ranging between 14 to 16 years. Total 150 school children were selected as subjects for the sample of the present study, from which 50 children were included in the plyometric training group, 50 children in circuit training group and 50 children were included in the control group.

Research design

Total 50 subjects were selected randomly for each group in the present study. The pretest on physiological variable was conducted on each group. Then, Group A was provided plyometric training and group-B, circuit training for 12 weeks. Group – C was accepted as the control group. Finally, the posttest was executed on all three groups.

The plyometric training group was made to take exercises such as hip twist, ankle hops, lateral cone hops, tuck jump with knee up, depth jump etc. whereas the circuit training group was made to take exercises like Stepping up and down, Push-ups, Squats, Bent Knee Sit-Ups, Rope Jump.

Mean difference was examined at 0.05 levels by using Least Significant Difference (Post Hoc) Test.

Table 1: Analysis of covariance of mean scores of Pulse Rate of two experimental groups and a control group

Test	Groups			Analysis of variance				
	Plyometric	Circuit	Control	Sum of classes (SS)		df	MSS	‘F’
Pre-Test Mean	81.12	80.64	80.72	A	6.613	2	3.306	
				W	2224.88	147	15.135	
Post-Test Mean	75.86	76.14	81.9	A	1162.293	2	581.147	51.077*
				W	1672.54	147	11.377	
Adjusted Mean	75.860	76.139	81.9	A	1161.717	2	580.859	50.704*
				W	1672.539	146	11.455	

*Significance Level at 0.05 ‘F’ (2,147) = 3.057 & (2,146) = 3.058

In the Table-1 above, the 'F' ratio of Post Test Means of all the three groups (Plyometric Group = 75.86, Circuit Group = 76.14 Control Group = 81.9) was found 51.077. Comparing it with Table value (3.058) it was found significant at 0.05 level. Therefore, it is proved that, because of the given training, the performance of the subjects is improved significantly. In addition, the 'F' ratio of Adjusted Means (Plyometric Group = 75.860, Circuit Group = 76.139 Control Group = 81.9) was

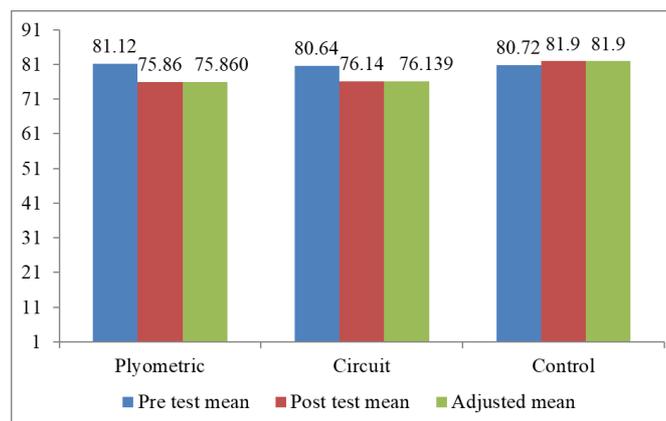
found to be 50.704. Comparing it with Table value (3.058) it was found significance at 0.05 level. The differences between Adjusted Means of all the three groups through 'F' ratio become significant. To check the significance of difference between Adjusted Means and to see which training effective from the training is given to Plyometric Group and Circuit Groups the significance of Adjusted Means and critical difference was checked. It is shown in Table-2.

Table 2: Critical difference of mean scores of Pulse Rate of two experimental groups and a control group

Mean			Mean difference	Critical difference
Plyometric training	Circuit training	Control group		
75.860	76.139		0.279	1.337
75.860		81.9	6.039*	
	76.139	81.9	5.760*	

* Significance at 0.05 levels

In the Table-2 above, the difference between Adjusted Means of pair of Two Experimental Group and control group Pulse Rate Test result can be seen clearly. The Data regarding mean difference shown in the above Table shows the difference between the Mean Differences of Plyometric Group – Circuit Group, Plyometric Group – Control Group, Circuit Group – Control Group. Comparing it with Critical Difference, it becomes easy to know how much consecutive improvement was in the group due to the training. According to Table-12 very significant difference is observed in Plyometric Training Group with mean difference of 6.039 Thereafter, Circuit Training Group shows improvement with mean difference of 5.760. In comparison with Control group, the significant effect of practical training given to both the Experimental Groups of Plyometric Group and the Circuit Group was seen. Between two Experimental Groups no significant effect of practical training was seen. But, in comparison to Control Group, significant effect of practical training was seen in two Experimental Groups.



