

STUDIES ON THE RESPIRATORY SYSTEM BY USING SUSTAINED MAXIMAL INSPIRATION TECHNIQUE

Physics

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ABSTRACT

Background: Human affected seriously by CORONA Virus during Pandemic COVID-19. Especially CORONA Virus attacks on respiratory system and causes deaths. More than 58.7 Lakhs deaths happened due to this Virus so far. Respiratory Organ is an important Organ in a human body whose capacity is varies with Age, Height, Sex, body surface area. As the respiratory system is complex one, very few findings were found out and so far, there is a need of plenty of research in this field. **Methods:** Sustained Maximal Inspiration Technique is one of the dynamic and extensively used lung function tests as it is very simple, authentic, and consistent. Peak Expiratory Flow Rate (PEFR) is very tactful and errorless marker of airway obstruction and the strength of respiratory muscles. **Results:** Inspired Volume was calculated both male and female for different age groups using sustained maximal Inspiration Technique for healthy and COVID-19 effected person. Significant variation was observed. This may be perhaps attributed to the effect of CORONA Virus on respiratory system. This is because of deoxygenation in lungs which leads to bad functioning of the lung. The Oxygen Level also plays a vital role on respiratory system of human being. The Results were tabulated and the comparative bar graphs were plotted. Further discussed the results. **Conclusions:** Male Inspirational Volume (2133225 cc) Female Inspirational Volume (1200110 cc). Female volume (608–90 cc) in COVID-19 individuals significantly lowers as compared to male volume (1183–125 cc). The volume is greater for both sexes (35–45 years).

KEYWORDS

Postoperative Pulmonary Complications, Respiratory Physiotherapy, Incentive Spirometry, CORONA Virus, Breathing Exercises, and the Stop Watch.

INTRODUCTION:

The Aim of the present study was to determined and compare the Inspiratory Volume of CORONA patients and healthy persons both for Men and Women using Incentive Spirometer. Present dangerous pandemic of CORONA Virus disease (COVID-19) caused and created by Severe Accurate Respiratory Syndrome CORONA Virus-2(SARS-COV-2). This outbreak was first identified at WUHAN China in 1st Dec 2020. World Health Organisation (WHO) promulgate outbreak to be a public health of Emergency of International Concerned on 30th Jan 2020 and recognized & declared as it is a pandemic on 11th March 2020. This Virus Spread and expand between people during close contact, often via small droplets produced by sneezing, cough or talking and via touching. Fever, cough and shortness of breath are common symptoms of this pandemic COVID-19 disease. Airborne bacteria, fungi, black fungi, Viruses like COVID-19 and Pollen are causes for many human lungs related diseases and different type of allergies. In the inflammatory reaction of the soft tissue of the lungs there are many cells and cellular elements playing a vital role. The condition is also known to be link with interference of the airways that is all the time reversible with the arbitration [1]. Earlier in the literature it also reported that the value of Peak Expiratory Flow Rate (PEFR) is influenced by many factors like Age, Anthropometry, Gender and Race [2, 3]. The PEFR also pivot on respiratory muscle energy. The functioning of particularly large airways, during the initial 100-200 ms of powered expiration was reported in the literature [4, 5]. However respiratory research may help us to better understand the relationship between aerial organisms, human health, ecosystems including important food resource.

MATERIALS AND METHODS:

Incentive spirometry works on the principle of Sustained Maximal Inspiration Technique. This Incentive Spirometer provides the feedback of CORONA patient and Healthy persons when they inhales at a predetermined flow or Inspiratory volume and sustains the inflation for at least 5 to 7 Seconds both for Male and Females. The subject is advised to hold the Spirometer in standing position, exhale normally and then put the lips tightly around the mouth piece. In the next step to set the target in a slow inhalation carried out to raise the ball (flow-oriented) or the piston/plate (Volume-oriented). The at maximum inhalation the mouth piece is removed followed by breath hold and normal exhalation. Directions of parents, curators and other health caretakers in the technique of incentive spirometry may help to

make possible the subject's appropriate use of the technique and help with motivating adherence to therapy.

