Dr. K Rajeshkumar
Assistant Professor, Department
of Physical Education, Tamil
Nadu Physical Education and
Sports University, Chennai,
Tamil Nadu, India

S Muralitharan
Ph.D. Research Scholar,
Department of Physical
Education, Tamil Nadu Physical
Education and Sports
University, Tamil Nadu, India

Impact of contrast and concurrent training on selected physical and physiological variables among hockey players

Dr. K Rajeshkumar and S Muralitharan

Abstract
The game field hockey is a team-based sport and it demands number of external and internal factors like anthropometrical, physical, physiological and psychological characteristics to play the game at elite level. The purpose of this study was to find out the impact of contrast and concurrent training on selected physical, physiological and performance parameters among hockey players. To achieve the purpose of the study, forty-five (N = 45) male inter-collegiate level hockey players were selected from the various colleges in and around Kanchipuram District. The age of subjects ranged from 18 to 25 years. The subjects had past experience of at least four years in hockey and only those who represented their respective college teams were taken as subjects. All the subjects were informed about the nature of the study and there was obtained to co-operate till the end of the experiment and testing period. Experimental Group-I underwent contrast training and Experimental Group-II underwent concurrent training respectively. The control group was not exposed to any specific training /conditioning programme. The experimental treatment namely contrast training and concurrent training was administrated for a duration of 12 weeks and the number of session per week was confined to three alternative days and each session lasted 70 minutes, in addition to the regular schedule of the Hockey training. The following variables were selected namely: Physical variables Speed and Explosive power Physiological variables, Vital capacity and Force vital capacity. The data collected data from the three groups prior to and immediately after the training programme on the selected criterion variables were statistically analyzed with dependent 't' test and Analysis of Covariance (ANCOVA). Whenever the 'F' ratio for adjusted post-test means was found to be significant, Scheffe's test was followed, as a post hoc test to determine which of the paired mean differences was significant.

Keywords: Physical fitness, strength training, contrast training and concurrent training

Introduction
Although these two terms namely sport and game may be related in meaning, there are different connotations. Both words describe the activities people do for pleasure in their leisure time. In modern usage, "sports" refer to organized an individual or group competitive activities requiring varying degrees of bodily strength, skill, or stamina, governed by rules or customs, and sometimes undertaken as a means of livelihood. Many sports are played in front of an audience as a form of entertainment. Games, on the other hand, are structured activities that have rules, can be competitive or co-operative and usually require the exertion of one's mental powers as opposed to bodily strength. To excel in sports and games one should have excellent technique, tactics, training, skill and etcetera. Sports science plays a critical role in Field Hockey performance. The game Field Hockey is a team-based sport and it demands number of external and internal factors like anthropometrical, physical, physiological and psychological characteristics to play the game at elite level.

Methodology
The purpose of this study was to find out the impact of contrast and concurrent training on selected physical and physiological variables among Hockey players. To achieve the purpose of the study, forty five (n=45) male inter-collegiate level Hockey players were selected from the various colleges in and around Kanchipuram, Tamil Nadu state, India. This study consisted of three equal groups of fifteen subjects each. The age of subjects ranged from 18 to 25 years.

Corresponding Author:
Dr. K Rajeshkumar
Assistant Professor, Department
of Physical Education, Tamil
Nadu Physical Education and
Sports University, Chennai,
Tamil Nadu, India

The subjects had past experience of at least four years in Hockey and only those who represented their respective college teams were taken as subjects. The following variables were selected namely: Physical variables Speed and explosive power Physiological variables, Vital capacity and Force vital capacity.

Training Procedure

Experimental Group-I underwent contrast training and experimental Group-II underwent concurrent training respectively. The control group was not exposed to any specific training/conditioning programme. The experimental treatments namely contrast training and concurrent training was administrated for duration of 12 weeks and the number of session per week was confined to three alternative days and each session lasted 70 minutes.

