



Study of role of nicotine dependence in assessing the severity of chronic obstructive pulmonary disease in chronic smokers

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Abstract

Chronic obstructive pulmonary disease continues to be a major cause of morbidity and mortality worldwide. Developing countries like India have a predominant population of unskilled labourers with poor socioeconomic status contributing to nicotine dependence. Majority subjects in our study were in age group of 25-34 years; with 63% of subjects were unskilled labourers. Nicotine dependence and severity of COPD were assessed through the Fagerstrom test score, Nicotine dependence severity scale, GOLD staging of COPD. The results showed, there was significantly higher Fagerstrom test score among COPD group compared to control by 2 score points indicating higher nicotine dependence among COPD cases as per Fagerstrom scores. The increase in severity of COPD in terms of FEV1 was significantly associated with Fagerstrom test score ($r=0.385$, $p<0.0001$). Fagerstrom test score was also significantly associated with other form of severity of COPD, St George severity scoring total St George scoring ($r=0.41$, $p<0.0001$), impact component ($r=0.41$, $p<0.0001$), activity component ($r=0.39$, $p<0.0001$), symptom component ($r=0.41$, $p<0.0001$). Fagerstrom test score is significantly correlated with COPD assessment Test, $r=0.3$, $p=0.02$. There was no statistically significant association between Fagerstrom test score category of nicotine dependency with severity of COPD as per GOLD guidelines.

Keywords: COPD, nicotine dependence, fagerstrom, emphysema, FEV1

Introduction

Chronic obstructive pulmonary disease (COPD) is a pulmonary disease (as emphysema or chronic bronchitis) that is characterized by chronic typically irreversible airway obstruction resulting in a slower rate of exhalation. COPD is a major contributor to global mortality and morbidity and its worldwide prevalence is predicted to increase further [1]. Smoking is the single most important cause of COPD, increasing the risk of developing and dying from this condition by a factor of 13 [2, 3]. It is vital to determine the scale of the problem of nicotine dependence in this vulnerable group, and the extent to which resources need to be put into place to tackle it. Moreover, many people with COPD do not recognize that they have this condition [4, 5] and would benefit greatly from stopping smoking [6, 7]. Cigarette smoking intensity is known to be associated with clinical features of COPD such as the rate of lung function decline [8-10] and COPD exacerbation frequency [11, 12]. In addition, it is correlated with symptoms of chronic bronchitis even in healthy smokers [13]. Nicotine dependence develops in many smokers, and smokers with dependency to nicotine tend to have increased smoking intensity [14]. Thus, nicotine dependence may increase the impact of smoking exposure due to altering the frequency or depth of smoke inhalation, even in COPD patients with the same pack-year history. As a result, it is reasonable to hypothesize that increased dependence to nicotine would facilitate the development and progression of COPD.

Aims & Objectives of the study

To study the correlation between Nicotine Dependence and severity of COPD in chronic smokers attending the Department of Internal medicine and Department of Psychiatry at Kanachur institute of Medical sciences, Mangalore

Materials and Methods

a. Source of data

100 patients with a history of smoking diagnosed with COPD at the Department of Internal Medicine, Kanachur institute of Medical sciences, Mangalore and 100 patients with a history of smoking without COPD brought to the Department of Psychiatry and Internal Medicine.

b. Methods of data collection

The following scales were applied

1. St George's respiratory questionnaire

Author-Professor Paul Jones introduced the scale in 1992.

The SGRQ is designed to measure health impairment in patients with COPD.

Part 1 (Questions 1-8) addresses the frequency of respiratory symptoms. It is not designed to be a precise epidemiological tool, but to assess the patient's perception of their recent respiratory problems.

Part 2 (Sections 9-16) addresses the patient's current state (i.e.

how they are these days).The Activity score measures

disturbances to daily physical activity. The Impacts score covers a range of disturbances of psycho-social function. The Impacts score is, therefore, the broadest component of the questionnaires, covering the whole range of disturbances that respiratory patients experience in their lives.

