Risk factors associated with chronic obstructive pulmonary disease in Arar, Saudi Arabia: A case-control study

Basem M M Salama¹, Abdelrahman M.A. Abukanna², Ahmed M. S. Hegazy³

¹Family & Community Medicine Department Faculty of Medicine, Northern Border University, KSA; and Community Medicine Department, Damietta Faculty of Medicine, Al-Azhar University, Egypt.
²Department of Medicine, Faculty of Medicine, Northern Border University, KSA
³Anatomy Department, Faculty of Medicine, Northern Border University, KSA; and Benha Faculty of Medicine, Benha University, Egypt

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a condition characterized by inflammation and narrowing of the lungs’ airways and damaged air sacs. It is a major preventable and treatable public health problem around the globe. The study aimed to identify risk factors associated with Chronic Obstructive Pulmonary Disease among adults. Subject and methods: A total of 314 participants (157 Cases (COPD) and 157 controls) were randomly selected in a case-control study conducted in Arar City, Northern Border Province, Saudi Arabia in the period from January 2019 to December 2019. Results: Risk factors with significant differences found between COPD and control groups were gender, age, level of education, residence, socioeconomic status, family
history, smoking passive smoking, and dusty work (P < 0.05). In multivariable analysis, smoking amount and duration, family history of COPD, history of poorly treated asthma, and age were the only independent factors associated with higher odds of having COPD. **Conclusion:** The results of this study showed that amount and duration of smoking not just smoking alone were important risk factors of COPD.

**Keywords:** Chronic, Obstructive, Pulmonary, Disease, smoking

1. INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a recognized common, treatable and preventable disease that’s characterized by chronic respiratory symptoms and airflow limitation which is because of the airway and/or alveolar abnormalities commonly caused by significant exposure to noxious gases or particles. The chronic airflow limitation that characterizes COPD is due to the effect of a both small airways disease like obstructive bronchiolitis and emphysema causing parenchymal destruction, which can vary from person to another. The characteristic features of the disease, airflow limitation, and mucociliary dysfunction are usually caused by the destruction and loss of small airways (Vestbo et al., 2017). In low- and middle-income countries, COPD associated with tobacco smoking and household air pollution (HAP). An estimated 328 million people have COPD worldwide, (Eisner et al., 2011) and in 15 years, COPD is anticipated to become the leading reason behind death (Alwan, 2010). Billion people worldwide are exposed to toxic amounts of household air pollution daily and this account for 3.5–4 million deaths annually (Gordon, et al., 2014).

Billion people worldwide use biomass and coal as their essential source of energy for cooking, heating, and other household purposes leading to indoor pollution which considered a greater fraction of COPD risk than smoking or outdoor pollution. This explained the high prevalence of COPD among nonsmoking women in the Middle East, Africa, and Asia. Indoor pollution resulting from the burning of wood and other biomass fuels is estimated to kill two million women and kids every year. Other risk factors for COPD include occupational dust and chemicals (such as vapors, irritants, and fumes) and frequent lower respiratory infections during childhood (WHO, 2020). It is known that genetic factors have an important role in the occurrence of COPD. It’s more common among relatives of those with COPD who smoke than unrelated smokers (Vestbo et al., 2017). Currently, the sole inherited risk factor is alpha1-antitrypsin deficiency (AAT) (Foreman et al., 2012). Wali et al., 2014 reported the prevalence of COPD within the general population of Saudi Arabia is 2.4%, which is below that reported in industrialized countries.

Clinical features of COPD are nonspecific, and individuals may incorrectly be labeled as having COPD. Alternatively, symptoms could also be mild and underestimated by patients, leading to substantial under-diagnosis. Spirometry is important to form the diagnosis and should be performed in patients with dyspnea, chronic cough or sputum production, and a history of exposure to risk factors (Charles et al., 2020). The typical presenting symptoms and signs in patients include cough, sputum production, progressive exercise intolerance, worsening dyspnea, and alteration in consciousness as a result of bronchitis, emphysema, and reactive airway disease. The most helpful information was usually provided by 3 signs including a self-reported smoking history of over 55 pack-year, wheezing on auscultation, and self-reported wheezing. However, in case, all 3 signs are absent, airflow obstruction is nearly ruled out (Qaseem et al., 2011). The risk factors related to the event of COPD and their association with occupation and age weren’t studied before in Arar city, this is the rationale why we conducted this study.

