EFFECT OF SHORT TERM YOGA PRACTICE ON VENTILATORY FUNCTION TESTS

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Summary : Twentyfive normal male volunteers undergoing a ten weeks course in the practice of yoga have been studied by some parameters of ventilatory functions tests. The observations recorded at the end of ten weeks of the course have shown improved ventilatory functions in the form of lowered respiratory rate, increased forced vital capacity, FEV_1, maximum breathing capacity and breath holding time, while tidal volume and $\%FEV_1$, did not reveal any significant change. Thus, a combined practice of yoga seems to be beneficial on respiratory efficiency.

Key words : ventilatory functions yoga

INTRODUCTION

In the recent years a lot of research work has been done to improve the beneficial effect of yogic training. Yogasanas help in prevention, control and rehabilitation of many respiratory diseases.

The present studies were undertaken with the objective to ascertain whether a short course of yogic practices has any influence on ventilatory functions in adult males. It is now almost a proved fact based on various yogic investigations that a prolonged continuous yogic practices relieve chronic respiratory ailments like bronchial asthma, chronic bronchitis and bronchiectasis and ventilatory functions are much improved in them.

This conclusive information of improvement of ventilatory functions by short yogic practices will be applied on respiratory disease patients in the form of yogic therapy and these studies will now be carried out on patients.

MATERIAL AND METHODS

A study was conducted on 25 healthy normal male subjects performing regular yogic exercises at different yoga centres. All the cases were in the age groups ranging from 20 to 50 years. All these subjects were given a training for one week by trained yoga teacher, during this period, they learnt the yogasanas. A control group of 15 cases of different age groups was also studied, they were not performing yoga or any other physical exercise.

All the experimental cases were examined in the beginning before starting yogic training and practices and again after a period of ten weeks of yogic practices. Similarly, control cases were examined at the beginning of studies and after an interval of ten weeks.

Observations : The ventilatory function tests include respiratory rate, tidal volume, forced vital capacity, timed vital capacity (FEV_1 second), percentage FEV_1, maximum voluntary ventilation and breath-holding time.

The study was carried out on Toshniwal's Expirograph and the values were converted to B.T.P.S.

Before actual recording of tracings, the tests were thoroughly explained and a mock test was given to all the subjects.

The subject was connected to the expirograph with the help of mouth piece through two-way tap and nose was closed with the nose clip.

The subject was asked to breath for 15-20 sec in sitting posture so as to record respiratory rate and tidal volume. After that, the subject was asked to take a deep inspiration and to hold it for a moment, during which the speed of tracing was changed from 60 to 1200/min. This is followed by forced expiration. This recorded forced vital capacity, FEV_1, and percentage FEV_1.

Afterwards the speed was changed back to 60/min and subject was asked to breath as rapidly and forcefully as he could for 15 sec to record maximum voluntary ventilation (M.V.V.).

Breath holding time was measured with the help of stop-watch. Subject was asked to take normal respiration for few seconds, then to take deep inspiration and then to hold the breath till he could do it. The time of "breath-hold" was calculated by stop-watch.

The following yogic practices were performed by test group subjects between 6.00 a.m. to 7.30 a.m. daily :

S. No.	*Name*	*Total duration*
1.	Surya Namaskar	8 minutes
2.	Sharir Sanchalan	15 minutes
3.	Asanas (a) Sarvangasana, (b) Halasana, (c) Matsayasana, (d) Paschimottasana, (e) Bhujangasana, (f) Shalbhasana, (g) Dhanurasana, (h) Vajrasana, (i) Padmasana, (j) Chakrasana and (k) Shirsasna	40 minutes
4.	Pranayama - Rechak, Kumbhak and Purak	25 minutes
5.	Prayer	2 minutes
	Total	90 minutes

TABLE I : Showing distribution of cases according to age.

S. No.	*Age range in years*	*Control group*		*Yoga group*	
		No. of cases	*Percentage*	*No. of cases*	*Percentage*
1.	25 to 30	9	60.00	18	72.00
2.	31 to 40	2	13.00	5	20.00
3.	41 to 50	4	27.00	2	8.00
	Total	15	100.00	25	100.00

TABLE II : Observations of Ventilatory Functions

S. No.	Ventilatory functions	Control group			Yoga group		
		Mean with S. D.		Effective P value	Mean with S. D.		Effective P value
		I	II		I	II	
1.	Respiratory rate (per min)	16.33 ±2.60	17.13 ±3.27	>0.01	17.00 ±2.45	13.00 ±1.13	<0.005
2.	Tidal Volume *(ml)*	624 72 ±195.18	627.48 ±212.75	>0.10	733.93 ±274.76	972.93 ±157.81	>0.005
3.	Vital Capacity *(ml)*	2778.14 ±384.20	2665.40 ±371.37	>0.10	2799.73 ±52.91	3310.88 ±37.54	<0.005
4.	FEV_1 *(ml)*	2417.96 ±311.72	2395.71 ±48.94	>0.005	2500.98 ±	2955.87 ±54.36	<0.005
5.	$FEV_1\%$	86.57 ±7.20	85.70 8 46	>0.05	90.02 ±8.6	90.43 5.68	>0.005
6.	MVV (Lit'mint)	68.27 ±8.26	67.14 ±8.19	>0.05	57.96 ±7.61	76.31 8.73	<0.005
7.	BHT (Sec)	40.00 ±5.13	41.00 ±5.39	>0.005	34.50 ±11.86	59.64 ±11.53	<0.05

