



A Clinical Study of Allergy and COPD Correlation With Spirometric and FENO Evaluation

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Article History:

Received: 03rd Sep., 2023

Accepted: 22nd Oct., 2023

Published: 30th Oct., 2023

Keywords:

Allergens, COPD, FENO, Spirometry, SPT

How to cite this Article:

Hemalata Dange, Rupali Patil and Chandrashekhar Upasani (2023). A Clinical Study of Allergy and COPD Correlation With Spirometric and FENO. *International Journal of Experimental Research and Review*, 34(Spl.), 138-145.

DOI : <https://doi.org/10.52756/ijerr.2023.v34spl.013>

Abstract: Occurrence of allergies & asthma increased in India and may be the top public health concern. The risk of allergies and other allergic diseases might grow with on-going exposure to allergens. There are various unusual allergies, including natural rubber latex, pollen, dust, medications (including antibiotics), food, fungus spores, insect and mite excrement, insect bites and stings (and their venom). The not unusual allergens which might be chargeable for respiratory troubles have been diagnosed after a sincere attempt. A take-look study was conducted on one hundred fifteen patients to assess hypersensitivity and COPD correlation. Their medical histories have been accrued to examine whether or not they were exposed to unique allergens or no longer in the past. All the individuals underwent a Skin Prick Test (SPT) with selected allergens to assess allergens exposure. Patient's Spirometry and FENO check statistics were collected for COPD prognosis. Most COPD patients showed mild to extreme allergic reactions to various allergens.

Introduction

Persistent airflow abnormalities in COPD result from the interaction of obstructive bronchiolitis (a disease of the small airways) with parenchymal degeneration (emphysema). These transformations may occur simultaneously but progress at different speeds throughout time (Ulrik et al., 2021).

People with normal spirometry may nonetheless experience chronic breathing symptoms before developing airflow limitation. Occupational exposure to chemicals, gases, and inorganic and organic dust also increases the risk of COPD (Dey and Guha, 2020; Sarkar et al., 2021; Tamura et al., 2022).

Uncertainty surrounds the position of outdoor air contaminants. The hallmark sign of COPD & cause of impairment in individuals having it is persistent and radical dyspnoea. Usually, the first sign of COPD is a cough. Additionally, coughing might be productive or ineffective. In 30% of patients, sputum production is accompanied by coughing. These symptoms might also

be conventional. Chest tightness and wheezing are two separate comorbid symptoms. Patients with severe and excessive COPD frequently experience fatigue, weight loss, and anorexia (Nawaz et al., 2022; Sarkar et al., 2022).

Spirometry gives a quantitative measure of airflow obstructions. Airflow obstruction is indicated by a FEV1/FVC ratio less than 0.07 after bronchodilator treatment. Current learning sought to quantify the frequency of hypersensitivity in COPD patients through the use of medical history and spirometry (Navuluri et al., 2023).

Role of Allergy in COPD

Allergy, airway hyper reactivity (AHR) & asthma are all hazardous causes of COPD, a complex illness with a wide range of phenotypes. A sensitive phenotype of COPD has been identified in recent years, and it's characterised by more severe symptoms of hyperventilation and an increased risk of acute



exacerbations. While decreased FEV1 and lung function were no longer linked to atopy, as seen in the same study.

Serum T IgE levels were strongly related to forced expiratory volume in one-second predictions & were also clearly associated with the span of dyspnea recordings. One-third of COPD acute exacerbations have unclear causes, even though several things, such as infections, can have a role. More research is needed to determine whether or whether airway allergy contributes to susceptibility to or is an unrecognised trigger for exacerbation, as the allergic phenotype of COPD was found to have an elevated risk of exacerbations. Longitudinal studies could be performed to further investigate the link between allergens and COPD (Karmaus et al., 2023).

Allergens

An allergen is any substance that can trigger an allergic reaction. Allergens are only recognised as foreign or dangerous by the immune systems of a tiny fraction of the population. In order to combat the allergen, the immune system produces immunoglobulin E (IgE), a type of antibody. Hypersensitivity symptoms typically occur after such a response (Nakwan et al., 2022).

