



BHARATHIAR NATIONAL JOURNAL OF  
PHYSICAL EDUCATION AND EXERCISE SCIENCES  
**BNJPEES**

**DOUBLE – BLIND REFERRED JOURNAL**



## **From the Editors' Desk**

Whilst we are striving hard to manage the new normal post Covid pandemic, there is a great realisation on health fitness and wellness. The department of Physical Education, Bharathiar university with societal responsibility publishes this 11<sup>th</sup> volume of 'The Bharathiar National Journal of Physical Education and Sports Sciences'. In spite of the pandemic break the editorial team had put in tremendous efforts to bring out this volume of research works and articles.

**The Bharathiar National Journal of Physical Education and Exercise Science (BNJPEES)** is an open access quarterly journal, double blind refereed journal with ISSN – 0976-3678 which publishes original articles, commentary, editorials, review articles and case reports covering recent innovative high quality researches on sports published by the Department of Physical Education, Bharathiar University Coimbatore since June 2010. The purpose of this journal is to enrich the field of physical education and sport with literary base dynamic latest research and articles. The field of sport and physical education with its dynamic nature needs a literary back up to keep the masses informed of the latest changes that are happening across this field. Since the Sports Climate is experiencing a wide range of change and is very much essential that we stretch ourselves to meet the key challenges on sports and games. Since the inception of the new editorial team from 2019, the journal has been upgraded online to increase the vicinity across the globe and provide a wider citation opportunity scaling up research heights. The journal has been indexed with google scholar, world cat, core and road.

We appreciate the research scholars for stepping forward to get their works published in our university journal. After thorough plagiarism check using Ithenticate and Turnitin, the articles are subjected to a double blind referee system for review. Based on the reviewers report the articles are accepted. Being We are also working hard towards quality control of the articles in par with the international standards.

From the editorial desk we submit to you that BNJPEES, with immense pleasure is working for the development of research in the field of Physical education and sports sciences which is the need of the hour. We encourage the authors to submit evidence based realtime research results which would benefit the society.



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## **Publisher's Desk**

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## INFLUENCE OF SILAMBAM PRACTICES AFTER YOGIC PRACTICES ON SELECTED PHYSICAL FITNESS VARIABLES OF COLLEGE STUDENTS

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### Abstract

*This study was designed to investigate the Influence of silambam practices after yogic practices on selected physical fitness variables of College Students. To achieve the purpose of the study 30 College Students from Bharathiar University Coimbatore district. Their age ranged from 20 to 25years. The subjects was randomly assigned to two equal groups. Group- I (n=15) underwent silambam practices after yogic practices (SPAYP) and Group – II (n=15) acted as control group (CG). The silambam practices after yogic practices was given to the experimental group for 3 days per week (Monday, Wednesday and Friday) for the period of eight weeks. The control group was not given any sort of training except their routine work. The physical fitness parameters muscular strength endurance (modified sit up test) and flexibility (tested at sit and reach test) were assessed before and after training period. The data collected from the subjects were statistically analyzed using 't' test to find muscular strength endurance and flexibility speculated significant improvement due to silambam practices after yogic practices with the limitations of diet, climate, life style status and previous training. The results of the present study are in confirmatory with the findings of (Review). Thus it is concluded that silambam practices after yogic practices significantly improves Speed and flexibility of College Students.*

**Keywords:** Silambam Practices, Yogic Practices, Muscular Strength endurance and Flexibility.

### INTRODUCTION

#### Silambam: A Moving Meditation

#### Yoga: Universal Spirit of God

Silambam is an ancient martial art of Tamil Nadu. "I think it is one of the oldest martial arts in the world—it is over 5,000 years old," says Pandian. "It was put together by the sage Agastya Munivar; he is to martial arts what Patanjali is to yoga." It is said that it was

Agasthiar who invented this art of Silambam. Later on the chera, Chozha and Pandiya kings introduced this art in their warfare and made it compulsory for all the soldiers in the five wings of their military.

India is a Land of Knowledge, where many Gods and Saints have given divine knowledge to lead a good human life. The art

of Silambam also has age-old history in ancient texts of South India. Silambam denotes an elastic cane bamboo, uniform in cross section from end to end, having a length a little less than that of the height of the performer wielding it (David Manuel Raj, 1967) Silambam is a common word now used in Tamil Nadu, for the Martial art of stick-fencing. In other parts of South India it is called by different names, such as Kolu Varasay or Dhonay Varasay in Karnataka, Kolu Aatta or Karadi Aatta in Andhra Pradesh, Neduvari in Kerala. Generally in silambam includes single stance (otrai suvado) separate stances, (pereevusuvado) double swing, weapons sequences, locks, throws long stick and short sticks series techniques are there (Arunachalam,1995). British government had banned the practice of warfare and martial art in any form in India and they knew the dangers of Indian martial art. British troops were well trained to use with explosive and guns, but they were lacking the physical compact skills. This fear leads them to impose restrictions on Indian martial arts. Even today we are looking in for the origination of the modern martial art; a scientific martial art that can protect human lives at dangerous situation. Today the great martial art of Tamilnadu is just reduced to a demonstration art in public gatherings and folk art festivals despite the effort of many well-wishers. Silambam has the potential to be included as a mainstream activity in

the physical education curriculum as it is simple, inexpensive and also has the capability of improving all the major biomotor abilities. According to a study by It is the true union of our will with the will of god. The present study was taken up to investigate the Influence of silambam practices and yogic practices on speed and flexibility among male football players. **(Twemlow and coworkers (1996))**.

## **METHODS**

### **Experimental Approach to the Problem**

In order to address the hypothesis presented herein, we selected 30 male College Students from Bharathiar University, Coimbatore District. Their age ranged from 20 to 25 years. The subjects were randomly assigned in to two equal groups namely, silambam practice after yoga practice group (SPAYP) (n=15) and Control group (CG) (n=15). The respective training was given to the experimental group the 3 days per weeks (alternate days) for the training period of eight weeks. The control group was not given any sort of training except their routine.

## **DESIGN**

The evaluated physical parameters were muscular strength endurance was assessed by modified sit ups and the unit of measurement was in counts, flexibility were assessed by sit and reach test the unit of measurement was in meters. The parameters

were measured at baseline and after 8 weeks of silambam practice after yoga practice were examined. The intensity was increased once in two weeks based on the variation of the exercises.

### TRAINING PROGRAMME

The training programme was lasted for 45 minutes for session in a day, 3 days in a week for a period of 8 weeks duration. These 45 minutes included warm up for 5 minutes, 35 minutes silambam practice after yoga practice and 5 minutes warm down. The equivalent in silambam practice after yoga practice is the length of the time each action in total 3 day per weeks (Monday, Wednesday and Friday).

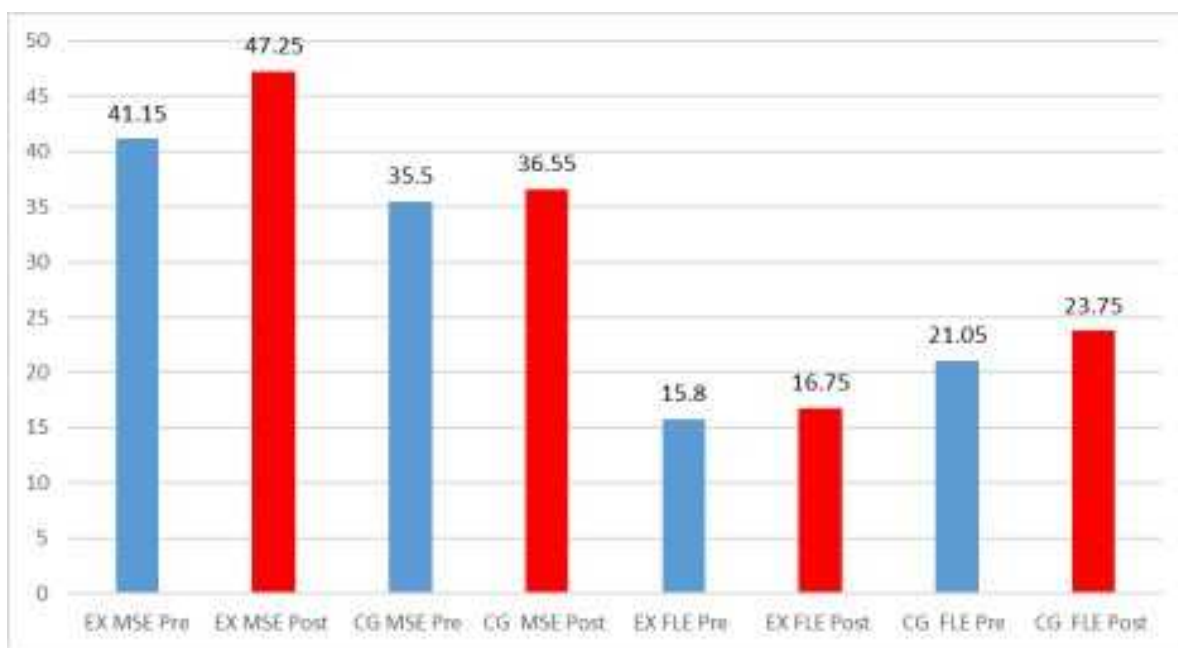
Table I reveals the computation of mean, standard deviation and 't' ratio on selected variables namely speed and flexibility of experimental group. The obtained 't' ratio on speed and flexibility were 7.91 and 4.25 respectively. The required table value was 2.14 for the degrees of freedom 1 and 14 at the 0.05 level of significance. Since the obtained 't' values were greater than the table value it was found to be statistically significant.

