Vitamin D in Egyptian obese children and its relation to insulin resistance and sensitivity

Thesis
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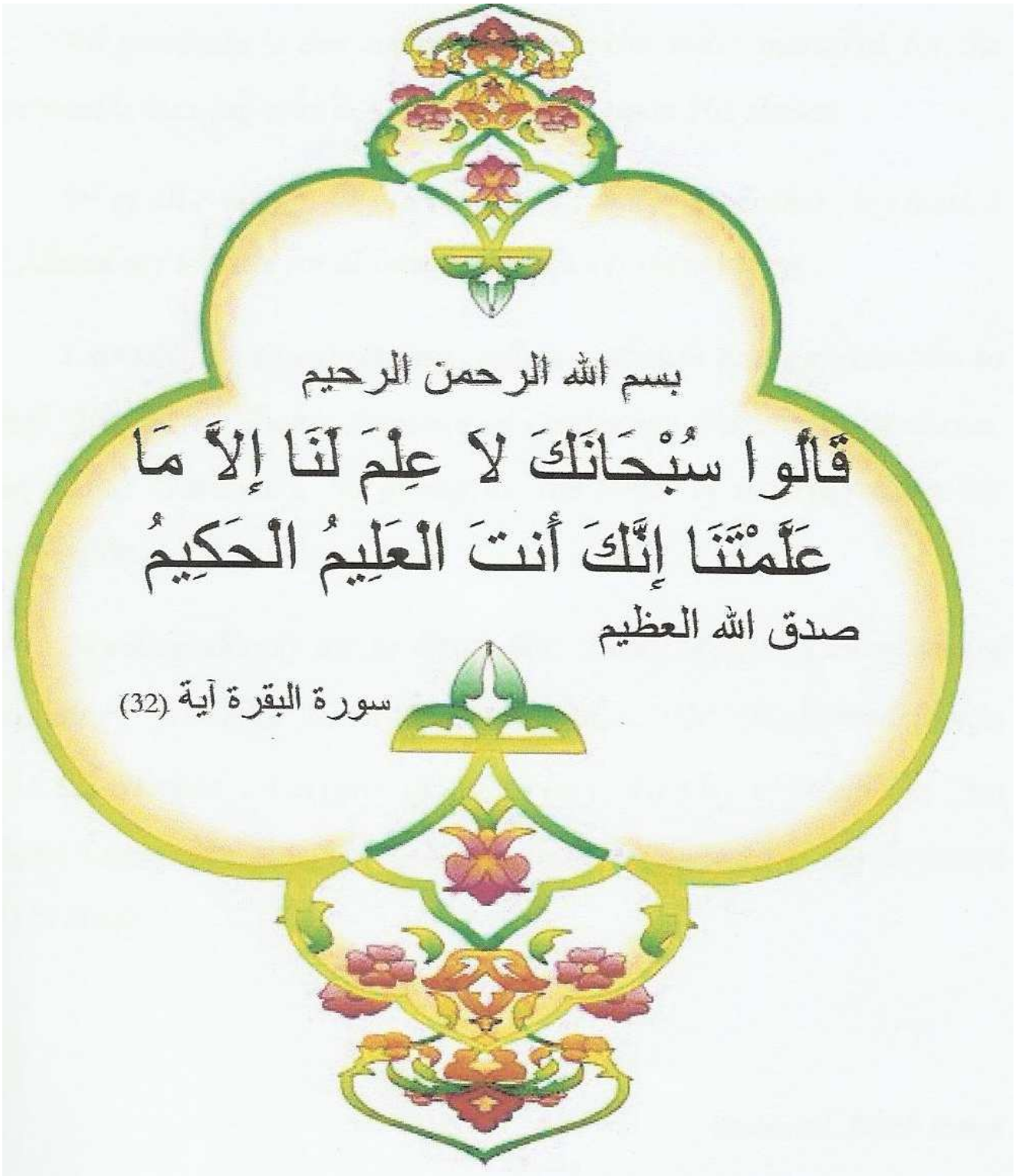
بسم الله الرحمن الرحيم
قَالُوا سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا
عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ
صدق الله العظيم
سورة البقرة آية (32)

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Abstract

Abstract: It is now known that insufficient serum 25(OH) D alters metabolic functions causing perturbation of many cellular functions including that of the pancreas. Recently there has been a resurgence of hypovitaminosis D3 in many populations. In parallel there has been a worldwide increase in the prevalence of obesity. Links between obesity and hypovitaminosis D has been reported.

Objective: to assess vitamin D status in obese Egyptian children and adolescents and to determine the effect of vitamin D on metabolic problems already linked to obesity.

Design: The study was a cross sectional study conducted on 50 obese subjects (BMI ≥ 95th percentile) aged 8 to 15 years recruited from Diabetes Endocrine and Metabolic Pediatric Unit at Cairo University Pediatric Hospital which were compared to 50 healthy children and adolescents age and sex matched included as controls.