Graph 6: Mean scores of Pulse Rate Test of two experimental groups and a control group

Table 3: Analysis of covariance of mean scores of Vital Capacity of two experimental groups and a control group

Test	Groups			Analysis of variance				
	Plyometric	Circuit	Control	Sum of classes (SS)		df	MSS	'F'
Pre-Test Mean	412.8	404.2	392.4	A	10489.333	2	5244.67	0.795
				W	969538	147	6595.5	
Post-Test Mean	442.6	434.4	396.8	A	59644	2	29822	4.965*
				W	882882	147	6006	
Adjusted Mean	434.026	433.454	406.32	A	24846.672	2	12423.3	15.086*
				W	120228.931	146	823.486	

*Significance Level at 0.05 'F' (2,147) = 3.057 & (2,146) = 3.058

In the Table-3 above, the 'F' ratio of Post Test Means of all the three groups (Plyometric Group = 442.6, Circuit Group = 434.4 Control Group = 396.8) was found 4.965. Comparing it with Table value (3.058) it was found significant at 0.05 level. Therefore, it is proved that, because of the given training, the performance of the subjects is improved significantly. In addition, the 'F' ratio of Adjusted Means (Plyometric Group = 434.026, Circuit Group = 433.454 Control Group = 406.32) was found to be 15.086. Comparing it with Table value

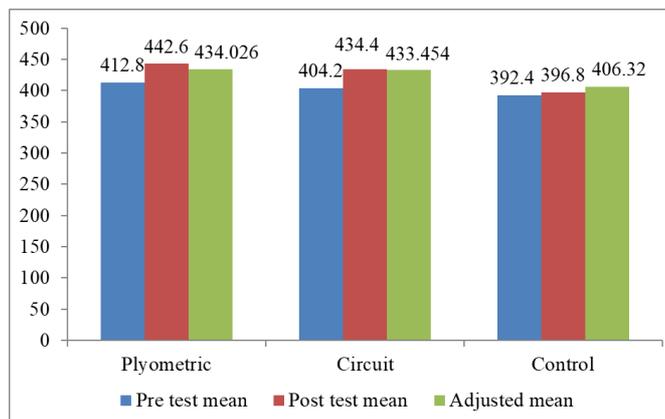
(3.058) it was found significance at 0.05 level. The differences between Adjusted Means of all the three groups through 'F' ratio become significant. To check the significance of difference between Adjusted Means and to see which training effective from the training is given to Plyometric Group and Circuit Groups the significance of Adjusted Means and critical difference was checked. It is shown in Table-4.

Table 4: Critical difference of mean scores of Vital Capacity of two experimental groups and a control group

Mean			Mean difference	Critical difference
Plyometric training	Circuit training	Control group		
434.026	433.454		0.572	11.340
434.026		406.32	27.706*	
	433.454	406.32	27.134*	

* Significance at 0.05 levels

In the Table-4 above, the difference between Adjusted Means of pair of Two Experimental Group and control group Vital Capacity Test result can be seen clearly. The Data regarding mean difference shown in the above Table shows the difference between the Mean Differences of Plyometric Group – Circuit Group, Plyometric Group – Control Group, Circuit Group – Control Group. Comparing it with Critical Difference, it becomes easy to know how much consecutive improvement was in the group due to the training. According to Table-14 very significant difference is observed in Plyometric Training Group with mean difference of 27.706 Thereafter, Circuit Training Group shows improvement with mean difference of 27.134. In comparison with Control group, the significant effect of practical training given to both the Experimental Groups of Plyometric Group and the Circuit Group was seen. Between two Experimental Groups no significant effect of practical training was seen. But, in comparison to Control Group, significant effect of practical training was seen in two Experimental Groups.



Graph 7: Mean scores of Vital Capacity Test of two experimental groups and a control group

Table 5: Analysis of covariance of mean scores of Systolic Blood Pressure of two experimental groups and a control group

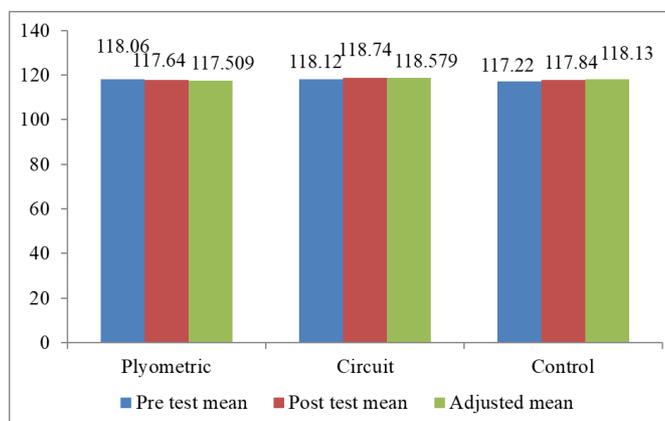
Test	Groups			Analysis of variance				
	Plyometric	Circuit	Control	Sum of classes (SS)		df	MSS	'F'
Pre-Test Mean	118.06	118.12	117.22	A	25.32	2	12.66	
				W	1842.68	147	12.535	
Post-Test Mean	117.64	118.74	117.84	A	34.333	2	17.166	0.320
				W	7871.86	147	53.550	
Adjusted Mean	117.509	118.579	118.13	A	28.864	2	14.432	0.284
				W	7409.127	146	50.747	

*Significance Level at 0.05 'F' (2,147) = 3.057 & (2,146) = 3.058

In the Table-5 above, the complete statistical data of Pre-Test Means, Post-Test Means and Analysis of Covariance is shown. Accordingly, in the performance of Systolic Blood Pressure Test 'F' ratio of means of pre test (Plyometric Training Group = 118.06, Circuit Training Group = 118.12 Control Group = 117.22) was found to be 1.009. Comparing it with Table value (3.057), it was found insignificant at 0.05 level. Therefore, the division of subjects in Two Experimental Group and control group was successful.

