

**Lung Functions among Post Covid Females during Different Trimesters of Pregnancy**Kavya Sri J.<sup>1</sup>, Sabarinath Ravichandar<sup>2</sup>, Mukunth kirubasankar<sup>3</sup>, Vani<sup>4</sup><sup>1</sup>Third Year MBBS Student, Sree Balaji Medical College and Hospital (SBMCH), Chromepet, Chennai, Tamil Nadu, India.<sup>2</sup>Assistant Professor, Department of Respiratory Medicine, Sree Balaji Medical College and Hospital (SBMCH), Chromepet, Chennai, Tamil Nadu, India.<sup>3</sup>Third Year MBBS Student, Sree Balaji Medical College and Hospital (SBMCH), Chromepet, Chennai, Tamil Nadu, India.<sup>4</sup>Professor & HOD, Department of Obstetrics and Gynaecology, Sree Balaji Medical College and Hospital (SBMCH), Chromepet, Chennai, Tamil Nadu, India.

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Conflict of interest: Nil

**Abstract**

**Background:** A variety of respiratory complications can be encountered in pregnancy. An understanding of the pathophysiology of pregnancy is important in the management of such complications. During healthy pregnancy, pulmonary function, ventilatory pattern and gas exchange are affected through both biochemical and mechanical pathways. [1] The normal lung function of a pregnant women changes in every trimester i.e., the lung volumes undergo major changes. Some women will have pre-existing respiratory conditions such as Asthma, TB, Cystic Fibrosis, COVID 19. The major physiologic changes that occur in pregnancy are the increased minute ventilation, which is caused by increased respiratory center sensitivity and drive; a compensated respiratory alkalosis; and a low expiratory reserve volume. The vital capacity and measures of forced expiration are well preserved. Patients with many lung diseases tolerate pregnancy well, with the exception of those with pulmonary hypertension or chronic respiratory insufficiency. [2]

The lung volume of post COVID pregnant women undergoes major changes like,

- ERV gradually decreases during second half of pregnancy.
- FRC decreases
- Increased inspiratory capacity
- Increased oxygen consumption and basal metabolic rate
- Dyspnea

**Methods:** A survey was conducted with a self-prepared questionnaire among the sample size of 102 pregnant women of different trimesters coming to Obstetrics and Gynaecology department of Sree Balaji Medical College and Hospital OPD, Chromepet. The questionnaire included questions about their Covid severity (Hospitalized/ICU admission) and their pre-existing respiratory complications. The descriptive statistical analysis was carried out including frequency and percentage. The results of the study were tabulated.

**Data entry and analysis:** Data entry was done in MS-EXCEL sheet, 2010

Graph was presented in MS EXCEL, 2010

**Results:** There is a significant relationship between FEV<sub>1</sub>/FVC values of patient when compared to if the patient is admitted to ICU and if she is Covid positive with P-VALUE<0.05. There is a significant relationship between FEV<sub>1</sub> values of the patient when compared to if the patient is admitted to ICU and if she Covid positive with P-VALUE<0.05. The mean age among the study population was 27 years. 8.06% was hospitalized for covid and 2.02% was admitted in ICU during covid. Among them 25.0% of women hospitalized for Covid and 16.7% of women admitted in ICU shows decreased FEV<sub>1</sub>/FVC and 100.0% of women hospitalized for Covid and 20.2% of women admitted in ICU decreased FEV<sub>1</sub> values.

**Conclusions:** The present study revealed that there is a significant change in lung function of 3<sup>rd</sup> trimester pregnant women who were previously hospitalized for COVID-19 and There is also a significant relationship between the patients admitted to ICU and their FEV<sub>1</sub> and FEV<sub>1</sub>/FVC values. The results of PFTs must be analysed with caution and considering the respiratory Comorbidities (asthma, cystic fibrosis).

