

# IMMEDIATE EFFECT OF DEEP BREATHING WITH INSPIRATORY HOLD ON OXYGEN SATURATION IN HEALTHY ELDERLY

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Abstract

**Background:** In even healthy elderly oxygen saturation significantly reduces due to normal ageing changes including reduced elastic recoil property of lung, reduced inspiratory capacity of thorax, decreased compliance of chest wall & impaired gas exchange thereby reducing oxygen saturation level. The Immediate effects of deep breathing with inspiratory hold have different types of benefits like significant decrease of atelectasis area, increase in aerated lung area, facilitates collateral ventilation ultimately improved gas exchange increase the level of oxygen saturation.

**Method:** 33 Healthy elderly subjects above the age of 65 years at Jalgaon city was included for the study. subjects with a history of cardiorespiratory disease, history of central nervous system and a history of peripheral vascular disease were excluded. Experimental study (pre and post) was conducted with a convenient sampling. oxygen saturation was measured using pulse Oxymeter. Then subjects were instructed to perform deep breathing with inspiratory hold (3 seconds) for 5 minutes this was followed by recording of oxygen saturation. Data was analyzed considering 95 % confidence interval and level of significance at 0.05.

**Results:** Oxygen saturation is found to be significantly increased ( $P=0.00$ ) after performing deep breathing with inspiratory hold.

**Conclusion:** The study concluded that there was a significant improvement in oxygen saturation with deep breathing with inspiratory hold technique in healthy elderly subjects above the age of 65 years.

## INTRODUCTION

Oxygen saturation is the fraction of oxygen saturated haemoglobin relative to total haemoglobin in the blood. It measures percentage of how much haemoglobin is currently bound oxygen compared to how much oxygen remains unbound. Oxygen saturation indicates oxygen saturated to haemoglobin. The significance of maintaining normal level of oxygen saturation is crucial because oxygen is used in cellular respiration (INTERNAL RESPIRATION) and many organic molecules contain oxygen such as protein, nucleic acid, fats and carbohydrates.

Decrease in oxygen saturation creates adverse effects on various body systems i.e., respiratory, cardiovascular and cerebrovascular systems. Low level of oxygen saturation indicates hypoxia (an absence of enough oxygen in the tissues to sustain bodily function). Symptoms of low oxygen level in blood (hypoxia) are confusion, a sense of euphoria, restlessness, shortness of breath, rapid breathing, dizziness, fainting and lack of co-ordination. Thus, Oxygen saturation is an indicator of how well the body distributes oxygen from lung to cells.

Oxygen saturation is measured by a device called as pulse oximeter. It is used to monitor oxygen saturation ( $SpO_2$ ) in individuals with COPD, asthma, pneumonia, lung cancer, anaemia and IHD. Normal oxygen saturation level in humans are 95 – 100 % if the level is below 90 % it is considered low and called hypoxia.

Elderly has been defined as a chronological age of 65 years old or older. The natural process of ageing involves a lot of changes in all the systems of human body including cardio-respiratory system. The effects of ageing on respiratory system are

- 1 . Reduced elastic recoil property of lung due to reduced pulmonary surfactant thus air trapping occurs in alveoli increasing pulmonary compliance leading to increased functional residual capacity.
- 2 . Increase in A-P diameter of thorax due to reduced elastic recoil of lung leading to resting in increased inspiratory position resulting in decreased inspiratory capacity of thorax.
- 3 . Also airway narrowing occurs which increases resistance to airflow further reducing ventilation and ineffective exhalation leading to carbondioxide accumulation.
- 4 . The alveolar dead space increases thus reduced surface area available for gas exchange.
- 5 . V/Q mismatching causes reduced arterial oxygen values .
- 6 . The reduction in pulmonary capillary surface area co-relate with decrease in pulmonary capillary blood flow and diffusion capacity leading to impaired gas exchange.

