# YOGA FOR VITAL CAPACITY

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**Abstract**:

***The purpose of this study was to ascertain the effect of yogic exercises and pranayam on the vital capacity adolescent school going boys. In total 60 numbers of school students (boys only) were taken as subjects and were divided equally (30 each) into two groups namely Experimental and Control groups. Pre tests on Vital Capacity was conducted prior to Yogic exercises and pranayam treatment to the experimental group and post test was made after a 12 week treatment and comparisons were made between and within the groups using descriptive statistics and Factorial ANOVA. It was concluded that Yoga Training Group (Experimental Group) improves Vital Capacity of adolescent students.***

**Key words: Yoga, Vital Capacity**

## Introduction:

The process of yoga is an ascent into the purity of the absolute perfection that is essential for all human beings. This goal requires the removal of our enveloping personal impurities, the stilling of our lower feelings and thoughts, and the establishment of a state of inner balance and harmony. Its methods are based on the perfection of our personalities that help to create a new world order. The secret of success lies in determination and following the proper guidelines. A frail body is not only vu lnerable and prone to illness, but also presents an obstacle to the development of mental forces and improvement of self expression. A clear thought and a perfect concentration emerge from sound health. A person, who is harmoniously balanced, both physically and mentally, can reach to a very high level of mental and spiritual forces.

It is here that yoga comes in like a divine intervention. It is a science applicable to all age groups. Its positive effect on the physical, mental and psychological states of human beings is considered to be a complete science of life, and an excellent sport for body and spirit. Inculcating the habit of yoga from very young is perhaps the ideal way to achieve balance in the mind -body-soul realm. Holistic health, which includes prevention of diseases by improving the thought pattern, regulating the energy flow in the body and realizing the divinity within, is very important for children.

**Bhole** (1971, 1972) **Ganguly** (1974) **and Gharote** (1976) have shown that practice of yoga asana had improved various components of fitness, such as flexibility, strength, endurance, balance and cardiovascular fitness [1-4]. **Bhole and Karambelkar** (1971-72) measured vital capacity in ml and breath holding time in seconds respectively in 147 females and 139 males between the age 18 and 50years before and after as three week training in 20 Asanas, two breathing practices and three kriyas, at nine Yoga camps held during the years 1959 to 1969 [1]. An average increase of 15 sec in breath holding time was observed after the training period.

**Vital capacity** is the maximum amount of air a person can expel from the lungs after a maximum inspiration. It is equal to the inspiratory reserve volume plus the tidal volume plus the expiratory reserve volume

The purpose of the study was to ascertain the effect of yogic exercises and pranayam on the vital capacity of adolescent school going boys.

**METHODOLOGY:**

**The Subject**: Total 60 boys of Delhi Public school, Nalconagar, Anugul were taken as subjects of the study. They were students of classes IX and XI belonging to the age group of 14-18 years.

**The Sampling**: On the basis of random sampling conducted in classes only 60 students were selected for the study. They were assigned to two equal groups numbering 30 in each group. The Groups were categorized as: *1. Experimental Group, 2. Control Group*

**Selection of Variables**: To obtain pertinent information about how yogic exercise programme has an impact on vital capacity of adolescent school going boys, the following parameters under dependant and independent variables were selected.

**Dependant Variables**: The following variables were being selected to measure the Vital Capacity of school going adolescent boys.

[***Pulmonary function (PFT)***]

1. ***Forced vital capacity (FVC)***,
2. ***Forced expiratory volume (FEV1)***,
3. ***Peak expiratory flow (PEF)***.

Measurements of the above variables were taken during pre and post test and standard methods were followed to procure the data.

**Independent Variables**: Training stimuli, adopted for a 12 weeks period, was considered here as independent variables.

**Instrumentations and Administration of Dependant variables:** Tests for vital capacity is also called pulmonary function tests (PFT) which evaluate how well the lungs work. The test determine how much air the lungs can hold, how quickly one can move air in and out of the lungs, and how well lungs put oxygen into and remove carbon dioxide from the blood. The measurements of vital capacity (PFT) is being done with spirometry are:

• **Forced vital capacity (FVC)**. This measures the amount of air one can exhale with force after one inhales as deeply as possible.

