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ORIGINAL ARTICLE

A comparative assessment of slow and fast breathing exercises on pulmonary functions.

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ABSTRACT
Yogic breathing exercises are now gaining importance and becoming increasingly acceptable to scientific community. Further it has become necessity to carry out comparative studies on fast, vitalizing and slow, calming yogic breathing exercises and its effects on health. Thus, an attempt is made to carry out comparative assessment of slow breathing i.e., Naadishodhan pranayama and fast breathing i.e. dog breathing exercises on pulmonary functions. Conferring to inclusion and exclusion criteria, 60 young apparently healthy subjects between ages of 19 to 25 Years of either sex participated in the study. The subjects were divided into two groups. One group of Subjects underwent slow breathing and other group of subjects went for fast breathing exercise 15 minutes for1 month. Each group was analysed pre and post with the help of PC spirometer. Our result showed that FEV 1.0 /FVC ratio are non-significant observed in both groups. FVC (L), FEF 25% - 75% (L/S), PEF (L/S), MVV (L), MV (L) were significant in both groups. SVC (L) was significant in Slow breathing and BMI, FEV 1.0 were significant in Fast breathing exercise group. Study shows that pulmonary function test values are improved after Slow breathing and Fast breathing exercise. Comparative assessment shows effect on pulmonary function tests in Slow breathing group are towards higher side than Fast breathing exercise group. Thus, slow breathing pranayama seems to be more effective than fast breathing exercise on pulmonary functions.
KEYWORDS-*Nadishodhan pranayama, Dog breathing exercise, pulmonary function.*

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INTRODUCTION

Pranayama is a sanskrit terminology assembled of the words 'Prana' meaning vital life force and "Ayama" meaning restraint. The word Pranayama consequently interprets as the regulation or control of life-force**.** Breathe is said to be external manifestation of Prana, the vital life force. Breath is Sthula i.e., Gross and Prana are Sukshma i.e., Subtle. By exercising control over this breathing, one can control the subtle Prana inside. Control of Prana is nothing but control of mind. (1,2)

All Pranayamas are vitalizing, in the sense that they boost the Pranic system. The tranquillizing Pranayama i.e., Nadishodhana, Ujjayi, Sheetali, Sitkari, Bhramari Pranayama are cooling and soothing. Slow deep breathing helps the individual to de - stress and itself has a calming effect on the mind. This relaxing effect may perhaps have a significant physiological effect on the lungs and cardiovascular system. (3) The vitalizing techniques i.e., Dog, Rabbit, and Tiger breathing are modified breathing exercises creating the opposite effect. The vitalizing technique, dog breathing does so in a dynamic way, arousing body and mind, creating alertness and heat at both the physical and subtle levels. It can be used to increase the energy or to move out of introspective or dull states of mind. They may be regarded as more advanced techniques.

Earlier studies have revealed that regular practice of Pranayama leads to enhancement in physiological functions and human performance. However, from the vitalizing techniques, less attention has been acknowledged on pulmonary functions. As hardly any such study has been done to see the effect of dog breathing exercises on pulmonary functions. So, it is need of the day to further evaluate and compare the assessment of individual tranquillizing Pranayama i.e., slow and control breathing along with vitalizing technique i.e., fast breathing on pulmonary functions. Thus, this study will be undertaken to find the effect of Nadishodhana Pranayama, slow and control breathing and Dog breathing exercise, fast breathing on pulmonary function by measuring lung functions in healthy young subjects.

