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EFFECT OF PRANAYAMA ON PULMONARY FUNCTION IN NORMAL HEALTHY INDIVIDUALS

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ABSTRACT **Background**: YOGA is the science practiced in India since ancient times. Yoga means 'union' union of mind, body and spirit of creation-the ones of all things. Modern medical science tries to achieve optimum physical & mental health of individual through preventive, curative, promotive approach.

Pranayama improves overall performance of the body. The regular practice of pranayama increases chest wall expansion and almost all lung functions. The beneficial effect of different pranayama is well reported and has sound scientific basis. Pranayama makes efficient use of abdominal and diaphragmatic muscles and improves the respiratory apparatus .Pranayama is a form of respiratory exercise has shown to improve various respiratory parameter such as rate of respiration, force vital capacity (FVC), forced expiratory volume in 1 second (FEV1), peak expiratory flow rates (PEFR) and breath holding time.

Purpose: Present study will be undertaken to study the effect of pranayama on pulmonary function in healthy young individuals. To analyze the effect of on peak expiratory flow rates and breath holding time in healthy individuals who are performing "Pranayama".

Method: The study sample subjects were selected based on the inclusion and exclusion criteria through simple random sampling method

Conclusion: Present study concludes that Pranayama seems to be beneficial in pulmonary function.

KEYWORDS : Pranayama, Pulmonary function test, Peak expiratory flow rate (PEFR), Forced vital capacity (FVC)

Introduction

YOGA is the science practiced in India since ancient times. Yoga means 'union' union of mind, body and spirit of creation-the ones of all thing.[1] Modern medical science tries to achieve optimum physical & mental health of individual through preventive , curative, promotive approach.[2]

Patanjali, the father of yoga, has suggested eight stages of yoga to secure health of body, mind & soul which are known as "Asthang Yoga"[2]. Patanjali in his Yoga Sutra decribes- Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana and Samadhi as eight angas (parts) of yoga. Among them, in the present materialistic world, the third and fourth part, pranayama and asana are considered as very important part and prescribed by modern medicine too.[3].Pranayama is derived from Sanskrit word that are "Prana" means breath and "ayama" means development or control. [4] So pranayama literally mean "control of prana" isn't just breathing exercise. Through pranayama you use breath to affect the constellation of energy that is your bodymind. Pranayama which is control of inspiration and expiration. The inspiration of prana-vayu is shwasa and expiration is prashwasa and cessation of both is characteristic of pranayama. [1] Pranayama improves overall performance of the body. The regular practice of pranayama increases chest wall expansion and almost all lung functions. The beneficial effect of different pranayama is well reported and has sound scientific basis. Pranayama makes efficient use of abdominal and diaphragmatic muscles and improves the respiratory apparatus. 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.Pranayama is a form of respiratory exercise has shown to improve various respiratory parameter such as rate of respiration, force vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), peak expiratory flow rates (PEFR) and breath holding time.[5]During pranayama training, regular inspiration and expiration for longer duration would lead to acclimatization of central and peripheral chemoreceptors for both hypercapnoea and hypoxia.[1]

Among many kind of Pranayama- anulom, vilom, bhastrika and kapalbhati considered as significant type of Pranayama[4].Kapalbhati is an important part of shatkarma the yogic system of body cleansing technique. The word kapalbhati is made up of two words kapal meaning 'skull' (here skull includes all the organ under the skull) and bhati means shining, illuminating. Due to the process, the brain are influenced in good manner. Kapalbhati Pranayama helps to detoxify lungs and respiratory tracts, boosts the supply of oxygen and purifies blood and helps to tone up the abdominal muscles. It also helpful in reducing abdominal fat, improves concentration span. Kapalbhati Pranayama requires breath co-ordination at higher rate and hence higher rate of respiratory muscle activity that produces strengthing of the respiratory muscle and resulted in improvement of pulmonary function [6].In 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. It 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. While, chest breathing utilizes intercostal muscles. It is less efficient.[1]

Pulmonary function tests (PFTs), in general can evaluate virtually every physiological aspects of breathing from respiratory muscle function to the diffusion of gas across the alveolar wall to the neurological control mechanisms that drive the process of breathing. Pulmonary function test are commonly employed to evaluated ventilator mechanics, ventilator regulation and airway reactivity [7]. It is generic term that includes spirometry and flow volume loop. Ventilatory mechanics assessment includes measurement of lung volumes and flow rates. Measurement of flow rates revels the general conditions of the airways[7].

