

List of Contents

List of Contents

Title	Page No.
<i>List of Abbreviations</i>	<i>II</i>
<i>List of Figures</i>	<i>V</i>
<i>List of Tables</i>	<i>VII</i>
<i>Introduction</i>	<i>1</i>
<i>Aim of the Work</i>	<i>3</i>
<i>Review of Literature</i>	
▪ <i>Normal bone anatomy and physiology</i>	<i>4</i>
▪ <i>Bone minerals</i>	<i>25</i>
▪ <i>Osteoporosis</i>	<i>44</i>
▪ <i>Dual energy X-ray absorptiometry</i>	<i>53</i>
<i>Subjects and Methods</i>	<i>71</i>
<i>Results</i>	<i>80</i>
<i>Discussion</i>	<i>96</i>
<i>Summary</i>	<i>105</i>
<i>Conclusions</i>	<i>108</i>
<i>Recommendations</i>	<i>109</i>
<i>References</i>	<i>110</i>
<i>Arabic summary</i>	-

List of Abbreviations

aBMD	:	areal bone mineral density
AI	:	Adequate intake
ALP	:	Alkaline phosphatase
ATP	:	Adenosine triphosphate
AR	:	Androgen receptor
BMC	:	Bone mineral content
BMD	:	Bone mineral density
BMPs	:	Bone morphogenetic proteins
BMU	:	Basic multicellular unit
CaBP	:	Cytosolic calcium binding protein
CaR	:	Calcium receptor
CT	:	Calcitonin
DEXA	:	Dual energy X-ray absorptiometry
DXR	:	Digital X-ray Radiography
ECM	:	Extra cellular matrix
ER	:	Estrogen receptor
FFM	:	Fat free mass
FGR	:	Fibroblast growth factor
GCs	:	Glucocorticoids
GH	:	Growth hormone
GIO	:	Glucocorticoid induce osteoporosis
IGF	:	Insulin growth factor
IL	:	Interleukin
ISCD	:	International Society for Clinical Densitometry
JIA	:	Juvenile idiopathic arthritis
LBM	:	Lean body mass

LRP5	:	Low-density lipoprotein receptor related protein 5
M-CSF	:	Monocyte colony stimulating factor
MRI	:	Magnetic resonance image
OC	:	Osteocalcin
OCPs	:	Osteoblast precursors
OI	:	Osteogenesis imperfecta
OP	:	Osteoporosis.
OPG	:	Osteoprotegrin
PBM	:	Peak bone mass
PGE2	:	Prostaglandin E2
PTH	:	Parathyroid hormone
PTHR	:	Parathyroid hormone receptor
PTHrP	:	Parathyroid hormone related peptide
QCT	:	Quantitative computed tomography
QUS	:	Quantitative ultrasound
RANK	:	Receptor activator nuclear factor Kappa
RANK-L	:	Receptor activator nuclear factor Kappa ligand
RER	:	Rough endoplasmic reticulum
RGD	:	Arginine-Glycine- Aspartic
ROI	:	Region of interest
Runx2	:	Runt related protein 2
SD	:	Standard deviation
SDS	:	Standard deviation score
SHBG	:	Sex hormone binding globulin
SIBLING	:	Small integrin binding ligand N-glycosylated protein
TFM	:	Total fat mass

TGF-B	:	Transforming growth factor -B
TNF	:	Tumor necrosis factor
UVB	:	Ultraviolet rays B
vBMD	:	Volumetric bone mineral density
VDR	:	Vitamin D receptor
VEGF	:	Vascular endothelial growth factor
WBPA	:	Weight bearing physical activity
WHO	:	World Health Organization

List of Figures

Fig. No	Title	Page
Figure (1):	Skeletal anatomy	5
Figure (2):	The four general categories of bones.....	7
Figure (3):	Structure of long bone.	8
Figure (4):	Compact bone & spongy (cancellous) bone.....	9
Figure (5):	Osteoclast cell.....	13
Figure (6):	Osteocyte cells	15
Figure (7):	Bones elongate by means of secondary centers of ossification	18
Figure (8):	During endochondral ossification, mesenchymal cells differentiate into chondrocytes and lead to the formation of cartilage templates.....	19
Figure (9):	The process of endochondral ossification is dependent upon neovascularization.....	20
Figure (10):	The process of endochondral ossification depends upon a switch in the expression of ECM molecule.....	21
Figure (11):	Regulation of epithelial calcium transport by 1,25(OH) ₂ D ₃	38
Figure (12):	Synthesis and Metabolism of Vitamin D in the Regulation of Calcium, Phosphorus, and Bone Metabolism	40

List of Figures (Cont.)

Fig. No	Title	Page
Figure (13):	The parathyroid axis.....	43
Figure (14):	Vertebral compression fractures in lumbar spine of a child with juvenile idiopathic osteoporosis	45
Figure (15):	A scanner used to measure bone density with dual-energy X-ray absorptiometry.....	54
Figure (16):	DEXA sites for measurements of BMD	60
Figure (17):	Correlation between whole body BMD and age	83
Figure (18):	Correlation between subtotal body BMD and age	83
Figure (19):	Correlation between whole body BMC and weight SDS	85
Figure (20):	Correlation between subtotal body BMD and height SDS.....	87
Figure (21):	Correlation between lumbar spine Z score and BMI.....	89
Figure (22):	Correlation between lumbar spine Z score and BMI SDS.....	89

List of Tables

Tab. No	Title	Page
Table (1):	Calcium Absorption.....	27
Table (2):	Mechanisms of gastrointestinal Calcium Absorption.	27
Table (3):	Recommended daily Ca intake.....	30
Table (4):	Serum phosphorus reference range during childhood.....	31
Table (5):	Distribution of age, dietary calcium intake, sunlight exposure and physical activity among studied subjects.....	79
Table (6):	Socioeconomic factors and score of studied subjects.....	79
Table (7):	Anthropometric measurements of studied subjects.	80
Table (8):	Laboratory bone parameters of studied subjects.	80
Table (9):	DEXA bone parameters of the studied subjects.	81
Table (10):	DEXA body composition parameters of the studied subjects.....	81
Table (11):	Correlations between DEXA parameters and age	82
Table (12):	Correlations between DEXA parameters & weight SDS.	84

List of Tables (Cont.)

Tab. No	Title	Page
Table (13):	Correlation between DEXA parameters & height SDS.....	86
Table (14):	Correlation between DEXA parameters & each of BMI and its SDS.	88
Table (15):	Correlations between laboratory bone parameters and DEXA parameters.....	90
Table (16):	Correlation between DEXA parameters and dietary calcium intake.	91
Table (17):	Correlation between DEXA parameters and physical activity.	92
Table (18):	Correlation between DEXA parameters and sun exposure.....	93
Table (19):	Correlation between DEXA parameters & El-Bohy score.....	94
Table (20):	Correlation between DEXA parameters and socioeconomic factors.....	95



Introduction





Aim of the Work





Review of Literature





Chapter (1)

Normal Bone Anatomy and Physiology





Chapter (2)

Bone Minerals





Chapter (3)

Osteoporosis





Chapter (4)

Dual Energy X-Ray Absorptiometry (DEXA)

