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Assessment of chronic obstructive pulmonary disease in rural women

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Abstract   COPD is now recognized as a common disease in developing countries. Biomass smoke exposure, is the biggest risk factor for COPD in women, however the awareness of COPD in non-smoking women is low. COPD is one of the fastest growing causes of death. Seventy-five percent of rural households reported firewood as their primary cooking fuel as compared to only 22% of urban households. Pulmonary function tests are essential for the diagnosis and evaluation of the severity of COPD but other measures of functional status are important; these include assessment of dyspnea, exercise performance and health status. The COPD assessment test (CAT) is a new eight-item specific questionnaire and is intended to provide a short, simple and self-administered test.

Objective: To compare the use of CAT scores and flow volume loop as a screening tool in COPD women.

Methods: A total of 50 healthy controls and 200 patients with newly diagnosed COPD were recruited. Pulmonary function test (PFT) values, COPD assessment test (CAT) scores, and demographics were recorded.

Results: More than half of the patients (83%) had a high CAT score of $\geqslant 10$. Forced expiratory volume in 1 s percent (FEV1%) predicted was significantly decreased and the CAT score was significantly increased in patients with COPD compared with healthy controls ($r = -.598$, $p = .000$). A positive correlation was seen between biomass duration and the CAT score ($p = .000$).

Conclusion: Most COPD patients have a poor health status and have a history of chronic symptoms before definitely being diagnosed with COPD by spirometry.

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Introduction

COPD, once regarded as a disease of developed countries, is now recognized as a common disease in developing countries. While the main contributing factors to COPD in developed countries are cigarette smoke and occupational causes, exposure to solid fuel smoke is a major contributing factor in developing countries [1].

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Biomass smoke exposure, is the biggest risk factor for COPD in women, however the awareness of COPD in non-smoking women is low [2]. COPD is one of the fastest growing causes of death; from its sixth position in 2000, it is expected to climb to the third position within a period of 20 years (2020) [3]. According to WHO estimates, 700,000 out of the 2.7 million global deaths due to COPD could be attributable to indoor air pollution from solid fuels, particularly in females [4]. Approximately 50% of the world's population use biomass fuels as the primary source of domestic energy such as cooking, light, and heat, often in dwellings where ventilation is poor [5]. Seventy-five percent of rural households reported firewood as their primary cooking fuel as compared to only 22% of urban households [6]. Typical biomass cook stoves convert 6–20% of the fuel carbon to toxic substances. Burning biomass fuels emits toxic fumes into the air [7]. Although the underlying mechanisms for the development of COPD among nonsmokers exposed to biomass fuels are still unknown, some human challenge and toxicological studies have reported that biomass burning produces chemicals with high oxidative potential, and have implicated that oxidative stress and DNA damage are underlying mechanisms responsible for the pathogenesis of COPD [1]. Pulmonary function tests are essential for diagnosis and evaluation of the severity of COPD but other measures of functional status are important; these include assessment of dyspnea, exercise performance and health status. The St George's Respiratory Questionnaire (SGRQ) and the modified Medical Research Council (mMRC) dyspnea scale which is a revised version of Medical Research Council dyspnea scale; are the most commonly used validated health-related quality of life measurements in COPD patients. However, the SGRQ is complex and time-consuming to complete. The COPD assessment test (CAT) has recently been developed based on the SGRQ and is intended to provide a short, simple and self-administered instrument for routine use [8]. The COPD Assessment Test (CAT), is a new eight-item specific questionnaire [3]. Eight questions are covering the most burdensome symptoms of COPD such as breathlessness and limitations in daily activities [9].

Objective

To compare the use of CAT scores and flow volume loop as screening tool in COPD women.