The 'F' ratio of Post Test Means of all the three groups (Plyometric Training Group = 117.64, Circuit Training Group = 118.74 Control Group = 117.84) was found 0.320. Comparing it with Table value (3.057) it was found insignificant at 0.05 level. Therefore, it is proved that, because of the given training, the performance of the subjects is improved insignificantly. In addition, the 'F' ratio of Adjusted Means (Plyometric Training Group = 117.509, Circuit Training Group = 118.579 Control Group = 118.13) was found to be 0.284. Comparing it with Table value (3.058) it was found insignificant at 0.05 level. The differences

between Adjusted Means of all the three groups through 'F' ratio become insignificant.



Graph 8: Mean scores of systolic blood pressure of two experimental groups and a control group

Table 6: Analysis of covariance of mean scores of Diastolic Blood Pressure of two experimental groups and a control group

Test	Groups			Analysis of variance				
	Plyometric	Circuit	Control	Sum of classes (SS)		df	MSS	'F'
Pre-Test Mean	80	78.5	79.56	A	59.453	2	29.726	
				W	3128.82	147	21.284	
Post-Test mean	78.3	78.98	79.62	A	43.573	2	21.786	1.161
				W	2757.26	147	18.756	
Adjusted Mean	78.266	79.024	79.609	A	45.231	2	22.615	1.201
				W	2748.753	146	18.827	

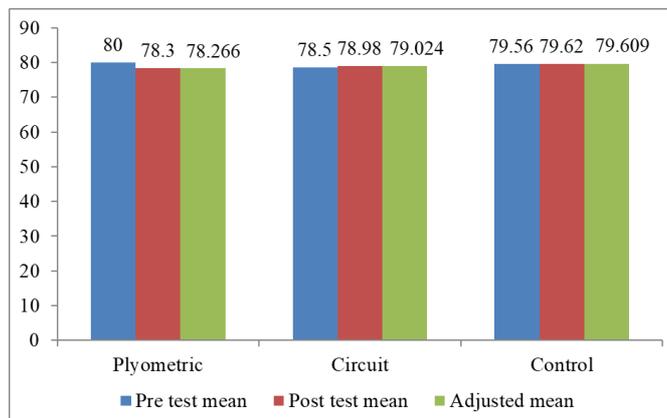
*Significance Level at 0.05 'F' (2,147) = 3.057 & (2,146) = 3.058

In the Table-6 above, the 'F' ratio of Post Test Means of all the three groups (Plyometric Training Group = 78.3, Circuit

Training Group = 78.98 Control Group = 79.62) was found 1.161. Comparing it with Table value (3.057) it was found

insignificant at 0.05 level. Therefore, it is proved that, because of the given training, the performance of the subjects is improved insignificantly. In addition, the 'F' ratio of Adjusted Means (Plyometric Training Group = 78.266, Circuit Training Group = 79.024 Control Group = 79.609)

was found to be 1.201. Comparing it with Table value (3.058) it was found insignificant at 0.05 level. The differences between Adjusted Means of all the three groups through 'F' ratio become insignificant.



Graph 9: Mean scores of Diastolic blood pressure of two experimental groups and a control group

Discussion of hypotheses

No.	Hypothesis	'F' ratio	Significance level 0.05	Accepted / Rejected
1	Significant effect will be found in Pulse Rate school children by Plyometric and Circuit Training.	50.704*	(2,57) = 3.159 & (2,56) = 3.162	Accepted
2	Significant effect will be found in Vital Capacity school children by Plyometric and Circuit Training.	15.086*	(2,57) = 3.159 & (2,56) = 3.162	Accepted
3	Significant effect will be found in Systolic Blood Pressure school children by Plyometric and Circuit Training.	0.284	(2,57) = 3.159 & (2,56) = 3.162	Rejected
4	Significant effect will be found in Diastolic Blood Pressure school children by Plyometric and Circuit Training.	1.201	(2,57) = 3.159 & (2,56) = 3.162	Rejected

Conclusions

- It is hereby clear that, due to Plyometric and Circuit training, significant improvement is seen in the performance of subjects in Pulse Rate with comparison to the Control Group. Noteworthy improvement is seen in Pulse Rate Test of the subjects selected through 12 weeks training.
- It is hereby clear that, due to Plyometric and Circuit training, significant improvement is seen in the performance of subjects in Vital Capacity with comparison to the Control Group. Noteworthy improvement is seen in Vital Capacity Test of the subjects selected through 12 weeks training.
- It is hereby clear that, due to Plyometric and Circuit training, no significant improvement is seen in the Systolic Blood Pressure of subjects with comparison to the Control Group. No improvement was seen in Systolic Blood Pressure Test of the subjects selected through 12 weeks training.
- It is hereby clear that, due to Plyometric and Circuit training, no significant improvement is seen in the Diastolic Blood Pressure of subjects with comparison to the Control Group. No improvement was seen in Diastolic Blood Pressure Test of the subjects selected through 12 weeks training.

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