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**EVALUATING THE EFFECT OF DUST PHENOMENON ON RESPIRATORY DISEASE
AND DEATH FROM CARDIOVASCULAR AND RESPIRATORY DISEASE
IN KERMANSHAH (2008-2013)**

**Meghdad Pirsahab¹, Somayeh Bakhshi¹, Ali Almasi^{1*}, Seyyed Alireza Mousavi¹, Mansour Rezaei²,
Kiomars Sharafi^{1,3}, Elahe Saleh²**

¹Department of Environmental Health Engineering, Public Health School, Kermanshah University of Medical Sciences, Kermanshah, Iran.

²Department of Biostatistics, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.

³Department of Environmental Health Engineering, Public Health School, Tehran University of Medical Sciences, Tehran, Iran.

Email: alialmasi@yahoo.com

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Abstract

Every year a large part of Iran especially western and south western region are affected by dust. The aim of this study is to determine the outcome of dust phenomenon occurrence and its impact on the number of patient's admission and mortality from cardiovascular and respiratory disease in Kermanshah during past few years. This is a descriptive study. In present study the data which related to the dust occurrence (concentration of particle PM₁₀), the number of respiratory patients admission and the number of death from cardiovascular and respiratory disease during the last 6 years in Kermanshah (2008-2013) were collected from environmental organization and Kermanshah's hospitals and the average of all the particles concentration PM₁₀ during 5 years was 122.82 µg/m³ with the standard deviation of 55.02 and the regression analysis showed a significant relation between dust concentration and the number of admitted patients whom suffer from respiratory infection and chronic pulmonary disease and death from cardiovascular disease. But there isn't a significant relation between the increase of dust concentration and chronic obstructive respiratory disease, angina, asthma and death from respiratory disease.

The results showed that by increasing the dust concentration, the number of respiratory infection patients, the chronic pulmonary disease and death from cardiovascular disease have increased.

Keywords: PM₁₀, respiratory, cardiovascular, disease, death, Kermanshah

Introduction

In recent years, the air pollution which caused by dust storm with natural origin would consider as a serious problem in Kermanshah city. Dust storms are a kind of natural disaster, which occurs frequently in arid and semi-arid region and reduced the horizontal visibility to less than 1 kilometer (1-3). Serious dust storm could reduce horizontal visibility to 50 meters (4, 5). Dust phenomenon occurrence caused environmental damages, respiratory and cardiovascular disease, air and ground traffic, hurts tourism, agriculture and etc. During recent years, dust storm in Middle East, especially in Sahara of Saudi Arabia and Iraq have adverse effect for these countries and its scope extended to major cities too. The extent damage of this phenomenon is not only limited to agricultural farm and industrial areas, but also it disturbed the citizen's life, become a serious thread for environment, and evokes a lot of reaction from public opinion (6). Paying attention to the dust phenomenon is important from different dimensions. First in recent 15 years, there have been 2 waves of deep droughts. The droughts of October 1998 to October 2003 and the droughts of October 2007, which continues. In the first waves of droughts, the water resources and consequently the natural plants growth of the region were damaged. But unfortunately in the period of 2003 to 2006 the precipitation was normal or even less than normal. Therefore the nature didn't have the possibility to rehabilitate it and the very deep drought has arrived in 2007-2008. The 2007 autumn without rain and the 2008 spring again without rain have stopped Middle East natural system. The Kermanshah's precipitation in all the agricultural year (2007-2008) was only 150mm. but evaluation of this droughts consequent was limited only to the evaluation of the direct damage of this droughts such as the reduction of water resources level. The long-term consequences of this natural system stop, was not evaluate and today we faced with a horrific consequences of it (7). Thick dust, which is not related to the dust storm, was the cause of regional dust phenomenon, which arises from regional flows and external origins (8). By synoptic analysis of dust waves in west of Iran, it revealed that high pressure Azor with western immigrant wind system, was one of the most important synoptic factor which effect regions dust system. Immigrant troughs and cyclones penetrate the region when the high pressure subtropical Azor was not in the region or become weakness (9). The synoptic analysis of the dust system in Kermanshah revealed that the closed cyclones on Iraq and north of Saudi Arabia were the main factor of regional dust. The dust particle effect the weather directly and indirectly (10). For example it causes changes in temperature. Which means if dust particles were dark they cause the absorption of radiation and increased the temperature and if the dust particles were lights they reflex the radiation and

