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Risk assessment for COPD using chronic CAT questionnaire and Vitalograph COPD-6 screening device

Muaed Jamal Alomar*

College of Pharmacy, Al Ain University of Science and Technology, Al Ain, Abu Dhabi, UAE

ABSTRACT

Aim: The aim was to evaluate the impact of the area of residence on lung capacity as a risk factor for chronic obstructive pulmonary disease (COPD) among the people of Fujairah, UAE. **Settings and Design:** After taking the permission from the manager of Fujairah City Center to carry out the study in the mall, COPD assessment test (CAT) and Vitalograph COPD-6 screening device were used for patient evaluation. **Materials and Methods:** Two hundred and eighty people were randomly selected based on specific inclusion and exclusion criteria to undergo lung examination using Vitalograph COPD-6 Screening device and CAT questionnaire. **Statistical Analysis Used:** SPSS version 17 was used for data analysis and statistical testing. The significance was tested using sample *t*-test of independent variables for equality of means (Levene's test for equality of variance). **Results:** Both genders (age mean = 31.25 years old) regardless of race and ethnicity were included in the study; the male to female ratio was 3:1. Among male smokers, 88% from those who live in the city center area had COPD score (COPDS) <10, while in the area near the port 59% had COPDS <10. On the other hand, the mean of forced expiratory volume in 1 second (FEV1) and FEV ratio was much lower among male smokers and non-smokers who live in the port area than those who live in the center of the city. **Conclusion:** Further focused and follow-up studies are needed to measure the seriousness of air pollution on the respiratory system in the Gulf region.

Key words: Capacity, chronic obstructive pulmonary disease, fumes, lung, smoking

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a serious pulmonary disease, which affects respiration process. COPD represents chronic lung diseases that cause limitations in lung airflow according to World Health Organization.[1] Eisner in an official American thoracic society public policy statement defines COPD as a limitation in the airways, which is irreversible to a certain extent which leads to serious inflammatory responses toward any foreign airborne hazards.[2] COPD is a disease manifested by a reduction in the expiratory air flow and a restriction in the exhalation process.[3,4] The aim of this study was to evaluate the impact of the area of residence on lung capacity as a risk factor for COPD among the people of Fujairah, UAE. COPD assessment test (CAT) and Vitalograph COPD-6 screening device were used for patient evaluation.

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MATERIALS AND METHODS

A selected sample of 280 individuals was examined for chronic obstructive pulmonary disease by Vitalograph

**Address for correspondence:*
Mr. Muaed Jamal Alomar, P.O.Box 222319, Al Ain, Abu Dhabi, UAE. Tel.: 00971507157641. E-mail: muayyad74@yahoo.com

COPD-6 screening device (with 280 disposable mouth peaces) and CAT questionnaire (an international questioner based on 10 questions each one rated from 0 to 5). CAT score <10 indicates low impact from COPD (most days are good; condition stops people from doing one/two things they want to do; cough several days a week), CAT score >10 indicated medium to very high impact from COPD (frequent coughing, frequent mucus production, limited activity at home, impact on self-confidence, potential impact on sleep). The summations of these points categorize the lungs health state of each patient. The CAT assessment questionnaire is a product of GlaxoSmithKline group of companies. Permission was taken from the manager of Fujairah City Center to carry out the study in the mall. For each person, a brief idea of the disease was given with some advice to prevent or minimize the progression of the disease. Twenty to sixty years old smokers, ex-smokers or non-smoker men and women living in Fujairah for more than 1 year were included, and pregnant women were excluded. Statistical analysis uses the calculated mean as a value for forced expiratory volume in 1 second (FEV1) and FEV/forced vital capacity (FVC) ratio. Sample *t*-test of independent variables and Chi-square tests were used to measure the level of significance considering $P = 0.05$ is the limit of significance.