Methods

This study was conducted at the outpatient clinics of the Fayoum University Hospitals. We recruited participants from female patients with past exposure to biomass smoke. From January 2012 to January 2014, we analyzed 390 patients who underwent spirometry and Arabic version of the CAT questionnaire was distributed to all participants. A total of 50 healthy controls were also enrolled. The control subjects were with approximately the same age as the patients. All the subjects underwent spirometry with a bronchodilator test. Patients were recruited if they met the established guidelines of GOLD: forced expiratory volume in one second/forced expiratory volume (FEV1/FVC) ratio < 0.7. [10]. When all the subjects were included in the study, a detailed medical history was complied. The study was approved by Faculty of Medicine, Fayoum

University ethics committee. All enrolled patients provided written informed consent before the study procedures. The COPD assessment test (CAT) comprises eight items. The eight items cover cough, expectoration, chest tightness, and breathlessness going up hills/stairs, activity limitations at home, confidence leaving home, sleep and energy. CAT score of ⩾10 is an indicator of a high level of symptoms.

Statistical analyses

Data were coded and entered using the statistical package SPSS version 15. Data were summarized using descriptive statistics: mean and standard deviation for quantitative normally distributed variables while median and range were used for quantitative variables, which are not normally distributed. Number and percentage were used for qualitative values. Statistical differences between groups were tested using the Chi Square test for qualitative variables, independent sample t test for quantitative normally distributed variables while the Nonparametric Mann–Whitney test was used for quantitative variables which are not normally distributed. Correlations were done to test for linear relations between variables. P-values less than or equal to 0.05 were considered statistically significant [11].

Results

A total of 200 patients were recruited from outpatient clinics. The mean age was 51.95 ± 6.6 years. The average FEV1 was $61.79\% \pm 20.16$ of predicted. CAT score mean was 16.75 ± 6.77 and duration of biomass was 24.04 ± 8.53. Table 1 shows the general characteristics of the study population.

Patients were stratified by CAT scores in relation to age and FEV1. The number of patients with a CAT score of ⩾10 was higher than to that of patients with a score of < 10 (34 vs. 166). Age and Forced expiratory volume in 1 s percent (FEV1%) predicted was decreased in patients with a high CAT score ⩾10 (Table 2).

Forced expiratory volume in 1 s percent (FEV1%) predicted and the CAT score were significantly correlated; low CAT score was detected only in mild (40.9%) and moderate (16.3%) COPD while a high CAT score was observed in severe (48%) and very severe (10%) COPD in addition to mild

Table 1 General characteristics of patients.

Characteristics	Mean ± SD (N = 200)
Age, mean (SD)	51.95 ± 6.66
FEV1	61.79 ± 20.16
CAT	16.75 ± 6.77
Comorbidities	(8)
Duration of biomass	24.04 ± 8.53

Table 2 General characteristics of CAT between patients.

	Number	Age	FEV1
CAT < 10	34 (17%)	47.94 ± 5.44	77.17 ± 13.86
CAT ⩾ 10	166 (83%)	52.77 ± 6.62	58.65 ± 19.85

Table 3 Correlation between CAT score and FEV1.

	Mild	Moderate	Severe	Very severe	p-Value
CAT < 10	18 (40.9%)	16 (16.3%)	0 (0%)	0 (0%)	.002
CAT ⩾ 10	26 (59.1%)	82 (83.7%)	48 (100%)	10 (100%)	

Table 4 Correlation between CAT score and FEF (25–75%).

	Normal	Mild	Moderate	Severe	Very severe	p-Value
CAT < 10	20 (34.5%)	10 (21.7%)	2 (5.0%)	2 (9.1%)	0 (0%)	.013
CAT ⩾ 10	38 (65.5%)	36 (78.3%)	38 (95.0%)	20 (90.9%)	34 (100%)	

Table 5 Correlation between CAT score and biomass duration.

	Biomass duration	p-Value
CAT < 10	34 (18.29 ± 7.03)	.003
CAT ⩾ 10	166 (25.22 ± 8.36)	

(59.1%) and moderate (83.7%) COPD as shown in Table 3. High CAT score was detected in normal (65.5%), mild (78.3%), moderate (95%), severe (90.9%) and very severe (100%) small airway disease (Table 4).

Table 5 shows that there was a positive correlation between age, biomass duration and the CAT score ($r = .268$, $p = .007$) ($r = .514$, $p = .000$), while there was a negative correlation between FEV1 and CAT score ($r = -.598$, $p = .000$) as shown in Table 6.

