Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 6, Issue 3, pp: (103-123), Month: September - December 2019, Available at: www.noveltyjournals.com

Comparison between pulmonary functional and clinical parameters among smokers versus ex-smokers chronic obstructive pulmonary disease patients

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Abstract: **Even though smoking is a major reason for the development and progression of chronic obstructive pulmonary disease (COPD) and quitting smoking is the only way to stop its progression, a significant number of smokers still continue to smoke after being diagnosed with COPD. This may be attributed to little information exists on how smoking cessation influences pulmonary functional parameters as PFT and SPO2 and clinical parameters as ADL, functional exercise capacity, respiratory symptoms and anxiety. Furthermore, the nurse plays an important role to help smokers to quit smoking; assess, advice, explain, motivate and refer to specific health services. This study aimed to: Compare between pulmonary functional and clinical parameters among smokers versus Ex-smokers chronic obstructive pulmonary disease patients. Research design: A descriptive comparative research design was used. Setting: This study was carried out at the Outpatient Clinic and Inpatient Chest Departments of the Alexandria Main University Hospital. Subjects: A convenience sample of 60 male and female adult patients from 40-60 years old currently diagnosed with chronic obstructive pulmonary disease. Tools: Two tools were used: Tool I: Pulmonary function assessment tool and Tool II: Clinical parameters assessment tool. Results: As for pulmonary function assessment, there were statistical significant differences among smoker and ex-smoker group regarding FEV1, FVC and oxygen saturation and there was no statistical significant difference regarding FEV1/FVC ratio. In relation to clinical parameters, there were statistical significant differences among smoker and ex-smoker group regarding Activities of daily living (ADL), functional exercise capacity that were assessed by (6MWT), respiratory symptoms (cough, sputum production, wheezing and grade of dyspnea that was assessed by mMRC) and there was no statistical significant difference regarding anxiety level. Recommendations: Study the similarities and differences between smokers and ex-smokers severe and very severe COPD patients and Study the psychological impact of smoking cessation of COPD patients.**

Keywords: **chronic obstructive pulmonary disease, clinical parameters, ex-smokers, pulmonary functional parameters, smokers.**

1. INTRODUCTION

Smoking has hazardous and widespread effects on human health, resulting in a highly increased risk to develop cancer, atherosclerosis, heart and lung diseases. It is the main risk factor in the development of chronic obstructive pulmonary disease (COPD), since 90% of patients with COPD have smoked or are still smoking [(1)].

According to the last recent World Health Organization's (WHO) 2017 standardized estimate of current total adults' smoking prevalence, 20.9 % (46.4% of men and 0.2 % of women) and 20% of Egypt's population overall are daily tobacco smokers[(2)]. Moreover, according to the last recent centers for disease control and prevention (CDC) 2017, Nearly 40 million United States' adults still smoke cigarettes, and about 4.7 million middle and high school students use at least one tobacco product, including cigarettes[(3)].

The harmful effects of cigarette smoking on various health outcomes have been determined by comparing individuals who are current smokers, ex-smokers, and never smokers. A ministry of health defined a smoking status as follows; a current smoker is an adult who has smoked greater than 100 cigarettes in their lifetime and has smoked in the last 28 days. An ex-smoker is an adult who has smoked greater than 100 cigarettes in their lifetime but has not smoked in the last 28 days. Never smoker is someone who has never smoked or has not smoked greater than 100 cigarettes in their lifetime and does not currently smoke[(4)].

Chronic obstructive pulmonary disease (COPD) is a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases. The chronic air flow limitation characteristic of COPD is caused by a mixture of small airways disease (obstructive bronchiolitis) and parenchymal destruction (emphysema), the relative contributions of which vary from person to person. Airflow obstruction usually accompanied with symptoms such as chronic cough, sputum production, exertion dyspnea, fatigue and wheezing [(5,6,7)].

Chronic obstructive pulmonary disease prevalence, morbidity, mortality vary across countries and across different groups within countries. Chronic obstructive pulmonary disease is the result of cumulative exposure over decades. Often, the prevalence of COPD is directly related to the prevalence of tobacco smoking. Although in many countries outdoor, occupational and indoor air pollution are major COPD risk factors. In Egypt statistical analysis for COPD (2018), prevalence was from 3.3 % up to 10 %. The prevalence rate in men was 6.7 % while it was 1.5 % in women but the prevalence in women is increasing as the rates of smoking among women increase [(8,9)].

Chronic obstructive pulmonary disease affects quality of life (QOL) by preventing or limiting every day activities such as working and activities requiring physical exertion. Consequently, individuals with COPD frequently demonstrate increased levels of anxiety and depression, along with decreased capacity for exercise, decreased physical activity levels and non-completion of activities of daily livings (adls) [(10,11,12)].

Chronic obstructive pulmonary disease is diagnosed by spirometric results that guide therapy. Patients with COPD typically show a decrease in both forced expiratory volume in one second (FEV1)which measures the volume of air that can be forcibly exhaled in one second and represent the rate of air movement out of the lungs. Forced expiratory volume in one second typically declines a very small amount per year in normal person, but the decline can be several times over the expected in people with COPD and forced vital capacity (FVC) which is the maximum volume of air forcibly exhaled from the point of maximal inhalation; it is often reduced in COPD because of air trapping. Pulse oximetry can also be used to evaluate a patient's oxygen saturation and need for supplemental oxygen therapy [(13,14,15)].

Smoking has several direct effects on the respiratory tract, its irritating effects can cause hyperplasia of the cells including goblet cells which subsequently results in increased production of mucus, reduces airway diameter and increases the difficulty in cleaning secretions. Moreover, it reduces the ciliary activity and may cause actual loss of ciliated cells. It also produces abnormal dilation of the distal air space with destruction of alveolar wall after a short time of smoking and changes in small airway function can develop[(16, 17)].

Smoking cessation is the only effective treatment for avoiding or reducing the progression of COPD. The available bronchodilators and inhaled corticosteroids may relieve respiratory symptoms, improve quality of life and reduce the number of exacerbations, yet they don't influence the progression of disease. The nurse should assess the patient's current and past history of tobacco use, including the type of tobacco, number of packs and number of years smoked, also offer the needed help to patient regarding smoking cessation[(18)].

Smoking cessation for COPD patients is challenging. Although predictions that smoking cessation can positively influence specific pulmonary functional parameters as pulmonary function test (PFT) and oxygen saturation (SPO2) and specific clinical parameters as respiratory symptoms, level of anxiety, activities of daily livings (adls), functional exercise

capacity, previous hospital admission and Length of stay in hospital, there is a lack of data supporting this assumption. So, further studies are necessary to determine the exact difference between these pulmonary functional parameters and clinical parameters among smokers (current smokers who have smoked in the last 6 months) versus Ex-smokers(recent quitters who haven't smoked at least since last 6 months) chronic obstructive pulmonary disease patients.

Operational definitions:

Smoker (Current smoker) is someone who has smoked in the last 6 months and his pack year index equals 30.

