

# Effectiveness of Plyometric and Resistive Run Training Program on Motor Fitness Components

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**Abstract**— For the purpose of this study 80 male students among 150 populations were selected randomly from Innovative Gujarati medium school, Rajkot city. Their age was ranging between 13 to 16 years and verified with school record. Total 80 subjects were divided randomly in three experimental groups A, B, C and one control group D. each group consisted 20 subjects. Group A was Plyometric, group B resistive run, group C plyometric and resistive run combined group, whereas group D not given any type of training. Before and after of 16 weeks training period pre and post test was conducted by North Carolina motor fitness test was administrated and data of muscle strength and endurance in number of sit ups, speed and agility by number of side stepping, explosive strength in inches by standing broad jump, strength of hand and shoulder in numbers of modified pull ups and a capacity of body to move rapidly by number of squat thrust were collected. The obtained data was statistically analyzed by Analysis of Covariance (ANCOVA) to find out the significant difference between the mean scores. The level of significance to compare the F-value was set at 0.05. The results shown that plyometric group A was shown more effectiveness compare to other experimental group in effect on Bent knee sits ups, standing broad jump and squat thrust compare to two other experimental groups. Whereas Resistive run training group was more significant on side stepping compare to two other experimental groups.

**Keywords**— *Plyometric, Resistive Run, motor fitness*

## I. INTRODUCTION

Physical education is a subject of motion. The training and coaching of motor skills is very important in physical education and sports [1]. An effective motor movement is based on synchronization of muscular and nerves systems. A plyometric exercise consists of three phases. The first is a rapid muscle lengthening movement called the eccentric phase. Second comes a short resting period called the amortization phase. Finally, the athlete engages in an explosive muscle shortening movement called the concentric phase. The athlete repeats this three-part cycle as quickly as his can. Soviet Bloc scientists developed Plyometric during the Cold War. The leading researcher of plyometric training was a Russian scientist named Yuri Verkhoshansky. Dr. Verkhoshansky developed a system of exercises called “Jump Training” that used repetitive jumping in order to increase the speed and explosiveness of Russian track

and field athletes. Plyometric improve the functions of muscles, tendons, and nerves so that you can run faster, jump higher and hit harder. They are high in intensity and use speed and strength to power explosive muscular contractions that invoke the “stretching reflex” [2], [3].

Resistance training is a form of exercise that improves muscular strength and endurance. During a resistance-training workout, you move your limbs against resistance provided by your body weight, gravity, bands, weighted bars or dumbbells. Any exercise where you move your body against resistance can be considered resistance or strength training [4]. The definition of resistance in this form of training is simple as well. Resistance is any force that makes the movement harder to perform. Resistance can be provided simply by moving your body against gravity or by adding weighted dumbbells.

## II. METHOD

The purpose of this study was to find out Effectiveness of Plyometric and Resistive run training program on selected components of body composition. For this study, 80 male students among 150 populations were selected randomly from Innovative Gujarati medium school, Rajkot city. Their age was ranging between 13 to 16 years and verified with school record. The medical examination was done for all the subjects. To remove accidental reasons, all the procedure for training, exercise and tests were explained to the subjects. Total 80 subjects were divided randomly in three experimental groups A, B, C and one control group D. each group consisted 20 subjects. Group A was Plyometric, group B resistive run, group C plyometric and resistive run combined group, whereas group D not given any type of training. Group A went through plyometric training. The plyometric training was performed thrice a week for 16 weeks and divided in four phases of four weeks. Which includes two feet ankle hopes, pull over pass, cone hopes, side throw, standing triple jump, overhead throw with jump, single leg bounding, backward throw with jump to box, incline pushups—depth jump and depth jump. Group B went through resistive running (harness running). Resistive run training was performed for thrice a week for 16 weeks. It includes variation in distance, weight, repetitions and intensity. Group C was undergone with combine training of plyometric

and resistance run whereas group D was not taken part in any kind of training.

Before and after of 16 weeks training period pre and posttest was conducted by North Carolina motor fitness test i.e. Bent knee sit-ups, side stepping, standing broad jump, modified pull-ups and squat thrust. The obtained data was statistically analyzed by Analysis of Covariance (ANCOVA) to find out the significant difference between the mean scores. The level of significance to compare the F-value was set at 0.05

**III. RESULT & DISCUSSION**

**A. Experimental and Control Groups**

This is the result of Bent Knee sit-ups exercise in each group trials

TABLE I. ANCOVA FOR THREE EXPERIMENTAL AND ONE CONTROL GROUP FOR BENT KNEE SIT-UPS

Test	SS	df	MSS	F
Pre Test	B : 9.7	03	3.23	0.510
	W: 481.5	76	6.33	
Post Test	B: 60.037	03	20.1	2.828*
	W: 537.65	76	7.07	
Adjusted Mean	B: 2.47	03	21.73	19.93*
	W: 259.07	75	1.09	

\*p < 0.05. B = between the group Variance, W= within the group Variance

It was evident from table I that F ratio of pretest in bent knee sit-ups was 0.510. It was not significant, so random distribution of samples at primary level was successful. Whereas F ratio of adjusted final mean is 19.93, it was significant at 0.05 level.

