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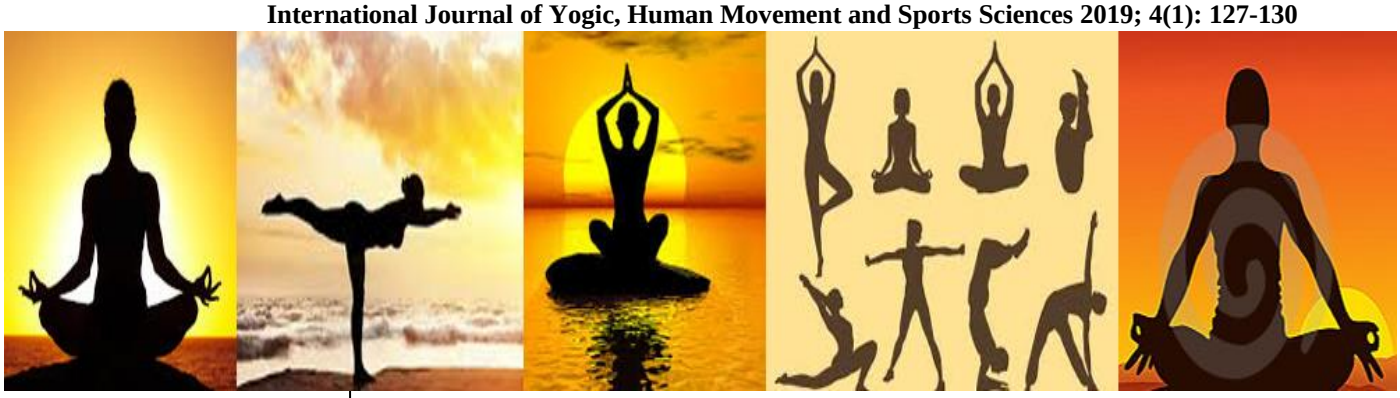

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Efficacy of extensive interval training and pranayama practices on selected physiological variables among untrained college male students

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Abstract
The purpose of the study is to find out the effect of extensive interval training and pranayama practices on selected physiological variables among untrained college male students. For the purpose of the study, thirty six (n=36) untrained college men students were selected from Annamalai University, Chidambaram. The selected subjects were randomly assigned to one of three groups of twelve (n=12) each, such as two experimental and a control groups. The Group I (n=12) undergone interval training and Group II (n=12) undergone pranayama practices for a duration of twelve weeks and the number of sessions per week was confined to three alternative days, in addition to the regular schedule, Group III (n=12) acted as control. The independent variables are interval training and pranayama practices. The criterion variables chosen for this investigation is breath holding time and vital capacity and it was assessed from the manual nostril clip method and Queen's College Step Test. The subjects in all the three groups were tested prior to and after twelve weeks of experimental treatment. The experimental design used for the present investigation was pre and post test randomized control group design. The data collected from the three groups prior to and post experimentation were statistically analysed by using dependent t-test and ANCOVA to find out the significant difference between pretest and posttest among the selected three groups. Whenever the obtained 'F' ratio values was found to be significant, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases, .05 level was fixed as level of significance. There was a significance improvement on breath holding time and vital capacity due to the extensive interval training and pranayama practices among untrained college male students. Pranayama practices was found better than extensive interval training on breath holding time and vital capacity.

Keywords: Pranayama, extensive interval training, breath holding time, vital capacity

Introduction
The spiritual-scientific discipline of yoga is the most precious gem of Vedic philosophy and our cultural heritage. It incorporates a wide variety of practices whose ultimate goal is the development of mental and physical health, well being, inner harmony and ultimate union of the human individual with the universal and transcendent existence (1-2). As a deep breathing technique, pranayama reduces dead space ventilation and decreases work of breathing. It also refreshes air throughout the lungs, in contrast with shallow breathing that refreshes air only at the base of the lungs (Bijlani RL, 2004) [5].

Pranayama has variable effect on cardio-respiratory system. Regular practice of pranayama improves cardio-vascular and respiratory functions, improves autonomic tone towards parasympathetic system, decreases the effect of stress and strain on the body and improves physical and mental health (Bhargava R, Gogate MG, Mascarenhas JF, 1988) [2]. Versions of pranayama vary from single nostril breathing to bellow breathing and it consists of three phases: Purak (inhalation), Kumbhak (retention) and Rechak (exhalation).

Regular interval training increases the amount of oxygen delivered to the tissues and removal of carbon dioxide from the body. It enhances the respiratory efficiency by increasing the strength of diaphragm and intercostal muscles, and by increasing the number of alveoli. It increases the vital capacity and prolongs the breath holding time. Breath holding training is useful in athletes to improve their respiratory endurance and their performance.

