BJMHR
British Journal of Medical and Health Research
Journal home page : www.bjmhr.com

Estimation of Vitamin D among Diabetic, Hypertensive, and Obese Sudanese Individuals

Razan M. Elabass[1], AbdElkarim A. Abdrabo[1]*
1 Department of clinical chemistry, Faculty of medical laboratory Sciences, Alneelain University-Khartoum-Sudan

ABSTRACT

This study was carried out to analyze and compare the concentration of vitamin D in the metabolic syndrome's individuals (diabetics, hypertensive, obese) with normal individuals. The study involved a group of healthy individuals as controls (N = 95, age range was 18-68 years) matched with a test group of metabolic syndrome's individuals (N = 65, age range was 11-61years). The groups contain 130 female and 130 male. The serum 25-OH vitamin D level was estimated using ELISA method. Appropriate statistical tests were used to assess significant difference in the means of the estimated concentrations between patients and the control group. The mean serum level of vitamin D significantly lower in metabolic syndrome's groups (diabetics: 20.32±12.46 ng/ml, hypertensive: 24.50±10.69 ng/ml, obese: 21.60±6.75 ng/ml) when compared with control group (37.52±11.14 ng/ml), $P< 0.000$. It may be useful to do early screening and treatment of hypovitaminosis D in metabolic syndrome's individuals to prevent the vitamin D deficiency and its complications.

Keywords: Metabolic syndrome, vitamin D, diabetes, hypertension, obesity.

*Corresponding Author Email: abdrabokarim@hotmail.com
Received 25 October 2014, Accepted 1 November 2014

Please cite this article as: Abdrabo AA *et al*., Estimation of Vitamin D among Diabetic, Hypertensive, and Obese Sudanese Individuals. British Journal of Medical and Health Research 2014.

INTRODUCTION

Metabolic syndrome is a group of risk factors for heart disease, include high blood pressure, high blood sugar, high cholesterol level, and increase abdominal fats[1]. Heart disease, diabetes, and stroke increases with the number of metabolic risk factors you have. In general, a person who has metabolic syndrome is twice as likely to develop heart disease and five times as likely to develop diabetes as someone who doesn't have metabolic syndrome[2].

Vitamin D is a fat-soluble vitamin that is naturally present in very few foods, added to others, and available as a dietary supplement. It is also produced endogenously when ultraviolet rays from sunlight strike the skin and trigger vitamin D synthesis[3-4]. Vitamin D promotes calcium absorption in the gut and maintains adequate serum calcium and phosphate concentrations to enable normal mineralization of bone and to prevent hypocalcaemic tetany. It is also needed for bone growth and bone remodeling by osteoblasts and osteoclasts[4]. Rickets and osteomalacia are classic vitamin D deficiency diseases. In children, vitamin D deficiency causes rickets, which is a softening or weakening of the bones. In adults, vitamin D deficiency can lead to osteomalacia, which causes weak bones and muscles[5]. Vitamin D has other roles in the body, including modulation of cell growth, neuromuscular and immune function, and reduction of inflammation[6].

There is growing evidence that vitamin D deficiency could be a contributing factor in the development of both type 1 and type 2 diabetes[7]. Also several epidemiologic and clinical studies have suggested an association between vitamin D deficiency and cardiovascular risk factors (e.g. hypertension) [8]. Observational studies have reported an increased risk of vitamin D deficiency in those who are obese[9]. So the aim of present study was to analyze and compare the concentration of vitamin D in the serum of patients with diabetes, hypertension, and obese individuals.

MATERIALS AND METHODS

This is a cross sectional case control study conducted in Khartoum state during the period from March 2014 to July 2014. The study was approved by AlneelainUniversity Ethics Committee and all subjects gave informed consent (Based on Helsinki Declaration).

The case group was composed of 260 patients, while the control group was composed of 95 apparently healthy individuals. Patients with conditions which may affect vitamin D level were excluded.

The data was collected by using a direct interviewing questionnaire. Medical information was collected from the patient with help of the physician. The questionnaire was used to collect data regarding name, age, gender, diseases (diabetes, hypertension, obesity), Duration of disease, and BMI.

Five ml venous blood was collected from each subject and poured into plain containers, and centrifuged at 3200 rpm for three minutes to obtain serum. Sera obtained were analyzed for 25-OH vitamin D level using ELISA system, at Total Lab Care-Khartoum-Sudan.

Statistical Analysis

Statistical evaluation was performed using the Microsoft Office Excel (Microsoft Office Excel for windows; 2007) and SPSS (SPSS for windows version 19). Normal distribution of the studied variables was examined using Kolmogorov-Smirnova and Shapiro-Wilk tests. Results were expressed as mean±standard deviation (M±SD). Unpaired T-test and Mann-Whitney U test were used to assess significant difference in the means of the studied variables in patients and control.

