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Full Length Research paper

Effect of anulom vilom and bhastrika pranayama on the vital capacity and maximal ventilatory volume

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To determine the effects of Anulom Vilom and Bhastrika Pranayama on Vital Capacity and Maximal Ventilatory Volume, thirty (N = 30) randomly selected male students aged 18 - 26 years volunteered to participate in the study from D.A.V. Institute of Engineering and Technology, Jalandhar (Punjab), India. They were randomly assigned into two groups: A (experimental) and B (control). The subjects were subjected to the eight week pranayama training programme that includes "Anulom Vilom Pranayam" and "Bhastrika Pranayam". The between-group differences were assessed using the Student's t-test for dependent data. The level of $p \leq 0.05$ was considered significant. The vital capacity and maximal ventilatory volume significantly improved in group A compared with the control one. Pranayama training programme may be recommended to improve vital capacity and maximal ventilatory volume.

Key words: Pranayama-bhastrika-anulom, vilom-vital, capacity-maximal ventilatory volume.

INTRODUCTION

Yogic techniques are known to improve one's overall performance and work capacity (Bhattacharyya and Krishna, 1960). Yoga appears to provide a comparable improvement in stress, anxiety and health status (Caroline et al., 2007). Yogic practices can be used as psychophysiologic stimuli to increase endogenous secretion of melatonin, which in turn, might be responsible for improved sense of well-being (Harinath et al., 2004). Training to yoga respiration selectively increases the respiratory sensation, perhaps through its persistent conditioning of the breathing pattern (Florence et al., 2005). Perhaps one of the most powerful tools in yogic practices is the use of the breath to bring our consciousness back in tune with the Divine Cosmic Breath. This cosmic breath is the rhythm of life itself. Yoga breathing, or pranayama, is the science of breath control. Pranayama (breathing exercise), one of the yogic techniques can produce different physiological responses in healthy individuals (Upadhyay et al., 2008). The science of pranayama is based on the retention of prana called 'kumbhaka'. Among the many kinds of pranayama, anulom vilom and bhastrika are considered as one of the significant types of the core structuration of pranayama. Bhastrika pranayama is mainly a combination of Kapalbhati and Uijayee. Rapid succession of forcible expulsion is a characteristic feature of bhastrika pranayama, whereas anulom vilom pranayama is also called "Nadishuddhi Pranayama", in this breathing technique you inhale from one nostril at one time and release the breath through the other nostril.

There have been many studies on yoga and its effects on physical function (Hadi, 2007) but with the phenomenal and ever increasing popularity of pranayama in the past few years, there is a lack of study on this particular discipline and as a result the present study has been undertaken to examine the effects of anulom vilom and bhastrika pranayama on the vital capacity and maximal ventilatory volume.

MATERIALS AND METHODS

Subjects

Thirty randomly selected male students aged 18 - 26 years volunteered to participate in the study from D.A.V. Institute of Engineering and Technology, Jalandhar (Punjab), India. They were randomly assigned into two groups: A (experimental) and B (control). The subjects were subjected to the eight week pranayama training programme. This lasted 8 weeks and consisted of daily sessions, lasting 50 min each, which included "Anulom Vilom Pranayam" and "Bhastrika Pranayam" (Figure 1).

Methodology

Spirometer was used to measure vital capacity. The subject was

Figure 1. Pranayam. A- Anulom Vilom Pranayam, B- Bhastrika Pranayam

made to sit and breathe normally through the mouthpiece of spirometer. Subjects filled their lung as much as possible. As soon as they had their lungs fully inflated, they blew all the air out as fast as they could. The procedure was repeated thrice. Maximal Ventilatory Volume was measured by a spirometer. The subject was made to sit and breathe through the mouthpiece. The bell was no more than half filled. The subject was instructed to take a series of deep breathes in and out for 10 - 20 s. They breathe out and hold it for about 3 - 5 s. The procedure was repeated thrice. Correct the highest volume from 10 - 20 seconds to one minute.

