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COAL DUST IMPACT AND THE PRESENCE OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN EXPOSED WORKERS IN KOSOVO POWER PLANT

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) is a condition that is characterized by airflow limitation that is not fully reversible and worsens with time. Worldwide, cigarette smoking is the most commonly encountered risk factor for COPD, although in many countries, air pollution resulting coal dust or from the burning of wood and other biomass fuels has also been identified as a COPD risk factor. COPD is a heterogeneous disorder that encompasses traditional clinical entities such as emphysema and chronic bronchitis (S Drivas *et al.,* 2007, BJ Make, *et al.,* 2010). The Global Initiative for Chronic Obstructive Lung Disease-GOLD (JB Soriano et al., 2017) a collaborative effort from the National Heart, Lung, and Blood Institute; the National Institutes of Health; and the World Health Organization, defines COPD as a usually progressive disease with airflow limitation / progressive dispnoea/ that is not fully reversible and associated with an abnormal inflammatory response of the lungs to noxious particles or gases.Patients with COPD present with a variety of clinical findings, including elements of chronic bronchitis and emphysema (RJ Halbert *et al.,* 2003, R Perez Padilla *et al.,* 2005, KR Chapman *et al.,* 2006). Although COPD and asthma are both associated with airflow obstruction and inflammation of the lung and airways, asthma-related airflow obstruction is more reversible and the disease course is more variable than with COPD (AD Lopez *et al.,* 2006, As Buist *et al.*, 2007, TJ Wilt *et al.,* 2005) Purpose of the study: **The purpose of this study** is to determine the role and relationship between occupational coal dust exposure and the presence of chronic obstructive pulmonary disease /COPD/ in exposed workers. This study is done in the Institute of Occupational health in Obiliq, Kosovo.

Key words: Coal Dust, Chronic Obstructive Pulmonary Disease, Obiliq

Material and methods: The group exposed to coal dust was workers in the maintenance department, while the control group was workers from another department with a lower level of coal dust air pollution. The both groups together included 192 workers.We tested the coefficient and the correlation parameters 'a' and 'b' for regression. Differences between variables were tested with t-test and X2-test.The average value of FVC - Forced Vital Capacity for all examined workers was 4.62 L with variability from minimum 2:41liters to maximum 7.13, without significant changes between groups. Differences are shown within each group, among workers with exposure up to 19 years and those over 20 years. Thus obtained values of average FVC were lower in workers with longer exposure. High negative coefficient of linear correlation was found high in both groups. In the exposed group r=-0.35, whereas in the control group r=-0.46. The average value of FEV1- Forced Expiratory Volume in one second for all workers was 3.69, with variability from minimum 1.99 to maximum 5.68, without significant changes between groups. FEV1, the average value for the longer exposed group was 3.50 versus 4.0 to another exposure. In the control group the difference was 3.53 for exposure more than 20 years, versus 3.94 for those with exposure up to 19 years. In general, FEV1/FVC ratio,

for all workers, show lower obtained values than predicted values, and the average difference was -0.36, with variability from -25.00 to +20.00.

Conclusions: Coal dust affects more the workers with longer exposure and older age than those with shorter exposure and younger age along with brief exposure and other chronic pulmonary disease. Coal dust along with smoking affects the reduction of values of the FVC parameters.