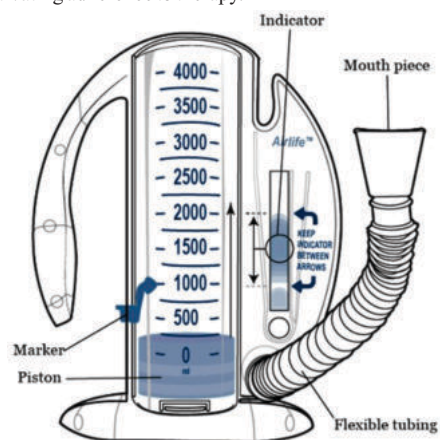


Figure 1. Incentive Inspirator

In the present investigation we calculated Inspired Volume, using sustained maximal inspiration technique for twenty each CORONA patients and healthy persons. It is used to perform a SMI in an upright (i.e., sitting) position. The inspiratory flow rate of the different age group subjects between 25 to 70 years above taken by using incentive spirometer both for male and female at Rajiv Gandhi Institute of Medical Sciences (RIMS) Kadapa. The Inspiratory Volume of CORONA Patients and Healthy Persons were recorded both for Female and Male. All the precautions were followed that these Subjects are not having Major Respiratory Problems, Cardiac Illness, or neurological disorders or with a history of major surgery or injury in the recent past, smoking alcohol consumption, obesity etc., and it is also seeing that pregnant females are excluded for this study. Tiwari et al. also presented similar type of study in his Research Work. [6]

Experimental Method

Inspiratory flow setting can be selected by turning the spirometer top to match the black number with the black arrow. A setting that allows pulling ball to the top of the spirometer can be chosen. Place the mouse

piece in the COVID-19 patients' mouth and from a normal resting respiration, inspiration at a slow get sufficient rate to raise the ball off the bottom of spirometer. Set the stop watch on and record the maximum inspiratory time. Repeated the experiment both for healing and COVID-19 patient at different Value of Inspiratory flow setting. Tabulated the reading in the Table. Calculated the inspiratory Volume both for the Healthy and COVID-19 patient by using the formula given below.

Inspiratory Volume = Inspiratory Time X Inspiratory Flow Setting

All the precautions and SOPs norms provided by the Govt. of India for COVID-19 were followed during the experimentation. For the improvement of Expiratory Flow Rate (EFR) in bronchial asthma patients Lee Wei Jie et al suggested the effective technique of pursed lip breathing and breathing control [7].

RESULTS:

The outcome of the present investigation was tabulated in the following manner. Table 1 represents the mean average data of Inspiratory Volume for 20 COVID-19 patients where Table 2 presents the mean average data of Inspiratory Volume for 20 healthy persons.

Table1: Mean Average Inspiratory Volume Data Of CORONA Patients Both For Male And Female

S.No	Inspiratory Flow Setting	Inspiratory Time Seconds		Inspiratory Volume cc	
		Male	Female	Male	Female
1	200	4	2.5	800	500
2	400	3	1.5	1200	600
3	600	2	1.0	1200	600
4	800	1.5	0.75	1200	600
5	1000	1.5	0.75	1500	750
6	1200	1	0.50	1200	600

Mean Average $\pm$ STD 1183 $\pm$ 125 608 $\pm$ 90

Table2: Mean Average Inspiratory Volume Data Of Healthy Persons Both For Male And Female

S.No	Inspiratory Flow Setting	Inspiratory Time Seconds		Inspiratory Volume cc	
		Male	Female	Male	Female
1	200	7.5	5.0	1500	1000
2	400	5.5	3.0	2200	1200
3	600	4.0	2.0	2400	1200
4	800	3.0	1.5	2400	1200
5	1000	2.5	1.5	2500	1500
6	1200	1.5	1.0	1800	1200

Mean Average $\pm$ STD 2133 $\pm$ 225 1200 $\pm$ 110

Table3: Mean Average Inspiratory Volume Data Of CORONA Patients Both For Male And Female For Different Age Groups

Sr.No	Age Group in Years	Inspiratory Volume for Males in cc	Inspiratory Volume for Females in cc
1	25	857 $\pm$ 89	493 $\pm$ 75
2	30	983 $\pm$ 97	555 $\pm$ 81
3	35	1055 $\pm$ 110	593 $\pm$ 86
4	40	1183 $\pm$ 125	608 $\pm$ 90
5	45	1009 $\pm$ 100	589 $\pm$ 88
6	50	987 $\pm$ 97	512 $\pm$ 82
7	55	899 $\pm$ 91	485 $\pm$ 76
8	60	786 $\pm$ 88	450 $\pm$ 69
9	65	712 $\pm$ 81	402 $\pm$ 55
10	70	677 $\pm$ 76	387 $\pm$ 49

Table4: Mean Average Inspiratory Volume Data Of Healthy Persons Both For Male And Female For Different Age Groups

Sr.No	Age Group in Years	Inspiratory Volume for Males in cc	Inspiratory Volume for Females in cc
1	25	1400 $\pm$ 147	993 $\pm$ 94
2	30	1690 $\pm$ 153	1078 $\pm$ 103
3	35	1895 $\pm$ 165	1112 $\pm$ 120
4	40	1875 $\pm$ 180	1284 $\pm$ 120
5	45	2430 $\pm$ 225	1390 $\pm$ 140
6	50	2130 $\pm$ 275	1250 $\pm$ 127
7	55	1810 $\pm$ 234	1190 $\pm$ 114

8	60	1723 $\pm$ 170	1063 $\pm$ 102
9	65	1535 $\pm$ 150	989 $\pm$ 95
10	70	1220 $\pm$ 124	873 $\pm$ 84

Table 1 and **Table 2** represent the mean average data of Inspiratory Volume for 20 healthy and CORONA patients. **Table 3** represents the mean average data of Inspiratory Volume for 20 COVID-19 patients where **Table 4** presents the mean average data of Inspiratory Volume for 20 healthy persons in different age groups.