Common allergens include

- Dust
- Animal proteins and animal dander
- Drugs (such as antibiotics or medicines)
- Fungal spores
- Foods (such as peanut, egg, soy, milk, nuts, animal meat, fish, and wheat)
- Insect bites and stings (their venom)
- Insect and mite faeces
- Pollen
- Natural latex rubber (Kellerer et al., 2021)

Material & Method

Patients having a clinical history of COPD who had been seen at the Sai Netralay and Speciality Clinic (Allergy, Asthma, and Eye Hospital), Pune, within the last two years were included in this prospective study (n=115; n=65 male, n=50 female). The Royal Pune Independent Ethic Committee in Pune approved the study's methodology (IEC Approval number: RPIEC0160121). Participants had to be over 40 years old, have a history of dyspnea and cough, and have been exposed to occupational dust, biomass fuel gas, or other noxious gases. All included patients gave their consent after a thorough medical history was taken, which included the onset, duration, and severity of their dyspnea. Exacerbations and other symptoms, including coughing, were recorded as well. All patients underwent

spirometry both before and after using a bronchodilator. A Gold 1 rating indicated persistent airflow limitation (predicted FEV1 80%), a Gold 2 rating (FEV1 50-80%), a Gold 3 rating (FEV1 30-50%), and a Gold 4 rating (FEV1 30%). Allergen exposure was evaluated in these patients by means of SPT. The patients FENO test data was collected to assess nitric oxide level which is one of the important predictors of Inflammation (Matsunaga et al., 2021). Inflammation is one of the major indicators of allergy. Data on the patients suffering from respiratory diseases and other co-morbid diseases was collected to assess the relationship between exposure to allergens (Table 1), progression of respiratory disease and effects of respiratory diseases on other comorbid diseases (Li et al., 2023).

Table 1. Allergens Used in the Study

Sr. No	Nature of Allergens	Name of Allergens
1	Pollen	1. <i>Bermuda Grass</i>
		2. Corn
		3. <i>Engl plantain</i>
		4. <i>Prosopis Juliflora</i>
		5. <i>Magniflora indica</i>
		6. <i>Chenopodium maralan</i>
		7. Wheat
2	Fungi	1. <i>Alternaria alternate</i>
		2. <i>Botrytis cinerea</i>
		3. <i>Fusarium moniliforme</i>
3	Dust Mites	1. <i>Dermatophagoides fairance</i>
		2. <i>Dermato pteronyssinus</i>
		3. <i>Blomia tropicalis</i>
		4. <i>Acarussiro</i>
		5. <i>Lepidglyphus destrescentiae</i>
		6. <i>Tyrophagus putrescentiae</i>
4	Mould	1. <i>Penicillium notatum</i>
		2. <i>Rhizopus higricans</i>
5	Other	1. Cat epithelia
		2. Cokcarch
		3. Pigeon Dropping

Results

Pollen Allergens

A study involved various pollen grain allergens like *B. grass*, *Corn*, *Engl plantain*, *P. pterocarpum*, *P. juliflora*, *M. indica*, *C. maralan* and Wheat (Figure 1).

Fungi Allergens

Numerous fungus allergies, including *A. alternata*, *B. cinerea* and *F. moniliforme*, were the subject of research (Figure 2).

Dust Mites Allergens

A study involved various Dust Mites allergens *D. Fairance*, *D. pteronyssinus*, and *B. tropicalis*, *A. siro*, *L. Destrescentiae* and *T. putrescentiae* dust mites' allergens (Figure 3).

Mould Allergy

Mould allergens used were *R.higricans* and *P. notatum* (Figure 4).

Other Type of Allergy

Other animal, bird, and insect allergies included in the study were dog and cat epithelia, pigeon droppings, and Cockroaches (Figure 5).

Spirometry Evaluation

The spirometric data of 115 patients was collected for assessment of airflow obstruction. Spirolab Spirometer was used to perform spirometer. For Spirometric evaluation, Gold Guidelines were followed. There was evidence of airflow restriction, as measured by the FEV1 value (Figure 6).

