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The effects of particulate matter on health

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Abstract

Background: Exposure to particulate matter was harmful in air pollution specially. But in the work places this exposure was too. Objective of this study was to determine the health effects of particulate matter exposure on workers.

Methods: People were employed. Groups were followed for cardiovascular, upper respiratory, lower respiratory and neurological symptoms and signs. These groups were exposed to concentrations of particulate matter; according to work sites, 5 groups were participated: work site 1, work site 2, work site 3, work site 4 and work site 5. Symptoms and signs were determined. Data were analyzed with SPSS and considering $P<0.05$ as significant level.

Results: Work site 5, had the most particulate matter concentration; 8.30±0.43 mg/m^3. Cardiovascular, upper respiratory, lower respiratory and neurological symptoms and signs were determined. Chest pain was the most in group 5 and relative risk was 5.10(1.81-13.75).

Conclusion: Particulate matter had health effects in low to moderate concentrations and might be caused chest pain.

Keywords: Particulate matter, Chest pain, Occupational exposure.

Introduction

Exposure to particulate matter was harmful in air pollution specially. But in the work places this exposure was too. Acute exposure to particulate matters could be caused respiratory symptoms and signs such as coughing, dyspnea and wheezing. [1] Occupational exposures might be concluded particulate matter and control was necessary. [2]

One of the most important exposures for health effects was particulate matter specially particulate matter or PM2.5 [.2,3] Particulate matters according their aerodynamic diameter were classified [.2,3]

If the aerodynamic diameter was less than 2.5 micrometers they were more effective than larger particles [.4-6] Cardiovascular and neurological disorders might be generated from particulate matter with aerodynamic diameter less than 2.5 [.7,8] The main etiology for many of disorders symptoms and signs in the workplaces was particulate matters from chemical risk factor [.9] Particulate matter were important harmful material. [10] The health system wanted to control it in countries, cities specially near the factories and

industrial workplaces. [11,12] If it was more than standards, 10 mg/m^3, health team had controlled.[13,14] But in recent years researchers showed generation of cardiovascular and neurological disorders with this standards. [15,16] Smoking was damaged health. [17]

Ambroz A and coworkers showed the impact of air pollution on oxidative DNA damage and lipid peroxidation sensitive groups. [18] Morakinyo OM and coworkers demonstrated the health outcomes of exposure to particulate matter. [19]

Gao ZX and coworkers worked on DNA damage in exposure to particulate matter 2.5 in this situation. [20] Filippini T and coworkers determined the effects of particulate matter from air pollution. [21]

Punjindasup A and coworkers studied about the risk of cancer in exposure to particulate matter. [22] It was an important effects that was need to prevention.

Exposure to high concentrations could be caused an acute case with acute symptoms and signs such as; headache, coughing, nausea, wheezing, dyspnea, blurred vision, mucous irritation for eyes , nose and throat. [22,23]But in long time exposure, unknown disorders might be seen. [24,25]

Some studies worked on health of workers and found the important factors for having healthy ones.[26,27] Health programs in workplace were necessary and occupational health team should be done as soon as possible. Assessing and measuring particulate matters in the work places as a risk factor was important subject in this situation.

Objective of this study was to determine the health effects of particulate matter exposure on workers.

Methods

In historical cohort study, people who were employed in different industries were in this study. Groups were followed for cardiovascular, upper respiratory, lower respiratory and neurological symptoms and signs. These groups were exposed to concentrations of particulate matter; according to work sites, 5 groups were participated: work site 1, work site 2, work site 3, work site 4 and work site 5. Symptoms and signs were determined.

Sampling method was used with α= 0.05, power= 80 , P1=32% and P2= 53%, the calculated study population was 875 for each group (5 groups), and 4375 in total.

These groups were exposed to low to moderate concentration of particulate matter; according to work sites the population was divided to five groups. Symptoms and signs of cardiovascular and central nervous system were determined by using interview and filling the questionnaire, physical examinations and tests.

Symptoms and sign were cardiovascular, upper respiratory, lower respiratory and neurologic or central nervous system; irritation of upper respiratory system, irritation of mucous membranes, asthma, allergy, chest pain, arrhythmia, fatigue, headache.

The Inclusion criteria were people who worked in general industries with at least 2.2 years work experience in the same work. The exclusion criteria were having the related diseases in cardiovascular, respiratory and neurological systems before beginning this job and having the positive family history of cardiovascular, respiratory and neurological disorders.

