

# Effects of Kapalbhathi on Peak Expiratory Flow Rate and Pulse Rate

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**Abstract.** The purpose of this study was to find out the effects of kapalbhathi on peak expiratory flow rate and pulse rate. The subjects for the present were selected on the basis of random group design. Thirty (N=30) female inter-college players of yoga were selected as subject for the present study from Guru Nanak Dev University, Amritsar (Punjab), INDIA. All subjects ranged between the chronological age of 18-24. The selected subjects were further divided into two groups. Experimental treatment was then assigned to group "A" and group "B" acts as control. The difference in the mean of each group for selected variable was tested for the significance of difference by "t" test. The level of significance was set at 0.05. The treatment of six week kapalabhati programme showed significant improvement in peak expiratory flow rate and pulse rate.

**Keywords:** Yoga, Kapal, Bhati, Pranayam, Pulse Rate, Peak Expiratory Flow Rate.

## 1. Introduction

In recent years there has been considerable interest in scientific research on yoga in India and in the west. Yoga, the ancient cultural heritage of India has recently become popular as a therapeutic adjuvant to modern scientific medicine and is being increasingly used as an adjuvant therapy for various conditions based on research done in the past many decades. Yoga has both preventive and therapeutic benefits. It offers both physical and mental benefits to body and mind. Of the many wonderful pranayama that yoga gives us, Kapalbhathi (aka Kapal Bhati) is one of the imperative breathing exercises. The process of kapalbhathi is related to the breathing process; however it is not a type of pranayam. But, certain sadhakas think in this manner and study kapalbhathi under the impression that they are studying a type of pranayam. However, process of cleaning the wind pipe is one of the shuddhikriyas. The word kapalbhathi is made up of two words, kapal meaning skull (here skull includes all the organs under the skull too) and bhati means shining, illuminating. Due to the process, the organs under the skull mainly the brain and the small brain are influenced in a good manner. Hence the word is used in that way. This paper attempts to focus on the effect of kapalabhati on peak expiratory flow rate and pulse rate.

### 1.1. Objective of The Study

- (1) To find out the current condition of the subjects in pulse rate and peak expiratory flow rate.
- (2) To determine whether pulse rate and peak expiratory flow rate would be improved with the six week kapalabhati programme.

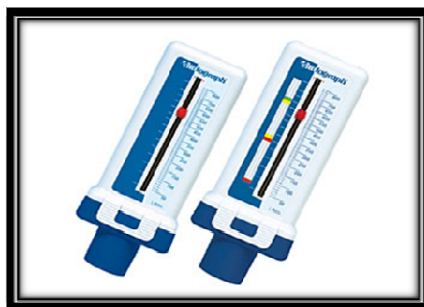
### 1.2. Methods and Materials

**Subjects.** The study was conducted on thirty (N=30) female inter-college players of yoga who represented Guru Nanak Dev University. All subjects ranged between the chronological age of 18-24. They were divided into two groups. Group "A" worked as experimental and Group "B" as control. Pulse rate and peak expiratory flow rate were taken as criterion measures for the study.

### 1.3. Test Administered

**Peak Expiratory Flow Rate.** Peak expiratory flow (PEF) measures how fast you breathe out when you try your hardest. It tells you how well your lungs are working. You measure PEF with a peak flow meter.

### 1.4. Peak Flow Meter



- (1) If you can breathe out quickly and with ease, you will have a higher number (higher peak flow rate).
- (2) If you can only breathe out slowly and with difficulty, you will have a lower number (lower peak flow).

**Pulse Rate.** The pulse rate is a measurement of the heart rate, or the number of times the heart beats per minute. As the heart pushes blood through the arteries, the arteries expand and contract with the flow of the blood. The pulse can be found on the side of the lower neck, on the inside of the elbow, or at the wrist. When taking your pulse:



Taking A Pulse

- (1) Turn the palm side of your hand facing up.
- (2) Place your index and middle fingers of your opposite hand on your wrist, approximately 1 inch below the base of your hand.
- (3) Press your fingers down in the groove between your middle tendons and your outside bone. You should feel a throbbing - your pulse.
- (4) Count the number of beats for 10 seconds, then multiply this number by 6. This will give you your heart rate for a minute.