Keywords: chronic obstructive pulmonary disease(COPD), coal dust, risk Factors

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD), one of the most prevalent healthcare problems in the world, constitutes a major cause of morbidity and mortality in both developed and underdeveloped countries. It is estimated to be responsible for the death of 250 people per hour worldwide.Tobacco use remains the main risk factor for development of COPD; nevertheless, this disease also develops in never smokers (RJ Halbert *et al.,* 2003).Occupational risk factors, data from the Third National Health and Nutrition Examination Survey, estimated that 19% of all cases of COPD (31% among never smokers) were attributed to occupational factors. (R Perez –Padilla *et al.* 2005) .COPD is defined by the World Health Organization (WHO) Global Obstructive Lung Disease (GOLD) initiative and the American Thoracic Society (ATS)/European Respiratory Society (ERS) guidelines as a disease characterized by airflow limitation that is not fully reversible and is progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases (S Drivas *et al.,* 2007) .The global burden of chronic obstructive pulmonary disease (COPD) is increasing; the disease is projected to be the third leading cause of death and fifth leading cause of overall disability worldwide by 2020 (Drivas et al., 2007) Men and women seem to be at an equal risk, and the death rate attributable to COPD is increasing significantly in both sexes The economic consequences of COPD are substantial. In 2002, the estimated total societal cost of COPD in the United States was $32 billion (S Drivas *et al.,* 20007, BJ Make *et al.,* 2010). COPD is a heterogeneous disorder that encompasses traditional clinical entities such as emphysema and chronic bronchitis. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) (R Perez –Padilla *et al.,* 2005) a collaborative effort from the National Heart, Lung, and Blood Institute; the National Institutes of Health; and the World Health Organization, defines COPD as a usually progressive disease with airflow limitation that is not fully reversible and that is associated with an abnormal inflammatory response in the airways and lung parenchyma that is generally distinguishable from the inflammation caused by asthma. Patients with COPD present with a variety of clinical findings: with coughing, sputum production, and dyspnea on exertion. However, none of these findings alone is diagnostic. including elements of chronic bronchitis and emphysema. Although COPD and asthma are both associated with airflow obstruction and inflammation of the lung and airways, asthma-related airflow obstruction is more reversible and the disease course is more variable than with COPD (KR Chapman *et al.,* 2006, AD Lopez *et al.*, 2006, AS Buist *et al.,* 2007). It is a condition that is characterized by a limitation of air circulation during expiration and which is not entirely reversible and worsens over time, It is simply a state of progressive dispnoea that in time worsens and is resistant to treatment,It poses a high public health threat.Fourth place as a cause of mortality and morbidity and early disability in US. According to WHO and World Bank until 2020, it will take the fifth place of mortality. Although in recent years there is a growing commitment to this disease, still

it is still ignored and unknown by public health and health personnel. Among the main causes of COPD is obviously smoking, though in industrialized countries where environmental pollution from fuels such as coal and other are also identified as a major risk factor for COPD. Kosovo is all covered with lignite, in some places the depth of lignite is shallow and there is no need for a dig deep. Its exploitation has started very early.Today besides being the main source of electricity in many cases it is also a source of heat as a raw burning material. Side effects or negatives of this,the side or negative effects of this exploitation are known, especially to employees who are in direct contact with it.Diagnostic criterion for COPD disease is a forced expiratory volume in one second/forced vital capacity ratio of less than 70 percent of the predicted value. Severity is further stratified based on forced expiratory volume in one second and symptoms. Chest radiography may rule out alternative diagnoses and comorbid conditions. Selected patients should be tested for α1-antitrypsin deficiency. Arterial blood gas testing is recommended for patients presenting with signs of severe disease, right-sided heart failure, or significant hypoxemia. Chronic obstructive pulmonary disease also is a systemic disorder with weight loss and dysfunction of respiratory and skeletal muscles. Exposure to tobacco smoke is the most significant risk factor for COPD, with 80 to 90 percent of all cases attributable to smoking.Evidence linking tobacco smoke exposure and COPD predominantly comes from population-based studies that have consistently shown that smoking is associated with diminished lung function, more frequent respiratory symptoms, and increased COPD-related deaths (TJ Wilt *et al.*, 2005, E Hnizo *et al.,* 2006, SD Roberts *et al.,* 2006). Pipe and cigar smoking are associated with increased COPD risk, but at a lesser rate than with cigarette smoking. Although cigarette smoking is a significant risk factor for COPD, only about 20 percent of cigarette smokers develop clinically significant COPD. The second most significant documented risk factor for COPD is α_1-antitrypsin deficiency. Although α_1-antitrypsin deficiency increases the risks associated with smoking, COPD can develop in never-smokers with α_1-antitrypsin deficiency. One percent of COPD cases are attributable to severe α_1-antitrypsin deficiency (BR Celli *er al,* 2003, OF Pedersen *et al.,* 2005)Certain occupational exposures are associated with increased risk of COPD . Exposure to solid biomass fuels, commonly used for indoor cooking and heating, is a risk factor for COPD, particularly in the developing world (OF Peersen *et al.,* 2005, PJ Sterk 2004)

Objectives: The objective of this study is to determine the role and relationship between occupational coal dust exposure and the presence of chronic obstructive pulmonary disease /COPD/ in exposed workers. The other objective is to determine the time of exposure, workplace and eventual correlation to the lung function of the lung ventilation.This study is done in the Institute of Occupational health in Obiliq, Kosovo.