2. Gold staging for COPD (COPD Severity Scale)

Gold is short for the Global Initiative for Chronic Obstructive Lung Disease, collaboration between the National Institutes of Health and the World Health Organization introduced the scale in 2006. The GOLD staging system classifies people with COPD based on their degree of airflow limitation (obstruction). The airflow limitation is measured during pulmonary function tests (PFTs).

Pulmonary function tests used to diagnose COPD and its severity:

- The volume in a one-second forced exhalation is called the forced expiratory volume in one second (FEV₁), measured in liters.
- The total exhaled breath is called the forced vital capacity (FVC), also measured in liters.
- In people with normal lung function, FEV₁ is at least 70% of FVC.

In GOLD COPD, classifications are then used to describe the severity of the obstruction or airflow limitation. The worse a person's airflow limitation is, the lower their FEV₁. As COPD progresses, FEV₁ tends to decline. GOLD COPD staging uses four categories of severity for COPD, based on the value of FEV₁:

Table 1

Stage I	Mild COPD	FEV1/FVC<0.70	FEV₁≥ 80% normal
Stage II	Moderate COPD	FEV1/FVC<0.70	FEV ₁ 50-79% normal
Stage III	Severe COPD	FEV1/FVC<0.70	FEV ₁ 30-49% normal
Stage IV	Very Severe COPD	FEV1/FVC<0.70	FEV ₁ <30% normal, or <50% normal with chronic respiratory failure present*

3. Fagerstrom test for nicotine dependence

Author-Karl Olov Fagerstrom introduced the scale in 1991. The Fagerström Test for Nicotine Dependence is a standard instrument for assessing the intensity of this physical nicotine addiction. The Fagerström test helps professionals document the indications for prescribing medication for nicotine withdrawal. The higher the Fagerström score, the more intense is the patient's physical dependence on nicotine. Higher scores indicate that treatment of withdrawal symptoms, usually with nicotine replacement therapy, will be an important factor in the patient's plan of care.

4. Nicotine dependence syndrome scale

Author- Saul Shiffman introduced the scale in 2003.The NDSS is a multifactorial instrument to assess tobacco dependence.

Factor analysis of the initial 23-item NDSS revealed 5 factors:

- Drive, which captures craving and withdrawal in abstinence
- Priority, which reflects the behavioral preference of smoking over other reinforcers
- Tolerance, which measures the reduced sensitivity to

smoking's effects

- Continuity, which taps the regularity of smoking
- Stereotypy, which assesses the invariance or the "sameness" of smoking
- A single factor overall score was also retained

c. Study Design

The study was done following institutional ethical committee clearance and written consent from the subjects. Patients were informed about the survey and interviewed by a doctor. Adequate privacy and confidentiality was ensured. OPD patients visiting department of internal medicine and attenders of patients visiting psychiatry OPD of KIMS, Mangalore were

recruited for the study.

Inclusion Criteria

1. Patients who were above 18 years of age and who gave informed consent
2. Patients already diagnosed with COPD with a history of smoking
3. No other health problems except complications secondary to COPD

Exclusion Criteria

1. Not giving informed consent
2. Any psychotic disorders, mental retardation, Alcohol Dependence, Schizophrenia, Diabetes Mellitus, Hypertension, Asthma

Statistical Analysis

1. Statistical Package for Social Sciences (SPSS) Version 19.0 for Windows was used for all analyses.
2. Frequency distributions and measures of central tendency were conducted to characterize the study sample.
3. Chi-square analyses were conducted to evaluate dose response relationship between severity of Nicotine Dependence and severity of COPD.
4. Pearson’s correlation was done between Fagerstrom scores and FEV1 percent predicted, FVC percent predicted and FEV1/FVC.

Results

As per observations from Fig-1, with reference to age wise distribution among study participants, the controls belonged predominantly 25-34 years (45%) followed by 35-44 yrs (32%) and 45-54 yrs (23). However the COPD cases belonged mostly older age group 65-74 yrs (41%), followed by 55-64 yrs (29%) and 45-54 yrs (18%). The age difference was statistically significant ($p < 0.0001$).