RESULTS AND DISCUSSION

The age range of control group was 18-68 years (38.69±13.89 years), and of diabetics group was 20-55 years (42.28±9.13 years), while age range of hypertensive group was 37-61 years (50.20±7.97 years), and of obese group was 23-45 years (24.85±4.79 years) and the BMI > 30kg/m^2 (33.94±2.79kg/m^2). The ages of patient groups were proportional to control group, P <0.05.

This study estimated the serum concentrations of vitamin D level in case and control subjects. The laboratory data and statistical findings showed that serum vitamin D levels in metabolic disorders individuals were significantly lower than those of control. The mean value of vitamin D level in control group was (37.52±11.14 ng/ml), and in metabolic disorders groups were (diabetics: 20.32±12.46 ng/ml, hypertensive: 24.50±10.69 ng/ml, obese: 21.60±6.75 ng/ml), (P =0.000), as shown in table 1.

Statistical significant differences in vitamin D level were observed in hypertensive, obese and control groups according to gender. Females have lower vitamin D level (hypertensive: 22.77±9.66 ng/ml, obese: 18.58±6.34 ng/ml, control: 33.66±9.17 ng/ml) compared to males (hypertensive: 40.00±7.07 ng/ml, obese: 26.12±4.64 ng/ml, control: 44.75±11.42 ng/ml), (P= 0.026, 0.01, and 0.019, respectively). In contrast there is no difference in vitamin D level between male and female in diabetic group (female: 20.08±12.16 ng/ml , male: 20.53±13.23 ng/ml, P = 0.93).

The duration of disease in diabetic group has reverse correlation with vitamin D level (r=0.54, P= 0.031), but in hypertensive group there is no correlation (r=0.034, P= 0.322).

In obese individuals, vitamin D level negatively correlates with BMI (r=0.422, P= 0.002).

The classic function of vitamin D is to increase the intestinal absorption of calcium for proper mineralization of bone[10]. Without sufficient vitamin D, bones can become malformed. Vitamin D sufficiency prevents rickets in children and osteomalacia in adults. Together with

calcium, vitamin D also helps protect older adults from osteoporosis[11].

Table 1, Means of age and vitamin D in study populations

Variables	Diabetics No (86)	Hypertensive No (87)	Obese No (87)	Control No (95)	P.values		
Age (years)	42.28±9.13	50.20±7.97	24.85±4.79	38.69±13.89	DM vs Control	HTN vs Control	Obese vs Control
Vit D (M±SD)	20.32±12.5	24.50±10	21.60±6.75	37.52±11.14	0.000	0.000	0.000

Table 2, Concentrations of vitamin D in study population according to gender

Gender	DM	HTN	Obese	Control
Male	20.53±13.23	40.00±7.07	26.12±4.64	44.75±11.42
Female	20.08±12.16	22.77±9.66	18.58±6.34	33.66±9.17
P.values	0.93	0.026	0.01	0.019

The present study indicated that serum vitamin D level was significantly lower in patients with metabolic diseases (diabetes, hypertension, obesity) compared to healthy individuals this is in agreement with many studies[12-14].

Patients with diabetes had significantly decreased vitamin D levels, this can be explained by: Firstly, the β-cell in the pancreas that secretes insulin has been shown to contain vitamin D receptors as well as the alpha hydroxylase enzyme[15]. Vitamin D deficiency leads to reduced insulin secretion. Low vitamin D may diminish calcium's ability to affect insulin secretion[16]. Other potential mechanisms associated with vitamin D and diabetes include improving insulin action by stimulating expression of the insulin receptor, enhancing insulin responsiveness for glucose transport, having an indirect effect on insulin action potentially via a calcium effect on insulin secretion, and improving systemic inflammation by a direct effect on cytokines[17].

Patients with hypertension had significantly decreased vitamin D level. Several mechanisms might explain the observed association of vitamin D plasma levels and hypertension. Intriguingly, vitamin D and its analogs inhibit renin secretion and activity, thereby acting as a negative endocrine regulator of the renin-angiotensin system[18]. Indeed, inhibition of 1,25-dihydroxyvitamin D3 synthesis increase renin expression. In addition, vitamin D regulation of renin expression is independent of calcium metabolism and 1,25(OH)2D3 suppresses renin transcription by a vitamin D receptor–mediated mechanism in cell cultures. Moreover, vitamin D has direct effects on the vascular wall, where it exerts antiproliferative effects on vascular smooth muscle cells[19].

Obese patients had significantly decreased vitamin D level. This is in agreement with many observational studies which had reported an increased risk of vitamin D deficiency in those who are obese; however, the underlying explanations and direction of causality are unclear

(9). Vitamin D is stored in the adipose tissue and, hence, perhaps the most likely explanation for the association is that the larger storage capacity for vitamin D in obese individuals leads to lower circulating 25-hydroxyvitamin D concentrations[20].

