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COMPARATIVE EFFECT OF TRAINING LOADS DOMINATED BY STRENGTH AND ENDURANCE ON SELECTED PHYSICAL FITNESS VARIABLES OF BASKETBALL PLAYERS

KEY WORDS: Training loads, Strength, Endurance, Physical fitness Variables, Basketball Players

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ABSTRACT

The purpose of the study was to compare the effects of training load, dominated by Strength and Endurance on selected physical fitness variables of Basketball players. One hundred and twenty male basketball players who had participated in inter college tournaments under Fakir Mohan University were acted as subjects and equally divided into three groups (two experimental and one control). The two experimental groups, administered with endurance dominated training and strength dominated training showed significant gains in performance of almost all physical fitness components after administration of training for 10 weeks duration.

Competitive Basketball demands high level of physical fitness. Only those trained with proper requisites in terms of loading of rudiments for the Execution of skills, will withstand the wear and tear of competition and put in, their best accordingly. Keeping the above facts in view, the present study was under taken to find out the effect of training loads dominated by strength and endurance on selected physical fitness variables of basketball players.

The purpose of the study was to compare the effects of training loads dominated by Strength and Endurance on selected physical fitness variables of Basketball players.

Methodology: The subjects were one hundred and twenty male basketball players from Baliapal College of Physical Education. The age of the subjects were ranged from 19 to 24 years. The subjects were equally assigned to three groups (two experimental and one control). The two experimental groups participated in the training programme for a period of ten weeks. The first group (Group A: Endurance dominated training group) performed endurance dominated exercises, the second group (Group B: Strength dominated training group) performed strength dominated exercises and the third group (Group C: Control group) was not allowed to do any such activities prescribed to the experimental groups.

The subjects belonging to the two experimental Groups underwent training for five days in a week that is from Monday to Friday for a period of ten weeks. No specific training was imparted to group C. All the three groups practiced Basketball skills during the experimental period as a part of their basketball training programme. Tests in selected physical fitness variables were administered to the subjects of all the groups before (pre test) and after (post test) the experimental periods of ten weeks.

Physical fitness Variables (Motor Components): Speed, Reaction Time, Strength (Explosive leg strength), Cardio-respiratory Endurance, Flexibility (Spine Flexibility), Agility, Balance (Dynamic Balance).

Speed was recorded in 1/10th of a second using 50-metre Dash. Reaction Time was measured using Nelson's Reaction Time. Explosive Leg Strength was recorded in centimetre using Standing Broad Jump. The Cardio-Respiratory Endurance was recorded in meter using Cooper's 12 Minutes Run/walk Test. Agility was assessed using 4x10 Meters Shuttle Run. The Dynamic Balance was measured using Modified Bass Test. To find out the differential effects of the treatments using the analysis of variance and covariance, the level of significance was set at 0.05 level of confidence which was considered adequate and appropriate for purpose of the study.

Findings: For each of the chosen variables, the results pertaining to significant difference, if any, between the pre test and post test means for the three groups after ten weeks of training, which were submitted to analysis of covariance, are given in Table 1 to Table 21.

Table -1: Significance of Difference between Pre-Test and Post-Test Means of the two Experimental Groups and the Control Group in Speed (50 Mt. Dash)

Groups	Pre-test mean±SE	Post-test mean±SE	Difference between mean	SE	't' ratio
ED	8.085±0.221	8.050±0.076	0.350	0.231	0.152
SD	8.200±0.074	7.842±0.062	0.356	0.338	10.590*
Control	8.388±0.223	8.347±0.209	0,040	0,041	0,977

* Significant at 0.05 level of confidence, 't' _{0.05} (39) = 2.023

Table 1 clearly reveals that the SD group improved significantly yielding 't' value 10.590, where as the ED and control group did not show any significant improvement in speed (50 mt. dash) performance of subjects indicating 't' values of 0.152 and 0,977, respectively. In speed (50 mt.dash), it was noted that the differences between the mean scores existed and the experimental group A (SD) improved and no significant change was observed in the B (ED) and control group.

