PA27) 도시 하천 복원이 대기오염에 미치는 영향

Effects of Urban Stream Restoration on Air Pollutions

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1. Introduction

The air pollution episode means an air pollution incident in a given area caused by a concentration of atmospheric pollution reacting that may result in a significant increase in illnesses or deaths. These episodes suggest the evidence that the mortality and morbidity is due to exposure of air pollution without consideration including age, gender, genetic inheritance, smoking, previous respiratory disease and weather condition. Recently studies also suggested the evidence that induction of respiratory diseases were associated with exposure to PM_{10}, SO_2, NO_2, CO, O_3 respectively or combined each others. To evaluate the effects of the restoration on urban atmosphere environment, we investigate the relation among air pollution, mortality and climate change following restoration of cheonggye stream.

2. Materials and Methods

The cheonggye stream reconstructed from July 2003 to September 2005, consequently, all data was analyzed between 2001 and 2007 (before and after restoration). And the restoration of cheonggye stream was included in six area of an administrative district and directly effect on Jongno-gu, Jung-gu and Dongdaemun-gu. Therefore, we analyzed change of climate and air pollutions between three district area and other urban area except the three area. The paired-T test was used to compare the change in before and after the restoration. To compare the regional effect of the reconstruction, one way ANOVA was conducted in Jongno-gu, Jung-gu and Dongdaemun-gu and whole urban (except three district area) respectively.

3. Results and Discussion

In a comparison of meteorological values, a significant difference was not observed in temperature and relative humidity. But the urban stream restoration induced an increase of wind velocity from May to November and annual mean value significantly (Fig. 1). The mean values of PM_{10}, CO and O_3 were decreased significantly, but the concentration of SO_2 and NO_2 was increased against other air pollutants in 2001 and 2007.

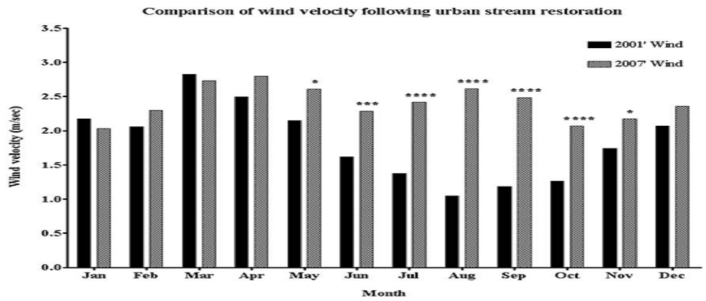

Fig. 1. Comparison of wind velocity variables between 2001 and 2007 year. *, **, ***, **** indicate a significant difference between 2001 and 2007 (*: p<0.05, **: p<0.01, ***: p<0.001, ****: p<0.0001).

Improvement of urban stream environment made a significant decrease of SO_2 concentration in Jung-gu but other district areas including Seoul were increased significantly (Table 1).

Table 1. Comparison of air pollutants following urban stream restoration.

	SO_2 (ppb)		NO_2 (ppb)		O_3 (ppb)		CO (ppm)		PM_{10} ($\mu g/m^3$)	
Area	2001	2007	2001	2007	2001	2007	2001	2007	2001	2007
A area	8.33* ±3.23	5.75 ±2.45	35.67 ±10.52	36.33 ±6.50	13.75 ±3.86	17.25 ±8.65	1.30*** ±0.46	0.71 ±0.23	56.58 ±18.39	58.67 ±19.72
B area	5.22 ±2.59	7.67* ±1.97	47.44*** ±11.38	37.25 ±6.30	20.67 ±9.20	17.92 ±7.50	0.71 ±0.24	0.73 ±0.24	94.44** ±36.73	59.17 ±16.31
C area	5.08 ±1.56	7.92** ±2.11	36.91 ±11.84	42.50 ±8.14	16.58 ±4.76	18.92 ±10.02	0.83 ±0.35	0.75 ±0.28	75.90** ±20.47	62.67 ±18.55
Seoul	4.78 ±1.65	6.35** ±2.09	36.57 ±7.44	38.00 ±7.99	14.79 ±5.42	18.01* ±8.24	0.85*** ±0.23	0.66 ±0.21	70.57 ±20.07	61.62 ±18.41

A, B and C area indicate Jung-gu, Jungno-gu and Dongdaemun-gu respectively.
*, **, ***, **** indicate a significant difference between 2001 and 2007 (*: $p<0.05$, **: $p<0.01$, ***: $p<0.001$, ****: $p<0.0001$). And all values were shown in mean±SD.

In comparison of other air pollutions, the concentration of NO_2 in Joungno-gu and O_3 in Seoul showed a significant difference only. Especially, the change of O_3 concentration suggested that there was a difference of increment between Seoul and three areas which was directly influenced by urban stream restoration. This assumption was elucidated in the change of CO concentration. The concentration of CO was notably decreased both Jung-gu and Seoul following urban stream restoration. But in the results of ANOVA test among each area in a year, the concentration of CO in Jung-gu was significantly low concentration ($p=0.012$) against Seoul in 2001 and significant difference was not observed among all areas in 2007(data not shown). And SO_2 concentration showed a significantly high level ($p=0.001$) against Seoul in 2001 but there was no significant difference in 2007 (data not shown). Apart from gaseous pollution, PM_{10} concentration was decreased in Jongno-gu and Dongdaemun-gu significantly. In conclusion, urban stream restoration induced improvement of air pollutions due to modulation of atmospheric environment.

References

Hong, Y.C., J.H. Leem, and E.H. Ha (1999) Air pollution and daily mortality in inchon, Korea, J Korean Med Sci, 14, 239-244.

Hong, Y.C., J.H. Leem, E.H. Ha, and D.C. Christiani (1999) PM_{10} exposure, gaseous pollutants, and daily mortality in Inchon, South Korea, Environ Heal Perspectives, 107(11), 873-878.

Moon, J.S., Y.S. Kim, J.H. Kim, B.S. Son, D.S. Kim, and W. Yang (2009) Respiratory health effects among schoolchildren and their relationship to air pollutants in Korea, Int J Environ Heal Res, 19(1), 31-48.

Nguyen, H.T. and K.H. Kim (2005) Changes in SO_2 concentration from major cities and provinces in Korea: A case study from 1998 to 2003, J. KOSAE, 21, 95-105.