Statistical Technique

The collected data from the three groups prior to and after the experimental treatments on selected physical, physiological and performance variables were statistically analyzed by using the statistical technique of analysis of covariance (ANCOVA). Whenever the 'F' ratio for adjusted post-test means was found to be significant, Scheffe's test was followed as a post hoc test to determine which of the paired means difference was significant. In all the cases 0.05 level of confidence was fixed as a level of confidence to test the hypotheses.

Results and Analysis

The influence of independent variables on each of the criterion variables is analyzed and presented below.

The training period was limited to twelve weeks. The dependent variables selected for this study were Physical variables Speed and Explosive power Physiological variables, Vital capacity and Force vital capacity. All the subjects were tested prior to and immediately after the experimental period on the selected dependent variables.

The data obtained from the experimental groups before and after the experimental period were statistically analyzed with dependent 't'-test and Analysis of covariance (ANCOVA). Whenever the 'F' ratio for adjusted post-test means was found to be significant, the Scheffe's Post hoc test was applied to determine the paired mean differences. The level of confidence was fixed at 0.05 level for all the cases.

Table 1: Computation of analysis of covariance of pre-test, post-test and adjusted post-test on speed of experimental groups and control group

Test	Contrast Training Group	Concurrent Training Group	Control Group	Source of Variance	Sum of Squares	DF	Mean Squares	F-ratio
Pre-Test Mean	7.15	7.15	7.09	Between groups	.034	2	0.17	0.25
				Within groups	2.873	42	.068	
Post-Test Mean	6.92	6.87	7.07	Between groups	0.332	2	0.166	4.28*
				Within groups	1.627	42	0.039	
Adjusted Post-Test Mean	6.91	6.85	7.10	Between sets	.489	2	.244	43.65*
				Within sets	.230	41	.006	

* Significant at 0.05 level of confidence

Table value for DF (2, 42) at 0.05 level = 3.22 Table value for DF (2, 41) at 0.05 level = 3.23

(Speed scores are in Seconds)

Table-1 shows that the obtained F-ratio value 0.25 for pre-test mean of contrast Training group, concurrent Training group and Control group on Speed is lesser than the required table value of 3.23 for significance with DF 2 and 42 at 0.05 level of confidence.

The obtained F-ratio value of 4.28 for post-test mean of contrast Training group, concurrent Training group and Control group on Speed is more than the required table value of 3.23 for significance with DF 2 and 42 at 0.05 level of confidence.

The obtained F-ratio value of 43.65 for adjusted post-test mean of contrast Training group, concurrent Training group and Control group on Speed is higher than the required table value of 3.23 for significance with DF 2 and 41 at 0.05 level of confidence.

The adjusted post mean values of contrast Training group, concurrent Training group and Control group on Speed are graphically represented in the.
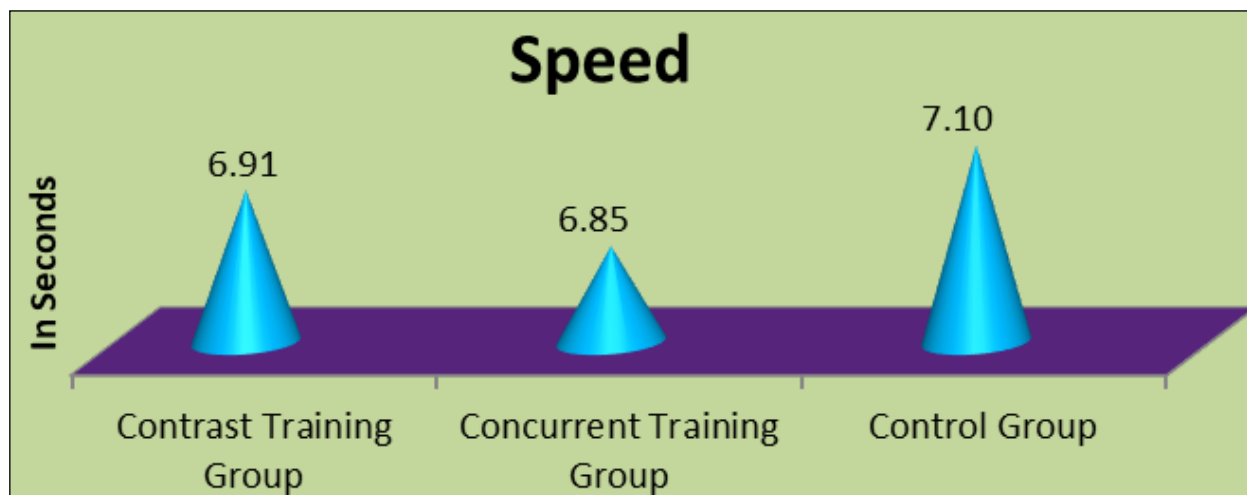