Table - 2: Analysis of Variance and Covariance of the Means of two Experimental Groups and the Control Group in Speed (50 Mt. Dash)

	ED group	SD group	Control group	Sum of squares	df	Mean square	F ratio
Pre-test means	8.085	8.200	8.388	B 1.865 W 162.275	2 117	0.933 1.387	0.672
Post-test means	8.050	7.842	8.347	B 5.155 W 83.118	2 117	2.577 0.710	3.628 *
Adjusted post-test means	8.118	7.854	8.268	B 3.501 W 44.771	2 116	1.751 0.386	4.536 *

* Significant at 0.05 level of confidence, N = 120, B = between group variance, W = within group variance

The analysis of covariance for speed (50 mt. dash) showed that the resultant 'F' ratio of 0.672 was not significant in case of pre-test means. The post test means yielded 'F' ratio of 3.628, which was found to be significant. The adjusted final means yielded the 'F' ratio of 4.536 and was found significant. The 'F' ratio, needed for significance at 0.05 level of confidence (df 2, 117) was 3.09.

Table – 3: Paired Adjusted Final Means and Differences between Means for the two Experimental Groups and the Control Group in Speed (50 Mt. Dash)

ED group	SD group	Control group	Difference between means	Critical differences for adjusted mean
8.118	7.854		0.264*	0.198
8.118		8.268	0.150	0.198
	7.854	8.268	0.414*	0.198

* Significance at 0.05 level

It is clear from the Table 3 that the mean difference with respect to performance in speed (50 mt. dash) of SD group was found to be significantly better than that of both ED and control groups. No significant difference between ED group and control group was found with respect to speed (50 mt. dash) performance.

Table – 4: Significance of Difference between Pre-Test and Post-Test Means of the two Experimental Groups and the Control Group in Reaction Time

Groups	Pre-test mean±SE	Post-test mean±SE	Difference between mean	SE	't' Ratio
ED (A)	0.257±0.003	0.249±0.003	0.008	0.004	1.804
SD (B)	0.243±0.002	0.238±0.002	0.005	0.001	5.606*
Control(C)	0.223±0.003	0.230±0.002	0.003	0.001	1.616

* Significant at 0.05 level of confidence, 't' _{0.05} (39) = 2.023

Table 4 reveals that SD group improved significantly yielding 't' value 5.606 whereas, Ed and control groups did not show any significant improvement in reaction time performance of subjects indicating 't' values of 1.804 and 1.616, respectively. With respect to reaction time, it was found that the differences between the means existed and the experimental groups improved and no significant change was observed in the control group.

Table – 5: Analysis of Variance and Covariance of the Means of two Experimental Groups and the Control Group in Reaction Time

	ED group	SD group	Control group	Sum of squares	df	Mean square	F ratio
Pre-test means	0.257	0.243	0.223	B 0.011 W 0.234	2 117	0.005 0.002	2.500
Post-test means	0.249	0.238	0.230	B 0.007 W 0.026	2 117	0.004 0.001	4.000*
Adjusted post-test means	0.244	0.238	0.235	B 0.001 W 0.021	2 116	0.001 0.0001	10.000*

* Significant at 0.05 level of confidence, N = 120, B = between group variance, W = within group variance

The analysis of variance for reaction time showed that the resultant 'F' ratio of 2.500 was not significant in case of pre-test means. The post test and adjusted final means yielded the 'F' ratio of 4.000 and 10.000, respectively, which were found to be significant. The 'F' ratio, needed for significance at 0.05 level of confidence (df 2, 117) was 3.09.

Table – 6: Paired Adjusted Final Means and Differences between Means for the two Experimental Groups and the Control Group in Reaction Time

ED group	SD group	Control group	Difference between means	Critical differences for adjusted mean
0.244	0.238		0.006*	0.002
0.244		0.235	0.009*	0.002
	0.238	0.235	0.003*	0.002

* Significant at 0.05 level

It is very much clear from the Table 6 that the performance in reaction time of both ED and SD groups were found to be significantly greater than that of control group. Significant

difference between ED and SD group was found with respect to reaction time performance and ED had the highest effect.

Table – 7: Significance of Difference between Pre-Test and Post-Test Means of the two Experimental Groups and the Control Group in Explosive Leg Strength

Groups	Pre-test mean±SE	Post-test mean±SE	Difference between mean	SE	't' Ratio
ED	148.120±2.856	168.880±2.795	20.750	3.479	5.965*
SD	163.180±2.995	190.080±3.332	26.900	1.131	23.784*
Control	150.200±4.747	146.800±3.493	3.400	2.492	1.364

* Significant at 0.05 level of confidence, 't' _{0.05} (39) = 2.023

Table 7 clearly reveals that both the ED and SD group improved significantly yielding 't' value of 5.965 and 23.784, respectively, whereas, control group did not show any significant improvement in explosive leg strength performance of subjects indicating 't' values of 1.364. In explosive leg strength performance, it was noted that the differences between the means existed and the experimental groups improved, whereas, no significant changes was observed in the control group.