Breath holding test is used as a rough index of cardiopulmonary reserve. BHT of less than 20 seconds indicates diminished cardiac or pulmonary reserve. Measures should be taken to increase physical activity among non-athletes to improve the ventilatory function and vital functions of the body to lead a good quality life (Upadhyay DK, Malhotra V, Sarkar D, Prajapati R, 2008) [16].

Purpose of the Study

By keeping the above concepts in mind, the purpose of the study is to find out the effect of pranayama practices on selected physiological variables among untrained college men students.

Methodology

Selection of subjects

For the purpose of the study, thirty six (n=36) untrained college men students were selected from, Annamalai University, Chidambaram. The selected subjects were randomly assigned to one of three groups of twelve (n=12) each, such as two experimental and a control groups.

Selection of Variables

The independent variables used in the present study are extensive interval training and pranayama practices. The criterion variables chosen for this investigation is breath holding time and vital capacity and it was calculated from the manual nostril clip method and Queen's College Step Test.

Experimentation

The Group I (n=12) undergone pranayama practices, Group II (n=12) undergone interval training for a duration of twelve weeks and the number of sessions per week was confined to three alternative days, in addition to the regular schedule, Group III (n=12) acted as control.

The participants in the pranayama practice group performed the prescribed exercises for specified durations, whereas the participants of the extensive interval training group sprinted during the work period that ranged from 20 or 15 seconds from 120 or 90 seconds in each set. The training load was increased once in two weeks, by manipulating either the work period or the active recovery period between repetitions. The subjects in all the three groups were tested prior to and after twelve weeks of experimental treatment.

Experimental Design

The experimental design used for the present investigation was pre and post test randomized control group design.

Statistical Technique

The data collected from the three groups prior to and post experimentation were statistically analysed by using dependent t-test and ANCOVA to find out the significant difference between pretest and posttest among the selected three groups. Whenever the obtained 'F' ratio values was found to be significant, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases, .05 level was fixed as level of significance. The data was analysed with the help of computer by using standard statistical package SPSS.

Results and Interpretations

The collected data were statistically analysed and the results were presented below.

Table 1: Summary of mean and dependent't' test on breath holding time and vital capacity between pre and post test of untrained college men students

Variables	Group	Mean		t – value
		Pre Test	Post Test	
Breath Holding Time	Interval Training Group	35.58	39.08	5.87*
	Pranayama Practice Group	33.50	45.50	8.56*
	Control Group	34.83	34.75	0.17
Vital Capacity	Interval Training Group	37.75	41.67	8.67*
	Pranayama Practice Group	37.83	44.75	13.08*
	Control Group	37.67	37.83	0.27

*Significant at .05 level. Table value required for significance at .05 levels for 't' with df 11 is 2.20.

The table 1 shows that the obtained dependent t-test values between pre-test and post test means of experimental and control groups on breath holding time are 8.56, 5.87 and 0.17 and vital capacity are 13.08, 8.67 and 0.41 respectively. The table value required for significant difference with df 11 at .05 level is 2.20. Since, the obtained t-test value of both experimental groups is greater than the tabulated t - value, it is concluded that extensive interval training and pranayama practices had significantly improved the performance of breath holding time and vital capacity and the control groups has not improved because they were not subjected to any specific training.

Table 2: Analysis of covariance (ancova) on selected physiological variables of experimental and control group

Variables	Adjusted Post Test Means			Source of Variance	Sum of Squares	df	Mean square	F - ratio
	Pranayama Practice Group	Interval Training Group	Control Group					
Breath Holding Time	45.50	39.08	34.75	Between	683.45	2	341.73	61.38*
				Within	178.17	32	5.57	
Vital Capacity	45.73	44.67	37.85	Between	284.02	2	142.01	65.67*
				Within	69.20	32	2.16	

* Significant at 0.05 level. The table value required for significance at 0.05 level with df 2 and 32 is 3.29)

Table 2 shows that the obtained F-ratio value of breath holding time is 61.38 and vital capacity is 65.67 which are higher than the table value of 3.29 with df 1 and 32 required for significance at .05 level. Since, the value of F- ratio is higher than the table value it indicates that there was significant difference exists between the adjusted post-test means of both experimental and control groups on breath holding time and vital capacity.

Table 3: Scheffe's test for difference between the paired means of selected physiological variables of untrained college men students

Variables	Mean Values			Mean Difference	CI
	Pranayama Practice Group	Interval Training Group	Control Group		
Breath Holding Time	45.50	39.08		6.42*	1.43
	45.50		34.75	10.75*	
		39.08	34.75	4.33*	
Vital Capacity	45.73	44.67		1.06*	0.89
	45.73		37.85	7.88*	
		44.67	37.85	6.82*	

*Significant at .05 level

Table 3 shows that the adjusted post test mean differences on breath holding time and vital capacity between pranayama and interval training groups; pranayama and control groups; and interval training and control groups are greater than the confidence interval value and shows significant difference at .05 level of significance. It may be concluded from the results of the study that there was a significant difference on breath holding time and vital capacity between pranayama and interval training groups; pranayama and control groups; and interval training and control groups. It was concluded that pranayama training programme is better than interval training programme and control groups in improving breath holding time and vital capacity.