RESULTS

Two hundred and eighty people were tested over a period of 2 days. CAT questionnaire and Vitalograph COPD-6 screening device were used to measure lung capacity. These tests provide three readings: FEV1, FEV ratio, and COPD score. Age was normally distributed with some positive skewness. No preferences were used in selecting patients regarding race or nationality since the main objective of this study was to measure occupational hazards and their impact on pulmonary function. Fujairah City Centre (Mall) was chosen as the venue for the study due to its size, which would imply a larger number of people. A stand showing posters on the importance of lung function testing was set up in a strategic location. People were invited to do the test and listen to some information about the importance of testing lung function.

Both genders, regardless race and ethnicity, were included in the study; the male to female ratio was 3:1 (Table 1). This ratio reflects the nature of the population in the UAE (the estimate of the total population was about 8,264,070 persons according to national bureau of statistics, 2010). The age distribution (mean = 30.25 years old) between 20 and 60 years old.

Two main areas were included in the study: The city center of Fujairah (which is located about 2-3 km away from the seaside where the port is located) and the port area (which contains a small refinery, refueling tanks, quarries, and sea freight). Some of the participants from outside Fujairah were included in the study while they were visiting the area. All participants except visitors had been living in Fujairah for more than one year. The majority of male participants were smokers and ex-smokers while the majority of female participants were non-smokers. Among male smokers, 88% of those who live in the city center area had COPD score (COPDS) <10, while in the area near the port 59% had COPDS <10. On the other hand, the mean of FEV1 and FEV ratio was much lower among male smokers and non-smokers who live in the port area than those who live in the center of the city. There was one exception in which FEV1 was higher among non-smokers who live near the port. The level of significance among male people with COPDS <10 who live in the city center area and those who live in the port area is illustrated in Table 2. The significance was tested using sample *t*-test of independent variables for equality of means (Levene's test for equality of variance). A comparison between locations among female smokers with COPDS <10 was invalid due to a lack of enough samples. This was due to the fact that the percentage of female smokers among female participants was 19% (Table 1). Table 2 shows the significant impact of location on FEV/FVC ratio. Occupational hazards and environmental pollutions play a major role in the development of lung diseases. This result is no different in male or female (Table 2), both genders were shown to be affected equally especially among non-smokers (Table 3). This study provides evidence that gender has no impact on the level of lung function when non-smokers were compared. Age factor does not seem to play a major role in this study since the difference in age (mean) between people living in different areas was not significant. The habit of smoking is more common among males (56%) than females (19%) with high statistical significant difference of $P = 0.001$ (Chi-square test). Table 4 shows the insignificant difference between smokers and non-smokers on the effect of FEV1 and FEV/FVC ratio. This comparison was done regardless of the area of residence. When FEV1 and FEV/FVC ratio were compared between smokers and non-smokers in the port area where more air pollution was expected, the results were different: FEV1 shows no significant difference, but FEV/FVC ratio shows a highly significant difference (Table 4).

DISCUSSION

Fujairah has a distinctive location between the Indian ocean from one side and rocky mountains on the other side.

Table 1: COPD risk assessment cross tabulation

Location	Gender (total=280, Age (mean=30.25 years old)																
	Male=211 (75%)									Female=69 (25%)							
	S=118 (56%)			EX=11 (5%)			*N*=82 (39%)			S=13 (19%)			EX=3 (4%)			*N*=53 (77%)	
	COPDS >10	COPDS <10	COPDS =10	COPDS >10	COPDS <10	COPDS =10	COPDS >10	COPDS <10	COPDS =10	COPDS >10	COPDS <10	COPDS =10	COPDS >10	COPDS <10	COPDS =10	COPDS >10	COPDS <10	COPDS =10
CC	17	65	2	4	7	0	4	41	0	5	6	1	1	2	0	13	24	1
NRQ	12	19	1	0	0	0	6	24	0	0	0	0	0	0	0	3	12	0
V	0	2	0	0	0	0	1	6	0	0	1	0	0	0	0	0	0	0
Total																		
	FEV1 (mean)																	
CC	86	89	86	82	93	0	86	90	0	96	78	90	82	96	0	88	87	100
NRQ	74	68	63	0	0	0	61	97	0	0	0	0	0	0	0	97	101	0
V	0	83	0	0	0	0	85	92	0	0	84	0	0	0	0	0	0	0
Total																		
	FEV/FVC ratio (mean)																	
CC	93	91	86	100	104	0	106	102	0	111	101	90	94	96	0	102	105	118
NRQ	61	50	63	0	0	0	52	64	0	0	0	0	0	0	0	63	67	0
V	0	83	0	0	0	0	85	103	0	96	96	0	0	0	0	0	0	0
Total																		
	Age in years (mean)																	
CC	28	27	30	46	32	0	46	30	0	28	26	24	32	23	0	34	28	52
NRQ	34	35	21	0	0	0	33	32	0	0	0	0	0	0	0	29	22	0
V	0	40	0	0	0	0	23	40	0	0	25	0	0	0	0	0	0	0
Total																		