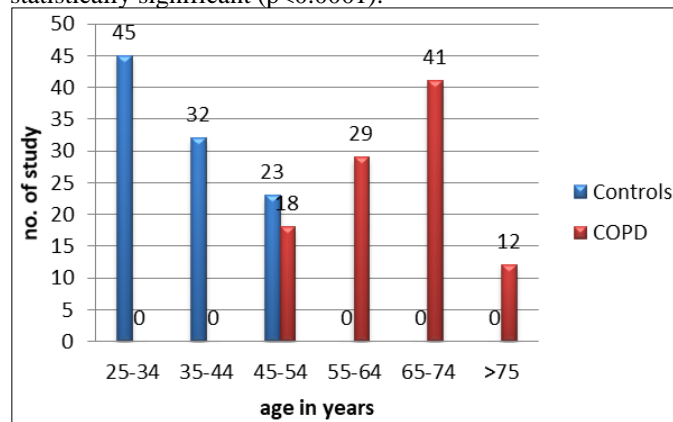


Fig 1: Age wise distribution among Controls and COPD

From Fig - 2, we observe that the Domicile status was similar in COPD case and controls group. Almost 70% were from rural and 30% from urban background.

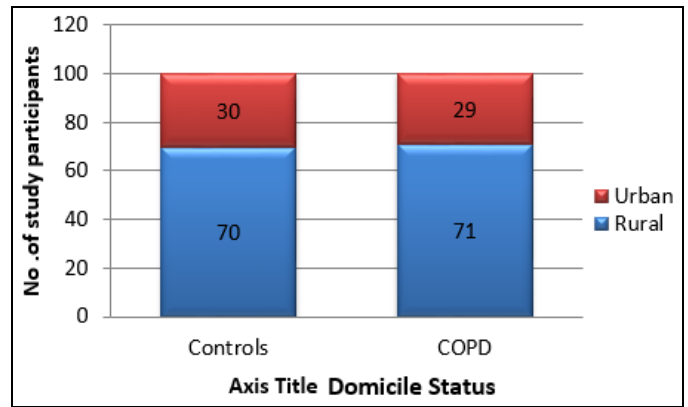


Fig 2: Distribution of domicile status among controls and COPD cases

Table 2: Distribution of Occupation Status among Controls and COPD cases

Occupation	Group			
	Controls		COPD	
	n	%	N	%
Business	3	3.0	12	12.0
Skilled	2	2.0	6	6.0
Semiskilled	13	13.0	18	18.0
Unemployed	19	19.0	12	12.0
Unskilled	63	63.0	52	52.0
Total	100	100.0	100	100.0

From the Table -2 above, with reference to the occupation status, we observed the following;

In controls majority were from unskilled worker (63%), followed by unemployed (19%), semiskilled (13%), Business (3%) and skilled (2%). So the study subjects predominantly belonged to unskilled labor.

In COPD majority were from unskilled worker (52%), followed by semiskilled (18%), unemployed (12%), Business (12%) and skilled (6%). So the study subjects predominantly

belonged to unskilled labor.

The difference in occupation was not statistically significant.

Table 3: Distribution of Housing conditions among Controls and COPD cases

Housing Conditions	Group			
	Controls		COPD	
	n	%	N	%
Common/Shared Room	4	4.0	13	13
Independent Room	96	96.0	87	87
Total	100	100.0	100	100.0

From the Table 3 above, with reference to the Housing Conditions, we observed the following

The majority of study participants in control group were staying in independent room (96%) and very few were having shared room (4%).

The majority of study participants in COPD group were staying in independent room (87%) and very few were having shared room (13%).