Fig 1: The adjusted post-test mean values of contrast training group, concurrent training group and control group on speed

Table 2: Computation of analysis of covariance of pre-test, post-test and adjusted post-test on explosive power of experimental groups and control group

Test	Contrast Training Group	Concurrent Training Group	Control Group	Source of Variance	Sum of Squares	DF	Mean Squares	F-Ratio
Pre-Test Mean	2.06	2.12	2.10	Between groups	.027	2	0.13	2.34
				Within groups	.241	42	.006	
Post-Test Mean	2.15	2.29	2.10	Between groups	.308	2	.154	23.61*
				Within groups	.274	42	.007	
Adjusted Post-Test Mean	2.17	2.77	2.10	Between sets	.229	2	.115	38.15*
				Within Sets	.123	41	.003	

*Significant at 0.05 level of confidence.
Table value for DF (2, 42) at 0.05 level = 3.22 Table value for DF (2, 41) at 0.05 level = 3.23.
(Explosive Power scores are in Meters).

Table-2 shows that the obtained F-ratio value 2.34 for pre-test mean of contrast Training group, concurrent Training group and Control group on Explosive Power is lesser than the required table value of 3.23 for significance with DF 2 and 42 at 0.05 level of confidence.

The obtained F-ratio value of 23.61 for post-test mean of contrast Training group, concurrent Training group and Control group on Explosive Power is more than the required table value of 3.23 for significance with DF 2 and 42 at 0.05 level of confidence.

The obtained F-ratio value of 38.15 for adjusted post-test mean of contrast Training group, concurrent Training group and Control group on Explosive Power is higher than the required table value of 3.23 for significance with DF 2 and 41 at 0.05 level of confidence.

Fig 2: The adjusted post-test mean values of contrast training group, concurrent training group and control group on explosive power

Table 3: Computation of analysis of covariance of pre-test, post-test and adjusted post-test on vital capacity of experimental groups and control group

Test	Contrast Training Group	Concurrent Training Group	Control Group	Source of Variance	Sum of Squares	DF	Mean Squares	F-Ratio
Pre-Test Mean	4.68	4.74	4.59	Between groups	0.165	2	0.083	3.03
				Within groups	1.143	42	0.027	
Post-Test Mean	4.90	5.07	4.61	Between groups	1.619	2	0.810	24.17*
				Within groups	1.407	42	0.033	
Adjusted Post-Test Mean	4.89	5.02	4.64	Between sets	0.812	2	0.406	22.23*
				Within sets	0.748	41	0.018	

* Significant at 0.05 level of confidence.
Table value for df (2, 42) at 0.05 level = 3.22 Table value for df (2, 41) at 0.05 level = 3.23.
(Vital Capacity scores are in Liters).

Table-3 shows that the obtained F-ratio value 3.03 for pre-test mean of contrast Training group, concurrent Training group and Control group on vital capacity is lesser than the required table value of 3.23 for significance with DF 2 and 42 at 0.05 level of confidence.

The obtained F-ratio value of 24.17 for post-test mean of contrast Training group, concurrent Training group and Control group on vital capacity is more than the required table value of 3.23 for significance with DF 2 and 42 at 0.05 level of confidence.