Discussion on Findings

Pranayama helps in bringing the sympathetic and parasympathetic nervous system into harmony. Through breathing we can influence the nervous system. Pranayama may allow bronchio-dilatation by correcting abnormal breathing patterns & reducing muscle tone of respiratory muscles (P Grover, VD Varma, D Pershad, SK Verma, 1998) [6]. These effects can be explained on the following basis:

Yoga training improves the strength of expiratory as well as inspiratory muscles (Mohan Madan, *et al*. 1992) [12]. Bhastrika Pranayama is a bellows type breathing in which one breath forcefully and rapidly and thus, exercises inspiratory as well as expiratory muscles (MR Bhargava, MG Gogate, 1982) [3].

In breathing exercises like Kapalbhati, short powerful strokes of exhalation in quick succession with contraction of abdominal and diaphragmatic muscles train the subject to make full use of diaphragm and abdominal muscles in breathing. It also helps in removal of secretions from bronchial tree, clearing up respiratory passages and the alveoli making room for more air. Hence it improves the breath holding time (NK Subbalakshmi, SK Saxena, Urmimala, JA Urban, 2005) [15].

There has been a case report (DB Johnson, MJ Tierney, PJ Sadighi, 2004) [9] of occurrence of pneumothorax with practice of Kapalabhati pranayama but there was no such occurrence. Yoga strengthens the respiratory musculature due to which chest and lungs inflate and deflate to fullest possible extent and muscles are made to work to maximal extent. Abdominal breathing uses the diaphragm and performs respiration with least effort, hence it elevate the lung capacity. While, chest breathing utilizes intercostal muscles, it is less efficient (RK Yadav, S Das, 2001) [17]. With the regular practice of breath holding the individual's central and peripheral chemoreceptor's gets adapted to the anoxia, this result is achieved by the body by causing hypo metabolism. Thus, reflecting as prolonged breath hold and decreased urge to breathe while doing so. In addition to this, the training of the stretch receptors in the respiratory muscles, chest wall and also walls of the alveoli support the breath holding (Amte, *et al.*, 2014) [1].

Pranayama training causes an increase in the voluntary breath holding time. This may be due to acclimatization of the chemoreceptors to hypercapnoea (V Shankarappa, *et al.*, 2012) [13]. Lung inflation near to TLC is a major stimulus for release of lung surfactant into alveolar spaces which increases the lung compliance. During pranayama, there is slow & prolonged inspiration and expiration. It stretches elastin & collagen fibres interwoven among lung parenchyma. Hence these fibres elongate to a greater extent (BKS Iyengar, 1968) [7].

During pranayama training, regular inspiration and expiration for longer duration would lead to acclimatization of central and peripheral chemoreceptors for both hypercapnoea and hypoxia (LN Joshi, VD Joshi, 1998) [11]. A study by Bhargava MR *et al*., showed a statistically significant increased breath holding time after the pranayama practice (MR Bhargava, MG Gogate, 1982) [3]. Acclimatization of the stretch receptors increase the synchronization between the lung tissue and the cortex. Continous pranayama training causes increased breath holding time (R Jerath, J Edry, V Barnes, V Jerath, 2008) [8].

Another possible explanation for the role of yoga in improving the functioning of Lungs and in reducing the mast cell degranulation could be based on the frictional stress from air flowing through narrowed airways damaging the airway mucosa and thereby perpetuating airway inflammation and airway obstruction. The slow and gentle breathing in some of the Pranayamas may reverse the process by reducing the frictional stress, and thereby stabilizing the mast cell degranulation (R Jerath, J Edry, V Barnes, V Jerath, 2008) [8].

A growing number of literatures have confirmed that endotoxin is the main mediator in byssinosis and obstructive lung diseases. The deep inspiration, retention of air and slow expiration increases the overall capacity of the lungs and gradually improves the ventilatory functioning of lungs. Due to the proper working of these organs, vital energy flows to maintain the normal homeostasis of the body and thus it helps in prevention, control and rehabilitation of many respiratory diseases (MR Bhargava, MG Gogate, 1982) [3].

Thus this present study indicates that the regular practice of pranayama improves pulmonary function and is beneficial to improve respiratory efficiency such as vital capacity and breath holding time.

Conclusions

There was a significance improvement on breath holding time and vital capacity due to the extensive interval training and pranayama practices among untrained college male students.

There was a significance improvement on breath holding time and vital capacity due extensive interval training and pranayama practices among untrained college male students.

There was significance difference among Pranayama, Interval training and control groups on breath holding time and vital capacity.

Pranayama training has better when compare with interval and control group on breath holding time and vital capacity among untrained college male students.

Control group was no significance difference on breath holding time and vital capacity among untrained college male students.

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