Further the computation of mean, standard deviation and 't' ratio on selected variables parameters, namely muscular strength and flexibility of control group.

<b>TABLE – I COMPUTATION OF 'T' RATIO ON SELECTED PARAMETERS OF COLLEGE STUDENTS ON EXPERIMENTAL GROUP AND CONTROL GROUP</b>					
(Scores in numbers)					
<b>Group</b>	<b>Test</b>		<b>Mean</b>	<b>Std. Deviation</b>	<b>T ratio</b>
Experimental Group	Muscular Strength endurance	Pre test	41.15	6.36	7.91
		Post test	47.25	8.20	
	Flexibility	Pre test	15.80	2.35	4.25
		Post test	16.75	2.44	
Control Group	Muscular Strength endurance	Pre test	36.55	5.52	0.97
		Post test	35.60	4.56	
	Flexibility	Pre test	21.05	1.53	1.56
		Post test	23.75	2.26	
*significant level 0.05 level (degree of freedom 2.14, 1 and 14)					

The obtained 't' ratio on muscular strength and flexibility were 0.97 and 1.56 respectively. The required table value was 2.14 for the degrees of freedom 1 and 14 at the 0.05 level of significance. Since the obtained't' values were lesser than the table value it was found to be statistically not significant.

Selvam et.al.,(2016) I) and they found that twenty four weeks there was significant improved in , Speed, Flexibility among female sprinters due to the influence of silambam practice and yogic practices.



**FIGURE- I BAR DIAGRAM SHOWING THE MEAN VALUE ON SELECTED PHYSICAL FITNESS VARIABLES COLLEGE STUDENTS ON EXPERIMENTAL GROUP AND CONTROL GROUP**

**DISCUSSION AND FINDINGS**

The present study experimented the influence of eight weeks silambam practice after yoga practice on the selected parameters of the College Students. The results of this study indicated that silambam practice after yoga practice is more efficient to bring out desirable changes over the muscular strength endurance and flexibility of the College Students.

Mohanavalli P et al, (2013) [6] and they found that twenty four weeks there was significant improved in cardio vascular endurance, and a significant reduction in body weight, BMI, lean body mass, and percent body fat among 40 sedentary college girls due to the influence of silambam training.



Another study was Sosamma John et al., (2011) and they found that twenty four weeks there was significant improved in Strength, Speed, Flexibility and Vital capacity among college Softball players due to the influence of yogic practices.

## Conclusions

From the results of the study and discussion the following conclusions were drawn.

1. Based on the result of the study it was concluded that the 8 weeks of silambam practices after yogic practices have been significantly improved muscular strength endurance of college students.
2. The 8 weeks of silambam practices after yogic practices have been significantly improved flexibility of college students.

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## EFFECT OF SURYANAMASKAR ON SELECTED PHYSICAL FITNESS VARIABLES OF TEACHER TRAINING STUDENTS

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### Abstract

**Objective:** The purpose of the study was to find out the effect of Suryanamaskar on selected physical fitness variables of Teacher Training Students. **Methods:** For this study 40 teacher training students were selected from Meerut using purposive random sampling technique. The pre-test was conducted on flexibility, BMI and cardiovascular endurance using sit and reach test, Height, weight and 12 min Cooper test. After completion of pre test the subjects were divided into two groups namely Group I- Experimental Group and Group II- Control group. Each group consists of 20 subjects. The age of the subjects ranged from 18 – 25 years. The experimental group underwent to six weeks training of Suryanamaskar practise. The control group did not do any practise other than regular work. After completion of 6 weeks training post test was conducted. **Results:** To find out the significant difference exists between pre and post training, t-ratio was applied. It was found that there was a significant difference ( $P < 0.05$ ) due to the suryanamaskar practise on selected physical fitness variables among teacher training students. The control group did not show any significant improvement on selected Physical fitness variables due to the effect of Suryanamaskar. **Conclusion:** Based on the results it was concluded that implication of suryanamaskar practise might have been the source of its dominance on the improvement of selected physical fitness variables among teacher training students.

**Keywords:** Suryanamaskar, teacher training students, Flexibility, BMI and Cardio vascular endurance.

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## INTRODUCTION

Today the world is moving around very fast through science and technology in all fields. It gives more benefits at that same time it lead to sedentary lifestyle making human being lazy thereby increase in number of harmful diseases in younger generations.

Suryanamaskar bring body, mind, consciousness and soul into balance. In this way Suryanamaskar assists us in coping have a holistic effect and with everyday demands, problems and worries. Suryanamaskar helps to develop a greater understanding of our self, the purpose of life [1-5].

## Hypotheses

**H1** – It was hypothesized there may be a significant difference on Flexibility due to suryanamaskar practice among teacher training students.

**H2** - It was hypothesized there may be a significant difference on BMI due to suryanamaskar practice among teacher training students.

**H3** - It was hypothesized there may be a significant difference on Cardio Vascular Endurance due to suryanamaskar practice among teacher training students.

**H4** - It was hypothesized that there may not be a significant difference on selected physical fitness variables of the control group among teacher training students.

## Methodology

### Selection of subjects and variables

To achieve the purpose of the study, 40 Teacher training students were randomly selected using purposive random sampling from Meerut, whose age ranged between 22 to 25 years.

Suryanamaskar is independent variable and Flexibility, BMI, Cardio Vascular Endurance are the dependent variable.

### Experimental Design

The study was to find out the effect of suryanamaskar practices on selected physical fitness variables among teacher training students. The subjects were divided in to two groups of 20 each. Experimental Group was given Suryanamaskar practices and Group II was acted as Control Group. The experimental group underwent 6 weeks of yogic practices. The control group did not undergo any training other than the regular work. Data were collected from each subject before and after the 6 weeks of training.

The test items were designed for this study after a thorough investigation on literature reviews consultation with experts of this field of study, physical education personals and medical experts as well. The criterion variables are presented in Table-I

**Training Programme**

The procedure adopted in the training programme for the present study is described in the following aspects.

During the training period, the experimental group underwent yogic practiced for 6 weeks. These groups practiced for duration of 45 minutes (Table II).

**Table-I**  
**Criterion Measures**

S. No	Variables	Testitems	Unit of measurements
1.	Flexibility	Sit and Reach Test	In Centimeters
2.	BMI	Height and Weight	Cms & kgs
3.	Cardio vascular Endura	Cooper 12mins run/Walk test	In Mins

**Table - II**

**SURYANAMASKAR PRACTICE TRAINING PROGRAM**

Days	1-8	9-16	17-24	25-32	33-40	41-48	49-60
Rep	5	6	7	9	11	13	15

**Note:** 10 seconds rest after 1 repetition.

**Analysis and Interpretation of Data**

**Table -III**

Table shows that the computation of 't' tests between pre and posttest means of the following variables

S.No	Variables	Pre test		Post test		't'
		Mean	SD	Mean	SD	
1	Flexibility	16.00	1.21	17.60	1.68	6.66*
2	Cardio Vascular Endurance	4.31	0.19	4.81	0.07	14.07*
3	BMI	30.50	3.76	26.30	4.47	5.13*

\*significant Table Value 2.14,for 0.05 Level

They started with a warming-up with loosening exercises for a period of 10 minutes. During the warming up the participants were trained to perform suryanamaskar in a slow manner so that each of the 12 poses was held for duration of 5 seconds. They performed suryanamaskar five rounds and gradually reached till 13 rounds. At the end of the class the participants performed relaxation asana such as savasana and matsyasana for a period of 5 minutes.

### Statistical Techniques

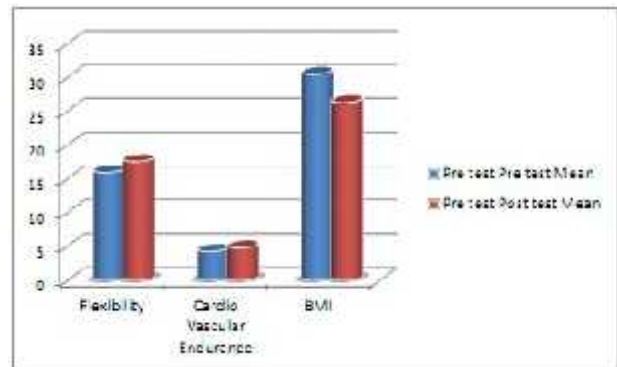
To analyses the effect of training t ratio was used. It identifies the significant difference between pre test and post test. To test the significance of the derived results, the alpha level was set at 0.05 level of confidence.

### Result of the study

't'ratio was applied to find out the significant training effect on both groups. It was shown in the table III.

An examination of table I indicates that the obtained 't' ratios 6.66,14.07and 5.13 Flexibility, BMI, Cardio Vascular Endurance of physical fitness variables respectively were found to be greater than the required table value of 2.09 at 0.05 level of significance for 19 degrees of freedom. Hence it was found to

be statistically significant. The result of the study reveals that the suryanamaskar significantly improved all the physical fitness variables of the experimental group (Figure 1).