CC: City center, NRQ: Near refinery and quarries, V: Visitors from other cities, M: Male, F: Female, S: Smoker, EX: Ex-smoker, N: Non-smoker, COPDS: Chronic obstructive pulmonary disease score. FEV1: Forced expiratory volume in 1 second, FVC: Forced vital capacity. FEV/FVC: A calculated ratio used in the diagnosis of lung diseases

This unique location gives the area an advantage over the other parts of the UAE in the tourism, industry and trade. It contains oil refinery, see port and quarries. The area is hot and humid in summer with cool and windy weather in winter; the lowest temperature recorded in January 2013 was 12°C. The total population of Fujairah exceeds 200,000 people. It is famous for being a tourist area due to its historical background and long sunny beach.[5,6]

Many factors contribute to the development of COPD, these factors include: Environmental issues (humidity, dust, hot weather, very cold weather, etc.), occupational hazards, cigarette smoking, fuel fumes and many others. Waness stated that many factors aggravate the development of COPD which are available in the Middle East like: Desert, high temperature, humidity, sudden drop in temperature during certain months of the year especially at night.[7] All these factors could contribute in the development of pulmonary inflammation either reversibly or irreversibly. Smoking plays an important role in developing COPD in the Middle East due to its wide prevalence.[8] Al Zaabi revealed in his study on 520 interviewed subjects (aged 40-80 years) in Abu Dhabi, that the prevalence of COPD was 3.7%.[9] He also found that this part of the world is famous for smoking water-pipes or hubbly-bubbly (narguile).[9] Taha found-that the usage of the water pipe is spreading in the world, especially in the Middle East.[10] A misperception about safety and health consequences could lead to shisha smoking among female gender, teenagers and children. Cob found that shisha smoke contains toxic components, and there is strong scientific evidence that shisha smoking is lead to chronic disorders including lung diseases, heart disorders and pregnancy-related medical consequences.[11]

Occupational exposure is a major risk factor of COPD. Gunen said that pesticides and chemical fertilizers in addition to industrial products are linked to pulmonary disease in the Middle East.[12] He also stated that the impact of industrialization and modernization on lung restrictive disorders of Middle East people is a serious situation.[12] Daher added other factors such as passive smoking and oil fumes and spells are increasing in the area. The use of chemical weapons in this region could lead to chronic irreversible lung diseases.[13] Jamil said after the Gulf war of 1991; many health conditions appeared which lead to the development of the new syndrome "Persian Gulf Syndrome."[14] "Desert-storm pneumonitis" also appeared from inhaled toxic material used during the gulf war and also desert dust which is usually mixed with chemicals to form what is called dubbed dirty dust.[15]

Continuous exposure to fuel fumes leads to many health risks especially restrictive and destructive lung diseases. These risks are exacerbated if other risk factors like smoking, humidity, dust and other industrial wastes are present. Some studies add traditional cooking wood may increase the risk of lung diseases.[16] One of these lung problems is COPD. Another study on cooking fuel has shown that there is a significant relationship between these gases and COPD.[17] Some studies provide evidence

