



“To Investigate the Prevalence, Sociodemographic, Clinical-Radiological Profile, and Correlation between the Degree of Airflow Obstruction and the COPD Assessment Test (Cat) In Women with Chronic Obstructive Pulmonary Disease”

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I. INTRODUCTION:

Chronic Obstructive Pulmonary Disease (COPD) is a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual patients. [1]

Numerous research have revealed that women are experiencing a higher rise in the prevalence of COPD. Active smoking appears to be a significant risk in rich and industrialised countries, while biomass exposure appears to be a significant factor in poor countries.

Women are more likely than men to be nonsmokers with COPD, indicating a genetic predisposition, environmental factors, and a higher lung sensitivity in women. Smoking and air pollution are more likely to harm their lungs. Gender differences in the disease may be caused by sexual dimorphism in the human immune system.

Asthma diagnoses are more common in women than COPD diagnoses.

increased likelihood of an underdiagnosis and insufficient care for their ailment. When compared to men, women also report a lower quality of life; for this reason, it is critical to identify COPD in women, as well as the likely risk factors, most common presenting symptoms, and how these affect daily living. Women report higher rates of chronic cough, dyspnoea, anxiety, and depressed symptoms. In addition, their nutritional status is poor, their quality of life is low, and they experience exacerbations more frequently. Women with COPD frequently had melancholy, anxiety, and osteoporosis. The negative effects of beta 2 agonists appear to affect women more than males.

As a result, we intend to investigate the prevalence and manifestation of COPD, its influence on pathologic and physiological deficits, and the likely risk factors linked to female patients

whopresent with chronic obstructive pulmonary disease.

II. REVIEW OF LITERATURE:

Underdiagnosis of COPD in women

Chapman k et al found that when hypothetical case of both man and a woman presented to the primary care physician with cough, dyspnea and smoking history , COPD was the most likely diagnosis for the male case scenario than the female. But with the use of spirometry the likelihood of diagnosis narrowed between men and women [2]. The primary care physicians are less likely to use spirometry. Women may not be referred to a higher centre for further diagnosis and less likely to receive spirometry. Ancochea et al. reveals the significant underdiagnosis that exists in Spain in women with COPD, and leads us to reflect on how to improve its diagnosis in the female population. [3]In most of these studies where there was underdiagnosis like the PLATINO study, the women tend to be younger and non smokers .[4]

Physiology of women COPD

We see increased incidence of asthma in boys when less than 15 years, but steadily increasing in women thereafter till perimenopausal period and there is also premenstrual aggravation of symptoms in airway diseases. All these point to the fact that sex hormones may play a role in airway disorder .[5]

Clinical presentation and symptoms of COPD in females

Since women tend to swallow and are less likely to acknowledge to having it, the fact that they were much younger, reported more coughing, and had less phlegm may be a cultural or sociological artefact. Women experience dyspnoea sooner in life and at an earlier stage of the illness. Additionally, compared to men with the same amount of airway impairment, they reported higher



levels of dyspnoea as assessed by the modified Medical Research Council scale. Women also score worse on the St. George's Respiratory Questionnaire (SGRQ) across all areas, which results in a lower quality of life. This could be because of

1. Dyspnoea comprises cognitive, affective, and physical components, therefore its effects are not solely correlated with the extent of lung damage but also with the patient's emotional reaction to and increased interpretation of the feeling. For instance, exercise performance limitations are more distressing than the actual dyspnoea feeling.
2. Women are more naturally sensitive to harmful stimuli, such as dyspnoea. Studies on neuroimaging show that the laterality of prefrontal cortex processing of unpleasant stimuli varies by gender.
3. Women are more prone than males to perceive dyspnoea because they are more cognisant of and attentive to physical sensations.
4. Their inspiratory muscular strength is generally inferior.
5. Bronchial hyperreactivity is more common in women and is a sign of the severity and course of the disease.

Biomass exposure - a significant risk factor in women

About two third of rural India use biomass fuel for cooking. Combustion of biomass fuels is the most important source of indoor air pollution in developing countries. A recent meta-analysis has shown that biomass fuel exposure is associated with a significant risk of chronic bronchitis and COPD and the strength of association similar to that of cigarette smoking [6] Those exposed to wood smoke having the greatest effect (relative risk 4.3) compared with animal dung / crop residue (relative risk 2.5) and coal / charcoal (relative risk 1.5-1.8).

