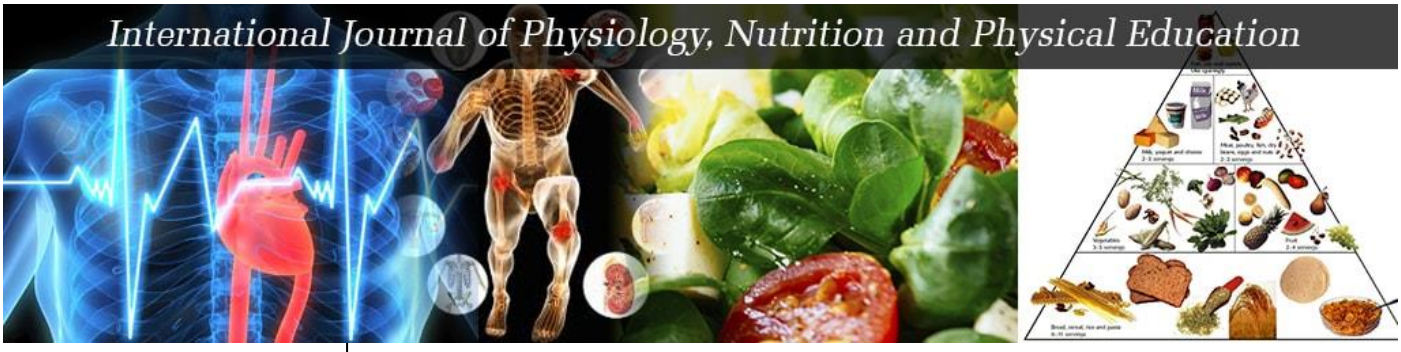

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Influence of uphill downhill and sprint runs in treadmill on VO_2 max and cardio respiratory endurance among long distance runners

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Abstract
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. The high level of physical fitness necessitates the controlling mind when we speak. Gracefully poised and well-conditioned individual comes from years of daily experience in a selected variety of vigorous physical activities. Consistence of physical fitness forms sports and the precision and nicety of body control. Physical fitness forms sports and the precision and nicety of body control. Sports lead to mental poise an emotional stability that should stand the athlete in good stead in future critical situations. The purpose of this study find out the influence of uphill, downhill and sprint runs in treadmill on vo_2 max and cardio respiratory endurance among long distance runners 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 downhill 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 VO_2 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.

Keywords: VO_2 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.

The high level of physical fitness necessitates the controlling mind when we speak. Gracefully poised and well-conditioned individual comes from years of daily experience in a selected variety of vigorous physical activities. Consistence of physical fitness forms sports and the precision and nicety of body control. Physical fitness forms sports and the precision and nicety of body control. Sports lead to mental poise an emotional stability that should stand the athlete in good stead in future critical situations.

Methodology

The purpose of the study was to find out the effect of uphill, downhill and sprint running on treadmill on VO_2 max and Cardio Repertory 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 Andhra Pradesh were selected as subjects. The selected subjects' age group was ranging from 18 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 downhill 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. 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 downhill 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 VO_2 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 pretest 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.

Results and Discussions

The statistical analysis comparing the initial and final means of VO_2 max due to uphill training, downhill training, sprint runs training and control groups of long distance runners is presented in Table I.

Table I: Computation of analysis of covariance due to uphill training, downhill training and sprint runs training on VO_2 max

	Uphill trainings Group	Downhill 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	
Std Dev	5.31	3.40	5.18	4.70	W	1242.55	56	22.19	0.75
Post-test Mean	46.36	46.61	44.79	41.77	B	223.29	3	74.43	
Std Dev	4.98	3.74	5.18	3.66	W	985.35	56	17.60	4.23*
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	

As shown in Table I, the pre-test mean on VO_2 max of uphill trainings group was 43.15 with standard deviation $\pm$ 5.31 pre-test mean of downhill 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 VO_2 max of uphill trainings group was 46.36 with standard deviation $\pm$ 4.98 post-test mean of downhill training group was 46.61 with standard deviation $\pm$ 3.74, the post-test mean of sprint runs training 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 VO_2 max on uphill trainings group was 45.37, downhill 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 VO_2 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 II.

Table 2: Multiple comparisons between uphill training, downhill training, sprint runs training and control groups and scheffe's post hoc analysis on VO_2 max

Uphill trainings Group	Downhill 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

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. 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.