All these factors affects ventilation & thus may cause decrease in level of oxygen saturation.

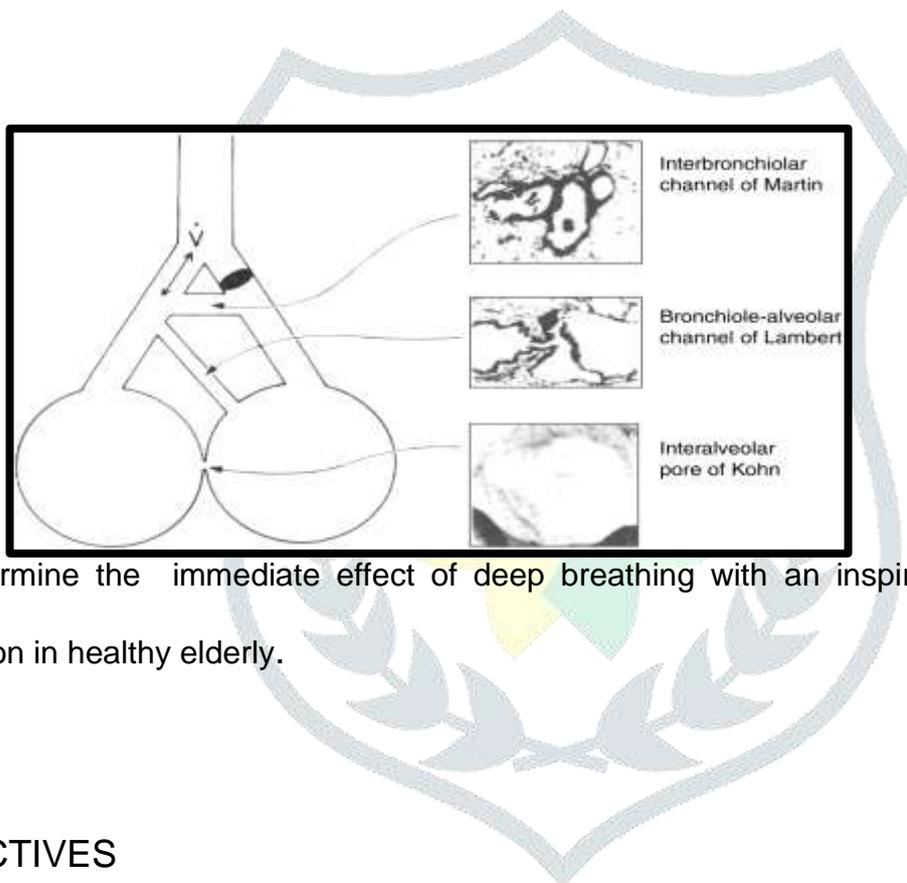
Research studies indicates that deep breathing exercises may improves overall pulmonary function. The effect of deep breathing exercise on respiratory system includes increased lung volume , increased ventilation, reduced airway resistance , increased surfactant secretion, increased V/Q matching, reduced dead space ratio and increased diffusion capacity. Many times, deep breathing is given in combination with inspiratory hold. Deep breathing with inspiratory hold involves slow deep inspiration followed by breath hold at the end of inspiration. Inspiratory hold is given to facilitate collateral ventilation i:e to open collateral ventilatory channels including Interbronchiolar channels of Martin, Bronchioalveolar channels of Lambert & Intraalveolar pores of Kohn. Collateral ventilation defined as ventilation of alveoli via pathways that bypass normal airways. Collateral ventilatory channels allows the flow of air to the terminal

most bronchioles leading to improvement in gas exchange. Ultimately, improved gas exchange may increase the level of oxygen saturation.

## Collateral ventilatory channels

### AIM AND OBJECTIVES

#### AIM



To determine the immediate effect of deep breathing with an inspiratory hold on oxygen saturation in healthy elderly.