Table – 8: Analysis of Variance and Covariance of the Means of two Experimental Groups and the Control Group in Explosive Leg Strength

	ED group	SD group	Control group	Sum of squares	df	Mean square	F ratio
Pre-test means	148.120	163.180	150.200	B 5322.117 W 61870.550	2 117	2661.058 528.808	5.032*
Post-test means	168.880	190.080	146.800	B 37459.617 W 48539.550	2 117	18729.808 414.868	45.146*
Adjusted post-test means	172.620	184.020	149.120	B 24430.636 W 22778.958	2 116	12215.318 196.370	62.206*

* Significant at 0.05 level of confidence, N = 120, B = between group variance, W = within group variance

The analysis of covariance for explosive leg strength showed that the resultant 'F' ratio of 5.032 was significant in case of pre-test means. The post-test and adjusted final means yielded the 'F' ratio of 45.146 and 62.206, respectively and were found to be significant. The 'F' ratio, needed for significance at 0.05 level of confidence (df 2, 117) was 3.09.

Table – 9: Paired Adjusted Final Means and Differences between Means for the Two Experimental Groups and the Control Group in Explosive Leg Strength

ED group	SD group	Control group	Difference between means	Critical differences for adjusted mean
172.620	184.020		11.400*	2.239
172.620		149.120	23.500*	2.239
	184.020	149.120	34.900*	2.239

* Significant at 0.05 level of confidence

It is very much clear from the Table 9 that the performance in explosive leg strength of ED and SD group were found to be significantly greater than that of control group. Significant difference existed between ED and SD group with respect to explosive leg strength performance.

TABLE – 10: Significance of Difference between Pre-Test and Post-Test Means of the two Experimental Groups and the

Control Group in Cardio Respiratory Endurance

Groups	Pre-test mean±SE	Post-test mean±SE	Difference between mean	SE	't' Ratio
ED	2140.000±48.510	2371.200±47.901	231.200	55.893	4.137*
SD	2407.500±54.436	2216.200±32.933	191.300	62.118	3.079*
Control	2376.200±58.671	2311.200±47.180	65.000	38.322	1.696

* Significant at 0.05 level of confidence, 't' _{0.05} (39) = 2.023

Table 10 clearly reveals that Ed and SD group improved significantly yielding 't' value of 4.137 and 3.079, respectively, whereas, control group did not show any significant improvement in cardio respiratory endurance performance of subjects indicating 't' values of 1.696.

Table – 11: Analysis of Variance and Covariance of the Means of two Experimental Groups and the Control Group in Cardio Respiratory Endurance

	ED group	SD group	Control group	Sum of squares	df	Mean square	F ratio
Pre-test means	2140.000	2407.500	2376.200	B 17112.967 W 136600.003	2 117	8556.458 11678.365	1.589
Post-test means	2371.200	2216.200	2311.200	B 48866.667 W 874381.250	2 117	24433.333 7473.344	3.269*
Adjusted post-test means	2428.000	2183.000	2188.000	B 109098.740 W 718721.846	2 116	54549.370 6195.878	8.804*

* Significant at 0.05 level of confidence, N = 120, B = between group variance, W = within group variance

The analysis of covariance for cardio respiratory endurance showed that the resultant 'F' ratio of 1.589 was not significant in case of pre test means. The post test and adjusted final means yielded the 'F' ratio of 3.269 and 8.804, respectively and differences among means were found significant. The 'F' ratio, needed for significance at 0.05 level of confidence (df 2, 117) was 3.09.

Table – 12: Paired Adjusted Final Means and Differences between Means for the two Experimental Groups and the Control Group in Cardio Respiratory Endurance

ED group	SD group	Control group	Difference between means	Critical differences for adjusted mean
2428.000	2183.000		245.000*	39.924
2428.000		2188.000	240.000*	39.924
	2183.000	2188.000	5.000	39.924

* Significant at 0.05 level of confidence

It was clear from the Table 12 that the performance in cardio respiratory endurance of ED group was found to be significantly better than that of SD and control group. No significant difference between SD and control group was found with respect to cardio respiratory endurance performance.