Methodology: The study was conducted at the Obiliq- Kosovo –occupational health Institute. The data were obtained from the database of a regular employee visits during the 7-year period of time at the occupational health institute in Obiliq . IPower Plant "Kosova B".The group exposed to coal dust were the workers in the maintenance department, and the control group were the workers out or far from contact with coal dust particlesStudies included if dust exposure was measured quantitatively, and a quantitative relationship between dust exposure and one of the outcomes of interest was calculated while controlling at least for smoking and age.

Methodological rigor was assessed, and data regarding the study populations, prognostic factors, and outcomes were extracted from database of medical record department.The retrospective method of epidemiological /cross sectional /a study and randomized selection were the basis for data collection.The sample size has been 182, of which 91 individuals belong to the group exposed to coal particles /noxious/ and 91 individuals (other control groups) away from exposure to lignite / coal dust nozzles.Data on diseases and functional lung tests are

obtained from the health card and are listed for analysis based on the questionnaire listed in advance.

Statistical data processing: Methodological rigor was assessed, and data regarding the study samples, prognostic factors, and outcomes were extracted from database of medical record department.In statistical processing, these statistical parameters are matched:Continuous variable are presented as mean (standard deviation SD) and categorical variables as absolute and relative frequencies.Association between categorical variables were explored by the use of *chi*-square test.Univariate analysis of normally distributed continuous variable was performed by *t*-test.Logistic regression analysis was used as the multivariate analysis in order to assess the impact on symptomatic status , and respiratory function of occupational exposure to lignite dust, smoking habit, and age. In these models of multivariate analysis symptoms of chronic bronchitis and the ratio FEV1/ FVC<70% were the dependent variable , while age, smoking and occupational exposure status were the independent one's. Odds ratios (OR) and 95% confidence interval CI were calculated. The statistical significance was set at 0.05

The results are presented in 4 chapters:

1. The first chapter presents the general data on the examined workers.
2. The second chapter analyzes the spirometry results, forced vital capacity measurements (FVC)
3. Third chapter - data analysis gained from the forced expiratory volume in first second(FEV1)
4. Fourth chapter –Tifnow index- ratio between FEV1 and FVC (In all chapters there are two groups compared, one exposed and that of control.

First chapter

Të ekzaminuarit sipas grup-moshës

Tab. 1.

Grup-mosha	grupi				Gjithsej	
	I ekspozuar		I kontrollit			
	N	%	N	%	N	%
20-29	2	2.2	4	4.4	6	3.3
30-39	20	22.0	14	15.4	34	18.7
40-49	21	23.1	43	47.3	64	35.2
50-59	45	49.5	21	23.1	66	36.3
60+	3	3.3	9	9.9	12	6.6
Gjithsej	91	100.0	91	100.0	182	100.0
mosha mesatare (Xb)	47.2		45.9		46.5	
devijimi standard (SD)	8.4		9.3		8.9	

Të ekzaminuarit sipas gjatësisë trupore

Tab. 2.

Gjatësia trupore cm.	grupi				Gjithsej	
	I ekspozuar		I kontrollit			
	N	%	N	%	N	%
150-159	2	2.2	3	3.3	5	2.7
160-169	18	19.8	23	25.3	41	22.5
170-179	56	61.5	53	58.2	109	59.9
180+	15	16.5	12	13.2	27	14.8
Gjithsej	91	100.0	91	100.0	182	100.0
Gjatësia mesatare (Xb)	174.1		172.4		173.2	
Devijimi standard (SD)	6.1		6.8		6.5	

Të ekzaminuarit sipas peshës trupore trupore

Tab. 3.

Pesha trupore kg.	grupi				Gjithsej	
	I ekspozuar		I kontrollit			
	N	%	N	%	N	%
40-59	3	3.3	3	3.3	6	3.3
60-79	34	37.4	33	36.3	67	36.8
80-99	46	50.5	46	50.5	92	50.5
100+	8	8.8	9	9.9	17	9.3
Gjithsej	91	100.0	91	100.0	182	100.0
Pesha mesatare (Xb)	83.2		83.4		83.3	
Devijimi standard (SD)	12.6		14.1		13.3	

Të ekzaminuarit sipas ekspozimit

Tab. 4.