Ex-smoker (recent quitter) is someone who has not smoked in the last 6 months and his pack year index equals 30.

Aim of the study:

Compare between pulmonary functional and clinical parameters among smokers versus Ex-smokers chronic obstructive pulmonary disease patients.

Research Question:

What are the differences between pulmonary functional and clinical parameters among smokers versus Ex-smokers chronic obstructive pulmonary disease patients?

2. MATERIALS AND METHOD

Research Design:

A descriptive comparative research design was utilized to conduct this study.

Setting:

This study was carried out at the Outpatient Clinic and Inpatient Chest Departments of the Alexandria Main University Hospital.

Subjects:

A convenience sample of 60 male and female adult patients from 40-60 years old currently diagnosed with chronic obstructive pulmonary disease.

- Patients were excluded to participate in the study if they met the following criteria:

- Acute exacerbation of COPD or respiratory failure.
- Other underlying chest diseases as T.B.
- Underlying heart diseases.
- Musculoskeletal disease limiting ADLs.

- Sample was assigned into two equal groups randomly according to criteria of smokers and ex-smokers each consist of 30 patients.

Tools of the study:

Two tools were used in this study to collect necessary data.

Tool (I) Pulmonary function assessment tool .

This tool was developed by the researcher based on review of relevant literature [19,20,21,22] to assess pulmonary functions for chronic obstructive pulmonary disease patients. It was composed of three parts:

Part1: Biosocio-demographic, clinical data and anthropometric measurements:

This part was used to elicit general characteristics of the patients including: age, sex and educational level, occupation, medical history, previous hospitalization, length of stay, previous exacerbations treated at home, condition of smoking, Number of cigarettes smoked / day, Number of years smoked and pack year index (smoking index), weight, height, BMI.

Part 2: Pulmonary Function Test (PFT):

This part was used to evaluate and compare the obstructive ventilatory defect among chronic obstructive pulmonary disease patients who are smokers and ex-smokers through the following parameters: Forced Expiratory Volume in 1 sec (FEV1), Forced Vital Capacity (FVC) and FEV1% rather than other parameters because these are the best indicators to assess the severity or staging of COPD.

Scoring system

Spirometric classification of COPD according to GOLD (Global Initiative for Chronic Obstructive Lung Disease) which was last updated in 2019 in relation to predicted percent of FEV1; FEV1 ≥80% of what is predicted for age, height, weight and race is considered GOLD1 (mild), FEV1 50% to < 80% is considered GOLD2 (moderate), FEV1 30% to < 50% is considered GOLD3 (severe) and FEV1 < 30% is considered GOLD4 (very severe) [23].

Part 3: Oxygen Saturation (SPO2) assessment:

This part was used to measure and compare the percentage of hemoglobin bound oxygen compared to total capacity of hemoglobin among chronic obstructive pulmonary disease patients who are smokers and ex-smokers by using portable pulse oximeter. It was measured as followed: SPO2 =70-90%, SPO2>90 %[24].

Tool (II) Clinical parameters assessment tool.

This tool was adapted by the researcher and necessary modifications were done based on review of relevant literature [25,26,27,28,29,30] to assess Activities of Daily Living, functional exercise capacity, anxiety level and respiratory symptoms for chronic obstructive pulmonary disease patients. It was composed of four parts:

Part 1: Activities of Daily Living (ADL) assessment:

Activities of Daily Living assessment was done using Katz Index of Independence in Activities of Daily Living tool [28]. It was adapted and necessary modifications were done by the researcher to assess patient's independence in activities of daily living:

- Independent; can perform his/her ADLs without supervision, direction or personal assistance.
- Dependent; perform his/her ADLs with supervision, direction, personal assistance or perceive total care.

This tool covered six domains which are bathing, dressing, toileting, transferring, continence and feeding.

Scoring system:

In relation to patient's level of dependency in activities of daily living, it was scored as follow:-

Independence = 1, Dependence = 0

The total score:

- High (patient independent) = 6
- Partially (patient partially dependent) = less than 6 and more than 0.
- Low (patient very dependent) = 0

Part 2: Functional Exercise Capacity assessment:

Functional Exercise Capacity assessment was done using 6 Minutes Walking Distance (6MWD) Or 6 Minutes' Walk Test (6MWT) which was developed in 1963 by Balke. This test measures the distance that a patient can quickly walk on a flat, hard surface in a Period of 6 Minutes [26,27].

Scoring system:

- Lower score (reflecting less distance covered in 6 minutes indicates worse function) < 300 m/ 6 min.

- Normal score ≥ 300 m/ 6 min.

Part 3: Anxiety level assessment:

Anxiety assessment was done using State-Trait Anxiety Inventory (STAI) by Spielberger et al 1983[29]. The STAI is an administered analysis of reported anxiety symptoms. This inventory measures two dimensions of anxiety, first: anxiety as a state which can be defined as a transient momentary emotional status that results from situational stress and second: anxiety as a trait which represents a predisposition to react with anxiety in stressful situations. Each dimension of the inventory consists of 20 items regarding present filling in likert format ranging from (1) Not at all, (2) A little, (3) Somewhat to (4) Very much. The dimension of the scale that measures anxiety as a state was only used for the purpose of this study. Some of the questions relate to the absence of anxiety and are reverse-scored.

The total score value ranges from 20 to 80, the higher the score the higher the anxiety level [30].

Part 4: Respiratory symptoms assessment:

This part included assessment and comparison of respiratory symptoms as cough, sputum production, shortness of breath and wheezing among smokers versus ex-smokers chronic obstructive pulmonary disease patients [25].

Assessment of breathlessness severity (dyspnea) by modified Medical Research Council (mMRC) scale [24]:

Method:

- An official letter was issued from the Faculty of Nursing, Alexandria University to the director of the Alexandria Main University Hospital and head of the Outpatient and Inpatient Chest Departments to obtain their permission to collect necessary data after explanation of the aim of the study.

- Tool I was developed by the researcher based on recent review of relevant literatures. Tool II was adapted by the researcher and necessary modifications were done. Part 1 and part 3 were translated into the Arabic language by the researcher.

- The tools were tested for content validity by 5 experts in the field of Medical Surgical Nursing and Chest diseases specialists in Alexandria University and necessary modifications in wording, statement and sequencing were done accordingly.

- The reliability of the tools was tested using cronbach's alpha test. The correlation coefficient was ($\alpha = 0.905$)

- A pilot study was conducted on 6 patients out of the sample who diagnosed with COPD and fulfilled the inclusion criteria before starting the data collection to test clarity, feasibility, validity, reliability and applicability of the tools and determine obstacles that may be encountered during the period of data collection. The necessary modifications were done accordingly and final tool was reconstructed.

Data collection:

After securing the administrative approval, the data collection was started which covered a period of 6 months (from September 2018 to February 2019).

Steps of the study:

- Patients were assigned randomly into two equal groups according to criteria of smokers and ex-smokers each consist of 30 patients.

- Every patient in the two groups was interviewed individually once for 30-45 minutes at his in patient room by the researcher to collect the needed data.

