Associations of Serum 25-Hydroxyvitamin D and Components of the Metabolic Syndrome in an Egyptian Cohort

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P2-531 (Fat metabolism and Obesity)

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Amany Ibrahim has no relevant financial or non financial relationships to disclose

INTRODUCTION AND OBJECTIVES

- ✓ Middle East and specially Egypt has one the highest rates of childhood obesity. According to CDC, the prevalence of childhood obesity reached 12.6% in Egypt [1].
- ✓ Vitamin D (25-OHD) deficiency is associated with increased risk of metabolic syndrome. Obesity and 25-OHD status are known to be associated, intervention studies showed that obese individuals need higher 25-OHD dosages than lean individuals to achieve the same 25-OHD concentrations [2]. As obese children are usually sedentary, therefore, less likely to play outdoors, this limits their sunlight exposure[3]. Unhealthy high caloric food is usually low in mineral and vitamin content [4]. Additionally, bioavailability of 25-OHD in obese subjects might be low because of its deposition in a fat tissue and higher body fat mass might be associated with a higher risk of 25-OHD deficiency [5] .
- ✓ This work aimed at assessing the relationship between 25-OHD and different components of metabolic syndrome in overweight and obese children and adolescents.

METHODS

- ➢ A cross-sectional study that included 98 obese and overweight children and adolescents (≥ 85th percentile for age and sex based on the Egyptian Growth Chart [6]) were recruited from DEMPU clinic, Cairo University.
- ➢ They were evaluated with blood pressures, anthropometric measurements (weight, height, waist circumference (WC) and hip circumference (HC)) and laboratory tests (fasting measurements of serum lipid profile, insulin, blood glucose (FBS), 25-OHD, calcium, phosphorous, and alkaline phosphatase). Homeostasis Model Assessment Method-Insulin Resistance (HOMA-IR) and Quantitative Insulin Sensitivity Check Index (QUICKI) which are simple surrogate indices for insulin sensitivity/resistance predicting fasting steady-state glucose and insulin concentrations were calculated as follows:
  - HOMA-IR = [(Fasting Insulin (µU/mL)) X (Fasting Glucose (mmol/L))]/22.5
  - QUICKI = 1/[Log (Fasting Insulin, µU/ml) + Log (Fasting Glucose, mg/dl)]
- ➢ Vitamin D is seriously deficient if <12 ng/ml (< 30 nmol/l)), insufficiency (deficient) if 12-30 ng/ml (30-75 nmol/l) and sufficient (adequately supplied) > 30 ng/ml (> 75 nmol/l) [7].
- ➢ Appling Guide-lines for the Prevention of Atherosclerosis in Childhood and Adolescence definition (IDPAIA) (BMI > 85th percentile according to sex and age, Plasma insulin > 15 µu/mL, SBP and/or DBP in > 90th and > 95th percentiles or always that BP > 120/80 mmHG, TC > 150 mg/dl, LDL > 100 mg/dl, HDL ≤ 45 mg/dl, TG > 100 mg/dl, 60 cases were diagnosed as metabolic syndrome (MS) 60 cases and 38 cases had no MS.

RESULTS

- ✓ The study group included 53 males (54.1%) [46 (86.8%) obese, 7 (13.2%) overweight] and 45 females (45.9%) [38 (84.4%) obese, 7 (15.6%) overweight], with an average age of 10.63 ± 2.29 years for obese males, 11.93± 2.95 years for overweight males, 10.65 ± 2.39 years for obese females and 10.07 ± 1.57 years for overweight females.
- ✓ 25-OHD deficiency affected 93 subjects (94.9%) of the studied group (fig 1).
- ✓ Using IDPAIA definition, comparison between MS and non MS groups showed that MS group had significant values regarding SBP, DBP, W.SDS, BMI SDS, TG, HDL, fasting insulin, HOMA IR, Log HOMA and HOMA β (table 1).
- ✓ Correlation between 25-OHD level and different MS variables showed a significant negative correlation between 25-OHD and both of FBS and Weight SDS (table 2)
- ✓ Regression Multivariate Analysis applied on 25-OHD after adjustment of age and sex showed that Weight SDS, WC, HC, W/H ratio, FBS, Fasting Insulin, HOMA-IR and QUICKI had significant relations with 25-OHD (table 3).

Fig (1): 25-OHD status of the study group

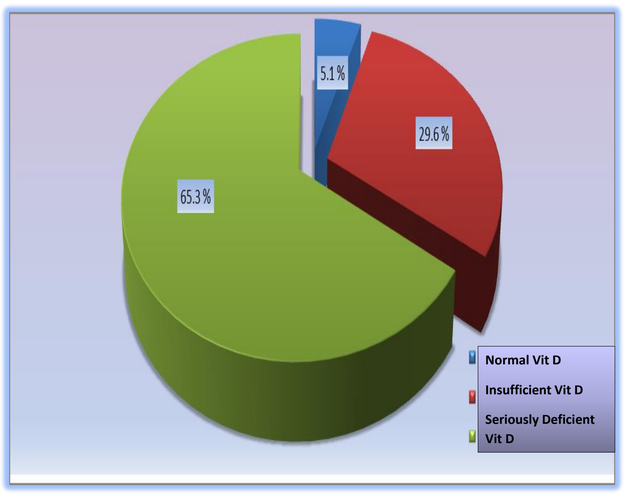

Table (1):Comparison between Metabolic and non Metabolic Syndrome Cases using IDPAIA definition