**Keywords:** Pulmonary function test, Spirometry, long COVID, Gestational age.

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## Introduction

The coronavirus contains a single-chain Ribonucleic acid (RNA) genome. This virus belongs to the Nidovirales order and is further classified into the Coronaviridae family and Coronavirinae subfamily. [3] Multiple etiological factors can lead to post-COVID respiratory symptoms, with post COVID fibrosis or diffuse parenchymal lung disease being the major concern. [4] Post COVID Condition (PCC) is a multisystem disorder which presents significant diagnostic challenges as many of the 200 symptoms [5,6] associated with the disorder can easily be mistaken for other common conditions. Progressive distension of the uterus causes changes in the lung volume and the shape of the chest wall by elevating the diaphragm. The enlarged uterus increases the abdominal end- Expiratory pressure and shifts the diaphragm upwards, increasing negative Pleural or esophageal pressure, which then causes early closure of the small airways. [7] This results in a decrease in the functional residual capacity (FRC) and Expiratory reserve volume (ERV). This condition occurs during the second half of pregnancy. The enlarged uterus also shortens the height of the thoracic cavity, consequently increasing inspiratory capacity (IC) to maintain constant total lung capacity (TLC). A decreased FRC is also associated with increased rib dimensions in the transverse and lower parts of the thorax. Chest wall compliance declines in the third trimester of pregnancy owing to increased abdominal content. [7] The increasing size of the uterus causes a shift in the resting position of the diaphragm by up to 5 cm. [8] Consequently, changing the diaphragm's ability to Immunological complications in pregnant women with COVID-19. Therefore, our study aimed to evaluate respiratory function, functional capacity, peripheral muscle strength, balance, physical activity, and quality of life in patients with severe COVID-19 infection to give a comprehensive overview of the patients after severe COVID-19.

An important respiratory change that occurs in pregnancy is an increased oxygen consumption, which is characterized by an elevation of the physiologic diaphragm that prompts a restriction in lung expansion, and hormone-induced edema of upper respiratory tract Mucosa.<sup>[9]</sup>

## Aim

To study the lung functions among post COVID females during different trimesters of pregnancy and to study the respiratory complications if present.

## Materials and Methods

The present study was conducted from April 2023 to September 2023. It was a Randomised control trial done by registering the post Covid pregnant women coming to OBG Department, Sree Balaji Medical College and Hospital using a self-prepared

questionnaire. The sample size was calculated using the formula

$$N = \frac{Z_{\alpha/2}^2 * P * (1 - P) * D}{E^2}$$

N equals to sample size of the study which is 102 participants and the anticipated duration for the Randomised control trial is 6 months. Study tool mainly used was the spirometer (Schiller health care- spirovit SP-1G2) to measure the pulmonary function variables.

## Inclusion Criteria

All the post COVID pregnant women of different trimesters.

## Exclusion Criteria

Patients who are not affected by COVID are excluded from the study.

## Procedure

Registering all the post COVID pregnant women of different trimesters and Informed Consent was taken, Questionnaire was given, pulmonary function test was performed and Data was recorded in Department of Respiratory Medicine SBMCH.

## Data entry and Analysis

Data entry was done in MS-EXCEL sheet, 2010, Graph was presented in MS EXCEL, 2010

## Statistical Analysis

There is a significant relationship between FEV1\_FVC values of patient when compared to if the patient is admitted to ICU and if he is Covid positive with P-Value < 0.05.

There Is A Significant Relationship Between FEV1 values of the patient when Compared to if the patient is admitted to ICU and if he is Covid positive with P-value < 0.05.

There is no significant mean difference between patient's age and relationship with his FEV1 values with P-value > 0.05 - KRUSKAL WALLIS TEST

There is no significant mean difference between patient's age and relationship with his FEV1\_FVC values with P-value > 0.05 - MANN-WHITNEY TEST

## Ethical Consideration

Study was approved by the Scientific research committee and Ethical Committee of Sree Balaji Medical College and Hospital, Chromepet.

Study participants were included in the study only after Written Informed consent was obtained from them.

