

Effect of 24-Week, Late-Evening Ingestion of a Calcium-Fortified, Milk-Based Protein Matrix on Biomarkers of Bone Metabolism and Site-Specific Bone Mineral Density in Postmenopausal Women with Osteopenia

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Dietary calcium intake is a modifiable, lifestyle factor that can affect bone health and the risk of fracture. The diurnal rhythm of bone remodelling suggests nocturnal dietary intervention to be most effective. This study investigated the effect of daily, bed-time ingestion of a calcium-fortified, milk-derived protein matrix (MBPM) or control (CON), for 24 weeks, on serum biomarkers of bone resorption (C-terminal telopeptide of type I collagen, CTX) and formation (serum pro-collagen type 1 N-terminal propeptide, P1NP), and site-specific aerial bone mineral density (BMD), trabecular bone score (TBS), in postmenopausal women with osteopenia. The MBPM supplement increased mean daily energy, protein, and calcium intake, by 11, 30, and 107%, respectively. 24-week supplementation with MBPM decreased CTX by 23%, from 0.547 (0.107) to 0.416 (0.087) ng/mL ($p < 0.001$) and P1NP by 17%, from 60.6 (9.1) to 49.7 (7.2) $\mu\text{g/L}$ ($p < 0.001$). Compared to CON, MBPM induced a significantly greater reduction in serum CTX (mean (CI95%); -9 (8.6) vs. -23 (8.5)%, $p = 0.025$ but not P1NP -19 (8.8) vs. -17 (5.2)%, $p = 0.802$). No significant change in TBS, AP spine or dual femur aerial BMD was observed for CON or MBPM. This study demonstrates the potential benefit of bed-time ingestion of a calcium-fortified, milk-based protein matrix on homeostatic bone remodelling but no resultant treatment effect on site-specific BMD in postmenopausal women with osteopenia.

Keywords: randomized control trial; milk protein matrix; nutrient intervention; nutrient timing; bone remodelling; bone turnover markers; bone health; osteopenia; postmenopausal women