ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 07, Issue, 07, pp.14017-14021, July, 2017

ORIGINAL RESEARCH ARTICLE

Open Access

CORRELATION OF VITAMIN D LEVEL WITH DIFFERENT COMPONENTS OF METABOLIC SYNDROME

[1,*]Nazish Raza, [2]Shadab A. Khan, [3]Abad Khan and [4]Ghausia Ahsan

[1]Department of Gastroenterology, Indira Gandhi Institute of Medical Science, Patna, Bihar, India
[2]Department of Medicine, Jawahar Lal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh, India
[3]Department of cardiology, Sher - I - Kashmir Institute of Medical Sciences, Soura, Srinagar, Jammu & Kashmir, India
[4]Medical Officer, Daudpur, Patna, Bihar, India

ARTICLE INFO

Article History:
Received 25th April, 2017
Received in revised form
19th May, 2017
Accepted 16th June, 2017
Published online 31st July, 2017

Keywords:
Vitamin D,
Metabolic Syndrome,
IDF Criteria.

ABSTRACT

Objecive: The objective of the study to investigate the correlation between vitamin D level with different components of metabolic syndrome.
Patients and Methods: An observational cross-sectional study on 100patients (male=55 and female=45), age range 30-60 year, was performed. Patients underwent physical examination and biochemical testing. Patients included who fulfill the IDF criteria of metabolic syndrome for South Asians. Analysis was performed using SPSS Statistical package for windows (SPSS VERSION 20).
Results: Only 6% of the subjects had optimal level of vitamin D level and67% of subjects are deficient. There was highly significant inverse association between waist circumference, BMI, with vitamin D level in both male and female (p-value 0.001).Increased level of triglyceride level was associated with low vitamin D level (p=0.02) and could not find any association between HDL and vitamin D level (p=0.125). There were inverse association of fasting blood glucose and HbA1C with vitamin D level (p-value 0.014 and <0.001 respectively). No association between systolic and diastolic blood pressure was reported in the study (p-value 0.778 and p-0.563 respectively).
Conclusion: Our results suggest correlation of vitamin D level with some components (waist circumference, serum triglyceride and fasting plasma glucose) of metabolic syndrome.

Corresponding author:

Citation: Nazish Raza, Shadab A. Khan, Abad Khan and Ghausia Ahsan. 2017. "Correlation of vitamin d level with different components of metabolic syndrome.", *International Journal of Development Research*, 7, (07), 14017-14021.

INTRODUCTION

Health concerns associated with low serum vitamin D are on the rise. Vitamin D is required not only for bone health (Holick, 1971) but also plays a role in a range of ailments such as autoimmune disease (Hypponen *et al*., 2001; Arnson *et al*., 2007), cardiovascular disease (CVD) (Maki, 2009; Hypponen, 2008; Baz-Hecht *et al*., 2010), type 2 diabetes mellitus (T2DM) (Baz-Hecht, 2010), hypertension (Judd *et al*., 2008), depression (Ganji, 2010), (Hoogendijk, 2008) and certain types of cancer (8). There is emerging evidence that low serum vitamin D concentration is associated with the development of CVD and mortality (Maki, 2009; Hypponen *et al*., 2008).

An inverse association between the prevalence of metabolic syndrome and vitamin D level has been established (Ford *et al*., 2005; Reis *et al*., 2008) Also, low serum vitamin D concentrations have been associated with various components of metabolic syndrome. This study focuses on the association between vitamin D level and components of metabolic syndrome which are central obesity, fasting plasma glucose, hypertension and dyslipidemia.

AIM OF THE STUDY: The aim of this study was to investigate the correlation between vitamin D concentration and components of metabolic syndrome patients.

