RESPIRATORY FUNCTIONS OF THE PEOPLE WORKING IN SOLID WASTE STORAGE CENTERS IN ISTANBUL

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ABSTRACT

Objective: *Solid storage sanitarian workers are exposed to many chemical and physical hazards. The aim of this study is to find out the environmental effects of the work-places on the respiratory functions of the people working in solid waste storage centers.*

Material and Method*: This cross-sectional study took place in Istanbul. It involved 592 solid waste sanitarian workers who worked in ten different storage areas. The study was carried out between October, 2006 and February, 2007. After the basic physical examination, respiratory functions were measured by Spirometer and the workers questioned about asthma. Moreover, the atmosphere of the working areas in the factories was assessed microbiologically.*

Results: *The study group of 592 workers consisted of 592 (100%) males. The mean age of the workers involved in the study was 38.5±8.1 and their average working year 4.7±3.9. Microorganisms were reproduced in different areas at different rates. Among the workers who were given a physical examination, wheeze, rhonchus and signs of bronchial obstruction were detected in 125 (21.1%) people. The number of people with indications of obstruction was 188 (31.8%). Types of the fungi isolated from ten different areas in the ambient air: Aspergillius sp (78.8%), Cladosporium sp (12.1%), Penicillium sp (5.5%), Alternaria sp (4.4%), Rhizopus sp (2.7%), Tricoderma sp (1.1%), Fusarium sp (0.9%) formed flora.*

Conclusion: *It is concluded that solid waste storage workers are at risk of developing both acute and chronic respiratory symptoms as well as ventilator capacity impairment as a result of occupational biological exposures.*

Key Words: *Solid waste storage workers, respiratory function test, occupational disease, moulds.* ***Nobel Med 2011; 7(1): 29-36***

İSTANBUL'DA KATI ATIK DEPOLAMA MERKEZLERİNDE ÇALIŞAN KİŞİLERDE SOLUNUM FONKSİYONLARI

ÖZET

Amaç: Katı atık toplama merkezlerinde fiziksel ve biyolojik etkenler, çalışanlarda solunum şikayetlerinin artmasına sebep olmakta, mesleki solunum sistemi hastalıklarının gelişimine zemin hazırlamaktadır. Bu çalışmada, katı atık toplama merkezlerinde, çalışma ortamının çalışanların solunum fonksiyon testleri üzerindeki etkisinin araştırılması amaçlanmıştır

Materyal ve Metod: İstanbul'da 10 farklı bölgede katı atık toplama merkezlerinde çalışan toplam 592 kişi çalışma kapsamına alındı. Çalışma Ekim 2006-Şubat 2007 tarihleri arasında gerçekleştirildi. Çalışanların sistemik fizik muayeneleri yapıldı. Astım yönünden sorgulamaları (NIOSH astım sorgulama formu ile) bire bir görüşme yöntemi ile yapıldı. Her bir çalışanın solunum fonksiyon testlerine (SFT) (MIR- Spirolab III) spirometre ile bakıldı. İç ortam hava kalitesinin kontrolü Merck Air Sampler MAS 100 (Merck KgaA-64271 Darmstadt-Germany) cihazi kullanılarak, aspirasyon hızı 100L/dk olacak şekilde çevreden örnek alınarak yapıldı.

Bulgular: Çalışmaya tamamı erkek 592 kişi alındı. Çalışmaya katılan kişilerin yaş ortalaması 38,5±8,1, çalışma yılı ortalaması 4,7±3,9 yıl olarak bulundu. Çalışma kapsamına alınan kişilerin 125'inde (%21,1) bronş obstrüksiyonunu gösteren wheeze ve ronküs belirtileri, solunum fonksiyon testlerine göre, %31,8'inde (188 kişi) obstrüksiyon bulundu. Ölçüm yapılan on farklı bölgede ortam havasında izole edilen küf mantarlar türleri: Aspergillius sp(%78,8), Cladosporium sp (%12,1), Penicillium sp (%5,5), Alternaria sp (%4,4), Rhizopus sp (%2,7), Tricoderma sp (%1,1), Fusarium sp (%0,9) florayı oluşturmuştur.

