AIR POLLUTANTS AND RESPIRATORY DISEASES - FOCUSED ON DAEGU CITY IN SOUTH KOREA FROM 2006 TO 2010 -

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Introduction

Recent climate change has influenced on many ecological environments and the increasing of air pollutant is one of them. KEI(Korean Environment Institute) study shows that in 2055, CO, NO and O_3 will be increased 2.9%, 2.8%, 4.8% respectively comparing with 1995 data.

Climate change does not always have direct correlation with air pollutant increasing. But air temperature increasing can affect on rising of air pollutant materials from the ground and it can contribute wide diffusion of air pollutants. In summer, air temperature seems to have positive correlation with generating O_3. In contrary increasing air temperature seems to be able to decrease the pollutant concentration in winter. From the study of C.M.Kang(2006) and S.Y.Kim(2004), we can find that air pollutants(NO, PM, O_3) are the chains to respiratory diseases.

This study was performed to get the evidences to show the relationship between air pollutants and respiratory diseases. For this we analyze 60- months(2006-2010)-data of Daegu city in South Korea.

Materials and methods

Air pollutant data and respiratory diseases data in Daegu City from 2006 to 2010 were used for this data analysis study.

Air pollutant data were from NIER(National Institute of Environmental Research) and it includes the measurement data of SO_2(ppm), PM10(㎍/㎥, Particulate Matter), O_3(ppm), NO_2(ppm) and CO(ppm). The standard unit of PM10 is '㎍/㎥' while that of the rest 4 materials is 'ppm'. PM10 means particulate matters that have the diameter of less-than-10㎛. For calculating ppm, the molecular weight is a must. But 'PM' is mixture of the matters which have various diameters and it becomes the reason why PM10 cannot be described with 'ppm' unit. The five air pollutants were measured in 11 stations in Daegu city(Table 1).

Respiratory diseases data were from NHIS(National Health Insurance Service) and it includes Rhinitis and Asthma, the two main diseases regarding respiratory system. Hospital visiting counts were used and case definition was performed before data analysis. Case definition means that re-visiting cases within 4 days and re-hospitalizing cases within 7 days were deleted.

Data analysis procedure was as followings; First, basic Statistics(Mean, SD) were performed. Second, correlations between air pollutant amount and hospital visiting cases of respiratory diseases were performed. Third, time(x) based change of air pollutant and respiratory diseases was performed by linear regression analysis. Before the analysis and drawing graph, all the data were standardized to (Z+2)*10.

Table 1. Air Pollution Monitoring Stations

Station No.	Longitude	Altitude
1	128 35 10.00	35 52 15.00
2	128 32 49.00	35 51 59.00
3	128 34 24.00	35 50 33.00
4	128 33 54.00	35 53 28.00
5	128 38 00.16	35 53 15.65
6	128 38 32.00	35 51 43.00
7	128 37 53.95	35 49 49.32
8	128 30 24.00	35 50 04.00
9	128 41 50.00	35 52 06.00
10	128 33 08.00	35 55 13.00
11	128 26 45.00	35 41 51.00

(from NIER Reports)

Results and discussion

From the basic Statistics(Mean, SD) result during 60 months(Jan.2006-Dec.2010), SO_2(ppm) was 0.006±0.002, PM10(㎍/㎥) was 52±14, O_3(ppm) was 0.022±0.009, NO_2(ppm) was 0.024±0.006 and CO(ppm) was 0.6±0.1. Rhinitis case was 1047±373 and that of asthma was 677±139. Rhinitis case was nearly two times more than that of asthma(Table 2). The total case of rhinitis in south Korea during the same 60 months was 213,406,820 and that of asthma was 65,602,525.

Table 2. Basic Statistics on Air Pollutants and Respiratory Diseases in Daegu, South Korea (from 2006 to 2010)

		2006		2007		2008		2009		2010		Total		Time based regression equation after standization ((Z+2)*10) (X: month)	F(P)
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD		
Air Pollutants	SO_2 (ppm)	0.006	0.002	0.007	0.002	0.005	0.002	0.005	0.002	0.005	0.002	0.006	0.002	Y = - .012X	2.548
	PM10 (㎍/㎥)	54	16	52	16	57	14	48	10	51	12	52	14	Y = -.006X	0.825
	O_3 (ppm)	0.020	0.008	0.021	0.009	0.024	0.009	0.023	0.009	0.022	0.009	0.022	0.009	Y = +.008X	0.107
	NO_2 (ppm)	0.023	0.005	0.024	0.007	0.024	0.007	0.024	0.006	0.025	0.007	0.024	0.006	Y = +.007X	0.134
	CO (ppm)	0.7	0.1	0.6	0.1	0.6	0.1	0.5	0.1	0.5	0.1	0.6	0.1	Y = -.030X	7.758**
Respir. Diseases	Rhinitis	742	247	893	284	1054	289	1232	381	1316	361	1047	373	Y = +.061X	16.793**
	Asthma	629	123	664	138	702	162	701	120	689	155	677	139	Y = +.013X	0.510

**(p<.01), *(p<.05)

From the correlation analysis result, the coefficient between rhinitis and NO_2 was 0.439(p=.000) and regarding asthma, the coefficients with 4 materials were over 0.3(SO_2:0.392, PM10:0.537, NO_2:0.686).