Ekspozimi vjet	grupi				Gjithsej	
	I ekspozuar		I kontrollit			
	N	%	N	%	N	%
0-9	23	25.3	29	31.9	52	28.6
10-19	7	7.7	10	11.0	17	9.3
20-29	44	48.4	31	34.1	75	41.2
30+	17	18.7	21	23.1	38	20.9
Gjithsej	91	100.0	91	100.0	182	100.0
Ekspozimi mesatar (Xb)	21.5		19.4		20.4	
Devijimi standard (SD)	9.8		10.0		10.0	

Second chapter

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FVC - vlerat e fituara

parametrat statistikor

Tab. 8.

FVC - vlerat e fituara	grupi				Gjithsej		
	I ekspozuar		I kontrollit				
	N	%	N	%	N	%	
2.00-3.49	5	5.5	5	5.5	10	5.5	
3.50-4.99	60	65.9	55	60.4	115	63.2	
5.00+	26	28.6	31	34.1	57	31.3	
Gjithsej	91	100.0	91	100.0	182	100.0	
vlera mesatare (Xb)	4.63		4.61		4.62		t=0.12
devijimi standard (SD)	0.70		0.83		0.76		P>0.05
vlera maksimale (Xmax)	6.23		7.13		7.13		
vlera minimale (Xmin)	2.41		3.01		2.41		

FVC- raporti midis vlerave të fituara dhe atyre referente (%)

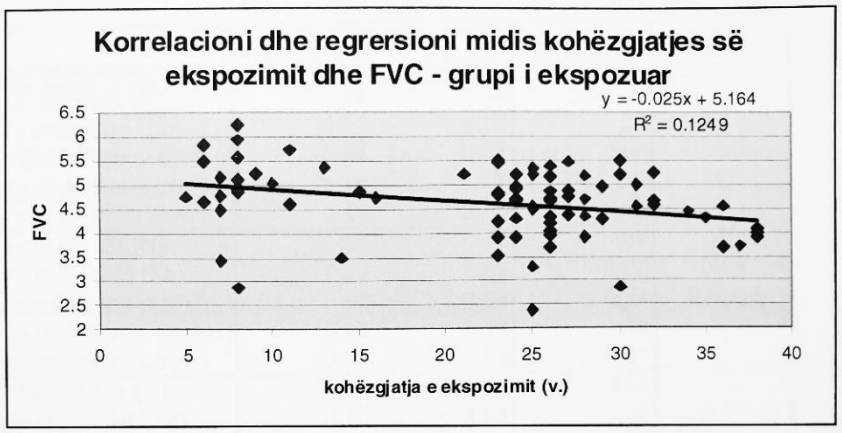
Shkalla e obstrukcionit sipas grupeve dhe tipareve te hulumtuara

Tab. 16.

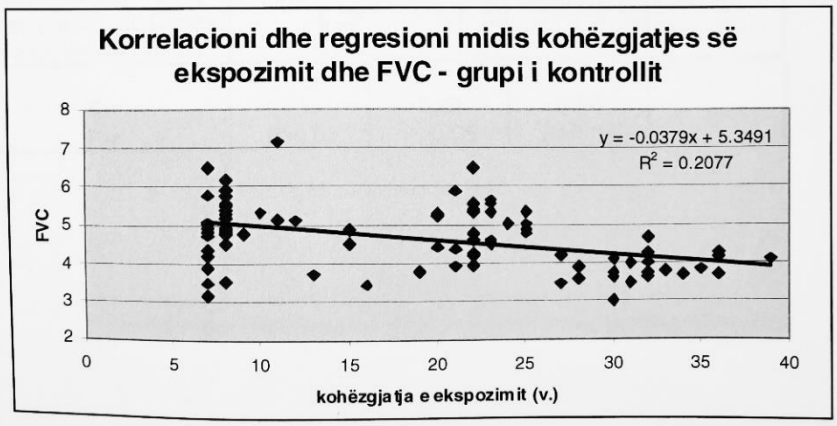
			grupi				Grand Total	
			I ekspozuar		I kontrollit			
			N	%	N	%	N	%
Gjithsej		te ekzaminuar	91	100.0	91	100.0	182	100.0
		me obstrukcion (60-79%)	5	5.5	4	4.4	9	4.9
ekspozimi	-19 v.	te ekzaminuar	30	100.0	39	100.0	69	100.0
		me obstrukcion (60-79%)	2	6.7	1	2.6	3	4.3
	20+	te ekzaminuar	61	100.0	52	100.0	113	100.0
		me obstrukcion (60-79%)	3	4.9	3	5.8	6	5.3
pirja e duhanit	po	te ekzaminuar	32	100.0	18	100.0	50	100.0
		me obstrukcion (60-79%)	2	6.3	3	16.7	5	10.0
	jo	te ekzaminuar	59	100.0	73	100.0	132	100.0
		me obstrukcion (60-79%)	3	5.1	1	1.4	4	3.0
diagnoza sëmundja	po	te ekzaminuar	34	100.0	5	100.0	39	100.0
		me obstrukcion (60-79%)	2	5.9	1	20.0	3	7.7
	jo	te ekzaminuar	57	100.0	86	100.0	143	100.0
		me obstrukcion (60-79%)	3	5.3	3	3.5	6	4.2