**Figure -1** Graphical Representation of the Mean Value of Pre and Post test on Flexibility, BMI, Cardio Vascular Endurance

### DISCUSSION ON FINDINGS

Results of the study indicated that the physical fitness variables such as Flexibility, BMI, Cardio Vascular Endurance were improved due to the participation in the 6 weeks of Suryanamaskar.

### Discussion on Hypotheses

H1 – It was hypothesized there may be a significant improvement on Flexibility due to suryanamaskar practice among teacher training students.

H2 - It was hypothesized there may be a significant improvement on BMI due to

suryanamaskar practice among teacher training students.

H3 - It was hypothesized there may be a significant improvement on Cardio Vascular Endurance due to suryanamaskar practice among teacher training students.

H4 - It was hypothesized that there may not be a significant difference on selected physical fitness variables of the control group among teacher training students.

- Hence the Hypotheses was accepted.

## CONCLUSION

Based on the results of the study, the following conclusions were drawn.

- Through this study we find out that the suryanamaskar practices improves the physical fitness variables.
- The investigator suggests the suryanamaskar practices to all the Teacher Training Students for improve their selected physical fitness variables among them.
- It is comfortable to all.

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## Impact of contrast training on selected physiological and performance related variables among handball players

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### Abstract

The purpose of the study was to find out the impact of contrast training on selected physiological and performance related variables among Hockey players. To achieve the purpose of the study thirty male Hockey players have been randomly selected from various colleges in the state of Tamil Nadu, India. The age ranged between 18 and 25 years. The subjects had past experience of at least three years in Hockey and only who those represented their respective college teams were taken as subjects. A series of physiological measurement was carried out on each participant. These included vital capacity, forced vital capacity, slow vital capacity, maximum voluntary ventilation assessed by spirometer and performance related variables namely dribbling and passing were assessed by using subjective rating. The subjects were randomly assigned into two groups of fifteen each, such as experimental and control groups. The Experimental group participated in the contrast training for 3 alternative days per week for eight weeks. Duration of training session in all days with one session was one hour approximately which including warming up and limbering down. The control group maintained their daily routine activities and no special training was given. The subjects of the two groups were tested on selected variables prior and immediately after the training period. The collected data were statistically analyzed through analysis of covariance (ANCOVA) to find out the significance difference, if any between the groups. In all case the criterion for statistical significant would set as 0.05 level of confidence. The results of the study showed that there was significant differences exist between contrast group and control group. And also contrast training group showed significant improvement on vital capacity, forced vital capacity, slow vital capacity, maximum voluntary ventilation, dribbling and Passing compared to control group.

**Keywords:** contrast training, Handball performance related variables.

### Introduction

Every sports and games have these movements of manifestations. Field Hockey chosen for the study has held a major place in sports programme throughout the world. It involves all the movements mentioned earlier. This is one of the major sports played with the stick and ball between two teams with eleven players on each side. There is a goal post at each end of the rectangular field and the object of the game is to hit the ball into the goal of the opponent's side as often as possible under certain rules. This is due to constant practices of the game and new training methods. Keeping this objective the investigator combined the contrast training on selected physiological and

Performance related variables among Hockey players

Contrast training is an example of strength and power training which aims to stress both ends of the force-velocity curve within the same session (**Walker, 2010**). Contrast training is an incredible tool for enhancing raw strength, power and overall athletic performance, but it seems relatively underappreciated and unknown in gyms up and down the country. Contrast training can be described as a set of heavy resistance repetitions followed immediately by an unloaded, explosive exercise utilising the same movement pattern. The concept of contrast training isn't a new one, in fact research investigations have been on-going



since the 1960s, with specialist coaches utilising this training method to achieve phenomenal results from their athletes. It has been known for world class sprinters to utilise dumbbells to perform squatting movements immediately prior to 100 metre events, in order to evoke the effects of contrast training in their subsequent sprinting performance.

Contrast training refers to a type of resistance training that alternates the use of heavy and light load exercises in order to improve muscular power. Improve power through training program the should focus on trying to produce more force or velocity with exercises. Contrast training accomplishes both by requiring performing two exercises back-to-back. The first exercise is a traditional strength exercise, and the second exercise is an explosive exercise that challenges the same muscles and movement pattern. Because the resistance in the first exercise is heavy, this will create more activation of the muscles involved in the movement. Then, by following the first exercise with a more explosive, lighter load exercise that works the same muscles, one will not only teach once body how to activate more muscle, but how to activate that muscle or groups of muscles more quickly resulting in improved power. Contrast training workout comprising of one set of a resistance exercise followed by one set of a matched plyometric exercise. For instance, squats followed by squat jumps or bench press followed by plyometric push-ups.

## II. Materials and Methods

The purpose of the study was thirty male Hockey players have been randomly selected from Bharathidasan University Tiruchirappalli in the state of Tamil Nadu, India. The age ranged between 18 and 25 years. The subjects had past experience of at least three years in Handball and only who those represented their respective college teams were taken as subjects. A series of physiological measurement was carried out on each participant. These included vital capacity, forced vital capacity, slow vital capacity, maximum voluntary ventilation assessed by spirometer and performance related variables namely dribbling and Passing were assessed by using subjective rating. The subjects were randomly assigned into two groups, such as experimental group (n=15) and control group (n=15). The Experimental group participated in the contrast training for 3 alternative days per week for eight weeks. Duration of training session in all days with one session was one hour approximately which including warming up and limbering down. The control group maintained their daily routine activities and no special training was given. The collected data were statistically analyzed through analysis of covariance (ANCOVA) to find out the significance difference, if any between the groups. In all case the criterion for statistical significant would set as 0.05 level of confidence.

**TABLE-I Criterion Measures**

S.No	Criterion measure	Test items	Unit of measurement
1	Vital capacity	Spirometer	In litres
2	Forced vital capacity	Spirometer	In litres
3	Slow vital capacity	Spirometer	In litres
4	Maximum voluntary ventilation	Spirometer	In litres
5	Dribbling	Subjective rating	In points
6	Passing	Subjective rating	In points

**TABLE – II Descriptive analysis of selected Physiological and Performance related variables among Control and Experimental groups**

S.No	Variables	Group	Pre-Test Mean	SD (±)	Post – Test Mean	SD (±)	Adjusted Mean
1	Vital capacity	CG	2.81	.08789	2.86	.15888	2.86
		CTG	2.80	.06543	3.18	.29730	3.18
2	Forced vital capacity	CG	3.77	.12536	3.88	.47549	3.88
		CTG	3.77	.09716	4.17	.26441	4.18
3	Slow vital capacity	CG	2.89	.15403	3.01	.37293	2.10
		CTG	2.81	.09604	3.39	.39577	3.43
4	Maximum voluntary ventilation	CG	110.47	3.73911	115.10	11.1395	115.08
		CTG	110.53	6.63181	125.07	8.19814	125.09
5	Dribbling	CG	6.33	1.34519	7.13	1.18723	7.20
		CTG	6.60	1.29835	7.93	1.16292	7.86
6	Passing	CG	5.87	1.24595	7.20	1.01419	7.39
		CTG	6.60	1.18322	8.20	.67612	8.01

**CTG= Contrast training group      CG= Control group**

**TABLE – III Computation of analysis of covariance on selected Physiological and Performance related variables among Handball players**

S.No	variables	Test	Sum of variance	Sum of squares	df	Mean square	F ratio
1	Vital capacity	Pre-test	Between group	0.00	1	0.00	.056
			Within group	0.17	28	0.01	
		Post-test	Between group	0.78	1	0.78	12.68*
			Within group	1.60	28	0.06	
		Adjusted means	Between sets	0.79	1	0.79	14.61*
			Within sets	1.57	27	0.06	
2	Forced Vital capacity	Pre-test	Between group	0.00	1	0.00	.017
			Within group	0.352	28	0.01	
		Post-test	Between group	0.66	1	0.66	4.46*
			Within group	4.14	28	0.15	
		Adjusted means	Between sets	0.68	1	0.68	4.66*
			Within sets	3.93	27	0.15	
3	slow vital capacity	Pre-test	Between group	0.04	1	0.04	2.58
			Within group	0.46	28	0.02	
		Post-test	Between group	1.05	1	1.05	7.12*
			Within group	4.14	28	0.15	
		Adjusted means	Between sets	1.44	1	1.44	11.92*
			Within sets	3.57	27	0.13	
4	Maximum voluntary ventilation	Pre-test	Between group	0.03	1	0.03	.001
			Within group	811.47	28	28.98	
		Post-test	Between group	744.51	1	744.51	7.68*
			Within group	2678.18	28	95.65	
		Adjusted	Between sets	752.65	1	752.65	9.41*

		means	Within sets	2135.90	27	79.11	
5	Dribbling	Pre-test	Between group	0.53	1	0.53	0.31
			Within group	48.93	28	1.75	
		Post-test	Between group	4.80	1	4.80	3.48
			Within group	38.67	28	1.38	
		Adjusted means	Between sets	3.22	1	3.22	3.49
			Within sets	24.92	27	0.92	
6	Passing	Pre-test	Between group	4.03	1	4.03	2.73
			Within group	41.33	28	1.48	
		Post-test	Between group	7.50	1	7.50	10.10*
			Within group	20.80	28	0.74	
		Adjusted means	Between sets	2.60	1	2.60	7.38*
			Within sets	9.51	27	0.35	
*Significant at 0.05 level of confidences (Table value for df 1 and 28 was 4.21, Table value for df 1 and 27 was 4.20)							

The tables II shows the pre and post-test means, standard deviations and adjusted means on selected physiological and performance related variables among Hockey players were presented in numerically. The analysis of covariance on selected variables of contrast training and control groups presented in table – III

The obtained F-ratio of 13.61 for adjusted mean was greater than the table value 4.20 for the degree of freedom 1 and 27 required for significance at 0.05 level of confidence. The result of the study indicates that there was a significant difference among control and experimental groups on vital capacity. The above table also indicates that pre test of control and experimental groups did not differ significantly and post test of control and experimental groups have significant difference on vital capacity.