have cooling effect? Also the radiation causes the greenhouse effect to reduce. The dusts nuclear may change the clouds properties. For example because of the dust storm, the number of droplets which forms the clouds may increase because of the nuclei increased. Also it may exacerbate the temperature inversion. Since the dust storm in regions with soil, moisture and plant may occur less than other region; the extensive dust storm occurrence has an inverse relation with the rain level. By droughts increased, the dust storm would increase too (11). When there is a dust storm, strong winds started to blow, the dusts and sands started to rise up, the air pressure increased, the air temperature reduced immediately (5°C), and the relative moisture would increase to 10% (12). Most of the epidemiological studies about particles evaluation, consider the particles with $10\ \mu$ diameters as an indicator for exposure and the rules which related to the air quality. Because it contains breathable particles which includes: coarse particles (particles with $2.5\text{-}10\ \mu$), fine particles (less than $2.5\ \mu$)(13, 14). Coarse particles ($2.5\text{-}10\ \mu$) originated from geological resources (soil or other tough materials) (15). In some cases the concentration of evaluated particles in dust storm was more than $6000\ \mu\text{g}/\text{m}^3$. While WHO determine the 24h average of PM_{10} in open air 250 and the annual average of it is $20\ \mu\text{g}/\text{m}^3$ (16, 17). The epidemiological studies showed that there is a relation between the particle and daily death [16]. In most of the epidemiological studies, there is a significant relation between fine particles and the issues which originated from diseases (18). The PM_{10} particle was the cause or resonator of diseases and deaths which related to the heart or pulmonary. Individuals who have cardiovascular or pulmonary disease such as congestive heart failure, coronary artery disease, asthma or chronic obstructive pulmonary disease, and the elderly are more likely to visit the emergency centers, admitted in hospitals or even die. Meanwhile, cardiac arrhythmias and heart attack are related to exposure with particles (19).

The WHO evaluation based on late 1990 decades, linked 700 cases of the annual death from the acute respiratory infection in under 4 years old kids in Europe to the exposure with PM_{10} (20). By increasing $100\ \mu\text{g}/\text{m}^3$ in PM_{10} 24 h average concentrate, 10% increasing incidence of pneumonia and 27% increasing incidence of chronic obstructive pulmonary disease were confirmed(21).

Regarding to the low present knowledge about dust and its effect in international level and also lack of the possibility to use this knowledge in Iran, due to the indigenous characteristics and culture, the idea which is present, is to identify the effect of dust on the health and the city's environment of Kermanshah, in order to reduce the effect of it to some extent. Kermanshah province because of its geological location and proximity to the large wilderness area affected by adverse

phenomenon of dust frequently. In addition, because of droughts condition in recent years, occurring this phenomenon has higher intensity and persistence.

Material & Methods

In this study, first we evaluate the outcome of dust occurrence in recent years in Kermanshah province and then evaluate its effect on diseases and deaths, which are related to the Kermanshah's air pollution during 4 years (2008-2013). This is a descriptive study which include data and statistics collection, filling out checklists, interview and analyzing them. In present study the statistics and data which related to the dust occurrence in recent years of Kermanshah (2008-2013) were collected from environmental organization of province. These data were reported as the number of days with triple status indicator (alert: 100-250, emergency: 250-350, crisis: more than 350) in different years.

The data about the admitted patients of disease which are related to the air pollution (respiratory infection, chronic obstructive respiratory disease, chronic pulmonary disease, angina and asthma) and some death from cardiovascular and respiratory disease in Kermanshah in recent years were collected from Kermanshah's hospitals (Imam Reza, Imam Ali, Imam Khomeini and Mohammad Kermanshah) to determine the relationship between the dust phenomenon and above variables, first the Kolmogorov Smirnov test was used to revealed the normal variables. Except asthma and chronic pulmonary disease variables the other variables were normal.