MATERIAL AND METHODS

TYPE AND PLACE OF STUDY: The present study is a cross-sectional, observational study of 100 patients of age group 30-60year (mostly in between 51-60year) attendingendocrinology, general medicine OPD, or admitted to medical wards in Jawahar Lal Nehru Medical College, AMU; Aligarh. INCLUSION CRITERIA: Patients included were in age group between 30 to 60 year and who fulfill the International Diabetes Federation (IDF) criteria of metabolic syndrome for South Asians. IDF criteria of metabolic syndrome for south Asian population include criterion for central obesity [waist circumference ≥ 90 cm (male), ≥ 80cm (female)] with at least two additional factors out of four - 1) *Reduced HDL Cholesterol:*< 40 mg/dL (1.03 mmol/L) in males, < 50 mg/dL (1.29 mmol/L) in females, or specific treatment for this lipid abnormality. 2) *Raised Triglycerides:*> 150 mg/dL (1.7 mmol/L), or specific treatment for this lipid abnormality. 3) *Raised Blood Pressure (BP):* systolic BP > 130 or diastolic BP >85 mm Hg, or treatment of previously diagnosed hypertension. 4) *Raised Fasting Plasma Glucose (FPG):*>100 mg/dL (5.6 mmol/L), or previously diagnosed type 2 diabetes**.**

EXCLUSION CRITERIA: Those who did not fulfill the inclusion criteria.

ANTHROPOMETRIC MEASUREMENT AND LABORATORY ANALYSIS: Study included clinical, physical and biochemical data. Clinical and physical data included –weight, height, body mass index, hip and waist circumference, systolic and diastolic blood pressure. Biochemical data included – fasting blood glucose, triglycerides, total cholesterol, low density lipid (LDL), high density lipid (HDL), HbA1C, and 25-hydroxy vitamin D (25-OH D) level. Vitamin D status was classified as: Sufficient: 25-OH D ≥ 75nmol/l Insufficient: 25-OH D < 75 ≥ 50 nmol/l Deficient: 25-OH D ≤ 50nmol/l.

STATISTICAL ANALYSIS: Statistical Analysis was performed using SPSS Statistical package for windows (SPSS VERSION 20). All p-values were two-tailed and p values < 0.05 were considered statistically significant.

RESULTS

Total number of study population was 100, out of which male was 55 and female was 45 in number. Most males were in age group 51to 60 year (45%), whereas most females were also in similar age group51to 60 year (24%).

Figure 1. Baseline Characteristics Of Study Subject

Base line characteristics	Mean	Std. error of mean	Std. deviation	Range
Age(year)	53.83	0.656	6.56	30.00
Weight(kg)	78.61	0.939	9.39	44.00
BMI(mg/kg²)	29.44	0.332	3.32	13.56
w.c.(cm)	103.11	0.922	9.22	39.00
SBP(mmHg)	161.42	1.096	10.96	52.00
DBP(mmHg)	94.04	0.496	4.96	30.00
FBS(mg/dl)	144.33	2.219	22.19	96.00
TG(mg/dl)	176.85	3.873	38.73	200.00
HDL(mg/dl)	39.21	0.415	4.15	20.00
LDL(mg/dl)	131.31	1.678	16.78	119.00
HbA1c(%)	8.09	0.132	1.32	6.30
25(OH)D (nmol/l)	44.79	1.260	12.60	51.64

