# Summary

**Introduction.** Calcium deficiency is a significant concern for postmenopausal women, contributing to osteoporosis, characterized by reduced bone density and increased fracture risk. Current treatments, such as bisphosphonates, can cause adverse effects, underscoring the need for safer and long-term alternatives.

**Objective.** This dissertation explored the potential of soy isoflavones and probiotics to enhance calcium bioavailability and improve bone health, particularly in the context of postmenopausal osteoporosis. The aim of this research was to investigate the effects of isoflavones and probiotics on calcium bioavailability and bone metabolism.

**Materials and methods**. The research was conducted through a series of integrated *in vitro* and *in vivo* studies. Human osteoblast-like Saos-2 cells were used to assess the impact of daidzein, tempeh, and *Lactobacillus acidophilus* on calcium deposition and osteogenic differentiation. Ovariectomized (OVX) rat models were employed to evaluate the effects of daily supplementation with tempeh, daidzein, and their combination with *L. acidophilus* on calcium status, calcium transporter expression, and bone metabolism biomarkers. Additionally, a clinical study involving postmenopausal women examined the impact of daily supplementation with *L. acidophilus* on calcium status, bone metabolism biomarkers, and bone mineral density (BMD) profiles.

**Results.** The results revealed that, in the *in vitro* study, daidzein, tempeh, and *L. acidophilus* did not significantly enhance calcium deposition in Saos-2 cells. However, these compounds showed potential in promoting osteogenic differentiation. In the OVX rat models, daily intake of tempeh and daidzein improved calcium status, increased the expression of calcium transporters, and positively influenced bone metabolism biomarkers. These effects were comparable to those observed with bisphosphonate drugs. In addition, the combined intake of *L. acidophilus* and isoflavone products, including tempeh and daidzein, showed beneficial effects on femoral bone calcium levels and bone metabolism biomarkers. This combination also impacted haematological parameters and lipid profiles, although it led to elevated blood glucose levels. In the clinical study involving postmenopausal women, daily supplementation with *L. acidophilus* did not significantly alter BMD profiles but appeared beneficial in stabilizing bone turnover. However, probiotic supplementation disrupted calcium and glucose levels in blood.

**Conclusion.** The findings of this dissertation suggest that soy isoflavones and probiotics offer promising dietary strategies for enhancing bone health. Tempeh, daidzein, and *L. acidophilus* have the potential to improve calcium status and bone metabolism, particularly in postmenopausal conditions. However, the observed side effects, such as elevated blood glucose level, underscore the necessity for further research and careful consideration in clinical applications.


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