Table 3: Mean and Standard deviation Tabulation of Cigarettes /day and Duration of Smoking among Controls and COPD cases

	Group			
	Controls		COPD	
	Mean	SD	Mean	SD
Cigarettes day	26.16	8.92	32.88	12.25
Duration of smoking in years P<0.0001	19.02	8.00	39.65	9.59

The Mean and Standard deviation Tabulation of Cigarettes /day, among study participants, is as per Table 4 above. As can be seen form Table-4, there was s higher cigarette usage among COPD compared to controls. Mean difference of around 6 Cigarettes per day. Similarly there was significantly longer duration of cigarette usage among COPD than controls.

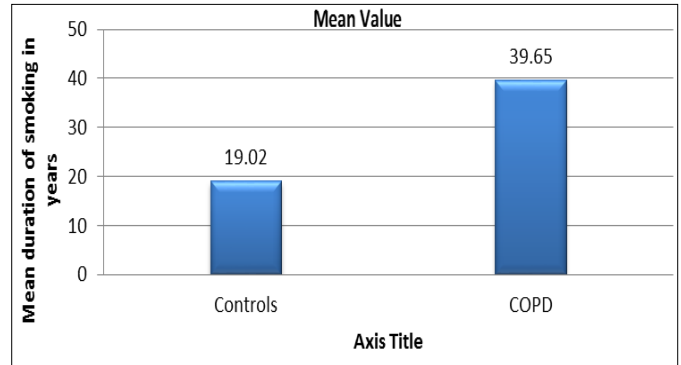


Fig 3: Chart showing Mean values of Duration of Smoking among Controls and COPD cases

The above chart depicts mean values of duration of smoking in among controls and COPD cases. Among cases with COPD had a mean duration value of 39.65 years of smoking history which shows predilection towards positive history of nicotine dependence and COPD occurrence among smokers.

Table 4: Mean and Standard deviation tabulation of nicotine dependency syndrome score and fagerstrom test score among controls and COPD cases

	Group				p	Adjusted p
	Controls		COPD			
	Mean	SD	Mean	SD		
Drive	-1.00	.86	-.91	.97	0.8	0.5
Stereotypy	3.06	1.50	2.85	1.57	0.3	0.9
Continuity	-.71	.90	-.57	.89	0.3	0.2
Priority	1.45	.88	1.41	1.00	0.6	0.6
tolerance	-.61	1.07	-.60	.96	0.9	0.4
Overall score	-.15	.62	-.20	.60	0.3	0.1
Fragerstrom_ test_ ND	3.96	1.40	5.91	1.10	<0.0001	<0.0001

Mean Value

As can be seen from Table -5, there was no statistically significant difference in different components and over all of Nicotine Dependency Syndrome Score. However, there was

significantly higher Fagerstrom test score among COPD group compared to control by 2 score points.

Table 5: Tabulation of nicotine dependency with severity of COPD

		FEV1	Symptoms component	Activity component	Impact component	Total Score	CAT
Fragerstrom_ test_ ND	r	-.385**	.406**	.387**	.411**	.411**	.301**
	p	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	.002
	N	100	100	100	100	100	100
Drive	r	-.124	.166	.124	.161	.161	.080
	p	.218	.099	.221	.109	.109	.429
	N	100	100	100	100	100	100
Stereotypy	r	.025	-.099	-.078	-.113	-.090	-.042
	p	.803	.329	.441	.262	.373	.680
	N	100	100	100	100	100	100

Continuity	r	-.023	.117	.081	.148	.128	.141
	p	.823	.247	.421	.142	.205	.163
	N	100	100	100	100	100	100
Priority	r	.038	-.066	-.044	-.020	-.040	-.110
	p	.707	.515	.666	.840	.695	.276
	N	100	100	100	100	100	100
tolerance	r	-.046	.034	.065	.033	.028	.158
	p	.646	.740	.522	.743	.781	.116
	N	100	100	100	100	100	100
Overall score	r	-.191	.193	.176	.220*	.206*	.121
	p	.058	.055	.079	.028	.040	.231
	N	100	100	100	100	100	100

As per the tabulation above (Table -6), the increase in severity of COPD in terms of FEV1 was significantly associated with Fagerstrom test score ($r=0.385$, $p<0.0001$). Fagerstrom test score was also significantly associated with other form of severity of COPD, St George severity scoring, total St George scoring ($r=0.41$, $p<0.0001$), impact component ($r=0.41$, $p<0.0001$), activity component ($r=0.39$, $p<0.0001$), symptom component ($r=0.41$, $p<0.0001$). Fagerstrom test score is significantly correlated with COPD assessment Test, $r=0.3$, $p=0.02$. This summarizes nicotine dependency in the form of

Fagerstrom test score is significantly associated with severity of symptoms of COPD. This implies higher dependency is associated with severity of COPD.