Sonuç: Katı atık toplama merkezlerinde çalışanlar mesleki olarak biyolojik etkenlere maruz kalmanın bir sonucu olarak akut ve kronik solunum yolu hastalıklarının gelişme riski ile karşı karşıyadır.

Anahtar Kelimeler: Katı atık işçileri, solunum fonksiyon testleri, meslek hastalıkları, küf mantarları.
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INTRODUCTION

Occupational health has been defined as establishing the employers' state of physical, mental and social well-being at the highest levels in all occupations but keeping health-related harmful effects of the environment at the lowest levels in work-places, putting into practice the methods of protection to avoid those harms and as employing the workers in jobs that are suited to their physical, anatomical and psychological characteristics.[1]

The two possible threats to the worker's health resulting from the workplaces are work-related injuries and occupational diseases. Occupational diseases are those that are preventable and can result from physical, chemical, biological, ergonomically and psycho-social factors. In the industry, health-related harms are not the only factor in different sectors, there are also different factors in working environment and the risks are getting higher and higher.[1]

Allergic diseases, bronchial asthma, allergic rhinitis and atopic dermatitis are dramatically increasing all over the world. Nowadays, more than 30% of the population is known to suffer from different types of allergic diseases. Major causative agents are pollen grains, fungal spores, dust mites, insect debris, animal epithelia, etc [2]. Solid waste storage and its maintenance is a high-risk sector covering all hazards mentioned before. There are fungi, bacteria and viruses which are classified as biological factors coming from work environment.[3]

Residential or office fungal exposures may be a substantial factor in developing an allergic airway disease depending on the subject's allergic sensitivity and the levels of indoor exposure [4]. In solid waste storage centers, physical and biological factors lead to a rise in respiratory complaints, precipitating occupational diseases relating to the respiratory system. Many indoor air pollutants directly affect the respiratory and cardiovascular systems; the severity of the effect varies according to the intensity and the duration of exposure as well as the health status of the population exposed.[5]

The aim of this study is to find out the environmental effects of the work-places on the respiratory functions of the people working in solid waste storage centers.

MATERIAL and METHOD

Sampling

We have included 8 waste storage centers, 4 from Anatolian and 4 from European part of Istanbul. The stored domestic waste is taken to two regular storage areas. The stored garbage is rehabilitated without damaging the environment using appropriate methods. This cross-sectional study took place in Istanbul.→

It involved 592 solid waste sanitarian workers who worked in ten different storage areas. The purpose of the study was explained to the people involved and we received their approval. The study was carried out between October, 2006 and February, 2007.

Questionnaire

In order to determine the health status of the 592 individuals, the following information was obtained through face-to-face interviews: their ages, smoking habits, previous jobs, any history of a serious disease, and whether they had previously worked in smoke or dust filled workplaces, whether they had pulmonary disease or suffered from one in the past and whether they had had allergies. We also asked if they ever coughed, if there was phlegm while coughing and whether they had shortness of breath, a stuffy nose, red, itchy and watery eyes, skin rash, eczema, dermatitis or hives. For the questions about asthma, the NIOSH asthma questionnaire form was used.[6] NIOSH asthma questionnaire translated to Turkish, modified and validated. They were used in two different industry-business areas. [7,8]

Spirometry evaluation

The respiratory functions (RFs) of all individuals were measured during the morning rest period by means of a computerized spirometer (Spirolab III, Medical International Research, Rome, Italy). The measurement methods were explained in detail to the individuals before testing. Each person was measured three times; the highest values of the sum of FEV1 and FVC were recorded. In order to eliminate age and height differences in the study group, the measured/predicted [as percentages (%)] values were used for FVC, FEV1, FEF25–75, PEF and FEV1/FVC values.