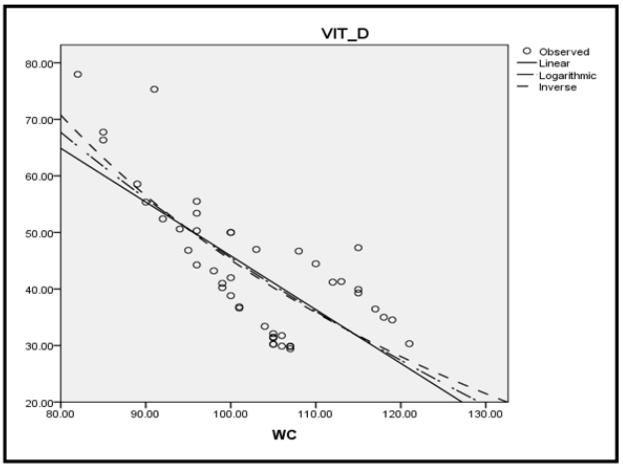

Figure 2: Showing association between vitamin d level and waist circumference

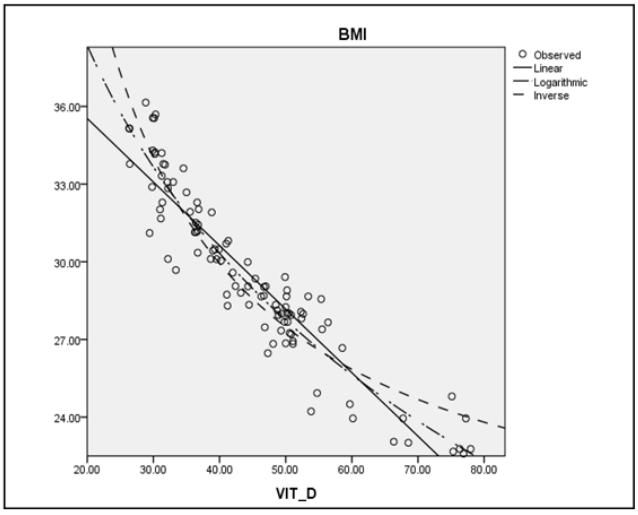

Figure 3. showing association between vitamin d level and body mass index

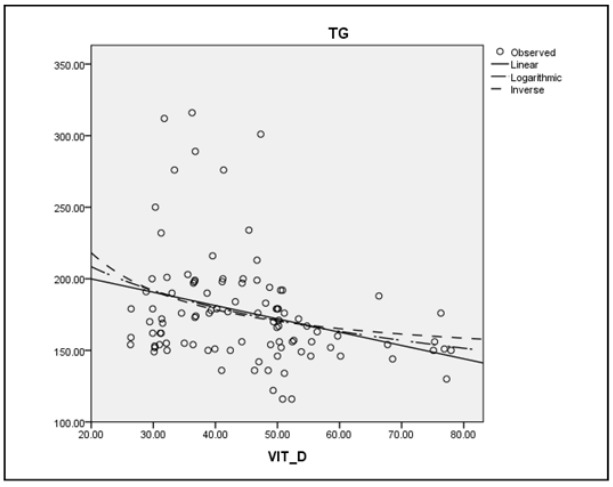

Figure 4. Showing association between vitamin d level and serum triglyceride level

Mean age of the total study population, male group and female group was 53.83, 55.35, 51.98 year respectively. Sufficient group depicted 6%, insufficient group 27% and deficient group 67% of the study population.

