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Investigation of the effects of dust transport on lung health

Toz taşınımının akciğer sağlığı üzerine etkilerinin araştırılması

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ABSTRACT

Objective: Southeast Anatolia was influenced by the desert dust coming from Syria On October 14, 2018. It was observed that the transportation of dust clouds to Ankara led to a decrease in visibility and an increase in air pollution. In our study, it was aimed to investigate the relationship between the dust exposure and the admission made to our emergency department since that date.

Methods: One hundred forty-three of the patients who were included in the study were admitted to the emergency room before dust exposure (group 1) and 203 (group 2) after dust exposure (group 2). According to the Ministry of Environment and Urbanization report, PM10 values have been between 52.8-175 µg/m^3 for one week starting from October 14th. It was determined that these values increased between 21-145 µg / m^3 according to the pre-dust transport.

Results: A total of 346 patients were included in the study. The number of patients who applied before dust exposure was significantly higher than that of the previous ones (p = 0.001). Groups were similar in terms of gender (p = 0.200). The complaint of cough increased significantly [37 (27.6%), 97 (72.4%); p = 0.001]. Group 1 and group 2 cases were compared to the diseases leading to the emergency department,

ÖZET

Amaç: Güneydoğu Anadolu bölgesi, 14 Ekim 2018'de Suriye'den gelen çöl tozundan etkilendi. Toz bulutlarının Ankara'ya taşınmasının görüş mesafesinin azalmasına ve hava kirliliğinin artmasına neden olduğu görüldü. Çalışmamızda, o tarihten itibaren acil servisimize yapılan başvurular ile toza maruz kalma arasındaki ilişkinin araştırılması amaçlandı.

Yöntem: Çalışmaya dahil edilen hastalardan 143 hasta (grup 1) toz maruziyetinden önce ve 203 olgu (grup 2) da toza maruz kaldıktan sonra acil servise yatırıldı. Bu çalışmada, 14 Ekim 2018 tarihinden önceki ve sonraki 14 gün, acil servise başvuran hastalar arasında farklılık olup olmadığını değerlendirmek üzere hastane kayıtları ve dosyalar incelendi. Çevre ve Şehircilik Bakanlığı raporuna göre, PM10 değerleri 14 Ekim 2018'den itibaren bir hafta süreyle 52,8-175 µg / m^3 aralığında yer aldı. Ön toz nakliyesine göre bu değerlerin 21-145 -1g / m^3 arasında arttığı tespit edildi.

Bulgular: Çalışmaya toplam 346 hasta dahil edildi. Toza maruz kalmadan önce başvuran hasta sayısı öncekilere göre anlamlı derecede yüksekti (p = 0,001). Gruplar cinsiyet açısından benzerdi (p = 0,200). Grup 1 olgularının yaş ortalaması grup 2'den anlamlı derecede yüksekti (sırasıyla 55,38 ± 18,86, 50,49 ± 22,06; p = 0,02). Gruplar cinsiyet açısından benzerdi (p = 0,200). Grup 2

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whereas lung diseases increased significantly (p = 0.001). 83 (40%) cases who presented with dyspnea or cough due to dust only and no other disease in lung disease, and 16 (7.9%) cases with heart failure outside the lung were found.

Conclusion: As a result of our study, it has been found that dust transport leads to a significant increase in respiratory symptoms and the rate of referral to the emergency department. Due to the geopolitical position of our country, dust transport is a major public health problem.

Key Words: Dust transport, lung disease, emergency service, effect

vakalarında grup 1 vakalarına göre öksürük yakınması anlamlı derecede arttı [sırasıyla 37 (%27,6), 97 (%72,4); p = 0,001]. Grup 1 ve grup 2 olgular, acil servise başvuru nedeni olan hastalıklar açısından karşılaştırıldığında, akciğer hastalıklarının anlamlı olarak arttığı görüldü (p = 0,001) (Tablo 1). Akciğer hastalığı olmayan ve sadece toz nedeniyle nefes darlığı veya öksürük şikayeti ile başvuran 83 (%40), akciğer hastalığı olmaksızın kalp yetmezliği olan 16 (%7,9) olgu saptandı.