-Biosocio-demographic, clinical data was collected, and t the anthropometric parameters then measured using tool I part 1.

- Clinical parameters of every COPD patient in the two gr groups were assessed by the researcher as follows:

- Level of anxiety using tool II part 3.
- Activity of daily living using tool II part 1.

- Respiratory symptoms including grade of dyspnea, using tool II part 4.
- Functional exercise capacity by doing 6 Minutes' Walk Test (6MWT).

- Pulmonary functional parameters of every COPD patient in the two groups were assessed by the researcher as follows:

- Pulmonary function test was done by the researcher using portable spirometry.
- Oxygen saturation was measured by the researcher using portable pulse oximeter.

Ethical Considerations:

1- Written informed consent will be obtained from patients participating in the study.

2- Confidentiality of data and patient has the right to withdraw at any time in the study will be emphasized to subjects of the study.

3- The anonymity and Privacy of patients will be ascertained.

Statistical Analysis:

- After data collection, data were coded and transformed into specially designed form to be suitable for computer feeding.

- Data were analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), arithmetic mean and standard deviation. Significance of the obtained results was judged at the 5% level .

The used tests were :

Chi-square test: for categorical variables to compare between different groups.

Monte Carlo correction: correction for chi-square when more than 20% of the cells have expected values less than 5.

Student t-test:for normally distributed quantitative variables to compare between two studied groups.

Fisher's exact test: correction for chi-square when more than 20% of the cells have expected values less than 5.

Pearson coefficient: to correlate between two normally distributed quantitative variables.

3. RESULTS

Figure 1: Distribution of the smoker and ex-smoker patients according to biosocio-demographic data:

Regarding patient's age, the results revealed that, more than half of COPD patients 66,7% were in the age group between (50-60 years) in the both smoker and ex-smoker patients. In relation to sex, all patients 100% were males in the both smoker and ex-smoker groups. Concerning patients' residence, the table showed that, more than one-half of the patients (70% & 56.7%) respectively were from rural areas in smoker and ex-smoker groups. Regarding level of education, one half 50% of the patients in smoker group were illiterate, while in ex-smoker group, more than one third 40% of them had secondary education. Concerning patients' occupation, it is obvious that manual work was the most common occupation encountered in smoker group 66.7%, while in ex-smoker group, one-half 50% of the patients were occupying a manual work and another half 50% were occupying a clerical work. Concerning marital status, the results revealed that, the majority of patients in smoker and ex-smoker groups (73.3%, 83.3%) respectively were married.

Figure II: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to clinical data:

Regarding previous hospitalizations due to exacerbations during the last 6 months, there were statistical significant differences between smoker and ex-smoker patients. It was noticed that the majority of the smoker group 83.3% had a frequency of previous hospitalization as compared to 56.7% of the ex-smoker group. Concerning previous exacerbations treated at home during the last 6 months, there were no statistical significant differences between smoker and ex-smoker patients. More than half (66.7%, 76.7%) respectively of smoker and ex-smoker groups had previous exacerbations treated at home during the last 6 months. In relation to length of stay at hospital, there were statistical significant differences

between smoker and ex-smoker patients. The results revealed that the majority of smoker group 80.0% had (7 – <14 days) length of stay at hospital as compared to 80.0% of ex-smoker group stay (<7 days) at hospital. The difference was statistically significance. As regards associated medical diseases, the table showed that more than half of the studied patients 66.7% had hypertension, and 22.8% had renal diseases.

Table 1: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to pulmonary function assessment:

As for pulmonary function test, this table revealed a statistical significant differences regarding Forced expiratory volume in 1 Sec between smoker and ex-smoker patients with Mean ± SD (49.73 ± 18.16, 58.40 ± 17.89) respectively. t =1.862, P=0.068. It was observed that more than half of the ex-smoker group patients 53.3% had moderate stage of COPD as compared to 43.3% of smoker group patients.

Concerning Forced vital capacity, there was a statistical significant difference between smoker and ex-smoker patients with Mean ± SD (78.03 ± 28.07, 93.40 ± 24.13) respectively. t = 2.274*, P= 0.027*. In relation to FEV1% (FEV1 /FVC ratio), there was no a statistical significant difference between smoker and ex-smoker group patients (χ2=□□□□□, MCp=0.611).

Regarding Oxygen saturation (SPO2), there was a statistical significant difference between smoker and ex-smoker patients with Mean ± SD (85.23 ± 8.77, 89.47 ± 5.24) respectively. (t=2.270*, p=0.028*). It was noticed that decline in O2 saturation to (70-90%) was most commonly encountered in the smoker group with percentage 60% as compared to 43.3% of ex-smoker group.

Table II: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to clinical parameters (Activities of daily living (ADL) and functional exercise capacity by (6MWT)):

Regarding Activities of daily living (ADL), there was a statistical significant difference between smoker and ex-smoker patients with Mean ± SD (5.17 ± 0.83, 5.60 ± 0.67) respectively. (t=2.213*, p=0.031*). The results revealed that the majority of ex-smoker patients 70% had a high level of independency in compared to 43.3% of smoker group.

Concerning functional exercise capacity that were assessed by (6MWT), The whole patients had a lower score and walked < 300 m/6min but there was a statistical significant difference between smoker and ex-smoker patients with Mean ± SD (185.5 ± 36.98, 208.7 ± 50.39) respectively. (t=2.030*, p=0.047*).

Table III: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to anxiety level assessment:

There was no statistical significant difference between smoker and ex-smoker patients (t=0.777, P=0.441). It was observed that the anxiety level is declined in ex-smoker group patients as compared to smoker group patients with Mean ± SD (49.07 ± 12.33, 51.60 ± 12.93) respectively.

Table IV: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to respiratory symptoms assessment:

In relation to cough, there was a statistical significant difference between smoker and ex-smoker patients (χ2=8.472*, MCp=0.032*). It was observed that one-half of smoker group patients 50%suffered from cough most days (>10) while more than one-third of ex-smoker group patients 36.7% suffered from cough few days (3–5).

Regarding sputum production, there was a statistical significant difference between smoker and ex-smoker patients (χ2=8.204*, P=0.042*). The results revealed that more than one third of smoker group patients 36.7% had productive cough several days (6 – 10) while more than one third of ex-smoker group patients 33.3% didn't produce sputum at all.

Concerning shortness of breath, there was a statistical significant difference between smoker and ex-smoker patients (χ2=6.429*, P=0.040*). It was noticed that more than half of smoker group patients 60% suffered from shortness of breath most days while 40% of ex-smoker group patients suffered from shortness of breath several days.

In relation to wheezing, there was a statistical significant difference between smoker and ex-smoker patients (χ2=10.738*, MCP=0.015*). It was observed that 43.3 % of smoker group patients suffered from wheezing most days while 40% of ex-smoker group patients suffered from wheezing few days.