The between-group differences were assessed using the Student's t-test for dependent data. The level of $p \leq 0.05$ was considered significant.

RESULTS

The study was conducted to determine the effects of anulom vilom and bhastrika pranayama on vital capacity and maximal ventilatory volume (Table 4). The statistical analysis of data collected on thirty (N = 30) subjects. For each of the chosen variable, the results pertaining to significant difference, if any, between experimental and control groups were assessed by "t" test (Florence et al., 2005) and are presented in the Tables.

Table 3 shows that the mean of vital capacity of pretest of experimental group and posttest of experimental group was 2.590 and 3.218, respectively, whereas the mean of vital capacity of pre-test of control and post test of control group (Table 2) was 2.767 and 2.785. The "t" value in case of experimental group was 13.132 and for control group it was 1.586. Since cal. t (= 13.132) > tab t 0.05 (14) (= 2.145), Ho (null hypothesis) is rejected at .05 level of significance. Thus it may be concluded that eight week pranayama training programme showed significant improvement in vital capacity. As per the study the above remark can be given at 95% confidence. The graphical representation of responses has been exhibited in Figure 2.

Table 6 shows that the mean of maximal ventilatory volume of pre-test of experimental group and post test of experimental (Table 5) group was 109.466 and 132.466 respectively, whereas the mean of maximal ventilatory volume of pre-test of control and post-test of control group was 115.333 and 117.400. The "t" value in case of experimental group was 8.322 and for control group it was 3.141. Since cal. t (= 8.322) > tab t 0.05 (14) (= 2.145), Ho (null hypothesis) is rejected at .05 level of significance. Thus it may be concluded that eight week pranayama training programme showed significant improvement in maximal ventilatory volume. As per the study the above remark can be given at 95% confidence. The graphical representation of responses has been exhibited in Figure 3.

DISCUSSION

Yoga asanas are psychophysical practices to culture body and mind. Yoga practices are known to significantly improve health status, and reduce stress and anxiety. From the results it is evident that the eight week of pranayama training programme showed significant improvement in vital capacity (Table 1) and maximal

Table 1. Vital capacity of experimental group paired samples t-test.

	Pre-test	Post-test
Sample size	15	15
Arithmetic mean	2.5900	3.2180
95% CI for the mean	2.2824 - 2.8976	2.9279 - 3.5081
Variance	0.3086	0.2744
Standard deviation	0.5555	0.5238
Standard error of the mean	0.1434	0.1352
Mean difference		0.6280
Standard deviation		0.1852
95% CI		0.5254 - 0.7306
Test statistic t		13.132
Degrees of freedom (DF)		14
Two-tailed probability		P < 0.0001

Table 2. Vital capacity of control group paired samples t-test.

	Pre-test	Post-test
Sample size	15	15
Arithmetic mean	2.7673	2.7847
95% CI for the mean	2.4109 - 3.1238	2.4259 - 3.1434
Variance	0.4143	0.4197
Standard deviation	0.6437	0.6478
Standard error of the mean	0.1662	0.1673
Mean difference		0.01733
Standard deviation		0.04234
95% CI		- 0.006112 - 0.04078
Test statistic t		1.586
Degrees of freedom (DF)		14
Two-tailed probability		P = 0.1351

Table 3. Mean, standard deviation (sd), standard error of mean (sem) of vital capacity of experimental and control group.

Group	Number	Mean	S.D.	SEM	't' Value
Experiment (pre-test)	15	2.590	0.555	0.143	13.132
Experimental (post-test)	15	3.218	0.524	0.135	
Control (pre-test)	15	2.767	0.644	0.166	
Control (post-test)	15	2.785	0.648	0.167	1.586