The European Respiratory Society (ERS, 1993) values were used for the predicted values. The respiratory function test (RFT) results of workers were evaluated as the mean and the standard deviation. In all, the parameters were calculated as percentages and the rates under 80% of the predicted value were evaluated/interpreted as an obstruction.

Medical examination

We measured the height and weight of the workers and conducted detailed medical examinations.

Statistical analysis

The evaluation of continuous variables such as RFT, age, working years, etc., (Results were tested according to the normal distribution method with One Sample Kolmogorov Smirnov) was given as the mean and standard deviation, whereas nominal variables were expressed as a percentage. Evaluation of non-continuous variables was made according to RF test (obstructive / non obstructive) using a chi square test and stepwise logistic regression analyses. Statistical significance was accepted as P <0.05 for results that were two-tailed.

Table 1: The frequency of fungal species detected in the areas of the study groups Fungal species

Fungal Species	Frequency (%)
Aspergillius sp	78.8
Cladosporium sp	12.1
Penicillium sp	5.5
Alternaria sp	4.4
Rhizopus sp	2.7
Tricoderma sp	1.1
Fusarium sp	0.9

Table 2: Distribution of airborne fungal propagule concentrations in CFU/m^3 in the study areas

Species	Mean	Std Deviation	Median	Minimum	Maximum
Aspergillius sp	16226.7	12282.4	26280	20	26280
Cladosporium sp	126.3	163.4	75	10	1020
Rhizopus sp	75.0	112.9	30	10	530
Alternaria sp	42.6	52.5	20	10	260
Tricoderma sp	23.3	13.6	20	10	40
Penicillium sp	22.5	12.8	20	10	40
Fusarium sp	10.0	0.0	10	10	10

Table 3: RFT results of the subjects included in the study

RFT variables	Frequency	Mean (%)	SD (%)	Frequency (<80%)	Percent (<80%)
FVC	592	99.7	14.2	57.0	9.6
FEV1	592	103.6	20.8	14.0	2.3
FEV1/FVC	592	83.1	3.04	3.00	0.5
PEF	592	117.6	36.4	200.0	33.7
FEF2575	592	97.9	34.3	164.0	27.7

SD: Standard Deviation

Air quality in the outdoor and indoor areas

For the bio-aerosols, a Merck Air Sampler 100 (MAS 100) (Merck KGaA-64271 Darmstadt-Germany) operated at 100L.min^{-1} of air in combination with Dichloran 18% Glycerol (DG-18) agar and Malt Extract Agar (MEA) was used to collect airborne fungal propagules.[9,10] During sampling, the MAS →

Table 4: The answers to the questionnaire and RFT results in the solid waste workers

Independent variables	Coding	Obstruction (RFT)				Two tailed significance	
		Non-obstructed		Obstructed			
		Frequency	Percent	Frequency	Percent	X^2	p
Working period (year)	<5 year	186	46.0	101	53.7	3.03	0.08
	>=5 year	218	53.9	87	46.2		
Still smoking	Yes	228	56.4	105	55.8	0.01	0.89
	No	176	43.5	83	44.1		
Allergy against chemical substance	Yes	8	1.9	6	3.1	0.81	0.36
	No	396	98.0	182	96.8		
Previously diagnosed as having asthma	Yes	10	2.4	7	3.7	0.71	0.39
	No	394	97.5	181	96.2		
Respiratory obstruction while walking	Yes	174	43.0	85	45.2	0.20	0.62
	No	230	56.9	103	54.7		
Coughing in winter	Yes	62	15.3	32	17.0	0.26	0.60
	No	342	84.6	156	82.9		
Phlegm in winter	Yes	126	31.1	54	28.7	0.36	0.54
	No	278	68.8	134	71.2		
Nasal obstruction and postnasal drip	Yes	122	30.2	62	32.9	0.46	0.49
	No	282	69.8	126	67.0		
Suspected asthma in questionnaire form	No	260	64.3	120	63.8	0.01	0.90
	Yes	144	35.6	68	36.1		
Common cold	Yes	27	6.6	10	5.3	0.40	0.52
	No	377	93.3	178	94.6		
Bronchitis	Yes	40	9.9	12	6.3	1.98	0.15
	No	364	90.1	176	93.6		
Pneumonia	Yes	20	4.9	8	4.2	0.13	0.71
	No	384	95.0	180	95.7		

