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Effect of Calciferol Supplementation on Antimicrobial Peptide Responses in Asian Patients with Active Pulmonary Tuberculosis: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Abstract

Vitamin D has been proposed as an adjunctive therapy for tuberculosis (TB) because of its immunomodulatory properties. However, evidence from randomized controlled trials (RCTs) remains inconsistent, particularly in Asia, where the TB burden and vitamin D deficiency are highly prevalent. This study evaluated the efficacy and safety of adjunctive vitamin D supplementation in Asian patients with active pulmonary TB receiving standard anti-tuberculosis therapy. A systematic search of PubMed, Scopus, ScienceDirect, and ClinicalTrials.gov was conducted through February 11, 2026, to identify RCTs conducted in Asia. Eligible studies compared vitamin D supplementation with placebo in adults receiving standard anti-tuberculosis treatment. The primary outcomes included sputum smear and culture conversion time, eight-week conversion rates, mortality, and adverse events. Data were pooled using a random-effects model following the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines. The protocol was registered in PROSPERO (CRD420261280520). Six RCTs involving 1,236 participants were included. Pooled analyses showed no significant differences between the vitamin D and

placebo groups in smear or culture conversion time, eight-week conversion rates, mortality, or the incidence of adverse events. Adjunctive vitamin D supplementation did not demonstrate significant clinical or microbiological benefits in Asian patients with active pulmonary TB. However, wide confidence intervals and substantial heterogeneity across several outcomes indicate limited precision. Further large, high-quality RCTs are warranted to clarify the efficacy and safety of vitamin D supplementation as an adjunct to standard anti-tuberculosis therapy.