EFFECT OF PRANAYAM ON VITAL AND LUNG PARAMETERS

Dr. Pallvi Pandey[1]*, Dr. Smriti Pandey[2] and Dr. Anuj Kumar[3]

[1]Assistant Professor, Ankerite Ayurvedic Medical College and Hospital, Lucknow.

[2]Lecturer, P.G. Department of Kriya Sharir, SAC, Lucknow.

[3]M.D. Scholar, P.G. Department of Kaya Chikitsa, SAC, Lucknow.

ABSTRACT

Introduction: Pranayam can be defined as controlling of the motion of exhalation and inhalation. It is a combination of three breath exercise puraka, kumbhaka and rechaka. Pranayam is a practice that helps to control the breathing voluntarily. It helps to change the depth, rate and pattern of breathing. **Aim:** The present study was conducted to understand the effects of pranayama on Vital parameters like respiratory rate, breathing rate, pulse rate, blood pressure, oxygen saturation and Lung parameters like vital capacity and breath holding time in healthy subjects divided into three groups on the basis of age. **Material and Methods:** Healthy subjects were directed to perform the pranayam daily for 30 minutes for a period of 15 days. Vital Parameters and lung parameters were assessed before and after pranayam session of 15 days. The parameters were analyzed by paired t-test. **Results:** Significant increase was observed in case of vital capacity, oxygen saturation, breath holding capacity and significant decrease was observed in breathing rate, pulse rate, in all three groups compared to pre pranayam practice. **Conclusion:** From this study it was concluded that the practice of pranayam can be adviced to improve the vital parameters and lung parameters. The study showed the benificial effect of pranayam and make the systems of body to function at its best.

KEYWORDS: Yoga, Pranayam, Lung Parameters, Vital Parameters, Vital Capacity, Oxygen Saturation, Breath Holding Time.

INTRODUCTION

The term yoga is derived from Sanskrit root "yujira-yoge" meaning to unite, to combine or to integrate., Yoga is an ancient discipline designed to bring balance and health to the physical,

mental, emotional, and spiritual dimensions of the individual.[1] The great Indian Philosopher Maharshi Patanjali describe Yoga in his Yoga Sutra as cessation of fluctuation of mind.[2] He contribute the scheme of yoga popularly known as Astang yoga, Pranayam is the fourth disciple of Astang yoga.[3]

The word prana means breath and ayama means to expand, to restrain, or to control. So the pranayam is translated "extension of prana" or "breath control".[4] The system is based on three stages of respiration i.e. inhalation(poorak), retention (kumbhaka) and exhalation (rechaka). By permuting and directing these three stages, the different practices of pranayam are obtained.

Maharshi Patanjali's Yoga sutra states that pranayam is the pause in the movement of inhalation and exhalation when that is secured. Pranayam is a practice that helps to control the breathing voluntarily. It teaches you to change the depth, rate and pattern of breathing.

REVIEW OF LITERATURE

In present study under literary section part all the scattered description about prana, prana vata, pranavaha srotas, yoga and pranayam was collected and arranged in systematic manner.

MATERIAL AND METHOD

The ethical clearance for the study was obtained from the institutional ethical committee (No.IEC/AYM/052/2016). The healthy subjects were selected for the study. The health of the subjects was assessed by knowing their past, present, family and personal history and by the thorough examination general systemic examination. An informed consent form was signed by all the subjects. The subjects were adviced not to perform any other physical exercise during 15 days of pranayam sessions. The study was carried out on total 100 healthy subjects .The subjects has been divided into three groups on the basis of age, first group (16-30years), second group (31-45years) and the third group (46-60years). The subjects below 16 years and above 60 years, subjects with any systemic disorders and pregnant or lactating mother were excluded.

Subjects were adviced to perform pranayam for 15 days for a time period of 30 minutes each day at P.G. Department of Kriya Sharir, State Ayurvedic College Lucknow. The parameters like vital capacity, oxygen saturation, pulse rate, respiratory rate, breath holding time, blood pressure were measured before performing pranayam and after doing pranayam for 15 days.

Pulse rate is the speed of the heartbeat measured by the number of contractions of the heart per minute (bpm). The breath holding is measured by asking the subject to pinch his/her nostrils with the thumb and forefinger, and hold his/her breath after quiet inspiration. Note the time for which the breath can be held. The respiratory rate is measured when a person is at rest and involves counting the number of breaths for one minute by counting how many times the chest rises. The blood pressure is measured by using Sphygmomanometer. The vital capacity is measured by spirometer. The subject is asked to take the deepest breath they can, and then exhale into the sensor as hard as possible, for as long as possible, preferably at least 6 seconds. During the test, soft nose clips have been used to prevent air escaping through the nose. The oxygen saturation was measured by pulse oximeter. A sensor device is placed on a thin part of the subject's body, usually a fingertip or earlobe.

The subjects were asked to performed four types of pranayam namely anulom vilom pranayam, Kapalbhati pranayam, Bhramari pranayam and Shitali Pranayam combinedly for a period of 30 minutes in the morning. The schedule of the session was.

