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A study on the five-year change trend in pulmonary function of workers in tile and ceramic industry

Farideh Golbabaei[1], Rezvan Abedinlou*[2], Nazanin Fekri[3],Ashkan Shapasandi[4],Hamzehmohammadi[2]

1- Department of Occupational Health, Faculty of Health, Tehran University of Medical Sciences, Tehran, Iran.
2- Department of Occupational Health, Faculty of Health, Tehran University of Medical Sciences, Tehran, Iran..*
3- Scientific Research Center, Tehran University of Medical Sciences, Tehran, Iran.
4- Department of Occupational Health, Faculty of Health, Mazandaran University of Medical Sciences,Sari, Iran

Abstract

Introduction: Among the pollutants present in the ceramic and tile industry, silica dust is particularly important, and many studies have investigated the effect of this material on the respiratory system. Many occupational exposures may result in a decrease in spirometric parameters.

Materials and Methods: In the present study, totally, 120 male workers and employees of the factory, who had work experience of over 5 years and were not changed during the study, were included. Demographic information, including age, height, weight, work experience, smoking status and spirometric indices, were extracted from the medical records of the workers from different groups for 5 consecutive years. All spirometry tests were performed using the FUKUDA ST 300 digital spirometer (Italy) calibrated once a year. The generalized Estimation Equation (GEE) method was used to study the trend of changes in each of the spirometric indices more accurately. Research related data were analyzed using SPSS software version 23.

Results: The trend of changes was only significant for the FEV1 / FVC and FEF indices; for other indexes, the trend of changes was only observed in some years. The trend of changes was not significant for the FEV1 index, but smoking had a significant effect on the changes in this index. So, the level of this index was lower for cigarette smokers.

Conclusion: In this study, a clear downward trend was not found in the spirometric indices over 5 years, and only the FEF1 / FVC and FEF 2575% indices markedly were reduced in some occupational units, but due to the decline in some indices as well as proving the bad effect of Silica dust and other compounds on the respiratory system, there was an urgent need to implement management and engineering controls and protect the workers in the workplaces

Key words: Pulmonary Function، Workers, Tile and Ceramic

*Corresponding Author: Rezvan Abedinloo
Email Address: R.abedini66@yahoo.com

1. Introduction

Over the past two decades, the ceramic and tile industry has developed significantly in Iran, and many workers have been employed in this industry [1]. Among the pollutants present in this industry, silica dust is particularly important, and many studies have investigated the effect of this material on the respiratory system [2]. Numerous studies have shown that prolonged inhalation of ceramic and tile dust during the production process is associated with an increased risk of development of the Pneumoconiosis and Chronic Obstructive Pulmonary Disease (COPD), and some other pulmonary diseases, although some studies have not shown any relationship between these factors [3]. Many occupational exposures may result in a decrease in spirometric parameters. Spirometric tests are widely used in professional health assessment, especially screening [4]. Regarding the presence of pathogens in the ceramic and tile industry, the present study was designed to investigate the trend of changes in pulmonary indices over 5 years of exposure among the workers working in main sectors of one of the most important ceramic and tile factory in Iran.

2. Methodology

Totally120، male workers and employees of the factory, who had work experience of over 5 years and were not changed during the study, were included in the present study. Demographic information, including age, height, weight, work experience, smoking status, and spirometric indices, were extracted from the medical records of the workers from different groups for 5 consecutive years. Spirometry tests were performed, and the results were recorded by a physician each year during periodic examinations in the winter. All the spirometry tests were performed using the FUKUDA ST 300 digital spirometer (Italy) calibrated once a year. All the analyses were performed according to the protocol recommended by the American Thoracic Society (ATS) [5]. The generalized Estimation Equation (GEE) method was used to study the trend of changes in each of spirometric indices more accurately. Data analysis was done by SPSS software version 23, and a P-value of 0.05 was considered as statistically significant.

3. Results and Discussion

The trend of changes was only significant for the FEV1 / FVC and FEF indices; for other indexes, the trend of changes was only observed in some years. The trend of changes was not significant for the FEV1 index, but smoking had a significant effect on the changes in this index. So, the level of this index was lower for cigarette smokers. In the mucilage and furnace units, the trend of changes was significant for the FEV1 / FVC index. For the FEF index, there was also a considerable difference in the mucilage and furnace units compared to the Sort unit, therefore, this value was higher in both furnace and mucilage units than the Sort unit. Regarding the PEF index, a downward trend was observed from the first year to the fourth year, and an upward trend was found from the fourth year to the fifth year, but this trend was not statistically significant. The furnace and office work areas were also significantly different in terms of the level of this index compared to the Sort unit area, consequently, in both of these occupational areas, the decline of index value was more significant than the Sort unit area. Figure 1 and Diagram 1 showed the obtained results.