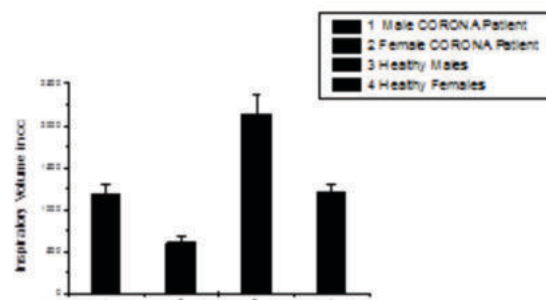


Figure2. Bar Graph for Inspiratory Volume of CORONA Patients and Healthy Persons both male and Females.

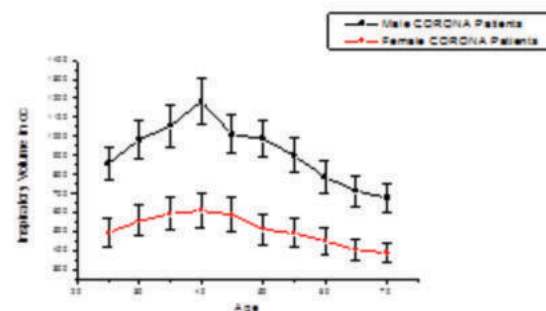


Figure3. A Graph for Inspiratory Volume of Male and Female CORONA Patients in different Age groups.

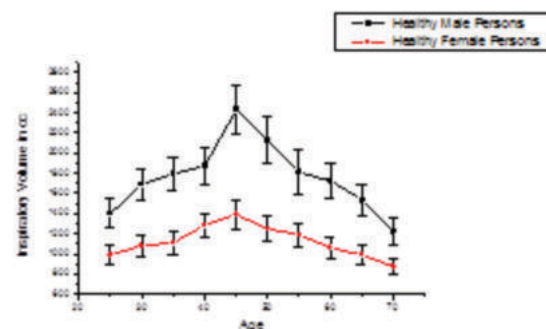


Figure 4. A Graph For Inspiratory Volume Of Healthy Male And Female Persons In Different Age Groups.

DISCUSSION:

Incentive spirometer is available in pharma store, every one by this examine the capacity of respiratory system with consult of Physician. In pandemic season easy to know the respiratory condition. From this experiment it is clear that male and female respiratory system working differently have different in capacity of respiration, inspiratory volume and due to COVID-19 respiratory system get influenced publically. Now a day we have to take precautions about our health and most important organ respiratory system. Takara et al also reported the PEFR values by using different spirometers [8]. However, there is no significant variation in PEFR value was observed by few other previous researchers [9, 10]. A similar study carried out by Dr. Shubhi Thomar on comparison of PEFR values using peak flow meter and spirometer agree with each other and the mean difference between PEF using peak flow meter and spirometer was statistically relevance ($P < 0.05$) [11]. Rossmax Swiss GmbH supplied different type of Incentive Spirometers, Peak flow meter and related devices. [12].

CONCLUSIONS:

From the Graph it's clear that Healthy Female Inspiratory Volume (1200 ± 110 cc) is lesser than Healthy Male Inspiratory Volume (2133 ± 225 cc) However in CORONA patients Inspiratory Volume in Female is drastically decreases (608 ± 90 cc) when compared to male CORONA patients (1183 ± 125 cc) From the Graphs it is also clearly observed that The Inspiratory Volume of CORONA Patient and Healthy person is higher in the age group between 35 to 45 years both for Male and Female.

Incentive spirometers are readily available in Medical Equipment and drug store worldwide. One can be acquired without prescription at low cost. However, while dealing with COVID patients, one must be followed Standard Operation Procedures (SOPs) provides by the Govt. of India. The symptoms of COVID-19 can be prevented by keeping distance 2 to 3 meters, hand washing with sanitizers, wearing masks, quarantine the patient and by keep away triggers like dust, pollen, and irritant or by the use of steroid hormone to reduce inflammation of the lung tissue by taking vaccination in time.

COI: "The authors have no conflicts of interest."

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