Table V: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to breathlessness severity (dyspnea) by modified Medical Research Council (mMRC):

Regarding grade of dyspnea, this table revealed mMRC scale assessment among smoker and ex-smoker patients. There was a statistical significant difference between smoker and ex-smoker patients ($\chi 2$=6.631, P=0.036*). An increased in the grade of dyspnea among smoker patients as more than half 56.7% had grade 4 of dyspnea while 43.3% of ex-smoker patients had grade 3 of dyspnea was observed.

Table VI: Correlation between pulmonary function test and another pulmonary functional parameter (SPO2) and clinical parameters in smoker group:

Regarding Forced expiratory volume in 1 Sec, there was a positive significance correlation between Forced expiratory volume in 1 Sec and Oxygen saturation (SPO2), Activities of daily living (ADL) and functional exercise capacity by 6 Minutes Walking Distance (6MWD), r= (0.940*, 0.759*, 0.762*) respectively in smoker group patients.

On the other hand, there was a negative significance correlation between Forced expiratory volume in 1 Sec and Respiratory symptoms, Breathlessness severity (dyspnea) by MMRC and Anxiety level, r= (-0.910*, -0.785*, -0.953*) respectively.

Concerning Forced Vital Capacity, there was a positive significance correlation between Forced Vital Capacity and Oxygen saturation (SPO2), Activities of daily living (ADL) and functional exercise capacity by 6 Minutes Walking Distance (6MWD), r= (0.949*, 0.754*,0.777*) respectively in smoker group patients.

On the other hand, , there was a negative significance correlation between Forced Vital Capacity and Respiratory symptoms, Breathlessness severity (dyspnea) by MMRC and Anxiety level , r=(-0.914*, -0.784*, -0.949*) respectively.

With reference to FEV1% (FEV1 /FVC ratio), there was a positive correlation between FEV1% (FEV1 /FVC ratio) and Respiratory symptoms, Breathlessness severity (dyspnea) by MMRC and Activities of daily living (ADL), r= (0.069, 0.090, 0.184) respectively in smoker group patients. The differences were not statistically significant, P= (0.717, 0.636, 0.330).

On the other hand, there was a negative correlation between FEV1% (FEV1 /FVC ratio) and Oxygen saturation (SPO2), Functional exercise capacity by 6 Minutes Walking Distance (6MWD) and Anxiety level , r=(-0.018, -0.033, -0.076) respectively. The differences were not statistically significant, P= (0.924, 0.861, 0.688).

Table VII: Correlation between pulmonary function test and different parameters in ex-smoker group (recent quitter):

Regarding Forced expiratory volume in 1 Sec, there was a positive significance correlation between Forced expiratory volume in 1 Sec and Oxygen saturation (SPO2), Activities of daily living (ADL) and functional exercise capacity by 6 Minutes Walking Distance (6MWD), r= (0.967*, 0.410*, 0.990*) respectively in ex-smoker group patients.

On the other hand, there was a negative significance correlation between Forced expiratory volume in 1 Sec and Respiratory symptoms, Breathlessness severity (dyspnea) by MMRC and Anxiety level, r= (-0.957*, -0.549*, -0.999*) respectively.

Concerning Forced Vital Capacity, there was a positive significance correlation between Forced Vital Capacity and Oxygen saturation (SPO2), Activities of daily living (ADL) and functional exercise capacity by 6 Minutes Walking Distance (6MWD), r= (0.957*, 0.445*, 0.975*) respectively in smoker group patients.

On the other hand, , there was a negative significance correlation between Forced Vital Capacity and Respiratory symptoms, Breathlessness severity (dyspnea) by MMRC and Anxiety level , r=(-0.922*, -0.517*,-0.984*) respectively.

With reference to FEV1% (FEV1 /FVC ratio), there was a positive significant correlation between FEV1% (FEV1 /FVC ratio) and Oxygen saturation (SPO2), Activities of daily living (ADL) and functional exercise capacity by 6 Minutes Walking Distance (6MWD), r= (0.802*, 0.319, 0.809*) respectively.

On the other hand, there was a negative significance correlation between FEV1% (FEV1/FVC ratio) and respiratory symptoms, Breathlessness severity (dyspnea) by mMRC and anxiety level. r = (-0.805*,-0.479*,-0.799*)

4. DISCUSSION

Inhaling tobacco smoke causes damage to many of the body's organs and systems. It is the main risk factor in the development of chronic obstructive pulmonary disease (COPD) which is a major cause of disability that dramatically alters the well-being of the patients as well as their quality of life. It is the main risk factor in the development of chronic obstructive pulmonary disease (COPD) which is a preventable and a treatable disease state characterized by airflow limitation that is not fully reversible with accelerated decline of lung function. The management of COPD has focused on strategies to prevent further deterioration of lung function, such as smoking cessation and standard medical treatment to try to improve symptoms. Moreover, a comprehensive care program e.g. pulmonary rehabilitation program to improve the patients' functional abilities and to help them cope with their condition [31, 32].

The results of the present study showed that, the patients' age ranged from (40-60) years old. This result is in accordance with Viegi (2001) and Al Ghobain (2011) who found that the prevalence of COPD is strongly associated with age (46-65) years[33,34]. This may be explained by that the occurrence of COPD is increasing with age as the air spaces get bigger and loose their elasticity, leading to less area for gases to be exchanged across. Moreover, the strength of the respiratory muscles (the diaphragm and intercostal muscles) decreases [35].

Regarding sex, the present study illustrated that all patients were males. This is congruent with Tag El-din (2012) who found that, men have higher prevalence rates of COPD than women, which has been attributed to the historically higher rates of cigarette smoking in males. However, the increased rates of cigarette smoking in females in the last several decades have been associated with steadily increasing rates of COPD in women [36].

The residence may give an idea about the circumstances in which the patients live. The majority of the patients in the present study were living in the rural area. This is in accordance with the results of the study of Tzanzkis et al (2004) which determined the prevalence of COPD in Greece and concluded that, the prevalence of COPD was significantly higher in rural areas [37]. This is possible due to higher smoking incidence in rural areas [38].

In relation to educational level, the current study illustrated that, the majority of the patients were illiterate. These results are similar to the results of Ansari et al., (2005) and Johnson et al (2011) who found that, the majority of the COPD patients were illiterate [39,40]. Moreover, the current study revealed that the majority of the subjects in smoker group were illiterate but the majority of the subjects in ex-smoker group had secondary education. This result is on line with Daldoul (2013) who reported that, smoking is more prevalent among illiterate people [41].

The present findings in relation to the residence and the level of education may be due to that, the setting of the study which is a free University governmental hospital that serves not only urban areas but also many rural areas and the majority of patients were having low educational and economical standards.

Regarding occupation, these results showed that the more than half of patients were manual workers and had occupational exposure in their work environment as cement, fumes, gases and cotton. This result is in accordance with Trupin (2003) who stated that, occupational exposures were associated with increased risk of COPD after adjustment for smoking history and demographic variables [42].

