RESEARCH ARTICLE

ASSOCIATION OF VITAMIN D AND INSULIN RESISTANCE IN INDIVIDUALS WITH METABOLIC SYNDROME

Shifa K, Jithesh TK, Parvathi K Warrier, Syamili mohan, Amina K
Department of Biochemistry, MES Medical College & Hospital, Kerala, Palachode, Kolathur, India

Correspondence to: Shifa K (jithesh@asia.com)

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ABSTRACT
Background: Metabolic syndrome (MetS), a lifestyle disease related with many biochemical alterations which prompt a person to type 2 diabetes and cardio vascular diseases (CVD). Widespread studies conceded right through the globe to come across superior diagnostic and prognostic markers of metabolic syndrome. Although studies are still going on the world over, broad studies are lacking from this area.
Aims & Objective: The present study undertaken with the objectives of correlating the vitamin D deficiency with insulin resistance (IR) of individuals having MetS.
Materials and Methods: We have evaluated the association of vitamin D and IR in patients with MetS. The IR calculated using serum levels of triglycerides (TG) and high density lipoprotein (HDL). Serum Magnesium (Mg) and Zinc (Zn) levels used as markers of glucose intolerance.
Results: From this study, it can be potted that Vitamin D deficiency found in persons with metabolic syndrome and TG/HDL found to be increased indicates an increase in IR. Serum Zn and Mg found to be decreased related to diminishing glucose tolerance.
Conclusion: These observations are in conformity with those in similar studies elsewhere. Further studies at the molecular level will help in relating the insulin resistance and alterations in vitamin D in persons with MetS.
Key Words: Metabolic Syndrome (MetS); Insulin Resistance; Glucose Tolerance; Vitamin D

Introduction

The Metabolic Syndrome (MetS) is a collection of central obesity, glucose intolerance, hyperinsulinemia, low HDL, high TG and hypertension (HTN). It is coupled with a high risk of coronary heart disease (CHD) and untimely mortality.[1] Besides ensuing in macro vascular complications, there is mounting facts that MetS, like diabetes mellitus (DM), causes micro vascular complications in patients with type 2 diabetes mellitus (T2DM). Almost 70-80% of the people with DM are diagnosed with MetS.[2] Mortality from CHD and all causes are superior in persons with diabetes and pre-existing CVD. MetS comprises IR, abdominal fat distribution, dyslipidemia, and HTN. High BP is a central element of MetS.[3] The primary mechanisms for string of HTN in MetS are very complex and still difficult to understand. Central obesity, IR, sympathetic over action, oxidative strain (OS), endothelial dysfunction, activated rennin-angiotensin system (RAS), augmented inflammatory mediators and obstructive sleep apnoea etc. have been likely to be possible factors to develop HTN in the MetS.

DM is generally associated with HTN, and an affluence of epidemiological data suggests that this connection is independent of age and fatness. Much confirmation indicates that the association amid diabetes and HTN is hyper insulinemia. The IR of essential HTN is positioned in peripheral tissues (muscle), is restricted to non-oxidative pathways of glucose disposal (glycogen synthesis), and correlate openly with the sternness of HTN.[4]

Mg deficit is found to be one of the mostly significant causes of IR.[5] Mg is one of the most plentiful ions present in the living cells and its plasma concentration surprisingly steady in healthy subjects. Plasma and intracellular Mg concentration are somewhat keeping pace by several factors. In vitro and in vivo studies recognized that insulin may amend the shift of Mg from extracellular to intracellular space. IR mechanism is also observed in Zn deficiency. Zn is a vital micro mineral that exists in all cells and is required by thousands of proteins for transcriptional, catalytic or structural functions. Zn is able to not only even out and put off the deficiency of insulin hexamers (a storage form of insulin in cells) but also perk up the binding of insulin to liver receptors and restrain the degradation by live plasma membranes. There is mounting confirmation following the role of Zn as an antioxidant that could defend insulin and cells from being attack by free radicals.[6]

Vitamin D has important effects on insulin act, and may

impact on a number of pathways which may be of significance in the progress of T2D. Experimental data propose that 1, 25(OH) 2D affect cardiac muscle directly, controls parathyroid hormone secretion, regulate the rennin-angiotensin- aldosterone system (RAAS), and adapt the immune system. Owing to these biologic effects, Vitamin D deficiency has been related with HTN, several types of vascular diseases, and heart failure. Subjects with hypovitaminosis D are at superior risk of IR and the MetS.[7] Hypovitaminosis D has long been understood as a risk factor for glucose intolerance.