Results

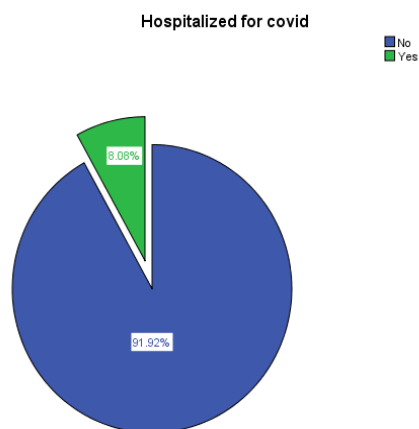


Figure 1: pie chart shows the patients hospitalized for COVID

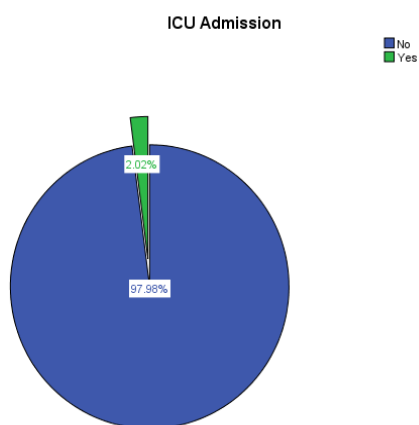


Figure 2: pie chart shows patients admitted in ICU for Covid-19

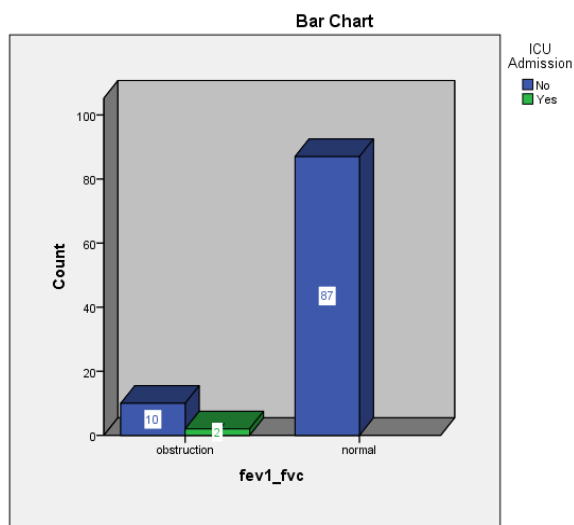


Figure 3: bar chart shows the FEV1/FVC of patients admitted in ICU for COVID

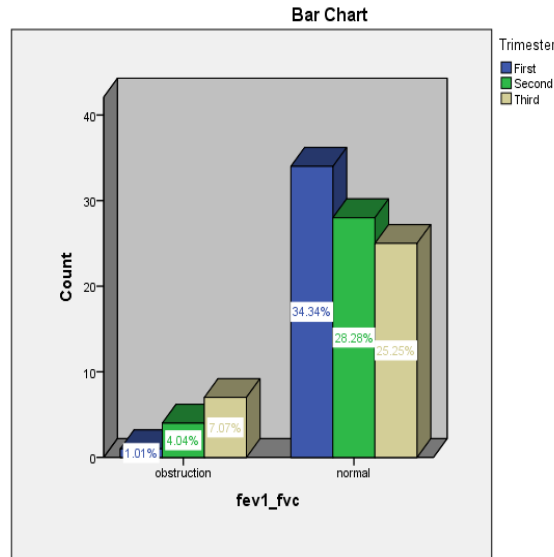


Figure 4: Bar chart shows the FEV1/FVC of different trimesters of pregnancy

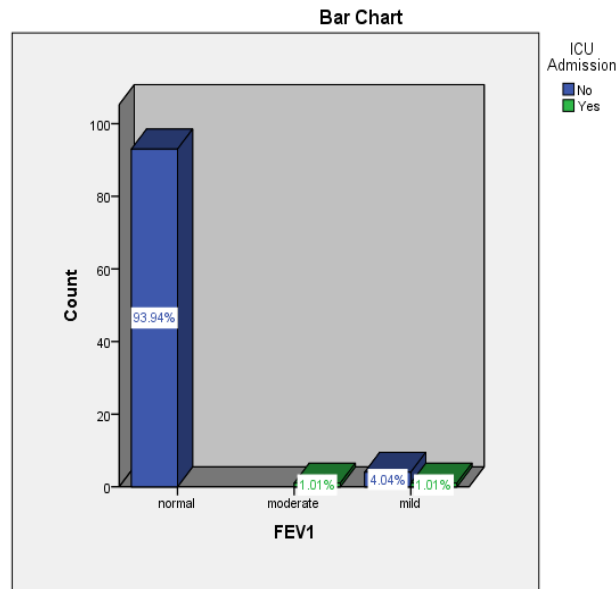


Figure 5: bar chart shows the FEV1 of patients admitted in ICU for COVID

Table 1: Association[relationship] between FEV1\_FVC and risk factors

		fev1_fvc				P-VALUE
		obstruction		normal		
		Count	Column N %	Count	Column N %	
Trimester	First	1	8.3%	34	39.1%	0.058
	Second	4	33.3%	28	32.2%	
	Third	7	58.3%	25	28.7%	
Hospitalized for covid	No	9	75.0%	82	94.3%	0.022
	Yes	3	25.0%	5	5.7%	
ICU Admission	No	10	83.3%	87	100.0%	0.001
	Yes	2	16.7%	0	0.0%	
Post Bronchdilator Reversibility	Absent	11	91.7%	84	96.6%	0.420
	Present	1	8.3%	3	3.4%	

There is a significant relationship between FEV1\_FVC values of patient when compared to if the patient is admitted to ICU and if he is COVID positive with P-value<0.05.

**Table 2: Association [Relationship] Between FEV1 and risk Factors**

		FEV1								P-VALUE
		normal		moderate		mild		severe		
		Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %	
Trimester	First	32	34.4%	0	0.0%	3	60.0%	0	0.0%	0.318
	Second	31	33.3%	1	100.0%	0	0.0%	0	0.0%	
	Third	30	32.3%	0	0.0%	2	40.0%	0	0.0%	
Hospitalized for covid	No	90	96.8%	0	0.0%	1	20.0%	0	0.0%	0.001
	Yes	3	3.2%	1	100.0%	4	80.0%	0	0.0%	
ICU Admission	No	93	100.0%	0	0.0%	4	80.0%	0	0.0%	0.001
	Yes	0	0.0%	1	100.0%	1	20.0%	0	0.0%	
Post Bronchdilator Reversibility	Absent	93	100.0%	0	0.0%	2	40.0%	0	0.0%	0.001
