

ABSTRACT FOR GENERAL PUBLIC

“DOBRY: [D]aidzein and pr[OB]iotic fo[R] health[Y]”

A Combination of Daidzein and *Lactobacillus acidophilus* To Improve Calcium Status and Bone Health

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Nowadays, we are implementing the 2030 Agenda for Sustainable Development. The Sustainable Development Goals (SDGs) are anchored on "Leaving no one behind". The SDG point 3, to ensure healthy lives and promote well-being for all ages, illustrates that the inadequate consumption of nutrients results in various long- and short-term health problems related to bone health, such as osteoporosis and low bone mass.

Bone health issue disrupts numerous people of all races and genders. The incidence of fractures starts to increase during the 7th decade of life exponentially. Resistance to fracture depends on various quantitative traits (bone mineral content/density, bone turnover, bone geometry and microstructure, bony tissue material level properties), which change with time under genetic, hormonal, nutritional, physical, and toxic factors. There is concern that excessive bone loss and the associated increase in serum calcium ion levels result in irreversible skeletal damage by knowing these phenomena. Thus, it is crystal clear that the loss of calcium from bone is a serious concern, and nutrition provides several potential ways to counteract bone loss.

The current recommendations for treating and preventing bone diseases are estrogen therapy and pharmacological agents. Estrogen treatment helps maintain or improve bone mineral density, but it increases the reproductive system's risk of cancers. Yet pharmacological agents such as bisphosphonates, calcitonin, and denosumab are not prescribed for long-term use. It thus appears that clinicians' current treatment and management of osteoporosis may not be sufficient to prevent bone loss entirely.

Probiotics could be used to decline postmenopausal bone loss by increasing gut epithelial stability. *Lactobacillus acidophilus* is capable of colonizing the human colon. *L. acidophilus* has antimicrobial effects and can be used to treat intestinal infections. Additionally, *L. acidophilus* in ovariectomized mice could enhance trabecular and cortical bone microarchitecture and increase bone mineral density and heterogeneity. The effect of *L. acidophilus* administration is due to its immunomodulatory effect on the host immune system.

Epidemiological data suggest that regular intake of isoflavones from soy reduces the incidence of estrogen-dependent and aging-associated disorders, such as menopause symptoms in women, osteoporosis, cardiovascular diseases, and cancer. Equol, produced from daidzein, is the isoflavone-derived metabolite with the greatest estrogenic and antioxidant activity. Consequently, equol has been endorsed as having many beneficial effects on human health. The conversion of daidzein into equol takes place in the intestine via the action of reductase enzymes belonging to incompletely characterized members of the gut microbiota. Moreover, daidzein is abundant in soy or soy products, such as fermented soy, namely tempeh, in which the isoflavones content is higher than in unfermented soy. The daidzein's ability from tempeh may be more efficient because it simultaneously influences their bioavailability and biological activity with other compounds.

Combining isoflavones and probiotics on calcium status and bone health is a novel and still-evolving research area. Isoflavones and probiotics positively impact bone health by regulating calcium uptake, gut microbiota, and various metabolic pathways linked to osteoblast activity and bone formation, acting as links in the gut–bone axis. This research will be divided into three steps. **Step 1** is to determine the characterization of daidzein, other isoflavones, and minerals content. **Step 2** is to determine the *in vitro* absorption and bioavailability of *L. acidophilus* and daidzein after the digested process. **Step 3** is to assess the obtained formula of *L. acidophilus* and daidzein (either from pure compound or tempeh) in an animal study in ovariectomized rats. This experiment's endpoint may contribute to maintaining bone health for the general population, replacing the existing supplementation with a specific food, and reducing the dose of the current medicines in postmenopausal women with osteoporosis safely for long-term usage.

Keywords: Daidzein, *Lactobacillus acidophilus*, calcium, bone