Discussion

The promotion of women who represent half of the society and an important axis of development is considered an essential step. The representation of women in the labor force in Fayoum is not high, this is due to prevailing customs and tradition which do not favor women's work. Most of the women were identified to have biomass fuels exposure especially early years of their lives and this is due to low income in the Fayoum governorate.

At least one fourth of patients with COPD are non-smokers and the burden of COPD in non-smokers is also higher than previously believed. Indoor and outdoor air pollution may play important roles in the pathogenesis of COPD in non-smokers [12].

Data from the present study, which was carried out in a representative sample of COPD women referring to outpatients clinics of the Fayoum University Hospital, confirm the sensitivity and the consistency of the CAT questionnaire, and lead to suggest its use as a quick and specific clinical tool for assessing the health status in newly diagnosed COPD patients.

Our study population who were living in Fayoum governorate, experienced household exposure to biomass fuel used for cooking. Biomass fuel consists of firewood, dung cakes, agricultural crop residues [6]. The patient profiles were in terms of age mean 51.95 years, FEV 1% predicted (mean 61.79).

The CAT is designed to assess the condition of patients and quantify the impact of COPD symptoms on patients' health status and to improve patient–physician communication. CAT scores have been associated with important representative parameters of the disease, such dyspnea and exercise capacity [13].

More than half of the patients (83%) had a high CAT score ⩾10 indicating a high level of symptom. CAT score <10 was found in patients with mild (40.9%) and moderate (16.3%) obstruction while CAT score ⩾10 was observed in mild (59.1%), moderate (83.7%), severe (100.0%) and very severe (100.0%) obstruction with highest percent in severe and very severe.

The correlation between CAT score and FEV 1% predicted was significant ($r = -.598$, p-value = .000). There was an inverse correlation between CAT and FEV1 compared with healthy controls, these results suggest that health impairment due to COPD is associated by low FEV1 and a high CAT score. The association of the CAT score with % FEV1 was modest ($r = -0.258$, $p < 0.001$) in the Miyazaki et al. study [14].

Results for CAT score and GOLD classification revealed a strong positive correlation ($P = .000$). This agrees with Ghobadi et al. study who revealed statically significant ($P < 0.001$) correlation between GOLD classification and their mean CAT score [15].

Even if the CAT score obviously proves significantly inversely correlated to the values of lung functions, it is not strictly linked to them: in other words, it is not an alternative measurement to lung function but, on the opposite, it focuses on different areas of the respiratory health in COPD patients so providing a useful tool in screening. Spirometry is the most objective measurement of airflow limitation to determine the severity of COPD [16].

Table 6 Correlation between CAT and age, biomass duration, FEV1 and FVC.

	Age		Biomass duration		FEV1	
	r	p-Value	r	p-Value	r	p-Value
CAT	.268	.007	.514	.000	−.598	.000

The mean CAT score in this study was 16.75 ± 6.77, which meant COPD significantly impaired the health status of the patients while mean CAT score in the Ghobadi et al. study was 19.61 ± 8.07 [15] while mean CAT in Japan was 12.4 ± 8.3 in the study by Miyazaki et al. [14].

Mean CAT score was 20.4 ± 7.6 in 120 patients from Gulf Cooperation Council countries in the Al Moamary et al. study [17].

On the contrary, Jones PW reported that health status scores were weakly correlated with FEV1 ($r = -0.23$, $p < 0.001$) [18].

Our results indicate that the CAT score is significantly correlated with age and biomass duration ($r = .268$, p-value $= .007$) ($r = .514$, p-value $= .000$) respectively. CAT score $\geqslant 10$ was associated with longer duration of biomass exposure (25.22 ± 8.36) than CAT score < 10 which was associated with (18.29 ± 7.03).

Conclusions

The CAT questionnaire is a sensitive test in detecting COPD as a simple and reliable tool which is capable of measuring COPD related health regardless of language differences. Most COPD patients have a poor health status and have a history of chronic symptoms before definitely being diagnosed with COPD by the spirometry. Patients' and clinicians' awareness of COPD should be improved to make an early diagnosis.

Conflict of interest

No conflict of interest in this work.

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