• **Forced expiratory volume (FEV)**. This measures the amount of air one can exhale with force in one breath. The amount of air one exhale may be measured at 1 second (FEV1), 2 seconds (FEV2), or 3 seconds (FEV3). FEV1 divided by FVC can also be determined.

• **Peak expiratory flow (PEF)**. This measures shows how quickly one can exhale.It is usually measured at the same time as forced vital capacity (FVC).

**Measurement of Forced expiratory volume (FEV1) and Forced vital capacity (FVC)**. The **Forced expiratory volume** (**FEV1**) is defined as maximum volume of gas which can be expired from the lungs in first one second of a forced expiration from a position of full inspiration. This indicates whether the air obstruction is there or not. The **Forced vital capacity** (**FVC)** is defined as the maximum volume of gas which can be expired from the lungs during a relaxed expiration from a position of full inspiration. When the term vital capacity is used without any further qualification, it refers to relaxed vital capacity (RVC). In a healthy adult, FVC and

RVC are almost equal. But in patients with obstructive lung diseases, FVC has got more diagnostics value as it often shows ab normal result due to dynamic collapsibility of lung during forced expiration where as, the patient can manage almost a normal RVC with a relaxed expiration.

**Normal value:** In average size adult male Indian-

FEV1 = 2.5 L - 3.0 L

FVC = 3.5 L - 4.0 L

**Procedure:** In this study base line FEV1 and FVC were measured by VITALOR SPIROMETER (for air shields)

**Operational Principle:** There is a flat surface over the spirometer, upon which the graph paper is mounted. The equipment is filled with a writing stylus. A flat balloon was there within the spirometer. When a subject exhales, the balloon swells, the flat top of the spirometer tilts forward and the stylus moves up. Then an electrical mechanism moves the flat surface sideways, so that the stylus write s on the graph paper. Values of FEV1 and FVC were taken from the graph. Three values were recorded and the best values were accepted. All the values were reported after correction with a Body temperature and pressure standard (BTPS) correction factor.

**General Principle:**

1. The subject should be correctly prepared for the tests.

2. The demographic information as regards to age, gender, body height, weight, clinical presentation, family history should be recorded in a proforma.

3. Ideally the subject should avoid the followings

a) Vigorous exercise for at least 30. mins prior to test.

b) Eating a substantial meal at least 2 hours prior to test.

c) Wearing tight clothes interfering chest expansion.

d) Subject should be relaxed as possible and should remain seated for 5 to 10 mins prior to test.

**Measurement of peak expiratory flow rate** (**PEFR)**

It is defined as the maximum flow achievable from a forced expiration starting at full inspiration with an open glottis.

**Normal value:** It differs from person to person according to height and age. **Peak Expiratory Flow rate** tends to decline with increasing weight. In average size adult male Indian -400 to 500 L/min

**Procedure:** In the present study, the **Peak expiratory flow rate** was measured with the help of WRIGHT PEAK FLOW MINI METER. It is based on the design of MEDICAL RESEARCH COUNCIL. This instrument has an orifice of variable area which is initially closed by a vane. During expiration the vane is deflected through an angle which is a function of the rate of gas flow. The deflecti on is recorded on the dial calibrated to give the flow rate in liters/min.

**Technique:** The subjects were asked to hold the instrument in their hands and put the mouth piece of the instrument in their mouth. An air tight shield was formed between the lips and the mouth piece. Then they were asked to breathe in deeply through the nose and to breathe out forcefully and quickly into the mouth piece of the instrument; fitted with a scale starting at 0 to 800 liters al ong which an indicator moves by the pressure of exhaled air.

1. The reading was taken directly from the dial in liters/min.

2. Three consecutive readings were taken and the best values recorded.

3. A blow should be rejected if the subject coughed during the procedure or lack at mouth was detected.

**Administration of Tests:** After conducting a pre-test on vital capacity, the students were divided homogenously into two group‟s viz., 1) Yogic Exercise group (Experimental Group) and 2) Non–Practitioner Group (control Group). The first group was told to participate on the specified activities, prescribed for them, according to the nature of their group. The second group, the non practitioner group was instructed not to participate in any of the activities of the other groups and to function as usual during the periods of treatment.