Method: All subjects were subjected to general examination, anthropometric assessment (weight, height, waist circumference, and hip circumference), body composition (using bioelectrical impedance device) and laboratory tests (Serum 25(OH) D, serum lipid profiles, serum fasting insulin, serum fasting glucose and C-reactive protein).Indices of insulin sensitivity and resistance (HOMA-IR, HOMA –β and QUICKI) were calculated from fasting insulin and fasting glucose.

Results: Among 50 child with simple obesity, 3 (6%) were vitamin D deficient

and 47 (94%) were vitamin D insufficient. On correlating 25(OH) D with variables among obese subjects it showed a significant negative correlation between vitamin D and waist circumference, hip circumference, fat % and fat mass and a significant positive correlation between vitamin D and Lean% and TG. No correlation was found between vitamin D and BMI z score, Systolic BP, Diastolic BP, insulin, glucose, HDL, LDL, cholesterol, TG, CRP, HOMA-IR, HOMA-B and QUICKI.
When classifying the 50 obese children according to the IDF definition of metabolic syndrome, 26(52%) had metabolic syndrome while 24(48%) were non metabolic. The comparison between both groups showed that the metabolic syndrome group had higher significant values regarding fasting blood glucose and HOMA-IR while lower significant values regarding HOMA-β and QUICKI were present.

Conclusion: 100% of the obese children had hypovitaminosis D and the vitamin D level was negativity correlated to the fat% and fat mass of the obese subjects highlighting the role of obesity in causing vitamin D deficiency. Vitamin D was neither correlated to the metabolic risk factors (Systolic BP, Diastolic BP, insulin, glucose, HDL, LDL, cholesterol, TG and CRP) nor the indices of insulin resistance and sensitivity (HOMA-IR, HOMA-B and QUICKI) which may show the need for further researches to elucidate such relation.

Key words:
Obese children – vitamin D – insulin

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List of Abbreviations

AgRP	Agouti-related peptide
Bax	Bcl-2–associated X protein
Bcl2	B-cell lymphoma 2
BIA	Bioelectrical impedance analysis
BMI	Body mass index
BP	Blood pressure
CART	Cocaine and amphetamine-regulated transcript
CKD	Chronic kidney disease
CRP	C-reactive protien
CVS	Cardiovascular system
CYP	Cytochrome P
DEMPU	Diabetes Endocrine and Metabolism Pediatric Unit
DEXA	Dual energy X-ray absorptiometry
Fas-L	Fas- ligand
FBG	Fasting blood glucose
FDA	Food and drug administration
FFAs	Free fatty acids
FGF-23	Fibroblast growth factor 23
FSIVGTT	Frequently Sampled Intravenous Glucose Tolerance Test
GERD	Gastroesophageal reflux disease
G/I ratio	Glucose/insulin ratio
HDL	High-density lipoprotein
HOMA	Homeostasis model assessment
IDF	International Diabetes Federation
IGF-I	Insulin-like growth factor I
IL	Interleukin
IST	Insulin suppression test
JIS	Joint Interim Statement
KATP	ATP-sensitive K+
LDL	Low-density lipoprotein
LH	Lateral hypothalamus

Mc3r	Melanocortin-3 receptors
Mc4r	Melanocortin-4 receptors
MCH	Melanin concentrating hormone
NAFLD	Non-alcoholic fatty liver disease
NCX1	Na^{+}/Ca^{2+} exchanger
NPY	Neuropeptide Y
OGTT	Oral Glucose Tolerance Test
OHS	Obesity hypoventilation syndrome
OPG	Osteoprotegerin
OSAS	Obstructive sleep apnea syndrome
PAI-1	Plasminogenactivator inhibitor-1
PC1	Prohormone convertase 1
PCOS	Polycystic ovary syndrome
PMCA1b	Plasma membrane Ca ATPase
POMC	Pro-opiomelanocortin
PPAR- δ	Peroxisome proliferator activated receptor δ
PTH	Parathyroid hormone
PVN	Paraventricular nucleus
QUICKI	Quantitative insulin sensitivity check index
RAAS	Renin-angiotensin-aldosterone system
RANK	Receptor nuclear factor-κB
RANKL	Receptor activator of nuclear factor-κB ligand
RXR	Retinoid x receptor
SCFE	Slipped capital femoral epiphysis
SSPG	Steady-state plasma glucose
SSPI	Steady-state plasma insulin
TG	Triglyceride
Th	T helper
TLRs	Toll like receptors
TNF	Tumor necrosis factor
Treg	T regulatory
TRPV5	Transient receptor potential cation channel, subfamily V, member 5
TRPV6	Transient receptor potential cation channel, subfamily V, member 6

US	Ultrasound
UV	Ultraviolet
VDCC	Voltage-dependent Ca2+ channels
VDR	Vitamin D receptor
VDRE	Vitamin D response element
VDR-RXR	Vitamin D receptor–retinoic acid x-receptor complex
VSMCs	Vascular smooth muscle cells
WC	Waist circumference
WHO	World health organization
WHR	Waist hip ratio

INTRODUCTION