To determine the relation between dust and normal variables the spearman test was used. In evaluation of dust phenomenon and its effect on health, there were confounding variables. Because in this study we collected many data from various centers and these data were related to the past (2008-2013), for controlling confounding variables in analyzing time the multivariate method was used.

Results

Statistical surveys of dusty days in statistical periods of 2008-2013 showed that the most dusty days were related to year 2009 which about one-third of days in year reported as air pollution and the lowest dusty days were related to year 2012. The trend of PM₁₀ particle concentration in terms of month, from April to July was increased, from July to December decline, and again increases from December. Second surveying of dusty days showed that the dustiest days were in spring and summer and the lowest days were in autumn and winter. Monthly surveying of dusty days showed that the dustiest day was in June and July and the lowest days were in January and February. Based on the results the most and the least

visitors for disease and death from air pollution in Kermanshah's hospital (code1: respiratory infection code2: chronic obstructive respiratory disease code3: chronic pulmonary disease, code4: angina disease, code5: asthma, code6: death from cardiovascular disease, code 7: death from respiratory disease) during the statistical period 2008-2013 in Kermanshah for respiratory infection disease were respectively: 32 and 2 person in October and August 2010, 46 and 5 persons in February and August 2011, 172 and 60 persons in February and November 2012, 160 and 74 persons in April and June 2013.

The most and the least visitors for chronic obstructive respiratory disease were respectively: 28 and 4 person in May and March 2010, 20 and 1 persons in October and March 2011, 79 and 22 persons in March and May 2012, 21 and 12 persons in April and May 2013. The most and the least visitors for chronic pulmonary disease were respectively: 4 and 0 persons in June and April 2010, 35 and 0 persons in May and March 2011, 9 and 0 persons in November and April 2012, 3 and 0 persons in April and May 2013.

The most and the least visitors for angina disease were respectively: 918 and 890 persons in May and April 2010, 1266 and 803 persons in August and December 2011, 1032 and 742 persons in September and March 2012, 813 and 401 persons in October and April 2013. The most and the least visitors for asthma disease were respectively: 30 and 12 persons in April and September 2010, 68 and 27 persons in January and December 2011, 34 and 12 persons in April and August 2012, 23 and 4 persons in May and June 2013.

The most and the least death from cardiovascular disease were respectively: 4 and 0 persons in March and June 2010, 29 and 0 persons in January and June 2011, 25 and 9 persons in May and January 2012, 26 and 13 persons in April and June 2013. And also, the most and the least death from respiratory disease wererespectively: 47 and 22 persons in March and April 2010, 23 and 12 persons in July and March 2011, 49 and 37 persons in August and April 2012, 62 and 56 persons in April and May 2013. The regression statistical analysis between dust concentration and the number of admitted patients of respiratory disease and death from cardiovascular and respiratory disease showed that the dust concentration affected the number of admitted patient of respiratory infection and chronic pulmonary disease and death from cardiovascular disease and the increase of dust concentration could cause the increasing of the chronic pulmonary disease and reduce the respiratory infection and death from cardiovascular disease. But the increase of dust concentration have not a significant relation with chronic obstructive respiratory disease, angina and asthma and death from respiratory disease (Figure1 to 7).