**Description of Experimental Group Activities:**

**Yoga:** The following yogic activities were given as treatment to the subjects for 12 weeks. Three classes in a week with duration of 40 minutes each were the timing schedule for the yoga group. The yogic activities included Asanas and Pranayama.

**Asana:** 1.Vriksasana, 2.Tadasana, 3.Natarajasana, 4.Padmasana, 5.Ardha-matsyendrasana, 6.Ustrasana, 7.Bhujangasana, 8. Dhanurasana, 9.Ardha shalbhasana, 10.Sarvangasana, 11.sputa-vajrasana 12.Shavasana

Students were instructed to maintain each yogasana at least for a period of 30seconds.

**Pranayama:** 1. Bhastrika Pranayama, 2. Anuloma-viloma Pranayama, 3. Kapalabhati Pranayama, 4. Bhramari Pranayama

**Statistical Analysis**: The descriptive statistics employed were mean and standard deviation of the subjects‟ scores in Vital Capacity tests. The measures of mean and standard deviation of both the experimental and control groups were also taken. Besides the scores of mean and standard deviation 2 x 2 x 5 and 2 x 2 x 3 Factorial ANOVA have been employed followed by scheffe‟s post hoc test to find out real significant difference on the data collected.

**Results:**

**Table I**
Analysis of Descriptive Data for Vital Capacity

| Variables | Group | Pre-test | | Post-test | |
|---|---|---|---|---|---|
| | | Mean | S.D. | Mean | S.D. |
| Forced Vital Capacity FVC(A1) Lit/min | Experimental Group | 3.27 | 0.53 | 3.92 | 0.52 |
| | Control Group | 3.32 | 0.44 | 3.35 | 0.40 |
| Forced Expiratory Volume FEC(A2) Lit/min | Experimental Group | 3.25 | 0.45 | 3.84 | 0.43 |
| | Control Group | 3.28 | 0.40 | 3.26 | 0.49 |
| Peak Expiratory Flow Rate PEFR(A3) Lit/min | Experimental Group | 6.64 | 0.59 | 6.98 | 0.55 |
| | Control Group | 6.59 | 0.53 | 6.65 | 0.49 |

**The result of mean and SD has been presented in Table I**

Thus, the result on the measures of mean and standard deviation as presented in Table I revealed that the training intervention i.e., "Yoga training" may have better treatment effect than the "Control" in improving Vital Capacity of the sub jects. However, from the above, it is not clearly evident statistically that the treatment stimulus helped to influence the variables. Therefore, inferential statistics (i.e., 2 x 2 x 3 Factorial ANOVA) have been employed followed by Scheffe"s post hoc test.

**Factorial Analysis of Data on Lungs function:** The report of analysis (2 x 2 x 3 Factorial ANOVA) as presented in Table II revealed that the achievement scores in the selected dependent variables among two groups (viz., Yoga training & Control) were signifi cantly different ($F=52.42$, $p<0.01$). The impact of such statistical difference has been evidenced in the case of their group comparison ($F=37.85$, $p<0.01$). This indicates, the interaction was not statistically significant ($F=6.57$, $p>0.05$). However, employing Scheffe"s Pos t Hoc techniques, the specific variables were identified, which showed significant changes as a result of Yoga intervention. The item-wise or event-wise analysis has been presented below.

**Table II**

**Factorial ANOVA for Mean Improvement in**

**Vital Capacity**

| Source of Variation | SS | df | MS | F |
|---|---|---|---|---|
| Total | 3628.15 | 19 | - | - |
| Dependant Variables (A) | 2039.12 | 2 | 1019.56 | 52.42** |
| Subjects Group (B) | 736.18 | 1 | 736.18 | 37.85* |
| Interaction (AB) | 638.90 | 5 | 127.78 | 6.57 |
| Error | 213.95 | 11 | 19.45 | |
| **P<0.01, *p<o.o5 | | | | |