Peak expiratory flow rates (PEFR), by definition it is "the largest expiratory flow rates achieved with maximally forced effort from a position of maximal inspiration expressed in liters/minutes. PEFR is considered as the simplest index of pulmonary function to assess the ventilatory capacity. It is effort dependent and reflect mainly the caliber of the bronchi and larger bronchioles, which are subjected to reflex bronchoconstriction[8]. It is relatively a simple procedure and may be carried out in the field using portable instrument. The average PEFR of healthy young Indian males and females are around 500 and 350 liters/ minutes respectively. The PEFR reaches to peak at about 18-20 yrs maintain this level up to about 30 yrs in males and 40 yrs in females then declines with age. The peak flow meter which is a reliable and safe, bedside instrument fulfils the need of assessing ventilatory function [8].

Mini Wright peak flow meter are frequently used for many year both

for research purpose and in routine clinical setting.[9] The peak flow meter was designed by Wright and McKerrow (1959) as a simple portable instrument for measuring the maximum forced expiratory flow. They found that it could measure obstruction of the airways as efficiently as the more elaborate and bulky machines. Thus the peak flow can be measured as quickly as the blood-pressure. It is the object of the study to assess the value of the peak flow meter as an objective clinical test of dyspnea, and to record the readings obtained from a sample of the healthy population of Sheffield.

Breath holding/voluntary apnea which is an instructive laboratory exercise is variable for different individuals depending on the functional status of the lungs, development of respiratory muscles, practice, age and sex [10].Arrest of breathing voluntarily is known as voluntary apnea or breath-holding. A normal person can hold his breath for about 40 to 60 seconds. It is called breath- holding time or apnea time. Breath-holding time can be increased by practice exercise, will power and yoga. At the end of voluntary apnea the subject is forced to breath, which is called breaking point. It is because of the accumulation of carbon dioxide in blood, which stimulate the respiratory centers resulting in breaking point.Apart from increased carbon dioxide content in blood, hypoxia and increased hydrogen ion concentration are also responsible for stimulation of respiratory centers [11]. Breath holding time increase after the pranayama practice. Acclimatization of the stretch receptors increases the synchronization between the lung tissue and the cortex. Continuous pranayama training causes increased breath holding time.

Hence the present study will be undertaken to study the effect of pranayama on pulmonary function in healthy young individuals.To analyze the effect of on peak expiratory flow rates and breath holding time in healthy individuals who are performing "Pranayama".

METHODS

Subjects

The study sample subjects were selected based on the inclusion and exclusion criteria through simple random sampling method

Inclusion Criteria:

- Age of the individuals lies between 18-35.
- Both males and females are included in the study.
- The BMI of the subject is between 19 to 30 kg/cm^2.
- All subjects were non-smokers.
- All were not on any medication since last 6 month.
- The person had not visited any doctor since last 6 month.
- All are continuing their job without any difficulty.

Exclusion Criteria:

- Individuals performing pranayama or breathing exercise in past.
- Recent Surgery
- Active Infection
- Malignancy
- Presence of known cardiovascular disorder
- Presence of known neurological disorder
- Presence of Psychological Abnormalities
- Pregnancy
- Uncooperative Patients
- Reluctance to participate

Tools

- Peak Flow Meter, Disposable mouth piece, Stop watch, Paper or Diary, Nose Clip

Procedure

Forty one healthy individual aged between18-35 were included in the study. The subjects were divided into 2 groups: Control Group(N=20) and Experimental Group(N=21). An informed consent was obtained. They were asked not to change their lifestyle during the period of study instructed not to perform any other physical exercises if they were not doing the same regularly.[12] For the subject in control group there were no exercises to be explained. They just have to do the ADLs and follow the normal routine. The pre-reading were taken from the subjects. Pulmonary function parameter was recorded by a Wright peak flow meter and stop watch. The subject was given proper instruction about the procedure to be performed the subject with the mini Wright Peak Flow Meter mouth- piece on his mouth was asked to breath in order to familiarize himself with the equipment. During the test the subjects were adequately encouraged performing at their optimum level and also a nose clip was applied during the maneuver. The subjects were asked to take a deep breath, place the mouth piece of the flow meter firmly between the teeth and lips and then blow out with sharp blast .The reading on scale was noted test was repeated at least 3 times at an interval of 5 minute and the best (maximum) matching result were considered for analysis.For the determination of Breath- Holding time (BHT), the subject is sited and is asked to pinch his nostril with the thumb and forefinger and hold his breath after a deep inspiration. The time for which the breath can be held is noted with a stop watch. Three observations are made at an interval of 5 minutes. The higher value gives the breath- holding time in second for the subjects.The control group also studied in control sessions which are of the same duration. Both the observations were repeated every 20 days. Two month following the training the PEFR is recorded in both the groups using the Wright Peak Flow Meter and the Breath- Holding Time by using stopwatch. This was, done during morning hours (9-10am).The protocol was approved by the institution where the work was done. All test were carried out at the same time of the day to avoid the possible variation, because rhythmic changes in the physiological function were formed to be associated with changes in performance during this period. The tests were done in quite room in order to alleviate the emotional and psychological stresses.[10]

Statistical analysis

Statistical analysis was performed using SPSS version 20.0 data is normally distributed so that parametric statistical tests were used. Paired sample and independent sample 't' – test was used for intra and inter group analysis .