Sonuç: Çalışmamız sonucunda, toz taşınmasının solunum semptomlarında ve acil servise başvurularda önemli artışa neden olduğu tespit edildi. Ülkemizin jeopolitik konumu nedeniyle toz taşınmasının önemli bir halk sağlığı sorunu olduğu değerlendirildi.

Anahtar Kelimeler: Toz taşınımı, akciğer hastalıkları, acil servis, etki

INTRODUCTION

Air pollution increases with population growth, regional transport and industry development. Not only the presence of polluting gases in the air, but also the lack of oxygen, the change in the ratio of gases in the normal air combination should be called air pollution (1).

Lungs are sensitive to inhalational exposure. Post-exposure damage can be seen in the airways and lung parenchyma not only in the acute period but also in the chronic period. In the acute period, radiological findings may appear mainly as pulmonary edema, pulmonary infiltrations, ground-glass appearance in the following weeks and months, reticular, interstitial pattern, honeycomb appearance and traction bronchiectasis.

Particles exposed in air pollution are divided into coarse, fine and very fine. Fine and very fine particles have been shown to be more associated with cardiovascular mortality and morbidity, such as myocardial infarction (MI), arrhythmia, heart failure exacerbation, and stroke. A similar relationship between MI and cardiovascular mortality has been shown between prolonged exposure to ozone and increased risk of pulmonary mortality (2).

According to standards of United States Environmental Protection Agency, air pollution is determined by the amount of ozone (O_3), carbon monoxide (CO) sulfur dioxide (SO_2) nitrogen oxide (NO), liquids and particles in the air. However, in practice, the pollution is generally determined by the amount of solid particles and SO_2 in the air (3). Particulate matter (PM) is a mixture of solid particles and liquid droplets suspended in the atmosphere.

In October 14, 2018, it was observed that the desert dust coming from Syria and the transport of dust clouds reached Ankara, causing a decrease in

visibility and an increase in air pollution. In this study, we aimed to investigate the relationship between the applications made to our emergency department since this date with dust exposure.

MATERIAL and METHOD

This study was planned as a retrospective, descriptive study. In this study, hospital records and files were examined to evaluate whether there was a difference between patients who presented to the emergency department for the 14 days before and after 14 October 2018 (1-28 October 2018). During this period, all patients who applied to the emergency department of Ankara Atatürk Research and Training Hospital in Ankara with shortness of breath International Classification of Diseases (ICD) code were included in the study. Forty-five patients whose data could not be accessed were excluded from the study. Three hundred forty-six patients who presented to the emergency department within the specified time interval were included in the study. 143 of these patients were admitted to the emergency service before dust exposure (group 1) and 203 after dust exposure (group 2). According to The Air Pollution Report of the Ministry of Environment and Urbanization, while PM-10 values are between 52.8-175 µg/m^3 for one week as of October 14; it was determined that these values increased between 21-145 µg/m^3 compared to before the dust transport. Approval was obtained from the Local Ethics Committee for the study.

Statistical Analysis

All statistical analyses were performed using IBM SPSS for Windows version 15.0 (SPSS, Chicago, IL, USA). Shapiro Wilks and Kolmogorov-Smirnov test was used to assess the assumption of normality. Normally distributed continuous variables were expressed as mean ± standard deviation while the continuous variables that do not have normal distribution were expressed as median (minimum-maximum). Also, categorical variables were summarized as counts (percentages). Comparisons of continuous variables between two independent groups were performed using Student's t test and Mann-Whitney U test. Associations between categorical variables were determined by chi-square test and Fisher's Exact test. A two-sided p-value<0.05 was considered as statistically significant.

