The Association between Serum Klotho and Metabolic Syndrome in Chronic Kidney Disease: Korean CKD Patients

Hyo Jin Kim[1], Dong-Wan Chae[2], Curie Ahn[3], Kook-Hwan Oh[3]

[1]Department of Internal Medicine, Dongguk University Gyeongju Hospital, Gyeongju-si, Gyeongsangbuk-do, Korea
[2]Department of Internal Medicine, Seoul National University Bundang Hospital, Seongnam-si, Gyeonggi-do, Korea
[3]Department of Internal Medicine, Seoul National University College of Medicine, Seoul, Korea

OBJECTIVES

- **Metabolic syndrome (MS)**
  - Cluster of hypertension, hyperglycemia, hypertriglyceridemia, decreased HDL cholesterol, and abdominal obesity
  - Prevalent in chronic kidney disease (CKD).
- **Klotho**
  - Mineral metabolism regulator
- Each component of MS and klotho has an association.
- Little is known about the association of klotho with presence of MS.

METHODS

- 1,268 CKD patients (excluded autosomal dominant polycystic kidney disease) evaluated for MS at baseline from the prospective KoreaN Cohort Study for Outcome in Patients With Chronic Kidney Disease (**KNOW-CKD**) study

- MS was defined using National Cholesterol Education Program Adult Treatment Panel (NCEP-ATP) III criteria..

- Serum klotho was measured by enzyme-linked immunosorbent assay.

RESULTS

- Patients were 55.0 ± 12.3 years old and 63.9% were male.
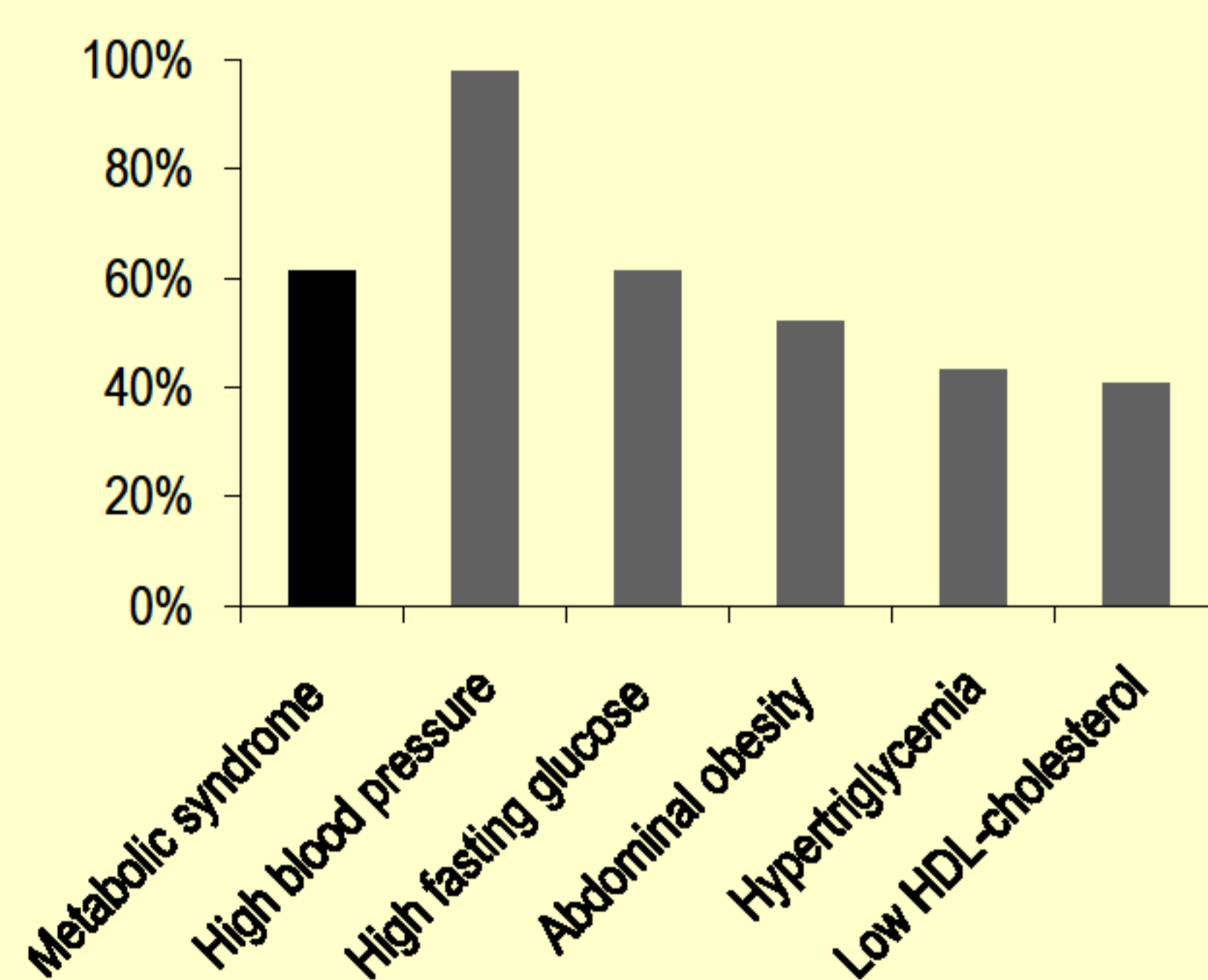- The prevalence of MS was 61% (n = 778)..