100s were placed at approximately 1m above the floor level and calibrated before use. To eliminate the possibility of contamination, three Petri dishes with MEA, DG- 18 agar and plate count agar without air sampling were also incubated for the same duration. After sampling, the agar plates were removed from the sampler and covered with lids. The agar plates were hand-carried to the laboratory. The plates for the fungi were incubated for up to 14 days at 22°C and 90% relative humidity (RH). The isolated fungi were identified by standard methods.[11–15]

Concentrations were calculated as colony forming units per cubic meter (CFU/m^3) of air by using the MAS 100 unit conversion table. The rate of aspiration was arranged to be as 100lt/minute, taking samples from the environment. Petri boxes were used in sampling and they were taken from 10 different points in each region. The assessment used 100 Petri in total by taking 10 samples from 10 different points.

RESULTS

The study group of 592 workers consisted of 592 (100%) males. The mean age of the workers involved in the study was 38.5±8.1 and their average working year was 4.7±3.9. After assessing their smoking status; 333 (56.2%) were current smoker. Among the smokers, the mean number of the cigarettes and the mean year of cigarette smoking was 20.2±10.1 and 17.6±6.2, respectively.

Working groups were questioned about their previous work (dusty and smoky) and it was found out that they had not worked in such a job before. Diseases diagnosed by a doctor for the study group were gastrointestinal complaints (9.7 %), followed by hypertension (6.5%), asthma (2.8%) and bronchitis (2.3%).

Questioning about Asthma

Some (n=144) 24.3 % of the people who answered the questions about asthma stated they had wheezing and a whistling sound while breathing. Half of the people with crackling respiration complaints also complained of shortness of breath (11.7%). The subjects who had had coughing attacks and a feeling of pressure on their chest - or discomfort on breathing lasting one year was 14.2%, while some others whose dyspnoea made breathing an effort was almost 15.9%. If, when →

Table 5: The frequency of fungal species detected in the areas of the study and relationship between detected obstruction in RFT

Independent variables	Coding	Obstruction (RFT)				Two tailed significance	
		Non-obstructed		Obstructed			
		Frequency	Percent	Frequency	Percent	X^2	p
Cladosporium sp	non isolates	334	82.6	130	69.1	1.84	p<0.001
	isolated	70	17.3	58	30.8		
Penicillium sp	non isolates	320	79.2	161	85.6	3.48	0.06
	isolated	84	20.7	27	14.3		
Alternaria sp	non isolates	208	51.4	108	57.4	1.83	0.17
	isolated	196	48.5	80	42.5		
Rhizopus sp	non isolates	51	12.6	23	12.2	0.01	0.89
	isolated	353	87.3	165	87.7		
Trikoderma sp	non isolates	365	90.3	172	91.4	0.19	0.65
	isolated	39	9.6	16	8.5		
Cladosporiım sp + Aspergillius sp	Only one of them	334	82.6	130	69.1	13.84	P<0.001
	Both of them together	70	17.3	58	30.8		
Cladosporiım sp+ Rhizopus sp	Only one of them	334	82.6	130	69.1	13.84	P<0.001
	Both of them together	70	17.3	58	30.8		
Aspergillius sp +Penicillium sp	Only one of them	320	79.2	161	85.6	3.48	0.06
	Both of them together	84	20.7	27	14.3		
Penicillium sp+Rhizopus sp	Only one of them	320	79.2	161	85.6	3.48	0.06
	Both of them together	84	20.7	27	14.3		
Rhizopus sp+ aspergillus sp	Only one of them	51	12.6	23	12.2	0.01	0.89
	Both of them together	353	87.3	165	87.7		

completing the asthma questionnaire, at least one of the answers to six questions was 'yes', it was diagnosed as suspected asthma. The total number of people who had possible asthma and who were diagnosed through questions during the interview was 215 (36.3%)