2. PATIENTS AND METHOD

**Study design and setting**

A case-control study carried out on adult individuals (aged >18 years) over the period from January 2019 to December 2019 in Arar city, which is the capital of Northern Border Province in Saudi Arabia near the Iraqi border.

**Sampling technique**

All participants who met the study criteria and gave their consent to take part in the study were consecutively selected. The sample size was calculated using Epi info program, version 7.1.5, 2015. Estimates were based on an odds ratio (OR) of 2.5, assuming a frequency of single exposure of 25% among controls and 45% among patients, with a power of 80% and a significance level of 5%.

**Study Population**

Cases were patients who had diagnosed with COPD (mild, moderate, or severe) by a chest physician, and had a post-bronchodilator FEV1/FVC <0.7. For each case, one control was selected (free of COPD) but attend the same units for other reasons. A total of 157 patients were included as cases and 157 patients as controls.
**Data Collection**

Informed consent was obtained from all patients and controls and a questionnaire was used to interview the respondents. Information obtained from the respondents consisted of age, residence, occupation, gender, smoking status (passive or active and current, previous or never smoker, duration, and amount) and family and medical histories.

**Statistical analysis**

Data will be analyzed by the use of SPSS software, version 16.0 (SPSS Inc. Chicago, USA). The univariate analysis will be used to compare variables for the outcomes of interest. Appropriate statistical tests were used for comparison between the two study groups (Continuous data will be compared using the Student’s t-test. Either χ² or Fisher’s exact tests were used to compare categorical variables). Odds ratio and 95% CI for it was calculated. A multivariate regression analysis was also performed to determine the predictors of COPD. Results were considered to be statistically significant at p < 0.05.

3. RESULTS

A total of 314 patients, 157 participants as cases (have COPD) and 157 participants as controls (have not COPD) were included in our study. Their average age was 60.7 ± 13.5 years.

**Table 1** Comparison between cases and control regarding age, amount, and duration of smoking

<table>
<thead>
<tr>
<th></th>
<th>Case</th>
<th>Control</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>63.8±12.9</td>
<td>57.7±13.4</td>
<td>0.001</td>
</tr>
<tr>
<td>Duration of smoking</td>
<td>27.6±12.5</td>
<td>19.4±16.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Amount of smoking</td>
<td>34.4±14.7</td>
<td>15.5±12.8</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table (1) and figure (1) shows a highly significant difference between case and control group regarding the mean of age, duration of smoking, and amount of smoking (P = 0.001).

![Figure 1 Amount and duration of smoking difference between cases and control groups](image)
Table 2  Socio-demographic, smoking status, and medical history difference between case and control group

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Case</th>
<th>Control</th>
<th>(OR)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (male)</td>
<td>90/157</td>
<td>72/46</td>
<td>1.6</td>
<td>0.04</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>below Secondary education</td>
<td>112/157</td>
<td>166/55.3</td>
<td>2.4</td>
<td>0.001</td>
</tr>
<tr>
<td>Secondary education and higher</td>
<td>38/157</td>
<td>134/44.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residence (urban)</td>
<td>135/157</td>
<td>120/76</td>
<td>1.9</td>
<td>0.03</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>20/157</td>
<td>11/7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>moderate</td>
<td>79/157</td>
<td>90/57</td>
<td>0.9**</td>
<td>0.6</td>
</tr>
<tr>
<td>high</td>
<td>58/157</td>
<td>56/37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family history(yes)</td>
<td>53/157</td>
<td>29/19</td>
<td>2.3</td>
<td>0.002</td>
</tr>
<tr>
<td>Smoking (yes)</td>
<td>140/157</td>
<td>73/44.7</td>
<td>6.3</td>
<td>0.001</td>
</tr>
<tr>
<td>Type of Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>shisha</td>
<td>11/157</td>
<td>11/11</td>
<td>2.7**</td>
<td>0.003</td>
</tr>
<tr>
<td>Both</td>
<td>33/157</td>
<td>8/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarette</td>
<td>96/157</td>
<td>82/82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondhand smoke(yes)</td>
<td>148/157</td>
<td>80/42</td>
<td>4.2</td>
<td>0.001</td>
</tr>
<tr>
<td>Indoor Pollution(yes)</td>
<td>40/157</td>
<td>20/30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dusty work (yes)</td>
<td>48/157</td>
<td>20/8</td>
<td>1.8</td>
<td>0.03</td>
</tr>
<tr>
<td>Poorly treated asthma(yes)</td>
<td>38/157</td>
<td>19/8</td>
<td>1.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Recurrent RTI (yes)</td>
<td>52/157</td>
<td>27/14</td>
<td>1.4</td>
<td>0.2</td>
</tr>
</tbody>
</table>