Table 1: Mean and Standard deviation of outcome measures

	Experimental group		Control group	
	Mean	Standard Deviation	Mean	Standard Deviation
BHT pre	38	14	33	13
BHT1	44	13	32	11
BHT2	50	14	31	9
BHT3	57	16	32	9
PEFR pre	412	131	388	95
PEFR1	445	118	384	80
PEFR2	475	127	365	79
PEFR3	498	129	373	84

Table 2: Paired Samples Test for experimental group

	Paired Differences					T	df	Sig. (2 -tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PEFR pre - PEFR1	-33.095	34.150	7.452	-48.640	-17.551	-4.441	20	.000
PEFR pre - PEFR2	-62.619	48.827	10.655	-84.845	-40.393	-5.877	20	.000
PEFR pre - PEFR3	-85.476	47.590	10.385	-107.139	-63.814	-8.231	20	.000
BHT pre - BHT1	-5.762	5.272	1.150	-8.162	-3.362	-5.009	20	.000
BHT pre - BHT2	-12.048	6.029	1.316	-14.792	-9.303	-9.157	20	.000
BHT pre - BHT3	-19.333	9.068	1.979	-23.461	-15.206	-9.770	20	.000

Table 3: Paired Samples Test for control group

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PEFR pre - PEFR1	4.000	42.476	9.498	-15.879	23.879	.421	19	.678
PEFR pre - PEFR2	23.500	53.339	11.927	-1.463	48.463	1.970	19	.064
PEFR pre - PEFR3	15.250	54.374	12.158	-10.198	40.698	1.254	19	.225
BHT pre - BHT1	1.200	4.150	.928	-.742	3.142	1.293	19	.211
BHT pre - BHT2	1.400	5.567	1.245	-1.205	4.005	1.125	19	.275
BHT pre - BHT3	.800	6.092	1.362	-2.051	3.651	.587	19	.564

Table : Independent 't' - test

	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference				
			Lower	Upper	t	df	Sig. (2-tailed)
PEFRpre	24.143	35.870	-48.412	96.698	.673	39	.505
PEFR1	61.238	31.690	-2.860	125.336	1.932	39	.061
PEFR2	110.262	33.165	43.180	177.344	3.325	39	.002
PEFR3	124.869	34.133	55.829	193.909	3.658	39	.001
BHTpre	4.962	4.193	-3.519	13.442	1.183	39	.244
BHT1	11.924	3.681	4.478	19.370	3.239	39	.002
BHT2	18.410	3.686	10.954	25.865	4.994	39	.000
BHT3	25.095	4.132	16.738	33.452	6.074	39	.000

Discussion

The aim of the study was to compare the effect of pranayama on PEFR and BHT on the healthy individuals. 41 healthy individuals were selected both males and females in the age group of 20 – 35 years.The result indicates that the PEFR & BHT response to pranayama was significantly higher in the experimental group than in control group. The reason for this difference may be the fact that during the pranayama, the compliance of the lung and thoracic system increases and the airway resistance decreases. The stretch receptors reflex decreases the trachea bronchial smooth muscle tone which in turn decreases air resistance and increases airway caliber which causes lung function to improve. A study conducted by Dr. Sheetal Parmar and associates, Upadhyay & colleagues, Joshi LN & colleagues in their study reported a statistically significant increase in PEFR similar to present study. They concluded that during pranayama, the compliance of the lung thoracic system increases and the airway resistance decreases. On the other study by Kumar et.al found no significant difference in PEFR after pranayama.In other type 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. Breath holding time was found to be significantly increased in our training group in this study. It may be because of the reason that during pranayama breathing, subject while keeping his skeletal muscles relaxed & immobile, exercise a close voluntary control over his respiratory muscles. In these prolonged effort at controlling his respiratory muscles, the subject consciously and persistently overrides the usual stimuli for respiratory centers [5]. Birkel DA suggested that pranayama increases frequency and duration of inhibitory neural impulses by activating pulmonary stretch receptors embedded in smooth muscles of the airways, on activation causes inhibition of inspiration and alters blood flow through lungs[13]. It also found that in control group in 2 months there is decrease in the PEFR and BHT. It reveals that pranayama seems to be beneficial for the pulmonary function. Further studies are needed to confirm the possible mechanism responsible for such an effect.

The present study had a few limitations, like; the sample study was small, future researches can be based upon a relatively larger sample that is more representative of the population. Also the age group studied was smaller; researches with larger age group could be done in the future.Another limitation of present study was short term effect of pranayama was assessed, i.e., long term effect can be assessed. The study can be done on patient suffering from respiratory conditions.

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