FENO Evaluation

Fractional exhaled nitric oxide (FENO) is a non-invasive and useful indicator for eosinophilia airway inflammation, especially in lung disorders. FENO is a biomarker naturally produced in the human respiratory tract that plays a crucial role in regulating airway function, such as neurotransmission, vasodilation, and immunoregulation. The measurement of FENO has been proven effective in diagnosing and monitoring lung illnesses and has also been associated with eosinophilia airway inflammation. Information from FENO and Skin Prick tests on individuals was compiled to find allergens that trigger respiratory inflammation and, potentially, the development of chronic obstructive pulmonary disease (Figure 7).

COPD with Other Chronic Diseases

Mounting evidence suggests COPD is more nuanced than just a problem with airways. Restricting breathing has far-reaching effects on the body as a whole, altering gas exchange and cardiac function. The morbidity of COPD is amplified by comorbid conditions, which raise mortality, hospitalizations, and healthcare expenditures. Comorbidities make managing COPD more difficult and need to be carefully considered. Data on the patients suffering from respiratory diseases and other comorbid diseases were collected to assess the relationship between

exposure to allergens, respiratory disease progression and effects of respiratory diseases on other comorbid diseases (Figure 8).

Out of 23 patients, 5 showed Heart disease, 8 showed onset of lung diseases, and 10 showed diabetes. Till date, any COPD patients suffering from Depression have not been observed.

Discussion

Average age of the participants in this study was consistent with the literature at 58 years. Men were hit harder than women because they were more likely to smoke and were more likely to be exposed to other risk factors. Patients exposed to different allergens had a higher prevalence of COPD. The study involved various pollen, mould, fungi, dust mites and other animal, bird-related allergens like cat epithelia, dog epithelia and pigeon feather allergens. Most of the patients were found to be severely allergic to pollen and dust mites. Total seven pollen allergens (*B. grass*, corn, *E. plantin*, *P. juliflora*, *M. indica*, *C. maralan* and three fungi allergens (*A. alternate*, *B. cinerea*, *F. moniliforme*) were investigated for allergic profile (Dange and Patil, 2021).

Out of these allergens, most of the patients showed allergy to *A. alternata* and *F. moniliforme* allergy. The study involved 5 dust mite allergens (*D. fairance*, *D. sinus*, *B. tropicalis*, *A. siro* and *Destrescentiae*). These results show that patients were allergic to most dust mite allergens. Study includes 2 mould allergens (*P. notatum*, *R. higricans*) (Kostorz-Nosal et al., 2023).

Patients showed moderate to severe allergy to both mould allergens. Several other allergens like *cat epithelia*, *dog epithelia*, *pigeon feather*, *pigeon dropping*, and *cockroach* were also observed. Most of the patients showed moderate to severe allergy to cat epithelia, cockroach, pigeon feather and pigeon dropping allergy. From the allergen study, it was observed that most of the patients who suffered from respiratory disorders showed the symptoms of chronic cough, shortness of breath, and wheezing (Maiti and Samanta, 2018; Cottini et al., 2023).

The above symptoms are one of the indicators of COPD onset. The patient and these symptoms also show moderate to severe allergic response to most of the allergens in SPT. Pollen, fungi, mould and animals, bird are the most common allergens we found. Foregoing suggests that allergen exposure is a potential cause of respiratory disorders, which, if left untreated, can lead to potentially fatal ailments. For confirmation of COPD, the