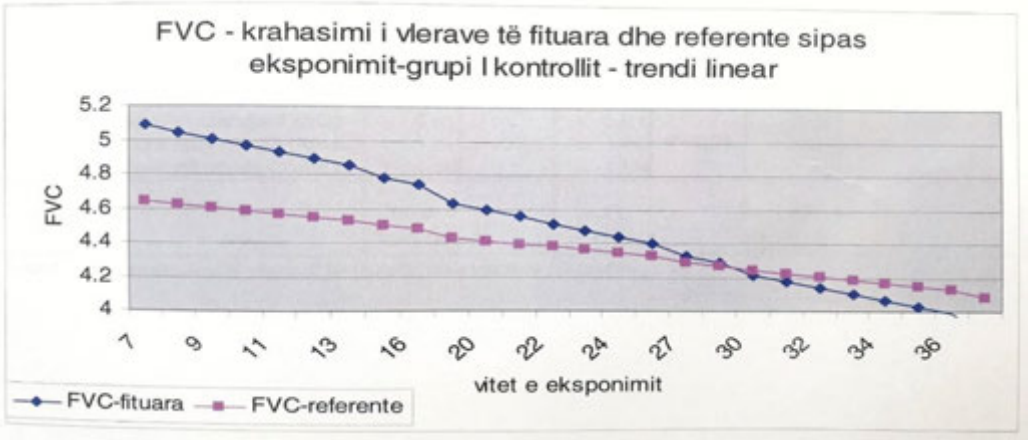
Third chapter

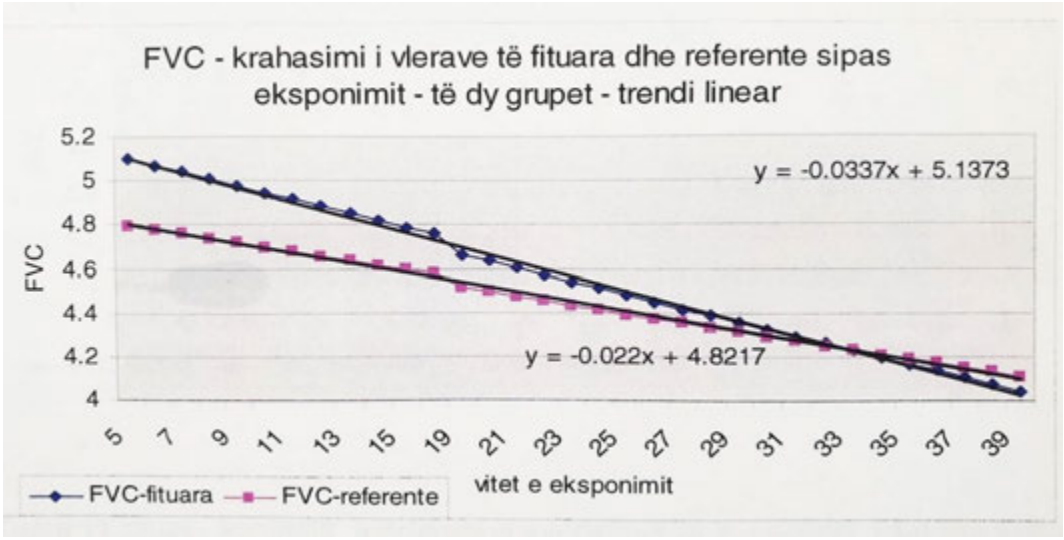
N= 91
R= -0.35
a= 5.16
b= -0.02
t= -3.56
p= <0.01