MATERIAL AND METHODS

This study was approved by institutional ethical committee. According to inclusion and exclusion criteria, 60 young apparently healthy subjects between ages of 19 to 25 Years of either sex having their written consent were actively participated in the study. All the subjects were examined and they were included in study randomly. The subjects were given proper instructions regarding their role in the study. Subjects were attending the yoga class six days a week. They were asked to perform on their own on Sundays at their residence. The subjects were divided into two groups by lottery method. One group of Subjects underwent slow breathing i.e. (Nadishodhana Pranayama) - Group- 1. Second group of subjects went for fast breathing exercise i.e. (Dog Breathing) - Group-2. Demonstration of Nadishodhana Pranayama & Dog Breathing Exercise was carried out. GROUP-1 performed Nadishodhana Pranayama and GROUP-2 performed Dog Breathing Exercise, 15 minutes as per the instructions for 1 month. The Effect of Pranayama and breathing exercises were assessed in 30 subjects from each group with the help of P.C. Spirometer in terms of Spirometric parameters (best of three efforts). Each group was analysed pre and post i.e., on first day and on 30th day. Record of all subjects included in study was documented. All the parameters in pre-test and post-test study were analysed using paired 't' test for statistical application and calculation using statistical software SPSS.

A) Inclusion Criteria:

1. Apparently healthy young individuals in the age group of 19 to 25 years with no major illness.
2. Subjects who are not practicing Pranayama or breathing exercise are Included
3. Gender - Male and Female.

B) Exclusion Criteria:

1. Subjects who are regular practicing Pranayama or breathing exercise.
2.Subjects with history of respiratory diseases, cardiovascular diseases, Diabetes and immunosuppressive diseases are excluded from the study.
3. Subjects with neurological disorders and those who will not able to perform respiratory function tests.
4. Subjects who smokes, consumes alcohol, or any drugs.

C) Duration of study: 1 month

Procedure:

1) Pranayama-Nadishodhana (Nadishudhi) Pranayama.

- Sthithi- Vajrasana (if not possible, sit in any meditative position)
- Adopt Nasikamudra.
- Close the right nostril with the right thumb and exhale completely through the left nostril.
- Then inhale deeply through the same left nostril.
- Close the left nostril with your ring and little finger of the Nasika mudra, Release the right nostril. Now exhale slowly and completely through the right nostril.
- Inhale deeply through the same (right) nostril. Then close the right nostril and exhale through the left nostril. This is one round of Nadishodhana Pranayama.
- Repeat for 15 minutes.
- Relax in sukhasana.

2) Breathing Exercise-Dog Breathing.

- Sthithi- Vajrasana.
- Place the palms of the hands on the ground beside the knees.
- Make the spine slightly concave and fix the gaze straight ahead.
- The mouth is opened wide; the tongue is pushed out to its maximum.
- Practice rapid, forceful inhalation and exhalation, expanding and contracting the abdomen vigorously like a dog.
- Repeat the practice for 15 minutes.
- Relax in Shashankasana.

RESULTS AND DISCUSSION

Our result showed FVC (L), FEF 25% - 75% (L/S), PEF (L/S), MVV (L), MV (L) were significantly increased in both groups. (Table2,5,6,8,9) SVC (L) was significantly increased in Pranayama group. SVC (L) was not significantly increased in breathing exercise group. (Table7) BMI Wt (Kg)/Ht (mt^2) was significantly decreased and FEV 1.0 was significantly increased in breathing exercise group. BMI (Wt (Kg)/Ht (mt^2) and FEV 1.0 were not significantly increased in Pranayama group. (Table-1,3) Significant increase of FVC (L), FEF 25% - 75% (L/S), PEF (L/S), MVV (L), MV (L) in both groups showed Significant increase in VC (TV, IRV, ERV), TLC (VC, RV), MVV, MV like lung capacities. (Table-2-9)

Table-1: Showing Comparison of BMI(Wt(Kg)/Ht(Mt^2)) ofSubjects in *Pranayama* and Breathing Exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean±SD)	Post Test (Mean ± SD)	Pre-Test (Mean ±SD)	Post Test (Mean ±SD)
BMI {Wt(Kg)/Ht(Mt^2)}	20.10±2.71	20.09±2.53	21.02±3.87	20.85±3.74
Paired T – Test	0.024		2.275	
Significant at 5% Level	Not Significant (P>0.05)		Significant (P<0.05)	

Table –2: Showing Comparison of FVC (L) in Pre-test and Post-test of subjects in *Pranayama* & Breathing exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean ± SD)	Post Test (Mean ± SD)	Pre-Test (Mean ±SD)	Post Test (Mean ± SD)
FVC(L)	2.39 ± 0.80	3.86 ± 1.16	2.95 ± 1.25	3.99 ± 1.68
Paired T –Test	7.708		3.078	
Significant at 5%Level	Significant (P<0.05)		Significant (P<0.05)	