RESULTS

A total of 346 cases were included in the study. Of these, 143 cases (41.3%) who presented before dust exposure were group 1, and 203 cases (58.7%) who presented after dust exposure were group 2.

The number of cases presenting after dust exposure was 17.4% significantly higher than before dust exposure (p = 0.001) (Figure 1). According to the information obtained from Directorate of Meteorology, Ankara after dust exposure, a significant decrease was recorded in air quality after 18 October (Figure 2).

The mean age of group 1 cases was significantly higher than group 2 (55.4 ± 18.9, 50.5 ± 22.1, respectively; p = 0.020). The groups were similar in terms of gender (p = 0.200). Cough was significantly increased in group 2 cases compared to group 1 cases [37 (27.6%), 97 (72.4%), respectively; p < 0.001].

Pulmonary diseases were observed in 91 cases (57.2%) and extrapulmonary diseases in 52 cases (27.8%) in group 1 cases who applied 14 days prior to dust exposure.

In group 2 cases who applied for 14 days after dust exposure, pulmonary diseases were observed in 151 cases (74%) and extrapulmonary diseases in 52 (26%) cases. When the patients in group 1 and group 2 were compared in terms of the diseases that caused admission to the emergency service, it was observed that nonpulmonary diseases were at the same level, while lung diseases increased significantly (p < 0.001).

When a comparison was made according to lung and heart diseases before and after exposure to dust cloud, there was an increase in patients with COPD (Chronic Obstructive Pulmonary Disease) among lung diseases,

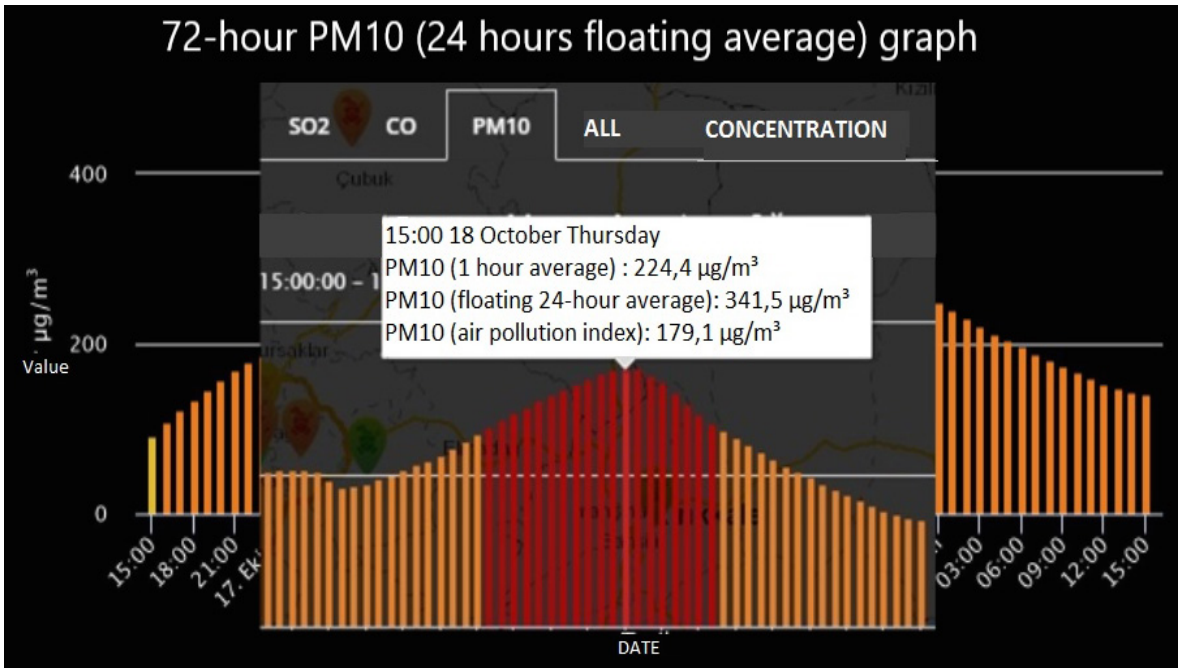

Figure 1. PM_{10} plot over the seventy-two hour period with the dust cloud. PM_{10} values for the increase in air pollution between 14-18 October 2018 due to dust cloud on October 14 in Figure 1