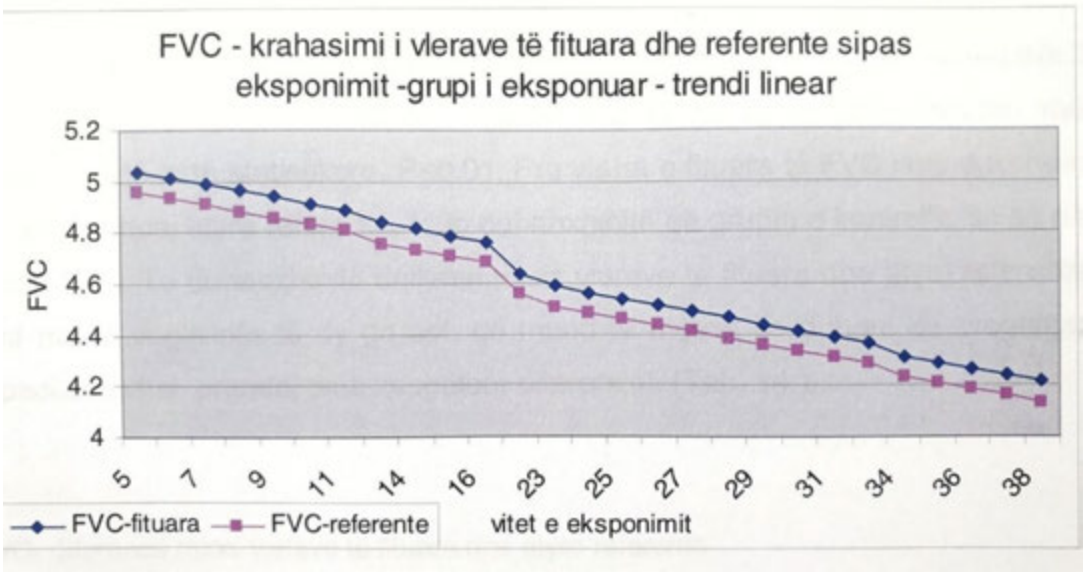


N= 91
R= -0.46
a= 5.35
b= -0.04
t= -4.83
p= <0.01









DISCUSSION

COPD is a preventable and treatable disease followed by some significant extrapulmonary changes that may affect its discourse

COPD can be diagnosed at any stage. It is a progressive disease that continues to get worse by **exposing to causing agents.** It is presented in 3 formes: light, moderate and severe Its severity is determined based on the spirometry values of the Tifnous FEV1 / FEV index.The results of the tests of the lung function found a statistically significant association between loss of lung function and cumulative respirable dust exposure. According to the results of the study, the exposed and the control group are comparable by age, length and body weight.The average age of the examinees was 46.5 years without significant differences between the groups.

Average body length 173.2 cm. The average body weight was 83.3 kg.The exposure time and the work time of the dust have been identical.The average exposure was 20.4 years.Of the 182 examinations, 50 of them have been declared as a smoker. According to the highest groups it was exposed to 35.2% versus 19.8% COPD is a condition characterized by progressive dysfunction that is not completely reversible and worsens over time.The main purpose of this paper has been to determine the role of air pollution with coal dust in the appearance/ PRESENCE of chronic obstructive lung diseases that are exposed to it..The study was done in Obiliq - Institute of Occupational Medicine.The data are taken from the database of systematic employee qualifications.Retrospective Research Method and Randomized Selection. Sample size 182.For cross-sectional study. Differences between variables are measured by t-test and X2 test, and p-value reliability.Average age 46.5 years, body length 173 cm, body weight 83.4. average exposure 20.4 years.
sequelPrevalence of smoking 27.5%. Highest in the exposed group.The average value of the FVC of all examined was 4.62 L / s with a minimum of 2.41 l / s (liter per second) variability up to a maximum of 7.13 l / s.No significant difference in the years of exposure.FVC values have been lower for longer exposure workers.According to smoking, there were no significant differences in FVC values.The average value of FEV1 for all examiners was 3.69 l / s, with a minimum of 1.99l / s variability up to 5.68 l / s at maximal..Generally, for all examiners, the values were lower than the reference values. The average figures was -0.36.In the exposure group the prevalence was higher at longer exposure. 4.9% to 3.3%.Conclusion based on the data we can conclude that coal dust affects more workers with longer exposure and in more retarded age than those in younger age, those with shorter exposure, and absence of chronic pulmonary disease.Coal dust along with smoking affects the reduction of spirometry values, VC, FEV, FEV1 and the ratios between them (tifno index).