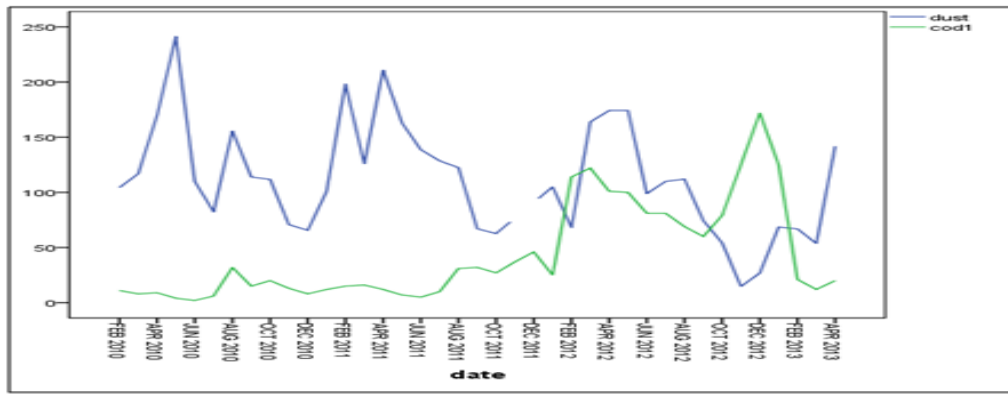


Figure-1. Time series the concentration of dust particles and code 1.

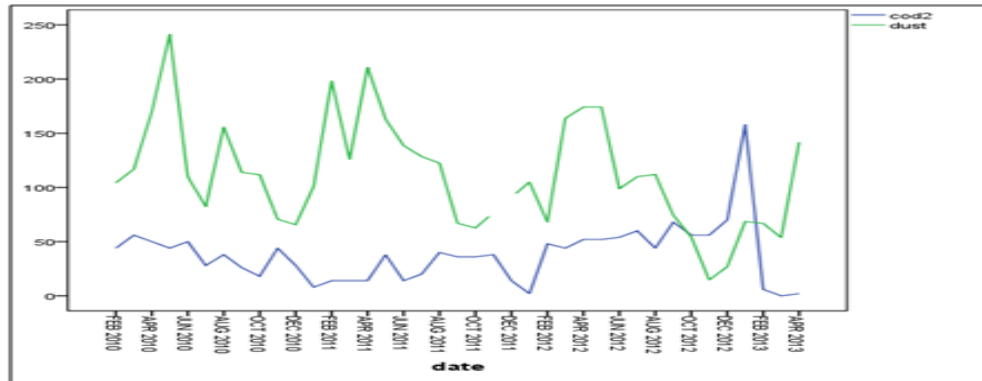


Figure-2. Time series the concentration of dust particles and code 2.

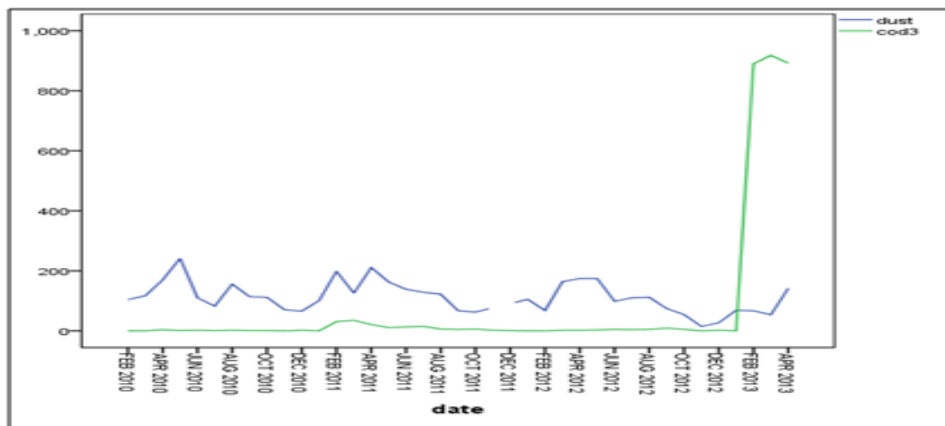


Figure-3. Time series the concentration of dust particles and code 3.

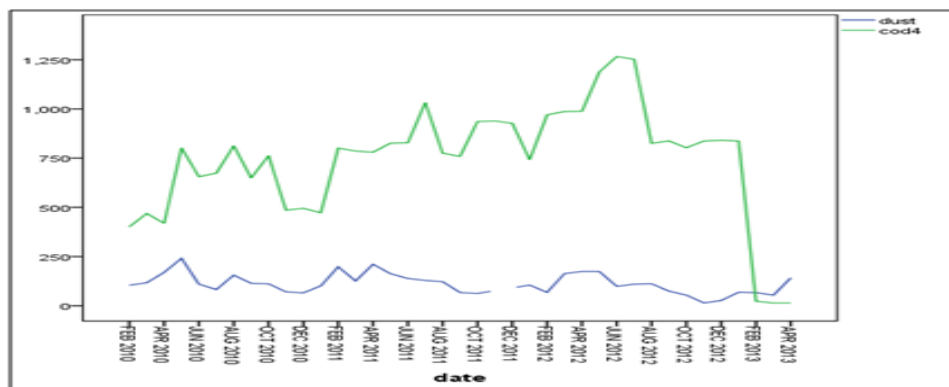


Figure-4. Time series the concentration of dust particles and code 4.