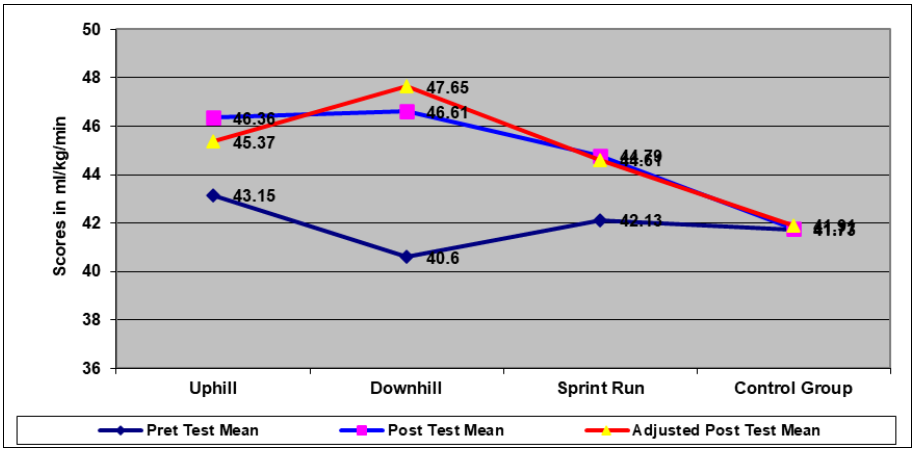

Fig I: Line graph showing pre, post and adjusted means on VO_2 max

Results on cardio respiratory endurance

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

Table 3: Computation of analysis of covariance due to uphill training, downhill training and sprint runs training on cardio respiratory endurance

	Uphill trainings Group	Downhill training Group	Sprint Runs Group	Control Group	SOV	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	

As shown in Table III, the pre-test mean on Cardio respiratory Endurance of uphill trainings group was 71.86 with standard deviation ± 6.26 pre-test mean of downhill 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 VII, the post-test mean on Cardio respiratory Endurance of uphill trainings group was 79.08 with standard deviation ± 7.78 post-test mean of downhill training group was 78.97 with standard deviation ± 7.00, the post-test mean of sprint runs training 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, downhill 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 IV.

Table IV: Multiple comparisons between uphill training, downhill training, sprint runs training and control groups and Scheffe's post hoc analysis on cardio respiratory endurance

Uphill trainings Group	Downhill 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

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.

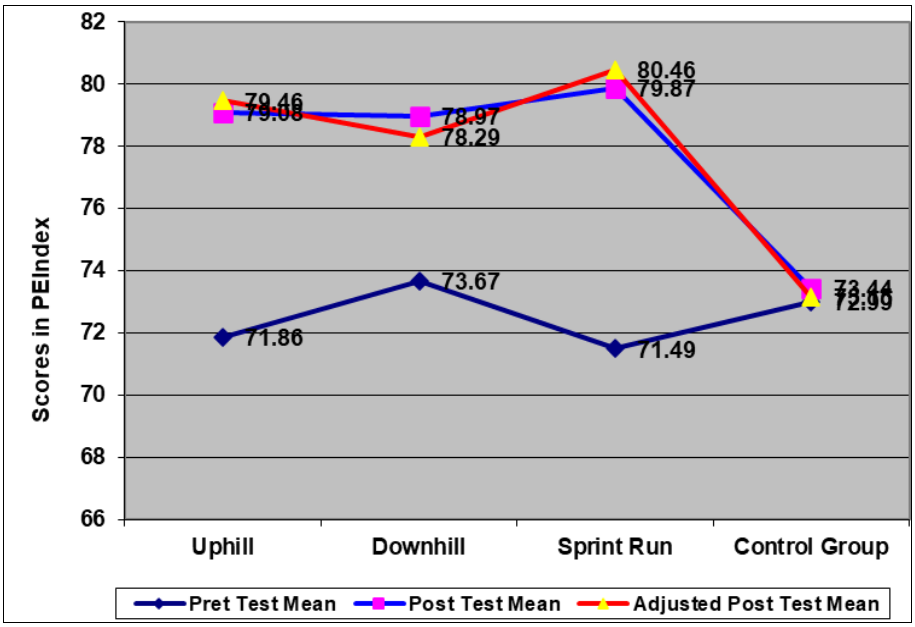

Fig II: Line graph showing pre, post and adjusted means on cardio respiratory endurance

Conclusions

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

1. It was concluded that uphill running, downhill running and sprint running on treadmill significantly influenced on VO_2 max of long distance runners compared to control group. Comparing among treatment groups, downhill running was significantly better than uphill running and sprint running in improving VO_2 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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