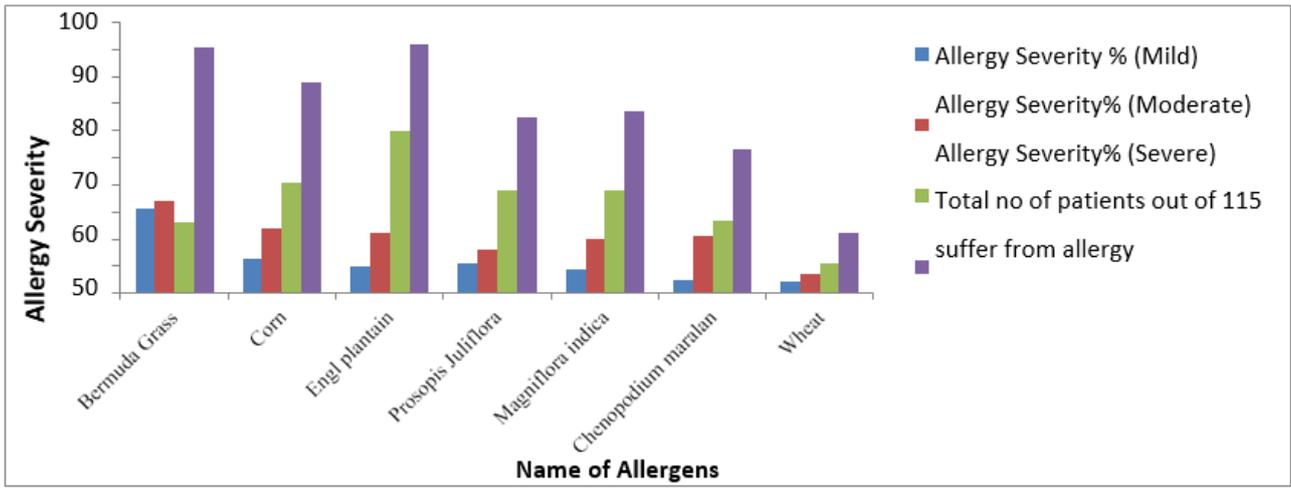


Figure 1. Allergy Severity of Pollen Allergens (%)

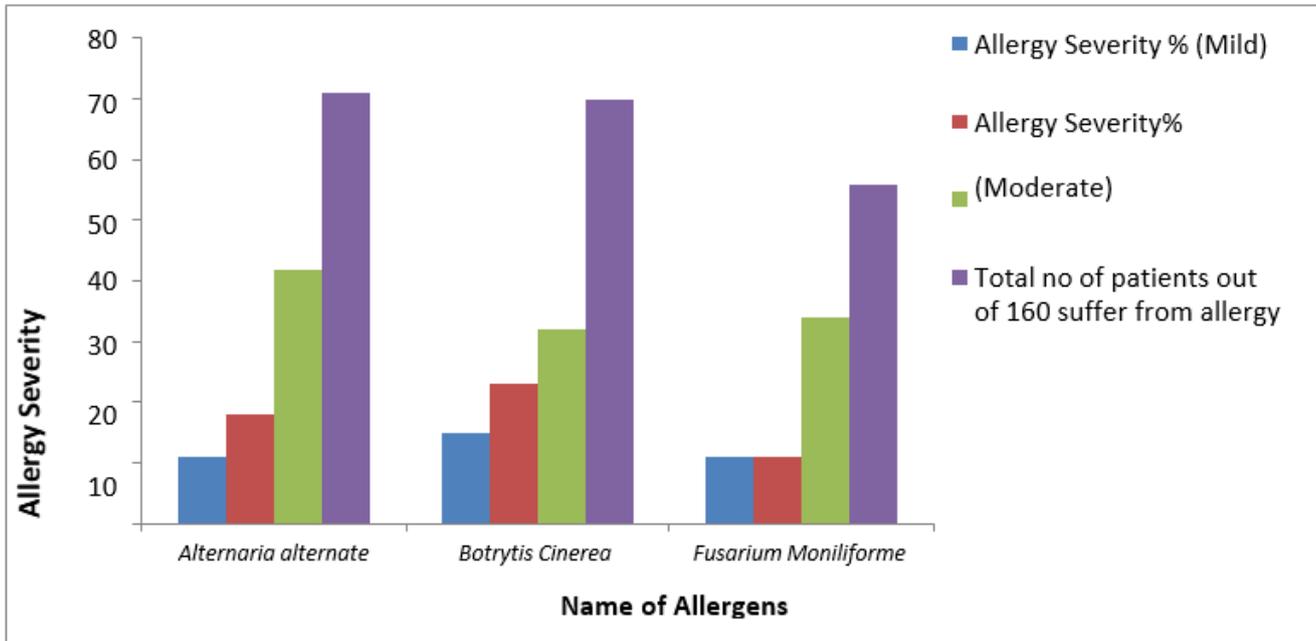


Figure 2. Allergy Severity of Fungi Allergens (%)

