



¹Department of Rehabilitation Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea, ²Department and Research Institute of Rehabilitation Medicine, Yonsei University College of Medicine, Seoul, Korea, ³Brain Korea 21 PLUS Project for Medical Science, Yonsei University College of Medicine, Seoul, Korea, ⁴Graduate Program of Biomedical Engineering, Yonsei University, Seoul, Korea, ⁵Rehabilitation Institute of Neuromuscular Disease, Yonsei University College of Medicine, Seoul, Korea

BACKGROUND

Osteoporosis is a common skeletal disease caused by reduced bone mass, resulting in an increased risk of fractures. However, owing to numerous side effects, such as atypical femoral fractures, associated with current osteoporosis treatments, further investigation is required to identify novel drugs for this condition. 3'-sialyllactose (3'-SL) is derived from human milk and regulates various biological functions. In this study, we aimed to investigate the molecular mechanisms underlying the effect of 3'-SL on the osteogenic and osteoclast differentiation of human bone marrow-derived mesenchymal stem cells (hBMSCs) and bone marrow-derived macrophages (BMMs), respectively.

MATERIALS AND METHODS

The hBMSCs or BMMs were continuously treated with 3'-SL, and its effects on osteogenic or osteoclast differentiation were determined by staining and its quantification, quantitative real-time reverse transcription polymerase chain reaction (qRT-PCR), western blotting, and immunofluorescence assays. An RNA sequencing analysis was performed to identify the target genes of 3'-SL, which were then validated using qRT-PCR analysis. A mouse osteoporosis model was established, and the therapeutic effect of 3'-SL was evaluated using dual-energy x-ray absorptiometry, micro-CT, histological analysis, and enzyme-linked immunosorbent assays.

RESULTS

Figure 1. 3'-SL promotes osteogenic differentiation of hBMSCs.

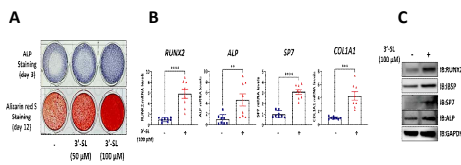


Figure 2. 3'-SL inhibits osteoclast differentiation of bMMs.

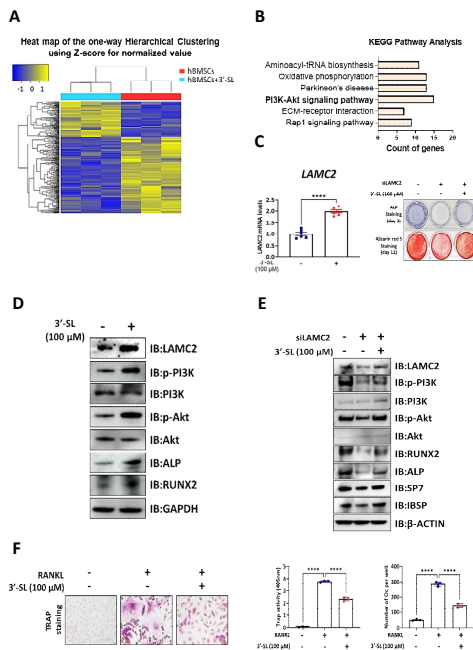


Figure 3. 3'-SL alleviates bone loss in a mouse OVX model.

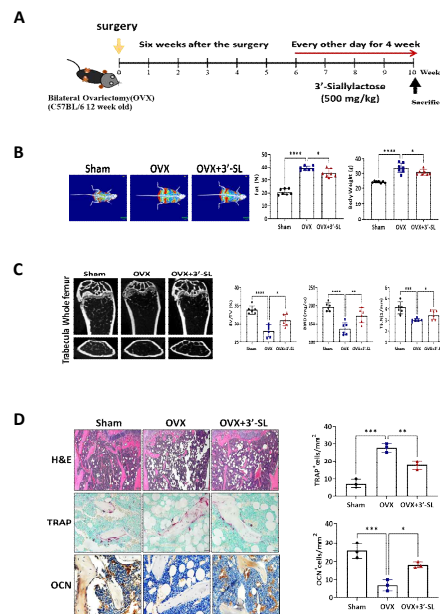
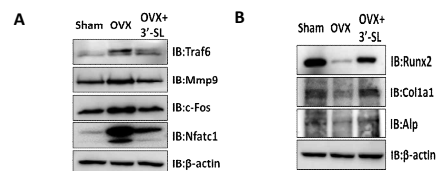


Figure 4. 3'-SL regulates bone homeostasis in a mouse OVX model.



Conclusion

We demonstrated that 3'-SL is a positive regulator of bone homeostasis by regulating bone formation and resorption *in vitro* and *in vivo*. Therefore, our findings suggest that 3'-SL may be a novel therapeutic agent for osteoporosis owing to its dual actions via the coordination of bone formation and resorption.

Acknowledgments

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