Results of Scheffe"s Post Hoc Test in Lungs Function

A) Results on Forced Vital Capacity i.e., FVC

In *Forced Vital Capacity i.e., FVC* (Lit./min.), the Ordered Means of "Yoga training Group" (Pre:1 & post: 2) and "Control Group" (Pre:3 & post:4) as presented in Table III were 3.30, 3.95, 3.31 and 3.34 respectively (Where, 1 = Pre-test of Yoga training Group, 2 = Post-test of Yoga training group, 3 = Pre-test of Control group, and 4 = Post-test of Control group). The statistical significance of Scheffe"s Post Hoc test presented in Table IV revealed that-

• *Control group* did not show significant improvement in Forced Vital Capacity ($CD=0.14$, $p>0.05$).

• *Yoga training group* showed significant improvement ($CD=0.33$, $p<0.05$) in Forced Vital Capacity.

• "Yoga training" showed significant superiority over the "Controls" in improving Forced Vital Capacity (CD=0.33, $p<0.05$) (Fig. 4.7).

**Thus, yoga training has positive effect towards improvement in *Forced Vital Capacity* test which in turn improves pulmonary function ability.**

**Table III**

Ordered Treatment Means of Forced Vital Capacity

(YOGA Training Group Vs Control Group)

| ORDER | | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Means | 3.30 | 3.95 | 3.31 | 3.34 |

WHERE, 1 = Pre-test Score of Yoga Training Group (Experimental),

2 = Post-test Score of Yoga Training Group (Experimental),

3 = Pre-test Score of Control Group,

4 = Post-test Score of Control Group

**Table IV**

Scheffe"s Post Hoc Test for Difference Between Pairs of Ordered Means in Forced Vital Capacity

(YOGA Training Group Vs Control Group)

| Steps | 3 | 2 | 1 |
|---|---|---|---|
| 4 | 0.14 | 0.31* | 0.30* |
| 3 | | 0.12 | 0.15 |
| 2 | | - | 0.33* |
| 1 | | | - |

WHERE, 1 = Pre-test Score of Yoga Training Group (Experimental),

2 = Post-test Score of Yoga Training Group (Experimental),

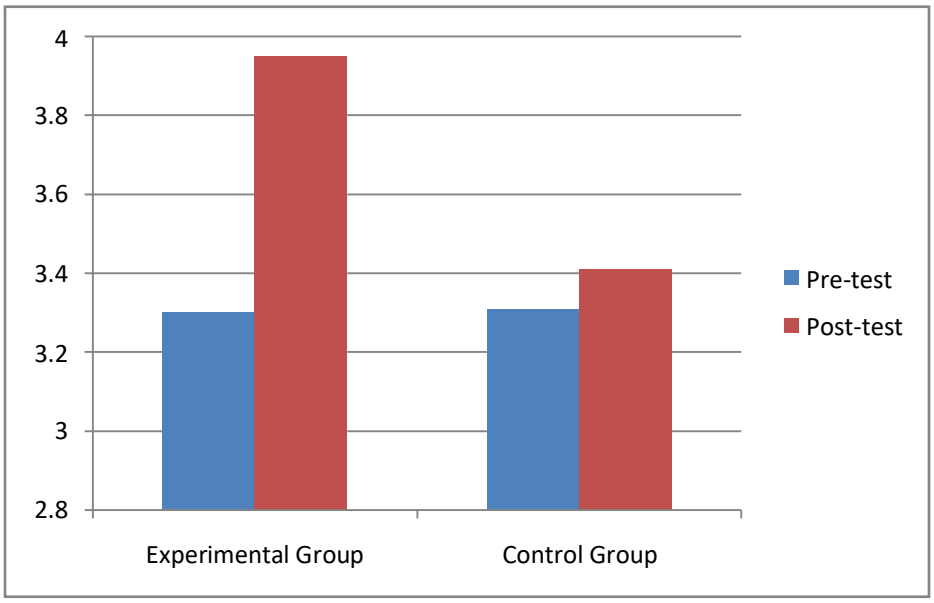
3 = Pre-test Score of Control Group,

4 = Post-test Score of Control Group

Fig. 1

Comparison between Experimental Group and Control Group on

Forced Vital Capacity




B) Results on Forced Expiratory Volume

In Forced expiratory volume (Lit./Min.) the Ordered Means of "Yoga training Group" (Pre:1 & post: 2) and "Control Group" (Pre:3 & post:4) as presented in Table V were 3.23, 3.87, 3.24, and 3.27 respectively (Where, 1 = Pre-test of Yoga training Group, 2 = Post-test of Yoga training group, 3 = Pre-test of Control group, and 4 = Post-test of Control group). The statistical significance of Scheffe"s Post Hoc test presented in Table VI

revealed that -

• *Control group* did not show significant change in *Forced expiratory volume* (CD=0.13, p>0.05).