Table – 13: Significance of Difference between Pre-Test and Post-Test Means of the two Experimental Groups and the Control Group in Spine Flexibility

Groups	Pre-test mean±SE	Post-test mean±SE	Difference between mean	SE	't' Ratio
ED	22.412±0.567	19.181±0.704	3.238	0.837	3.868*

SD	19.657±0.729	19.709±1.381	0.052	1.264	0.042
Control	15.397±0.554	15.695±0.522	0.298	0.204	1.460

* Significant at 0.05 level of confidence, 't' 0.05 (39) = 2.023

Table 13 clearly reveals that the ED group improved significantly yielding 't' value of 3.868, whereas, SD and control group did not show any significant improvement in spine flexibility performance of subjects indicating 't' values of 0.042 and 1.460, respectively. It was noted that the differences between the mean scores existed in ED group and no significant changes was observed either in the control group or in SD group.

Table – 14: Analysis of Variance and Covariance of the Means of Two Experimental Groups and the Control Group in Spine Flexibility

	ED group	SD group	Control group	Sum of squares	df	Mean square	F ratio
Pre-test means	22.412	19.657	15.397	B 80.999 W 1810.525	2 117	40.500 15.475	2.617
Post-test means	19.181	19.709	15.695	B 380.517 W 4172.737	2 117	190.258 35.664	5.335*
Adjusted post-test means	17.081	19.388	18.117	B 202.521 W 3422.064	2 116	101.260 29.501	3.432*

* Significant at 0.05 level of confidence, N = 120, B = between group variance, W = within group variance

The analysis of covariance for spine flexibility showed that the resultant 'F' ratio of 2.617 was not significant in case of pre test means. The post test and adjusted final means yielded the 'F' ratio of 5.335 and 3.432, respectively and were found to be significant. The 'F' ratio, needed for significance at 0.05 level of confidence (df 2, 117) was 3.09.

Table – 15: Paired Adjusted Final Means and Differences between Means for the Two Experimental Groups and the Control Group in Spine Flexibility

ED group	SD group	Control group	Difference between means	Critical differences for adjusted mean
17.081	19.388		2.307*	0.861
17.081		18.117	1.036*	0.861
	19.388	18.117	1.271*	0.861

* Significant at 0.05 level of confidence

It is clearly evident from the Table 15 that the performance in spine flexibility of SD group was found to be significantly greater than that of both ED group and control group. Significant difference between ED group and control group was also found with respect to spine flexibility performance.

Table – 16: Significance of Difference between Pre-Test and Post-Test Means of the Two Experimental Groups and the Control Group in Agility (Shuttle Run)

Groups	Pre-test mean±SE	Post-test mean±SE	Difference between mean	SE	't' Ratio
ED	10.900±0.128	10.578±0.084	0.322	0.136	2.379*
SD	11.743±0.112	11.543±0.103	0.200	0.018	11.171*
Control	11.850±0.252	11.885±0.247	0.035	0.033	1.063

* Significant at 0.05 level of confidence, 't' 0.05 (39) = 2.023

Table 16 clearly reveals that, ED and SD group improved significantly yielding 't' value of 2.379 and 11.171, respectively, whereas, control group did not show any significant improvement in agility (shuttle run) performance of subjects indicating 't' values

of 1.063.

Table – 17: Analysis of Variance and Covariance of the Means of Two Experimental Groups and the Control Group in Agility (Shuttle Run)

	ED group	SD group	Control group	Sum of squares	df	Mean square	F ratio
Pre-test means	10.900	11.743	11.850	B 2.165 W 144.318	2 117	1.083 1.233	0.878
Post-test means	10.578	11.543	11.885	B 36.774 W 122.498	2 117	18.387 1.047	17.562*
Adjusted post-test means	11.066	11.342	11.597	B 5.014 W 26.053	2 116	2.507 0.225	11.162*

* Significant at 0.05 level of confidence, N = 120, B = between group variance, W = within group variance

The analysis of covariance for agility (shuttle run) showed that the resultant 'F' ratio of 0.878 was not significant in case of pre-test means. The post-test and adjusted final means yielded the 'F' ratio of 17.562 and 11.162 and were found significant. The 'F' ratio, needed for significance at 0.05 level of confidence (df 2, 117) was 3.09.