The obtained F-ratio value of 22.23 for adjusted post-test mean of contrast Training group, concurrent Training group and Control group on vital capacity is higher than the required table value of 3.23 for significance with DF 2 and 41 at 0.05 level of confidence.
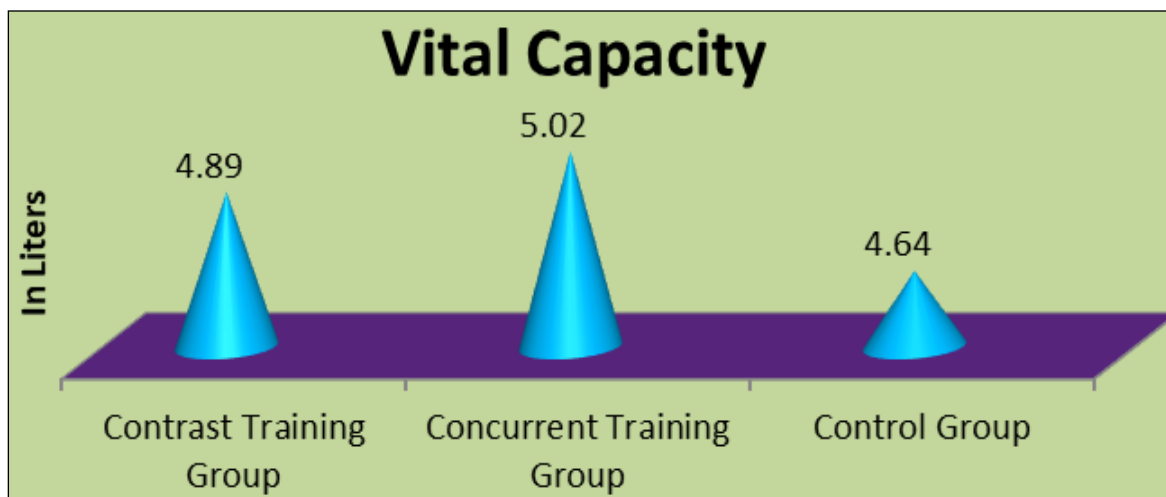
Fig 3: The adjusted post-test mean values of contrast training group, concurrent training group and control group on vital capacity

Table 4: Computation of analysis of covariance of pre-test, post-test and adjusted post-test on forced vital capacity of experimental groups and control group

Test	Contrast Training Group	Concurrent Training Group	Control Group	Source of Variance	Sum of Squares	DF	Mean Squares	F-Ratio
Pre-Test Mean	3.40	3.54	3.39	Between groups	0.216	2	0.108	1.59
				Within groups	2.856	42	0.068	
Post-Test Mean	3.62	3.83	3.42	Between groups	1.281	2	0.641	11.08*
				Within groups	2.427	42	0.058	
Adjusted Post-Test Mean	3.66	3.75	3.46	Between sets	0.599	2	0.299	36.97*
				Within sets	0.332	41	0.008	

* Significant at 0.05 level of confidence.
Table value for DF (2, 42) at 0.05 level = 3.22 Table value for DF (2, 41) at 0.05 level = 3.23.
(Forced Vital capacity scores are in Liters).

Table-4 shows that the obtained F-ratio value 3.03 for pre-test mean of contrast Training group, concurrent Training group and Control group on forced vital capacity is lesser than the required table value of 1.59 for significance with DF 2 and 42 at 0.05 level of confidence.

The obtained F-ratio value of 11.08 for post-test mean of contrast Training group, concurrent Training group and Control group on forced vital capacity is more than the required table value of 3.23 for significance with DF 2 and 42 at 0.05 level of confidence.