The table shows effect of ten weeks yoga-asanas on ventilatory functions as compared to control.
(1) There is significant decrease in rate of respiration. (2) There is no improvement in tidal volume. (3) There is significant improvement in vital capacity. (4) There is significant improvement in FEV_1. (5) There is no improvement in $FEV_1\%$. (6) There is significant improvement in maximum voluntary ventilation. (7) There is significant increase in breath-holding time.

NOTE : I Reading—Observations before starting yoga.
II Reading—Follow-up reading after 10 weeks duration in both the cases.

DISCUSSION

Respiratory rate : There is significant decrease in rate of respiration in yoga group. The mean value decreases from 17.0±2.45 to 13.0±1.13 per min with $P<0.005$ as compared to 16.33±2.6 to 17.13±3.27 per min with $P>0.1$ in control group. Similar type of observations have been recorded by others (5, 12).

Breath-holding time : Breath holding time in yoga group is found to be increased significantly. All the 25 cases showed a remarkable increase in BHT. It increase from 44.3±11.86 to 59.64±11.53 seconds ($P<0.005$), as compared to 40.0±5.13 to 41.0±5.39 sec in control group ($P>0.005$). Similar observations are noted by other workers (3, 5, 10, 12).

Pranayama is said to be the main yogic breathing exercise causing increase in breath holding time. It is explained as shift of autonomic nervous control towards parasympathetic side. Also, pranayama trains the respiratory centres to suspend the breath for quite a long time (11). The prolonged effort at controlling the respiratory muscles done in yogic breathing, the subject consciously persistently overriding the usual stimuli of respiratory centres leading to increased breath holding time (5).

Tidal volume : Tidal volume did not show any significant change in both yoga and control group. Although 18 out of 25 cases showed an increase in tidal volume in yoga group but the changes are not significant statiscally.

Sachdeva *et al.* (10) also recorded insignificant change in tidal volume in yoga practitioners. While, Gopal Bhatnagar *et al.* (4) recorded a significant increase in tidal volume after six months of yoga practice.

Vital capacity : Vital capacity has been found to be increased significantly in yoga group. The mean value changes from 2799.73±52.91 to 3310.88±37.54 *ml* ($P<0.05$) as compared to 2778.14±384.20 to 2665.40±371.37 *ml* ($P>0.10$) in control group. Similar observations have been recorded by others (7, 12).

The improvement in vital capacity is due in part to increased development of respiratory musculature incidental to regular practice of yogic exercises (5).

The increase in vital capacity can also be explained as follows :

In yogic breathing exercises (as in Kapalbhati) short powerful strokes of exhalation in

quick succession with contraction of abdominal and diaphragmatic muscles trains 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. Pranayama, on the other hand, is characterised by slow and deep inhalation and exhalation. The stress is on more prolonged expiration and efficient use of abdominal and diaphragmatic muscles. This act trains the respiratory apparatus to get emptied and filled more completely and efficiently which is recorded in terms of increased vital capacity.

In other types of yogic breathing the negative pressure created in abdominal and thoracic capacity raises the diaphragm at a higher level than its normal excursion. This further helps in efficient movement of diaphragm leading to improvement in vital capacity. Further, the removal of undue tension from the skeletal muscles in yogasanas helps the thorax to relax better than before. All these practices seem to increase E.R.V. thereby increasing the vital capacity (2).

Fev_1 : Forced expiratory volume during first second is found to be increased significantly in experimental group, while it remains unaltered in control group. It increases from 2500.98 ± 98.0 to 2955.87 ± 54.36 *ml* with $P < 0.005$ in yoga practitioners as compared to 2417.96 ± 311.73 to 2395.71 ± 48.94 *ml* in control group ($P > 0.005$).

The increase in FEV_1 might be due to highly significant increase in vital capacity in yoga group. But the percentage FEV_1 in experimental as well as in control group did not alter significantly.

Maximum voluntary ventilation (MVV) : The observation shows that maximum voluntary ventilation in yoga group is improved significantly. The mean value changing from 57.96 ± 7.61 to 76.31 ± 8.73 lit/min with $P < 0.005$ as compared to 68.27 ± 8.26 to 67.14 ± 8.19 lit/min in control group with $P > 0.05$.

The increase in M. V. V. might be due to improvement in respiratory mechanism and strengthening of respiratory muscles and also due to regular practice of yogasanas and yogic breathing exercises.

Thus the results obtained showed that there is an over all improvement in ventilatory functions in yoga group as compared to normal subjects. Rate of respiration decreases, $\%FEV_1$ and tidal volume shows no significant change, while vital capacity, FEV_1, maximum voluntary ventilation and breath-holding time showed significant improvement in yoga group.

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