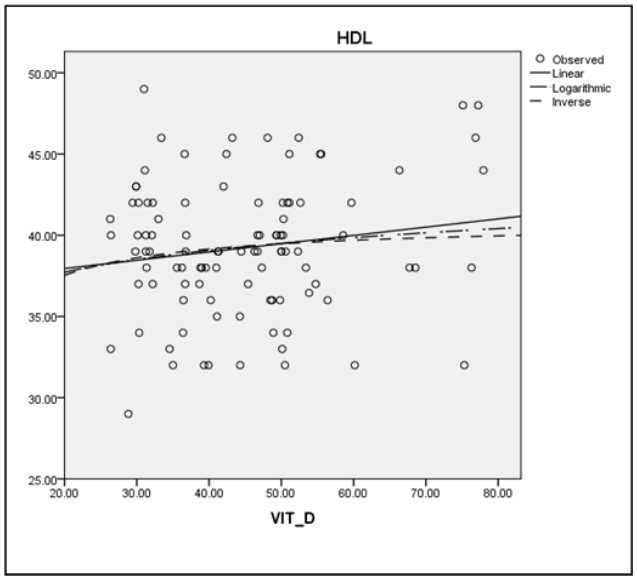

Figure 5. showing association between vitamin d level and hdl level

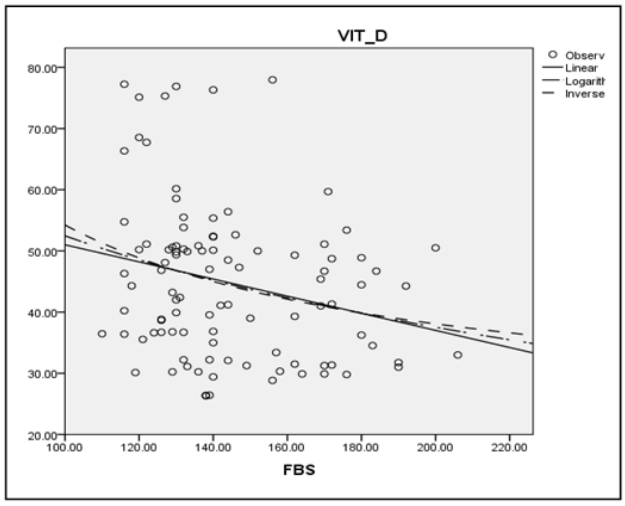

Figure 6. showing association between vitamin d level and fasting blood sugar

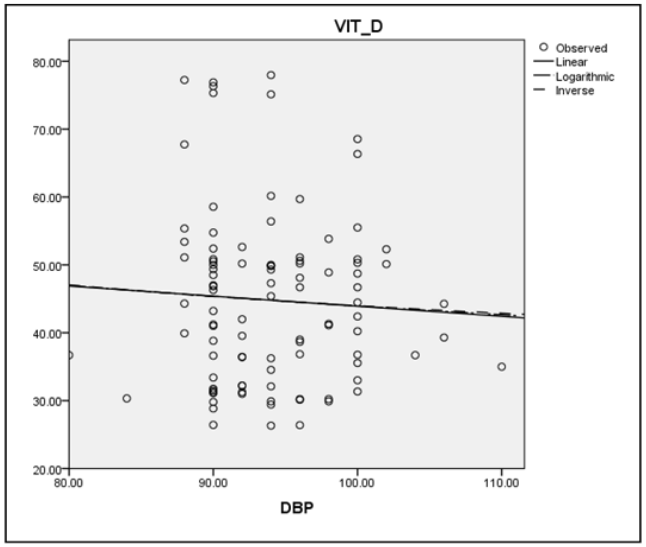

Figure 7: showing association between vitamin d level and diastolic blood pressure

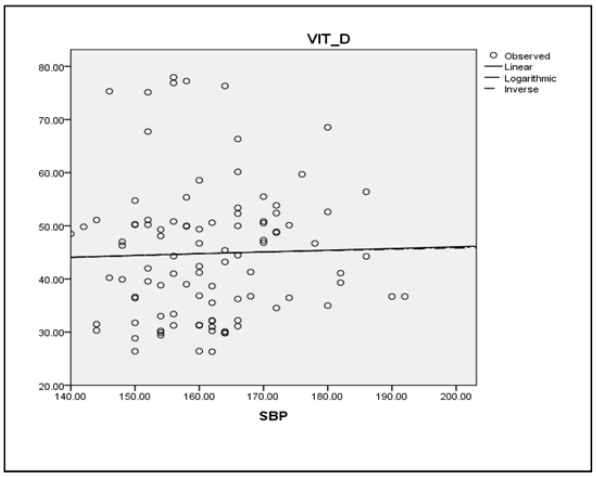

Figure 8. Showing association between vitamin d level and systolic blood pressure

We could not find any statistical significant association between age and vitamin D level (r =0.094, p=0.354) in study subjects. Mean waist circumference (in cm) of male 105.87 ± 1.29 and of female 102.51±9.44. There is highly significant association between waist circumference with vitamin D level(p-value <0.001) in both male and female. Increased waist circumference was associated with low level of vitamin D. Deficient group has comparatively higher waist circumference than insufficient and sufficient group. Mean body mass index (BMI) of was 29.44±3.32 kg/m^2. Higher level of BMI was significantly associated with low level of vitamin D level (p-value<0.001).Meantriglyceride level was 176.87± 38.73 mg/dl. Increased level of triglyceride level was associated with low vitamin D level (p=0.02). Mean HDL level was 39.21± 4.15mg/dl and could not find any association between HDL and vitamin D level (p=0.125). Mean fasting blood glucose and mean HbA1C of study subjects was 144.33±22.19 mg/dl and 8.09±1.32% respectively. There were inverse association of fasting blood glucose and HbA1C with vitamin D level (p-value 0.014and <0.001 respectively). Mean systolic and diastolic blood pressure was 161.42±10.96mmHg and 94.04±4.96mmHg respectively. No association between systolic (p=0.778) and diastolic blood pressure (p=0.563) with vitamin D level was reported in the study.