The obtained F-ratio value of 36.97 for adjusted post-test mean of contrast Training group, concurrent Training group and Control group on forced vital capacity is higher than the required table value of 3.23 for significance with DF 2 and 41 at 0.05 level of confidence.
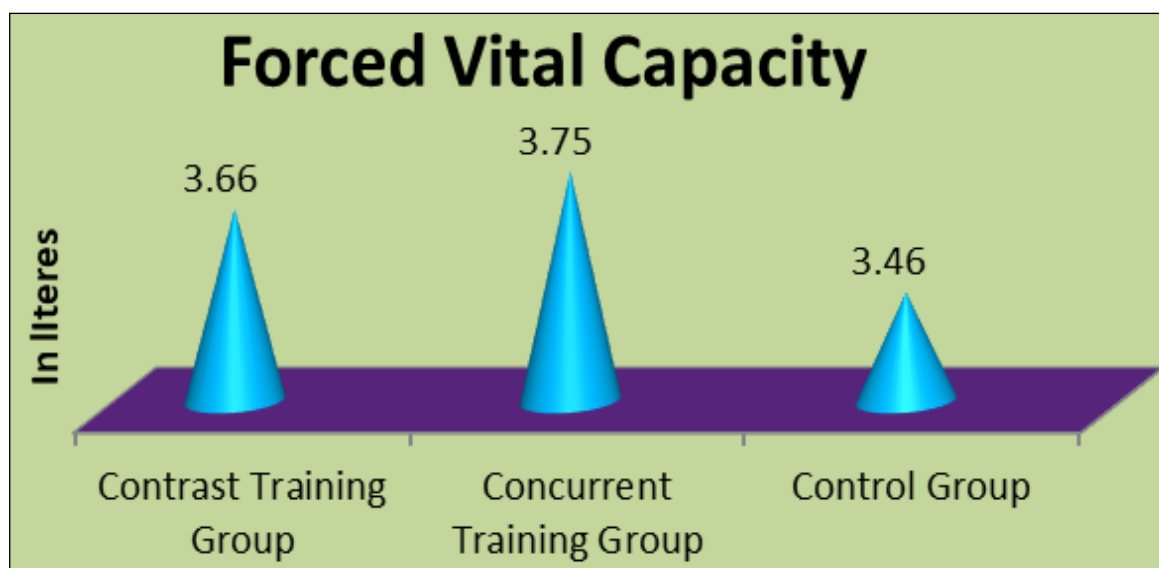

Fig 4: The adjusted post-test mean values of contrast training group, concurrent training group and control group on forced vital capacity

Conclusion
The findings of the study showed that there was a statistically significant improvement in the physical fitness variables speed, explosive power physiological variables vital capacity and Forced vital capacity as compared to control group.
Based on the results of the study, it was concluded that the

concurrent training program has resulted in significant increase in selected physical fitness variables and physiological variables such as speed, explosive power, and vital capacity and forced vital capacity.

Recommendations

A Similar study may be conducted for the fairer sex also keeping age and other factors in to consideration for experimental variables.

Studies may be also being conducted on similar lines with different nutritional plans.

References

1. Henrik Petré, Pontus Löfving, Niklas Psilander. The Effect of Two Different Concurrent Training Programs on Strength and Power Gains in Highly-Trained Individuals J Sports Sci Med. E Collection. 2018 May;17(2):167-173.
2. S J, Albert Chandrasekar, Jaya Prakash K. The effect of specific training on selected physiological variable among Kabaddi players Indian. Journal of Public Health Research & Development, 2020 Feb;11:2. DOI: 10.37506/v11/i2/2020/ijphrd/19476.
3. Pinto SS, Cadore EL, Alberton CL, Zaffari P, Bagatini NC, Baroni BM, *et al*. Effects of Intra-session Exercise Sequence during Water-based Concurrent Training Pinto SS *et al*. Effects of Intra-session Exercise Int J Sports Med; c2013. DOI: 10.1055/s-0033-1345129.
4. Mohan S, Rameshkumar S, Sanakr A. Effect of complex training with game specific training on physical and physiological variables among high school level Kho Kho players The Journal of Indian Art History Congress. ISSN: 0975-7945. 2020;2(13):2020-2021.
5. Kerry Mcgawley. The Order of concurrent training does not affect soccer-related performance adaptations. International Journal of Sports Medicine. 2013;34:11. DOI: 10.1055/s-0033-1334969
6. Marta C, Marinho DA, Barbosa TM, Izquierdo M, Marques MC. Effects of concurrent training on explosive strength and VO(2max) in prepubescent children Int J Sports Med. 2013;34(10):888-96. DOI: 10.1055/s-0033-1333695.