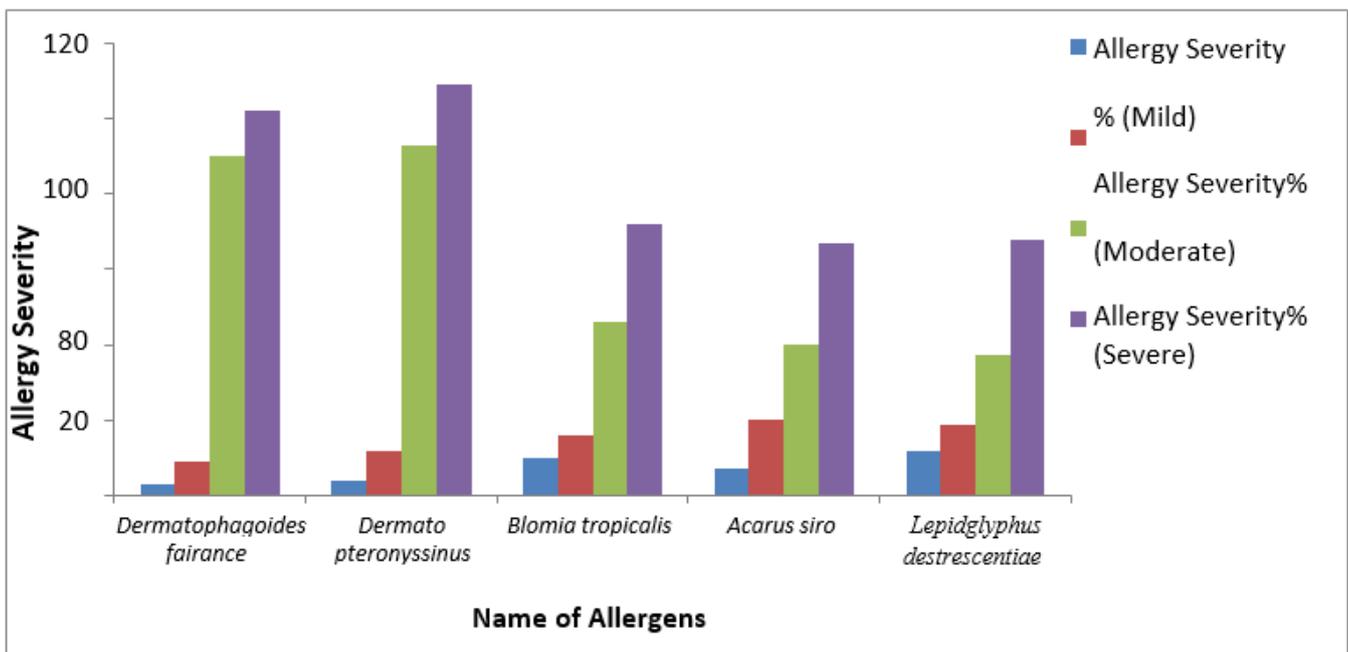


Figure 3. Allergy Severity of Dust Mites Allergens (%)