By this study we evaluate the association of vitamin D and IR in patients with MetS. Vitamin D is measured by CLIA, and photometric methods are used to assess the parameters required to calculate IR in both controls and patient's samples.

Materials and Methods

Patients who attended the MES Medical College for routine medical checkup formed the cases for the present cross-sectional study. The total of 30 cases that referred to the hospital during January to July, 2013 was enrolled into the study. Informed consent was taken from all the subjects. MetS was diagnosed according to the NCEP-ATP III criteria. Age and sex matched controls were selected from the teaching and nonteaching staffs of MES medical college, Perinthalmanna those who without have any of the symptoms above criteria. Five ml blood was collected from the patient with their consent by vein puncture under sterile conditions in a plain bottle and then centrifuged at 3000 rpm for 10 minutes. The serum thus obtained was used for blood sugar, Lipid profile, Vitamin D assay, and zinc and Magnesium determination.

The statistical analysis of each parameter also performed. In this the results expressed as ± standard deviation and group statistics and test significance is evaluate by the t test using SPSS. Regression analysis using Pearson rank correlation also performs to find out the correlation between each parameter with the MetS.

Results

Out of 60 samples, 30 selected as tests and 30 as controls. Minimum age of the selected sample is 28 and maximum age is 65. Mean of age calculated is 46.90 and standard deviation is 8.810. Height in controls is higher than in tests and weight is lower than the controls like this the BMI value of controls is 22.63 ± 1.57 and that of tests 26.25 ± 2.42. The group statistics showed that the height and weight are significant and the BMI is highly significant in HTN and MetS.

The Histogram chart of this 3 parameters (height, weight, and BMI) seen in figure1. The mean and standard deviation of the BP of test and control population shown in table 1. Systolic pressure found to be significant and diastolic pressure is not significant in HTN and MetS. Mean value of Mg is 2.09 ± 0.27 and Zn is 1.31 ± 0.32 in test samples these are very low compared with the controls. The group statistics is seen in table 2. Regression analysis of IR performed for Mg, Zn, anthropological characters, BP, other biochemical parameters, and vitamin D. All variables are significant which is proved by Pearson rank correlation. Table 3.

Table-1: Blood Pressure in study population

Blood Pressure	Category	Mean ± SD	p Value	Significance
Systolic BP (mmHg)	Control	125.67 ± 7.28	0.005	S
	Test	134 ± 13.8		
Diastolic BP (mmHg)	Control	82 ± 4.07	0.248	NS
	Test	83.67 ± 6.69		

Table-2: Blood Concentration of Zn and Mg in study population

Blood Concentration	Category	Mean ± SD	p Value	Significance
Zinc	Control	86.27 ± 9.57	0.000	HS
	Test	1.31 ± 0.32		
Magnesium	Control	5.29 ± 1.14	0.000	HS
	Test	2.09 ± 0.27		

Discussion

The MetS refers to the co-occurrence of quite a few known cardiovascular risk factors, together with IR, obesity, atherogenic dyslipidemia and HTN.[8] These states of affairs are unified and share basic mediators, mechanisms and pathways. IR was found to be vital to the pathophysiology of the MetS.

Vitamin D deficiency is widespread and has central role in the pathogenesis of CVD and HTN. If vitamin D value is below 20 ng/dl it is referred as vitamin D deficiency and if it is in the range of 20-30ng/dl vitamin D insufficiency occurs. Normal vitamin D is in the range of 30-100ng/dl. In the Control samples mean value is 36.38 which is normal and in tests mean value is 12.77 which is deficient. The p value is 0.000 which is highly significant, demonstrating that vitamin D deficiency highly noteworthy in the progress of MetS. In this study, TG/ HDL ratio used for assessing IR, and Zn & Mg used for assessing glucose tolerance of the patients. From the mean value of test and control it's clear that Zn and Mg are deficient in the test populations. Mean value of Mg is 2.09 ± 0.27 and Zn is 1.31 ± 0.32 in test samples these are very low compared with the controls.