	Present	0	0.0%	1	100.0%	3	60.0%	0	0.0%	

There is a significant relationship between FEV1 values of the patient when compared to if the patient is admitted to ICU and if he is COVID positive with P-value<0.05.

**Discussion**

**Coronavirus disease 2019 (COVID-19)** is a contagious disease caused by the virus SARS CoV. The first known case was identified in Wuhan, China, in December 2019. [10] During the initial outbreak in Wuhan, the virus and disease were commonly referred to as "coronavirus" and "Wuhan coronavirus", with the disease sometimes called "Wuhan pneumonia". [11] The first cases of COVID-19 in India were reported on 30 January 2020 in three towns of Kerala, among three Indian medical students who had returned from Wuhan, the epicenter of the pandemic. [12,13] Lockdowns were announced in Kerala on 23 March, and in the rest of the country on 25 March. A second wave beginning in March 2021 was much more devastating than the first, with shortages of vaccines, hospital beds, Oxygen cylinders and other medical supplies in parts of the country. [14] Covid 19 transmits when infectious particles are breathed in or come into contact with the eyes, nose, or mouth. The risk is highest when people are in close proximity, but small airborne particles containing the virus can remain suspended in the air and travel over longer distances, particularly indoors. Currently the COVID-19 pandemic is a crucial matter of debate across the world. women who are pregnant or were recently pregnant are at increased risk of severe illness with COVID-19. Severe illness means that the patient needs to be hospitalized, have intensive care or be placed on a ventilator to help with breathing. [15] Numerous reports have shown that COVID-19 has a variety of long-term effects on

