

KORELASI Z-SCORE BONE MINERAL DENSITY DENGAN ESTIMATED GLOMERULAR FILTRATION RATE PADA ANAK DENGAN PENYAKIT GINJAL

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INTISARI

Latar Belakang: *Chronic Kidney Disease* (CKD) pada anak sering disertai *Chronic Kidney Disease Mineral and Bone Disorder* (CKD-MBD) yang berpotensi menurunkan *bone mineral density* (BMD). *Dual-energy X-ray Absorptiometry* (DXA) merupakan baku emas untuk menilai BMD. Namun, hubungan antara Z-score BMD dan *estimated glomerular filtration rate* (eGFR) masih menunjukkan hasil yang tidak konsisten dan belum pernah dilaporkan pada populasi anak di Indonesia.

Tujuan: Mengevaluasi korelasi antara Z-score BMD dan eGFR pada anak dengan penyakit ginjal di RSUP Dr. Sardjito.

Metode: Penelitian potong lintang retrospektif ini melibatkan anak usia 2–18 tahun dengan penyakit ginjal yang menjalani pemeriksaan DXA periode Agustus 2023–September 2025. eGFR dihitung menggunakan rumus *bedside Schwartz*. Z-score BMD dinilai pada vertebra lumbal (L1–L4) dan leher femur kiri. Analisis korelasi menggunakan uji *Spearman*, dan regresi linear multivariat dilakukan dengan penyesuaian usia, jenis kelamin, dan indeks massa tubuh (IMT). Nilai $p < 0,05$ dianggap bermakna.

Hasil: Sebanyak 56 subjek dianalisis (rerata usia $13,07 \pm 3,52$ tahun). Tidak terdapat korelasi bermakna antara eGFR dan Z-score vertebra lumbal ($r = 0,173$; $p = 0,202$) maupun leher femur kiri ($r = 0,041$; $p = 0,765$). Pada analisis multivariat, eGFR bukan merupakan prediktor independen terhadap Z-score BMD. Nilai *adjusted R²* yang rendah menunjukkan kontribusi eGFR terhadap variasi BMD terbatas.

Kesimpulan: eGFR tidak berhubungan secara bermakna dengan Z-score BMD pada anak dengan penyakit ginjal, sehingga evaluasi kesehatan tulang perlu dilakukan secara komprehensif dan tidak hanya berdasarkan fungsi ginjal.

Kata kunci: penyakit ginjal anak, BMD, DXA, eGFR, Z-score, CKD-MBD.

CORRELATION BETWEEN BONE MINERAL DENSITY Z-SCORE AND ESTIMATED GLOMERULAR FILTRATION RATE IN CHILDREN WITH KIDNEY DISEASE

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ABSTRACT

Background: Chronic Kidney Disease (CKD) in children is commonly accompanied by disturbances in mineral and bone metabolism, referred to as CKD–Mineral and Bone Disorder (CKD-MBD), which may contribute to reduced bone mineral density (BMD). Dual-energy X-ray Absorptiometry (DXA) is the gold standard for evaluating BMD. However, evidence regarding the association between BMD Z-score and estimated glomerular filtration rate (eGFR) remains inconsistent, and data in Indonesian pediatric populations are limited.

Objective: To evaluate the correlation between BMD Z-score and eGFR in children with kidney disease at Dr. Sardjito General Hospital.

Methods: This retrospective cross-sectional study included children aged 2–18 years diagnosed with kidney disease who underwent DXA examination between August 2023 and September 2025. eGFR was calculated using the bedside Schwartz formula. BMD Z-score s were obtained at the lumbar spine (L1–L4) and left femoral neck. Normality was assessed using the Kolmogorov–Smirnov test. Because eGFR was not normally distributed, Spearman’s correlation was used. Multivariable linear regression analysis was performed to evaluate whether eGFR independently predicted BMD Z-score s after adjustment for age, sex, and BMI. A p-value < 0.05 was considered statistically significant.

Results: Fifty-six subjects were included (mean age 13.07 ± 3.52 years). The mean eGFR was 84.82 ± 47.40 mL/min/1.73 m². The mean Z-score was -1.35 ± 1.45 at L1–L4 and -1.81 ± 1.59 at the left femoral neck. No statistically significant correlation was observed between eGFR and lumbar spine Z-score ($r = 0.173$; $p = 0.202$) or femoral neck Z-score ($r = 0.041$; $p = 0.765$). In multivariable regression models adjusting for age, sex, and BMI, eGFR was not independently associated with lumbar spine or left femoral neck Z-score s. The adjusted R² values were low, suggesting that renal function explained only a small proportion of BMD variability.

Conclusion: eGFR was not significantly associated with BMD Z-score s in children with kidney disease. These findings suggest that bone health impairment in this population may not be solely determined by the degree of renal dysfunction and warrants comprehensive evaluation.

Keywords: pediatric kidney disease, bone mineral density, DXA, eGFR, Z-score, CKD-MBD