



Professional Resource Page: Vitamin D Deficiency

1. Al-Aly Z, Qazi RA, González EA, et al. Changes in serum 25-hydroxyvitamin D and plasma intact PTH levels following treatment with ergocalciferol in patients with CKD. *Am J Kidney Dis.* 2007; 50:59-68.
2. Al-Badr W, Martin KJ. Vitamin D and kidney disease. *Clin J Am Soc Nephrol.* 2008;3:1555-1560.
3. Armas LA, Hollis BW, Heaney RP. Vitamin D2 is much less effective than vitamin D3 in humans. *J Clin Endocrinol Metab.* 2004;89:5387-5391.
4. Berg AH, Thadhani RI. Aiming Too Low: Reevaluation of target concentrations of serum 25-hydroxyvitamin D in secondary hyperparathyroidism. *Am J Nephrol.* 2019;49:281-283.
5. Bhan I, Dobens D, Tamez H, et al. Nutritional vitamin D supplementation in dialysis: a randomized trial. *Clin J Am Soc Nephrol.* 2015;10:611-619.
6. Binkley N, Krueger D, Cowgill CS, et al. Assay variation confounds the diagnosis of hypovitaminosis D: a call for standardization. *J Clin Endocrinol Metab.* 2004;89:3152-3157.
7. Binkley N, Sempas CT; Vitamin D Standardization Program (VDSP). Standardizing vitamin D assays: the way forward. *J Bone Miner Res.* 2014;29:1709-1714.
8. Block GA, Klassen PS, Lazarus JM, et al. Mineral metabolism, mortality, and morbidity in maintenance hemodialysis. *J Am Soc Nephrol.* 2004;15:2208-2218.
9. Broe KE, Chen TC, Weinberg J, et al. A higher dose of vitamin D reduces the risk of falls in nursing home residents: a randomized, multiple-dose study. *J Am Geriatr Soc* 2007; 55:234-239.
10. de Boer IH, Sachs MC, Chonchol M, et al. Estimated GFR and circulating 24,25-dihydroxyvitamin D3 concentration: a participant-level analysis of 5 cohort studies and clinical trials. *Am J Kidney Dis.* 2014;64:187-197.
11. Ennis JL, Worcester EM, Coe FL, Sprague SM. Current recommended 25-hydroxyvitamin D targets for chronic kidney disease management may be too low. *J Nephrol.* 2016;29:63-70.
12. Feldman D, ed. Vitamin D Volume 1: Biochemistry, Physiology and Diagnostics. 4th ed, Cambridge, MA: Academic Press; 2018.
13. Feldman D, ed. Vitamin D Volume 2: Health, Disease and Therapeutics. 4th ed, Cambridge, MA: Academic Press; 2017.
14. Gonzalez EA, Sachdeva A, Oliver DA, Martin KJ. Vitamin D insufficiency and deficiency in chronic kidney disease. A single center observational study. *Am J Nephrol.* 2004;24:503-510.
15. Holick MF, Biancuzzo RM, Chen TC, et al. Vitamin D2 is as effective as vitamin D3 in maintaining circulating concentrations of 25-hydroxyvitamin D. *J Clin Endocrinol Metab.* 2008;93:677-681.
16. Holick MF, Binkley NC, Bischoff-Ferrari HA, et al. Evaluation, treatment and prevention of vitamin D deficiency: An Endocrine Society Clinical Practice Guideline. *J Clin Endocrinol Metab.* 2011;96:1911-1930.
17. Institute of Medicine (IOM). Dietary reference intakes for calcium and vitamin D. Washington, DC: The National Academies Press; 2011.
18. Isakova T, Nickolas TL, Denburg M, et al. KDOQI US commentary on the 2017 KDIGO clinical practice guideline update for the diagnosis, evaluation, prevention, and treatment of chronic kidney disease-mineral and bone disorder (CKD-MBD). *Am J Kidney Dis.* 2017 Dec;70:737-751.
19. Jetter A, Egli A, Dawson-Hughes B, et al. Pharmacokinetics of oral vitamin D(3) and calcifediol. *Bone.* 2014;59:14-19.
20. Jones G. Interpreting vitamin D assay results: proceed with caution. *Clin J Am Soc Nephrol.* 2015;10:331-334.
21. Kalantar-Zadeh K, Kovesdy CP. Clinical outcomes with active versus nutritional vitamin D compounds in chronic kidney disease. *Clin J Am Soc Nephrol* 2009; 4:1529-1539.
22. Kandula P, Dobre M, Schold JD, et al. Vitamin D supplementation in chronic kidney disease: a systematic review and meta-analysis of observational studies and randomized controlled trials. *Clin J Am Soc Nephrol.* 2011;6:50-62.
23. Kidney Disease: Improving Global Outcomes (KDIGO). KDIGO clinical practice guideline for the diagnosis, evaluation, prevention, and treatment of chronic kidney disease-mineral and bone disorder (CKD-MBD). *Kidney Int.* 2009;76(suppl 113):S9-S21.
24. Kidney Disease: Improving Global Outcomes (KDIGO) CKD-MBD Update Work Group. KDIGO 2017 clinical practice guideline update for the diagnosis, evaluation, prevention, and treatment of chronic kidney disease-mineral and bone disorder (CKD-MBD). *Kidney Int Suppl.* 2017;7:1-59.