Table -3 Showing Comparison of FEV 1.0 (L) in Pre-test and Post-test of subjects in *Pranayama* & Breathing exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean ± SD)	Post Test (Mean ± SD)	Pre-Test (Mean ±SD)	Post Test (Mean ± SD)
FEV 1.0 (L)	1.39 ± 1.24	2.09 ± 1.70	1.73 ± 1.16	2.84 ± 1.84
Paired T –Test	1.755		3..290	
Significantat 5% Level	Not Significant (P>0.05)		Significant (P<0.05)	

Table –4: Showing Comparison of FEV 1.0/FVC (%) in Pre-testand Post-test of subjects in *Pranayama* & Breathing exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean ±SD)	Post Test (Mean ± SD)	Pre-Test(Mean ±SD)	Post Test (Mean ± SD)
FEV1.0/FVC (%)	56.67 ±45.96	58.49 ±45.61	53.45 ±37.37	68.58 ± 39.74
Paired T –Test	0.149		1.766	
Significantat 5% Level	Not Significant(P>0.05)		Not Significant (P>0.05)	

Table –5: Showing Comparison of the FEF 25% - 75% (L/S) inPre-test and Post-test of subjects in *Pranayama* & Breathing exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean ± SD)	Post Test (Mean ± SD)	Pre-Test (Mean ±SD)	Post Test (Mean ± SD)
FEF25%-75%(L/S)	3.92 ± 1.33	6.30 ± 2.49	3.08 ± 1.06	5.56 ± 1.50
Paired T –Test	6.131		9.190	
Significantat 5% Level	Significant (P<0.05)		Significant (P<0.05)	

Table –6: Showing Comparison of the PEF (L/S) in Pre-test andPost-test of subjects in *Pranayama* & Breathing exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean ± SD)	Post Test (Mean ± SD)	Pre-Test (Mean ±SD)	Post-Test (Mean ± SD)
PEF(L/S)	4.91 ± 1.82	8.38 ± 2.80	4.24 ± 1.50	7.44 ± 1.72
Paired T –Test	7.997		7.869	
Significantat 5% Level	Significant (P<0.05)		Significant (P<0.05)	

Table –7: Showing Comparison of the SVC (L) in Pre-test and Post-test of subjects in *Pranayama* & Breathing exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean ± SD)	Post Test (Mean ± SD)	Pre-Test (Mean ±SD)	Post-Test (Mean ± SD)
SVC(L)	3.55 ± 1.06	4.42 ± 1.22	4.02 ± 1.76	4.51 ± 1.77
Paired T –Test	4.678		1.499	
Significant at 5 % Level	Significant (P<0.05)		Not Significant (P>0.05)	

Table –8: Showing Comparison of the MVV (L) in Pre-test and Post-test of subjects in *Pranayama* & Breathing exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean ± SD)	Post Test (Mean ± SD)	Pre-Test (Mean ±SD)	Post Test (Mean ± SD)
MVV (L)	98.33±33.70	135.49 ±50.20	82.04 ±22.15	110.53 ±26.84
Paired T –Test	7.683		6.262	
Significant at 5 % Level	Significant (P<0.05)		Significant (P<0.05)	

Table –9: Showing Comparison of the MV (L) in Pre-test and Post-test of subjects in *Pranayama* & Breathing exercise group.