Biomass-induced indoor air pollution is the tenth most preventable risk factor for the world's illness burden. Over 90% of biomass smoke is in the respirable range of less than 10 microns and is a complex mixture of hundreds of volatile and particulate materials, including organic and inorganic chemicals. Solid particulate matter (PM10 and PM2.5), carbon monoxide, nitrogen and sulphur monoxides, aldehydes like formaldehyde, polycyclic aromatic hydrocarbons like benzopyrene, volatile organic compounds, and free radicals are the most significant hazardous elements.

The degree of particulate matter exposure is influenced by ventilation and house type. The majority of homes in rural India are made of mud, lack a separate kitchen, have inadequate ventilation,

and have no windows to allow burning.

High exposure results from particles settling in the home. Additionally, because there aren't enough rooms or space, people sleep and spend time in the same room, which lengthens the exposure hours.

Exposure to biomass throughout childhood increases the likelihood of developing COPD. The burning of biomass fuels exposes developing lungs to PM particle matter, which can cause serious harm. In rural India, where biomass use is prevalent, schoolchildren's lung function significantly declines and their bronchial hyperreactivity increases. Grigg et al 2009, showed a direct link between childhood exposure to PM of biomass and development of COPD in non cigarette smoking women.[7]

Nutritional status of women

Nutritional status is mainly evaluated by BMI. Charlotte Landbo et al in his analysis over 17 years showed an independent effect of BMI on survival, with significantly higher mortality seen in underweight subjects than in those of normal weight. In subjects with mild or moderate COPD, the associations between BMI and mortality did not reach significance, but the relation tended to be U-shaped. The impact of BMI on COPD mortality was stronger than that 10 on all-cause mortality, with RRs between the lowest and highest BMI of 5.56 (range: 2.47 to 12.54) and 7.17 (range: 2.45 to 21.00) in men and women, respectively. [8]

Long standing asthma and the risk of COPD

Chronic airway obstruction is defined as low FEV1 that persists despite pharmaceutical attempts to reverse it. Asthma that lasts longer can cause serious airway blockage. A further drop in FEV1 than usual is linked to asthma. Male sex, mucus production, significant bronchial hyperresponsiveness, low baseline lung function, reduced response to beta agonists, and frequent exacerbations all contribute to ongoing airflow restriction.

Outdoor air pollution as a risk factor

Numerous pollutants, including those from industry, transportation, and other sources, combine to form outdoor air pollution. According to data -Living close to busy roads has been linked to exposure to particulate matter, O₂, and NO₂, which can have a negative impact on the airways through systemic airway oxidative stress and "pulmonary inflammation". There is evidence that daily variation in outdoor air pollution can lead to exacerbation of COPD. The German SALIA study



showed higher PM10 in the environment lead to increase in COPD prevalence [9].

Second hand smoke as a risk factor for COPD

Rachel E Jordan et al showed that never smokers having clinically significant COPD, where never smokers exposed to between 1 and 19h of passive smoking in a week had a 52% excess risk and those exposed to >20h had an excess risk of 98%. [10]

Occupational exposure as a risk factor for COPD

Among construction and extraction workers, the odds of having chronic bronchitis were 1.4 times that of workers in management occupations, indicating that there are factors associated with construction and extraction work. [11]. Doney et al in the National Health Interview Survey Data 2004 to 2011, showed that females had a higher prevalence than males, which is consistent with findings reported by Ford et al. [12][13]

Low socioeconomic status as a risk factor

Bakke et al. have showed that low educational level is an independent determinant for COPD. [14] Individuals of the lowest socioeconomic strata were at least twice as likely to have poor outcomes as those of the highest (range from no difference to 10-fold difference). Gershon et al showed evidence that social and economic disadvantage appears to have a significant consistent impact on COPD mortality and morbidity. [15]

Severity of symptoms by CAT score CAT scores in women

The COPD assessment test is a short and simple (set of 8 questions) completed by the patient which aim to assess the impact of cough, sputum, dyspnea, chest tightness on the health status of the patient due to COPD. It has a high correlation with SGRQ ($r=0.84$) which is a validated score to assess the quality of life. Higher scores denote a more severe impact of COPD on a patient's life. The difference between stable and exacerbation patients was five units.

Impact of CAT score on degree of airflow limitation.