Generally, the trend of changes was significant only for the FEV1 / FVC and FEF 2575% indices, and they declined during the second to fourth years. But, contrary to what has been expected, the FVC index did not show any significant changes during the studied years. However, in general, there was no statistically significant difference in the FEV1 and PEF indices. In the SAKAR et al. study the FEV1 index was not significantly different between workers who were exposed to Silica Dust compared to the control group [6]. In the study by Halvani et al., the workers exposed to dust in the ceramic and tile production process had close to standard results in the pulmonary function tests despite significant changes in symptoms of pulmonary disorders such

as cough, shortness of breath and sputum, and did not show a significant difference in comparison with the control group [3]. In the current study, decreasing in FEV1 level was only substantial for smokers. This is likely due to the synergistic effect of cigarettes and environmental pollutants, such as silica [4]. In the present study, the highest decline in the FEV1/FVC index was seen in the Sorting unit and pressing units. Given the high pollution load of the mentioned units, this is acceptable. Also, at FEF 2575% index, the furnace unit by the fourth year and mucilage line from second to the fourth year of the study have had the most decline, Mehrparvar et al., in contrast, are concluded that the most decrease in indices was related to BallMill and mill units [7]. Ascending increase in most spirometry indices in the fifth year, means improving pulmonary performance, is significant point of the study. Due to no change in work process, this sudden change is likely because of confounding factors such as error in measuring height or other reasons like right learning to perform maneuver by individuals over time.

Some findings suggest that the pulmonary function of ceramic workers with less than 20 years of work experience is similar to control groups, but the decline in pulmonary indices has significantly increased in exposures over 20 years [8]. Generally, the declines in pulmonary function as well as the symptoms of occupational pollution complications have not been clinically recognized for a long time [3]. The average work experience of the workers under study is 14 years and the possibility of changes in their respiratory function should be considered in the long term.

4. References

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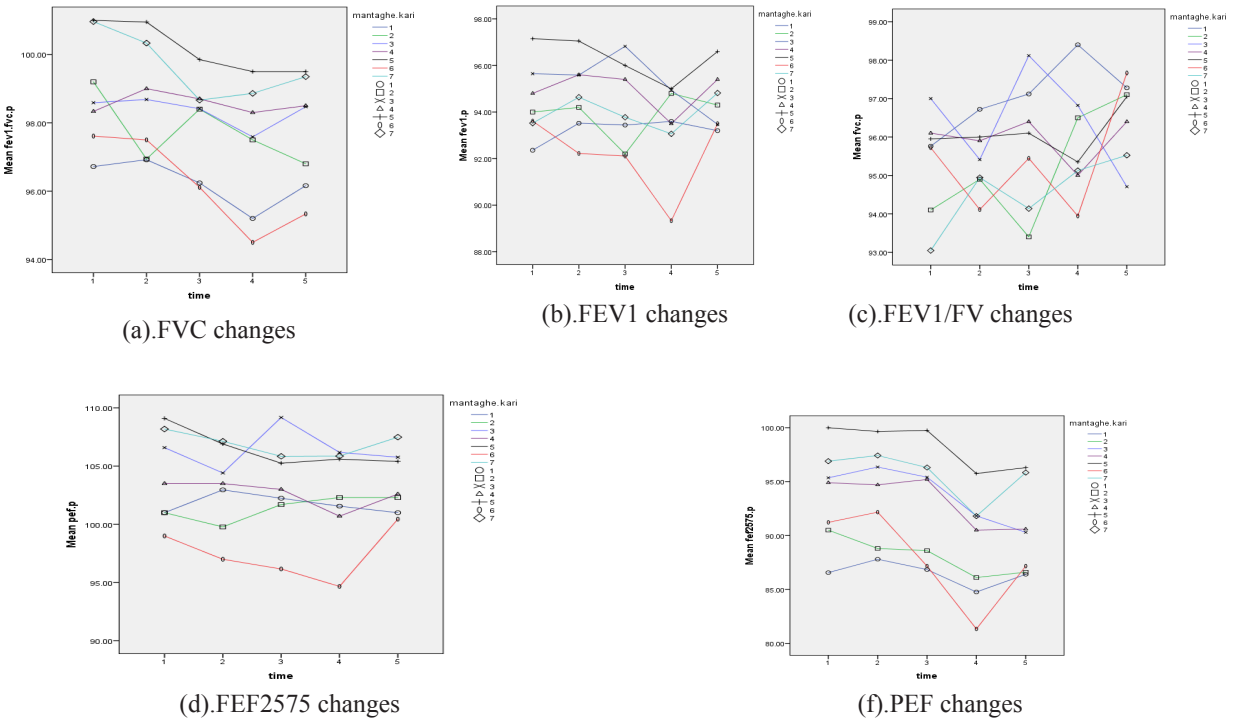

(a).FVC changes (b).FEV1 changes (c).FEV1/FV changes

(d).FEF2575 changes (f).PEF changes

Fig. 1. changes of 5-year performance indices in the study units

Table 1. Effective factors on FEV1/FVC

				95% confidence interval		
Variable	**Level**	**Beta coefficient**	**Standard error**	**Lower limit**	**Upper limit**	**p-Value**
Width of origin		97.770	1.4725	94.883	100.656	> 0.001
Smoking	Consumption	-2.491	1.5278	-5.486	.504	.103
	Non-consumption	-				
Year	(2010) 1	-	-	-	-	-
	(2011) 2	-.186	.3284	-.829	.458	.572
	(2012) 3	-.939	.3281	-1.582	-.296	.004
	(2013) 4	-1.648	.2699	-2.177	-1.119	.000
	(2014) 5	-1.158	.2887	-1.724	-.592	.000
Working region	(Sort unit) 1	-	-	-	-	-
	(Mucilage preparation) 2	-.441	2.2038	-4.760	3.879	.841
	(Mucilage line) 3	1.583	2.1351	-2.602	5.768	.458
	(body preparation) 4	.908	2.4325	-3.859	5.676	.709
	(Furnace)5	3.026	1.9371	-.770	6.823	.118
	(press)6	1.353	2.3325	-3.219	5.924	.562
	(office)7	3.447	1.9881	-.450	7.344	.083

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