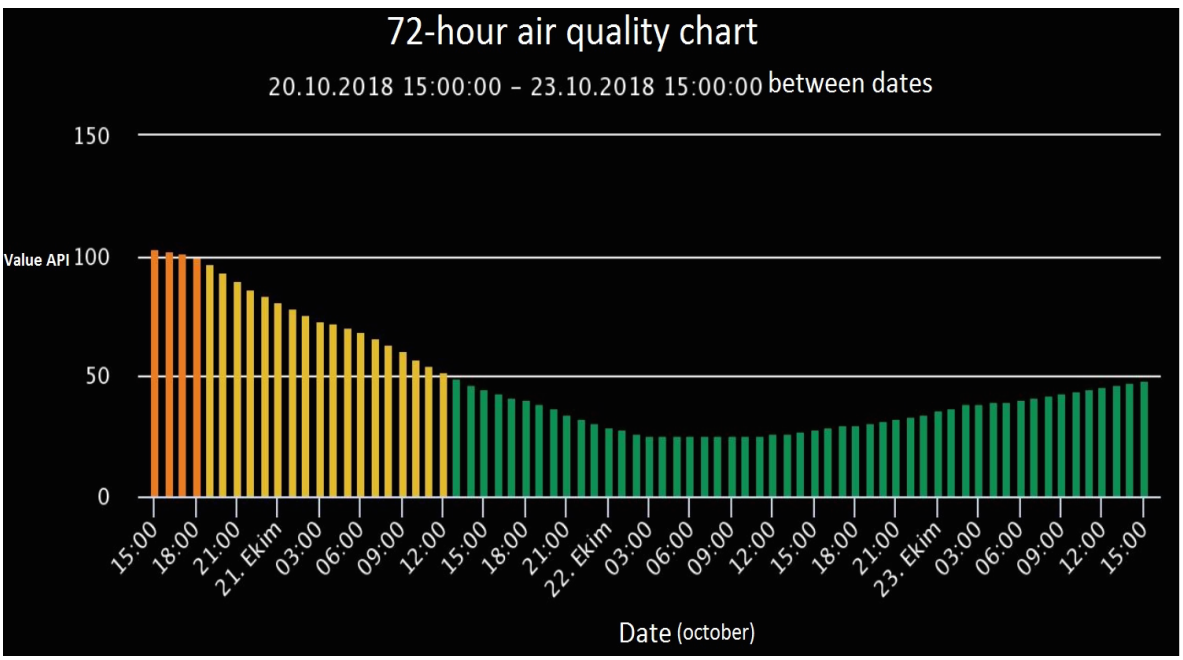

Figure 2. Air quality graph in the seventy-two hour period with the dust cloud.

and an acute coronary syndrome among heart disease. However, it was observed that these increases were not statistically significant (p> 0.05) (Figure 3).

Among the lung diseases, there were 83 (40%) patients presenting with only dust-related shortness of breath or cough and 16 (7.9%) patients presenting with heart failure (Figure 4).

When the cases were evaluated according to the application address, although the number of patients who applied from Yenimahalle and Çankaya increased, there was no significant difference (p> 0.05). (Before Yenimahalle dust was 8 (5.6%), after dust was 17 (8.4%), Çankaya pre-dust was 33 (23.1%), and post-dust application was 42 (20.7%).