25. Kramer H, Berns JS, Choi MJ, et al. 25-hydroxyvitamin D testing and supplementation in CKD: an NKF-KDOQI controversies report. *Am J Kidney Dis.* 2014;64:499-509.
26. Levin A, Bakris GL, Molitch M, et al. Prevalence of abnormal serum vitamin D, PTH, calcium, and phosphorus in patients with chronic kidney disease: results of the study to evaluate early kidney disease. *Kidney Int.* 2007;71:31-38.
27. Mann MC, Hobbs AJ, Hemmelgarn BR, et al. Effect of oral vitamin D analogs on mortality and cardiovascular outcomes among adults with chronic kidney disease: a meta-analysis. *Clin Kidney J.* 2015;8:41-48.
28. Mariani LH, White MT, Shults J, et al; CRIC Study Investigators. Increasing use of vitamin D supplementation in the chronic renal insufficiency cohort study. *J Ren Nutr.* 2014;24:186-193.
29. Mehrotra R, Kermah D, Budoff M, et al. Hypovitaminosis D in chronic kidney disease. *Clin J Am Soc Nephrol.* 2008;3:1144-1151.
30. Melamed ML, Michos ED, Post W, Astor B. 25-hydroxyvitamin D levels and the risk of mortality in the general population. *Arch Intern Med.* 2008;168:1629-1637.
31. Melamed ML, Chonchol M, Gutiérrez OM, et al. The role of vitamin D in CKD stages 3 to 4: report of a scientific workshop sponsored by the National Kidney Foundation. *Am J Kidney Dis.* 2018 Dec;72:834-845.
32. Michaud J, Naud J, Ouimet D, et al. Reduced hepatic synthesis of calcidiol in uremia. *J Am Soc Nephrol* 2010;21:1488-1497.
33. Moe S, Drüeke T, Cunningham J, et al. Definition, evaluation, and classification of renal osteodystrophy: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int.* 2006;69:1945-1953.
34. Moe SM, Saifullah A, LaClair RE, et al. A randomized trial of cholecalciferol versus doxercalciferol for lowering parathyroid hormone in chronic kidney disease. *Clin J Am Soc Nephrol.* 2010;5:299-306.
35. Moorthi RN, Kandula P, Moe SM. Optimal vitamin D, calcitriol, and vitamin D analog replacement in chronic kidney disease: to D or not to D: that is the question. *Curr Opin Nephrol Hypertens.* 2011;20:35435-9.
36. National Institutes of Health Office of Dietary Supplements. Vitamin D. <https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/>. Published November 10 2014. Accessed June 20 2019.
37. National Institutes of Health Office of Dietary Supplements. Vitamin D Standardization Program. (VDSP) Standardized Laboratory Measurement. <https://ods.od.nih.gov/Research/vdsp.aspx>. Published Nov 2011. Updated April 2015. Accessed July 22 2019.
38. Nigwekar SU, Bhan I, Thadhani R. Ergocalciferol and cholecalciferol in CKD. *Am J Kidney Dis.* 2012;60:139-156.
39. Nigwekar SU, Tamez H, Thadhani RI. Vitamin D and chronic kidney disease-mineral bone disease (CKD-MBD). *Bonekey Rep.* 2014 Feb;3:498.
40. Parikh A, Chase HS, Vernocchi L, Stern L. Vitamin D resistance in chronic kidney disease (CKD). *BMC Nephrology.* 2014;15:47.
41. Petkovich M, Melnick J, White J, et al. Modified-release oral calcifediol corrects vitamin D insufficiency with minimal CYP24A1 upregulation. *J Steroid Biochem Mol Biol.* 2014 Nov 22.
42. Quarles LD. Role of FGF23 in vitamin D and phosphate metabolism: implications in chronic kidney disease. *Exp Cell Res.* 2012;318:1040-1048.
43. Sempos CT, Heijboer AC, Bikle DD, et al. Vitamin D assays and the definition of hypovitaminosis D: results from the First International Conference on Controversies in Vitamin D. *Br J Clin Pharmacol.* 2018;84:2194-2207.
44. Sprague SM, Silva AL, Al-Saghir F, et al. Modified-release calcifediol effectively controls secondary hyperparathyroidism associated with vitamin D insufficiency in chronic kidney disease. *Am J Nephrol.* 2014;40:535-545.
45. Sprague SM, Crawford PW, Melnick JZ, et al. Use of extended-release calcifediol to treat secondary hyperparathyroidism in stages 3 and 4 chronic kidney disease. *Am J Nephrol.* 2016;44:316-325.
46. Strugnell SA, Sprague SM, Ashfaq A, et al. Rationale for raising current clinical practice guideline target for serum 25-hydroxyvitamin D in chronic kidney disease. *Am J Nephrol.* 2019;49:284-293.
47. Thimachai P, Supasyndh O, Chaiprasert A, Satirapoj B. Efficacy of high vs. conventional ergocalciferol dose for increasing 25-hydroxyvitamin D and suppressing parathyroid hormone levels in stage III-IV CKD with vitamin D deficiency/insufficiency: a randomized controlled trial. *J Med Assoc Thai.* 2015;98:643-648.
48. Uhlig K, Berns JS, Kestenbaum B, et al. KDOQI US Commentary on the 2009 KDIGO clinical practice guideline for the diagnosis, evaluation, prevention and treatment of chronic disease-mineral and bone disorder (CKD-MBD). *Am J Kidney Dis.* 2010; 55:773-799.
49. Vande Griend JP, McQueen RB, Linnebur SA, Vondracek SF. Prescription ergocalciferol dosing for vitamin D repletion: a retrospective evaluation. *Pharmacotherapy.* 2012;32:135-141.
50. Williams S, Malatesta K, Norris K. Vitamin D and chronic kidney disease. *Ethn Dis.* 2009;19:S5-8-11.
51. Zisman AL, Hristova M, Ho LT, Sprague SM. Impact of ergocalciferol treatment of vitamin D deficiency on serum parathyroid hormone concentrations in chronic kidney disease. *Am J Nephrol.* 2007; 27:36-43.