#### OBJECTIVES

To analyze the immediate effect on oxygen saturation in healthy elderly before and after deep breathing with inspiratory hold in healthy elderly.

### MATERIALS AND METHODOLOGY

Study Design : Experimental Study.

Place of Study :

Study Duration : 6 Months.

Sample size : 33

Sampling Method : Convenient Sampling.

## MATERIALS

1. Pen and paper.
2. Pulse oximeter.
3. Chair.



Pulse Oxymeter



Chair

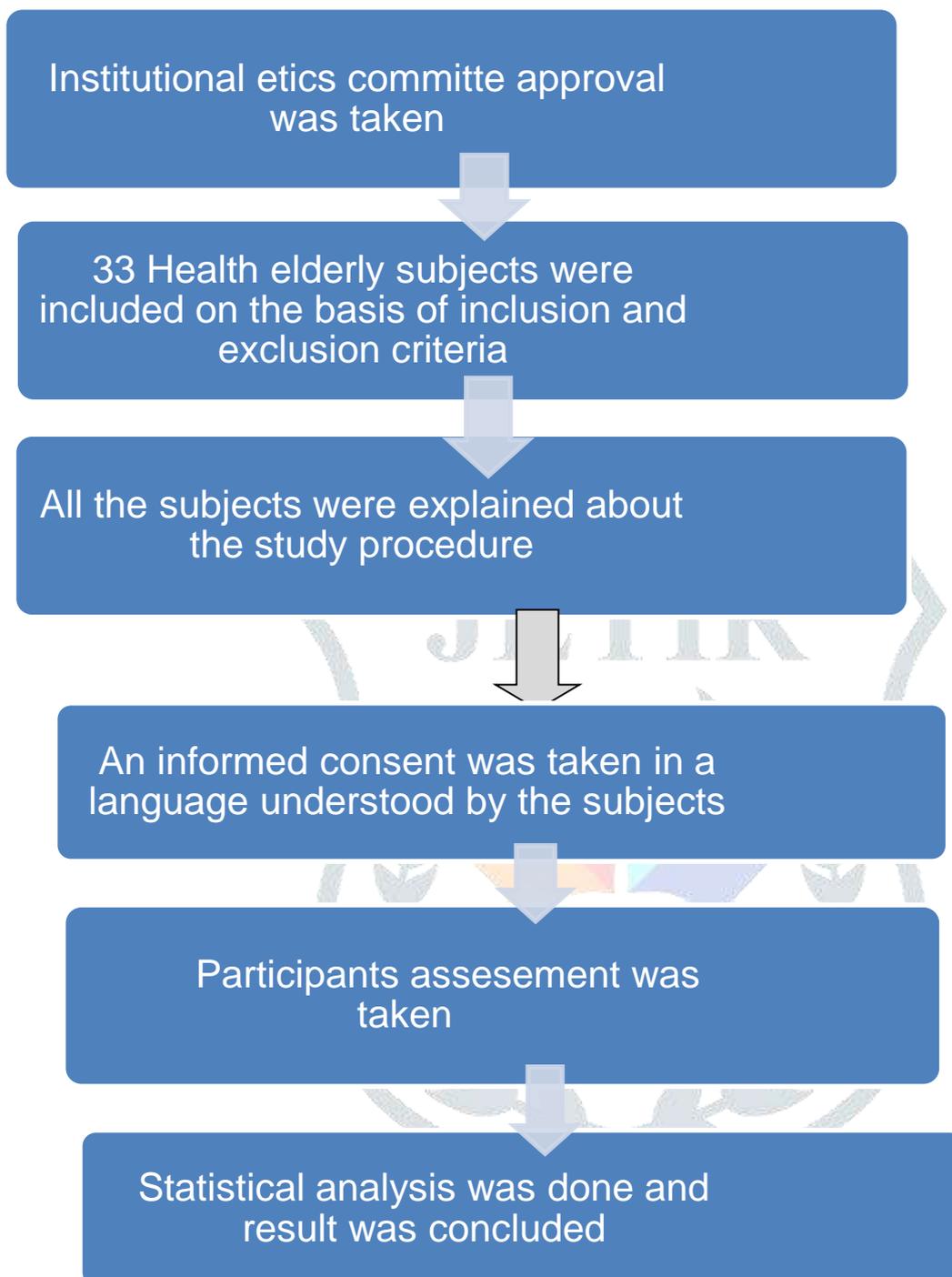
## INCLUSION CRITERIA

1. Age > 65 years .
2. Both males and females.
3. Healthy subjects.
4. Those who are willing to perform.

## EXCLUSION CRITERIA

1. Subject with history of cardiorespiratory, history of central nervous system and history of peripheral vascular diseases.

## METHODOLOGY



## Outcome Measure

Oxygen saturation was measured by pulse oxymeter. The subject was instructed to perform deep breathing with inspiratory hold for (3 seconds) in relaxed sitting position then immediately oxygen saturation was measured.

## PROCEDURE

Basic demographic data (name, age, gender) were obtained .

Oxygen saturation was taken by using pulse oxymeter before and after deep breathing with inspiratory hold.

. Normal oxygen saturation level in humans are 95 – 100 % if the level is below 90 % it is considered low and called hypoxia.

Procedure for Deep Breathing with inspiratory hold.(3 seconds)

1. Prepare the subject in relaxed supported sitting or semi-fowlers position.