Exposure assessment; all exposures assessed and calculated the risks. Other work exposures were kept in the standard levels. Particulate matter measured and calculated according to standards of occupational safety and health administration. Samples are collected with a known volume of air from tared 37-mm diameter polyvinyl chloride (PVC). Samples are dried in a

controlled room. This standard operating procedure is done to the work station. [28]

The questionnaire were checked and also with performing a small study with correlation coefficient 92%. The participants were examined by author using a questionnaire that fill by interview, physical exams and tests.

For statistical analysis with SPSS, Chi-2, ANOVA were done, P value < 0.05 was considered for significant levels, RRs were taken.

Ethical consideration; the study was implemented with the consent and the participants 'names were confidential. Ethical standards had been done.

Results

The study participants were divided into 5 groups based on work sites.

Work site 5, had the most particulate matter concentration; 8.30±0.43 mg/m^3. Cardiovascular, upper respiratory, lower respiratory and neurological symptoms and signs were determined.

Cardiovascular, respiratory and neurological symptoms and sign were determined. Chest pain, irritation of pharynx and fatigue were the most in group 5 and relative risks were 5.10(1.81-13.75) ,1.87(1.37-9.47) and 1.54(1.07-2.42). All of the symptoms and signs were the most in group 5.

Table 1 showed the minimum, maximum and means of particulate matter concentration in five groups. Group 5 had the highest concentration and group 1 had the lowest concentration of particulate matter. There were significant differences between five groups.(P<0.05)

The highest number of symptoms and signs were in group 5: irritation of pharynx, asthma, allergy, chest pain, arrhythmia, fatigue, headaches. The lowest number of symptoms and signs was from group 1. There were significant differences. These items were demonstrated in table 2. (P<0.05)

The relative risks for symptoms and signs were determined, group 5 had the highest risks. Relative risk in group 4 for chest pain was 3.12 (1.91-14.74) and for irritation of pharynx was 1.12(1.22-11.05). Relative risk in group 3 and 2 for chest pain were 2.10(1.51-11.75), 1.50(1.01-2.20) and for irritability were 1.65(1.27-8.37), 1.50(1.35-8.87). Table 3 shows the relative risks in different groups. By using the logistic regression, these were had significant differences.

Discussion

According to our findings, Work site 5, had the most particulate matter concentration; 8.30±0.43 mg/m^3. Cardiovascular, upper respiratory, lower respiratory and neurological symptoms and signs were determined. Cardiovascular, respiratory and neurological symptoms and sign were determined. Chest pain and irritation of the pharynx were the most in group 5 and relative risks were 5.10(1.81-13.75) and 1.87(1.37-9.47).The all of the symptoms and signs were the most in group 5 with the highest particulate matter concentration.

According to the finding; group 5 had the highest number of symptoms and signs for cardiovascular, respiratory and neurological systems: irritation of pharynx, asthma, allergy, chest pain, arrhythmia, fatigue, headaches. The lowest number of symptoms and signs was from group 1. Group 1 had the lowest concentration of particulate matter. There were significant differences between five groups.

The relative risks for symptoms and signs were assessed, group 5 had the highest relative risks. Relative risk in group 5 for chest pain was 5.10(1.81-13.75) and for irritation of pharynx was 1.87(1.37-9.47) there were significant. Relative risk in group 4 for chest pain and irritability were 3.12(1.91-14.74), 1.77(1.47-

9.87) and in group 5 and 4 for fatigue were 1.54(1.07-2.42), 1.44(1.06-1.82). There were significant too. By using the logistic regression, these were had significant differences. It mean symptoms and signs were not related to other occupational exposure and environmental exposures, age.

Other studies showed the same as these results and demonstrated the special effects of particulate matter on cardiovascular, respiratory and neurological systems. [2] Particulate matter had effects on respiratory systems and aggravation of respiratory diseases. [2] In this study all of these symptoms and signs related to respiratory, cardiovascular and neurological disorders were determined. [20]

It seems that particulate matter that was affected on vital organs such as heart, lung and brain. [2] These were more prominent on respiratory symptoms. In this study researcher showed that group 5 had the most frequency in irritation of the upper respiratory system, irritation of pharynx, asthma, allergy, chest pain, arrhythmia, fatigue, headaches. This group had the highest level of particulate matter. Other studies had demonstrated the harmful effects of particulate matter on wellbeing and health. [1,2]

The highest numbers of people with chest pain and arrhythmia were the most in group 5. The effects of this matter on aggravation of heart disorders had been demonstrated in other researches. [1,24]

After deleting the effects of other exposures, age and body mass index the risk of diseases had significant difference. The risk of neurological symptoms and sign such as fatigue, headaches was showed in some studies. [2,3] Neurological symptoms could be caused by exposure to particulate matter. [2,3] This study showed the effects of low concentration of this agent on neurological symptoms and signs.

