Biome Osteo™ Probiotic

Mechanism of Action

MECHANISM OF ACTION

Bone Remodelling

Bone is a dynamic organ, which undergoes continual remodelling throughout the lifespan. Remodelling of bone is primarily achieved by two highly specialised cells: osteoblasts, which build bone, and osteoclasts, which break bone down. The process of breaking down bone is also known as bone resorption. The immune system plays a key role in the regulation of the activity of osteoblasts and osteoclasts through the production of cytokines, which are signalling molecules. Cytokines can either promote bone formation (i.e., their effect is 'pro-osteogenic') or promote bone breakdown (a 'pro-osteoclastogenic' effect).

Post-menopausal bone loss

For most of adult life, the two opposing processes of bone formation and bone resorption are delicately balanced. In women, menopause is characterised by a dramatic decline in estrogen levels, which ordinarily protects bone. As a result, women enter a period of accelerated bone loss after menopause. In fact, 50% of the bone loss a woman will experience in her lifetime occurs within the first 10 years after menopause. Post-menopausal bone loss occurs in two distinct phases: an early, rapid phase, caused by increased activity of osteoclasts, and a prolonged, slower phase, resulting from decreased osteoblast activity.

Low levels of estrogen results in the expression of proinflammatory cytokines, including IL-6, IL-7 and TNF-α, which results in a systemic proinflammatory state. Further, in the gut, low estrogen levels reduce microbial abundance and diversity, weakening the ability of the microbiota to ward off pathogenic microorganisms. Low estrogen levels also weaken the integrity of the intestinal barrier, increasing intestinal permeability. This permits bacterial translocation across the intestinal wall, which activates the immune system and increases the expression of pro-osteoclastogenic cytokines.

Biome Osteo™ Probiotic may help to promote bone health in adults, via the following mechanisms:

1. A preclinical study conducted in a mouse model showed that the novel three-strain probiotic combination of Lactobacillus paracasei 8700:2 (DSM 13434), Lactobacillus plantarum HEAL9 (DSM 15312) and Lactobacillus plantarum HEAL19 (DSM 15313) found in Biome Osteo™ Probiotic **suppressed the expression of proinflammatory cytokines (TNF-α and IL-1β) and increased the expression of osteoprotegerin, an inhibitor of osteoclastogensis**, reducing osteoclast-mediated bone resorption (Ohlsson et al, 2014).
2. The intestinal epithelium provides a selective barrier that prevents translocation of harmful substances and pathogenic microorganisms from the intestinal lumen into the bloodstream. Intestinal epithelial cells are joined by tight junction proteins, which facilitate selective transport across the membrane. Low estrogen levels negatively affect intestinal barrier function, increasing intestinal permeability, and resulting in the production of pro-osteoclastogenic cytokines. In a mouse model of estrogen deficiency-associated bone loss, treatment with **probiotics strengthened the intestinal epithelial barrier**, reduced the formation of pro-osteoclastogenic cytokines, and protected against bone loss (Li et al 2016).

REFERENCES

Ohlsson C, Engdahl C, Fåk F, Andersson A, Windahl SH, Farman HH, et al. Probiotics Protect Mice from Ovariectomy-Induced Cortical Bone Loss. Ryffel B, editor. PLoS ONE. 2014 Mar 17;9(3):e92368.

Ohlsson C, Sjögren K. Effects of the gut microbiota on bone mass. Trends Endocrinol Metab. 2015 Feb;26(2):69–74.

McCabe LR, Parameswaran N. Advances in Probiotic Regulation of Bone and Mineral Metabolism. Calcif Tissue Int. 2018;102(4):480–8.

Xu X, Jia X, Mo L, Liu C, Zheng L, Yuan Q, et al. Intestinal microbiota: a potential target for the treatment of postmenopausal osteoporosis. Bone Res [Internet]. 2017 Dec [cited 2019 Oct 8];5(1). Available from: http://www.nature.com/articles/boneres201746

McCabe L, Britton RA, Parameswaran N. Prebiotic and Probiotic Regulation of Bone Health: Role of the Intestine and its Microbiome. Curr Osteoporos Rep. 2015 Dec;13(6):363–71.

Li J-Y, Chassaing B, Tyagi AM, Vaccaro C, Luo T, Adams J, et al. Sex steroid deficiency–associated bone loss is microbiota dependent and prevented by probiotics. J Clin Invest. 2016 Apr 25;126(6):2049–63.

Rizzoli R. Nutritional influence on bone: role of gut microbiota. Aging Clin Exp Res. 2019 Jun;31(6):743–51.

Collins FL, Rios-Arce ND, Schepper JD, Parameswaran N, McCabe LR. The Potential of Probiotics as a Therapy for Osteoporosis. Microbiol Spectr [Internet]. 2017 Aug 1 [cited 2019 Oct 8];5(4). Available from: http://www.asmscience.org/content/journal/microbiolspec/10.1128/microbiolspec.BAD-0015-2016

Jones RM, Mulle JG, Pacifici R. Osteomicrobiology: The influence of gut microbiota on bone in health and disease. Bone. 2018 Oct;115:59–67.

Quach D, Britton RA. Gut Microbiota and Bone Health. In: McCabe LR, Parameswaran N, editors. Understanding the Gut-Bone Signaling Axis [Internet]. Cham: Springer International Publishing; 2017 [cited 2019 Oct 8]. p. 47–58. Available from: http://link.springer.com/10.1007/978-3-319-66653-2_4

Schepper JD, Irwin R, Kang J, Dagenais K, Lemon T, Shinouskis A, et al. Probiotics in Gut-Bone Signaling. In: McCabe LR, Parameswaran N, editors. Understanding the Gut-Bone Signaling Axis [Internet]. Cham: Springer International Publishing; 2017 [cited 2019 Nov 29]. p. 225–47. Available from: http://link.springer.com/10.1007/978-3-319-66653-2_1