S.N.	Name	Time Period
1.	Prayer and Omkar citation	2 min
2.	Asanas	10 min
3.	Pranayam(Anulom-vilom,Kapalbhati,Bhramari,Shitali)	30 min

The obtained data was then subjected to various statistical analysis, it is decoded and discussed on the basis of available references and appropriate justification is given.

OBSERVATIONS

Table -1: Distribution of subjects according to Group.

S.N.	Age	No. of subjects	%
1. (Group A)	16-30	43	43
2. (Group B)	31-45	32	32
3. (Group C)	46-60	25	25

Table. 2: Distribution of Gender among groups.

S. N.	Gender	GROUP A n=43		GROUP B n =32		GROUP C n =25	
		No	%	No	%	No	%
1.	Male	15	34.88	14	43.75	12	48
2.	Female	28	65.12	18	56.25	13	52

Table–3: Effect of Pranayam on Pulse rate, Breath holding time, Respiratory Rate, SBP and DBP.

Group A.

Test	Sample Size	Mean Before	Mean After	Mean Difference	SD+-	t	P
Respiratory rate	43	18.2	17.5	-0.7	0.61	5.2	Significant
Breath holding time	43	34.5	45.6	11.1	9.66	4.3	Significant
Pulse Rate	43	78.4	74.2	-4.2	3.63	6.1	Significant
SBP	43	118.4	114.8	-3.6	3.14	2.1	Not Significant
DBP	43	76.4	78.6	2.2	1.91	2.2	Not Significant

Group B.

Test	Sample Size	Mean Before	Mean After	Mean Difference	SD	t	P
Respiratory rate	32	19.2	18.7	-0.5	0.42	4.8	Significant
Breath holding time	32	30.9	39.8	8.9	7.74	5.5	Significant
Pulse Rate	32	74.6	71.8	-2.8	2.43	4.8	Significant
SBP	32	128.2	126.4	-1.8	1.56	2.5	Not Significant
DBP	32	80.2	78.6	-1.6	1.32	2.7	Not Significant

Group C.

Test	Sample Size	Mean Before	Mean After	Mean Difference	SD	t	P
Respiratory rate	25	20.2	19.5	-0.7	0.62	7.1	Significant
Breath holding time	25	24.6	28.5	3.9	3.39	4.6	Significant
Pulse Rate	25	73.5	71.6	-1.9	1.67	6.2	Significant
SBP	25	134.2	132.8	-1.4	1.32	3.1	Not Significant
DBP	25	84.2	82.6	-1.6	1.53	2.3	Not Significant

Table. 4: Change in vital capacity before and after the Pranayam session among groups.

Group-A.

Data	
Hypothesized Mean Difference	**0**
Level of significance	**0.05**
Intermediate Calculations	
Sample Size	43
DBar	0.3030
Degrees of Freedom	42
S_D	0.1646
Standard Error	0.0251
t Test Statistic	**12.0742**
Upper-Tail Test	
Upper Critical Value	**1.6820**
p-Value	**0.000000000000002**
Reject the null hypothesis	

Group –B.

Data	
Hypothesized Mean Difference	**0**
Level of significance	**0.05**
Intermediate Calculations	
Sample Size	32
DBar	0.2675
Degrees of Freedom	31
S_D	0.1373
Standard Error	0.0243
t Test Statistic	**11.0249**
Upper-Tail Test	
Upper Critical Value	**1.6955**
p-Value	**0.0000000000015**
Reject the null hypothesis	

Group –C.

Data	
Hypothesized Mean Difference	**0**
Level of significance	**0.05**
Intermediate Calculations	
Sample Size	25
DBar	0.1980
Degrees of Freedom	24
S_D	0.0835
Standard Error	0.0167
t Test Statistic	**11.8539**
Upper-Tail Test	
Upper Critical Value	**1.7109**
p-Value	**0.000000000008**
Reject the null hypothesis	

Table-5: Change in oxygen saturation before and after pranayam session among groups

Group A.

Paired t Test	
Data	
Hypothesized Mean Difference	**0**
Level of significance	**0.05**
Intermediate Calculations	
Sample Size	43
DBar	0.7907
Degrees of Freedom	42
S_D	0.5999
Standard Error	0.0915
t Test Statistic	**8.6426**
Upper-Tail Test	

Upper Critical Value	1.6820
p-Value	0.0000
Reject the null hypothesis	

Group B.

Paired t Test	
Data	
Hypothesized Mean Difference	**0**
Level of significance	**0.05**
Intermediate Calculations	
Sample Size	32
DBar	0.8750
Degrees of Freedom	31
S_D	0.7071
Standard Error	0.1250
t Test Statistic	**7.0000**
Upper-Tail Test	
Upper Critical Value	**1.6955**
p-Value	**0.0000**
Reject the null hypothesis	

Group C.