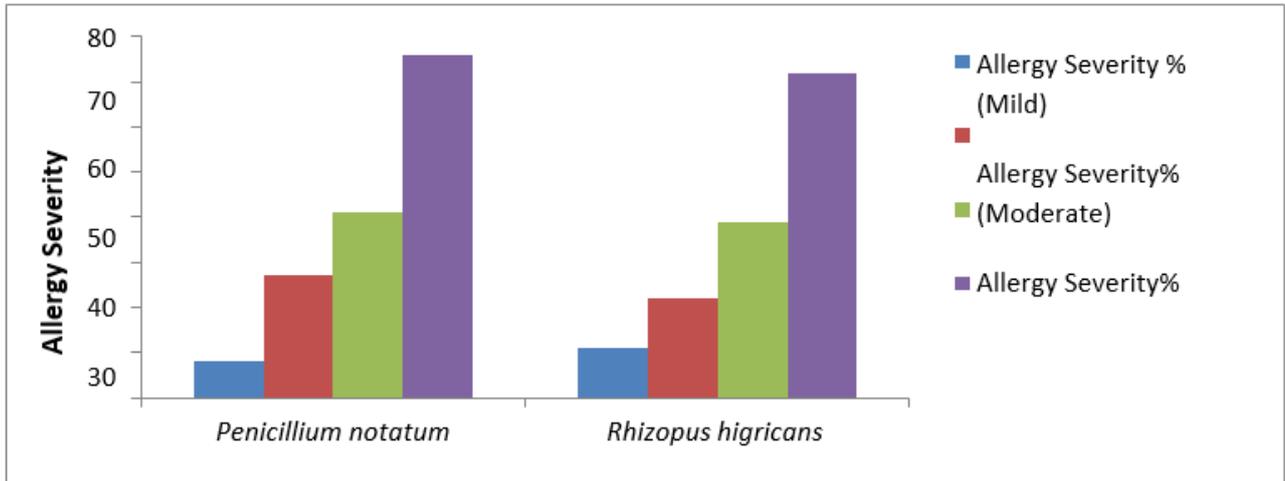


Figure 4. Allergy Severity of Mould Allergens (%)

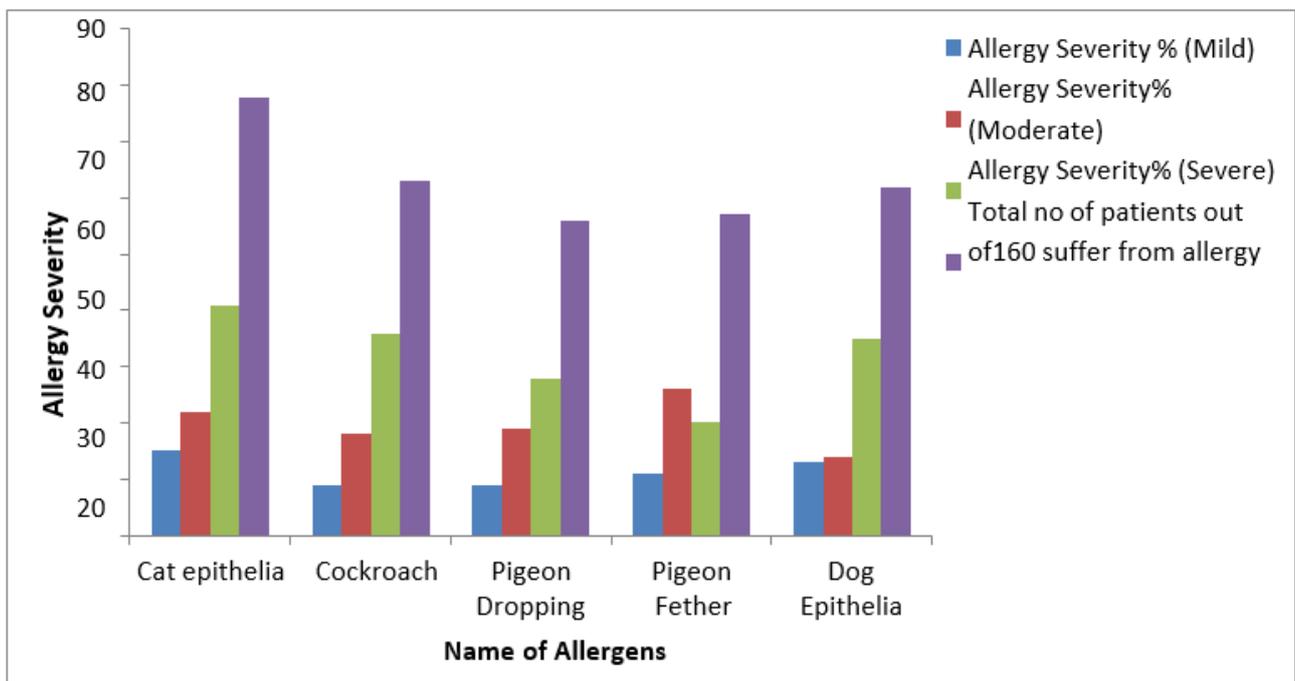


Figure 5. Allergy Severity of Other Allergens (%)