• *Yoga training group* also could show significant improvement (CD=0.32,

p<0.05) in *Forced expiratory volume.*

• "*Yoga*" training showed better improvement in *Forced expiratory volume* than the control (CD=0.27, p<0.05) (Fig. 4.8).

**Thus, yoga training has positive effect towards improvement in *Forced Expiratory Volume* test which in turn improves pulmonary function ability.**

**Table V**

Ordered Treatment Means of Forced expiratory volume

(YOGA Training Group Vs Control Group)

| ORDER | | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Means | 3.23 | 3.87 | 3.24 | 3.27 |

WHERE, 1 = Pre-test Score of Yoga Training Group (Experimental),

2 = Post-test Score of Yoga Training Group (Experimental),

3 = Pre-test Score of Control Group,

4 = Post-test Score of Control Group

**Table VI**

Scheffe"s Post Hoc Test for Difference Between Pairs of Ordered Means in Forced Expiratory Volume

(YOGA Training Group Vs Control Group)

| Steps | 3 | 2 | 1 |
|---|---|---|---|
| 4 | 0.13 | 0.27* | 0.29* |
| 3 | | 0.15 | 0.11 |
| 2 | | - | 0.32* |
| 1 | | | - |

WHERE, 1 = Pre-test Score of Yoga Training Group (Experimental),

2 = Post-test Score of Yoga Training Group (Experimental),

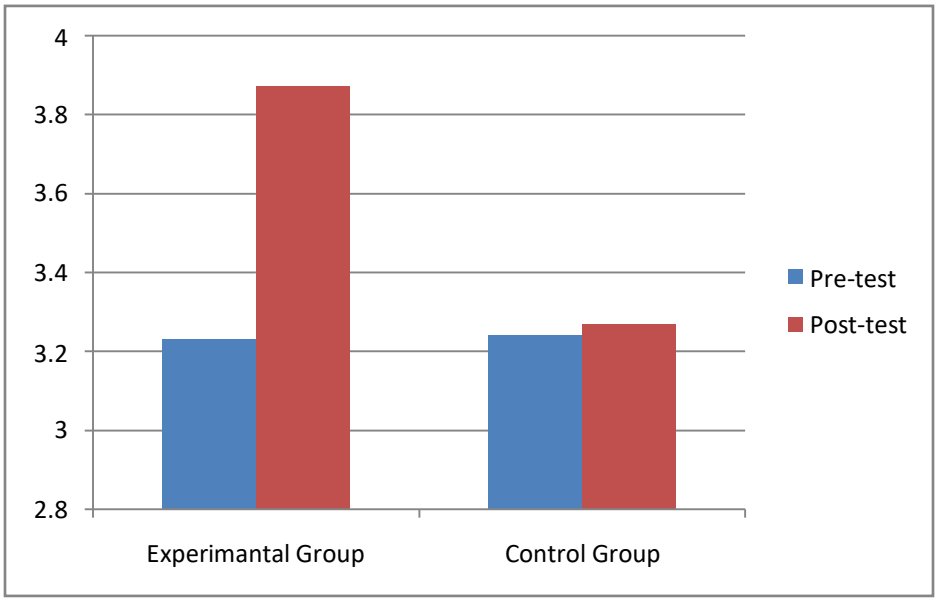
3 = Pre-test Score of Control Group,

4 = Post-test Score of Control Group

**Fig. 2**

Comparison between Experimental Group and Control Group on

Forced Expiratory Volume




**C) Results on Peak Expiratory Flow Rate**

In **Peak expiratory flow rate (Lit./Min.)** the Ordered Means of "*Yoga training* Group" (Pre:1 & post: 2) and "Control Group" (Pre:3 & post:4) as presented in Table VII were 6.61, 7.02, 6.63 and 6.65 respectively (Where, 1 = Pre-test of YOGA training Group, 2 = Post-test of YOGA training group, 3 = Pre-test of Control group, and 4 = Post-test of Control group).