The obtained F-ratio of 4.66 for adjusted mean was greater than the table value 4.20 for the degree of freedom 1 and 27 required for significance at 0.05 level of confidence. The result of the study indicates that there was a significant difference among control and experimental groups on forced vital capacity. The above table also indicates that pre test of control and experimental groups did not differ significantly and post test of control and experimental groups have significant difference on forced vital capacity.

The obtained F-ratio of 10.92 for adjusted mean was greater than the table value 4.20 for the degree of freedom 1 and 27 required for

significance at 0.05 level of confidence. The result of the study indicates that there was a significant difference among control and experimental groups on slow vital capacity. The above table also indicates that pre test of control and experimental groups did not differ significantly and post test of control and experimental groups have significant difference on slow vital capacity.

The obtained F-ratio of 9.51 for adjusted mean was greater than the table value 4.20 for the degree of freedom 1 and 27 required for significance at 0.05 level of confidence. The result of the study indicates that there was a significant difference among control and experimental groups on maximum voluntary ventilation. The above table also indicates that pre test of control and experimental groups did not differ significantly and post test of control and experimental groups have significant difference on maximum voluntary ventilation.

The obtained F-ratio of 3.49 for adjusted mean was lesser than the table value 4.20 for the degree of freedom 1 and 27 required for significance at 0.05 level of confidence. The result of the study indicates that there was no significant difference among control and experimental groups on dribbling. The above table also indicates that pre and post test of control and experimental groups did not differ significantly on dribbling.

The obtained F-ratio of 7.38 for adjusted mean was greater than the table value 4.20 for the degree of freedom 1 and 27 required for

significance at 0.05 level of confidence. The result of the study indicates that there was a significant difference among control and experimental groups on Passing. The above table also indicates that pre test of control and experimental groups did not differ significantly and post test of control and experimental groups have significant difference on Passing.

### III. Discussion of findings

The results of the study indicate that the experimental group which underwent contrast training had showed significant improved in the selected variables namely such as vital capacity, forced vital capacity, slow vital capacity, maximum voluntary ventilation and Toe touch when compared to the control group. The control did not show significant improvement in any of the selected variables.

The past studies on selected physical variables also reveals Argus et al., (2012) who had found that tapering had significant improvement vertical jump, 3-RM squat and 3-RM bench press and chin-up (max) and 10-m sprint performance. bodyweight squat jump was a bodyweight countermovement jump, 50 kg countermovement jump, 50 kg squat jump, broad jump, and reactive strength index jump height divided by contact time during a depth jump performance Our findings suggest that high-level rugby union athletes should be exposed to higher volume-load contrast training which includes one heavy lifting session each week for larger and more uniform adaptation to occur in explosive power throughout a competitive phase of the season. (Duthie et., al (2002) with the higher strength group having a greater improvement in performance using the contrast training method compared with the traditional method. It was concluded that contrast training is advantageous for increasing power output but only for athletes with relatively high strength levels.

### 5. Conclusions

From the analysis of data, the following conclusions were drawn.

1.The experimental group showed significant improvement in all the selected physiological and performance related variables such as vital capacity, forced vital capacity, slow vital capacity, maximum voluntary ventilation and toe touch.

2.The control group did not show significant improvement in any of selected variables.

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## Effect of complex training on selected physiological variables among basketball players

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### Abstract

The present study explores the impact of 12 weeks complex training on the various physiological variables among basketball players. Thirty (30) basketball players were randomly selected from Karpagam Institute of Technology, Coimbatore, TamilNadu. The age of the students ranged from 18 -23 years. The players were randomly divided into two groups, complex training group (N=10) and control group (N=10). Random group design has been used in the study. The training programme was scheduled for one and a half hour, i.e., 4:00-5:30pm per day for twice a week (Monday and Thursday) for complex training group. The control group was prohibited to participate in any of the training programmes except for their daily routine practice. The selected physiological variables for the study were resting pulse rate, systolic blood pressure, diastolic blood pressure, resting respiratory rate and peak expiratory flow rate. To compare the mean difference between pre-test and post-test, 't' test was computed with the help of SPSS software and level of significance chosen was 0.05. Significant differences were found with pre-test and post-test results with respect to pulse rate, systolic blood pressure, diastolic blood pressure, resting respiratory rate, etc. it can be therefore inferred that complex training indeed affects the physiological variables and rather improves them. No significant was found between pre-test and post-test of control group on physiological variables. Therefore, this training should be an integral part of the overall training programmes for basketball players.

**Keywords:** Complex Training, Physiological Variables & Basketball Players

### Introduction

Complex training is a combination of high intensity resistance training followed by plyometrics. Complex training, one of the most advanced forms of sports training, integrates strength training, plyometrics, and sport-specific movement. It consists of an intense strength exercise followed by a plyometric exercise. Complex training activates and works the nervous system and fast twitch muscle fibers simultaneously. The strength exercise activates the fast twitch muscle fibers. The plyometric movement stresses those muscle fibers that have been activated by the strength training movement. During this activated state, the muscles have a tremendous ability to adapt. This form of intense training can teach slow twitch muscle fibers to perform like fast twitch fibers (Beven, 2003).

The main aim of a basketball player is to obtain points by putting the ball into the basket of the opponent team's court. A goal is considered when the ball enters into the basket from above and passes through or remains in the net. The main goal of tactics is to determine the means, methods and actions of play against a particular opponent. Thus the player's tactical actions lie essentially in the continuous solving of tasks which unfold during the constantly changing situations of play in attack and defense. (Kunha, 2008).

### Review of Literature

Alves et al. (2018) analyzed the short-term effects of complex and contrast training (CCT) on vertical jump (squat and countermovement jump), sprint (5 and 15 m), and agility (505 Agility Test) abilities in soccer

players. Twenty-three young elite Portuguese soccer players (age 17.4  $\pm$  0.6 years) were divided into 2 experimental groups (G1, n = 9, and G2, n = 8) and 1 control group (G3, n = 6). Groups G1 and G2 have done their regular soccer training along with a 6-week strength training program of CCT, with 1 and 2 training sessions/week, respectively. G3 has been kept to their regular soccer training program. Each training session from the CCT program was organized in 3 stations in which a general exercise, a multiform exercise, and a specific exercise were performed. The load was increased by 5% from 1 repetition maximum each 2 weeks. Obtained results allowed identifying a reduction in sprint times over 5 and 15 m (9.2 and 6.2% for G1 and 7.0 and 3.1%, for G2; p , 0.05) and an increase on squat and jump (12.6% for G1 and 9.6% for G2; p , 0.05). The results suggested that the CCT induced the performance increase in 5 and 15 m sprint and in squat jump. Vertical jump and sprint performances after CCT program were not influenced by the number of CCT sessions per week (1 or 2 sessions/week). From the obtained results, it was suggested that the CCT is an adequate training strategy to develop soccer players' muscle power and speed.

Daniel, et al. (2019) evaluated and to compare the effects of a complex training program and a conventional training program, on power and strength development in sport science students. Sixteen undergraduates were randomly divided into two equivalent groups: Complex Training Group (CPG; n=8) and Conventional Training Group (CVG, n=8), both of which completed a similar volume and intensity of training. CPG combined maximum strength exercises with power exercises using the complex training method. Subjects comprising the CVG group performed similarly to their CPG counterparts in the first four weeks and the equivalent power training during the second half of the program. Both programs produced gains in the weight lifted ( $p < 0.01$ ) 1RM back squat and the Squat Jump ( $p < 0.01$ ). CPG subjects achieved gains in Maximum Strength, the Counter Movement Jump ( $p < 0.01$ ), and 10, 15 and 20-m runs ( $p < 0.05$ ) whereas CVG subjects achieved improvements in the 5-m run

( $p < 0.05$ ). After detraining, CPG subjects experienced a decline in the Counter Movement Jump and in the 10-m run ( $p < 0.05$ ). Complex and non-complex training programs in untrained subjects may increase the power and maximum strength, and generally result in improvement of these parameters without any one program showing appreciable advantages over the other.

## Method and Procedure

The present study is a kind of analytical research which uses experimental method. A random group design, which was experimental in nature, was implemented for this study. The sample of the study comprises Thirty (30) basketball players from Karpagam Institute of Technology, Coimbatore, TamilNadu. The age of the students ranged from 18-23 years. The players were randomly divided into two groups, complex training group (N=15) and control group (N=15). The training programme was scheduled for one and a half hour, i.e., 4:00-5:30 PM per day for twice a week (Monday and Thursday) for complex training group. The control group was prohibited to participate in any of the training programmes except for their daily routine practice. After transmuting the data into statistical analysis, the study was concluded. Measurements for variables were taken at the initial (pre-test) and at the end of experimental training period after 12 weeks (post-test).