FEV1 VALUES

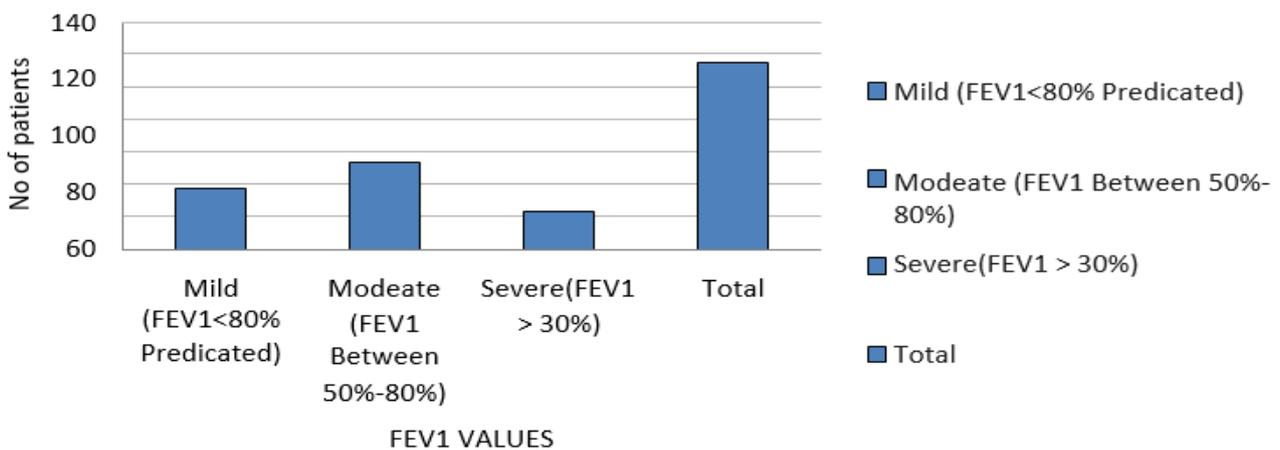


Figure 6. Spirometry Result

FENO Test

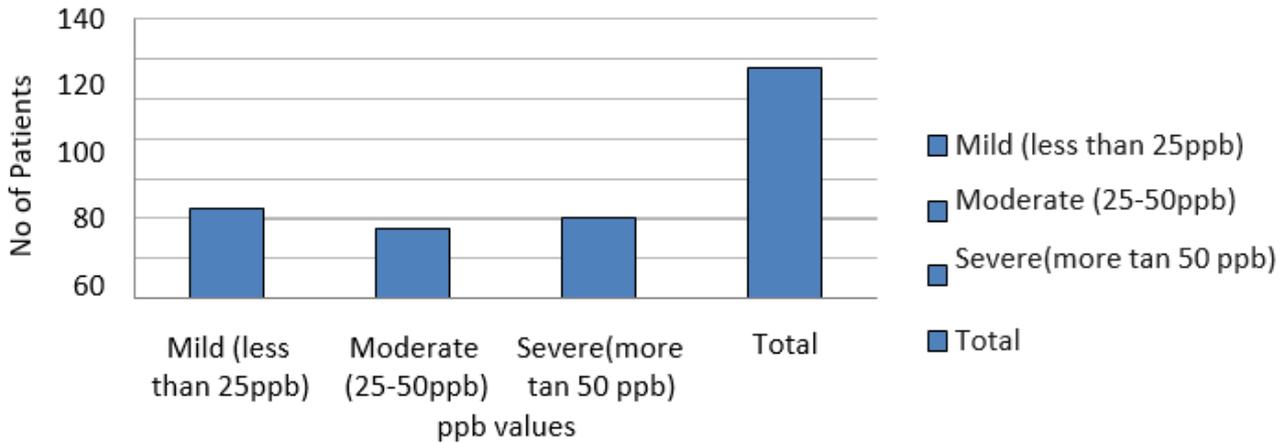


Figure 7. FENO Result

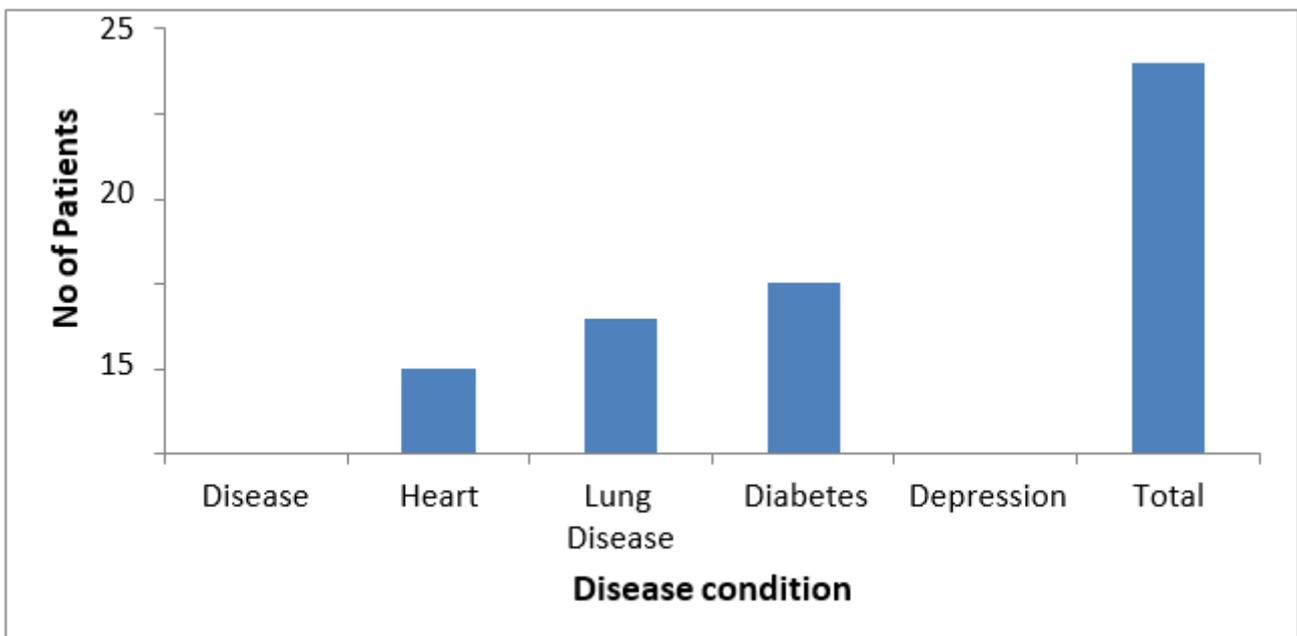


Figure 8. Comorbid Diseases

spirometric study was conducted on the patients who showed allergic responses to most of the allergens in SPT. The study observes that allergic patients (23%) had extremely significant airflow obstruction in the current research. Patient FENO test data were also collected to diagnose nitric oxide levels, which is the predictor of inflammation and plays a key role in Allergic reactions. Almost 40% of the allergic patients showed severe nitric oxide levels, indicating severe respiratory inflammation (Ambrosino et al., 2021; Bao et al., 2021).

As COPD is a chronic disease, it is also responsible for the onset of systemic inflammation caused by other chronic ailments like lung diseases; there is a risk of developing comorbid illnesses. Collected data showed that out of 23 patients, 5 patients showed Heart disease, 8

patients showed onset of lung diseases and 10 patients showed diabetes.

Conclusion

Majority of patients with COPD were men, with a mean age at diagnosis between 50 and 59 years old. The most common causal factor was being exposed to dust at work, followed by using biomass fuel and smoking cigarettes. Next in prevalence were allergies to mould, animal dander, fungi, dust mites, pollen, and pigeon poop. Most often reported clinical symptoms included dyspnea, coughing up blood, wheezing, chest tightness, fever and weight loss. Severe inflammation and allergies of moderate to severe severity went hand in hand with significant airflow limitation.

Conflict of interest

Nil

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How to cite this Article:

Hemalata Dange, Rupali Patil and Chandrashekhar Upasani (2023). A Clinical Study of Allergy and COPD Correlation With Spirometric and FENO. *International Journal of Experimental Research and Review*, 34(Spl.), 138-145.

DOI : <https://doi.org/10.52756/ijerr.2023.v34spl.013>



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