ventilatory volume. The findings are supported by the study conducted by Upadhyay et al. (2008), showed a significant increment in Peak expiratory flow rate (PEFR L/min) and Pulse pressure (PP). Although systolic blood pressure (SBP) was decreased insignificantly, the decrease in pulse rate (PR), respiratory rate (RR), diastolic blood pressure (DBP) was significant (Upadhyay et al., 2008). In the present study the bhastrika pranayama showed significant improvement in vital capacity and maximal ventilatory volume which is supported by the study conducted by Pramanik et al. (2009). Pranayama increases frequency and duration of inhibitory neural impulses by activating pulmonary stretch receptors during above tidal volume inhalation as in Hering Bruer reflex, which bring about withdrawal of sympathetic tone in the skeletal muscle blood vessels, leading to widespread vasodilatation, thus causing decrease in peripheral resistance and thus decreasing the diastolic blood pressure (Pramanik et al., 2009). Anulom Vilom pranayama also showed significant

Table 4. Maximal ventilatory volume of experimental group paired samples t-test.

	Pre-test	Post-test
Sample size	15	15
Arithmetic mean	109.4667	132.4667
95% CI for the mean	97.8734 - 121.0600	118.2955 - 146.6378
Variance	438.2667	654.8381
Standard deviation	20.9348	25.5898
Standard error of the mean	5.4053	6.6073
Mean difference		23.000
Standard deviation		10.7038
95% CI		17.0724 - 28.9276
Test statistic t		8.322
Degrees of freedom (DF)		14
Two-tailed probability		P < 0.0001

Table 5. Maximal ventilatory volume of control group paired samples t-test.

	Pre-test	Post-test
Sample size	15	15
Arithmetic mean	115.3333	117.4000
95% CI for the mean	104.6346 - 126.0320	107.0127 - 127.7873
Variance	373.2381	351.8286
Standard deviation	19.3194	18.7571
Standard error of the mean	4.9882	4.8431
Mean difference		2.0667
Standard deviation		2.5486
95% CI		0.6553 - 3.4780
Test statistic t		3.141
Degrees of freedom (DF)		14
Two-tailed probability		P = 0.0072

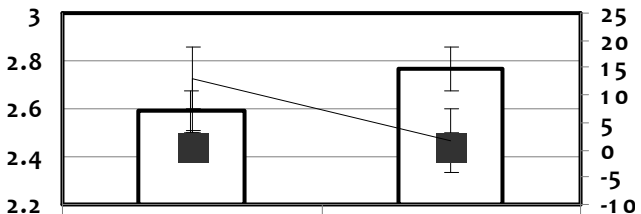
Table 6. Mean, standard deviation (sd), standard error of mean (sem) of maximal ventilatory volume of experimental and control group.

Group	Number	Mean	S.D.	SEM	't' Value
Experiment (Pre-test)	15	109.466	20.934	5.405	8.322
Experimental (Post-test)	15	132.466	25.589	6.607	
Control (Pre-test)	15	115.333	19.319	4.988	
Control (Post-test)	15	117.400	18.757	4.843	3.141

improvement in vital capacity and maximal ventilatory volume and the result is supported by the study conducted by Joshi et al. (1992). There was improvement in Ventilatory functions in the form of lowered respiratory rate (RR), and increases in the forced vital capacity (FVC), forced expiratory volume at the end of 1st second (FEV1%), maximum voluntary ventilation (MVV), peak expiratory flow rate (PEFR-lit/sec), and prolongation of breath holding time(Joshi et al., 1992).

Conclusion

Summing up, the 8-week pranayama training programme had significant effect on vital capacity and maximal ventilatory volume. Thus, such training may be



	Experimental	Control
Pre-test Mean	2.59	2.7673
Post-test Mean	3.218	2.7847
SD Pre-test	0.5555	0.6437
SD Post-test	0.5238	0.6478

Figure 2. Mean, standard deviation (sd), standard error of mean (sem) of vital capacity of experimental and control group.

	Experimental	Control
Pre-test Mean	109.4667	115.3333
Post-test Mean	132.4667	117.4
SD Pre-test	20.9348	19.3194
SD Post-test	25.5898	18.7571

Figure 3. Mean, standard deviation (sd), standard error of mean (sem) of maximal ventilatory volume of experimental and control group.

recommended to improve physical fitness-based performance.

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