	MS (N=60) Mean ± SD	no MS (N=38) Mean ± SD	P-value
SBP	125.33 ± 13.7	117.24 ± 10.76	0.003*
DBP	86.17 ± 12.99	78.63 ± 10.12	0.003*
Weight SDS	5.07 ± 2.48	3.81 ± 1.65	0.007*
BMI SDS	3.59 ± 0.73	3.13 ± 0.68	0.003*
Height SDS	0.017 ± 1.24	-0.25 ± 1.08	0.27
Waist C.	94.13 ± 13.67	93.13 ± 11.17	0.71
Hip C.	100.57 ± 14.48	98.75 ± 12.82	0.53
W/hH ratio	0.93 ± 0.05	0.94 ± 0.047	0.66
FBS	107.57 ± 16.19	106.95 ± 10.8	0.84
TG	126.75 ± 69.72	74.32 ± 30.87	0.001*
HDL	37.1 ± 7.38	41.82 ± 8.59	0.005*
Fasting Insulin	12.88 ± 11.79	8.42 ± 5.93	0.03*
HOMA IR	3.48 ± 3.46	2.27 ± 1.7	0.047*
HOMA β	130.25 ± 161.54	70.08 ± 43.83	0.027*
QUICKI	0.33 ± 0.037	0.35 ± 0.033	0.07
Vitamin D	22.78 ± 22.23	24.63 ± 29.83	0.73

Table (2): Correlation between 25-OHD level and variables

Variables	25 OHD r	25 OHD p
Height SDS	-0.081	0.428
Weight SDS	-0.216*	0.033*
BMI SDS	-0.147	0.149
WC	0.036	0.723
HC	0.015	0.881
W/H ratio	0.124	0.225
SBP	-0.186	0.067
DBP	-0.088	0.389
TG	-0.055	0.589
HDL	-0.119	0.244
FBS	-0.343	0.001*
Fasting Insulin	-0.108	0.288
HOMA IR	-0.150	0.140
QUICKI	0.042	0.684

Table (3): Regression Analysis for 25-OHD dependent MS variables

Variables	P- value	95% Confidence Interval for B Lower Bound	95% Confidence Interval for B Upper Bound
Weight SDS	0.038*	-12.478	-0.356
Height SDS	0.133	-2.289	17.003
BMI SDS	0.693	-10.597	15.849
WC	0.025*	-6.262	-0.44
HC	0.036*	0.215	5.993
W/H ratio	0.015*	79.467	721.379
SBP	0.101	-1.469	0.133
DBP	0.31	-0.382	1.19
TG	0.213	-0.134	0.03
HDL	0.628	-0.777	0.472
FBS	0.019*	-1.623	-0.148
Fasting Insulin	0.007*	-7.81	-1.313
HOMA IR	0.02*	1.997	22.826
QUICKI	0.04*	-812.257	-19.968

BMI: body mass index, SDS: stander deviation score, WC: waist circumference, HC: hip circumference W/H ratio: waist/hip ratio, SBP: systolic blood pressure, DBP: diastolic blood pressure, FBS: fasting blood sugar, TG: triglyceride, HDL: high density lipoproteins, HOMA IR: The Homeostasis Model Assessment of Insulin Resistance, HOMA β: Homeostasis model assessment method β cell function, QUICKI: Quantitative Insulin Sensitivity Check Index, P value is significant if < 0.05

CONCLUSIONS

- ➢ Hypovitaminosis D is prevalent in obese and overweight Egyptian subjects.
- ➢ Significant relationship between 25-OHD and each of Weight SDS, WC, HC, W/H ratio, FBS, Fasting Insulin, HOMA-IR and QUICKI were suggestive of possible adverse influences of 25-OHD deficiency. The study showed a significant negative correlation between 25-OHD and FBS and weight SDS.
- ➢ Low 25-OHD concentration was associated with indices of adiposity (Weight SDS, WC, HC and W/H ratio), insulin resistance and MS risk factors (FBS, Fasting Insulin, HOMA-IR and QUICKI). This makes obesity a risk factor in term of hypovitaminosis D in children and adolescent.
- ➢ The rise of the epidemic of obesity in Egypt and its association with 25-OHD deficiency and the multiple associated co-morbidities, both with obesity and 25-OHD raises the concerns of the additive effect of both on the cardiovascular risks and the ultimate reduction of their quality of life with a need to manage the problem of the growing numbers of obesity early in childhood.

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55ESPE 531--P2

Fat metabolism and Obesity

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DOI: 10.3252/pso.eu.55ESPE.2016

Poster presented at: ESPE 2016 PARIS

PosterSessionOnline.com