### 1.5. Six Week Training Programme

In the present study the following five stages were made part of the kapalabhathi technique:

#### Stage-1

Find a comfortable seated position. Gently exhale all the air from lungs then inhale a little. Exhale rapidly like a gentle sneeze a sound with the mouth closed. Then inhale rapidly and begin to exhale and inhale in quick rhythm.

#### Stage -2

Inhale and exhale rapidly through both nostrils partially blocked. Control the air flow so that it enters through the nostrils.

#### Stage -3

Inhale and exhale through the right nostril with the left nostril fully blocked. Breathe in and out of the same nostril. Switch after at least 5 breaths. So this time inhalations and exhalations are done through the left nostril.

#### Stage -4

Inhale through the right nostril and exhale through the left.

#### Stage -5

Inhale through both nostrils and exhale through the left then inhale through both nostrils and exhale through the right.

## 2. Findings and Results

The study was conducted to find out the effects of kapalbhati on peak expiratory flow rate and pulse rate. 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” ratio and are presented in following tables:

Tab.1 Peak Expiratory Flow Rate Of Experimental Group

	<b>Pre-Test</b>	<b>Post-Test</b>
Sample size	15	15
Arithmetic mean	251.3333	346.0000
95% CI for the mean	177.1872 to 325.4794	284.8758 to 407.1242
Variance	17926.6667	12182.8571
Standard deviation	133.8905	110.3760
Standard error of the mean	34.5704	28.4990

Paired samples t-test

Mean difference	94.6667
Standard deviation	118.0718
95% CI	29.2807 to 160.0527
<b>Test statistic t</b>	<b>3.105</b>
Degrees of Freedom (DF)	14

Tab. 2 Peak Expiratory Flow Rate of Control Group

	<b>Pre-Test</b>	<b>Post-Test</b>
Sample size	15	15
Arithmetic mean	337.3333	328.6667
95% CI for the mean	282.9746 to 391.6921	280.9887 to 376.3446
Variance	9635.2381	7412.3810
Standard deviation	98.1592	86.0952
Standard error of the mean	25.3446	22.2297

Paired samples t-test

Mean difference	-8.6667
Standard deviation	25.3170
95% CI	-22.6868 to 5.3534
<b>Test statistic t</b>	<b>-1.326</b>
Degrees of Freedom (DF)	14

Tab. 3 Mean, Standard Deviation (Sd), Standard Error of Mean (Sem) of Peak Expiratory Flow Rate of Experimental and Control Group

Group	Number	Mean	S.D.	SEM	't' Value
Experiment (Pre-test)	15	251.333	133.89	34.570	<b>3.105</b>
Experimental (Post-test)	15	346.000	110.37	28.499	
Control (Pre-test)	15	<b>337.333</b>	<b>98.159</b>	<b>25.344</b>	<b>-1.326</b>
Control (Post-test)	15	<b>328.666</b>	<b>86.095</b>	<b>22.229</b>	

\*Significant at 0.05 level of confidence. "t" .05 (14) = 2.145

Table-3 shows that the mean of pulse rate of pretest of experimental group and posttest of experimental group was 251.333 and 346.000 respectively, whereas the mean of pulse rate of pretest of control and posttest of control group was **337.333** and **328.666**. The "t" ratio in case of experimental group was **3.105** and for control group it was **-1.326**. Since cal.  $t (=3.105) \geq \text{tab } t .05 (14) (=2.145)$ ,  $H_0$  (null hypothesis) is rejected at .05 level of significance. Thus it may be concluded that six week kapalabhathi programme showed significant improvement in peak expiratory flow rate. As per the study the above remark can be given at 95% confidence. The graphical representation of responses has been exhibited in figure-1.