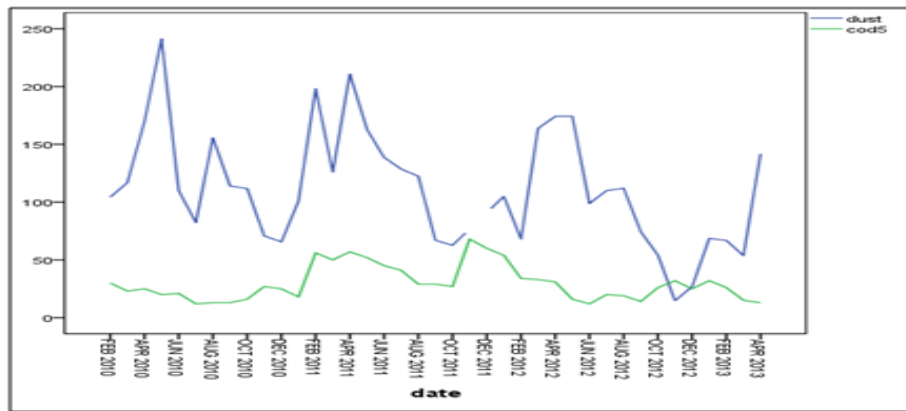


Figure-5. Time series the concentration of dust particles and code 5.

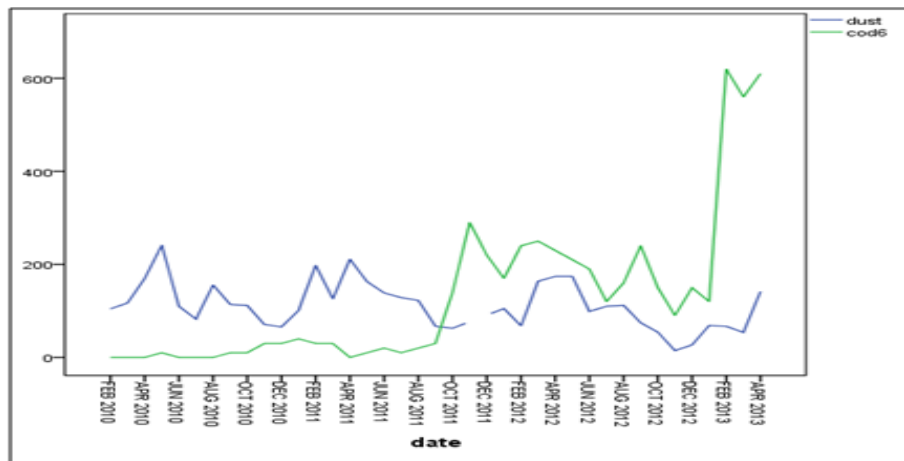


Figure-6. Time series the concentration of dust particles and code 6.