The selected physiological variables were resting pulse rate, systolic blood pressure, diastolic blood pressure, resting respiratory rate and peak expiratory flow rate of the study were measured in the units of beats/minute, mmhg, breath/minute and liters respectively. To compare the mean difference between pre-test and post-test, 't' test was computed with the help of SPSS software and level of significance chosen was 0.05.

## Data Analysis and Results

For the variables, the statistical analysis between the pre-test and post-test of experimental group and control group regarding resting pulse rate, systolic blood pressure, diastolic blood pressure, resting

respiratory rate and peak expiratory flow rate among basketball players has been given in table 1 and 2. There were significant differences between the pre-test and post-test results.

**Table 1:** Comparison of pre-test and post test of complex training group with regard to selected physiological variables among basketball players (Experimental group)

Variables	Test Condition	N	Mean	Std. Deviation	Mean Difference	t-Value	p-Value
Resting Pulse Rate(Beats/Minute)	Pre-test	10	72.4	6.7	4.9	6.648	<b>0.0001*</b>
	Post-test	10	67.5	5.2			
Systolic Blood Pressure (mmhg)	Pre-test	10	120.3	5.2	6.0	12.136	<b>0.0001*</b>
	Post-test	10	114.3	4.1			
Diastolic Blood Pressure(mmhg)	Pre-test	10	80.8	5.8	6.4	6.532	<b>0.0001*</b>
	Post-test	10	74.4	5.4			
Resting Respiratory Rate (Breath/Minute)	Pre-test	10	19.9	1.8	5.1	10.583	<b>0.0001*</b>
	Post-test	10	14.8	1.5			
Peak Expiratory Flow Rate(Litters)	Pre-test	10	433.0	52.1	77.0	16.293	<b>0.0001*</b>
	Post-test	10	510.0	49.7			

**Table 2:** Comparison of pre-test and post test of control group with regard to selected physiological variables among basketball players

Variables	Test Condition	N	Mean	Std. Deviation	Mean Difference	t-Value	p-Value
Resting Pulse Rate(Beats/Minute)	Pre-test	15	73.1	6.6	0.7	1.769	<b>0.111NS</b>
	Post-test	15	72.4	6.5			
Systolic Blood Pressure(mmhg)	Pre-test	15	120.0	2.8	0.9	0.797	<b>0.446NS</b>
	Post-test	15	119.1	3.9			
Diastolic Blood Pressure(mmhg)	Pre-test	15	77.5	3.3	0.6	1.203	<b>0.260NS</b>
	Post-test	15	78.1	3.6			
Resting Respiratory Rate (Breath/Minute)	Pre-test	15	19.4	1.2	0.3	0.580	<b>0.576NS</b>
	Post-test	15	19.7	1.8			
Peak Expiratory Flow Rate(Liters)	Pre-test	15	445.0	49.7	3.0	0.818	<b>0.434NS</b>
	Post-test	15	448.0	50.1			



A perusal of contents of table-1 pertaining to pre-test, post test and post-test complex training group on the resting pulse rate would show that pre-test group had secured mean 72.4 and standard deviation 6.7. Whereas post group had secured mean 67.5 and standard deviation 5.2. The t-value for pre-test and post- test of resting pulse rate was found to be statistically significant as the value obtained was 6.648 with p- value 0.0001 (<0.001) which is less than 0.001 level of significance. Thus, it means that there is a highly significant difference between pre-test group and post group for the resting pulse rate variable.

A paired sample 't' test showed that the complex training group difference with regard to systolic blood pressure for the pre-test group M = 120.3 and S.D. = 5.2 and the post group M = 114.3, S.D. = 4.1 which were statistically significant with t-value 12.136 and p-value 0.0001 (<0.001). Thus, it means that there is a highly significant difference between pre-test group and post group for the systolic blood pressure variable. It is shown that mean and SD values with regard to pre-test for complex training group on the basketball players diastolic blood pressure were 80.8 and 5.8 and post group had obtained the mean 74.4 and standard deviation 5.4. The t-value for pre-test and post test on the basketball players diastolic blood pressure was 6.532 with p-value 0.0001 (<0.001). Thus, there is a highly significant difference between pre-test and post group for the basketball players diastolic blood pressure. On the variable resting respiratory rate, pre-test and posttest Complex training group revealed M = 19.9 and S.D. = 1.8 for pre-test, M = 14.8 and S.D. =1.5 for post test. The t-value for pre-test and post test was found to be statistically significant as the value was obtained 10.583 with p-value 0.0001(<0.001).Thus, it means that there is a highly significant difference between pre-test group and post group for the resting respiratory rate variable.

In case of pre-test peak expiratory flow rate the mean score, standard deviation of complex training group were M = 433.0 and S.D. = 52.1 and in case of post-test peak expiratory flow rate the mean score, standard deviation of

complex training group were 510.0 and 49.7. The t-value for pre-test and post test on the basketball players peak expiratory flow rate was found to be statistically significant as the value was 16.293 with p- value 0.0001 (<0.001).Thus, it means that there is a highly significant difference between pre-test group and post group for the peak expiratory flow rate variable.

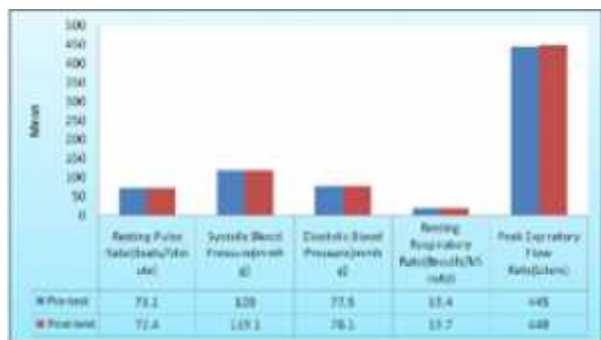
Table- 2 depicts the descriptive statistics and paired t-ratio for Pre-test and post test of control group with regard to physiological variables like resting pulse rate, systolic blood pressure, diastolic blood pressure, resting respiratory rate and peak expiratory flow rate among basketball players. It is shown that mean and SD values with regard to pre-test of Control group on the basketball players resting pulse rate were 73.1 and 6.6 as compared to these values post group had obtained the mean 72.4, standard deviation 6.5. The t-value for pre-test and post test on the basketball players resting pulse rate was 1.769 with p-value 0.111 which was found to be non-significant at 5% level of significance.

Pre-test and post test of control group on basketball players systolic blood pressure, concluded the mean score of 120.0 and SD 2.8 for pre-test and mean score 119.1 and SD 3.9 for post test. The t-value for pre-test and post test was found to be statistically non-significant as the value was obtained 0.797 with p-value 0.446 (>0.05). Diastolic blood pressure of pre-test group had secured mean 77.5, standard deviation 3.3. However post group had secured mean 78.1, standard deviation 3.6. The t-value for pre-test and post-test of diastolic blood pressure was found to be statistically non-significant as the value obtained was 1.203 with p-value 0.260 (>0.05). In case of pre-test resting respiratory rate the mean score, standard deviation of control group were 19.4. 1.2 and in case of post-test resting respiratory rate the mean score, standard deviation of Control group were 19.7, 1.8. The t-value for pre-test and post test on the basketball players resting respiratory rate was found to be statistically non-significant as the value was 0.580 with p-value 0.576 (>0.05).

A paired sample ‘t’ test showed that the control group difference with regard to peak expiratory flow rate between the pre-test mean 445.0, standard deviation 49.7 and the post group mean 448.0, standard deviation 50.1 which were statistically non-significant with t-value 0.818 and p-value 0.434 (>0.05).



**Figure-1** The Graphical Representation of Mean Score of Pre-Test and Post-Test Measurements for Experimental Group



**Figure-2** The Graphical Representation of Mean Score of Pre-Test and Post-Test Measurements for Control Group

**Discussion**

The results of the study regarding the physiological variables like resting pulse rate, systolic blood pressure, diastolic blood pressure, resting respiratory rate and peak expiratory flow rate among basketball players reveal that the experimental group namely complex training group had significantly improved after the 12 weeks of training and there was no significant difference was existed between pre-test and post-test of control group. The results are in line with that of study earlier conducted by Singh & Singh(2015) revealed that complex training group had significantly improved physiological variables- resting pulse rate, systolic blood

pressure, diastolic blood pressure, resting respiratory rate, peak expiratory flow rate and maximum breath holding capacity after the 12 weeks of training and there was no significant difference was existed between pre-test and post-test of control group . It was also observed by P.SenthilKumar(2015) in his study that complex training produce significant changes on selected physical, physiological variables and skill performance variables of college men football players.

**5. Conclusions**

Complex training program is an important part of training for athletes which also affects the performance and physiological variables of these athletes. Further, many studies have also highlighted its usefulness for athletes and players. The objective of the present study was to analyze the impact of complex training program for athletes and to find out its impact on the physiological variables such as respiratory rate, systolic blood pressure, etc. basketball players were chosen as the subjects for the study. It was found that there was a noticeable and significant impact of complex training on the physiological variables chosen for the study. Most of the variables showed a significant difference with respect to pre and post-test results. Therefore, it can be inferred that complex training has an observable impact as far as the various physiological measurements of players are concerned. It is an effective training to improve the levels of physiological variables of players.

