

**INFLUENCE OF UP HILL, DOWN HILL AND SPRINT RUNS IN TREADMILL ON
VO₂ MAX AND CARDIO RESPIRATORY ENDURANCE AMONG LONG
DISTANCE RUNNERS**

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ABSTRACT

The Purpose of the Study Was to find out effect of varied intensities of plyometric training on vo₂ max and resting heart rate, random group design was employed. Randomly selected long distance runners (N=60) were divided into four groups consisting of 15 in each group. Experimental Group I underwent uphill treadmill walking and running exercises, experimental group II underwent down hill treadmill walking and running exercises and experimental group three underwent sprint running on treadmill, group four was control group which did not participated in any special training. The control group did not participate in any special exercises except of their routine. Pre test scores were obtained using standard tests on selected VO₂ max, and cardio respiratory endurance before the experimental period and the post test scores were obtained immediately after the twelve weeks experimental period. The difference between the pre test and post test means were subjected to statistical treatment using ANCOVA, which was the effect of uphill, downhill and sprint running on treadmill. In all cases 0.05 level was fixed to test the hypothesis of the study.

Key Words: vo₂ max and cardio respiratory endurance

INTRODUCTION

The man's day to day life physical activity takes an important role. The man becomes fit for physical activity by developing required skills, strength and endurance. Man should be more fit than what the daily necessities of his life required, so that he can meet the occasional emergencies that arise. These emergencies may include sudden need to increase great efficiency in his working hours to take care of some immediate situation. The situation may be very vital and upsetting. Whatever the emergency that thrusts itself on man, he has to carry on. Sports are a means of developing these emergency fitness.

STATEMENT OF THE PROBLEM

The purpose of the study was to find out the influence of uphill, downhill and sprint runs in treadmill on vo₂ max and cardio respiratory endurance among long distance runners

DELIMITATION

The study would be delimited in the following aspects and while interpreting the results. It should be taken into consideration.

1. The study would be delimited to 60 long distance runners of collegiate level athletes in Tamilnadu and their age was between 18 to 25 years.
2. In this study, the following variables would be selected:
 1. VO₂ max
 2. Cardio respiratory endurance

LIMITATIONS

1. The investigator could not control the life style, psychological stress and factors that affect metabolic function.
2. Psychological and sociological aspects of their day-to-day life interactions to their environment could not be controlled.
3. The daily routine, climatic conditions, nutritional actors, motivational factors and socio-economic factors, were not taken into consideration.
4. The time of training and time of testing were the working days, in mostly morning and evening hours.

SELECTION OF SUBJECTS

The purpose of the study was to find out the influence of up hill, down hill and sprint runs in treadmill on vo₂ max cardio respiratory endurance among long distance runners To achieve the purpose of this study, sixty long distance runners who had participated at intercollegiate level competitions from different colleges in Tamilnadu were selected as subjects. The selected subjects' age group was ranging from 19 to 25 years. The subjects were randomly divided into four groups and each group consists of fifteen subjects. Group one acted as experimental group one and Group two acted as experimental group two, group three acted as experimental group three and group four acted as control group. Group one underwent uphill treadmill walking and running exercises, group II underwent down hill treadmill walking and running exercises and group three underwent sprint running on treadmill, group four was control group which did not participated in any special training.

SELECTION OF VARIABLES

Dependent Variables

1. VO₂ max
2. Cardiorespiratory Endurance

Independent Variables

1. Uphill training on Treadmill for twelve weeks
2. Downhill Training on Treadmill for twelve weeks
3. Sprint running training on Treadmill for twelve weeks

EXPERIMENTAL DESIGN

For the purpose of the study, random group design was employed. Randomly selected long distance runners (N=60) were divided into four groups consisting of 15 in each group. Experimental Group I underwent uphill treadmill walking and running exercises, experimental group II underwent down hill treadmill walking and running exercises and experimental group three underwent sprint running on treadmill, group four was control group which did not participated in any special training. The control group did not participate in any special exercises except of their routine. Pre test scores were obtained using standard tests on selected VO₂ max, and cardio respiratory endurance before the experimental period and the post test scores were obtained immediately after the twelve weeks experimental period. The difference between the pre test and post test means were subjected to statistical treatment using ANCOVA, which was the effect of uphill, downhill and sprint running on treadmill. In all cases 0.05 level was fixed to test the hypothesis of the study.

CRITERION MEASURES

Table 1 shows the variables selected and the tests administered to measure the criterion measures of the study.