DISCUSSION

In our cross sectional, observational study conducted in 100 patients of metabolic syndrome we concluded that 67% patients were Vitamin D deficient. In the study population mean 25(OH) D level was 44.79±12.6 nmol/l. In the previous studies by Ling *et al*. (2009) and Hossein-Nezhad *et al*. (2009) mean 25(OH)D level was 40.4 nmol/l and 31.33±21.45 nmol/l. This difference of result was because of small sample size of our study and study population of current study was from different ethnic group than those of previous studies. Several studies showing an inverse association between concentrations of vitamin D and the prevalence of the metabolic syndrome (Reis, 2009; Ford *et al*., 2005; Chiu *et al*., 2004; Lind *et al*., 1988). In earlier studies by Fauci *et al*. (2008) and Ford *et al* (2004) prevalence of metabolic syndrome increases with age. In our study we could not find any association between age distribution of study population and vitamin D level of the study population (p=0.354).There was highly significant inverse association between waist circumference and BMI with vitamin D level in both male and female i.e; subjects with low level of vitamin D level had high waist circumference and

BMI.HUNT study, Szmitko *et al*. (2006) and Ford *et al*. (2004) also show that the increased waist circumference is associated with low vitamin D level (28,22). Also, there was significant inverse association between triglyceride level and vitamin D level but there is no association between HDL and vitamin D level. Skaaby *et al*. (2012) , Ford *et al*. (2005), Brauser *et al*. (2013) and udo *et al*. (2013) also showed that high level of triglyceride associated with low vitamin D level andcontrasted with result of Maki *et al*. (2009) which showed low serum vitamin D independently associated with Metabolic syndrome and with HDL. High level of fasting plasma glucose and HbA1C was associated with low level of vitamin D.W Garry John *et al*. (185), Ford *et al*. (2004) , Yin *et al*. (2012), Brauser *et al*(36) and udo *et al*. (2013) has been reported similar results. But, Christine *et al*. (2011) has been reported contrast result and showed that there is no significant association between fasting blood glucose and vitamin D level.Current study has reported mean HbA1c 8.09±1.32%. Anne-Thea McGill *et al*. (2008) has been reported mean 5.25±0.82% and Christine *et al*. (2011) reported 5.9%. In current study there is highly significant association between HbA1c and vitamin D level. This was further supported by study of Christine *et al*. (2011) but in contrast Anne-Thea McGill *et al*. (2008) showed there was no association between these two. We could not find any association of systolic and diastolic blood pressure with vitamin D level. Maki *et al*. (2009) and Kilic *et al* (35) have also been reported not any association between them.

Conclusion

This study conclude that some components of metabolic syndrome - waist circumference, triglyceride level and fasting plasma glucose- showed association with vitamin D level while other components-HDL level, systolic and diastolic blood pressure-did not show any association with vitamin D level. In the future, randomized controlled trials are needed to establish a cause-effect relationship between vitamin D deficiency, obesity and its metabolic consequence and to evaluate the use the vitamin D3 in metabolic syndrome patients. The principal limitation of our study was its cross-sectional design, and thus the causative nature of the association cannot be established. In addition, this study was based on a single measurement of vitamin D.

Acknowledgments

I wish to express my sincere gratitude to all whom in one way or another made the production of this article possible.

Abbreviations

CVD-cardiovascular disease, IDF-international diabetes federation, BMI-body mass index, HDL-high density lipid, LDL-low density lipid, TG-triglyceride, HBA1c-glycated hemoglobin, T2DM-type2 diabetes mellitus, OPD-out patient department, AMU-aligarhmuslim university, BP-blood pressure, SBP-systolic blood pressure, DBP-diastolic blood pressure, FPG-fasting plasma glucose, FBS-fasting blood sugar, 25 OH D-25 hydroxy vitamin D, WC-waist circumference.

REFERENCES

Alvarez JA, Ashraf A. 2010. Role of vitamin d in insulin secretion and insulin sensitivity for glucose homeostasis. *Int J Endocrinol.* 2010; Article ID 351385.

Anne-Thea McGill, Joanna M Stewart, Fiona E Lithander, 2008. Caroline M Strik1 and Sally D Poppitt. Relationships of low serum vitamin D3 with anthropometry and markers of the metabolic syndrome and diabetes in overweight and obesity Nutrition Journal, 7:4 doi:10.1186/1475-2891-7-4

Arnson Y, Amital H, Shoenfeld Y. 2007. Vitamin D and autoimmunity: new aetiological and therapeutic considerations. *Ann Rheum Dis.* Sep; 66(9):1137-1142.

Baz-Hecht M, Goldfine AB. 2010. The impact of vitamin D deficiency on diabetes and cardiovascular risk. CurrOpinEndocrinol Diabetes Obes. Apr; 17(2):113-119.