A least significant difference test (Post hoc LSD) was applied to find out that, among group A, B and C, which experimental group treatment, was being effective on bent knee sit-ups.

TABLE II. LEAST SIGNIFICANT DIFFERENCE TEST AMONG THREE EXPERIMENTAL AND ONE CONTROL GROUP IN BENT KNEE SIT-UPS

Means of Groups				DM
A	B	C	D	
14.04	13.59	-	-	0.450
14.04		13.57		0.470
14.04			12.52	1.520*
	13.59	13.57		0.020
	13.59		12.52	1.075*
		13.57	12.52	1.050*

\*p < 0.05

It was shown from table II that there was significant difference between groups A, B and C compare with control group D. A plyometric group A was shown more effectiveness compare to other experimental group.

TABLE III. LEAST SIGNIFICANT DIFFERENCE TEST AMONG THREE EXPERIMENTAL AND ONE CONTROL GROUP IN BENT KNEE SIT-UPS

Test	SS	df	MSS	F
Pre Test	B : 7.73	03	2.579	0.729
	W: 268.75	76	3.536	
Post Test	B: 51.25	03	17.083	4.211*
	W: 308.3	76	4.0565	
Adjusted Mean	B: 2.475	03	17.86	23.36*
	W: 259.7	75	0.764	

\*p < 0.05. B = between the group Variance, W= within the group Variance

It was evident from table III that F ratio of pretest in sidestepping was 1.63. It was not significant, so random distribution of samples at primary level was successful. It was also observed that F ratio of posttest was 4.211, which was significant at 0.05 level. Whereas F ratio of adjusted final mean is 23.36, it was significant at 0.05 level.

A least significant difference test (Post hoc LSD) was applied to find out that, among group A, B and C, which experimental group treatment, was being effective on sidestepping.

TABLE IV. LEAST SIGNIFICANT DIFFERENCE TEST AMONG THREE EXPERIMENTAL AND ONE CONTROL GROUP IN SIDESTEPPING

Means of Groups				DM
A	B	C	D	
14.18	14.41	-	-	0.23
14.18		14.15		0.03
14.18			12.95	1.23*
	14.41	14.15		0.26
	14.41		12.95	1.46*
		14.15	12.95	1.20*

\*p < 0.05

It was shown from table IV that there was significant difference between groups A, B and C compare with control group D. the resistive run training group B was shown more effectiveness compare to other experimental group.

TABLE V. ANCOVA FOR THREE EXPERIMENTAL AND ONE CONTROL GROUP FOR STANDING BROAD JUMP

Test	SS	df	MSS	F
Pre Test	B : 20.63	03	6.879	0.399
	W: 1307.55	76	17.204	
Post Test	B: 135.43	03	45.145	2.879*
	W: 1191.55	76	15.678	
Adjusted Mean	B: 52.312	03	19.25	9.349*
	W: 1164.5	75	2.059	

\*p < 0.05. B = between the group Variance, W= within the group Variance

It was evident from table V that F ratio of pre test in standing broad jump was 0.399. It was not significant, so random distribution of samples at primary level was successful. It was also observed that F ratio of post test was 2.879, which was significant at 0.05 level. Whereas F ratio of adjusted final mean is 9.349, it was significant at 0.05 level.

A least significant difference test (Post hoc LSD) was applied to find out that, among group A, B and C, which experimental group treatment, was being effective on standing broad jump.

TABLE VI. LEAST SIGNIFICANT DIFFERENCE TEST AMONG THREE EXPERIMENTAL AND ONE CONTROL GROUP IN SIDESTEPPING

Means of Groups				DM
A	B	C	D	
57.36	56.15	-	-	1.21*
57.36		56.43		0.93
57.36			53.98	3.38*
	56.15	56.43		0.28
	56.15		53.98	2.52*
		56.43	53.98	2.45*

\*p < 0.05

It was shown from table VI that there was significant difference between groups A, B and C compare with control

group D. the plyometric training group A was shown more effectiveness compare to other experimental group.