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## Effects of varied intensity interval training on selected endurance parameters among intercollegiate athletes

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### Abstract

The purpose of the present study was to find out effect of Varied Intensity Interval training on selected Endurance parameter among Intercollegiate athletes. For this study N=36 participants were selected St. Johns College of Physical Education, Veeravanallur, Tamil Nadu, India who were participated I the intercollegiate athletic championship by randomly and their age range between 18 to 21 years. The selected participants (N=36) were divided into three groups equally by random method. Each group consisted of 12 participants. Experimental Group I underwent Moderate Intensity Interval Training group; Group II underwent High Intensity Interval Training group and Group III acted as Control Group. The experimental groups were treated with their respective training for one and half hour per day for All days a week for a period of Twelve weeks. Speed Endurance measures with 150 M run in seconds, and Cardio Vascular Endurance measures with 12 min cooper run and walk test in meters. The paired sample 't' test was applied to determine the improvement between the means of groups. To find out whether there was any significance improvement difference between the experimental and control groups the analysis of covariance (ANCOVA) was used and the scheffe's post-hoc test was used to determine which of the paired means differed significantly where the differences in adjusted posttest means resided in univariate ANCOVA among three groups. 0.05 were fixed to test the level of significance. The result of study shows that, there was a significant improvement take place on Speed Endurance, and Cardio Vascular Endurance of intercollegiate athletes due moderate and High Intensity Interval Training.

**Keywords:** Moderate and High Intensity Interval Training, Endurance parameters.

### Introduction

High intensity interval training is a common strategy used by athletes and conditioning practitioners to improve performance. Previous research has shown that despite significant reductions in both training time and volume, High intensity interval training produces greater improvements in aerobic fitness and greater increases in anaerobic power compared to traditional, continuous endurance exercise (Naimo, De Souza, Wilson, Carpenter, Gilchrist, Lowery, & Joy, 2015). High-intensity interval training, involving short to long intensive work intervals interspersed by active or passive recovery periods, is frequently used in training programs of competitive team sport athletes (Wiewelhove, Raeder, Meyer, Kellmann, Pfeiffer, & Ferrauti, 2015). High Interval training in endurance events has been well established as a

means of increasing performance in both trained and untrained athletes (Laursen and Jenkins, 2002).

Relatively new approach to Physical Activity that has gathered significant attention in the systematic community and general public is high-intensity interval training. The basic parameters of High intensity interval training are linked to sport training but have been elaborated and adapted for both general and experimental populations (Martinez, Kilpatrick, Salomon, Jung, & Little, 2015). High intensity interval training for endurance athletes generally emphasizes participation in long-duration low- or moderate-intensity exercise during the base or preparation phase of the season, with the inclusion of shorter-

duration high-intensity efforts as the competitive phase approaches (Jones & Carter, 2000).

## Methodology

For this study N=36 participants were selected St. Johns College of Physical Education, Veeravanallur, Tamil Nadu, India who were participated in the intercollegiate athletic championship by randomly and their age range between 18 to 21 years. The selected participants (N=36) were divided into three groups equally by random method. Each group consisted of 12 participants. Experimental Group I underwent Moderate Intensity Interval Training group; Group II underwent High Intensity Interval Training group and Group III acted as Control Group. The experimental groups were treated with their respective training for one and half hour per day for All days a week for a period of Twelve weeks. Speed Endurance measures with 150 M run in seconds, and Cardio Vascular Endurance measures with 12 min cooper run and walk test in meters.

## Training Program

The interval training was imparted at St. Johns College of Physical Education, Veeravanallur, Tamil Nadu, India. First, they were familiarized with each exercise which they had to undergo with the help of an expert. It was a twelve-week progressive interval training program for the two experimental groups at progressive intensities. Pretest and post test data were collected from experimental group and as well as from the control group.

The duration of training session in all days was between one hour to one and half hours approximately which included warming up and limbering down. Group III acted as control, which did not participate in any specific training on par with experimental groups. All the participants involved in this study were carefully monitored throughout the training program to be away from injuries. They were questioned about their health status throughout the training program. None of them reported with any injuries. However, muscle soreness appeared in the earlier period of the training program and was reduced in due course.

The participants were trained for three days a week (alternate days) at the college ground.

## Statistical Technique

The paired sample 't' test was applied to determine the improvement between the means of groups. To find out whether there was any significance improvement difference between the experimental and control groups the analysis of covariance (ANCOVA) was used and the scheffe's post-hoc test was used to determine which of the paired means differed significantly where the differences in adjusted posttest means resided in univariate ANCOVA among three groups. 0.05 were fixed to test the level of significance.

Table 2 shows the pre and posttest mean, standard deviation and adjusted posttest value on Speed Endurance t test Value of MIITG = 10.55\*, HIITG = 6.00\*, CG = 0.44 and Cardio Vascular Endurance t test Value of MIITG = 20.85\*, HIITG = 11.02\*, CG = 1.41\* respectively. The obtain t table value is 2.201 with df (11). The Statistical results shows that the obtained Speed Endurance and Cardio Vascular Endurance t value of MIITG and HIITG greater than the t table value. It shows that the Experimental group had significance improvement on selected dependent variable.

Statistical results shows that the obtained Speed Endurance and Cardio Vascular Endurance t value of CG lesser than the t table value. It shows that the Control group had no significance improvement on selected dependent variable.

The table 4 shows that the mean difference value of speed endurance between MIITG and HITTG  $0.537 > 0.37$ , MITTG and CG  $0.664 > 0.37$  and HITTG and CG  $1.201 > 0.37$ . Also cardio vascular endurance between MIITG and HITTG  $84.37 > 41.37$ , MITTG and CG  $115.33 > 41.37$  and HITTG and CG  $199.64 > 41.37$ . from the above table it was conclude that the MIITG has better in speed endurance and cardio vascular endurance than the HITTG and CG intercollegiate athletes. Also HITTG are better in speed endurance and cardio vascular endurance than the CG intercollegiate athletes.

**Table 1 Selection of variables and criterion measures**

SI. No	Variables	Tests	Units of Measurement
1	Speed Endurance	150 M run	In seconds
2	Cardio Vascular Endurance	12 minutes run	In Meters

**Table 2 Means, standard deviations and Parried sample t test for each dependent variable by the training groups**

Variables	Tests	MIITG		HIITG		CG	
		Mean	SD	Mean	SD	Mean	SD
Speed Endurance	Pre-Test	19.91	1.22	20.10	1.67	20.93	2.40
	Post Test	19.39	1.18	19.03	1.28	20.97	2.30
	t Test	10.55*		6.00*		0.44*	
Cardio Vascular Endurance	Pre-Test	2475.83	292.93	2464.17	293.64	2427.50	298.76
	Post Test	2570.00	296.43	2643.33	254.18	2409.17	288.93
	t Test	20.85*		11.02*		1.41*	

**Table 3 Results of analysis of covariance for the selected dependent variables among three groups**

VARIABLES	OBTAINED 'F'-RATIO	ETA <sup>2</sup>	ACCOUNT OF VARIANCE	SIG.
Speed endurance	33.87	0.966	97%	0.009
Cardio vascular endurance	76.99	0.983	98%	0.000

Significance level at 0.05 is 3.284 with df 2,33.

**Table 4 Summary of the Scheffe's post hoc pairwise comparisons**

Variables	MIITG vs HIITG	MIITG vs CG	HIITG vs CG	C.I Value
Speed Endurance	0.537*	0.664*	1.201*	0.37
Cardio Vascular Endurance	84.34*	115.33*	199.64*	41.37

### Discussions on findings

The findings clearly show that improvement in the Endurance Parameters of the Intercollegiate athletes due to the effect of the Moderate Intensity Interval Training and High Intensity Interval Training on the various systems of their body.

Vigneshwaran, & Sundar, (2020) Effect of interval training and strength endurance training on selected fitness parameter among long distance athletes. The result of study shows that, there was a significant improvement take place on Speed, Cardio respiratory endurance and Muscular strength of long-distance athletes. Conclusion: Improved Speed, Cardio respiratory endurance and Muscular strength after regular practice of Interval and Strength Endurance training is beneficial of the long-distance athletes.

Dupont, Akakpo, & Berthoin, (2004) The Effect of In-Season High Intensity Interval Training in Soccer Players. The results indicate that the high intensity interval training have shown that maximal aerobic speed was improved and that the time of the 40-m sprint was decreased while no change in either parameters were observed during control period. This study shows that improvements in physical qualities can be made during the in-season period.

Paton, & Hopkins, (2004). Effects of high-intensity training on performance and physiology of endurance athletes. The results indicate that the addition of explosive resistance and high-intensity interval training to a generally low-intensity training program will produce substantial gains in performance. More research is needed to clarify the effects of the various forms of high-intensity training on endurance performance, to determine whether prescribing specific forms of resistance training can improve specific deficits of an endurance athlete's physiology, and to determine the effects of combining the various forms in periodized programs

### Conclusions

- There is significant improvement between pre and posttest mean on speed endurance, cardio

vascular endurance due to the twelve weeks of Moderate Intensity Interval Training.