In relation to marital status, this study revealed the majority of smoker and ex-smoker COPD patients were married. This is in line with sultana et al (2017) who stated that, most of the patients in their study were married [43]. Conversely, this is in opposite with Centers for Disease Control and Prevention (CDC), in their Morbidity and Mortality Weekly Report (MMWR) about Chronic Obstructive Pulmonary Disease Among Adults in United States (2011), who reported that respondents who were divorced, widowed, or separated were more likely to report COPD than married respondents [44].

Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of emergency hospital medical admissions worldwide and the second largest cause within the UK. Hospital admissions account for over 60% of the direct cost of the management of COPD. Frequent exacerbation-related admissions are associated with worsening lung function, poorer quality of life, increased risk of subsequent exacerbation, and a decline in health status [45].

Based on our study, it was observed that the majority of the smoker group had a frequency of previous hospitalization due to COPD exacerbations during the last 6 months as compared to more than one half of the ex-smoker group. This is

supported by the study of Purdy (2011) who mentioned that, around more than one third of patients admitted to hospital with COPD are current smokers and this has been unchanged over 10 years. [46].

According to this study more than half of smoker and ex-smoker groups had previous exacerbations treated at home during the last 6 months. This is congruent with the study of Hurst et al (2010) who reported, that exacerbations became more frequent as the severity of COPD increased. However, they stated hospital admissions due to COPD exacerbations are a major problem in the management of the disease due to patients' negative impact on health-related quality of life, prognosis and costs [47].

The drive to reduce long hospital stays for COPD patients has made Length of Stay (LOS) a marker of quality in COPD management in secondary care. Possible influences on the LOS of COPD admissions include age, socioeconomic deprivation, comorbidities, disease severity and hyperglycemia [48].

In relation to length of stay at hospital (LOS), the results in this study revealed that the majority of smoker group had (7 – <14 days) length of stay at hospital but the majority of ex-smoker group stay (<7 days) at hospital. This is in congruent with Harries et al (2015) in London, who stated that variations between hospitals of nearly 5 days in Length of Stay (LOS) for COPD admissions suggests that significant improvements in patient outcomes and in savings in health care utilization could be made in hospitals with longer LOS[49].

Pulmonary function tests (PFTs) are the primary diagnostic tools for COPD. These tests demonstrate characteristic abnormalities in lung function confirm or support the diagnosis of COPD and give some idea of the degree of impairment and prognosis [50].

This study revealed that the mean of FEV1, FVC and FEV1% (FEV1 /FVC ratio) were lower in smokers COPD than ex-smokers COPD patients. However, there was no a statistical significant difference between smoker and ex-smoker group patients related to FEV1% (FEV1 /FVC ratio) and this is possible due to smokers and ex-smokers COPD patients already had a mild-to-severe degree of disease and COPD is a progressive and irreversible disease. This is supported by Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2015 which stated that, smoking cessation remains the most effective intervention that reduces lung function decline in COPD and slowing the annual decrease of FEV1 to a rate comparable with that of nonsmokers. Moreover, the study of Dhariwal et al (2014) who reported that, patients with COPD who quit smoking had a marked, but transient improvement in FEV1 at 6 weeks that was still present at 12 weeks and only partially maintained at 1 year [51,52].

Patients with chronic obstructive pulmonary disease frequently develop nocturnal oxygen desaturation and during activity of daily living. So, arterial oxygenation should be monitored in patients with COPD. These current results clarified that more than half of smoker group had a decline in O2 saturation to (70-90%) as compared to more than one third in ex-smoker group. This study was in agreement with Vold et al (2014), who concluded that smoking cessation seem to be an important measure to avoid SpO2 decreases in the general population[53]. In addition, the study of Abdul Hasshim and Anas (2016), in India about Correlation of haematocrit and smoking score with severity of COPD, who found that, oxygen desaturation, was directly related to smoking score[54].

Chronic obstructive pulmonary disease (COPD) is a chronic progressive respiratory disorder causing physical disability with an increasing burden to the patient, his family and to the health services. Patients with COPD commonly experience reduced exercise capacity and activity of daily living limitation. So, an improvement in physical activity and exercise capacity is a key goal of COPD management [24].

Regarding Activities of daily living (ADL), the present findings revealed that, the majority of ex-smoker COPD patients had a high level of independency as compared to approximately more than one third of smoker COPD patients. This is in line with Javier et al (2007), in their study about the impact of COPD on activities of daily living, which had shown that the disease had a considerable impact on daily activities in patients. Aspects of daily life are most affected, either due to smoking and the severity of the disease or the existence of social, economic, or occupational factors that could interfere with the management of the disease or complicate its progression [55].

Disease severity in COPD affects exercise tolerance such as walking distance. Six minute walk test (6MWT) is an exercise test, used as a clinical indicator of the functional capacity, in patients with cardiopulmonary diseases [56]. In

relation to functional exercise capacity that was assessed by (6MWT), the whole patients had a lower score and walked < 300 m/6min but the ex-smoker group represented a significant improvement more than smoker group. This is in respect with Carr (2009) and Eaton (2009) who found that, six-minute walk distance was significantly improved by pulmonary rehabilitation which included smoking cessation program [57,58].

Three nonmutually exclusive models may explain the smoking–anxiety association. First, smoking may lead to increased anxiety; second, anxiety may increase smoking rates; or third, smoking and anxiety rates may both be influenced by shared vulnerability factor(s)[59].

As regards anxiety level, it was declined in ex-smoker COPD patients as compared to smoker COPD patients In this aspect, Cuijpers et al (2007), Pedersen and von Soest (2009) and Lawrence et al (2010) documented that, smoking appears to increase the risk of developing increased anxiety [60,61,62].

This result was also in agreement with Taylor et al (2014) who reported that, Smoking cessation is associated with reduced depression, anxiety, and stress and improved positive mood and quality of life compared with continuing to smoke [63].

But this result wasn't statistically significant may be due to the majority of ex-smokers had passive smokers in their home or work or this is possible due to anxiety is a withdrawal symptom after quitting smoking.

On the contrary, Morissette et al (2007) in their study about - Anxiety, anxiety disorders, tobacco use, and nicotine: a critical review of interrelationships mentioned that, cigarette smoke can reduce anxiety in some smokers [64]. In addition, Bolam et al (2011) and McDermott et al (2013) stated that smokers often report increased anxiety post smoking cessation, although recent data conflict with this finding [65, 66].

In relation to respiratory symptoms (cough, sputum production, shortness of breath and wheezing) the results denoted that, these symptoms were improved in ex-smoker group and sustained less duration than in smoker group. This is on line with Tashkin et al (2011) who reported that, in a 1-year cessation trial of smokers with COPD, continuous abstinence compared with continuous smoking significantly improved Clinical COPD Questionnaire (CCQ) which measuring respiratory symptoms and health-related quality of life Total Scores at Week 12 and , with sustained improvement thereafter [67].

Zamzam et al (2012) added that, a higher smoking index affects the COPD subjects' QOL especially with patients' symptoms (cough, sputum production, shortness of breath, wheezing) and impact score (which describe patients' psychological state)[25]. In addition to, Boskabady et al (2011), who documented that respiratory symptoms increased among smokers [68] and Liu et al (2015) added that, prolonged tobacco use is associated with respiratory symptoms and COPD [69].

