CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

36332

Project Title

Moringa oleifera and Boswellia serrata, Natural Calcium, and BMP-6 Inducers to Treat Osteoporosis

Abstract

Objectives/Goals

The objective was to explore alternative anti-osteoporotic treatment that is more efficient and natural than presently available by conducting several in vitro experiments, measuring how Moringa oleifera and Boswellia serrata plant extracts might stimulate calcium deposits in preosteoblast cells and incite biochemical pathways for osteoblastic bone formation.

Methods/Materials

15,000 MC3T3-El pre-osteoblastic cells were seeded per chamber in 5 sets of 24 well-plates, suspended in DMEM media with 10% Fetal Bovine Serum and grown in a CO2 incubator. Cells were treated with aqueous soluble extracts of Moringa leaf or Boswellia at low, medium and high concentrations with or without Lipopolysaccharide (LPS), a component of gram-negative bacteria, which was used as an agent to mimic osteoporosis by virtue of its degenerative properties. All extract samples were cultured in triplicates for ten days with PBS wash and change of media on every third day. On the tenth day, the cells were assessed for the extracts' effects on: bone cell viability, proliferation, cell cycle progression, calcium nodule formation, and targeted gene expressions related to osteoporosis management.

Results

At lower doses, the cells are viable and alter cellular metabolism, as seen in gene expression related to bone formation and inflammation. An increase in the expression of BMP-6 gene indicates bone and cartilage regeneration attributes and down-regulation of COX-2 indicates the extracts' ability to suppress osteoclast activity. Strong inhibition of COX-2 indicates a possible protection against plaque development and progressive inflammatory disease. Calcium nodules enrichment as evidenced in the Alizarin experiment strongly indicates that both Moringa and Boswellia have potential to induce osteoblastogenesis. Cell cycle analysis after treatment showed an alteration in cell cycle regulation and induction of cellular senescence. Further, cytotoxicity at high dose may suggest the potency of these two herbs that can be harnessed for effective cancer therapy.

Conclusions/Discussion

The current findings are novel, providing a trigger for further in-depth studies to completely explore the clinical use of Moringa and Boswellia as a treatment of osteoporosis, which have not been recognized and reported previously. Their osteogenic potential needs to be confirmed at the molecular level exploring further their signaling and pathways' induction.

Summary Statement

The studies illuminated Moringa and Boswellia's calcium enriched properties and their abilities to activate the BMP-6 indicating their strong osteogenic differentiation inducing cartilage and bone cells growth critical for tissue repair.

Help Received

Dr. Rajendra Gangalum at UCLA graciously assisted me in performing my qPCR and FACS procedures at his lab. Dr. Shiva Sreenath Andrali oversaw my entire project conducted at TheLab. Dr. Cox/ Dr. Rippen provided initial cell culture training at LabLaunch, and my mom was always there for me.