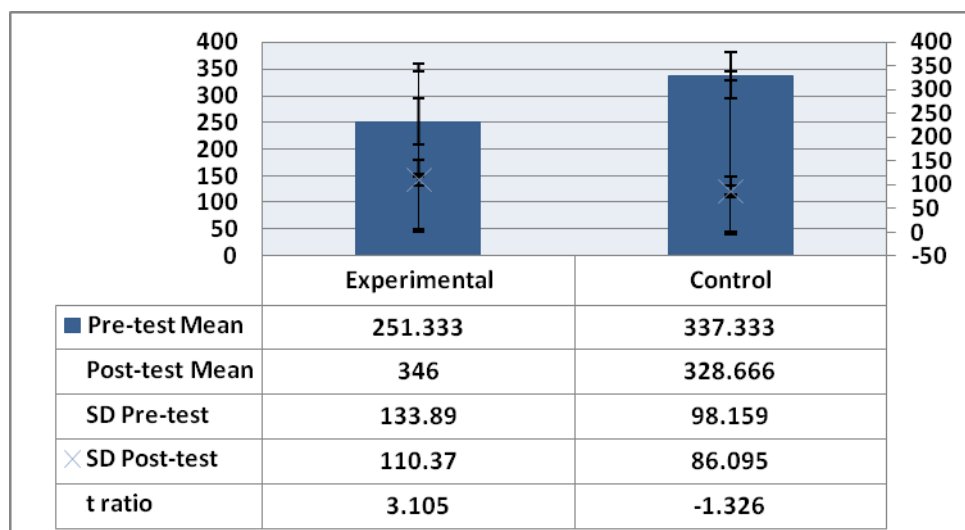


Fig.1 Mean, Standard Deviation (Sd), Standard Error of Mean (Sem) of Peak Expiratory Flow Rate of Experimental and Control Group

P-Value for the student t-Test of Experimental Group of Peak Expiratory Flow Rate.

This will tell you the one-tailed and two-tailed probability values of a t-test, given the t-value and the degrees of freedom.

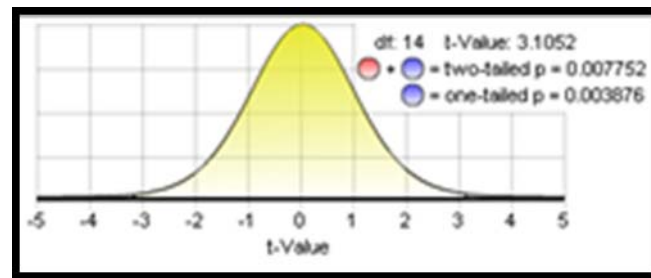


Fig.2 P-Value, Two Tailed and One Tailed Probability Values of A T-Test of Experimental Group of Peak Expiratory Flow Rate

P-Value for the student t-Test of Control Group of Peak Expiratory Flow Rate.

This will tell you the one-tailed and two-tailed probability values of a t-test, given the t-value and the degrees of freedom.

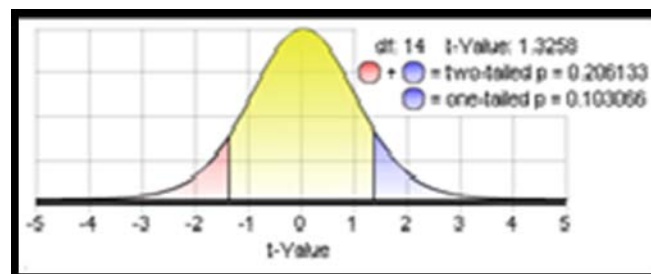


Fig.3 P-Value, Two Tailed and One Tailed Probability Values of A T-Test of Control Group Peak Expiratory Flow Rate

Tab.4 Pulse Rate of Experimental Group

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	81.6000	75.4667
95% CI for the mean	79.2617 to 83.9383	72.5523 to 78.3810
Variance	17.8286	27.6952
Standard deviation	4.2224	5.2626
Standard error of the mean	1.0902	1.3588

Paired samples t-test

Mean difference	-6.1333
Standard deviation	6.5232
95% CI	-9.7458 to -2.5209
<b>Test statistic t</b>	<b>-3.641</b>
Degrees of Freedom (DF)	14

Tab.5 Pulse Rate of Control Group

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	79.3333	78.8667
95% CI for the mean	76.7135 to 81.9532	77.2203 to 80.5130
Variance	22.3810	8.8381
Standard deviation	4.7309	2.9729
Standard error of the mean	1.2215	0.7676

Paired samples t-test

Mean difference	-0.4667
Standard deviation	2.9488
95% CI	-2.0996 to 1.1663
Test statistic t	-0.613
Degrees of Freedom (DF)	14

Tab.6 Mean, Standard Deviation (Sd), Standard Error of Mean (Sem) of Peak Expiratory Flow Rate of Experimental and Control Group

Group	Number	Mean	S.D.	SEM	't' Value
Experiment (Pre-test)	15	81.6000	4.2224	1.0902	<b>-3.641</b>
Experimental (Post-test)	15	75.4667	5.2626	1.3588	
Control (Pre-test)	15	79.3333	4.7309	1.2215	<b>-0.613</b>
Control (Post-test)	15	78.8667	2.9729	0.7676	

\*Significant at 0.05 level of confidence.