Figure 1. Prevalence of the metabolic syndrome and components of the metabolic syndrome in total patients.
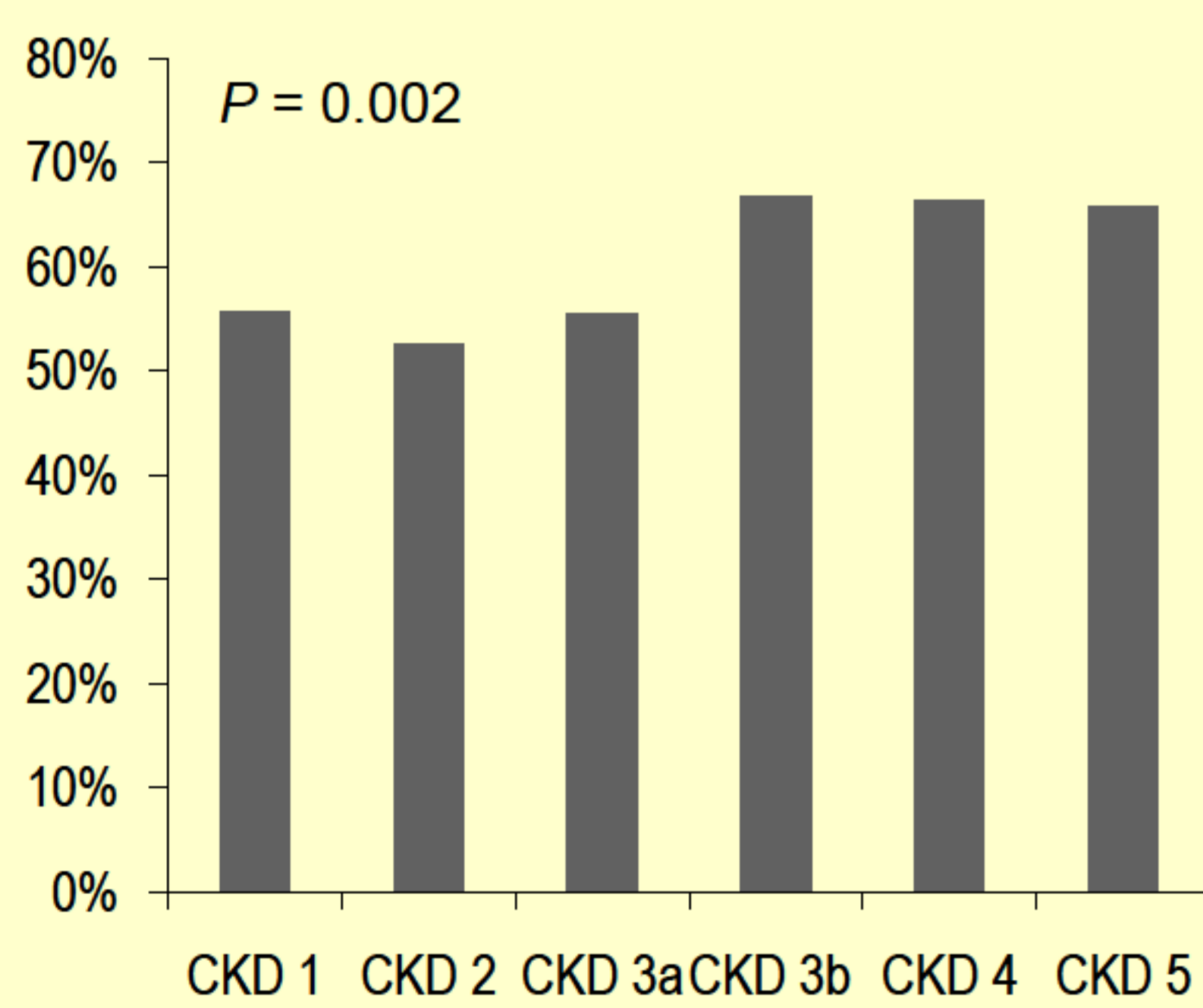