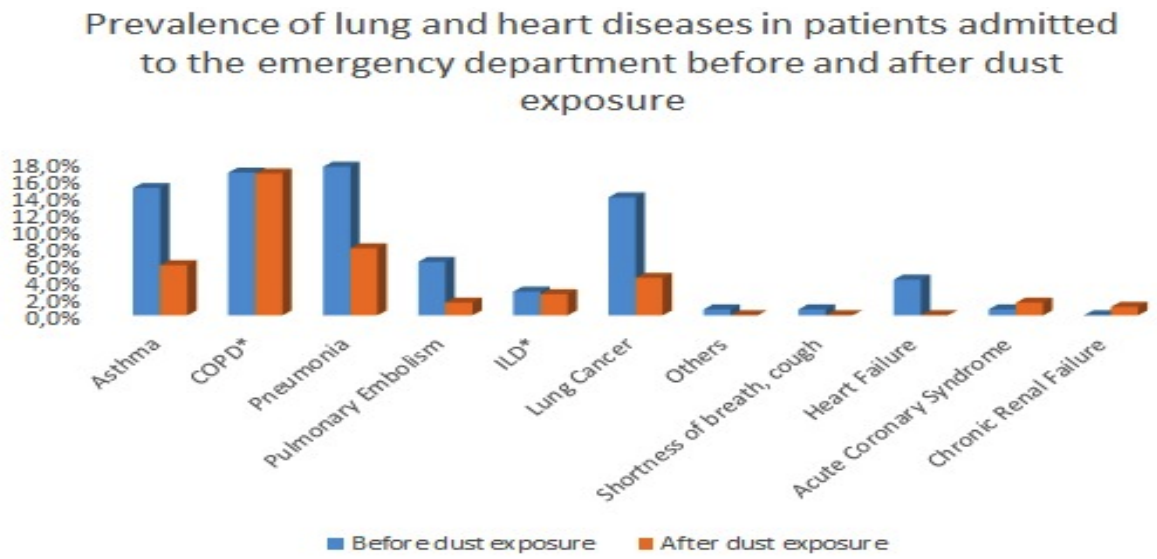

Figure 3. Prevalence of lung and heart diseases in patients admitted to the emergency department before and after dust exposure.

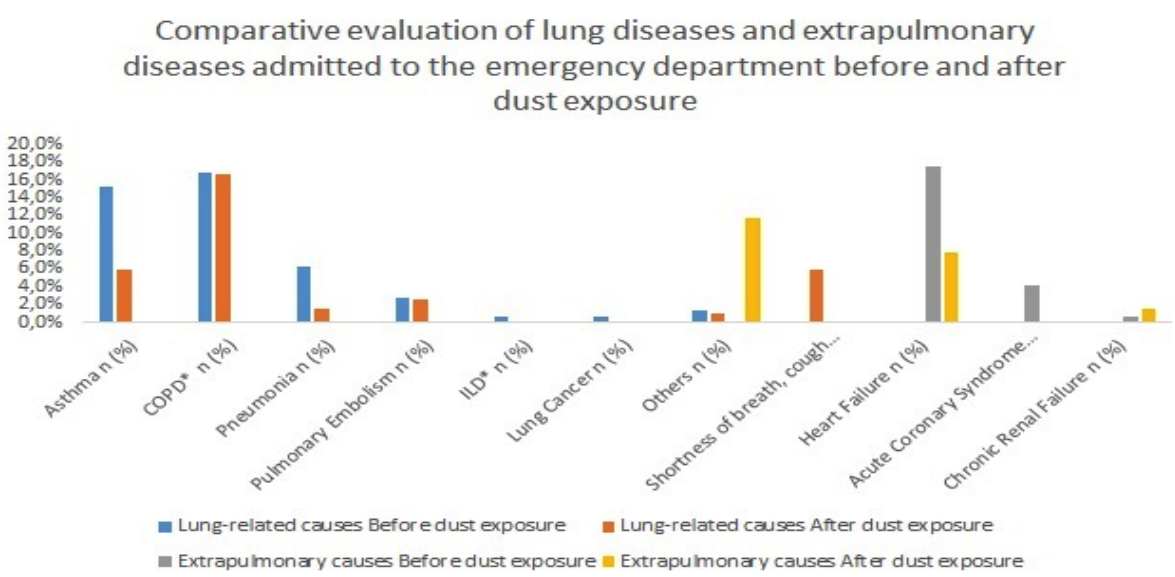

Figure 4. Comparative evaluation of lung diseases and extrapulmonary diseases admitted to the emergency department before and after dust exposure.