CONCLUSION

The findings of this study showed that the hypovitaminosis D was associated with metabolic diseases in Sudan. It may be useful to do early screening and treatment of hypovitaminosis D in such individuals to prevent the vitamin D deficiency and its complications.

DISCLOSURE

There are no conflicts of interest in this work.

REFERENCES

1. Grundy SM, Brewer HB, Jr., Cleeman JI, Smith SC, Jr., Lenfant C. Definition of metabolic syndrome: report of the National Heart, Lung, and Blood Institute/American Heart Association conference on scientific issues related to definition. Arterioscler Thromb Vasc Biol 2004 Feb;24(2):e13-e18.
2. Lorenzo C, Okoloise M, Williams K, Stern MP, Haffner SM. The metabolic syndrome as predictor of type 2 diabetes: the San Antonio heart study.1Diabetes Care 2003 Nov;26(11):3153-9.
3. Institute of Medicine. Dietary Reference Intakes for Calcium and Vitamin D. Washington, DC: National Academy Press; 2010 Oct 10 .
4. Cranney A, Horsley T, O'Donnell S, Weiler H, Puil L, Ooi D, et al. Effectiveness and safety of vitamin D in relation to bone health. Evid Rep Technol Assess (Full Rep) 2007 Aug;(158):1-235.
5. Zurlo JV, Wagner SR. Incidental rickets in the emergency department setting. Case Rep Med 2012;2012:163289.
6. Norman AW, Henry HH. Vitamin D. In: Bowman BA, Russell RM, eds. Present Knowledge in Nutrition, 9th ed. Washington DC: ILSI Press, 2006.
7. Zhang R, Naughton DP. Vitamin D in health and disease: current perspectives. Nutr J. 2010 Dec 8;9:65.
8. Ku YC, Liu ME, Ku CS, Liu TY, Lin SL. Relationship between vitamin D deficiency and cardiovascular disease. World J Cardiol. 2013 Sep 26;5(9):337-46.
9. Wortsman J, Matsuoka LY, Chen TC, Lu Z, Holick MF. Decreased bioavailability of vitamin D in obesity. Am J Clin Nutr. 2000 Sep;72(3):690-3. Erratum in: Am J Clin Nutr. 2003 May;77(5):1342.
10. Wacker M, Holick MF. Vitamin D - effects on skeletal and extraskeletal health and the need for supplementation. Nutrients. 2013 Jan 10;5(1):111-48.

11. Bischoff-Ferrari HA, Dawson-Hughes B, Staehelin HB, Orav JE, Stuck AE, Theiler R, et al. Fall prevention with supplemental and active forms of vitamin D: a meta-analysis of randomised controlled trials. BMJ. 2009 Oct 1;339:b3692.
12. Orgaz-Molina J, Magro-Checa C, Rosales-Alexander JL, Arrabal-Polo MA, Buendia-Eisman A, Raya-Alvarez E, et al. Association of 25-hydroxyvitamin D serum levels and metabolic parameters in psoriatic patients with and without arthritis. J Am Acad Dermatol 2013 Dec;69(6):938-46.
13. Lee SH, Kim SM, Park HS, Choi KM, Cho GJ, Ko BJ, et al. Serum 25-hydroxyvitamin D levels, obesity and the metabolic syndrome among Korean children. Nutr Metab Cardiovasc Dis 2013 Aug;23(8):785-91.
14. Rafraf M, Hasanabad SK, Jafarabadi MA. Vitamin D status and its relationship with metabolic syndrome risk factors among adolescent girls in Boukan, Iran. Public Health Nutr 2014 Apr;17(4):803-9.
15. Badawi A, Sayegh S, Sadoun E, Al-Thani M, Arora P, Haddad PS. Relationship between insulin resistance and plasma vitamin D in adults. Diabetes Metab Syndr Obes. 2014 Jul 7;7:297-303.
16. Sung CC, Liao MT, Lu KC, Wu CC. Role of vitamin D in insulin resistance .J Biomed Biotechnol 2012;2012:634195.
17. Harinarayan CV. Vitamin D and diabetes mellitus. Hormones (Athens). 2014 Apr-Jun;13(2):163-81.
18. Kota SK, Kota SK, Jammula S, Meher LK, Panda S, Tripathy PR, Modi KD. Renin-angiotensin system activity in vitamin D deficient, obese individuals with hypertension: An urban Indian study. Indian J Endocrinol Metab. 2011 Oct;15 Suppl 4:S395-401.
19. Al M, I, Patel R, Murrow J, Morris A, Rahman A, Fike L, et al. Vitamin D status is associated with arterial stiffness and vascular dysfunction in healthy humans. J Am Coll Cardiol 2011 Jul 5;58(2):186-92.
20. Cândido FG, Bressan J. Vitamin D: link between osteoporosis, obesity, and diabetes? Int J Mol Sci. 2014 Apr 17;15(4):6569-91.