almost all systems, including respiratory, cardiovascular, gastrointestinal, neurological, psychiatric, and dermatological systems. Pregnancy is a physiological condition that influences breathing as it increases oxygen demand. Increased oxygen demand increases with gestational age. [16] In the present study, we have tried to associate the post COVID lung function of the pregnant women with the trimester of pregnancy. A variety of respiratory complications can be encountered in pregnancy. An understanding of the pathophysiology of pregnancy is important in the management of such complications. The effect of progesterone on the nasal Mucosa facilitates the attachment of SARS-CoV- 2 and impedes its elimination. Increased uterine size is also a risk factor preventing lung expansion. This results in a reduced total lung capacity and an inability to effectively clear pulmonary secretions. Another risk factor to severe COVID-19 is altered functioning of the respiratory system during pregnancy.

Out of 100 patients, 35.5% of them were in the 1<sup>st</sup> trimester, 32.32% of them were in 2<sup>nd</sup> trimester and 32.32% of them were in 3<sup>rd</sup> trimester. The mean age of the study participants was 27. Similar findings were observed by Yu-Minao Zhao et.al that there is significant physiological respiratory abnormalities that existed in a high proportion of COVID-19 Patients 3 months after discharge. This study signifies that there is correlation of the physiological respiratory changes with COVID-19. [17] Besides these immunological and physiological alterations, increased oxygen consumption and respiratory mucous membrane edema could potentially affect the severity and susceptibility to COVID-19 in pregnant women, increasing hypoxic compromise. Also the study done by Jacktan Josephat Ruhighira

comparing the gestational age and Spirometry test, the mean FVC, FEV1 and their % predicted decreased as gestational age increased. This study shows that there is significant relationship between FEV1/FVC and FVC values with the gestational age (fig 4, tab 2). Our study shows, out of 32 post COVID pregnant women who are in 3<sup>rd</sup> trimester, 7 of them have mild obstruction in their respiratory changes by reduced FEV1/FVC values (fig 4). [18] This is a systemic review that signifies (fig 2, table 1,2) that there is relationship between the patients admitted to ICU and if she was positive for COVID 19, which is in concordance to the study conducted by Carlos Robeiro Carvalho et al, in which the patients admitted in ICU showed 5% obstructive pattern in their FVC and FEV1 values. Thus, our study results elucidate a significant parallelism between gestational age, ICU admission with the respiratory functions of post COVID pregnant female. [19] The recent introduction of a diagnostic test for PCC [20] with a reported 90% accuracy across all COVID-19 strains is likely to improve management outside pregnancy. Studies like this requires joint initiative input from all relevant partners, including, but not limited to, healthcare professionals, researchers, Methodologists, patients, and carers. Pregnant women with COVID-19 have an increased risk of ICU admission and mechanical ventilation.

### Conclusion

Post-COVID lung impairment and diseases are major public health concern in the pandemic of COVID-19. This study tries to address, the lung functions among post COVID pregnant females in the population coming to Sree Balaji Medical College and Hospital, Chrompet and commentate on its correlation with various respiratory changes in different trimesters. This study offers 2 major contributions to the literature by showing that: Firstly, there is a significant change in lung function of 3<sup>rd</sup> trimester pregnant women who were previously hospitalized for COVID-19. Post-infection COVID-19 patients in their 3<sup>rd</sup> trimester showed mild alterations in respiratory function (Decreased FEV1/FVC). Secondly, there is also a significant relationship between the patients admitted to ICU and their FEV1 and FEV1/FVC values. The results of PFTs must be analysed with caution and considering the respiratory Comorbidities (asthma, cystic fibrosis). The symptoms of shortness of breath due to COVID-19 may overlap with respiratory physiological alterations due to pregnancy. More research on lung function after COVID-19 disease is needed, especially with focus on longitudinal data.

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