From the linear regression analysis result, O3(+.008), NO_2(+.007), Rhinitis(+061), Asthma(+0.013) have increasing patterns with positive slope in regression equations. Rhinitis shows the most significant result($p<.01$)

The amount of air pollutants(especially O_3 and NO_2) is estimated to be increased gradually. Respiratory diseases seem to be increased much more. Continuous estimation and ready for action should come up with an effective counterplan for national health.

Table 3. Pearson Correlations (Air Pollutants vs. Respiratory Diseases)

		SO_2 (ppm)	PM10 ($\mu g/m^3$)	O_3 (ppm)	NO_2 (ppm)	CO (ppm)
Rhinitis	Corr. Coefficient	.094	.069	-.199	.439	-.169
	p	.473	.603	.128	.000	.197
Asthma	Corr. Coefficient	.392	.537	-.081	.686	.226
	p	.002	.000	.537	.000	.083

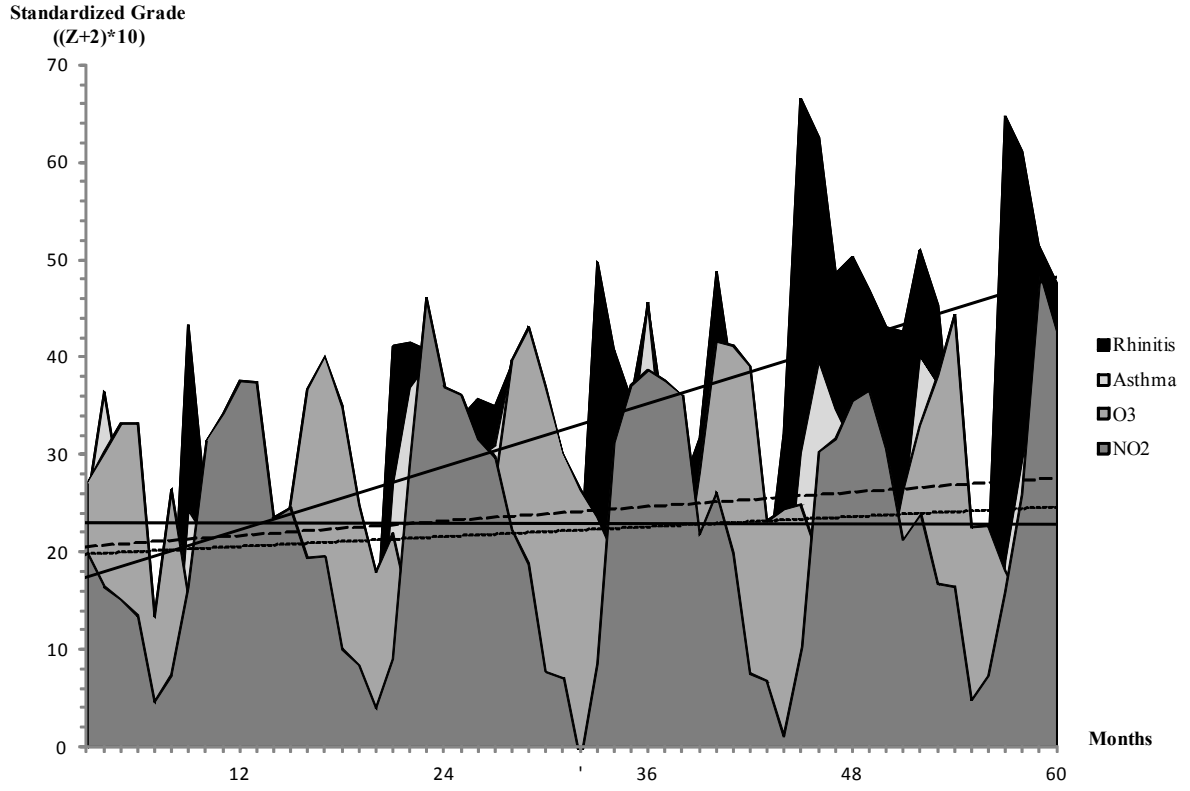

Fig.1.Time Series Line of Respiratory Diseases(Rhinitis, Asthma) and Air Pollutants(O_3 and NO_2)

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