Dyspnea is the main symptom perceived by COPD patients. In clinical practice, the quantitative assessment of this symptom can be useful for defining the patient's real level of respiratory disability. [70].

The present study illustrated that, more than half of smoker group had grade 4 of dyspnea while more than one third of ex-smoker group had grade 3 of dyspnea. This supported by British lung foundation (2019) which reported that, from 3 to 9 months after quitting smoking, lung function increases by up to 10%making breathing easier. Andreas et al (2009) clarified that, smoking cessation improves pulmonary function, alleviates dyspnea and cough, reduces the frequency of COPD exacerbations, and lowers mortality [71, 72]. This result was also in congruent with Riesco et al (2017) who proved that, active smoking was significantly associated with a higher dyspnea grade [73].

In the present study, In ex-smoker group, spirometry variables (FEV1, FVC and FEV1% (FEV1/FVC ratio)) had a positive significant correlation with oxygen saturation (SPO2), Activities of daily living (ADL) and functional exercise capacity by 6 Minutes Walking Distance (6MWD) and had a negative significant correlation with respiratory symptoms, breathlessness severity (dyspnea) by mMRC and Anxiety level. This was in accordance with Maharem (2012) who found that, there was a positive significant correlation between PFT and oxygen saturation (SPO2), functional exercise capacity by 6 Minutes Walking Distance (6MWD) and CAT scale which assess quality of life for COPD patients a negative correlation between PFT and mMRC and anxiety level after implementing a pulmonary rehabilitation program for COPD patients [24].

Papadopoulos et al (2011), in their study about smoking cessation which can improve quality of life among COPD patients: Validation of the clinical COPD questionnaire into Greek, found that The CCQ scores had a negative significant correlation with FEV1, FEV1/FVC and also with the quality of life questionnaire SF-12. Smoking cessation also lead to a significant reduction in CCQ score and increase in the SF-12 score [74].

While in smoker group, spirometry variables (FEV1 and FVC) had a positive significant correlation with oxygen saturation (SPO2), Activities of daily living (ADL) and functional exercise capacity by 6 Minutes Walking Distance (6MWD) and had a negative significant correlation with respiratory symptoms, breathlessness severity (dyspnea) by mMRC and Anxiety level.

This was congruent with Agrawal and Awad (2015) who concluded that, there was a significant correlation found between 6MWT & spirometry variables (FEV1, FVC) and Zamzam et al (2012) who mentioned that, activity domain in SGRQ-C (a questionnaire assess quality of life) was found to correlate with all pulmonary function parameters [75,25].

5. CONCLUSION

Smoking cessation prevents further deterioration of lung function and further alteration in physical and psychosocial well-being for COPD patients as follows:

- As for pulmonary function assessment, there were statistical significant differences among smoker and ex-smoker group regarding FEV1, FVC and oxygen saturation and there was no statistical significant difference regarding FEV1/FVC ratio and this is possible due to smokers and ex-smokers COPD patients already had a mild-to-severe degree of disease and COPD is a progressive and irreversible disease.

- In relation to clinical parameters, there were statistical significant differences among smoker and ex-smoker group regarding Activities of daily living (ADL), functional exercise capacity that were assessed by (6MWT), respiratory symptoms (cough, sputum production, wheezing and grade of dyspnea that was assessed by mMRC). Anxiety level is declined in ex-smoker COPD patients as compared to smoker COPD patients but this result wasn't statistically significant may be due to the majority 80% of ex-smokers had passive smokers in their home or work or this is possible due to anxiety is a withdrawal symptom after quitting smoking.

6. RECOMMENDATIONS

The following recommendations are derived and suggested:

Recommendations for patients:

- Developing a structured educational program for behavioral change using films, video tapes for smoker COPD patients and educational program about how to use portable spirometer for all COPD patients.

- Community programs for patients should be developed to increase awareness about smoking hazardous and prevention of further complications of the COPD disease especially in rural areas.

Recommendations for nurses:

- In – service training to all nurses and health care providers in hospital and outpatients clinics to update their knowledge and increase their ability to care for patients with COPD and help smoker COPD to quit smoking.

- In-service education program should be instituted for nurses about patients' rehabilitation and development of Arabic colored educational booklet concerning types and hazardous of smoking.

Regarding future researches:

- Study the similarities and differences between smokers and ex-smokers severe COPD patients.

- Impact of quitting smoking on symptoms of chronic bronchitis, lung functions, airway hypersensitivity and inflammation.

- Study the psychological impact of smoking cessation of COPD patients.

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ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 6, Issue 3, pp: (103-123), Month: September - December 2019, Available at: www.noveltyjournals.com