Paired t Test	
Data	
Hypothesized Mean Difference	**0**
Level of significance	**0.05**
Intermediate Calculations	
Sample Size	25
DBar	0.7200
Degrees of Freedom	24
S_D	0.6137
Standard Error	0.1227
t Test Statistic	**5.8658**
Upper-Tail Test	
Upper Critical Value	**1.7109**
p-Value	**0.0000**
Reject the null hypothesis	

RESULT

On evaluating the effect of regular practice of pranayam for 15 days, it was found that the vital parameters and lung parameters like vital capacity, oxygen saturation, breath holding time, respiratory rate, pulse rate showed significant changes. We can explain this on the following basis.

- The mean respiratory rate before doing the pranayam and after doing the pranayam was 18.2 and 17.5 respectively in group A; 19.2 and 18.7 in group B; 20.2 and 19.5 in group C (Table 3). This indicates significant decrease in the respiratory rate and it was found to be statistically significant.

- The mean breath holding time before doing the pranayam and after doing the pranayam was 34.5 and 45.6 respectively in group A; 30.9 and 39.8 respectively in group B; 24.6 and 28.5 respectively in group C(Table 3). This indicates significant increase in the breath holding time and it was found to be statistically significant.

- The mean pulse rate before doing the pranayam and after doing the pranayam was 78.4 and 74.2 respectively in group A; 74.6 and 71.8 respectively in group B; 73.5 and 71.6 respectively in group C(Table 3). This indicates significant decrease in the breath holding time and it was found to be statistically significant.

- The mean SBP before doing the pranayam and after doing the pranayam was 118.4 and 114.8 respectively in group A; 128.2 and 126.4 respectively in group B; 134.2 and 132.8 respectively in group C(Table 3). This was found to be statistically insignificant.

- The mean DBP before doing the pranayam and after doing the pranayam was 76.4 and 78.6 respectively in group A; 80.2 and 78.6 respectively in group B; 84.2 and 82.6 respectively in group C(Table 3). This was found to be statistically insignificant.

- The vital capacity was found statistically significant in all the three groups. (Table 4)

- The oxygen saturation was found statistically significant in all the three groups.(Table 5)

DISCUSSION

The result obtained can be explained on the following basis: I. The rate, rhythm and force of respiration are controlled by group of neurons known as respiratory centres. Depending upon the situation in the brainstem, the respiratory centers are classified into two groups: First is Medullary Center which consist of dorsal respiratory group of neurons and ventral respiratory group of neurons. Second is pontine center which comprised of pneumotaxic center and Apneustic center. Dorsal group of neurons are responsible for basic rhythm of respiration. The ventral group neurons are inactive during quiet breathing and become active during forced breathing. During forced breathing, these neurons stimulate both inspiratory muscle and expiratory muscles. The pneumotaxic center influences the switching between inspiration and expiration. The pneumotaxic center increases the respiratory rate by reducing the duration of inspiration. The Apneustic center increases the depth of inspiration by acting directly on the dorsal group neurons.[6] We can say that the regular practice of pranayam for

few weeks adjusted respiratory centers to new pattern of breathing which is slower than its basal rythm which in turn decreases the respiratory rate.[7]

II. There is significant increase in breath holding time in all the three groups. The possible explanantions are discussed below

- Regular practice of pranayam produces the hypometabolic state of the body characterised by decreased CO_2 production and decreased consumption,. This allows the breath holding for a longer time.[7,9]

- Also we can further explain it as the regular practice of pranayarnic breathing increases muscle endurance and delays the onset of their fatigue thus promoting breath holding for longer time.[8]

- By practicing the pranayam regularly, the alveoli are trained in such a way to withstand the maximum extend of stretching. Thus allowing the breath holding for longer time.[8]

III. The significant increase was observed in vital capacity in all the three groups. This can be explained as

- Regular practice of pranayam strengthen the respiratory musculature of the body so that the lungs inflate and deflate to the fullest. The interwoven elastic and collagen fibres present in lung parenchyma streches while performing slow and prolonged inspiration.[10]

- Lung inflation near to total lung capacity is a major physiological stimulus for the release of lung surfactant and prostaglandins into alveolar spaces which increase compliance and decrease bronchial smooth muscle tone.

- Kapalbhati pranayam involves the contraction of lower abdomen during inhalation and during exhalation the breath is forced out with powerful stroke. This allows the subject to make use of the diaphragm and abdominal muscle to fullest. It also helps in clearing the respiratory passage.[10]

- Yoga with its calming effects on the mind can reduce the emotional stress there by withdrawing the bronchial constrictor effect.[10]

IV. Regular practice of pranayam influence the pulse rate. In the previous studies it has been reported that pranayam stimulate the prarasympathetic system. Also evidence of production of gamma wave indicating that parasympathetic dominanace.[11]

CONCLUSION

Pranayam showed its advantageous effect on vital parameters and lung parameter There is significant effect of pranayam on V.C., oxygen saturation, BHT, pulse rate and respiratory rate.

LIMITATIONS OF THE STUDY

The sample size was small so the study must be conducted on large scale to be globally accepted. Stipulate time of the pranayam session was 15 days. It was less as these things require longer time to show effects.

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