Original Article

Vitamin D level in non-diabetic adult people with metabolic syndrome

Bahman Ghaderian, Zivar Shirinpour*, Armaghan Moravej Aleali, Seyed Mahmoud Latifi, Seyed Peyman Payami, Reza Amani, Marzieh Ghasemi, Mitra Zaheri Birgani

Health Research Institute, Diabetes Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Khuzestan, Iran

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ABSTRACT

Aims: The aim of this study is comparison the level of Vitamin D deficiency in non-diabetic adult people with metabolic syndrome in Ahvaz.

Material & methods: This descriptive study investigation carried out on a population of individuals with metabolic syndrome. ATPIII criteria were used for metabolic syndrome. Serum concentration of 25 (OH Vit D) of below 5 ng/ml was considered as severe deficiency, 5–10 ng/ml as average deficiency, 10–20 ng/ml as slight deficiency, and above 20 ng/ml as normal.

Results: The results showed mean level of vitamin D was not significant in individuals with and without HTN and in different genders (P > 0.5). No significant difference was found between case and control groups in terms of the distribution level of vitamin D (P > 0.5). In both groups, the difference between blood pressure (systole and diastole) was not significant in cases of severe and average deficiencies. But it was significant different in the group with slight deficiency (P = 0.03). In the case group, 58% of the participants had FBS>100.

Conclusion: The group with metabolic syndrome had a higher intensity of vitamin D deficiency compared to the control group.

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1. Introduction

According to various reports, vitamin D (Vit D) deficiency is highly prevalent in the world especially among Asians [1,2]. Vit D is one of the fat-soluble vitamins that was discovered in 1930 and named calcitriol. In addition to its important role in bone health, other functions are also recognized for Vit D, including preventing cell proliferation in colorectal, prostate, and breast cancers and its role in autoimmune diseases [3]. A decrease in Vit D level causes an increase in parathormone hormone (PTH) which in turn results in an increase in intercellular calcium ion that in turn controls insulin receptors in the target tissues and closes the Glat 4 channel (the important channel of inside glucose in the muscle and adipose tissue) [4].

In pathogenesis of many diseases like diabetes or metabolic syndrome, researchers have referred to the role of low Vit D serum level [5]. Metabolic syndrome can cause diabetes and cardiovascular diseases. Diabetes is also one of the prevalent disorders of endocrine glands all over the world and an important global issue for the societies' health [6]. About 50% of the patients with type-2 diabetes are afflicted by metabolic syndrome which causes higher chances of developing complications like stroke, retinopathy, neuropathy and microalbuminuria [7].

Prevalence of metabolic syndrome has been reported to be 12.8–14.1% [8].

According to the researcher, the prevalence of Vit D lack in the world is 10–80% [1]. High prevalence of hypervitaminosis D is also reported in Iran. This rate was reported to be 79.6% in 2001 in Tehran and 72.3% in Zahedan in summer of 2002 [9]. This study was carried out due to the high prevalence of Vit D and its consequences. It was aimed at comparing the level of Vit D in non-diabetic patients with metabolic syndrome with over-20 healthy individuals in order to advise all individuals with metabolic syndrome to check the level of their Vit D in case of presence of such a relationship.

* Corresponding author. Diabetes Research Center, Health Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, 61357, Iran.
E-mail addresses: bahmanint@yahoo.com (B. Ghaderian), shirinpourz@yahoo.com (Z. Shirinpour), a.m.aleali69@gmail.com (A.M. Aleali), sml1381@yahoo.com (S.M. Latifi), peyman_payami1@yahoo.com (S.P. Payami), rezaamani@hotmail.com (R. Amani), diabetes_center@yahoo.com (M. Ghasemi), golestandrc@yahoo.com (M.Z. Birgani).