DISCUSSION

As a result of our study, it was determined that dust transport caused a significant increase in respiratory system symptoms and the rate of patients presenting to the emergency department.

Dust transport, which has the risk of recurrence due to the geopolitical location of our country, is an important public health problem (3).

Billions of tons of dust are released into the atmosphere every year. The most important sources of these are the Sahara desert and Sahel region in North Africa, Gobi and Takla Makan regions in Asia. Wind-blown dust plays an important role in the global ecological cycle. For example, dust particles originating from the Sahara desert play a critical role in the fertility of plants in large areas in the Atlantic Ocean due to nitrogen, iron and phosphorus in their content. However, the wind also carries significant desert dust to densely populated areas. A dramatic increase in dust concentration is observed in the ambient air over the days in the affected areas. On days when the Sahara sand increases, in regions such as Southern Europe, PM levels rise far above the previously determined or recommended levels, causing recurrent air quality problems. Although particle pollution caused by natural events such as sandstorms is excluded in the daily PM_{-10} values measurements in the newly introduced European regulations, it is still a matter of debate whether this natural dust has negative effects on human health alone or in combination with other particles created by human activities. It is thought that inflammatory or allergic effects may be observed due to the fact that dust particles are loaded with fungi, viruses and bacteria. Some population studies have also shown adverse health effects from these dust storms. All these data were highlighted by the European Respiratory Society and the negative effects of the dust cloud on lung health were emphasized in the translations made by the Turkish Thoracic Society (4).

In the five-year follow-up of 4757 female patients diagnosed with COPD in Germany, it has been reported that every 7 $\mu m/m^3$ increase in PM_{-10} causes a 5.1% decrease in FEV_1 (5). It has also been reported that the progression of COPD is faster in women who live close to high streets (3).

In a study, the outdoor air quality data and monthly averages of meteorological data measured in the same period with the applications made to the emergency department due to COPD at Istanbul University Hospital between 1997-2001 were examined. A total of 1586 patient records were used. There was a negative correlation between the number of applications made for COPD and temperature, and a positive correlation for SO_2 and PM_{-10}. No relationship has been found with other pollutants (6).

Three hundred sixty-five community-acquired pneumonia cases with a mean age of 65 were compared with 494 control groups and NO_2, $PM_{-2.5}$ and SO_2 values exposed by the groups in the previous year were calculated. It has been reported that exposure to high concentrations of NO_2 and $PM_{-2.5}$ for more than one year significantly increases the risk of developing community-acquired pneumonia (7).

In another magnetic resonance study conducted on 3827 patients living near major roads, a higher left ventricular muscle mass index was detected in this population in relation to $PM_{-2.5}$, indicating one more end-organ damage caused by traffic-induced air pollution in the cardiovascular system (8). Similar studies have shown an increase in air pollution and cardiovascular diseases and an increase in inflammatory markers such as fibrinogen in the blood (9-11).

Sahara dust with the low pressure system over northern Africa and the influence of winds, mainly in Southeast Anatolia affects all of Turkey. Therefore, the recognition of Sahara dust is very important in terms of respiratory health as well as regional climate systems. Turkey Global Chronic Respiratory Disease Prevention Council (Turkey-GARD) in partnership

with the ministry of health report conducted by the representatives of these issues were mentioned: It has been proposed that an observation network that will represent the city in its entirety should be established to measure many gas and aerosol pollutants. Especially in our cities where urbanization is observed, it is planned to create a detailed and accurate emission inventory to include all emissions. It was reported that developing a consistent, continuous and all-emissions inventory for the whole country would be an important remedy. Considering the importance of long-distance transport, it has been reported that in addition to our cities and our country, conducting inventory studies on a regional scale (including the Sahara effect) is essential in preventing air pollution in general and dust cloud impacts from the Sahara deserts (12).

