Evaluation of Bone Mineral Density and Body Composition in 11-12 years Old Egyptian Males

Thesis

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*First of all, thanks to **ALLAH** whose magnificent help was the main factor in completing this work.*

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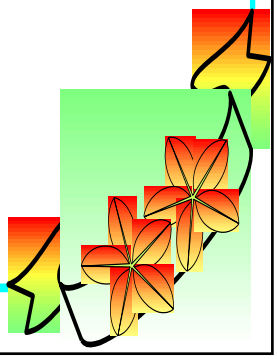
Shaimaa Mohammed

Dedication

- *To my father and my mother*
- *To my husband and my son*
- *To my sisters and my family*

I dedicate this work

Shaimaa Mohammed



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List of Abbreviations

aBMD	Areal bone mineral density
AI	Adequate intake
ALP	Alkaline Phosphatase
ATP	Adenosine triphosphate
BA	bone area
BMC	Bone mineral content
BMD	Bone mineral density
BMI	body mass index
BMP	Bone morphogenetic proteins
Ca^{2+}	Calcium
cAMP	Cyclic adenosine monophosphate
CGRP	calcitonin gene-related peptide
CT	Calcitonin
CV%	Coefficient of variation
DRI	Dietary reference intake
DXA	Dual energy X-ray absorptiometry
DXR	Digital X-ray Radiogrammetry
FDA	Food and drug adminstration
FFM	Fat free mass
FFQ	Food Frequency Questionnaire
FGF-23	Fibroblast growth factor 23
FN	Femoral neck
FNB	Food and nutrition board
GC	Glucocorticoids
GH	Growth hormone
GHD	Growth hormone deficiency

IGF	Insulin growth factor
IGFBPs	IGF-binding proteins
Ihh	Indian hedgehog
IL	interleukin
IOM	Institute of Medicine
IR	Interquartile range
ISCD	International Society of Clinical Densitometry
LBM	Lean body mass
LRP5	Low-density lipoprotein receptor related protein 5
LS	Lumbar spine
MRI	Magnetic resonance imaging
NAS	National Academy of Sciences
OI	Osteogenesis imperfecta
OPG	Osteoprotegrin
PBF	percent body fat
PBM	peak bone mass
PDEXA	perpheral DEXA
PDGF	Platelet derived growth factor
P_i	inorganic phosphorus
PQCT	Peripheral quantitative computed tomography
PTH	Parathyroid hormone
PTHrp	PTH-related peptider
QCT	Quantitative computed tomography
QUS	Quantitative ultra sound
RA	Radiographic absorptiometry
RANK	Receptor activation of nuclear factor kappa
RANKL	Receptor activator of nuclear factor κappa B Ligand
RDA	Recommended dietary allowance

ROI_S	Regions of interest
SB	Subtotal body
SD	Standard deviation
SDS	Standard deviation score
SPECT	Single photon emission computed tomography
SXA	Single-energy x-ray absorptiometry
TBF	total body fat
TFM	Total fat mass
TGF-B	Transforming growth factor beta
TNF	Tumor necrosis factor
TRP	Transient receptor potential
UL	Tolerable upper level
UVB	Utraviolet B radiation
vBMD	volumetric bone mineral density
VDR	Vitamin D receptor
VEGF	vascular endothelial growth factor
VFA	Vertebral fracture assessment
WB	Whole body
WHO	World health organization

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Introduction

Bone densitometry is a widely used and universally accepted tool for the assessment of bone mass in adults. In the last two decades, however, interest in bone densitometry in children has increased. This can be explained firstly by the introduction of more effective treatment regimens aimed at increasing and maintaining bone density in a variety of diseases influencing bone development and or growth and secondly, by the fact that several reports have indicated the importance of peak bone mass in relation to future development of osteoporosis ***(Van Rijn et al., 2006).***

There are 2 main reasons for measuring bone mineral content (BMC) in children: to quantify the deficits in bone mineral associated with the various disorders that cause osteopenia in children and to improve our understanding of the childhood antecedents of osteoporosis, a condition that happens to manifest itself in elderly subjects. Available data suggest that the genetic susceptibility to osteoporosis may be detectable in early childhood ***(Gilsanz and Wren, 2007).***

Measurement of bone mineral density (BMD) by dual – energy X-ray absorptiometry (DXA) is viewed widely as the preferred method for clinical use in children because of its speed, precision, safety, and wide spread availability. The radiation exposure is comparable to that received during a round trip transcontinental airplane flight ***(Bachrach, 2005).***

DXA is an attractive option for clinical use that gives estimates of bone mineral mass, fat free mass (FFM), which is approximately equivalent to lean body mass (LBM), and total fat mass (TFM). DXA exploits the fact that the energy dependency of the strength of interaction between X-rays and bone mineral differs from that for soft tissue. At low energies, bone dominates the attenuation process while, at higher

energies, X-rays interact to about the same extent with bone and soft tissue ***(Sala et al., 2006).***

The 3 main limitations of DXA measurement in children are: (1) the current lack of a standardized pediatric normative database, (2) the lack of a meaningful clinical outcome measure related to DXA values in children, and (3) inaccuracies resulting from growth -related variations in bone and body size and composition ***(Gilsanz and Wren, 2007).***