CONCLUSION

Coal dust affects more workers with longer exposure and more advanced age than those with younger shorter exposure time and chronic illness.Coal dust along with smoking affects the spirometry values, the FVC parameter Vital capacity (VC) decreases with years of exposure.Even in workers with no significant occupational exposure but with smoking habits, impairment of lung function is unavoidable.Exposure to coal dust causes obstructive changes in lung ventilation. FEV1 and Tifnow index are the most significant indicators of the airway obstruction .The studie found a statistically significant association between loss of lung function and cumulative respirable dust exposure. The exact diagnosis of COPD is done only with spirometry measurements, FVC and FEV1 parameters and the ratios between them (tifno index) Preventive measures.COPD preventive measures consist of:In reducing exposure to dust, smoke and gas in the workplace.Purifying polluted air.Establish appropriate powerful filters to prevent the emission of toxic and harmful gases.Education of the population in the damage caused by tobacco smoke.

REFERENCES

[1]. S Drivas, G Rachiotis, FD Vlastos, C Zacharias. Occupational exposure to lignite and impact on respiratory system among heavy industry personnel… - Industrial …, 2007 - jstage.jst.go.jp. Objective is to evaluate the impact of occupational exposure to lignite dust on respiratory system. 103

[2]. BJ Make, KF Rabe, SI Rennard Chronic obstructive pulmonary disease phenotypes: the future of COPD journal of respiratory …, 2010 - atsjournals.org

[3]. JB Soriano, AA Abajobir, KH Abate, SF Abera. [HTML] Global, regional, and national deaths, prevalence, disability-adjusted life years, and years lived with disability for chronic obstructive pulmonary disease and …The Lancet Respiratory …, 2017 - Elsevier

[4]. RJ Halbert, S Isonaka, D George, A Iqbal . Interpreting COPD prevalence estimates: what is the true burden of disease?- Chest, 2003 - Elsevier

[5]. R Perez-Padilla, JRB Jardim, A Muiño, MV Lopez. Chronic obstructive pulmonary disease in five Latin American cities (the PLATINO study): a prevalence study- The Lancet, 2005 - Elsevier

[6]. KR Chapman, DM Mannino, JB Soriano.Epidemiology and costs of chronic obstructive pulmonary disease, European …, 2006 - Eur Respiratory Soc World

[7]. AD Lopez, K Shibuya, C Rao .Chronic obstructive pulmonary disease: current burden and future projections. European …, 2006 - Eur Respiratory Soc.

[8]. AS Buist, MA McBurnie, WM Vollmer, S Gillespie International variation in the prevalence of COPD (the BOLD Study): a population-based prevalence study.The Lancet, 2007 - Elsevier

[9]. TJ Wilt, D Niewoehner, C Kim, RL Kane.Use of spirometry for case finding, diagnosis, and management of chronic obstructive pulmonary disease (COPD): AHRQ Evidence …, 2005 - MEDLINE ncbi.nlm.nih.gov

[10]. E Hnizdo, HW Glindmeyer, EL Petsonk .Case definitions for chronic obstructive pulmonary disease COPD: Journal of …, 2006 - Taylor & Francis

[11]. SD Roberts, MO Farber, KS Knox, GS Phillips, NY Bhatt… FEV1/FVC ratio of 70% misclassifies patients with obstruction at the extremes of age- Chest, 2006 - Elsevier

[12]. B.R Celli, RJ Halbert, S Isonaka…Population impact of different definitions of airway obstruction, European Respiratory …, 2003 - Eur Respiratory Soc.

[13]. O.F Pedersen, R Pellegrino, G Viegi, Standardisation of spirometry - European respiratory …, 2005 - Eur Respiratory Soc.

[14]. PJ Sterk Let's not forget: the GOLD criteria for COPD are based on post-bronchodilator FEV1, 2004 - Eur Respiratory Soc