The statistical significance of Scheffe"s Post Hoc test presented in Table VIII revealed that- • *Control group* did not show significant improvement in Peak Expiratory Flow Rate (CD=0.12, p>0.05). • *Yoga training group* could show significant improvement in Peak Expiratory Flow Rate (CD=0.54, p<0.01).

• "Yoga training" was found better than the "Control" in Peak Expiratory Flow Rate (CD=0.42, p<0.05) (Fig. 4.9).

**Thus, yoga training has positive effect towards improvement in *Peak Expiratory Flow Rate* test which in turn improves pulmonary function ability**.

**Table VII**
Ordered Treatment Means of Peak Expiratory Flow Rate
(YOGA Training Group Vs Control Group)

| ORDER | | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Means | 6.61 | 7.02 | 6.63 | 6.65 |

WHERE, 1 = Pre-test Score of Yoga Training Group (Experimental),

2 = Post-test Score of Yoga Training Group (Experimental),

3 = Pre-test Score of Control Group,

4 = Post-test Score of Control Group

**Table VIII**

Scheffe"s Post Hoc Test for Difference Between Pairs of Ordered Means in Peak Expiratory Flow Rate

(YOGA Training Group Vs Control Group)

| Steps | 3 | 2 | 1 |
|---|---|---|---|
| 4 | 0.12 | 0.42* | 0.43* |
| 3 | | 0.10 | 0.11 |
| 2 | | - | 0.54* |
| 1 | | | - |

WHERE, 1 = Pre-test Score of Yoga Training Group (Experimental),

2 = Post-test Score of Yoga Training Group (Experimental),

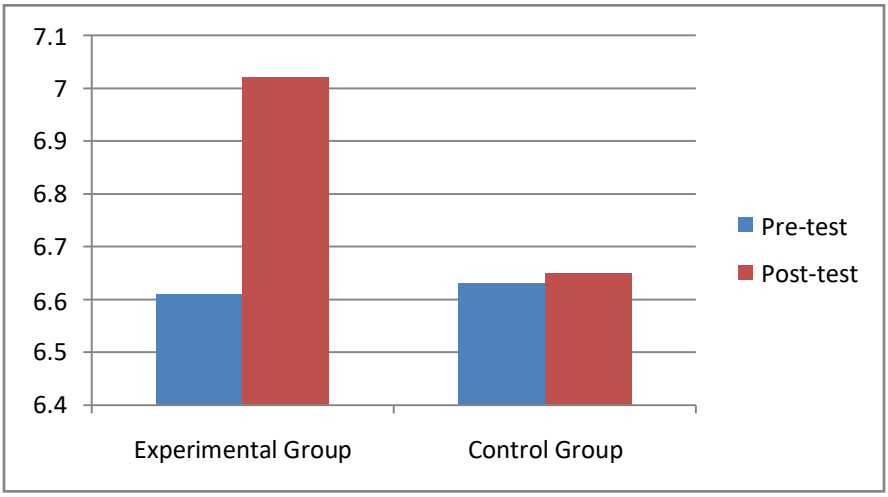
3 = Pre-test Score of Control Group,

4 = Post-test Score of Control Group

**Fig.3**

Comparison between Experimental Group and Control Group on

Peak Expiratory Flow Rate



**Findings:**

*"Yoga training"* showed significant superiority over the "Controls" in improving *Forced Vital Capacity* (CD=0.33, $p<0.05$)

- *"Yoga training"* showed better improvement in *Forced expiratory volume* than the control (CD=0.27, $p<0.05$)

- "*Yoga training*" was found better than the "Control" in *Peak Expiratory Flow Rate* (CD=0.42, $p<0.05$)

**It was concluded that yogic exercises improves Vital Capacity of School going Adolescent Boys.**

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