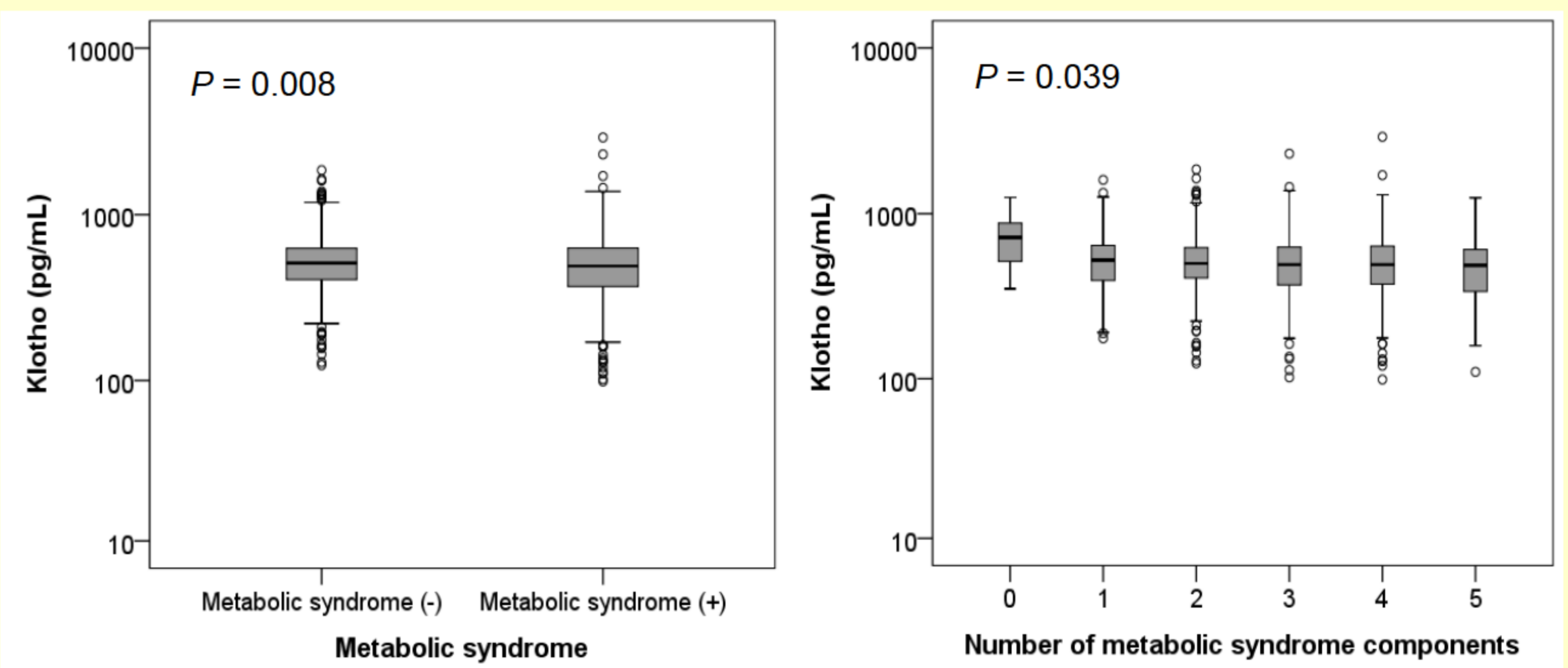**Figure 2.** Prevalence of the metabolic syndrome according to CKD stages.

Figure 3. Serum klotho level according to the metabolic syndrome and number of the metabolic syndrome components.

Table 1. Odds ratios for the association of metabolic syndrome with variables estimated by binominal Logistic regression model

Variable	Model A[a] Adjusted OR (95% CI)	Model B[b] Adjusted OR (95% CI)	Model C[c] Adjusted OR (95% CI)
Log klotho (pg/mL)	0.39 (0.20- 0.75)†	0.45 (0.23-0.88)†	0.34 (0.16-0.70)†
Age (per 10 year)	1.29 (1.17-1.43)†	1.31 (1.18-1.45)†	1.11 (0.99-1.24)
Sex (male *vs.* female)	1.10 (0.86 -1.40)	1.17 (0.91-1.50)	1.08 (0.82-1.42)
eGFR (per 10 mL/min/1.73m^2)		0.97 (0.93-1.02)	1.02 (0.97-1.07)
Overt proteinuria*		1.55 (1.21-2.00)†	1.21 (0.92-1.59)
DM (yes *vs.* no)			5.48 (4.00-7.49)†
Hypertension (yes *vs.* no)			2.57 (1.34-4.92)†

[a]Model A adjusted for log klotho, age, and sex.
[b]Model B adjusted for covariates in Model A plus eGFR, overt proteinuria.
[c]Model C adjusted for covariates in Model B plus DM, hypertension.
*Random urine protein to creatinine ratio > 500mg/g
OR: Odds ratio; CI: confidence interval; DM: diabetes mellitus; eGFR: estimated glomerular filtration rate.
†significant association with metabolic syndrome ($P < 0.05$). $P < 0.05$ was considered significant.

CONCLUSIONS

- Lower serum klotho level was significantly associated with increased presence of MS.

- Further studies are warranted to elucidate the mechanistic link between klotho and MS in CKD patients.

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