2. Instruct the subject to a place hand on abdomen just below anterior costal margin.
3. Ask the subject to breath in slowly and deeply through nose with inspiratory hold for 3 seconds then tell the subject to relax and exhale through mouth.
4. Instruct the patient to keep the upper chest and shoulders relaxed.
5. Repeat the procedure for upto 5 minutes and allow the subject to relax.
6. Immediately oxygen saturation measure by pulse oximeter.



Performing Deep Breathing with Inspiratory hold

Instructions for pulse oxymeter handling.

1. The finger wiped with an alcohol preparation or remove nail varnish.
2. Turn the pulse oximeter on.
3. Place the pulse oximeter probe on thumb or middle finger.
4. Make sure probe fits easily without being too loose or too tight.
5. Look for the displayed pulse indicator that shows the oximeter has detected a pulse, without a pulse signals readings are meaningless.
6. Once the oximeter displays pulse and oxygen saturation the values are record.

Oxygen saturation is measured immediately before and after performing deep breathing with inspiratory hold(3 second).

## RESULT AND DATA ANALYSIS

All the test was performed considering 95% confidence interval and significance at 0.05.

Collected data i.e, oxygen saturation values are quantitative in nature.

To compare difference between oxygen saturation values before and after deep breathing with inspiratory hold.

Conical charts were used for visual representation of the analyzed data.