APPENDICES-A

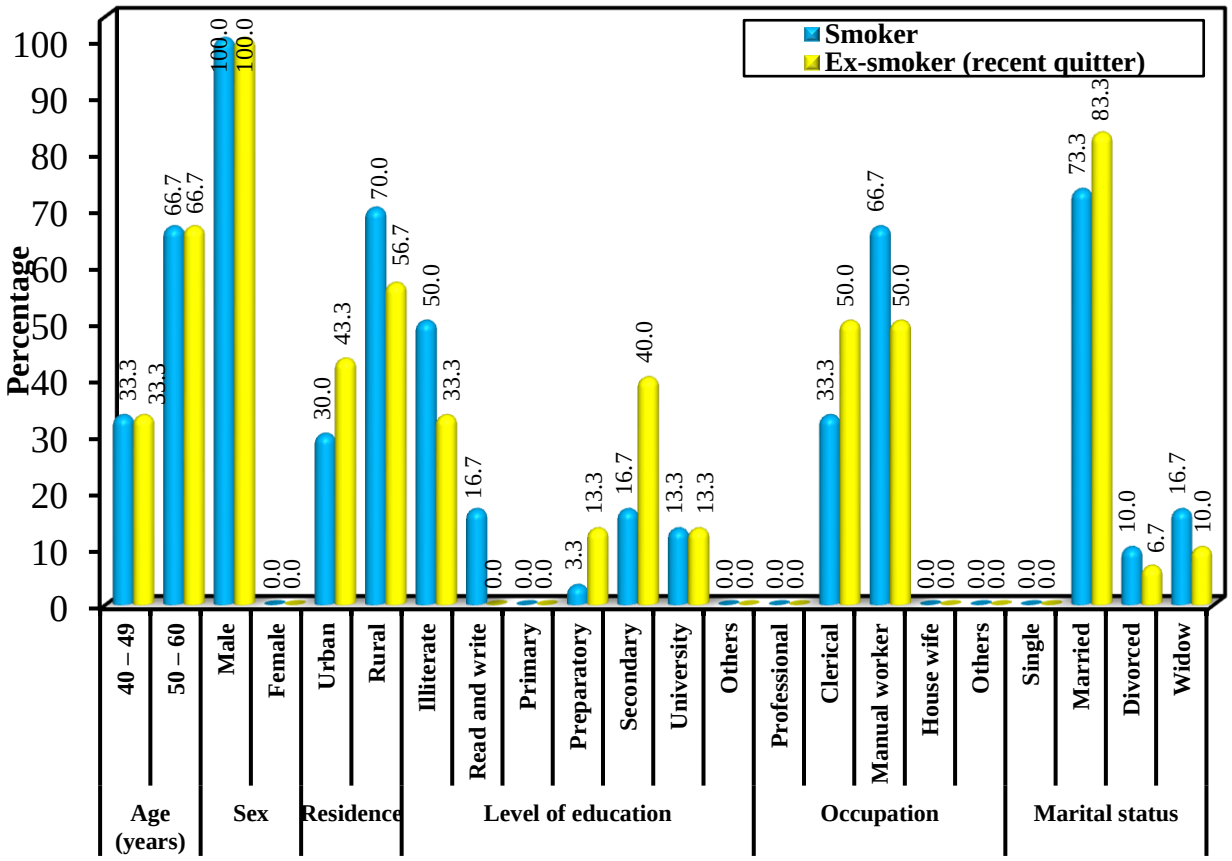

Fig .I: Distribution of the smoker and ex-smoker patients regarding to biosocio-demographic data (n=60)

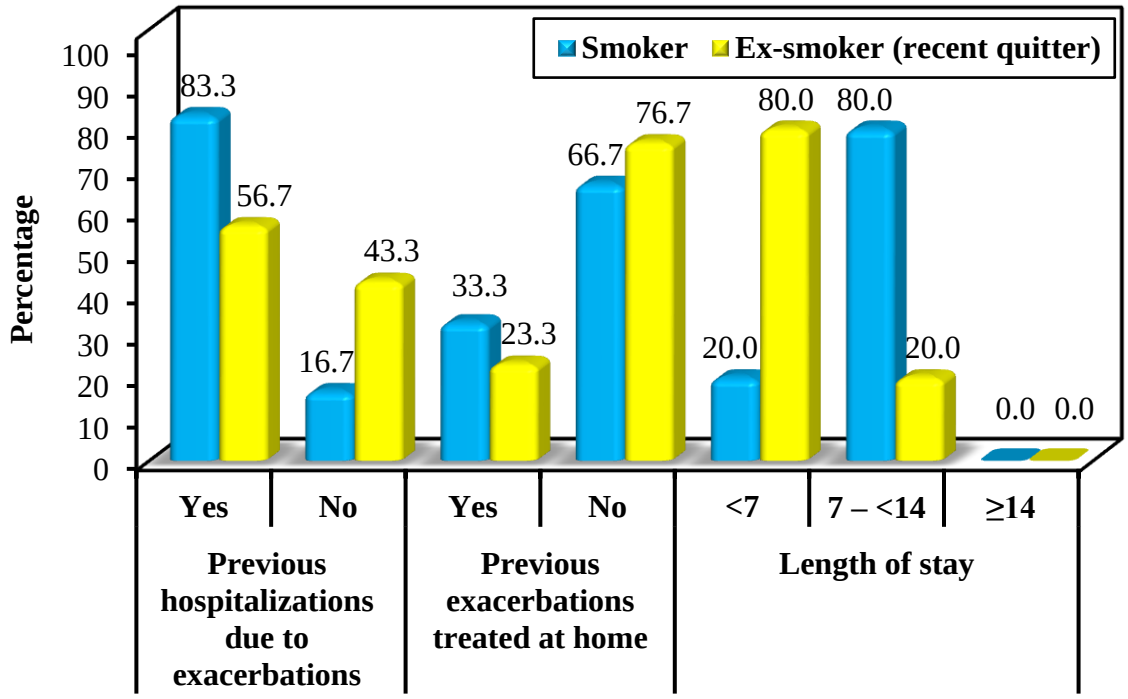

Fig .II: Distribution of the smoker and ex-smoker patients regarding to clinical data (n=60)

Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 6, Issue 3, pp: (103-123), Month: September - December 2019, Available at: www.noveltyjournals.com

Table I: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to pulmonary function assessment (n=60)

PULMONARY FUNCTION ASSESSMENT	CURRENT CONDITION OF SMOKING				TOTAL (N = 60)		TEST OF SIG.	P
	SMOKER (N = 30)		EX-SMOKER (RECENT QUITTER) (N = 30)					
	No.	%	No.	%	No.	%		
FORCED EXPIRATORY VOLUME IN 1 SEC								
≥80 (mild)	3	10.0	5	16.7	8	13.3		
50 – <80 (moderate)	**13**	**43.3**	**16**	**53.3**	**29**	**48.3**	χ^2= 2.087	^{MC}p= 0.611
30 – 50 (severe)	8	26.7	6	20.0	14	23.3		
<30 (very severe)	6	20.0	3	10.0	9	15.0		
Min. – Max.	14.0 – 83.0		28.0 – 83.0		14.0 – 83.0		t=1.862	0.068
Mean ± SD.	49.73 ± 18.16		58.40 ± 17.89		54.07 ± 18.40			
FORCED VITAL CAPACITY								
Min. – Max.	24.0 – 132.0		50.0 – 125.0		24.0 – 132.0		t=2.274*	0.027*
Mean ± SD.	78.03 ± 28.07		93.40 ± 24.13		85.72 ± 27.08			
FEV1% (FEV1 /FVC RATIO)								
Min. – Max.	48.0 – 69.0		55.0 – 68.0		48.0 – 69.0		t=1.337	
Mean ± SD.	63.03 ± 4.03		61.70 ± 3.69		62.37 ± 3.89		0.186	
OXYGEN SATURATION (SPO_2)								
70 – 90	**18**	**60.0**	13	43.3	**31**	**51.7**	χ^2= 1.669	0.196
>90	12	40.0	**17**	**56.7**	29	48.3		
Min. – Max.	70.0 – 96.0		77.0 – 96.0		70.0 – 96.0		t=2.270*	0.028*
Mean ± SD.	85.23 ± 8.77		89.47 ± 5.24		87.35 ± 7.47			

χ^2: Chi square test MC: Monte Carlo t: Student t-test

*: Statistically significant at $p \leq 0.05$

Table II: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to clinical parameters (Activities of daily living (ADL) and functional exercise capacity by (6MWT)) (n=60)

