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Chronic kidney disease and the indoor and ambient PM2.5 ratio

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Objectives : It is well known that various air pollution factors increase the risk of kidney disease. We aimed to elucidate the risk of chronic kidney disease according to the indoor and ambient particulate matter 2.5 (PM2.5).
Methods : The kidney function and the ratio of indoor and ambient PM2.5 was extracted from the Korea National Health and Nutrition Examination Survey (KNHANES) VIII (2019—2021) dataset. CKD was defined as estimated glomerular filtration rate (eGFR) less than 60 mL/min/1.73m^2, and the association between the indoor and ambient PM2.5 ratio and CKD was analyzed through multiple linear regression model. The indoor and ambient PM2.5 ratio was divided into tertile groups (T1, T2, and T3).
Results : The indoor air quality of 1,319 participants was analyzed in this study. The indoor PM2.5 concentration and the ambient PM2.5 concentration did not show a statistically significant association with CKD respectively. However, the highest quartile of indoor and ambient PM2.5 ratio was associated with increased risk of CKD (odds ratio, 4.28; 95% confidence interval, 1.43—12.75, p-value 0.009) after adjustment of age, sex, comorbidities, and window opening status.
Conclusions : In this cross-sectional study, the indoor air quality of PM2.5 relative to the concentration of PM2.5 in the ambient air was associated with the deterioration of kidney function.

Table 1_A1174.png

Table 1. Baseline characteristics according to eGFR

	Total	eGFR <60 mL/min/1.73m²		p-value
		No	Yes	
	1,319	1,294	25	
Age	48.17 ± 0.71	47.43 ± 0.7	57.73 ± 2.44	<0.001
≥20 and <30	15.69 (1.65)	15.91 (1.68)		
≥30 and <40	16.79 (1.51)	17.03 (1.52)		
≥40 and <50	19.89 (1.78)	20.18 (1.81)		
≥50 and <60	20.89 (1.83)	20.90 (1.85)	19.89 (7.88)	
≥60 and <70	16.34 (1.23)	16.29 (1.23)	20.13 (10.76)	
≥70	10.40 (1.00)	9.70 (0.98)	59.98 (9.97)	
Sex (%)				0.772
Male	50.65 (1.34)	50.60 (1.35)	53.75 (10.66)	
Female	49.35 (1.34)	49.40 (1.35)	46.25 (10.66)	
BMI (%)				
<18 kg/m²	2.63 (0.61)	2.67 (0.62)		
18≤ <25 kg/m²	59.85 (1.47)	59.77 (1.51)	65.20 (12.43)	
25≤ <30 kg/m²	30.45 (1.41)	30.38 (1.44)	34.80 (12.43)	
≥30 kg/m²	7.08 (1.09)	7.18 (1.10)		
Smoking status (%)				0.715
Never smoker	58.87 (1.51)	58.78 (1.54)	65.02 (8.94)	
Ex-smoker	23.09 (1.28)	23.19 (1.30)	16.48 (7.59)	
Current smoker	18.03 (1.39)	18.03 (1.40)	18.50 (7.28)	
Alcohol consumption (%)				-
Never	23.36 (1.52)	22.80 (1.50)	62.62 (9.55)	
Mild	68.02 (1.65)	68.45 (1.64)	37.38 (9.55)	
Heavy	8.63 (0.93)	8.75 (0.94)		
Physical activity (%)				0.008
No	52.41 (1.82)	51.99 (1.84)	82.60 (8.68)	
Yes	47.59 (1.82)	48.01 (1.84)	17.40 (8.68)	
Income level (%)				0.016
Q1	11.36 (1.35)	11.13 (1.37)	27.79 (11.01)	
Q2	23.78 (1.88)	23.58 (1.90)	38.09 (11.63)	
Q3	27.82 (2.24)	27.84 (2.27)	26.80 (10.31)	
Q4	37.03 (2.91)	37.45 (2.93)	7.32 (5.59)	
Residential area (%)				0.980
Urban	48.33 (2.87)	48.33 (2.89)	47.98 (14.32)	
Rural	51.67 (2.87)	51.67 (2.89)	52.02 (14.32)	
Comorbidities (%)				
Hypertension	26.31 (1.63)	25.54 (1.63)	81.04 (10.09)	<0.001
Diabetes mellitus	11.44 (1.02)	11.26 (1.02)	24.00 (10.20)	0.097
Triglyceride (mg/dL)	130.12 ± 4.82	130.11 ± 5.05	134.76 ± 9.53	0.111

Data are presented as the mean±standard deviation, or %(standard error)
Abbreviation: eGFR, estimated glomerular filtration rate; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol

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Table 2. The risk of the deterioration of eGFR according to indoor and ambient PM2.5 concentration

		N (%)	Model 1	Model 2	Model 3	Model 4
Indoor PM2.5 / Ambient PM2.5	Tertile 1	0.75 (0.35)	1 (reference)	1 (reference)	1 (reference)	1 (reference)
	Tertile 2	1.40 (0.57)	1.89 (0.55, 6.52)	1.82 (0.51, 6.54)	1.93 (0.52, 7.23)	1.52 (0.41, 5.60)
	Tertile 3	3.01 (0.97)	4.13 (1.40, 12.19)	4.62 (1.50, 14.23)	5.28 (1.71, 16.31)	4.28 (1.43, 12.75)
	P for trend		0.010	0.009	0.005	0.009
Indoor PM2.5	Tertile 1	1.92 (0.73)	1 (reference)	1 (reference)	1 (reference)	1 (reference)
	Tertile 2	0.71 (0.39)	0.37 (0.09, 1.44)	0.37 (0.09, 1.50)	0.38 (0.08, 1.76)	0.34 (0.08, 1.59)
	Tertile 3	2.65 (0.87)	1.39 (0.52, 3.74)	1.09 (0.39, 3.02)	1.04 (0.38, 2.88)	0.97 (0.37, 2.50)
	P for trend		0.489	0.773	0.839	0.925
Ambient PM2.5	Tertile 1	1.71 (0.77)	1 (reference)	1 (reference)	1 (reference)	1 (reference)
	Tertile 2	1.68 (0.64)	0.98 (0.30, 3.23)	0.64 (0.18, 2.29)	0.50 (0.14, 1.85)	0.72 (0.20, 2.54)
	Tertile 3	1.82 (0.72)	1.067 (0.33, 3.46)	0.85 (0.26, 2.85)	0.72 (0.23, 2.26)	0.88 (0.30, 2.61)
	P for trend		0.914	0.842	0.678	0.873

Abbreviation: eGFR, estimated glomerular filtration rate; PM2.5, particulate matter 2.5
Model 1 was non-adjusted.
Model 2 was adjusted for age and sex.
Model 3 was adjusted for variables in model 2 and BMI, smoking history, alcohol consumption, hypertension and diabetes mellitus
Model 4 was adjusted for variables in model 3 and window opening status