The relationship between CAT score and FEV1% predicted suggests that CAT score is linked to severity of airflow limitation and GOLD classification in stable COPD patients. There was a significant association between the FEV1%

predicted and total CAT score ($r= -0.55$, $p< 0.001$). Health status as measured by CAT worsens with severity of airflow limitation. [16]

Factors affecting severity of airflow limitation

The impact of age on FEV1 was proven when We Johannes et al studied the incidence and significance of airflow limitation in a population-based geriatric sample using both an age-dependent predicted lower limit of normal (LLN) value and a fixed-ratio of $< .70$ spirometric criterion. The incidence increased dramatically with age when using a fixed ratio, but less so when using LLN. In addition, a sex effect was observed with the LLN criterion. He found that female sex may be a risk factor for developing airflow limitation and consequently COPD. [17]

Common co-morbidities in female COPD

It has been observed in the ECLIPSE study that comorbidities were significantly higher in patients with COPD than in smokers and never smokers [18] Dal Negro RW et al assessed that the overall prevalence of co morbidities was 2.6 per patient with 2.5 in males and 3.0 in females. ($p<0.05$). [19] The important comorbidities associated with COPD are cardiovascular disorders (coronary artery disease and chronic heart failure, hypertension), metabolic diseases (diabetes mellitus, metabolic syndrome and obesity), bone disease (osteoporosis and osteopenia), stroke, lung cancer, cachexia, skeletal muscle weakness, anaemia, depression and cognitive decline. [20]

III. AIMS AND OBJECTIVES

1. To study the prevalence, sociodemographic, clinico-radiological profile and severity of airway obstruction in females with Chronic Obstructive Pulmonary Disease.
2. To assess the correlation of COPD assessment test (CAT) and degree of airflow obstruction in Chronic Obstructive Pulmonary Disease - females.

IV. MATERIALS AND METHODS

Study design: a cross sectional randomised observational study

Study period: August 2023 to feb 2024

Study centre: Kanachur Institute medical sciences, Mangalore

Subject selection

Inclusion criteria:

- Female patients more than 40 years of age
- Spirometric diagnosis of COPD according to GOLD guidelines 2020 with post bronchodilator FEV1/FVC under 0.70



Exclusion criteria:

- Relative contraindications for spirometry, such as a recent history of myocardial infarction or a recent upper abdominal/thoracic illness; surgery, cataract surgery, and haemoptysis history
- Active TB or treated pulmonary TB
- Psychiatric illness other than depression
- Patients with considerable cognitive impairment were also not included
- Besides since we wanted our study participants to undergo six minute walk test, therefore those with disabling loco motor diseases and bed ridden patients were not included in the study.
- Patients who refuse to participate in the trial.

Sample size:

- 91 female patients who satisfied the inclusion and exclusion criteria were enrolled in the study

V. RESULTS:

The mean FEV1 of the study population was 53.29% of predicted. Prevalence of airflow obstruction as defined by GOLD guidelines was as follows: 0% in mild degree (FEV1 > 80% of predicted), 63.7% moderate (FEV1 50% to 80% of predicted), 31.9% severe (FEV1 30% to 50% of predicted) and 4.4% were having very severe (FEV1 < 30% of predicted) degree of airflow

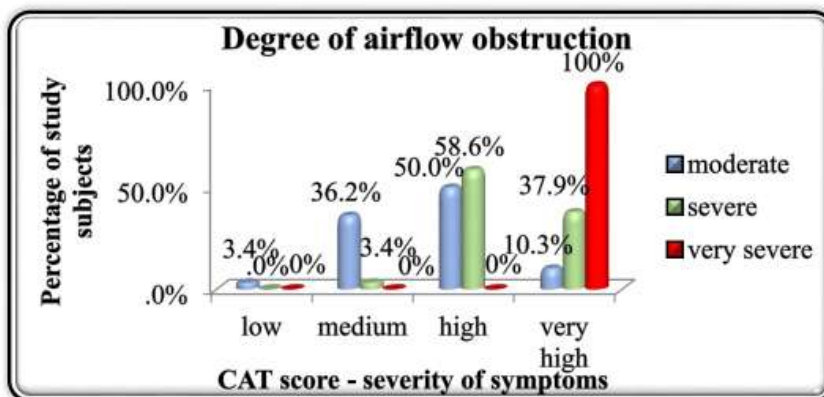
obstruction. Majority (63.7%) were having moderate degree of airflow obstruction. The most commonly reported symptom was cough (70 patients). Dyspnea grade 3 (53.8%) followed by grade 2 (35.1%) was reported by most of the study subjects, as per mMRC grading of dyspnea.