2. Method

The present study was a descriptive investigation that was carried out on a population of 2700 individuals with metabolic syndrome in Ahvaz. To diagnose metabolic syndrome, Modified Adult Treatment Panel III (ATPIII) criteria were employed, including:

1. Abdominal obesity (waist circumference of 102 < for men and 88 < for women),
2. Triglyceride (TG) over 150 mg/d or during medicine consumption,
3. HDL of below 35 mg/dl
4. Blood pressure of over 130/85 mmHg or during medicine consumption, and
5. FPG between 110 and 125

Radioimmunoassay method (Pars Azmn Co. Kit) was employed in order to measure the level of 25(OH Vit D) serum. Serum concentration of 25 (OH Vit D) of below 5 ng/ml was considered as severe deficiency, 5–10 ng/ml as average deficiency, 10–20 ng/ml as slight deficiency, and above 20 ng/ml as normal.

According to the results of the studies that have previously been conducted [10,11] that reported a standard deviation of vitamin level of 52 ± 23 in individuals with metabolic syndrome with $\alpha = 5\%$ and $\beta = 0.2$, the size of each sample was determined to be 378 individuals; therefore, the sample size was 756 individuals who were categorized based on their gender, age, BMI, and BP.

Chi-square test and T-test were employed to analyze the collected data using SPSS 17.0. All of the tests were 2 ranges, and the p-value was set below 0.05.

3. Results

Two groups were investigated: those who were afflicted by non-diabetic metabolic syndrome as the experimental group and healthy ones as the control group.

According to the level of Vit D in the experimental group, 10 patients (20%) had severe deficiency, 19 (38%) had average deficiency, 15 (30%) had slight deficiency, and 6 (12%) had a normal level of Vit D. In the control group; however, 2 individuals had severe deficiency, 16 (31.4%) had average deficiency, 28 (54.9%) had slight deficiency, and 5 (9.8%) had a normal level of Vit D (Table 1).

First, T test was used for distribution, the results of which indicated that the average level of Vit D in the experimental group was 12.5 ± 10.2 and in the control group 12.9 ± 5.7, which were not significantly different (P = 82%).

Moreover, regarding HTN, the results of T-test indicated that the level of Vit D among individuals with and without HTN was different at a level of P = 0.33. The mean level of Vit D in the group with normal BP was 11.8 ± 9.9 and in the group with high BP was 11 ± 15.2.

In regard with the participants' gender, the results of T-test indicated that the levels of Vit D among men and women were 13.4 ± 4.2 and 11.9 ± 8, respectively, which was not significant (P = 0.38). In the experimental group, the mean of men was 15.5 ± 10.7 and that of women was 10.55 ± 9.5, which was not a

significant difference (P = 0.09). The men's average was 15.5 ± 10 while it was 13.4 ± 4.2 for men of the control group, this difference was not significant either (P = 0.30). These figure for women of the experimental and control groups were respectively 10.5 ± 9.5 and 11.9 ± 7.9, which was not a significant difference (P = 0.62).

Afterwards, chi-square test was employed, and its results indicated that the distribution of Vit D level in the two groups was not significant (P = 0.22). The intensity of Vit D deficiency was higher among the participants of the experimental group than the control group.

The results of chi-square test did not prove a significant difference between the two groups in regard with gender.

The participants' waist circumference was investigated through chi-square test. The results indicated that experimental individuals with normal waist circumference had 14.3% Vit D deficiency; however, control individuals with normal waist circumference had 3.9% Vit D deficiency. This difference; however, was not significant. In the control group, all of the participants had a normal waist circumference while only 14 experimental participants had a normal waist circumference. In the experimental group, 22.2% of the individuals with abnormal waist circumference had severe Vit D deficiency and 41.7% had average Vit D deficiency while there was no participant with abnormal waist circumference in the control group.

The two groups were not different in terms of severe deficiency while they were significantly different regarding average and slight deficiency and individuals with normal level of Vit D deficiency. In average Vit D deficiency, 78.9% individuals and 66.7% of them with a normal level of Vit D in the experimental group had high waist circumference; however, in the control group, individuals with average and normal Vit D deficiency did not have high waist circumference.

In general, 72% of the experimental individuals had high waist circumference, which was significant (P = 0.001). The control participants; however, did not have such waist circumference.

Chi-square was used to examine the difference between the two groups in terms of their blood pressure (systole and diastole), which was not significant; however, it was different in the group with slight deficiency ((P = 0.03). In the experimental group, 20% of the individuals had blood pressure; however, there was no increase in blood pressure among the control group.

