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Anemia, iron status, and anemia development in relation to body mass index in non-dialysis chronic kidney disease patients: The results from the KNOW-CKD study

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Objectives: Anemia and iron deficiency are frequent findings in obese subjects. However, there were inconsistent results in adult studies. We aimed to investigate anemia, iron status, and anemia development in relation to body mass index (BMI) in chronic kidney disease patient.

Methods: This prospective study included 2,214 patients from the KNOW-CKD study (KoreaN Cohort Study for Outcome in Patients With Chronic Kidney Disease). Participants were classified by BMI categories as underweight (<18.5 kg/m²), normal weight (18.5 to <23 kg/m²), overweight (23 to <25 kg/m²), and obese (≥25 kg/m²) according to Asia-Pacific classification. Central obesity was defined as a waist circumference according to Asian-Pacific threshold (male ≥90cm, female ≥80cm). Hemoglobin levels were measured yearly during a mean follow-up period of 37.5±22.1 months. Anemia was defined as hemoglobin <13.0 g/dL in men and 12.0 g/dL in women. Iron deficiency was defined as ferritin <100 ng/mL or transferrin saturation <20%.

Results: The prevalence of underweight, normal weight, overweight, and obese was 2.4%, 29.4%, 26.5%, and 41.7%, respectively. Obese patients had the highest hemoglobin concentration compared with other BMI groups ($P<0.001$). The prevalence of anemia ($P<0.001$) and iron deficiency ($P<0.001$) and usage of iron supplement ($P<0.001$) and erythropoietin stimulating agent ($P=0.015$) were significantly decreased in high BMI categories. BMI was positively associated with hemoglobin in multivariable linear regression analysis with adjustment (β , 0.16; 95% confidence interval [CI], 0.22-0.61; $P<0.001$). Central obesity was also positively associated with hemoglobin ($P<0.001$). Among 1,165 patients without anemia at baseline, 414 (35.5%) patients developed anemia during a follow-up period. In multivariable Cox regression analysis after adjustment, obese patients had a significantly lower risk of anemia development than those in the normal weight patients (HR, 0.76; 95% CI, 0.58-0.99; $P=0.046$).

Conclusions: Obese patients had the highest hemoglobin concentration and had a significantly lower risk of anemia development than those in the normal weight patients.