Table 2: Comparison between locations among gender with COPDS<10

Group	Variable (mean)	City center	Port area	Significance	*P* value	Statistical test
Smokers (male)	FEV1	89	68	Significant	0.001	Levene's test for equality of variance
	FEV ratio	91	50	Insignificant	0.123	Levene's test for equality of variance
Non-smokers (male)	FEV1	90	97	Significant	0.004	Levene's test for equality of variance
	FEV/FVC ratio	102	64	Significant	0.025	Levene's test for equality of variance
Non-smokers (female)	FEV1	87	101	Significant	0.034	Levene's test for equality of variance
	FEV/FVC ratio	105	67	Significant	0.003	Levene's test for equality of variance

FEV1: Forced expiratory volume in 1 second, FVC: Forced vital capacity, COPDS: Chronic obstructive pulmonary disease score

Table 3: Comparison between genders among people with COPDS<10

Group	Variable (mean)	Male	Female	Level of significance	*P* value	Statistical test
Non-smokers	FEV1	92	96	Insignificant	0.168	Levene's test for equality of variance
	FEV/FVC ratio	88	92	Insignificant	0.803	Levene's test for equality of variance

FEV1: Forced expiratory volume in 1 second, FVC: Forced vital capacity, COPD: Chronic obstructive pulmonary disease

Table 4: Comparison between smokers and non-smokers

Group	Variable (mean)	Smokers	Non- smokers	Level of significance	*P* value	Statistical test
Smoking (regardless location)	FEV1	84	91	Insignificant	0.179	Levene's test for equality of variance
	FEV/FVC ratio	84	89	Insignificant	0.162	Levene's test for equality of variance
Smoking (port area)	FEV1	70	93	Insignificant	0.547	Levene's test for equality of variance
	FEV/FVC ratio	54	62	Significant	0.001	Levene's test for equality of variance

FEV1: Forced expiratory volume in 1 second, FVC: Forced vital capacity

on the possible effect of biomass, fuel gas, indoor air pollution, bad economic and social lifestyle and the presence of comorbidities on the occurrence of COPD. Occupational exposure to air pollution is one of the most important risk factors of COPD. According to the global initiative for chronic obstructive lung disease report found that occupational exposure to noxious particles is an under-appreciated risk factor for COPD and the types of noxious particles to which workers might be exposed include organic and inorganic dusts, chemical agents and fumes. It also found that outdoor air pollution as a risk factor is not well established, but if cigarette smoking is added, COPD will increase significantly.[18]

WHO in (2004) announced that COPD is worldwide disorder which leads to increase the number of chronic irreversible lung distress and death due to respiratory failure.[19] The currently available data underestimate the prevalence of COPD, since the disease is often not diagnosed until it is moderately advanced and awareness of the disease among primary care physicians has historically been low. Schirnhofer *et al.* have reported prevalence rates for men over 40 years of age are higher than women over 40 years of age.[20] According to WHO estimates in (2011), 65 million people suffer from different levels of COPD.[21]

This study provides some evidence that people exposed to different kinds of air pollution are at risk of developing COPD. It also shows that cigarette smoking, dust and humidity might exacerbate the risk of COPD. Avoiding highly polluted areas could be a way to reduce that risk. Itis documented that cigarette smoking is a significant risk factor for COPD. It is estimated to be the reason for 95% of COPD cases worldwide.[22] Other studies support the effect of inhaled fuel smoke on the occurrence of COPD and chronic bronchitis.[23]

CONCLUSION

Many precipitating factors play a role in the development of COPD and a decrease in lung capacity and expansibility. Occupational hazards are considered major risk factors which lead directly and indirectly to COPD. Fuel fumes, cooking wood fumes, dust, humidity and chemical warfare lead to air pollution. This study emphasizes the need for a focused study on the impact of the Arabian Peninsula environment on air pollution. Some of the data provided in this study support the assumed negative effect of fuel fumes, dust and other air pollution on the respiratory system. It also supports the negative impact of water-pipe and cigarette smoking as exacerbating factors which participate in the reduction of lung function test results. More focus on male gender in this region will be more effective when COPD risk factors are evaluated. Males tend to smoke cigarettes and water pipes more commonly than females according to this study, education and counseling regarding avoiding polluted areas, water pipe shops and other forms of pollutions is needed. It is suggested that heath campaigns could provide some awareness about these hazards.

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