Table I
Showing the Variables and Tests for the Research

S.No	Variables	Tests
1	VO ₂ max	Cooper's 12 Minutes Run / Walk
2	Cardio respiratory Endurance	Harvard Step up test

Table II

Intra Class Correlation Coefficient of Test – Retest Scores

S.No	Variables	Tests	Obtained 'r'
1	VO ₂ max	Cooper's 12 Minutes Run / Walk	0.90*
2	Cardio respiratory Endurance	Harvard Step up test	0.92*

* Significant at 0.01 level

RESULTS ON VO₂ MAX

The statistical analysis comparing the initial and final means of VO₂ max due to uphill training, down hill training, sprint runs training and control groups of long distance runners is presented in Table III

Table III

COMPUTATION OF ANALYSIS OF COVARIANCE DUE TO UPHILL TRAINING, DOWN HILL TRAINING AND SPRINT RUNS TRAINING ON VO₂ MAX

	Uphill trainings Group	Down hill training Group	Sprint Runs Group	Control Group	SOV	Sum of Squares	df	Mean Squares	Obtained F
Pre Test Mean	43.15	40.60	42.13	41.73	B	49.94	3	16.65	0.75
Std Dev	5.31	3.40	5.18	4.70	W	1242.55	56	22.19	
Post Test Mean	46.36	46.61	44.79	41.77	B	223.29	3	74.43	4.23*
Std Dev	4.98	3.74	5.18	3.66	W	985.35	56	17.60	
Adjusted Post Test Mean	45.37	47.65	44.61	41.91	B	251.23	3	83.74	23.96*
					W	192.20	55	3.49	

SOV: Source of Variance; B: Between W: Within

Required $F_{(0.05), (df 3,75)} = 2.77$

* Significant at 0.05 level of confidence

As shown in Table III, the pre test mean on VO₂ max of uphill trainings group was 43.15 with standard deviation ± 5.31 pre test mean of down hill training group was 40.60 with

standard deviation \pm 3.40, the pre test mean of sprint runs training group was 42.13 with standard deviation \pm 5.18, the pre test mean of control group was 41.73 with standard deviation \pm 4.70. The obtained F ratio of 0.75 on pre test means of the groups was not significant at 0.05 level as the obtained F value was less than the required table F value of 2.77 to be significant at 0.05 level. This shows that there was no significant difference in means of the groups at initial stage.

The results presented in Table III, the post test mean on VO₂ max of uphill trainings group was 46.36 with standard deviation \pm 4.98 post test mean of down hill training group was 46.61 with standard deviation \pm 3.74, the post test mean of sprint runs training group group was 44.79 with standard deviation \pm 3.74, the post test mean of control group was 41.77 with standard deviation \pm 3.66. The obtained F ratio of 4.23 on post test means of the groups was significant at 0.05 level as the obtained F value was greater than the required table F value of 2.77 to be significant at 0.05 level. This shows that there was significant difference in means of the groups at post experimental stage.

Taking into consideration of the pre test means and post test means, adjusted post test means were determined and analysis of covariance was done. The adjusted mean on VO₂ max on uphill trainings group was 45.37, down hill training group was 47.65, sprint runs training group was 44.61 and control group was 41.91. The obtained F value on adjusted means was 23.96. The obtained F value was greater than the required value of 2.77 and hence it was accepted that there was significant differences among the adjusted means on the VO₂ max of the subjects.

Since significant improvements were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table IV

Table IV
Multiple Comparisons between Uphill training, Down hill training, Sprint runs training and Control Groups and Scheffe's Post Hoc Analysis on VO₂ max

Uphill trainings Group	Down hill training Group	Sprint Runs Training Group	Control Group	MEAN DIFF	C. I
45.37	47.65			2.29*	1.97
45.37		44.61		0.75	1.97
45.37			41.91	3.46*	1.97
	47.65	44.61		3.04*	1.97
	47.65		41.91	5.74*	1.97

		44.61	41.91	2.70*	1.97
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* Significant at 0.05 level.

The post hoc analysis of obtained ordered adjusted means proved that to be significant at 0.05 level confidence the required confidence interval was 1.97. The following paired mean comparisons were greater than the required confidence interval and were significant at 0.05 level.