* low and moderate Socio economic status grouped for statistical analysis
** Shisha and both (shisha and cigarettes) grouped for statistical analysis

Table (2) shows a highly significant difference between the case and control group regarding gender, residence, and educational level (P = 0.001). A dusty work was significantly associated with COPD (P = 0.03). Participant cases were significantly (P= 0.001) more likely to report a history of cigarette smoking, second-hand smoke, and family history of COPD. Who smoked shisha or both (shisha and cigarettes) at higher risk of COPD (2.7) times more than who smoked cigarettes only. In multivariate logistic regression analysis, smoking amount and duration, family history of COPD, history of poorly treated asthma and age (OR =7.0, CI = [2.4-11.1], OR =4.3, CI = [1.8-9.9], OR =3.4, CI = [1.2-9.7], OR =2.9, CI = [1.2-6.9], OR =2.0, CI = [1.1-3.8] respectively) were found to be independently associated with COPD (Table 3).

Table 3  Multivariate logistic regression analysis of risk factors of COPD

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>P-value</th>
<th>Adj. OR</th>
<th>CI (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking amount</td>
<td>0.001</td>
<td>7.0</td>
<td>2.4-11.1</td>
</tr>
<tr>
<td>Smoking duration</td>
<td>0.001</td>
<td>4.3</td>
<td>1.8-9.9</td>
</tr>
<tr>
<td>Family history of COPD</td>
<td>0.02</td>
<td>3.4</td>
<td>1.2-9.7</td>
</tr>
<tr>
<td>Poorly treated asthma</td>
<td>0.02</td>
<td>2.9</td>
<td>1.2-6.9</td>
</tr>
<tr>
<td>Age</td>
<td>0.036</td>
<td>2.0</td>
<td>1.1-3.8</td>
</tr>
<tr>
<td>Recurrent respiratory infection</td>
<td>0.08</td>
<td>1.8</td>
<td>0.94-9.6</td>
</tr>
</tbody>
</table>
4. DISCUSSION
In this study, we included 157 patients confirmed to have COPD as a study group and 175 individuals without COPD as a control group. We found a significant difference with regard to age, duration of smoking, and the amount of smoking between the study group and controls. This was consistent with most of the studies in western countries (Figueira & Pérez, 2017) Asia and Saudi arabia (Rubin & Tuder, 2012; Wang et al., 2018; Zha et al., 2019; Idolor et al., 2011; Bhome and Brashier, 2014; Al Ghobain et al., 2015; Al Ghobain, et al., 2011), although other studies found that the duration of smoking alone is more essential than the number of cigarettes smoked per day and also packed years (Bhatt et al., 2018). There is a significant difference related to age in our study group compared to the control group especially in men which were found to be affected more than women (57% and 43% respectively), this is consistent with many studies worldwide (Fragoso, 2016; Aryal et al., 2013; Jindal, 2012) although many studies are showing the increasing prevalence of COPD among women especially in developed countries (Georgios et al., 2018).

In this study we found a significant difference in family history of COPD between the study and control groups, suggesting the importance of possible genetic factors. This is consistent with the finding of Terzikhan et al., 2016. There is also a significant difference related to poorly treated bronchial asthma between the study and control groups suggesting its possible role as a risk factor for COPD. This is similar to the finding of Hayden et al., 2018 study. In this study, we found the majority of COPD patients (74.7%) had an educational level below the secondary school, which is found as a major risk factor for COPD (Wang et al., 2018).

5. CONCLUSION
This study showed that the amount and duration of smoking were important risk factors for development of COPD in addition to family history, poorly treated asthma and low education level.

Recommendation
- More measures to prevent smoking
- Health education programs to increase the awareness of the community about the dangers of smoking and empowering them to stop it.

Limitations
First the study used a case-control design and data on the exposure were collected retrospectively, so recall bias is common. Second, the sample was not representative of all the Saudia population as it was conducted in one governorate only.

Funding
This study was funded by Deanship of Scientific Research, Northern Border University.

Conflict of Interest
The authors declare that they have no conflict of interest.
Informed consent
Informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval
Ethical was considered and the study was approved by the local committee of research in Northern Border University, Saudi Arabia (H: 09- A: 51). All participants included in the study gave their consent to participate in the research and they were informed that all collected data will be used for scientific purposes only.

Acknowledgments
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REFERENCE