Clinical findings

Among the workers who were given a physical examination, wheeze, rhonchus and prolonged expiratory time signs of bronchial obstruction were detected in 125 (21.1%) people.

Evaluation of microbiological findings in the outdoor and indoor areas

Envioronmental measurements results were shown in Table 1 and Table 2. Distribution of airborne fungal propagule concentrations in CFU/m^3 in the study as detailed Table 2. During the microbiological evaluations, microorganisms were collected in all Petri dishes that were opened in the 10 different areas. They were assessed over 100 Petri in total by taking 10 samples from 10 different points. Microorganisms were reproduced in different areas at different rates. In all Petri boxes, *Aspergillus sp - as the first and the greatest in amount* , then *Aspergillus sp*, *Cladosporium sp, Penicillium sp, Alternaria sp, Rhizopus sp,Tricoderma sp,* and *Fusarium sp* were isolated in all areas.

In our study 7 different spieces were isolated. *Aspergillius sp* (78.8%), *Cladosporium sp* (12.1%), *Penicillium sp* (5.50%), *Alternaria sp* (4.4%), *Rhizopus sp* (2.7%), *Tricoderma sp* (1.1%), *Fusarium sp* (0.96%) isolated spices were normal flora. Even if solid waste storage and rehabilitation centers are the appropriate environment for the formation of mold flora, *Aspergillus sp*. were isolated (78.8%) more than expected in cold winter days. Organic material's wealth in household waste collected in the center had high humidity, in addition to the humidity of the wind. On the other hand, wind, temperature and the presence of some specific source of contamination affect the concentration of airborne fungi spices. High-humidity facilitates the mold *Aspergillus* species in the environment. High humidity and lower temperatures in the winter period has produced a higher density of *Aspergillus sp*. in the work environment.

Results of RFT

Following measurement of FVC%, FEV1%, FEV1/FVC%, PEF%, FEF25–75%, the cases that had less than 80% of the expected values were 57 (9.6%) people for low FVC%, 14 (2.3%) for FEV1%, 3 (0.51%) for FEV1/FVC%, 200 (33.7%) for PEF% and 164 (27.7%) for FEF25–75%. From these results it can be seen that an appreciable number of people had some degree of airway obstruction. More details→

Table 6: Results of regression models detailing the parameters

Variables		B	S.E.	Wald	df	Sig.	OR	95% CI for OR	
	independent variables							Lower	Upper
Variables in the Equation	Ref (Only Cladosporim sp)						1		
	Cladosporium sp + Aspergillius sp	0.7	0.20	13.5	1	p<0.001	2.1	1.4	3.1
	Constant	-0.9	0.10	83.3	1	p<0.001	0.3		

OR: Odds Ratio **SE:** Standard Error, **B:** regression coefficient, **df:** Degrees of freedom

are given in Table 3. As a criterion in the RFT in the values lower than 80% of FEV1/FVC%, PEF% or FEF 25–75% were evaluated as obstruction. The number of people with obstruction according to RFT was 188 (31.8%). Obstruction related factors are shown in Table 4 and Table 5. Obstruction was statistically significant in the *Cladosporium sp, Cladosporium sp+Aspergillus sp, Cladosporium sp + Rhizopus sp* groups (Table 5). A logistic model was formed with the RF and the independent variables listed in Table 4 and Table 5. The independent variables and RF were compared as univariate analyses.