The physician must worked on this important item in occupational health system. Modifying the workplace specially from particulate matter was necessary and then the employee could be worked in the work places. [20,21]

According to the results of this study, researcher thought that job analysis should be done for measuring the risk factors in the workplace. In other studies were worked with determination of risk factors by attention to particulate matter in related industries. [27]

Author found that the particulate matter was an important risk factor for cardiovascular, respiratory and neurological disorders even in low to moderate concentrations. The low concentration in long time might be followed by neurological, respiratory, cardiovascular and cancer screening. [2,3]

Interview, history, Examination and tests in occupational health were an important subject. Cardiovascular, respiratory and neurological disorders could be assessed in theses assessments. The author of this article advised health groups, must be assessed particulate materials in different sizes because of their effects and must be modified the workplaces, they should be examined even for cancer and assessed these exposures.

Particulate matter exposure could be resulted from outdoor air pollution, the occupational health team might be studied about their health effect on cardiovascular system.

Conclusions

Particulate matter had health effects in low to moderate concentrations and might be caused chest pain.

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Legend Tables

Table 1: Means of particulate matter (PM 2.5) concentration in mg/m^3 and comparison between working sections.(P<0.05)

Group / Variable	work site 1	work site 2	work site 3	work site 4	work site 5
Concentration Minimum	2.0±0.01	3.01±1.01	5.0.20±0.04	6. 0±0.10	7.50±0.06
Concentration Maximum	2.70±0.20	4.50±0.10	5.80±0.10	6.50±0.01	10.10±0.80
Concentration Mean±SD	2.35±0.11	3.75±0.05	5.40±0.07	6.25±0.05	8.30±0.43
P value	0.001				

Table 2: Frequencies of symptoms and signs and comparison between working sections.(P<0.05)

Groups / Symptoms and signs	Work site 1N(%)	Work site 2 N(%)	Work site 3 N(%)	Work site 4 N(%)	Work site 5 N(%)	P value
Fatigue	2(0. 2)	5(0.5)	10(1.0)	16(1.6)	18(1.8)	0.01
Headache	2(0. 2)	5(0.5)	9(0.9)	10(1.0)	10(1.0)	0.04
Chest pain	1(0.1)	4(0.4)	7(0.7)	15(1.5)	22(2.2)	0.04
Arrhythmia	1(0. 1)	3(0.3)	5(0. 5)	10(1.0)	12(1.2)	0.04
Allergy	7(0. 7)	10(1.0)	10(1.0)	12(1.2)	15(1.5)	0.01
Asthma , Bronchitis	1(0. 1)	3(0.3)	5(0. 5)	5(0.5)	7(0.7)	0.03
Irritation of pharynx	5(0. 5)	10(1.0)	10(1.0)	13(1.3)	20(2.0)	0.03

Table 3: Relative risk of symptoms and signs between working sections. (P<0.05)

Groups / Symptoms and signs	work site 1 RR(CI)	work site 2 RR(CI)	work site 3 RR(CI)	work site 4 RR(CI)	work site 5 RR(CI)
Fatigue	1.22(1.02-2.52)	1.30(1.04-2.33)	1.34(1.05-1.62)	1.44(1.06-1.82)	1.54(1.07-2.42)
Headache	1.20(1.10-2.10)	1.27(1.03-2.02)	1.30(1.03-2.02)	1.34(1.12-2.45)	1.40(1.13-2.12)
Chest pain	1.10(1.81-4.75)	1.12(1.22-11.05)	2.10(1.51-11.75	3.12(1.91-14.74)	5.10(1.81-13.75)
Arrhythmia	1.08(1.02-1.10)	1.09(1.01-1.12)	1.10(1.00-1.22)	1.11(1.01-2.12)	1.12(1.02-2.22)
Allergy	1.10(1.01-1.20)	1.22(1.03-1.60)	1.40(1.04-1.62)	1.48(1.04-1.60)	1.50(1.05-1.70)
Asthma , Bronchitis	1.15(1.02-1.32)	1.18(1.10-2.12)	1.25(1.13-1.02)	1.27(1.11-2.32)	1.30(1.12-2.02)
Irritation of pharynx	1.45(1.36-7.97)	1.50(1.35-8.87)	1.65(1.27-8.37)	1.77(1.47-9.87)	1.87(1.37-9.47)