

Urinary Albumin Excretion and Cardiovascular Risk in Nondiabetic Middle-Aged Adults : the 2011-2012 Korean National Health and Nutrition Examination Survey

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OBJECTIVES

Microalbuminuria is known as a predictor of cardiovascular disease (CVD) in patients with and without diabetes, as well as the general population. Recent studies have suggested that high normal albuminuria levels also indicate an increased risk of CVD in the general population. The objective was to determine whether there was an association between the urinary albumin excretion and CVD risk by estimating the Framingham Risk Score (FRS) in nondiabetic middle-aged adults.

METHODS

This study was based on data from the Korea National Health and Nutrition Examination Survey (KNHANES), which was conducted by the Korean Ministry of Health and Welfare in 2011-2012. From the 16,576 participants, data for 5,165 adults who were 40-79 years of age were included in the analysis. Based on the urinary albumin to creatinine ratio (UACR), the subjects were categorized into normal (≤ 9.9 mg/g), high normal (10.0 to 29.9 mg/g), and microalbuminuria (30.0 to 299.9 mg/g) groups.

Table 1. Characteristics of the study population according to urinary albumin-to-creatinine ratio in men

	Urinary albumin-to-creatinine ratio (mg/g)				P value
	Total	Normal ≤ 9.9	High normal 10.0 to 29.9	Microalbuminuria ≥ 30	
n	2219	1886	234	99	
Age (years)	52.69 ± 0.26	52.12 ± 0.25	53.63 ± 0.91	56.96 ± 1.37	<0.001
BMI (kg/m ²)	23.96 ± 0.08	23.87 ± 0.08	24.17 ± 0.27	25.26 ± 0.43	0.004
WC (cm)	84.42 ± 0.23	84.01 ± 0.23	86.22 ± 0.79	88.25 ± 1.16	<0.001
SBP (mmHg)	121.92 ± 0.42	120.30 ± 0.43	131.99 ± 1.40	130.09 ± 1.84	<0.001
DBP (mmHg)	80.46 ± 0.28	79.88 ± 0.29	84.43 ± 1.28	82.67 ± 1.32	<0.001
FPG (mg/dL)	95.48 ± 0.27	95.28 ± 0.29	95.77 ± 0.85	98.77 ± 1.31	0.038
HbA1c (%)	5.57 ± 0.00	5.57 ± 0.00	5.57 ± 0.30	5.65 ± 0.39	0.168
TC (mg/dL)	192.59 ± 0.92	192.77 ± 0.99	188.95 ± 2.71	197.62 ± 3.88	0.174
TG (mg/dL)	155.27 ± 2.89	152.13 ± 3.05	175.49 ± 10.65	169.63 ± 11.51	0.048
LDL-C (mg/dL)	112.16 ± 0.87	112.96 ± 0.97	105.41 ± 2.51	112.34 ± 3.37	0.016
HDL-C (mg/dL)	49.37 ± 0.32	49.38 ± 0.35	48.44 ± 0.95	51.35 ± 2.10	0.426
Serum Cr (mg/dL)	0.96 ± 0.00	0.96 ± 0.00	0.95 ± 0.01	1.00 ± 0.02	0.244
Smoking (%)					0.611
None	16.1	16.1	17.0	14.5	
Ex	42.8	43.6	37.9	38.7	
Current	41.1	40.3	45.1	46.8	
Alcohol drinking (%)					0.327
None	16.0	15.9	20.1	9.5	
≤ 1/week	39.8	40.0	38.7	38.3	
2-3/week	27.7	27.5	26.0	35.0	
≥ 4/week	16.5	16.6	15.3	17.1	
Family income ^a (%)					0.035
< 100	10.5	9.9	12.7	17.0	
100-199	15.4	14.8	17.4	23.2	
200-299	17.7	18.4	17.0	6.0	
≥ 300	56.4	56.9	53.0	53.8	
Less than high school education (%)	30.6	29.2	34.7	48.8	0.002
Residence in urban area (%)	44.3	44.9	46.0	28.8	0.045
Regular exercise ^b (yes, %)	9.2	9.7	3.1	12.4	0.013
Known HTN (%)	16.2	14.4	25.2	31.0	<0.001
eGFR (ml/min/1.73 m ²)	84.08 ± 0.41	84.24 ± 0.42	84.05 ± 1.20	81.08 ± 2.21	0.338
FRS	11.90 ± 0.06	11.33 ± 0.09	12.50 ± 0.28	13.18 ± 0.32	<0.001
10-year risk of CHD (%)					<0.001
< 10%	38.3	40.4	31.1	18.8	
10-19%	45.3	45.2	44.8	49.3	
≥ 20%	16.1	14.4	24.1	31.9	

Table 2. Characteristics of the study population according to urinary albumin-to-creatinine ratio in women