TABLE VII. LEAST SIGNIFICANT DIFFERENCE TEST AMONG THREE EXPERIMENTAL AND ONE CONTROL GROUP IN SIDESTEPPING

Test	SS	df	MSS	F
Pre Test	B : 20.63	03	6.879	0.399
	W:1307.55	76	17.204	
Post Test	B: 135.43	03	45.145	2.879*
	W:1191.55	76	15.678	
Adjusted Mean	B: 52.312	03	19.25	9.349*
	W: 1164.5	75	2.059	

\*p < 0.05. B = between the group Variance, W= within the group Variance

It was evident from table VII that F ratio of pre test in standing broad jump was 0.399. It was not significant, so random distribution of samples at primary level was successful. It was also observed that F ratio of post test was 2.879, which was significant at 0.05 level. Whereas F ratio of adjusted final mean is 9.349, it was significant at 0.05 level.

A least significant difference test (Post hoc LSD) was applied to find out that, among group A, B and C, which experimental group treatment, was being effective on standing broad jump.

TABLE VIII. LEAST SIGNIFICANT DIFFERENCE TEST AMONG THREE EXPERIMENTAL AND ONE CONTROL GROUP IN SIDESTEPPING

Means of Groups				DM
A	B	C	D	
57.36	56.15	-	-	1.21*
57.36		56.43		0.93
57.36			53.98	3.38*
	56.15	56.43		0.28
	56.15		53.98	2.52*
		56.43	53.98	2.45*

\*p < 0.05

It was shown from table VIII that there was significant difference between groups A, B and C compare with control group D. the plyometric training group A was shown more effectiveness compare to other experimental group.

TABLE IX. ANCOVA FOR THREE EXPERIMENTAL AND ONE CONTROL GROUP FOR MODIFIED PULL-UPS

Test	SS	df	MSS	F
Pre Test	B : 9.75	03	3.25	1.063
	W: 232.2	76	3.055	
Post Test	B: 18.73	03	6.245	1.613
	W: 294.15	76	3.870	
Adjusted Mean	B: 11.375	03	1.918	2.18
	W: 230.2	75	0.879	

\*p < 0.05. B = between the group Variance, W= within the group Variance

It was evident from table IX that F ratio of pretest in standing broad jump was 1.063. It was not significant, so random distribution of samples at primary level was successful. It was also observed that F ratio of posttest was 1.613, which was not significant at 0.05 level. Whereas F ratio of adjusted final mean is 2.18, it was also not significant at 0.05 level. At this stage, no one training was being significant in the modified pull-ups.

TABLE X. ANCOVA FOR THREE EXPERIMENTAL AND ONE CONTROL GROUP FOR SQUAT THRUST

Test	SS	df	MSS	F
Pre Test	B : 1.3	03	0.433	0.187
	W: 175.5	76	2.309	
Post Test	B: 70.03	03	23.34	11.715*
	W: 151.45	76	1.99	

Test	SS	df	MSS	F
Adjusted Final Mean	B: 8.6	03	19.58	20.22*
	W: 117.6	75	0.96	

\*p < 0.05. B = between the group Variance, W= within the group Variance

It was evident from table X that F ratio of pretest in standing broad jump was 0.187. It was not significant, so random distribution of samples at primary level was successful. It was also observed that F ratio of posttest was 11.715, which was significant at 0.05 level. Whereas F ratio of adjusted final mean is 20.22, it was significant at 0.05 level.

A least significant difference test (Post hoc LSD) was applied to find out that, among group A, B and C, which experimental group treatment, was being effective on Squat thrust

TABLE XI. LEAST SIGNIFICANT DIFFERENCE TEST AMONG THREE EXPERIMENTAL AND ONE CONTROL GROUP IN SQUAT THRUST

Means of Groups				DM
A	B	C	D	
12.54	12.39	-	-	0.15
12.54		12.25		0.29
12.54			10.25	2.20*
	12.39	12.25		0.14
	12.39		10.25	2.14*
		12.25	10.25	2.00*

\*p < 0.05

It was shown from table XI that there was significant difference between groups A, B and C compare with control group D. the plyometric training group A was shown more effectiveness compare to other experimental group.

**B. Discussion**

The results shown that plyometric group A was shown more effectiveness compare to other experimental group in motor fitness components. Here among three experimental groups plyometric group consist set of exercises, which was more stretchable and extensive thus resulting in more elasticity in muscles. Due to this body's capacity of utilize motor energy is increases [5]. So plyometric group shown more effectiveness compare to other groups [6], [7].

It was observed from results that resistative run training group B was more effective in sidestepping. It is evident from research that resistance exercises proved more significant to improve muscle strength [8] For kinematics of body coordination of neurons and body, organs are necessary [9]–[11]. Here Plyometric training includes developing exercise of elastic strength and resistative run training includes different load and distance. Therefore, they both lead to improvement in bio chemical reactions, contraction and extension of muscles.

**IV. CONCLUSION**

Plyometric training group was shown more significant effect on Bent knee sits ups, standing broad jump and squat thrust compare to two other experimental groups. Resistive run training group was more significant on side stepping compare to two other experimental groups.

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