Parameter	*PRANAYAMA*		BREATHING EXERCISE	
TEST →	Pre-Test (Mean ± SD)	Post Test (Mean ±SD)	Pre-Test (Mean ±SD)	Post Test (Mean ± SD)
MV (L)	31.62±13.37	38.63 ±16.80	31.83 ±12.93	42.44 ± 15.75
Paired T –Test	3.241		4.594	
Significantat 5 % Level	Significant (P<0.05)		Significant (P<0.05)	

It is said that Pranayama, the controlled and conscious breathing, not only improves the respiratory functions, but also improves the general well-being of the individual. It helps to maintain a better homeostasis and prevents body from degeneration and dysfunctions. (4) Yogic breathing performed even for a short duration regularly shows beneficial changes in the lung function parameters. Yogic breathing is effective because it reduces dead space ventilation as well as decreases the workload on the heart. It also renews air throughout the lungs in contrast with shallow breathing which renews air only at the base of the lungs. (5)

BMI-

In our study we observed a significant increase in BMI (Wt (Kg)/Ht (Mt^2)) of subjects in breathing exercise group. However, BMI was not significant in Pranayama group. It might help in burning of fats and ultimately decreases the body weight which may be the cause of weight reduction. It might be result of rise in oxygen consumption and therefore may be of advantageous to the obese that are known to have a lowered resting metabolic rate than the non-obese. The proper oxygen supply improves the metabolic rate. (6) Breathing exercise may modifies the autonomic status by increasing sympathetic activity with reduced vagal activity. (7)

FVC-

In our study we found FVC (L) was statistically highly significant in both Pranayama and Breathing exercise groups. In Pranayama group, it shows that increase in TLC (Total lung capacity), the volume in the lungs at maximal inflation. It is the totality of VC and RV. FVC is normally equivalent to the Slow Vital Capacity. In normal healthy subjects without airway obstruction the FVC and VC should be within 5% of each other. It may be that the regular inspiration and expiration for prolonged period leads the lungs to inflate and deflate maximally and that it causes strengthening and increased endurance of the respiratory muscles. The stretch receptors reflex reduces the tracheobronchial smooth muscle tone activity, which leads to decreased air flow resistance and increased airway calibre, this causes the dynamic parameters of the lung function test to improve. (8)

FEV 1.0 (L)-

In our study we observed FEV 1.0 (L) (forced expiratory volume in first second) of subjects in breathing exercise group were significantly increase but not significant in Pranayama group. It is the most widely used parameter, for assessment of airway obstruction. Dog breathing is a bellow type breathing in which one can breathe forcefully and rapidly and thus, exercises inspiratory as well as expiratory muscles. It might be that, a short powerful stroke of exhalation and inhalation in quick sequence with contraction of abdominal and diaphragmatic muscles trains the individual to make full use of diaphragm and abdominal muscles in breathing. Respiratory muscle training has been recognized to enhance lung function in healthy individuals. It also helps in removal of secretions from bronchial tree, clearing up respiratory passages and the alveoli making room for more air. (9,10)

FEV 1.0 / FVC (%)-

FEV 1.0 / FVC (%) indicates what % of the total FVC was expelled from the lungs during the first second of forced exhalation. We observed FEV 1.0 / FVC (%) of subjects in Pranayama and Breathing exercise group were not statistically significant.

FEF 25% - 75% (L/S)-

In our study we found FEF 25% - 75% (L/S) was significantly increased in both Pranayama and Breathing exercise groups. It shows mean Forced Expiratory Flow during middle half of FVC measured in L/Sec reflect independent expiration and the status of small airways. (11)

PEF (L/S)-

PEF(L/S) is determined by lung volume, calibre of airways and elastic recoil of lung. It helps to assess the degree of large airway function. In our study we found PEF(L/S) was statistically highly significant in both Pranayama and Breathing exercise group. It may be due to stretch of elastin and collagen fibres interwoven among the lung parenchyma. Hence, these fibres can elongate to a greater extent, thus, increasing the compliance of lungs. (12)

SVC (L)-

SVC is the Lung volume measured from a complete expiration following a deep inspiration. SVC is the volume equal to VC (ERV+IRV+TV). In our study we observed SVC (L) of subjects in Pranayama of Pre-test and Post-test study were highly significant but not significant in breathing exercise group It might be that, Pranayama is characterized by slow and deep inhalation and prolonged exhalation. The stress is on more prolonged expiration and efficient use of abdominal and diaphragmatic muscles. (13)