Table – 18: Paired Adjusted Final Means and Differences between Means for the two Experimental Groups and the Control Group in Agility (Shuttle Run)

ED group	SD group	Control group	Difference between means	Critical differences for adjusted mean
11.066	11.342		0.275*	0.076
11.066		11.597	0.531*	0.076
	11.342	11.597	0.255*	0.076

* Significant at 0.05 level of confidence

It is clear from the Table 18 that the performance in agility (shuttle run) of SD group was found to be significantly greater than that of both ED group and control group. Significant difference between ED group and control group was also found with respect to agility (shuttle run) performance.

Table –19: Significance of Difference between Pre-Test and Post-Test Means of the two Experimental Groups and the Control Group in Dynamic Balance

Groups	Pre-test mean±SE	Post-test mean±SE	Difference between mean	SE	't' Ratio
ED	59.825±1.591	69.675±1.250	9.888	1.563	6.300*
SD	50.375±1.696	55.925±1.699	5.550	0.559	9.924*
Control	62.175±1.487	61.025±1.389	1.150	1.353	0.850

* Significant at 0.05 level of confidence, 't' _{0.05} (39) = 2.023

Table 19 very clearly reveals that, both the experimental groups improved significantly yielding 't' value of 6.300 and 9.924, whereas, control group did not show any significant improvement in dynamic balance performance of subjects indicating 't' values of 0.850. With respect to dynamic balance, it was found that the differences between the means existed and the experimental groups improved and no significant changes were observed in the control group.

Table – 20: Analysis of Variance and Covariance of the Means of Two Experimental Groups and the Control Group in Dynamic Balance.

	ED group	SD group	Control group	Sum of squares	df	Mean square	F ratio
Pre-test means	59.825	50.375	62.175	B 312.087 W 11884.925	2 117	156.043 101.581	1.536
Post-test means	69.675	55.925	61.025	B 3865.267 W 9952.525	2 117	1932.633 85.064	22.720*
Adjusted post-test means	68.213	60.300	58.112	B 2251.763 W 5418.587	2 116	1125.882 46.712	24.103*

* Significant at 0.05 level of confidence, N = 120, B = between group variance, W = within group variance

The analysis of covariance for dynamic balance showed that the resultant 'F' ratio of 1.536 was not significant in case of post test means. The post test and adjusted final means yielded the 'F' ratio of 22.720 and 24.103, respectively and were found to be significant. The 'F' ratio, needed for significance at 0.05 level of confidence (df 2, 117) was 3.09.

Table – 21: Paired Adjusted Final Means and Differences between Means for the two Experimental Groups and the Control Group in Dynamic Balance

ED group	SD group	Control group	Difference between means	Critical differences for adjusted mean
68.213	60.300		7.913*	1.168
68.213		58.112	10.101*	1.168
	60.300	58.112	2.188*	1.168

* Significant at 0.05 level of confidence

It is clearly evident from Table 21 that the performance in static balance of both ED and SD group was found to be significantly greater than that of control group. Significant difference between ED and SD group was also found with respect to dynamic balance performance making ED group better than other two groups.

Discussion on Findings: The analysis of data revealed that the two experimental groups, administered with endurance dominated training and strength dominated training showed significant gains in performance of almost all physical and physiological components after administration of training for a duration of 10 weeks. The control group did not show any significant increase in the performance of any variable under study.

The endurance dominated (ED) training showed significant gain in performance of Cardio-respiratory Endurance. Strength dominated (SD) training schedule could enhance the performance in Speed, Reaction Time, whereas both ED and SD training showed significant increase in performance in Explosive Leg Strength, Spine Flexibility, Agility, and Dynamic Balance.

Explosive power is a function of both strength and speed of muscular contraction, Strength dominated exercises might have enhanced the health status of players' neuromuscular system to apply a greater level of force in a shorter period of time, thereby improved the parameters related to speed and agility. Strength dominated training also placed a high level of stress on joints, connective tissue and in the neuromuscular system, which was well reflected in the present study as revealed by the gain in explosive leg strength and dynamic balance under present study. Therefore, the observed result in the present study on variables like speed, reaction time, explosive leg strength, agility, and dynamic balance are justified.

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