Table-3: Regression analysis

Parameters		SBP (mmHg)	DBP (mmHg)	Triglycerides (mg/dL)	HDL (mg/dL)	LDL (mg/dL)	VLDL (mg/dL)	Vit. D	Zn	Mg
SBP (mmHg)	Pearson Correlation	1	0.633	0.347	-0.292	0.300	0.329	-0.344	-0.345	0.401
	(2-tailed)		0.000	0.007	0.024	0.020	0.010	0.007	0.007	0.002
DBP (mmHg)	Pearson Correlation	0.633	1	0.324	-0.041	0.283	0.262	-0.107	-0.145	0.076
	(2-tailed)	0.000		0.012	0.758	0.029	0.043	0.416	0.270	0.564
BMI	Pearson Correlation	0.266	0.184	0.399	-0.192	0.467	0.389	-0.593	-0.654	0.512
	(2-tailed)	0.040	0.160	0.002	0.141	0.000	0.002	0.000	0.000	0.000
Vit. D	Pearson Correlation	-0.344	-0.107	-0.531	0.518	-0.547	-0.562	1	0.925	-0.837
	(2-tailed)	0.007	0.416	0.000	0.000	0.000	0.000		0.000	0.000
Zn	Pearson Correlation	-0.345	-0.145	-0.597	0.446	-0.584	-0.616	0.925	1	-0.879
	(2-tailed)	0.007	0.270	0.000	0.000	0.000	0.000	0.000		0.000
Mg	Pearson Correlation	0.401	0.076	0.417	-0.459	0.416	0.442	-0.837	-0.879	1
	(2-tailed)	0.002	0.564	0.001	0.000	0.001	0.000	0.000	0.000	

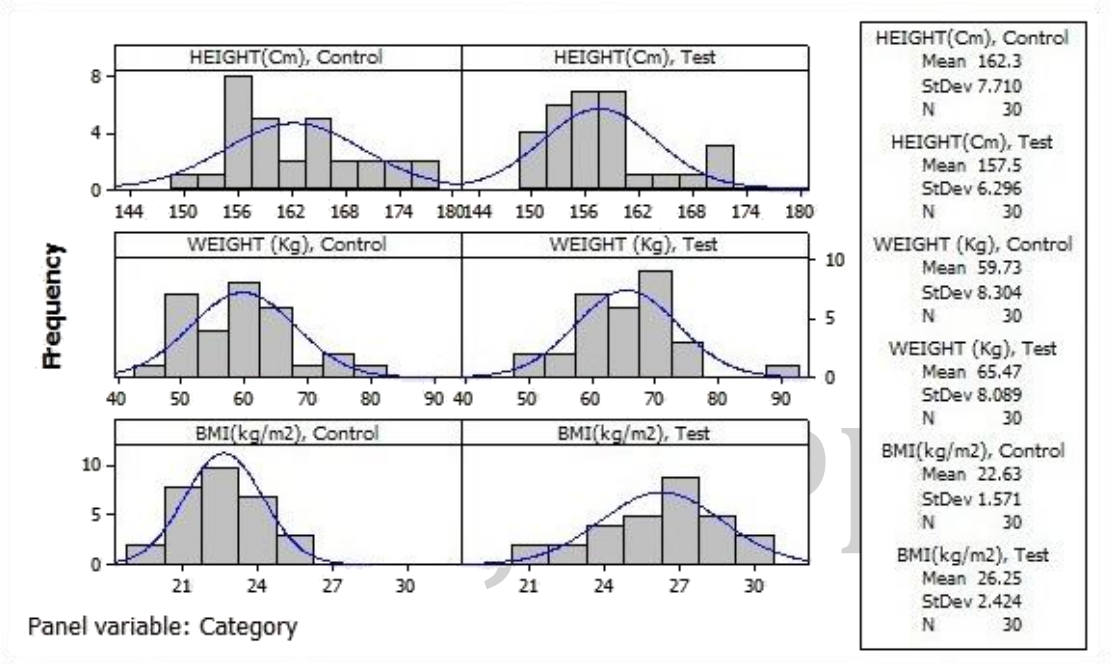

Figure-1: Histogram chart of height, weight, and BMI

Association between risk factors of test and control checked by regression analysis and the severity of significance (non-significant, significant and highly significant) is interpreted by t test. These observations indicated that vitamin D directly or indirectly related to IR and which is the major cause of T2D. The complications of T2D are risk of CVD. Diabetes and CVD are the clinical presentation of Mets.

Conclusion

The present study undertaken with the objectives of correlating the vitamin D deficiency with insulin resistance of individuals having MetS. From this study it can be summarized that Vitamin D deficiency found in persons with MetS. An increase in IR is found in test population compared to control population. Serum Zn and Mg are found to be decreased, may be related to diminishing glucose tolerance. These observations are in agreement with those in similar studies elsewhere. Further studies at the molecular level will help in relating the IR and alterations in vitamin D in persons with MetS.

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