MVV (L)-

MVV is the maximum volume of air breathed in and out of lungs with maximum voluntary effort in minute (to avoid the effect of increased Pco2 & decreased Po2 during this procedure, recording is done for 10-15 sec. and the value is calculated for 1min). Our findings showed MVV (L) was statistically highly significant in both Pranayama and Breathing exercise group. It measures the strength and endurance of respiratory muscles. It is a method to evaluate respiratory muscle performance, using a short-term respiratory endurance task non-invasively. It is a test for overall function of respiratory system. It is influenced by the status of respiratory muscles, the compliance of lung-thoracic system, condition of the ventilatory control mechanism and the resistance offered by airways and tissues. The possible explanation for increased

MVV could be that regular deep inhalation and expiration of the lungs for prolonged periods has led to strengthening of respiratory muscles. (14,15)

MV (L)-

MV (L) is Volume of expired air in litres per minute measured over a minimum of one minute. MV is the volume equal to TV+RR. MV (L) was statistically highly significant in pretest and post-test study of both Pranayama and Breathing exercise group. Yogic breathing maneuvers may inflate lung near to total lung capacity that help in release of lung surfactant and prostaglandins into alveolar spaces which increase lung compliance and decrease bronchial smooth muscle tone, respectively. (15) Appropriate yogic breathing improves pulmonary muscular strength and efficiency, which can ultimately help in the improvement of lung volumes and capacities. (17,18)

Most of the studies conducted so far have generalized their results irrespective of age, duration, and type of yogic practice. However, some studies which are consistent with our results are discussed here, Suman Rai (2010) observed a significant increase in FVC, FEV1, FEV1/FVC and PEFR. (19,20) However, in comparison with our finding; we have seen no significant increase in FEV1, FEV1/FVC with Anulom-Vilom (Nadi shodhana) Pranayama. This may be due to difference in duration of yoga practice. Observations shown by Kamakhya Kumar (2013) are like our study. Vinayak.P.Doijad *et.al.*, (2012) Shankarappa V. *et al*., (2012) studied in similar way, However, in comparison with our finding; we have seen no significant increase in FEV1 with Nadishodhana Pranayama. (21,22) This may be due to short duration yogic breathing practice and may be due to collective effect of other types of Pranayama that they have included in their study. Observations shown by B. Singh BAL *et al.*, (2010) significant improvement in vital capacity and maximal ventilatory volume with AnulomVilom and Bhastrika Pranayama are like our study. (23) Sivapriya (2010) observed a significant increase in PEFR, FVC, FEV1, and significant decrease in RR with Nadishodhana Pranayama. (24,25) These observations are like our study. However, in comparison with our finding; we have seen no significant increase in FEV1 with Nadishodhana Pranayama which may be due to difference in duration of yogic breathing practice. Observations shown by Shivraj Manaspure *et al.,* (2010) significant decrease in RR with practicing Nadishodhana (Anulom vilom), Bhramari, Kapalbhati, Udgeeeth Pranayama is like our study.

However, Slow, and controlled breathing i.e., Nadishodhana Pranayama may increase parasympathetic activity whereas fast breathing i.e., Dog breathing exercise increase the sympathetic activity. Fast breathing exercise is having limitations like older, diseased, or weaker can't perform. Whereas in case of slow and controlled breathing, it is the most convenient and can be done anywhere and anytime and anyone can do, one who is young, older, diseased, or weak (26-28). The outcome of the study shows that effect on pulmonary function tests in slow and control breathing group were comparatively towards higher side than fast breathing exercise group.

The above result and discussion conclude that, there is a significant decreased BMI in Fast breathing exercise group. Pulmonary function test values were improved in both slow and controlled breathing and fast breathing exercise group. Effect on pulmonary function tests in slow and control breathing group were comparatively towards higher side than fast breathing group. Yogic breathing like Nadishodhan pranayama and dog breathing exercises not only improve the breathing pattern but it also improves pulmonary functions. Yogic breathing improves respiratory efficiency in healthy individuals and control overall circulatory process of body. Slow breathing and fast breathing exercises can play greater preventive role as well as curative role for common respiratory problems. Thus, it can be included as an essential part of healthy lifestyle and must be advocated as an adjunctive or alternative to conventional therapy for respiratory diseases.

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