Our study has some negative aspects. Being retrospective has narrowed the scope of the study. In addition, it has been a disadvantage that the patients who applied with the complaint of post-dust cough and shortness of breath did not have chest diseases records in our hospital system after Pulmonary Founction Test's. No interpretation could be made regarding the diagnosis of diseases causing shortness of breath and cough.

As a result of our study, it was observed that after the dust cloud from Syria, there was a significant increase in the admissions to the emergency department in those with lung diseases. There was an increase in the admission of patients with heart failure from non-pulmonary diseases. In addition, a significant increase in the symptoms of shortness of breath and cough after dust cloud was observed. On the days when dust clouds form, the outdoor air quality is seriously affected, causing human health and various economic damages. These events nationwide for the protection of public health ahead, the provision of local governments and even personally taking precautions is a must for sensitive country like Turkey to be effective transport of dust.

ETHICS COMITTEE APPROVAL

* The study was approved by the Ankara City Hospital Clinic Research Ethics Committee (Date: 17.03.2021 and Number: E.Kurul-E1-21-1680).

REFERENCES

1. Tekbaş ÖF. Çevre Sağlığı. 1. basım. Ankara: GATA Basımevi, 2010 .
2. Ozmen İ. Akut inhalasyon hasarı olgu örnekleri. https://www.researchgate.net publication/333984847_Akut_Inhalasyon_Hasari Olgu_Ornekleri, (Dated Accessed: 01.01.2021).
3. Schikowski T, Sugiri D, Ranft U, Gehring U, Heinrich J, Wichmann HE, et al. Long-term air pollution exposure and living close to busy roads are associated with COPD in women. Respir Res, 2005; 6: 152.
4. A draft of this booklet was reviewed by the ERS Environment and Health Committee, https:// HYPERLINK "http://www.ersnet.org" www.ersnet.org, (Dated Accessed: 01.01.2021).
5. Robert J, Lambach MD. Outdoor air pollutants and patient health. Am FamPhysician, 2010; 81 (2): 175-80.
6. Hapcioglu B, Issever H, Kocyigit E, Disci R, Vatansever S, Ozdilli K. The effect of air pollution and meteorological parameters on chronic obstructive pulmonary disease at an Istanbul hospital. Indoor Built Environ, 2006; 15 (2): 147-53.
7. Neupane B, Jerrett M, Burnett RT, Marrie T, Arain A, Loeb M. Long-term exposure to ambient air pollution and risk of hospitalization with community-acquired pneumonia in older adults. Am J Respir Crit Care Med, 2010; 181 (1): 47-53.
8. Van Hee VC, Adar SD, Szpiro AA, Barr RG, Bluemke AD, Diez Roux VA, et al. Affiliations expandet all. Exposure to traffic and left ventricular mass and function: the Multi-Ethnic Study of Atherosclerosis. Am J Respir Crit Care Med, 2009; 179: 827–34.
9. Peters A, Frohlich M, Doring A, Immervoll T, Wichmann HE, Hutchinson WL. Particulate air pollution is associated with an acute phase response in men; results from the MONICA-Augsburg Study Eur Heart J, 2001; 22: 1198–204.
10. Pekkanen J, Brunner EJ, Anderson HR, Tiittanen P, Atkinson RW. Daily concentrations of air pollution and plasma fibrinogen in London. Occup Environ Med, 2000; 57: 818–22.
11. Schwartz J. Air pollution and blood markers of cardiovascular risk. Environ Health Perspect, 2001; 109: 405–9.
12. GARD Türkiye Raporu. https://www.saglik.gov.tr, (Dated Accessed: 01.01.2021).