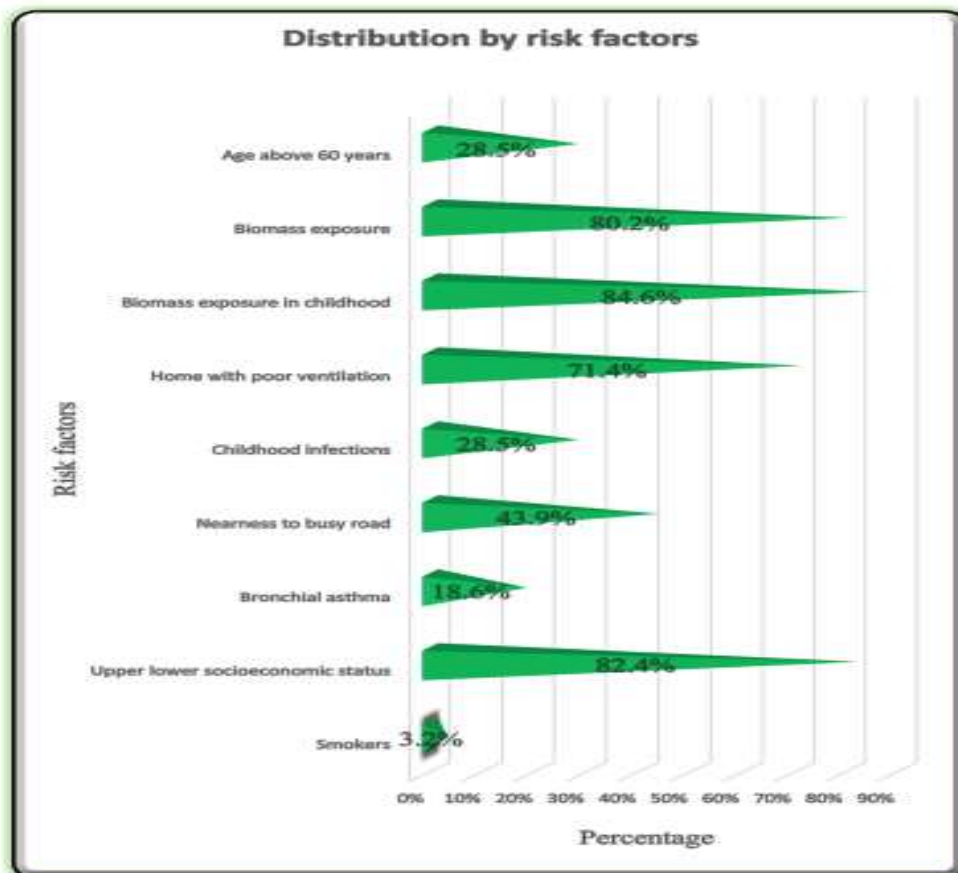
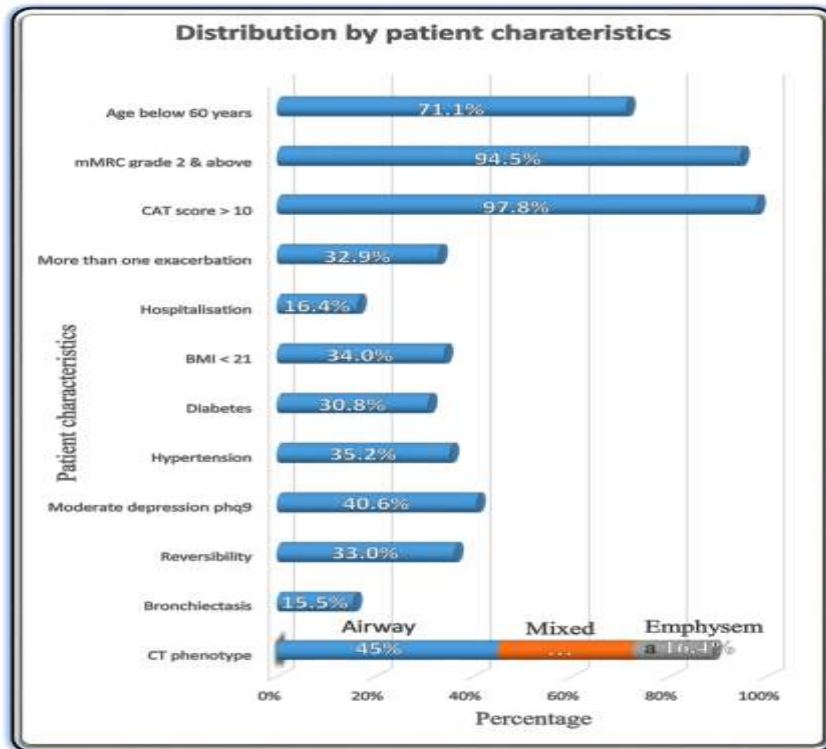
About half of the study subjects (50.5%) were categorized high as per CAT scoring of COPD symptom severity. Majority (82.4%) of the study subjects were belonging to upper lower scale of socio economic status as per modified Kuppaswamy's classification.