"t" .05 (14) = 2.145

Table-3 shows that the mean of pulse rate of pretest of experimental group and posttest of experimental group was 81.6000 and 75.4667 respectively, whereas the mean of pulse rate of pretest of control and posttest of control group was 79.3333 and 78.8667. Since cal.  $t (=3.105) \geq \text{tab } t .05 (14) (=2.145)$ ,  $H_0$  (null hypothesis) is rejected at .05 level of significance. Thus it may be concluded that six week kapalabhathi programme showed significant improvement in pulse rate. As per the study the above remark can be given at 95% confidence. "t" ratio in case of experimental group was **-3.641** and for control group it was **-0.613**. The graphical representation of responses has been exhibited in figure-4.

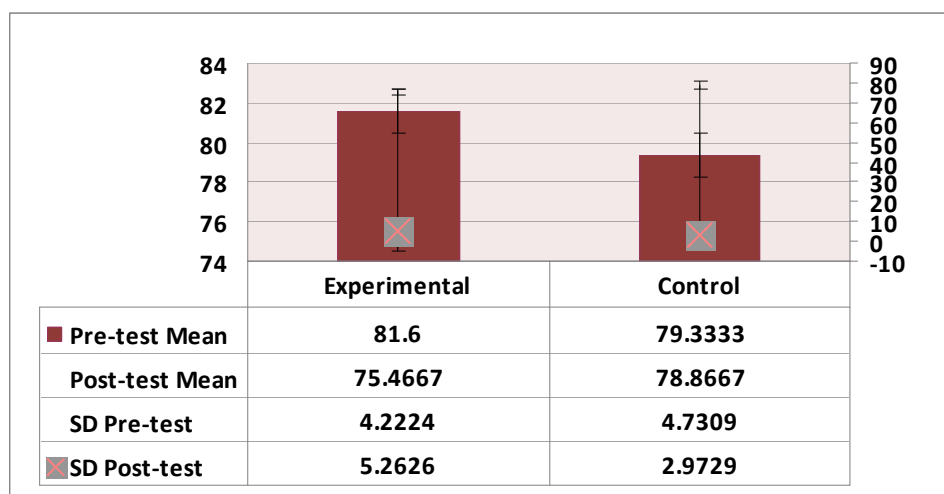


Fig.4 Mean, Standard Deviation (Sd), Standard Error of Mean (Sem) of Peak Expiratory Flow Rate of Experimental and Control Group

### P-Value for the Student t-Test of Experimental Group of Pulse Rate.

This will tell you the one-tailed and two-tailed probability values of a t-test, given the t-value and the degrees of freedom.

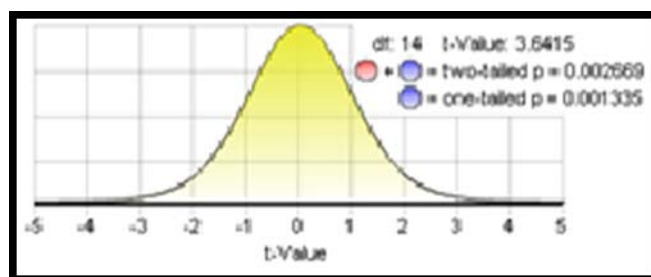


Fig.5 P-Value, Two Tailed and One Tailed Probability Values of A T-Test of Experimental Group of Pulse Rate

### P-Value for the Student t-Test of Control Group of Pulse Rate.

This will tell you the one-tailed and two-tailed probability values of a t-test, given the t-value and the degrees of freedom.