The overall NDSS score is significantly correlated with impact component and total St George scoring system ($r=0.22$, $p=0.028$, $r=0.21$, $p=0.04$). However, NDSS was not correlated significantly with activity and symptom component of St George Scoring system. None of the components of NDSS is significantly correlated with severity of COPD.

Table 6: Association between fagerstrom test score category of nicotine dependency with severity of COPD as per GOLD guidelines.

Fev1cat	FTND					
	Low to Moderate Dependence		Moderate Dependence		High Dependence	
	N	%	n	%	n	%
Mild COPD	1	14.3	6	85.7	0	.0
Moderate COPD	8	9.3	72	83.7	6	7.0
Severe COPD	0	.0	5	71.4	2	28.6

$P=0.25$, chi-square test

As can be seen from Table 7, there was no statistically significant association between Fagerstrom test score category of nicotine dependency with severity of COPD as per GOLD guidelines. This is because majority of study subjects 83/100 were in moderate dependency group.

Discussion

The observed relationship between cigarette smoking and COPD appears to be confounded by DSM-IV nicotine dependence, as nicotine dependence is strongly associated with both an increased odds of cigarette smoking and COPD. The consistency of these findings with previous results as well as the clinical implications will be discussed below.

1. Sociodemographic Variables

Only male patients with a history of smoking have sought treatment for COPD, though it was not an exclusion criterion for female subjects. In this study, the subjects in the Controls group, about 45% belonged predominantly to the 25-34 years age group, followed by 32 % in the 35-44 yrs age group and 23% in the 45-54 yrs age group, however the COPD cases belonged mostly to the older age group, about 41% in the 65-74 yrs age group, followed by 29% in the 55-64 yrs age group and 18% in the 45-54 yr s age group. This age difference between cases and controls is probably because the younger age groups who were keener to quit smoking consulted the psychiatry OPD.

Domicile status of the subjects was similar in COPD cases and

Controls group. Almost 70% were from rural and 30% from urban background.

The difference in occupation status between the COPD and Control groups was not statistically significant, with the study subjects predominantly belonged to unskilled labour category. In the Controls group, the majority, 63%, were from unskilled worker, followed by 19% unemployed, semiskilled 13%, Business 3% and skilled 2%. In COPD Group majority were from unskilled worker 52%, followed by semiskilled 18%, unemployed 12%, Business 12% and skilled 6%.

The majority of study subjects in control group were staying in independent room (96%) and very few were having shared room (4%). The majority of study subjects in COPD group were staying in independent room 87/100 and very few were having shared room (13/100).

2. Comparison of the two study groups (a) with COPD and (b) Controls (without COPD)

2(a) Cigarettes smoked per day and duration of smoking

With reference to the mean number of cigarettes smoked per day by the study subjects, There was higher cigarette usage among COPD (32.88) compared to controls (26.16). Mean difference of around 6 Cigarettes per day. Which is in accordance with Report on Tobacco control in India, about 90% of the study participants smoked more than 15 cigarettes/ beedies per day. Recent population studies from the US [15, 16, 17] and Europe [18, 19, 20] have similarly found high rates of current smoking among individuals with COPD in the 30-40%

range.

With reference to the mean duration of smoking in years by the study subjects, there was significantly longer duration of cigarette usage among COPD(39.65) than controls(19.02) indicating that duration of smoking is associated strongly in the progression of COPD.