- There is significant improvement between pre and posttest mean on speed endurance, cardio vascular endurance due to the twelve weeks of High Intensity Interval Training.
- The control group had a no significant Improvement on selected Endurance Parameters.
- Also, there is significant improvement difference between experimental and control group on selected dependent variables.
- Moderate Intensity Interval Training had better in improving endurance parameters than the High Intensity Interval Training and control groups.
- High Intensity Interval Training had better in improving endurance parameters than the control groups..

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None of the authors have any conflicts of interest to declare.

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## Complex and contrast training on explosive power performance of male basketball players

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### Abstract

Forty five male basketball players were randomly assigned as complex training group (COMTG), contrast training group (CONTG), and traditional method training group (TMG), assessments for jump squat, counter movement jump and seated medicine ball throw were performed before and after 8 weeks training programme. All the three groups kept up their regular basketball practice and additionally all the groups performed 3 sessions per week of a respective programme. The univariate analysis of variance showed that the training induced significant improvement in squat jump for the three groups: The contrast training group had significantly higher averaged adjusted values than the other two groups. Training also induced significant improvements in counter movement jump for the three groups. The CONTG had significantly higher average adjusted values than the other two groups. Training further induced significant improvements in seated medicine ball throw for the three groups. The CONTG had significantly higher average adjusted values than the other groups.

**Keywords:** Basketball, Training, Medicine ball.

### Introduction

Success in sports depends heavily upon the player's explosive power and muscular strength. Power training is commonly conducted using lighter resistances that are performed explosively. To achieve the greater benefits from power training, It should be performed at the beginning of an exercise session or on a separate training day. The best results are attained when a combination of heavy and light loads are implemented within the work out. By performing heavy loads before light power exercises, there is greater activation and preparation for maximal effort in the lighter load. The heavy resistance work gets the nervous system into full action, so that more Type II b fibers are available for the explosive exercise. The use of heavy resistance exercises and lighter resistance exercises with in a session has repeatedly been referred to as "complex training". The terms "complex training" and 'contrast training" have been used interchangeably to define the use of heavy and light resistance loads with in the same workout. For the purpose of this investigation "Complex

training" defines various sets of complex exercises performed in a manner in which several sets of heavy resistance exercises are followed by set of lighter resistance exercise.

The purpose of this investigation was to compare the effects of complex and contrast training methods in the improvement of power performance throughout an entire weight training session.

### Methodology

Forty five collegiate male basketball players were randomly assigned to the complex training group (COMTG) (n=15 : age  $19.2 \pm 0.6$  years old; weight  $65.4 \pm 10.2$  kg; height  $174.3 \pm 6.4$  cm; and basketball training experience  $3 \pm 1.3$  years) Contrast training group (CONTG) ( n = 15 : age  $19.4 \pm 0.7$  years old : weight  $65.6 \pm 10.4$  kg : height  $175.4 \pm 6.7$  cm ; basketball training experience  $3.4 \pm 1.5$  years ) Traditional method of training group or Control group ( n = 15: age  $19.6 \pm 0.6$  years old ; weight  $65.4 \pm 10.8$  kg ; height

176.4  $\pm$  6.2 cm ; basketball training experience 3.2  $\pm$  1.2 years). None of the subjects had training experience using plyometric training programme before this study. Forty five basketball players were randomly divided into three groups namely; The experimental group I Complex Training group (COMTG), The experimental group II Contrast Training group (CONTG) and The experimental group III Traditional Method of Training group (TMG). The experimental group I underwent complex training programme, the experimental group II underwent contrast training programme, and the control group underwent traditional method of training i.e plyometric followed by resistance training. The training programme lasted for 8 weeks during, which 24 training sessions were conducted 3 times per week.

Subjects were assessed before and after 8 weeks training programme for upper and lower body explosive power. The assessment was done in a). Jump squat (JS), b). Counter movement jump (CMJ), and c). Seated medicine ball throw (MBT). The traditional method of training group practiced plyometrics followed by weight training exercises. The complex training group practiced weight training followed by plyometrics, and contrast training group practiced weight training exercises followed by one set of a matched plyometrics exercise.

The complex training workout comprised 3 sets of resistance exercises followed by a matched plyometric exercise e.g : Squats followed by squat jumps. All the subjects performed twelve repetition maximum of the exercise before they were fatigued. The subjects in the complex training group performed five weight training exercise: Squats, Bench press, Barbell lunge, lateral pull down and abdominal crunches and five plyometric drills : Vertical jumps, Medicine ball chest pass, step jumps, medicine ball over head pass and medicine ball sit up and throw.

The contrast training workout comprised one set of resistance exercise followed immediately by one set of the biomechanically matched plyometric exercise. The subjects in the contrast training group performed all the 5 weight exercises and 5 plyometric exercises prescribed for the complex group. This group completed one set with 10 repetition of the weight exercises with a recovery of 60 seconds followed by plyometric movement, 1 set of 10 repetitions as explosive as possible.

The traditional training workout comprised 3 sets of plyometric exercise (light resistance) followed by matched 3 sets of resistance exercises (heavy resistance exercise) . The same weight training exercises of plyometric exercise given to the complex group are given to this traditional group and same method of workout was followed.

S.NO	Exercise	Sets x Reps	Rest/Exercise	Rest/Sets
1	Half Squat Vertical Jump	3x12 RM 3x10	60 Sec 30 Sec	30 Minutes 90 Seconds
2	Bench Press Medicine Ball Chest Pass	3x12 RM 3x10	60 Sec 30 Sec	30 Minutes 90 Seconds
3	Barbell Lunge Step Jumps	3x12 RM 3x10	60 Sec 30 Sec	30 Minutes 90 Seconds
4	Lat Pull Down Medicine Ball Overhead Pass	3x12 RM 3x10	60 Sec 30 Sec	30 Minutes 90 Seconds
5	Abdominal Crunches Medicine ball Sit-up & Throw	3x12 RM 3x10	60 Sec 30 Sec	30 Minutes 90 Seconds

Table – II Comparison of explosive power test results mean ( ± SD) between the 3 groups in pre – and posttest conditions							
Test		Pre	Post	Gains		Value	
				Absolute	%	“t”	Ft
SJ (cm)	COMTG	22.70 ±4.0	26.20 ±4.8	3.5	15.12	0.240* Δ	0.134
	CONTG	22.02 ±4.4	26.20 ± 4.4	4.48	20.34	0.094* Δ Δ	
	TMT	20.04± 4.3	18.20± 3.9	1.48	9.18	0.845	
CMJ (cm)	COMTG	28.64 ± 5.4	32.44 ±6.1	3.8	13.27	0.055* Δ	0.320
	CONTG	29.25 ± 5.6	33.15 ±6.2	3.9	13.33	0.124* Δ Δ	
	TMT	30.42 ± 4.8	28.60 ± 4.4	1.82	5.98	0.752	
MBT (cm)	COMTG	3.10 ± 0.5	4.20 ± 0.6	1.1	35.48	0.042* Δ	0.245
	CONTG	3.15 ± 0.6	4.30 ± 0.5	1.15	36.51	0.022* Δ	
	TMT	3.05 ± 0.4	3.20 ± 0.4	0.15	4.92	0.675Δ	

SJ= Squat Jump, CMJ = Counter Movement Jump, MBT= Medicine Ball Throw.  
 \* Significant difference from pre to post (p< 0.05)  
 Significant difference between groups post training (p< 0.05)  
 Δ Δ Significantly better than complex and control group  
 Δ Significantly better than and control group

A repeated measure ‘t’ test was used to determine the presence or absence of gains in each group, because of the slight differences in the initial groups, analysis of covariance with the pre-test values as the covariate was used to determine significant differences between the post-test adjusted means in the groups. A significance level of 0.05 was used. All statistical analyses were conducted using SPSSv10.

The results between the pre-and post-test for explosive power performance scores of all the three groups and the results between of the groups at baseline and after the training programme are presented in table II.

Eight weeks of contrast training elicited significant increase in jump squats, 22.02 +/- 4.4 vs 26.20 +/- 4.4 counter movement jump 29.25+/- 5.6 vs 33.15+/- 6.2, and seated medicine ball throw 3.15 +/-0.6 vs 4.30 +/- 0.5 from pre to post. Similarly the complex training also elicited significant increase in jump squats 22.70 +/- 4.0 vs 26.20 +/- 4.8; counter movement jump 28.64+/- 5.4 vs 32.44+/- 6.1 and seated medicine ball throw 3.10+/-0.5 vs 4.20+/-0.6 from pre to post test.

The traditional method of training group did not show significant increase in the three variables. The contrast training group elicited significantly greater increase in jump squats 20.34 vs 15.42% counter movement jump 13.33 vs 13.27 % and seated medicine ball throw 36.51 vs 35.48% than the complex training group and increased significantly in jump squat 20.34 vs 9.18% counter movement jump 13.13 vs 5.98 % and seated medicine ball throw 36.5 vs 4.92 % than the control group. The complex training group significantly increased in jump squat 15.42 vs 9.18 % counter movement jump 13.27 vs 5.98 % and seated medicine ball throw 35.48 vs 4.92 % better than the control group.