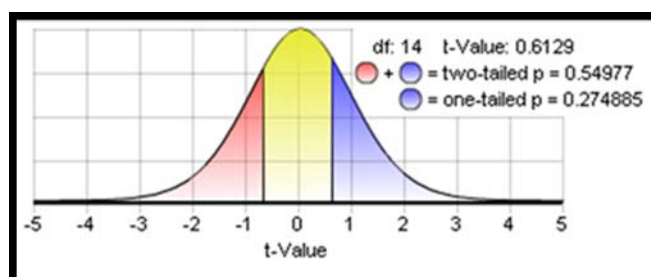


Fig. 6 P-Value, Two Tailed and One Tailed Probability Values of a T-Test of Control Group Pulse Rate Statistical Procedure Used

The difference in the mean of each group for selected variable was tested for the significance of difference by “t” test. The level of significance was set at 0.05.

Hypothesis:

$$H_0: \mu_y = \mu_x$$

$$H_1: \mu_y \geq \mu_x$$

Level of significance:

.05

Inference:

Since calculated “t” is greater than tab t.05,  $H_0$  (null hypothesis) may be rejected at .05 level of significance. Thus it may be concluded that kapalabhati have a significant effect on peak expiratory flow rate and pulse rate. As per the study the above remark can be given at 95% confidence.

## 3. Discussion

From the results it is evident that the kapalabhati have a vital role in the improvement of peak expiratory flow rate and pulse rate. The findings is supported by the study conducted by Shirley Telles, Nagarathna R., and Nagendra, H.R. to assess the physiological effects of a yoga breathing practice that involves breathing exclusively through the right nostril where the results signify that there was a significant ( $P < .05$ , paired t test) increase in oxygen consumption (17%) and in systolic blood pressure (mean increase 9.4mm Hg). Heart rate increases during yogic rapid breathing. Average heart rate increased from a baseline of 77 beats per minute to 86 beats per minute for 12 subjects performing automatic inhalation rapid breathing at about 120 breaths per minute (Bhole, 1982). Likewise, Wenger and Bagchi (1961) found that average heart rate for five yogis increased from about 77 to about 90 beats per minute while performing automatic inhalation rapid breathing (“kapalabhati”). Average respiration rate was not reported, but the example record showed about two breaths per second. Average heart rate of 64 beats per minute at rest increased to 94 beats per minute



during thoracic forced inhalation breathing at about 4 cycles per second for three highly trained subjects (Frostell, Pande, & Hedenstierna, 1983).

#### 4. Conclusion

The treatment of six week kapalabhathi programme showed significant improvement in peak expiratory flow rate and pulse rate.

#### 5. References

- [1] Angelone, A., & Coulter, N. A. Heart rate response to held lung volume. *Journal of Applied Physiology*. 1965, **20**, 464-468.
- [2] Bhole, M. V. *Study of respiratory functions during Kapalbhathi - Part II*. Yoga Review, 1982, **2**: 217-222.
- [3] Bhole, M. V., & Karamblekar, P. V. *Significance of nostrils in breathing*. Yoga-Mimamsa. 1968, **10**(4): 1-12.
- [4] Gopal, K. S., Bhatnagar, O. P., Subramanian, N., & Nishith, S. D. Effect of yogasanas and pranayamas on blood pressure, pulse rate and some respiratory functions. *Indian Journal of Physiology and Pharmacology*. 1973, **17**: 273-276.
- [5] Gore, M. M., & Gharote, M. L. *Immediate effect of one minute kapalabhathi on respiratory functions*. Yoga-Mimamsa. 1987, **25**(3 &4): 14-23.
- [6] Karambelkar, P. V., & Bhole, M. V. *Respiratory studies during kapalbhathi for 1, 2, 3 and 5 minutes*. Yoga-Mimamsa. 1988, **27**(1 & 2): 69-74.
- [7] Karambelkar, P. V., Deshapande, R. R., & Bhole, M. V. *Some respiratory studies in respect of 'kapalabhathi' and voluntary hyperventilation*. Yoga-Mimamsa. 1982, **21**(1 & 2): 54-58.
- [8] Kuvalayananda, S., & Karambelkar, P. V. *Studies of alveolar air in Kapalabhathi--I: Alveolar air at the end of two minute kapalabhathi*. Yoga-Mimamsa. 1957a, **7**(1): 18-25.

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