44% of the study subjects reported living in proximity to a busy road. About 15.4% of study subjects gave history of asthma more than 10 years. Prevalence of diabetes among the study population was found to be 30.8%. Only 3 study subjects revealed a history of tobacco smoking and all were of moderate smoking index (100 – 300). Exposure to second hand tobacco smoke was found in 44%. 59.3% of the study subjects had a biomass exposure index greater than 60.

Variables significantly associated with degree of airflow obstruction in COPD patients include elderly age, mMRC grade of dyspnea, CAT scoring of symptom severity, exacerbations, biomass exposure index, number of years of biomass exposure, pulmonary hypertension, exercise capacity by 6MWD, and body mass index.

Fig 32: CAT score grading and degree of airflow obstruction





VI. DISCUSSION



This cross sectional study was conducted on 91 female patients aged above 40 years presenting with symptoms suggestive of Chronic Obstructive Pulmonary Disease at the OPD. This research was done in order to study the prevalence, socio-demographic, clinico-radiological profile and also correlation of COPD assessment test (CAT) and degree of airflow obstruction in females.

Majority (63.7%) of our study subjects were having moderate degree of airflow obstruction. Similarly, more than half of the study population of Sumer C et al too was suffering from moderate degree of airflow obstruction as evident by their FEV1 values.[21]

CAT scoring was significantly associated ($p=0.000$) with the degree of airflow obstruction in the present study. This association of CAT score with the degree of airflow obstruction was also significantly observed by Sumer C et al.[21]

Out of the 35 who were homemakers, 28 had exposure to biomass fuel at home thus exposing them for longer hours. In our study 17 were constructional workers, another 17 agricultural workers, 5 were sweepers, 5 were cooks, 5 housemaids and 4 were flour handlers. These exposures were proven as significant risk factors for the development of COPD by John Dement et al[22]

In the present study, 73 out of 91 females had a history of exposure to biomass fuel during cooking. The mean biomass exposure index was 56.33 with a standard deviation of 38.71. In a meta-analysis conducted by Guoping Hu et al, [6] the authors concluded that individuals exposed to biomass smoke were more than two times likely to develop COPD compared to those not exposed

VII. CONCLUSION:

In this study the prevalence of airflow obstruction in female COPD (as defined by GOLD guidelines) as follows: 0% mild degree, 63.7% moderate, 31.9% severe and 4.4% very severe degree of airflow obstruction. Smoking was present in only 3.2% of the female COPD patients. The most prevalent risk factor for two thirds of the research group was exposure to solid biomass fuel at home, with a biomass exposure index more than 60. With a high CAT score for symptom severity and mMRC grade 3 dyspnoea, cough was the most frequently reported symptom among the study participants. After taking a bronchodilator, one-third of the patients saw considerable reversibility, and their elevated peripheral eosinophil count likely indicated an overlap with asthma. Airway predominance was the most prevalent CT phenotype, followed by mixed phenotype and

emphysematous predominance, which was the least prevalent kind. The degree of airflow obstruction was found to be statistically significantly correlated with the following clinico-radiological parameters: body mass index, exercise capacity by 6MWD, number of exacerbations, mMRC grade of dyspnoea, and CAT grading of symptom severity. This study emphasises the need for more social awareness, particularly among women, on the need to switch to alternative fuels for cooking instead of solid biomass fuel at home.

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