



**ASSESSMENT OF THE OSTEOGENIC  
POTENTIAL OF ALENDRONATE ON  
ISOLATED ADIPOSE DERIVED STEM  
CELLS: AN EX-VIVO AND IN-VIVO STUDY**

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Ain Shams University  
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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# DEDICATION

*My Great Parents,*

*My Husband,*

*My little Daughters Shahi & Rita*

*All of whom have contributed and sacrificed endlessly to make my  
life meaningful and allow for this thesis to see the sunlight.*

*To the soul of my father in law/Dr. Ibrahim Mar3i, I wish you  
were here with us....We miss you a lot.*



# تقييم القدرة العظمية للاليندرونات علي الخلايا الجدعية المستمدة من الدهون:دراسة في الجسم الحي وخارجة

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## LIST OF ABBREVIATIONS

<b>ActR-IA</b>	: Activin Receptor- IA
<b>ActRII</b>	: Activin Receptor II
<b>ActRIIB</b>	: Activin Receptor IIB
<b>ADSCs</b>	: Adipose Derived Stem Cells
<b>ALK-2</b>	: Activin receptor like kinase -2
<b>ALK-3</b>	: Activin receptor like kinase -3
<b>ALK-6</b>	: Activin receptor like kinase -6
<b>Aln</b>	: Alendronate
<b>Aln/PCL</b>	: Alendronate/polycaprolactone
<b>ALP</b>	: Alkaline Phosphatase
<b>ASCs</b>	: Adipose Stem Cells
<b>BFR</b>	: Bone Formation Rate
<b>BMMSCs</b>	: Bone Marrow Mesenchymal Stem Cells
<b>BMPs</b>	: Bone Morphogenetic Proteins
<b>BMPR-IA</b>	: Bone morphogenetic receptor type IA
<b>CBCT</b>	: Cone Beam Computed Tomography
<b>CD</b>	: Cluster of Differentiation
<b>cDNA</b>	: Complementary Deoxyribonucleic Acid
<b>cm</b>	: Centimeter
<b>CMF</b>	: Craniomaxillofacial
<b>CSD</b>	: Critical -Sized Defect
<b>CT</b>	: Computed Tomography
<b>°C</b>	: Degree Celsius
<b>DMEM</b>	: Dulbecco Modified Eagle's Medium

<b>DNA</b>	: Deoxyribonucleic Acid
<b>DNase</b>	: Deoxyribonuclease
<b>dNTPs</b>	: Deoxynucleotide triphosphates
<b><math>\Delta E/mn</math></b>	: Kinetic energy/ minute
<b>ECM</b>	: Extracellular Matrix
<b>ESCs</b>	: Embryonic Stem Cells
<b>FBS</b>	: Fetal Bovine Serum
<b>Fgfr</b>	: FGF tyrosine kinase receptor isoforms
<b>FGFR</b>	: Fibroblast Growth Factor Receptor
<b>FZD</b>	: Membrane-spanning frizzled
<b>GFs</b>	: Growth Factors
<b>GSK-3</b>	: Glycogen Synthase Kinase-3
<b>H&amp;E</b>	: Hematoxylin and Eosin
<b>HA/TCP</b>	: Hydroxyapatite / $\beta$ -tricalcium phosphate
<b>hADSCs</b>	: Human Adipose Derived Stem Cells
<b>hBMSCs</b>	: Human Bone Marrow Stem Cells
<b>Hh</b>	: Hedgehog signaling
<b>hMSCs</b>	: Human Mesenchymal Stem Cells
<b>HSCs</b>	: Hematopoietic Stem Cells
<b>IGF</b>	: Insulin Growth Factor
<b>IGF1R</b>	: Insulin Growth Factor Receptor 1
<b>IGF2R</b>	: Insulin Growth Factor Receptor 2
<b>Ihh</b>	: Indian hedgehog
<b>IL</b>	: Interleukin
<b>IP</b>	: Imaging Plate
<b>IRS1</b>	: Insulin receptor substrate 1