The main findings from this study were the significant increase in the height of the different jumps and in the distance of the MBT (medicine ball throw), which proved the complex training and contrast training efficacy. The increase in the height of the SJ (squat jump) and CMJ (counter movement jump) (5.2 % and 3.4 % respectively) were statistically significant and the increase in the distance of the MBT (6.4 %) was also statistically significant from pre to post test of the

contrast training group. These findings show the quality of the contrast training programme design.

The complex training group also increased the height of the SJ and CMJ (4.8 % and 2.4 % respectively) were statistically significant and the increase in the distance of the MBT (5.4%) was also statistically significant from pre to post testing.

## Conclusions

It can be concluded that the contrast training and complex training methods for power development may lead to greater improvements in power performance than the traditional method of training.

Among the contrast and complex training methods the contrast training method may be better than the complex training method in improving the upper and lower extremity power performance. Any practical application requires careful implementation and individual experimentation. The most important findings in this research are that significant strength levels are required for an athlete to use the complex and contrast training methods effectively.

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## Combined Effect of Game Specific Fitness Training Associated with Jump Rope Training on Speed and Explosive Power Among Veterinary College Volleyball Players

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### Abstract

The purpose of the study was to find out the combined effect of game specific fitness training associated with jump rope training on speed and explosive power among veterinary college volleyball players. Twenty four (24) male volleyball players those who are studying Bachelor of Veterinary Sciences (B.V.Sc.) from Veterinary College and Research Institute, Tirunelveli were selected randomly as subjects. The volleyball players from all the five years were restricted to act as subjects for this study. The age of the subjects ranged from 18 to 23 years. The selected subjects were divided into two groups. Group I underwent Game Specific Fitness Training Associated with Jump Rope Training (GSFTAJRT) and Group II acted as control (CG). The experimental group (Game Specific Fitness Training Associated with Jump Rope Training) was subjected to do specific training for five days (Monday, Tuesday, Wednesday, Thursday and Friday) for up to six weeks. The training was restricted to practice on the evening session after completion of all the classes in all the years. The Game Specific Fitness Training Associated with Jump Rope Training (GSFTAJRT) was selected as Independent Variable and the criterion variables Speed and Explosive Power were selected as dependent variables and the selected dependent variables were assessed by the standardized test items. Speed was assessed by 50 meters run and the unit of measurement in seconds and Explosive Power was assessed by vertical jump test and the unit of measurement in centimetres. The experimental design selected for this study was pre and post test randomized design. The data were collected from each subject before and after the training period and statistically analyzed by using paired sample 't' test and analysis of covariance (ANCOVA). It was found that there was a significant improvement and significant difference exist due to the combined effect of game specific fitness training associated with jump rope training among Veterinary College volleyball players.

**Keywords:** Fitness Training, Speed, power and athletes.

### 1. Introduction

The team sports such as water polo, football and hockey require to have well developed speed, muscular strength and power. However well – developed physiological capacities are important for team sports and players are also required to have well developed technical skill and decision-making ability. Further players are required adequately to demonstrate these qualities under sky-scraping level of

difficulty and tiredness. (Reilly, T and Gilbourne, D. 2003).

Game – based training is more and more being used to get better the skilfulness and physical fitness of team game players. The use of games in training is based on the principle that the greatest development in performance occur when the physiological demands and movements patterns replicate the demands of the sports. (Tim Gabbett et.al., 2009).

Game based training is increasingly being used as means of improving the skill and physical fitness levels of team game players. Although game based training has been shown to provide a specific training stimulus that generally replicates the overall demands of team sport competition (Tim Gabbett et.al., 2009).

Jump rope is one of the top calorie burners on the planet, ranking up there in calories burned per minute with vigorous games. Jump rope needs a rope about four feet of horizontal space and eight feet of vertical space. Additionally, jump rope can be used as a high intensity interval training workout, it is an exercise strategy used to improve the athletic related performance or the skill related the performance to burn the fat and increase the motor fitness (Brett and Jason).

Jump Rope has been around for many years as spare time activity for children and physical exercise. Jump rope is a gymnastic competitive sport for individuals and teams which require extreme motor fitness. It is exceptionally agreeable to watch and perform, and jump rope fitness has been around the 1990's and has been promoted in different types of programs. Jump rope fitness intensity and energy expenditure, calories burned and training effect depends on the body weight, rope weight, jumping speed, and the jumping height (Mariana Aagaard).

Jumping to a beat or rhythm makes jump rope is an ideal tool for humanizing the motor fitness namely speed and explosive power. There is only one right way to run and jump for better sports and athletic performance. Jump rope is an excellent way of developing speed and explosive power, only high intensity jump rope training procedure the greatest benefits in the least amount of time for improved fitness and sports performance (Lee, 2003)

Jumping rope has many benefits, primarily conditioning the heart and lungs. However it can increase body awareness and develop better hand and foot coordination (Kahn and Biscontini, 2007). The jump rope is a tried and true method for improving conditioning and coordination. If one has never jumped rope before, it can expect a challenge.

## Methodology

To achieve the purpose, twenty four (24) male volleyball players those who are studying Bachelor of Veterinary Sciences (B.V.Sc.,) from Veterinary College and Research Institute, Tirunelveli were selected randomly as subjects. The volleyball players from all the five years were restricted to act as subjects for this study. The age of the subjects ranged from 18 to 23 years. The selected subjects were divided into two groups. The study restricted to select the male volleyball players as a subject of the study. The age of the subjects ranged from 18 to 23 years. They were assigned randomly into two groups (Group I) underwent Game Specific Fitness Training Associated with Jump Rope Training (GSFTAJRT) and (Group II) acted as control of twelve each. The experimental group were subjected to the Game Specific Fitness Training Associated with Jump Rope Training (GSFTAJRT) during the evening hours for five days (Monday, Tuesday, Wednesday, Thursday and Friday). The training was restricted to practice on the evening session after completion of all the classes in all the years and Group II acted as control. The control group was instructed to practice their regular routine work of the evening hours. The Game Specific Fitness Training Associated with Jump Rope Training (GSTAJRT) was selected as Independent Variable and the criterion variables speed and explosive power were selected as dependent variables and the selected dependent variables were assessed by the standardized test items. Speed was assessed by 50 meters run and the unit of measurement in seconds, and the explosive power was measured by vertical jump test and the unit of measurement in centimetres. The experimental design selected for this study was pre and post randomized design. The data were collected from each subject before and after the training period and statistically analysed by using paired sample 't' test and analysis of co variance (ANCOVA).

## Results and Discussion

The data pertaining to the variables in this study were examined by using paired sample 't' test to find out the significant improvement and analysis of covariance (ANCOVA) for each

variables separately in order to determine the difference and tested at 0.05 level of significance. The analysis of paired sample 't' test on a data obtained for speed and explosive power of the pre and post test means of experimental and control groups have been analysed and presented in Table I.

**Table- I Mean and paired sample 't' test of experimental and control groups on selected variables**

Variables	Mean	Game Specific Fitness Training Associated with Jump Rope Training	Control Group
Speed	Pre test Mean	8.15	8.14
	Post test Mean	8.14	8.14
	't' test	<b>11.00*</b>	<b>1.00</b>
Explosive Power	Pre test Mean	45.42	44.92
	Post test Mean	46.13	44.83
	't' test	<b>9.53*</b>	<b>1.00</b>

**Significant at 0.05 level of confidence (11) = 2.201**

**Table- II Analysis of covariance of experimental and control groups on selected variables**

Variables	Adjusted Post Test Means		Source of Variance	SS	df	Mean Squares	'F'-Ratio
	Game Specific Fitness Training Associated with Jump Rope Training	Control Group					
Speed	8.14	8.15	Between	00005.06	1	00005.06	<b>59.13*</b>
			Within	00001.79	21	0000008.56	
Explosive Power	45.90	45.06	Between	4.068	1	4.068	<b>65.79*</b>
			Within	1.229	21	0.06183	

\*Significant at .05 level of confidence, df (1, 21) = 4.32

The obtained paired sample 't' ratio value on Speed and Explosive Power of experimental group is higher than the table value, it is understood that the game specific fitness training associated with jump rope training has made significant improvement on speed and explosive power. However, the control group has not made significant improvement as the obtained 't' value is less than the table value, because it was not

subjected to any specific training. The analysis of covariance on the data obtained on speed and explosive power due to the effect of game specific fitness training associated with jump rope training group and control groups have been analysed and presented in Table II.

Table II showed that the obtained 'F' ratio values are 59.13 and 65.79 which are higher than the table value 4.32 with df 1 and 21 required to be significant at 0.05 level. Since the

obtained value of 'F' ratio is higher than the table value, it indicates that there is significant difference has made among the adjusted post means of game specific fitness training associated with jump rope training and control group on speed, and explosive power.

The Game Specific Fitness Training Associated with Jump Rope Training practices may influence the significant difference on speed and explosive power

## Conclusion

1. The Game Specific Fitness Training Associated with Jump Rope Training (GSFTAJRT) practices had significantly improves the speed, and explosive power.
2. There was significant difference among the adjusted post – test means of Game Specific Fitness Training Associated with Jump Rope Training (GSFTAJRT) practices and Control group (CG) on speed and explosive power.

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## Conflict of interest

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