Uphill trainings Group Vs Down hill Training Group (MD: 2.29)

Uphill trainings Group Vs Control Group (MD: 3.46)

Down hill training Group Vs Sprint runs Training Group (MD: 3.04)

Down hill training Group Vs Control Group (MD: 5.74)

Sprint runs training Group Vs Control Group (MD: 2.70)

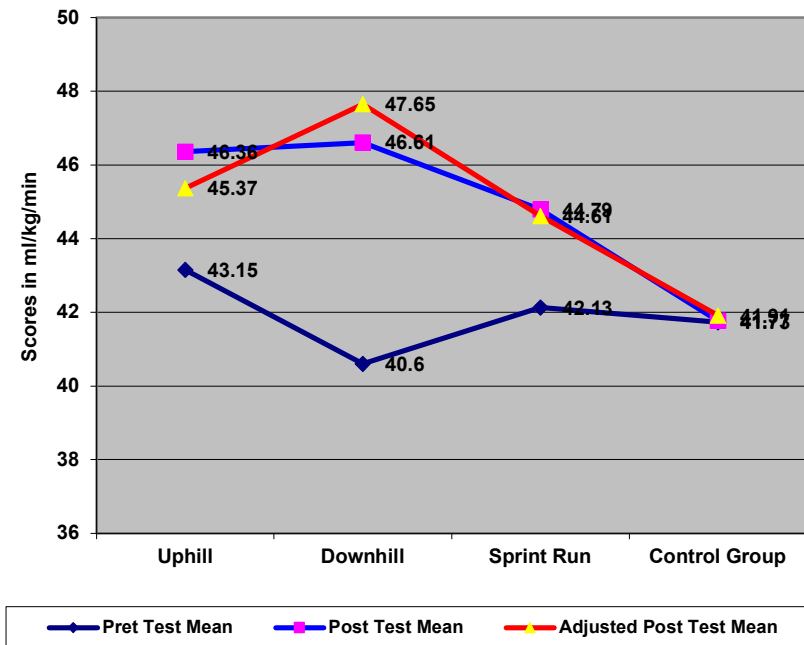
The following paired mean comparisons were less than the required confidence interval and were not significant at 0.05 level.

Uphill trainings Group Vs Sprint runs Training Group (MD: 0.75)

The pre test, post test and ordered adjusted means were presented through line graph for better understanding of the results of this study in Figure I.

Figure I

LINE GRAPH SHOWING PRE, POST AND ADJUSTED MEANS ON VO₂ MAX



RESULTS ON CARDIO RESPIRATORY ENDURANCE

The statistical analysis comparing the initial and final means of Cardio respiratory Endurance due to uphill training, down hill training, sprint runs training and control groups of long distance runners is presented in Table v

Table V

COMPUTATION OF ANALYSIS OF COVARIANCE DUE TO UPHILL TRAINING, DOWN HILL TRAINING AND SPRINT RUNS TRAINING ON CARDIO RESPIRATORY ENDURANCE

	Uphill trainings Group	Down hill training Group	Sprint Runs Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
Pre Test Mean	71.86	73.67	71.49	72.99	B	45.79	3	15.26	0.25
Std Dev	6.26	7.20	8.50	9.04	W	3428.52	56	61.22	
Post Test Mean	79.08	78.97	79.87	73.44	B	395.07	3	131.69	2.35
Std Dev	7.78	7.00	8.50	7.63	W	3142.54	56	56.12	
Adjusted Post Test Mean	79.46	78.29	80.46	73.15	B	473.27	3	157.76	4.39*
					W	1975.02	55	35.91	

SOV: Source of Variance; B: Between W: Within

Required $F_{(0.05), (df 3,75)} = 2.77$

* Significant at 0.05 level of confidence

As shown in Table V, the pre test mean on Cardio respiratory Endurance of uphill trainings group was 71.86 with standard deviation ± 6.26 pre test mean of down hill training group was 73.67 with standard deviation ± 7.20 , the pre test mean of sprint runs training group was 71.49 with standard deviation ± 8.50 , the pre test mean of control group was 72.99 with standard deviation ± 9.04 . The obtained F ratio of 0.25 on pre test means of the groups was not significant at 0.05 level as the obtained F value was less than the required table F value of 2.77 to be significant at 0.05 level. This shows that there was no significant difference in means of the groups at initial stage.

The results presented in Table V, the post test mean on Cardio respiratory Endurance of uphill trainings group was 79.08 with standard deviation ± 7.78 post test mean of down hill training group was 78.97 with standard deviation ± 7.00 , the post test mean of sprint runs training group group was 79.87 with standard deviation ± 7.00 , the post test mean of control group was 73.44 with standard deviation ± 7.63 . The obtained F ratio of 2.35 on post test

means of the groups was insignificant at 0.05 level as the obtained F value was lesser than the required table F value of 2.77 to be significant at 0.05 level. This shows that there was no significant difference in means of the groups at post experimental stage.

Taking into consideration of the pre test means and post test means, adjusted post test means were determined and analysis of covariance was done. The adjusted mean on Cardio respiratory Endurance on uphill trainings group was 79.46, down hill training group was 78.29, sprint runs training group was 80.46 and control group was 73.15. The obtained F value on adjusted means was 4.39. The obtained F value was greater than the required value of 2.77 and hence it was accepted that there was significant differences among the adjusted means on the Cardio respiratory Endurance of the subjects.