As per a study published in India the risk of COPD increases with increase in the number of cigarettes as well as with the duration of smoking [21]. The study reported that prevalence of COPD in smokers with less than 20 pack years (smoking 20 cigarettes (1 pack) per day for 20 years) was 9.6%, which increased to 18% in subjects who smoked more than 20 pack years.

2(b) Review of scales for assessment of nicotine dependence

Nicotine dependence remains a substantial problem worldwide. Of those individuals who have ever tried smoking, about one-third becomes daily smokers [22]. Although not all smokers become nicotine dependent, the prevalence of individuals diagnosed as nicotine dependent is higher than that for any other substance abuse disorder [23, 24, 25]. Since 1991, FTND is one of the most widely accepted evaluative instruments to establish and quantify nicotine dependence and also has been found to be reliable and valid in several different contexts [26, 27].

The NDSS is a 19-item self-report measure. This measure is scored using factor loadings. To calculate an individual's score on each subscale and on the total NDSS, we must multiply the participant's answer on each question by the specific factor loading provided by [28] and then sum each factor-adjusted answer relevant to the subscale being calculated. Some items are reversed scored and have negative factor loadings. The chief value of the NDSS may be that it permits assessment of particular motivational influences on smoking and may be more sensitive to particular smoking motive. The different patterns of relations of scales with criteria may suggest different causal influences on smoking features or outcomes, a notion that has been studied for more than 40 years among researchers of smoking motivations [29, 30, 31, 32, 33].

The FTND consists of six forced-choice questions regarding smoking preferences, and has been shown to be a reliable and valid instrument for assessing level of nicotine dependence and distinguishing heavier smokers from lighter smokers: the coefficient alpha for the FTND is 0.61 [34], and each item has been biochemically validated as a measure of nicotine dependence. FTND scores of 4 or greater reflect high dependence [35].

2(c) Mean and Standard deviation of Nicotine dependence among COPD and controls

In the present study, there was no statistically significant difference in different components and over all of Nicotine Dependence Syndrome Score. However, there was significantly higher Fagerstrom test score among COPD group compared to control by 2 score points indicating higher nicotine dependence among COPD cases as per Fagerstrom scores. This also indicates a higher sensitivity to nicotine dependence among COPD patients by Fagerstrom scale.

Renee *et al.* in a study on the role of nicotine dependence in COPD, depression and anxiety observed that 36.0% of those with COPD had lifetime nicotine dependence and almost 1 in 10 individuals with nicotine dependence had COPD [36].

2(d) Nicotine dependency with severity of COPD

The increase in severity of COPD in terms of FEV1 was significantly associated with Fagerstrom test score ($r=0.385$, $p<0.0001$). Fagerstrom test score was also significantly associated with other form of severity of COPD, St George severity scoring total St George scoring ($r=0.41$, $p<0.0001$), impact component ($r=0.41$, $p<0.0001$), activity component ($r=0.39$, $p<0.0001$), symptom component ($r=0.41$, $p<0.0001$). Fagerstrom test score is significantly correlated with COPD assessment Test, $r=0.3$, $p=0.02$. This summarizes nicotine dependency in the form of Fagerstrom test score is significantly associated with severity of symptoms of COPD. This implies higher dependency is associated with severity of COPD. In a study by Kim *et al.* Among 842 currently smoking subjects (335 COPD cases and 507 controls), 329 subjects (39.1%) showed high nicotine dependence. Subjects with high nicotine dependence had greater cumulative and current amounts of smoking. However, emphysema severity was negatively correlated with the FTND score in controls as well as in COPD cases and the FTND score decreased with increasing GOLD stage [37]. In a study by Nicholas *et al.* after adjusting for sociodemographic and smoking behavior confounders, among current smokers, greater odds of high or very high nicotine addiction were observed among women with versus without COPD and among women with versus without asthma [38]. Similar to previous studies [39, 19, 20] we have found increased nicotine dependence among smokers with COPD

There was no statistically significant association between Fagerstrom test score category of nicotine dependency with severity of COPD as per GOLD guidelines. This is because majority of study subjects (83%) were in moderate dependency group.

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