	Urinary albumin-to-creatinine ratio (mg/g)				P value
	Total	Normal ≤ 9.9	High normal 10.0 to 29.9	Microalbuminuria ≥ 30	
n	2846	2380	386	180	
Age (years)	53.97 ± 0.24	53.03 ± 0.24	57.20 ± 0.66	59.60 ± 1.06	<0.001
BMI (kg/m ²)	23.74 ± 0.07	23.57 ± 0.07	24.28 ± 0.27	24.88 ± 0.29	<0.001
WC (cm)	79.46 ± 0.23	78.85 ± 0.23	81.48 ± 0.72	83.47 ± 0.91	<0.001
SBP (mmHg)	118.96 ± 0.45	116.57 ± 0.41	128.80 ± 1.26	130.21 ± 1.72	<0.001
DBP (mmHg)	75.80 ± 0.24	74.94 ± 0.23	79.39 ± 0.69	79.95 ± 0.97	<0.001
FPG (mg/dL)	92.61 ± 0.23	91.98 ± 0.22	95.15 ± 0.66	95.71 ± 1.07	<0.001
HbA1c (%)	5.58 ± 0.00	5.56 ± 0.00	5.63 ± 0.02	5.71 ± 0.03	<0.001
TC (mg/dL)	200.89 ± 0.84	200.03 ± 0.89	204.75 ± 2.17	204.17 ± 3.33	0.077
TG (mg/dL)	122.14 ± 1.84	118.04 ± 1.87	131.98 ± 5.61	157.72 ± 11.36	0.001
LDL-C (mg/dL)	121.99 ± 0.69	121.55 ± 0.75	124.85 ± 1.88	121.69 ± 2.89	0.260
HDL-C (mg/dL)	54.46 ± 0.32	54.87 ± 0.33	53.47 ± 0.85	50.93 ± 0.98	0.001
Serum Cr (mg/dL)	0.71 ± 0.00	0.72 ± 0.00	0.70 ± 0.00	0.72 ± 0.01	0.332
Smoking (%)					0.507
None	91.6	91.4	91.7	93.8	
Ex	3.4	3.6	2.0	3.3	
Current	5.1	5.0	6.3	2.9	
Alcohol drinking (%)					0.609
None	36.7	36.0	38.0	43.7	
≤ 1/week	55.5	56.4	53.6	47.8	
2-3/week	5.6	5.6	5.8	5.9	
≥ 4/week	2.1	2.0	2.6	2.6	
Family income ^a (%)					<0.001
< 100	14.8	12.5	25.8	22.4	
100-199	17.2	16.6	16.8	25.9	
200-299	16.6	16.9	16.6	12.0	
≥ 300	51.4	54.0	40.9	39.7	
Less than high school education (%)	47.8	44.2	63.5	62.0	<0.001
Residence in urban area (%)	45.6	46.4	41.6	42.8	0.314
Regular exercise ^b (yes, %)	7.4	7.3	7.5	8.2	0.927
Known HTN (%)	19.1	15.0	34.7	41.4	<0.001
eGFR (ml/min/1.73 m ²)	87.09 ± 0.39	87.03 ± 0.41	88.10 ± 1.12	85.84 ± 1.49	0.462
FRS	10.89 ± 0.13	10.32 ± 0.14	13.10 ± 0.32	14.00 ± 0.48	<0.001
10-year risk of CHD (%)					<0.001
< 10%	94.9	96.5	89.6	84.6	
10-19%	4.6	3.1	9.6	14.5	
≥ 20%	0.5	0.4	0.8	0.9	

Table 3. Odds ratio(95% CI) for $\geq 20\%$ 10-year risk of Coronary heart disease according to urinary albumin to creatinine ratio in man

	Normal ≤ 9.9 mg/g (ref.)	High normal 10.0 to 29.9 mg/g	Microalbuminuria ≥ 30 mg/g
Model 1	1.00	1.826 (1.252-2.664)*	2.939 (1.754-4.924)*
Model 2	1.00	1.766 (1.202-2.596)*	2.623 (1.505-4.571)*
Model 3	1.00	1.813 (1.236-2.658)*	2.376 (1.264-4.467)*
Model 4	1.00	1.777 (1.216-2.597)*	2.232 (1.197-4.160)*

Table 4. Odds ratio(95% CI) for $\geq 10\%$ 10-year risk of Coronary heart disease according to urinary albumin to creatinine ratio in woman

	Normal ≤ 9.9 mg/g (ref.)	High normal 10.0 to 29.9 mg/g	Microalbuminuria ≥ 30 mg/g
Model 1	1.00	3.205 (1.963-5.232)*	4.864 (2.637-8.970)*
Model 2	1.00	2.162 (1.213-3.854)*	3.669 (1.968-6.840)*
Model 3	1.00	1.920 (1.100-3.350)*	3.227 (1.638-6.355)*
Model 4	1.00	2.041 (1.173-3.550)*	3.115 (1.538-6.308)*

RESULTS

The mean FRS was significantly different in each of the UACR subgroups, and it increased with increases in the UACR: 11.53 ± 0.09 in the normal, 12.50 ± 0.28 in the high normal, and 13.18 ± 0.32 in the microalbuminuria in men; 10.32 ± 0.14 in the normal, 13.10 ± 0.32 in the high normal, and 14.00 ± 0.48 in the microalbuminuria in women. After fully adjusting for potential confounding factors, including lifestyle, sociodemographic factors, known CVD risk factors, and eGFR, high normal levels and microalbuminuria were significantly associated with $\geq 10\%$ 10-year risk of CVD (odds ratio [OR] 1.777, 95% confidence interval [CI], 1.216-2.597) and OR 2.232 [1.197-4.160], respectively) compared with the normal subgroup in men. High normal levels and microalbuminuria were also significantly associated with a $\geq 10\%$ 10-year risk of CVD (OR 2.041 [1.173-3.550] and OR 3.115 [1.538-6.308], respectively) after adjusting for the above covariates in women.

CONCLUSIONS

Urinary albumin excretion reflects CVD risk in middle-aged adults without diabetes, and high normal levels and microalbuminuria were independently associated with a higher risk of CVD.

We propose that urinary albumin excretion may reflect the CVD risk in middle-aged adults without diabetes and that it should be considered a risk factor for CVD.

To effectively prevent CVD in middle-aged adults without diabetes, more attention should be focused on middle-aged adults with microalbuminuria and even those with higher albuminuria levels that are within the normal range.

References

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