Evaluation of Bone Mineral Density and Body Composition in 6-7 Year old Egyptian Males

Thesis

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قَالُوا سُبْحَانَكَ لاَ عِلْمَ لَنَا
إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ
الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم
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To souls of:

My Dear Parents

Who gave me too much

And received too little

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List of Abbreviations

AAP	American Academy of Pediatrics.
aBMD	areal bone mineral density
ALP	Alkaline phosphatase
ATP	Adenosine triphosphate
BA	Bone age
BMC	Bone mineral content
BMD	Bone mineral density
BMPs	Bone morphogenetic proteins
BMU	Basic multicellular unit
cAMP	Cyclic adenosine monophosphate
CaBP	Cytosolic calcium binding protein
C S F	Colony stimulating factor
CFU-GM	Colony-forming unit for granulocyte-macrophage
CGRP	Calcitonin gene-related peptide
DEXA	Dual energy X-ray absorptiometry
ECM	Extra cellular matrix
FACIT	Fibril associated collagen with interrupted triple
FFM	Fat free mass
FGF	Fibroblast growth factor
GH	Growth hormone
IGF	Insulin growth factor
IGFBPs	IGF-binding proteins
Ihh	Indian hedgehog
IL	Interlukin
ISCD	International Society of Clinical Densitometry

JIA	Juvenil idiopathic arthritis
LBM	Lean body mass
LDL	Low density lipoprotein
LRP5	Low-density lipoprotein receptor related protein 5
M-CSF	Macrophage colony stimulating factor
MEPE	Matrix extracellular phosphoglycoprotein
mM	Millimolar
MMP	Matrix metalloprotease
mSv	Millisievert
nM	Nanomolar
OP	Osteoprosis.
OPG	Osteoprotegrin
PBM	Peak bone mass
PDGF	Platlet derived growth factor
PKC	Protein kinase C
PMCA1	Plasma membrane calcium ATPase
PQCT	Peripheral quantitative computed tomography
PGE_2	Prostaglandin E_2
PTH	Parathyroid hormone
PTHrP	PTH related peptide
QUS	Quantitative ultrasound
RA	Radiographic absorptiometry
RANK	Receptor activation of nuclear factor kappa
RANKL	Receptor activator of nuclear factor κappa B Ligand
RDI	Recommended daily intake
rhPTH	Recombinant human parathyroid hormone

RGD	Arginin, glycin and asparagines
ROI_S	Regions of interest
SD	Standard deviation
SDS	Standard deviation score
SIBLING proteins	Small integrin Binding Ligand N – glycosylated proteins
SPECT	Single-photon emission computed tomography
SXA	Single-energy x-ray absorptiometry
TGF β	Transforming growth factor beta
TNF	Tumer necrosis factor
TRPV6	Transient receptor potential vanilloid6
µM	Micromolar
vBMD	Volumetric bone mineral density
VDR	Vitamin D receptor
VEGF	Vascular endothelial growth factor
VFA	Vertebral fracture assessment
WBPA	Weight bearing physical activity

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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 first 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 (DEXA) 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).***

DEXA 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). DEXA 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 DEXA 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 DEXA values in children, and (3) inaccuracies resulting from growth -related variations in bone and body size and composition ***(Gilsanz and Wren, 2007).***