Brauser D. 2013. Binge Eating More Likely to Lead to Metabolic Syndrome in Men. Medscape Medical News. Available at http://www.medscape.com/ viewarticle/ 811732. Accessed October 7.

Chiu KC, Chu A, Go VL, Saad MF. 2008. Hypovitaminosis D is associated with insulin resistance and beta cell dysfunction. *Am J ClinNutr.* May 2004; 79(5):820-825.

Christine Dalgård, Maria Skaalum Petersen, Pal Weihe, and Philippe Grandjean. 2011. DMSC Vitamin D Status in Relation to Glucose Metabolism and Type 2 Diabetes in Septuagenarians Received November 3, 2010. Accepted March 22. © 2011 by the American Diabetes Association

Cook S, Weitzman M, Auinger P, Nguyen M, Dietz WH. 2003. Prevalence of a metabolic syndrome phenotype in adolescents: findings from the third National Health and Nutrition Examination Survey, 1988-1994. *Arch PediatrAdolesc Med.* Aug 157(8):821-827.

DamlaCoksertKilic, Gonca Tamer, Safiye Arik and AytekinOguz Metabolic Syndrome is More Common in Patients with 25 Hydroxy Vitamin D Levels Less than 10 ng/ml http://dx.doi.org/10.4172/scientificreports.

Duncan GE, Li SM, Zhou XH. 2004. Prevalence and trends of a metabolic syndrome phenotype among u.s. Adolescents, 1999-2000. *Diabetes Care.* Oct 27(10):2438-2443.

Fauci, Anthony S. 2008. Harrison's principles of internal medicine. McGraw-Hill Medical.

Ford ES, Ajani UA, McGuire LC, Liu S. 2005. Concentrations of serum vitamin D and the metabolic syndrome among U.S. adults. *Diabetes Care.* May; 28(5):1228-1230.

Ford ES, Giles W, Mokdad A. 2004. Increasing prevalence of the metabolic syndrome among US adults. Diabetes Care; 27:2444–2449.

Ganji V, Milone C, Cody MM, McCarthy F, Wang YT. 2010. Serum vitamin D concentrations are related to depression in young adult US population: the Third National Health and Nutrition Examination Survey. *Int Arch Med.* Nov 11; 3(1):29-30.

Holick MF, Schnoes HK, Deluca HF, Suda T, Cousins RJ 1971. "Isolation and identification of 1,25-dihydroxycholecalciferol. A metabolite of vitamin D active in intestine". *Biochemistry*10 (14): 2799–804.

Hoogendijk WJ, Lips P, Dik MG, Deeg DJ, Beekman AT, Penninx BW. 2008. Depression is associated with decreased 25-hydroxyvitamin D and increased parathyroid hormone levels in older adults. *Arch Gen Psychiatry.* May; 65(5):508-512.

Hossein-Nezhad, A., KhoshniatNikoo, M., Maghbooli, Z.,Karimi, F., Mirzaei, K., Hosseini A., Larijani, B. 2009. Relationship between serum Vitamin D concentration and Metabolic Syndrome among Iranian Adults Population. Endocrinology and Metabolism Research Center, Tehran University of Medical Sciences,Tehran, Iran Received 26 May 2009; Revised 31 Oct 2009; Accepted 4 Nov.

Huh SY, Gordon CM. Vitamin D deficiency in children and adolescents: epidemiology, impact and treatment. *Rev EndocrMetabDisord.* Jun 9(2):161-170.

Hypponen E, Boucher BJ, Berry DJ, Power C. 2008. 25-hydroxyvitamin D, IGF-1, and metabolic syndrome at 45 years of age: a cross-sectional study in the 1958 British Birth Cohort. *Diabetes.* Feb 57(2):298-305.

Hypponen E, Laara E, Reunanen A, Jarvelin MR, Virtanen SM. 2001.Intake of vitamin D and risk of type 1 diabetes: a birth-cohort study. *Lancet.* Nov 3; 358(9292):1500-1503.