CLINICAL PARAMETERS	CURRENT CONDITION OF SMOKING				TOTAL (N = 60)		TEST OF SIG.	P
	SMOKER (N = 30)		EX-SMOKER (RECENT QUITTER) (N = 30)					
	No.	%	No.	%	No.	%		
ACTIVITIES OF DAILY LIVING (ADL)								
Low(very dependent)	0	0.0	0	0.0	0	0.0		
0 – <6 (partially dependent)	**17**	**56.7**	9	30.0	26	43.3	χ^2= 4.344*	0.037*
6 High (independent)	13	43.3	**21**	**70.0**	**34**	**56.7**		
Min. – Max.	4.0 – 6.0		4.0 – 6.0		4.0 – 6.0		t= 2.213*	0.031*
Mean ± SD.	5.17 ± 0.83		5.60 ± 0.67		5.38 ± 0.78			
FUNCTIONAL EXERCISE CAPACITY BY (6MWT)								
≥ 300 m/ 6 min (Normal score)	0	0	0	0	0	0		
<300 (low score)	**30**	**100.0**	**30**	**100.0**	**60**	**100.0**	-	-
Min. – Max.	150.0 – 270.0		130.0 – 290.0		130.0 – 290.0		t= 2.030*	0.047*
Mean ± SD.	185.5 ± 36.98		208.7 ± 50.39		197.1 ± 45.35			

χ^2: Chi square test t: Student t-test

*: Statistically significant at $p \leq 0.05$

Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 6, Issue 3, pp: (103-123), Month: September - December 2019, Available at: www.noveltyjournals.com

Table III: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to anxiety level assessment (n=60)

ANXIETY LEVEL ASSESSMENT	CURRENT CONDITION OF SMOKING		TOTAL (N = 60)	T	P
	SMOKER (N = 30)	EX-SMOKER (RECENT QUITTER) (N = 30)			
Min. – Max.	37.0 – 73.0	30.0 – 70.0	30.0 – 73.0	0.777	0.441
Mean ± SD.	51.60 ± 12.93	49.07 ± 12.33	50.33 ± 12.59		

t: Student t-test

Table IV: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to respiratory symptoms assessment (n=60)

RESPIRATORY SYMPTOMS ASSESSMENT	CURRENT CONDITION OF SMOKING				TOTAL (N = 60)		X^2	P
	SMOKER (N = 30)		EX-SMOKER (RECENT QUITTER) (N = 30)					
	No.	%	No.	%	No.	%		
COUGH								
Absent	0	0.0	4	13.3	4	6.7		
Present few days (3–5)	7	23.3	**11**	**36.7**	18	30.0		
Present several days (6 – 10)	8	26.7	9	30.0	17	28.3	8.472*	$^{MC}p=0.032^*$
Present most days (>10)	**15**	**50.0**	6	20.0	**21**	**35.0**		
SPUTUM PRODUCTION								
Absent	2	6.7	**10**	**33.3**	12	20.0		
Present few days(3–5)	8	26.7	9	30.0	17	28.3		
Present several days (6 – 10)	**11**	**36.7**	7	23.3	**18**	**30.0**	8.204*	0.042*
Present most days (>10)	9	30.0	4	13.3	13	21.7		
SHORTNESS OF BREATH								
Absent	0	0.0	0	0.0	0	0.0		
Present few days(3–5)	3	10.0	9	30.0	12	20.0		
Present several days (6 – 10)	9	30.0	**12**	**40.0**	21	35.0	6.429*	0.040*
Present most days (>10)	**18**	**60.0**	9	30.0	**27**	**45.0**		
WHEEZING								
Absent	2	6.7	7	23.3	9	15.0		
Present few days(3–5)	5	16.7	**12**	**40.0**	**17**	**28.3**		
Present several days (6 – 10)	10	33.3	7	23.3	**17**	**28.3**	10.738*	$^{MC}p=0.015^*$
Present most days (>10)	**13**	**43.3**	4	13.3	**17**	**28.3**		

χ^2: Chi square test MC: Monte Carlo

*: Statistically significant at $p \leq 0.05$

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Table V: Distribution of the smoker and ex-smoker patients and the significance of differences regarding to breathlessness severity (dyspnea) by modified Medical Research Council (mMRC) (n=60)

BREATHLESSNESS SEVERITY (DYSPNEA) BY MMRC	CURRENT CONDITION OF SMOKING				TOTAL (N = 60)		X^2	P
	SMOKER (N = 30)		EX-SMOKER (RECENT QUITTER) (N = 30)					
	No.	%	No.	%	No.	%		
GRADE 0	0	0.0	0	0.0	0	0.0	6.631	0.036*
GRADE 1	0	0.0	0	0.0	0	0.0		
GRADE 2	3	10.0	9	30.0	12	20.0		
GRADE 3	10	33.3	**13**	**43.3**	23	38.3		
GRADE 4	**17**	**56.7**	8	26.7	**25**	**41.7**		

χ^2: Chi square test

Table VI: Correlation between pulmonary function test and different parameters in smoker group (n = 30)

DIFFERENT PARAMETERS		PULMONARY FUNCTION TEST (PFT)		
		FORCED EXPIRATORY VOLUME IN 1 SEC	FORCED VITAL CAPACITY	FEV1% (FEV1 /FVC RATIO)
OXYGEN SATURATION (SPO_2)	**R**	0.940*	0.949*	-0.018
	P	<0.001*	<0.001*	0.924
RESPIRATORY SYMPTOMS ASSESSMENT	**R**	-0.910*	-0.914*	0.069
	P	<0.001*	<0.001*	0.717
BREATHLESSNESS SEVERITY (DYSPNEA) BY MMRC	**R**	-0.785*	-0.784*	0.090
	P	<0.001*	<0.001*	0.636
ACTIVITIES OF DAILY LIVING (ADL)	**R**	0.759*	0.754*	0.184
	P	<0.001*	<0.001*	0.330
FUNCTIONAL EXERCISE CAPACITY BY 6 MINUTES WALKING DISTANCE (6MWD)	**R**	0.762*	0.777*	-0.033
	P	<0.001*	<0.001*	0.861
ANXIETY LEVEL ASSESSMENT	**R**	-0.953*	-0.949*	-0.076
	P	<0.001*	<0.001*	0.688

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

Table VII: Correlation between pulmonary function test and different parameters in ex-smoker group (recent quitter) (n = 30)

DIFFERENT PARAMETERS		PULMONARY FUNCTION TEST		
		FORCED EXPIRATORY VOLUME IN 1 SEC	FORCED VITAL CAPACITY	FEV1% (FEV1 /FVC RATIO)
OXYGEN SATURATION (SPO_2)	**R**	0.967*	0.957*	0.802*
	P	<0.001*	<0.001*	<0.001*
RESPIRATORY SYMPTOMS ASSESSMENT	**R**	-0.957*	-0.922*	-0.805*
	P	<0.001*	<0.001*	<0.001*

BREATHLESSNESS SEVERITY (DYSPNEA) BY MMRC	**R**	-0.549*	-0.517*	-0.479*
	P	0.002*	0.003*	0.007*
ACTIVITIES OF DAILY LIVING (ADL)	**R**	0.410*	0.445*	0.319
	P	0.024*	0.014*	0.086
FUNCTIONAL EXERCISE CAPACITY BY 6 MINUTES WALKING DISTANCE (6MWD)	**R**	0.990*	0.975*	0.809*
	P	<0.001*	<0.001*	<0.001*
ANXIETY LEVEL ASSESSMENT	**R**	-0.999*	-0.984*	-0.799*
	P	<0.001*	<0.001*	<0.001*

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$