The results were listed in Table 6. In the model which had overall 22 independent and one dependent variable (the ones which are obstructed or non-obstructed according to respiratory function test), a diagnosis of respiratory obstruction based on the RFT dependent variables could be explained by only one independent variable: *Cladosporium sp + aspergillius sp*. 2.13 times higher obstructed pulmonary functions tests were obtained in *Cladosporium sp + Aspergillius sp*. isolated centers rather than *Cladosporium sp* isolated centers. (OR=2,1 : 95 % CI: 1.4-3.1). These results are depend on the development of molds in the work environment.

DISCUSSION

The study is aimed at assessing the negative effects of the working environment on the respiratory functions of the workers in the solid waste collecting and rehabilitation centres. The quality of the working environment was mycologically assessed. When the fungi isolated from the environment were assessed, 7 different types of them were determined and when they were assessed in terms of percentages, *Aspergillius sp* (78.8%) was found to be the first and *Cladosporium sp* (12.1%) the second. There was an abundance of organic materials found in the house waste collected from the centers where the study was carried out and there was a great amount of moisture as a result of these materials. Lin and Li[15] state a certain relationship between meteorological factors and physical and chemical pollutants and fungus concentrations. On the other hand, wind, humidity, heat and the presence of some specific contamination sources (agricultural, industrial, and animal wastes) are the parameters affecting fungus concentrations in the air. People working continually in hot, humid and stinking solid waste rehabilitation centers are at risk of contracting diseases related with fungus and bacterium.[16, 17] In the detailed physical examination of the subjects, signs of wheeze and rhonchus, prolonged expiratory time indicating bronchus obstruction were found in 125 (21.1%) and obstruction was found in 188 (31.8%) subjects according to respiratory function tests.

According to asthma questionnaire, the total number of people who had possible asthma and who were diagnosed through questions during the interview was 215 (36.3%).

Solid waste storage and its rehabilitation is a sector in high-risk group, which include all hazards mentioned above. People working in centers of solid waste storage do their jobs under hard conditions and are dissatisfied with these conditions. In a study of Almeida and et al., [18] the youngest garbage collectors presented a lower degree of life satisfaction. In a different study, when people were questioned about the job characteristics in solid waste storage units, it was revealed that the workers were complaining of: repugnant odor, high dust concentrations, excessive physical effort, and changing atmospheric conditions.[19]

The respiratory problems of workers in the solid waste storage industry were investigated in a cross sectional study. Evaluating the results of RFT, the number of people presenting with the results less than 80% of the expected values were determined as PEF %200 with the rate of 33.8% and FEF 25-75% 164 with the rate of 27.70%. It was observed that the indicators of airway obstruction were found in higher rates. After assessing their smoking status; 56.2% (333) were found to be still smoking. In the smokers, the mean number of the cigarettes and the mean year of cigarette smoking was 20.2±10.1 and 17.6±6.2 respectively. Mustajbegovic et al., showed that smoking and the respiratory complaints in the workplaces are significantly related.[20] In the study carried out by Eisner et al., smoking is rated the first among the factors affecting health in the workplaces.[21] In our study, we found no significant difference between the obstruction identified in RFT and the smokers and nonsmokers. When smoking history was evaluated, no statistically significant relation between smoking history and airway obstruction was detected. Exposure to fungi in workplaces and residential areas and gases dispersed from the environment in →

different periods and intensity lead to exacerbating allergic reactions depending on the person's allergic susceptibility. Continuous and repeated exposure precipitate the development of allergic reactions and allergic respiratory diseases.[22-24]

Exposure to moulds is thought to cause adverse health effects ranging from vague subjective symptoms to allergy and respiratory diseases.[25] In most studies *Cladosporium sp*. and *Aspergillus sp*. have been reported to comprise the majority of airborne spores in indoor air [26]. Wiszniewska's study shows an important role of fungi as occupational allergens for museum workers.[27] In the present study, the fungal genera most often detected were *Aspergillus sp*. followed by *Cladosporium sp, Rhizopus sp.* and *Penicillium sp* multiplying at various rates.