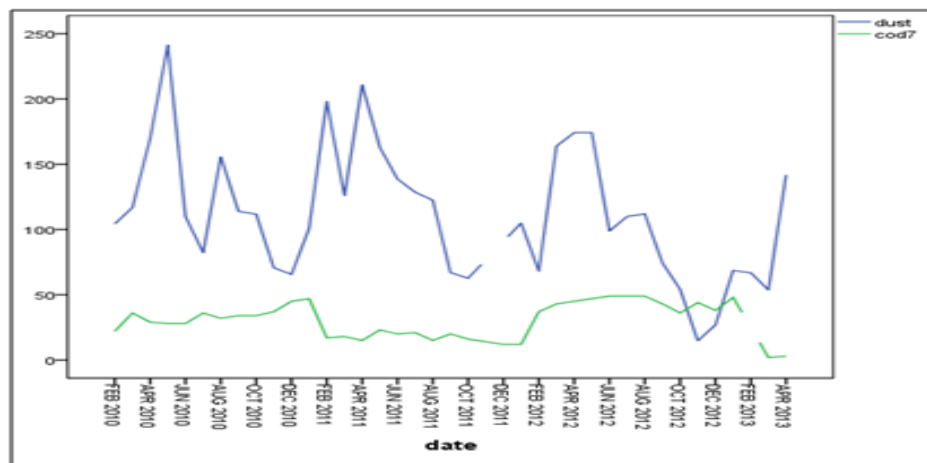


Figure -7. Time series the concentration of dust particles and code 7.

Discussion

Statistical evaluation of dusty days during a statistical period of 2008-2013 showed that the dustiest days were related to the 2009 year and one-third of days in a year reported as a polluted air and the least dusty days were related to the 2011. Second evaluation of dusty days showed that, the dustiest days were in spring and summer and the least dusty days were in autumn and winter. Monthly evaluation of dusty days during this period showed that the dustiest days were in June and

July and the least dusty days were related to the December and January. The PM₁₀ particles concentration from April to July was increased and from July to December was reduced and from December, again it increased.

Bahiraei et al (2011) in a synoptic statistical analysis about dust phenomenon in Ilam showed that the frequency of this phenomenon occurrence in hot months of the year was higher than cold months(22).Omidvar (2011) by evaluating a 20 years period (1998-2008) of dust showed that the dusty days in the statistical period have an increasing process. Also, in this city in a hot period of year (spring and summer) especially in the afternoon the condition for dust phenomenon occurrence is better than the other times(23).

The hospitals data resources and recorder systems are not sufficient and precise. Therefore with the collected data in present study which is not an enrich statistic, there isn't a logical relation between dusts and admitted patients of respiratory disease and death from cardiovascular and respiratory disease. Because of the chronic nature of respiratory disease, the number of respiratory patient is not increased immediately after the increased of dust concentration, it will prepare the field for the increasing in sequences time and also it have suggested that for logical analyzing of dusts etiology and its effect on health, an cohort study with extended dimension and confounding factors should be done.

The increasing of dust concentration itself can't be the cause of increased in chronic respiratory disease, angina, asthma and death from respiratory disease because they occurred as a chronic disease and other factors are involved in creating them and dusts are only exacerbate them. Dusts affect the inhaled level and reduced the capacity of pure air and also dusts, sensitizer materials, disease resonant (plants pollen, toxic materials, Aromatic compounds, primary and secondary pollutants) may cause a person who expose to them become sick.

However since the dust occurred the respiratory patients prefer to stay home and often in dusty days all the activities would be stopped or limited. Therefore the possibility for the respiratory patients and admission of them in hospital is become lower.

Najim et al (2009) in their study about physical and chemical compounds of entry dust of country in western province showed that these dusts have an adverse effect on the respiratory tract and pulmonary and hurts the human health(24).Dobidi (2010) evaluate the interactive effect of air pollution and Korkomalonga and regulate exercise on selected indicators that are related to the cardiovascular disease and found that being exposed to the air pollution and inhaled air pollutant, developed arthrosclerosis, cardiovascular disease and even death(25).

Conclusion

the average of all the particles concentration PM10 during 5 years was 122.82 $\mu\text{g}/\text{m}^3$ with the standard deviation of 55.02 and the regression analysis showed a significant relation between dust concentration and the number of admitted patients whom suffer from respiratory infection and chronic pulmonary disease and death from cardiovascular disease. But there isn't a significant relation between the increase of dust concentration and chronic obstructive respiratory disease, angina, asthma and death from respiratory disease. The results showed that by increasing the dust concentration, the number of respiratory infection patients, the chronic pulmonary disease and death from cardiovascular disease have increased.

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Corresponding Author:

Ali Almasi*,

Email: alialmasi@yahoo.com