The results of chi-square test indicated that a total of 58% of the experimental participants had FBS>100, but there was not such a case in the control group. In the experimental group individuals, severe deficiency was not significantly different (P = 0.31). However, groups with average, slight, and normal deficiency were significantly different. It was discovered that in the experimental group, 57.9% participants had average deficiency, 60% had slight deficiency, and 66.7% had a normal level of Vit D while none of the control participants had deficiency, this difference was significant (P = 0.0001). In groups with average and slight deficiencies and with normal level of Vit D, the difference was significant (P = 0.045).

The results of the study indicated that HDL was significantly different either in all groups and those with severe, average, slight, and normal deficiency. In the experimental group, 100%, 89.5%, and 86.7% of individuals with respectively severe, average, and slight deficiency had a low level of HDL while it was not seen in any of the control participants. The two groups were significantly different in terms of severe deficiency (P = 0.15) and average and slight deficiencies (P = 0.0001). In the experimental group with a normal level of Vit D, 66.7% of the individuals had a low HDL while it was not seen in any of the control participants, this difference was significant (P = 0.045).

Table 1
Vitamin D deficiency in case and control group.

	Sever (%)	Medium (%)	Low (%)	Normal (%)	Total
Case	10 (20)	19 (38)	15 (30)	6 (12)	50
Control	2 (3.9)	16 (31.4)	28 (54.9)	5 (9.8)	51

4. Discussion

The results of the study indicated that individuals with metabolic syndrome had a higher level of Vit D deficiency, which is proportionate with the severity of Vit D deficiency. Some parameters of metabolic syndrome also indicated the severity, and it was not correlated with gender.

The results of the present study are in agreement with those of the cross-sectional study carried out in the US in 2008 on 834 men and 820 women of over 20 years using ATP III criterion. The results of that study indicated that metabolic syndrome was less prevalent in the Vit D level of above 25(OH) and was not correlated with age or gender [12]. Moreover, they were in line with the study carried out in Spain in 2008 on 298 patients with severe obesity based on ATP III by a cross-sectional method, and it was concluded that those with Vit D deficiency had 25(OH) and a lower level of metabolic syndrome [13].

In the present study, in the experimental group consisted of 378 participants, only 14 individuals did not have abdominal obesity. In a study carried out on 73 very obese patients in Spain in 2007, it was concluded that Vit D deficiency was observed among 37 patients (50.7%) and 46 (63%) had metabolic syndrome. Vit D deficiency was more prevalent among obese patients with metabolic syndrome compared to those without it (60.9% vs. 33.3%, P = 23%), which proves a clear relationship between Vit D deficiency and metabolic syndrome among obese patients [14].

In the present investigation, the level of Vit D had a reverse relationship with metabolic syndrome parameters, which is relatively in agreement with the study carried out on 1443 men and 1819 women in Shanghai, Beijing. The Vit D deficiency was reported to be 69.2%, and it was observed that low level of Vit D was accompanied by an increase in incidence of metabolic syndrome and resistance to insulin [15].

In the present study, it was observed that Vit D deficiency plays an important role in development of metabolic syndrome and its complications (such as pre-diabetes) which is in agreement with the results of the study conducted by Hosseinnezhad et al. in 2009 in Tehran University of Medical Sciences [16].

Moreover, in a study that was carried out in 2012 on the civil population of., it was concluded that Vit D had a reverse relationship with central obesity, hyperglycemia and hypertriglyceridemia, and hypertension; therefore, Vit D level plays an important role in development of metabolic syndrome, and that study indicated that Vit D level was related with abdominal obesity in severe and average cases, it was also correlated with HTN, which is to some extent in agreement with the present study. The level of HDL was low in all cases on Vit D deficiency [17].

5. Conclusion

Vit D deficiency was more severe in the group with metabolic syndrome that the control group. Due to this relationship, all individuals with metabolic syndrome are advised to examine the level of their Vit D.

Conflicts of interest

The authors declare that they have no conflict of interest.

Acknowledgements

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.dsx.2018.08.003.

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