Since significant improvements were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table VI

Table VI
Multiple Comparisons between Uphill training, Down hill training, Sprint runs training and Control Groups and Scheffe's Post Hoc Analysis on Cardio respiratory Endurance

Uphill trainings Group	Down hill training Group	Sprint Runs Training Group	Control Group	MEAN DIFF	C.I
79.46	78.29			1.17	6.31
79.46		80.46		-1.00	6.31
79.46			73.15	6.31*	6.31
	78.29	80.46		-2.17	6.31
	78.29		73.15	5.14	6.31
		80.46	73.15	7.31*	6.31

* Significant at 0.05 level.

The post hoc analysis of obtained ordered adjusted means proved that to be significant at 0.05 level confidence the required confidence interval was 6.31. The following paired mean comparisons were greater than the required confidence interval and were significant at 0.05 level.

Uphill trainings Group Vs Control Group (MD: 6.31)

Sprint runs training Group Vs Control Group (MD: 7.31)

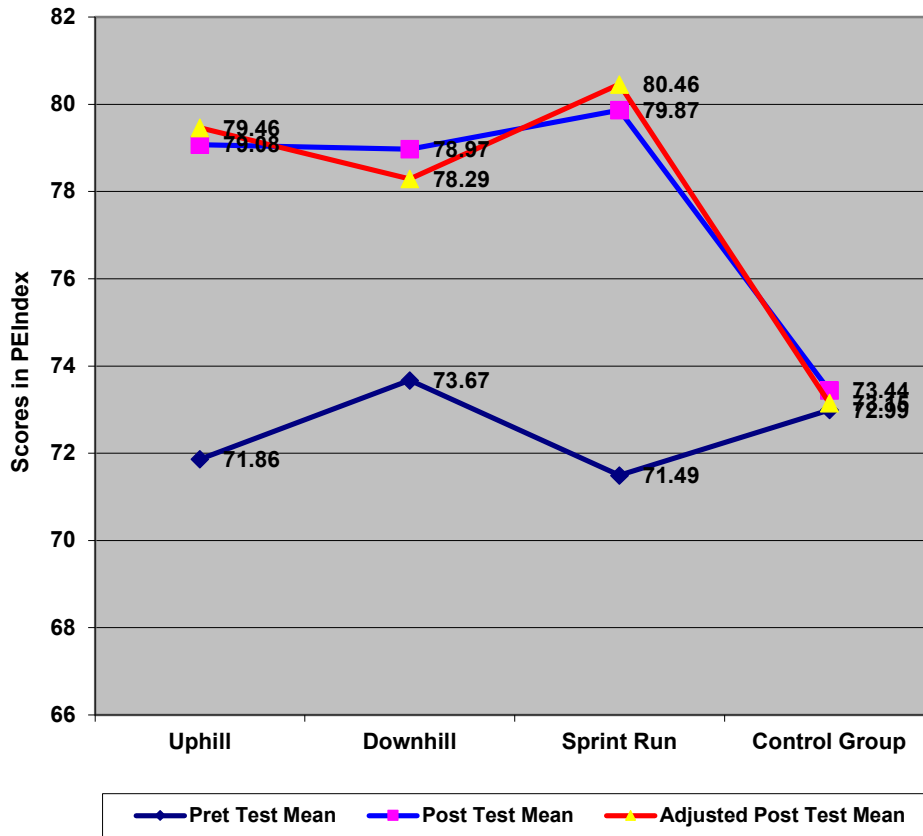
The following paired mean comparisons were less than the required confidence interval and were not significant at 0.05 level.

Uphill trainings Group Vs Down hill Training Group (MD: 1.17)
 Uphill trainings Group Vs Sprint runs Training Group (MD: 1.00)
 Down hill training Group Vs Sprint runs Training Group (MD: 2.17)
 Down hill training Group Vs Control Group (MD: 5.14)

The pre test, post test and ordered adjusted means were presented through line graph for better understanding of the results of this study in Figure II.

Figure II

LINE GRAPH SHOWING PRE, POST AND ADJUSTED MEANS ON CARDIO RESPIRATORY ENDURANCE



CONCLUSIONS

Within the limitations and delimitations of the study the following conclusions were drawn:

1. It was concluded that uphill running, down hill running and sprint running on treadmill significantly on VO₂ max of long distance runners compared to control group. Comparing among treatment groups, down hill running was significantly better than uphill running and sprint running in improving VO₂ max of the long distance runners.

2. It was concluded that uphill running and sprint running on treadmill significantly influenced on cardio respiratory endurance of long distance runners compared to control group. Comparing among treatment groups, there was no significant differences in altering cardio respiratory endurance of the long distance runners.

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