Robert et al,[28] found an association between emergency visits for asthma and outdoor *Aspergillus/Penicillium* yet the indoor concentrations of this fungus may be several times higher than outdoors Univariate assessments performed in the present study showed that the incidence of obstruction was significantly higher for the subjects working in environments in which there was simultaneous isolation of *Cladosporium sp, Cladosporium sp + Aspergillus sp, and Cladosporium sp + Rhizopus sp* combinations present.

Halonen and coworkers point out that asthma is often associated with multiple allergies.[29] Therefore *Alternaria* sensitivity may reflect a causative agent and/or it may be an indicator of several important allergic sensitivities. For example, Persanowski[30] reported that patients with sensitized to *Cladosporium* were usually sensitized to *Alternaria*.

Cladosporium is one of the most common airborne molds found in indoor and outdoor environments. *Cladosporium* spores are important aeroallergens, and prolonged exposure to elevated spore concentrations can provoke chronic allergy and asthma.[31]

Indoor mould growth and dampness are associated with respiratory health effects and allergies according to several studies. Aspergillus versicolor and *Penicillium expansum* are responsible for indoor mould exposure.[32] In addition to house dust mites, there is increasing evidence that mold allergens, especially *Alternaria,* are implicated in contributing to allergic reaction, rhinitis, and asthma indoors. Fung et al[33] presented a case of *Alternaria* associated asthma. Most daytime hours are spent at home or in the workplace, both of which are closed areas. There is a strong relationship between a healthy working environment and the healthy worker. Allergic reactions resulting from biological factors are generally confined to rhinitis, eye irritation, cough, and aggravation of asthma, but hypersensitivity pneumonitis is also related to these biological factors in the environment. In the most common allergic conditions the biological particles, such as fungal spores, are largely respirable and generally have a diameter greater than 5 mm.[34]

The survey of Palmas et al showed that fungi can play a significant role in allergic and non-allergic diseases in modern working environments.[35] In our study, the number of subjects with obsruction was identified in the RFT and the obstruction rate was significantly higher for subjects working in environments where *Cladosporium sp+ Aspergillus sp* were isolated.

In our study, the number of subjects with suspected asthma determined by an asthma questionnaire and the number of those for whom obstructive airway disease was defined through RFT evaluation was 215 (35.9%) and 188 (31.8%), respectively. The number of subjects with obstruction defined by RF testing was high. However, in this study, bronchial provocation tests could not be performed in their workplaces because the required permission for the peak expiratory flow (PEF) procedure had not been given. Related results were seen to be similar in different sectors of the industry. The rates found in the studies carried out among the leather workers were found to be 36.2% and 40.27%, respectively.[36]

Asthma and the disorders in respiratory functions appeared in different jobs, not only chemicals, but also biological factors were proved to cause them in the environment.

Ross et al [37] had reported that associations between indoor levels of mold spores, bacteria, and dust-mite allergens investigated with several asthma severity indicators, mold-spore abundance was associated only with emergency room (ER) visits for asthma. The results of the research by Mustajbegović show that street cleaners may develop chronic respiratory symptoms and changes in FVC and FEV1 in terms of lung functions.[38] Identifying and announcing occupational diseases are among the most important problems in our country. It is quite difficult to determine asthma related with occupational reasons in scanning studies. Among the workers of solid waste storage centers, bad working conditions and gases (methane, hydrogen sulphur, etc) dispersed in the environment give rise to increase in respiratory complaints and precipitate occupational diseases.

Our findings showed that biological factors as well as heavy smoking among the workers lead to →

deterioration in their respiratory capacity, causing acute and chronic respiratory diseases among workers of solid waste storage centers. Moreover, we conclude that solid waste storage workers are at risk of developing both acute and chronic respiratory symptoms as well as ventilator capacity impairment as a result of occupational biological exposures.

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