Judd SE, Nanes MS, Ziegler TR, Wilson PW, Tangpricha V. 2008. Optimal vitamin D status attenuates the age-associated increase in systolic blood pressure in white Americans: results from the third National Health and Nutrition Examination Survey. *Am J ClinNutr.* Jan; 87(1):136-14

Lee S, Bacha F, Gungor N, Arslanian S. 2008. Comparison of different definitions of pediatric metabolic syndrome: relation to abdominal adiposity, insulin resistance, adiponectin, and inflammatory biomarkers. *J Pediatr.* Feb 152(2):177-184.

Lind L, Wengle B, Wide L, Sorensen OH, Ljunghall S. 1988. Hypertension in primary hyperparathyroidism--reduction of blood pressure by long-term treatment with vitamin D (alphacalcidol). A double-blind, placebo-controlled study. Am J Hypertens. Oct; 1(4 Pt 1):397-402.

Ling Lu, Zhijie Yu, An Pan, Frank B. Hu, Oscar H. Franco, Huaixing Li, Xiaoying Li, XilinYang,Yan Chen, Xu Lin. 2009. Plasma 25-Hydroxyvitamin D Concentration and Metabolic Syndrome Among Middle-Aged and Elderly Chinese Individuals. DIABETES CARE, VOLUME 32, NUMBER 7, JULY.

Mai XM, Chen Y, Camargo CA 2012. Jr, Langhammer A Cross-Sectional and Prospective Cohort Study of Serum 25-Hydroxyvitamin D Level and Obesity in Adults: The HUNT Study Am J Epidemiol. Feb 6

Maki KC, Rubin MR, Wong LG, *et al*. 2009. Serum 23-hydroxyvitamin D is independently associated with high-density lipoprotein cholesterol and the metabolic syndrome in men and women. *J ClinLipidology.* 3:289-296.

Oliveira AC, Oliveira AM, Adan LF, Oliveira NF, Silva AM, Ladeia AM. 2008. Creactive protein and metabolic syndrome in youth: a strong relationship? *Obesity(Silver Spring)*. May; 16(5):1094-1098.

Reinehr T, de Sousa G, Alexy U, Kersting M, Andler W. 2007. Vitamin D status and parathyroid hormone in obese children before and after weight loss. *Eur J Endocrinol.* Aug; 157(2):225-232.

Reis JP, von Muhlen D, Miller ER, 2008. 3rd. Relation of 25-hydroxyvitamin D and parathyroid hormone levels with metabolic syndrome among US adults. *Eur JEndocrinol.* Jul; 159(1):41-48.

Reis JP, von Muhlen D, Miller ER, 3rd, Michos ED, Appel LJ. 2009. Vitamin D Status and Cardiometabolic Risk Factors in the United States Adolescent Population. *Pediatrics.* Aug 3:e371-e379.

Skaaby, T, Husemoen LL, Pisinger C, Jorgensen T, *et al*. 2012. Vitamin D Status and Changes in Cardiovascular Risk Factors: A Prospective Study of a General Population Cardiology. 123(1): 62-70

Spina CS, Tangpricha V, Uskokovic M, Adorinic L, Maehr H, Holick MF. 2006. Vitamin D and cancer. *Anticancer Res.* Jul-Aug 26(4A):2515-2524.

Szmitko PE, Verma S. 2006. C-reactive protein and the metabolic syndrome: useful addition to the cardiovascular risk profile? J CardiometabSyndr. Winter; 1(1):66-69; quiz 70-61.

Teegarden D, Donkin SS. 2009. Vitamin D: emerging new roles in insulin sensitivity. *Nutr Res Rev.* Jun; 22(1):82-92.

Thivel D, Malina RM, Isacco L, Aucouturier J, Meyer M, Duche P. 2009. Metabolic syndrome in obese children and adolescents: dichotomous or continuous? *MetabSyndrRelatDisord.* Dec 7(6):549-555.

Udo T, McKee SA, White MA, Masheb RM, Barnes RD, Grilo CM. 2013. Sex differences in biopsychosocial correlates of binge eating disorder: a study of treatment-seeking obese adults in primary care setting. Gen Hosp Psychiatry. Aug 19; [Medline].

Xiao Yin, Qiang Sun, Xiuping Zhang, Yong Lu, Chao Sun, Ying Cui and Shaolian Wang. 2012. Serum 25(OH)D is inversely associated with metabolic syndrome risk profile among urban middle-aged Chinese population.Yin *et al*. Nutrition Journal, 11:68 http://www. nutritionj. com/ content / 11/1/68