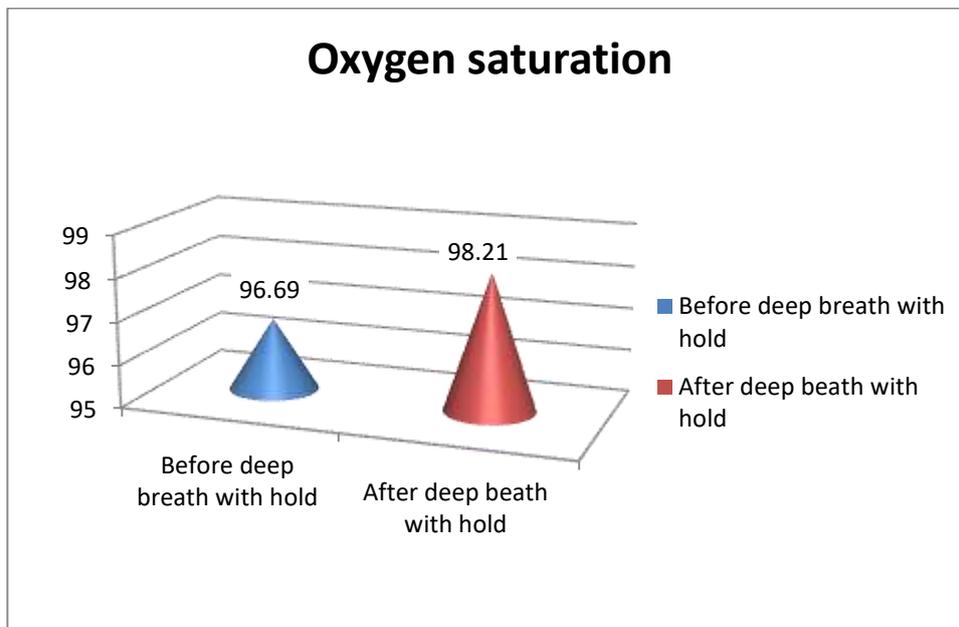
Table no. 1 subgroups according to age

Variable	Range	Total	Male	Female
		Frequency	Frequency	Frequency
AGE	65-75	28	20	8
	76-85	4	2	2
	86-95	1	0	1

Inference : In males, 20 subjects were between age group of 65 to 75 years, 2 subjects were between age group of 76 to 85 years. In females 8 subjects were between age group of 65 to 75 years, 2 subjects were between age group of 76 to 85 years, 1 subject was between age group of 86 to 95 years.

Table no. 2 Mean oxygen saturation before and after deep breathing with inspiratoryhold

Oxygen saturation	N	Mean	SD
Before deep breath inspiratory hold	33	96.6	1.75
After deep breath inspiratory hold		98.2	1.05



Inference : Mean oxygen saturation before deep breathing with hold is 96.6 and mean Oxygen saturation after deep breathing with hold is 98.21.

Table no. 3

o2 saturation	N	Mean	SD	T value	P value
Before deep breath inspiratory hold	33	96.69	1.75	2.89	0.003
After deep breath inspiratory hold		98.21	1.05		

Inference : \*p value less than 0.05, shows the significant difference in the means.

## DISCUSSION

Oxygen saturation indicates oxygen saturated to hamoglobin. Normal level of oxygen saturation is 95 % - 100 % if the level is below 90 % it is considered low and called hypoxia. Symptoms of low oxygen saturation level in blood are restlessness, shortness of breath, rapid breathing and lack of co-ordination, thus oxygen saturation is an indicator of how well body distributes oxygen from lung to cells. Elderly has been defined as chronological age of 65 years old or older. The natural process of ageing passes throughout the age involves a lot of changes in all systems of human body including cardiorespiratory system i.e, reduced elastic recoil property of lung, increase in AP diameter of thorax, airway narrowing, increase in alveolar dead space, V/Q

mismatching. All these factors affects ventilation and thus may cause decrease in level of oxygen saturation. The one of the intervention to improve overall pulmonary function is deep breathing with inspiratory hold. The effect of deep breathing with inspiratory hold are increasing in lung volume, increase ventilation, reduced airway resistance, increase surfactant secretion and increase V/Q matching. Review of previous literature shows that breath hold at the end of deep inspiration distributes air more evenly between lung segments and allows collateral ventilation by increasing alveolar pressure. But there is no documented literature on effect of a combination of deep breathing with inspiratory hold on oxygen saturation in healthy elderly individuals. Thus, the need of study is to determine immediate effect of deep breathing with an inspiratory hold on oxygen saturation in healthy elderly individuals.

Table no. 2 represents oxygen saturation before and after a deep breath with inspiratory hold. Mean oxygen saturation before deep breath with inspiratory hold is 96.69 and mean oxygen saturation after deep breath with inspiratory hold is 98.21

So, In this study we found that oxygen saturation increased after performing deep breathing with inspiratory hold(3 seconds) for 5 minutes

Research Study done by poonam nariyani et al , entitled “Immediate effect of deep breathing on healthy subjects.” Showed that Deep breathing involves contraction of diaphragm , expansion of belly and deepening of inspiration and expiration and is a technique that involves slow rhythmic breathing.Deep breathing is only part of programme design to improve pulmonary status and to improve a patients overall endurance and functions in activities of daily living(ADL's) . Deep breathing causes alveolar Pco<sub>2</sub> decreases from its normal value of 40 mmHg to a low of 15 mm Hg. This creates a considerable diffusion gradient for carbon dioxide runoff into the alveoli from venous blood that enters the pulmonary capillaries. Consequently, a larger than normal quantity of carbon dioxide leaves the blood and arterial Pco<sub>2</sub> decreases. This causes the drop down of RR and extends the breath holding duration until the arterial Pco<sub>2</sub> and/or H<sup>+</sup> concentration rises to level that again stimulates to breath.

The another possible mechanism that contributed in significantly increased breath holding time can be stimulation of the pulmonary stretch receptors due to maximum inflation of the lung during deep breathing relaxes the smooth muscles of tracheo bronchial tree. The stretch receptors are thus trained to withstand more and more stretching this helps us to hold the breath for a long period . Surfactant which is secreted by the type II pneumocytes is increased after deep breathing and this surfactant increases the compliance of the lung.

Oxygen saturation increase significantly after the deep breathing exercise. Oxygen saturation increase suggests that slow deep breathing improves the efficiency of ventilation. We are likely to have increased the used alveolar volume with slow deep breathing and consequently, we have reduced dead space minute ventilation.

Research study done by Bindu C.B et al, (2013) entitled “Comparative study of the immediate effect of deep breathing exercise coupled with breath holding up to breaking point , on respiratory rate, heart rate, mean arterial blood pressure and peak expiratory flow rate in young adults.” Showed that the immediate effects of deep breathing exercises have different types of benefits like significant decrease of atelectatic area, increase in aerated lung area and a small increase in PaO<sub>2</sub> is well known . Voluntary deep breathing at slower rate helps to minimize the wastage of breathing through dead space and increase minute ventilation, in turn increasing the alveolar PO<sub>2</sub> & decreasing PCO<sub>2</sub>.

All these factors leads to collectively increase in oxygen saturation after deep breathing in healthy elderly which signifies deep breathing with hold is effective in improving oxygen saturation by facilitating collateral ventilation and improved gas exchange.

## CONCLUSION

The study concluded that there was a significant improvement in oxygen saturation with Deep breathing with Inspiratory hold technique in healthy elderly subjects above the age of 65 years.

## CLINICAL IMPLICATIONS

The implementation deep breathing with inspiratory hold is very easy and does not require special equipment, and can be done anywhere.

Patients can do this exercise at home to improve oxygen saturation so that the patient's quality of life improves.

## LIMITATIONS & RECOMMENDATIONS

Study done with only one parameter (oxygen saturation) was recorded as a outcome measure.

The study was restricted to only jalgaon district.

## SUMMARY

The study entitles "Immediate Effect Of Deep Breathing With Inspiratory Hold On Oxygen Saturation In Healthy Elderly." The objective of the study was to analyze the immediate effect on oxygen saturation in healthy elderly before and after deep breathing with inspiratory hold . An Experimental study was carried out with the age group above 65 years of age. Outcome measures was Oxygen saturation measured by pulse oximeter. Prepare the subject in relaxed supported sitting. oxygen saturation was measured immediately before and after Deep breathing with inspiratory hold. Ask the subject to breath in slowly and deeply through nose with inspiratory hold (3 seconds) then relax and exhale through mouth for 5 minutes. The study concluded that there was a significant improvement in oxygen saturation with Deep breathing with Inspiratory hold technique in healthy elderly subjects above the age of 65 years.

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